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Proceedings of the Workshop on Linkages between Wastelands and Biodiversity

16-19 September 1991

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Indian Institute of Science
Bangalore 560012

CENTRE FOR
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WORKSHOP

ON

LINKAGES BETWEEN BIODIVERSITY

AND

DEGRADED LANDS

Dates : 16 - 19 September 1991

Venue : Centre for Ecological Sciences
Indian Institute of Science
Bangalore 560012

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8. Mr. R. Prabhakar
9. Mr. P.R. Seshagiri Rao
10. Mr. T.V. Ramachandra
11. Mr. Hans Raj Negi

PROGRAMME

Monday, 16 September 1991

09.30 - 09.45	Objectives and expected outcome of the workshop	Samar Singh
10.45 - 11.00	Organization of the workshop	Madhav Gadgil
11.00 - 11.15	Tea	
11.15 - 12.00	Restoration of degraded lands and biodiversity - an overview Part - I	Madhav Gadgil
12.00 - 12.45	Restoration of degraded lands and biodiversity - an overview Part - II	N.H. Ravindrar
12.45 - 2.00	Lunch	
2.00 - 3.45	Presentations by the participants These would focus on specific policy and action points	
	1. Alan Rodgers	
	2. M.V. Nadkarni	
	3. Vinod Vyasulu	
	4. H.S. Panwar	
	5. Ashish Kothari	
	6. P.S. Ramakrishnan	
	7. D. Nutan	
	8. Darshan Shankar	
	9. P.D. Dogra	
3.45 - 4.00	Tea	
4.00 - 6.00	Presentations by participants continued	
	10. H.K. Srivastava	

11. Madhu Sarin

12. H. Sudarshan

13. Ajay Mehta

14. S.L. Shah

15. Sudhakar

16. Walter Fernandes

17. S. Shyam Sunder

18. Anil Gupta

Tuesday, 17 September 1991

9.00 - 12.30 Presentations by the participants continued

19. K.P.S. Chauhan

20. D.K. Biswas

21. N.S. Adkoli

22. Chhatrapati Singh

23. S.R. Ramaswamy

24. G.S. Bhat

25. Geeta Menon

26. P.V.S. Kumar

27. Thomas Mathew

10.45 - 11.00 Tea

11.00 - 12.30 Presentations by the participants continued

28. Tara Gandhi

29. M.K. Prasad

30. C.J. Saldanha

31. Rusi Engineer

32. Debal Deb

33. R.Shailaja

34. Avani Vaish

12.30 - 2.00	Lunch
2.00 - 5.00	Working Groups Session - I

Wednesday, 18 September 1991

9.30 - 11.00	Plenary Session - Reports of the Working Groups
11.00 - 11.15	Tea
11.00 - 1.00	Working Group Session II
1.00 - 2.00	Lunch
2.00 - 5.00	Working Group Session III

Thursday, 19 Sepatember 1991

9.00 - 11.15	Plenary presentation of recommendations of Working Groups	
11.15 - 11.30	Tea	
11.30 - 1.00	General discussion	
12.45 - 2.00	Lunch	
2.00 - 2.15	Summary presentation	Madhav Gadgil
2.15 - 3.15	Valedictory address	M.S. Swaminath
3.15	Tea	

COMPOSITION OF THE WORKING GROUPS

Working Group I : Erosion of biodiversity and ecological degradation causes and consequences

1. M.V. Nadkarni (Convener)
2. Alan Rodgers
3. Vinod Vyasulu
4. H.S. Panwar
5. Ashish Kothari
6. Madhav Gadgil

Working Group II : Technical issues in promotion of biodiversity degraded lands

1. D. Nutan (Convenver)
2. P.S. Ramakrishnan
3. Darshan Shankar
4. P.D. Dogra
5. H.K. Srivastava

Working Group III : Current approaches and performances of programme on biodiversity and restoration of degraded lands

1. Ajay Mehta (Convener)
2. Madhu Sarin
3. H. Sudarshan
4. S.L. Shah
5. Sudhakar
6. Avani Vaish

Working Group IV : Institutional and policy issues in promotion biodiversity and restoration of degraded lands

1. Walter Fernandes (Convener)
2. S. Shyam Sunder
3. Anil K. Gupta
4. K.P.S. Chauhan
5. D.K. Biswas
6. Tara Gandhi

Working Group V : Legal issues, property rights, biotechnology & prospects for conservation of biodiverstiy

1. P.V.S. Kumar (Convener)
2. N.S. Adkoli
3. Chhatrapati Singh
4. S.R. Ramaswamy
5. G.S. Bhat
6. Geeta Menon

Working Group VI : Community involvement, creation of awareness and resource development

1. C.J. Saldanha (Convener)
2. Thomas Mathew
3. M.K. Prasad
4. Rusi Engineer
5. Debal Deb
6. R. Shailaja

WHAT ROLE DO INDUSTRIAL PLANTATIONS HAVE IN WASTELAND DEVELOPMENT ? HOW DO THEY RELATE TO BIODIVERSITY. HOW DO THEY AFFECT THE QUALITY OF LIFE OF THE RURAL PEOPLE.

BY

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A B S T R A C T

Creation of industrial plantations is an economic necessity for India. Renewable resources have to be relied upon for energy and not finite sources. Available wood resources are grossly inadequate for the energy needs and wood based industries of the country.

Wastelands available for man-made forestry are listed. The inadequancy of plan outlays, shortcomings of the present forest policy have been given. Fears of monoculture are baseless.

Land, species, investments neaded for industrial forests etc., are dealt with. Such wasteland development and their relation to economic development and biodiversity are described. The positive results of such industrial plantations to the quality of rural life are analysed. Examples of such industrial plantations and their beneficiary effects are cited to prove the point.

What Role do Industrial plantations have in Wasteland Development? How do they relate to biodiversity. How do they affect the quality of life of the rural people.

By N.S. ADKOLI.

1. Need for Industrial Plantations :-

1.1. Needs of Industry :-

There are many industries which depend on forest based raw-material for their [a] energy needs and [b] raw-material for a finished product. The energy needs of an industry can come from Fossil Fuels like coal, coke, lignite and petroleum products, or fission for nuclear energy or renewable resource like wood or charcoal or bioproducts. Efforts at utilising solar, wind or wave-energy are also being made continuously round the world. But reesults of such efforts have yet to reach stages of commercial application so as to be-useful for meeting industrial needs.

1.1.1. Finite Sources :-

Fossil fuels like coal, petroleum products and sources of nuclear energy are all finite sources. There is lurking fear that the world will exhaust these sources some day. A certain degree of pollution of either air or water is inevitable in the process of conversion of these finite sources to the form of usable energies

like electricity or heat. Deposits of these energy sources are available at certain points in this world. Collection, handling and transport of such sources of energy require use of part of such energy for making them available to the site of their usage.

1.1.2. **Renewable sources** :-

These originate from the plant kingdom which is blessed with one of the greatest creations of Nature, the chlorophyll, which is capable of harnessing solar energy for conversion of harmful gas of carbondioxide into different tissues of plant life and releasing life-saving oxygen in the process. These tissues which develop into different organs of the plant are available for different usable forms like food, fodder, wood, fibres, flosses, resins, gums, oils, medicines, tans, dyes, animals and their products etc.

The fibers and plant products are available for production of energy directly as in the case of wood, twigs, leaves and so on or indirectly as in the case of bio-energy. The advantages of these sources lie in their renewable nature, possibility of growing them close to the centres of their usage and freedom from pollution. The ides of energy plantations comes from such known advantages.

1.2. **Industrial Raw-material** :-

The industrial raw-material from forests can be for primary use or secondary use to mankind. Wood including bamboos is the primary source for industries

manufacturing sawn wood, pulp, panelwood, wood wool etc. These primary products are in turn convertible into secondary uses like housing, packaging, paper, communications, defence equipment, furniture, rayon and so on. Several minor forest produce are also used as primary products like Beedi-leaves, gums, edible and non-edible oils, essential oils, rawdrugs, spices etc and many of them in secondary usage like soaps, paints, leather industry, garments condiments, perfumes, pharmaceuticals etc. Most of the products are of essential needs to mankind and generate goods and services needed for vital economic well being of a nation, and particularly so to a highly populated and developing country like India.

1.3 **Availability of raw-material** :-

With increasing shortages of wood and other forest produce needed for a growing population, with a Government aiming at improving the living standards for a majority of havenots, with the needs of products like paper, clothing, sawn-wood or panelwood, the country cannot afford to depend on natural resources. Just as efforts have to be made continuously for increasing quantities of agricultural productivity like cereals, pulses, oil-seeds, sugarcane, cotton, tubers etc, similar efforts are needed for increasing productvity of forest raw-material In tropical forest ecosystems which occupy bulk of our geographical areas of forests, the diversity of vegetation can hardly produce raw-material of proper quality and high quantity per unit area. The natural

tropical forests support a host of species in different levels of forest conopy, which have diverse uses and not necessarily suited for a particular end-use Although most species can be useful as sources of energy in the form of firewood or charcoal, their efficiency can be improved by concentrated production of higher quantity per unit area of better wood of higher calorific value Since land needed for producing either timbers, fuelwood, pulpwood or minor forest produce required for running the wheels of industries is a limited and scarce resource in a populated country like India, the best way of meeting the requirement is to raise them in a concentrated manner for achieving the required quantity and the desired quality. This is the basic concept of industrial plantations all over the world.

2. Land Resources :-

2.1 Usages :-

The first and the biggest charge on our land resources is to agricultural production to meet the food and clothing of our teeming population. Fodder and grazing needs for our equally large domestic animals are overlapping on both agricultural and non-agricultural lands. In the process of land classification under the land revenue act and the Indian Forest Act, available lands had been classified into protection and reserve forests for ecological needs, Production forests for the utility of forests product, minor forests or protected forests, village

forests and treelands or pasture lands all of which were meant for meeting the needs of local population. Similarly some reservation had been made for gaonthanas" or village sites, Gomals, Gurucharans, or Gocharav or Kaval lands for grazing of cattle, lands for cemetries, tanks, shandies and so on. In post-independent India, successive Governments doled out both forest and nonforest Government lands by [a] regularising encroachments, distribution of lands in excess of ceiling limits on holdings, grant of land especially to weaker sections of the society, in conformity with the policy of 'land for the tiller', removal of povery' etc resulting in honey-combing of forests, loss of village common lands set aside for grazing and exercise of previleges etc. The result of such appeasement policy was that forests reduced in extent and quality and non-forest Government lands were lost to agriculture in a big-way, including un-economic agriculture on large extents of marginal farmlands.

2.2. **Wastelands** :-

Wastelands are the result of either natural causes or biotic factors or a combination of both. The vast stretches of deserts in Rajasthan and large extents of land which are subject to long periods of snow, inundation by brackish water etc., are deserts due to natural causes. Action of avalanches or land-slides create wastelands. But large extents of wastelands owe their origin to biotic factors. Shifting

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cultivation was a pernicious method of land-use practiced by tribals both in the western ghats and the hills of north-eastern Indian States. Vast streches of forests on hill-slopes got cleared and burnt by such cultivators. Attempts of nature to rehabilitate such areas for change into natural forests got foiled by biotic factors like repeated annual fires, heavy incidence of grazing and consequent washing down of top soil, formation of gullies and so on. Faulty methods of cultivation like ploughing along the slopes, utter disregard to any method of soil conservation, faulty crop practices etc., cause wastelands. Over-exercise of rights and previleges, over-grazing etc cause decimation of vegetation followed by degradation of the soil to levels of infertility and generates wastelands. Droughts and floods also cause wastelands.

2.2.1. **Availability of Wastelands** :-

Several reports reel out figures of wastelands in India. Staggering figures of loss of 1.5 million ha. of forests annually are quoted to indicate addition to forest wastelands The vast extents of degraded forest lands, marginal and uneconomic farm lands have been quoted on the basis of satellite imageries taken by the National Remote Sensing Agency to quantify available wastelands in India. Large parts of the country are photographed aerially to indicate the extent of wastelands and degraded forests The wasteland development board created in 1985 and after 3 years, converted into a National wasteland mission,

has defined wastelands, classified them and laid out plans to rehabilitate them at great expense. The policy speech made by the Prime Minister on assumption of Office in January 1985 indicated a resolve to reclothe 5 million ha of wastelands annually with tree-growth.

The extents of Forest land in India as per land-set data of 1974-75 are given below.

Area in Sq. Kms.

Geographical area	Wooded forest	Open and degraded forests	Coastal forest (Mangroves	Others Snow clad etc	Total forest land	% age of land
1	2	3	4	5	6	7
3287790	464226	87673	3281	173468	555180	16.89

According to a report prepared by F.A.O. in 1981 the forest areas classified and quoted are given below :-

Area in Sq. Kms.

Total forest area	Un-productive forest	Fallow forest	Open forest	Scrub	Total of 2 to 5	% age of forest
1	2	3	4	5	6	7
720820	89690	94700	539300	53789	292100	40.50

Even out of the 42.8 million ha of productive forests, FAO report of 1981 mentions that only 32.5 million ha

are well-managed forests making up only 44% of the total forest area.

The Directorate of economics and statistics in the Ministry of Agriculture had given the following table about land use in the country during 1980.

Dategory of land	Area in million ha.	Percentage
Area under forest	66.8	22.Ø
Area under nonagriculture uses	17 5	5.8
Barren and uncultibale land	21.9	7.2
Permanent pastures	12 5	4.1
Miscellaneous tree crops	3.9	1.3
Culturable wastes and fallow	41.1	13 5
Agricultural land	14Ø.3	46.1
Total	3Ø4.ØØ	1ØØ.ØØ

Thus it can be seen that the total wasteland available both in Forest and nonforest areas is at least 5Ø% of total land.

3. Man-made Forests :-

3.1 History :-

Roadside avenue plantations had been practiced during the regime of Emperors Ashoka and Akbar The Mysore dynastry of the 18th Century had also arranged for roadside planting and tree-groves called Gund-topes" mainly to provide shade for weekly market (Shandies) cattle fairs etc. Systematic man-made forests were first started in 1842 by O.conolly collector of Malabar, who entrusted the work of taking up Teak plantations near Nilambur to one chattu menon. Teak plantations were started in the western ghats-Malbar, North and South Canaras and in West Bengal in 1845. Man-made forests till independence of India were

limited to trees of economic importance viz.

Teak :- Tectonagrandis Deodar-Cedrus deodara Sal :- Shorea robusta Sandal :- Santalum album red-sanders :- Pterocarpus santalinus, Bhogi :- Hopea parviflora and Biuegum-Eucalyptus globulus (only in Nilgiris). Teak plantations were also started in Shimoga, Kodagu and Chikmangalore districts in the last part of 19th century. The only exotic among these was bluegum. Some planting of Casuarina equisetifolia was taken up on the coastal sands of both east and westcoast and some private lands in old Mysore region for supply of poles and fuelwood for boilers as industrial fuel.

3.2 **Production Forests** :-

The post indedendent India witnessed substantial increase in establishment of woodbased industries of which the important ones were pulp mills, panelwood units and matchfactories. Production of industrial timbers was deemed necessary as per the forest policy of 1952 to meet the needs of defence, communications, buildings and industries. The commencement of five year plans from 1951 saw allocation of plan funds for plantations of species of economic and industrial importance. Since forestry received low priority in plan allocations, the outlay for forest development started with only Ø 49% of total plan outlay in the Ist five year plan and has just exceeded 1% in recent developmental plans. Considering the extent of forests quoted at about 21% of geographical area of

which nearly 50% of forest is degraded and needs rehabilitation, the plan allocation for forest development is very negligeable [1]

3.3. Plan outlays and man-made forests

Sl. No.	V Year plan	Outlay in Rs. million	Amount used	Production forestry in ha.	Farm - forestry	
					Target	Achieved
1.	Ist (1951-56)	97.0	(N.A.)	50,000	-	-
2.	IInd	193.0	"	1,64,000	-	-
3.	IIIrd	514.00	317	1,80,000	2,55,692	20,800
4.	IVth	1,220.00	(N.A.)	6,26,000	75,000	80,000
5.	Vth	2,808.20	"	22,00,000	N.A.	N.A.
6.	VIth	6,924.00	"	6,20,000	-	6,00,000
7.	VIIth	7,970.10	"	20,00,000	1,00,000	N.A.

The summary of achievements and targets of man-made forests under the plan schemes is given below in million ha.

Particulars	1951 to 1980	6th Plan 1980 to 1985	Target for 7th Plan
Production forestry	2.13	0.62	2.0
Social forestry	1.43	3.47	10.5

3 3 1. Social Forestry :-

Planting under the social forestry schemes started in

the VIth Five Year Plan with an outlay of Rs. 972.1 million. Initially started in 101 districts with central assistance, these projects soon got international assistance. Eleven states got such projects in the VIth Plan. By 1984 these projects had enveloped many other states. An outlay of over Rs. 8,000 million to cover a target of 1.21 million ha. and distribution of 407 million sedlings was available for the VIIth Plan.

3.3.2. **%age of forest area to manmade forests of economic species** :-

The total area of forests brought under manmade plantations of economic species comes to 4.75 million ha. upto the end of the VIIth Plan. This is about seven percent of total forest-land of the country. The plantations of Eucalyptus raised under economic plantations or industrial plantations during the second to fourth five year plans would have come for replacement already. Most of the Teak and Plywood or matchwood plantations have merged with the natural forest by mixture of natural species between them. The criticism about monoculture doesnot hold water when so many species are raised in small extents and get merged with natural forests or mixed with natural trees in our tropical climate.

4. **Projected requirements** :-

4.1. **Pattern of use** :-

On the basis of a study undertaken by the Central Forestry Commision (1980-81), the percentage of wood

output of the country[1] by usage for a few important items of consumption are given below :-

Particulars	Percentage	in million tonnes
Fuel wood	41.99	45.ØØ
Building Construction	9.34	2.5Ø
Railway Sleepers	5.6Ø	1.5Ø
Plywood & Particle Board	3.52	Ø.94
Paper and Board	16.8Ø	4.5Ø
Matchboxes & Splints	5.23	1.4Ø
Packing cases	7.47	2.ØØ

These figures indicate that fuelwood is the single largest item of consumption even from accounted quantities produced. The removals by previlege holders remains unaccounted quantity in addition It is needless to mention that efforts at production should be commensurate with projected consumptions on which depend the demands. It is also true that felling and processing residues coming out of removal of timber for industrial uses produce about 5Ø% of fuelwood for domestic use by the poorest people. The fuelwood needs of our country estimated for a populationof 8ØØ million is 163 million M.T.

4.2. **Shortages for industrial uses** :-

The National commission on Agriculture in its report (1974) has projected the shortfall for industrial timbers as given below.

Commodity	Projected Demanded for the year 2000 in million M^3	Additional requirement in million M^3
Timber	46.775	10.000
Pulpwood	17.695	32.300
Bamboos	7.005	2.731

4.3. **Present Production of important industrial Products :-**

The production of paper, board and newsprint and pulp in India as on 01-01-1989 is given below :-

Item	No. of Units	Installed capacity in M.T. p.a.	Production M.T. p.a.	Remarks
Paper and Board	305	14,229	17,20,000	(1988) 75 units with 6,25,000 M.T. p.a. capacity are closed)

The installed capacity of production of rayon-grade pulp of five units in India is 1,96,250 M.T. and that of 5 units of Newsprint manufacture is 3,00,000 M.T These units have been working to over 96% capacity in the last two years.

Panelwood :-

The installed capacity and production of panel-products in India during 1985 is summarised below :-

Sl. No.	Product	No. of Mg units	installed capacity in million M^2	Production million M^2	Remarks
1.	Plywood	58	116.510	88.680	on 4 mm basis
2.	Particle board	9	64.100	31.035	M. Tonne
3.	Fibreboard	3	53.000	34.383	M. Tonne

The capacity utilisation has been about 60% due to shortage of timber supply all of which came from natural forests. The plywood mills are now depending on imported logs which cost over Rs. 200 million p.a. to the country in foreign exchange.

Tan barks :-

Natural tanbarks have dwindled in availability, Bulk of tanbarks come from wattle plantations of Kodai canal and Nilgiri Hills. India is a net importer of tan-barks.

4.3. **Filling the gap** :-

It is clear that India is not self-sufficient in forest based raw-material even for the existing industries. Fuel wood production for meeting the basic fuelneeds of rural folk is also essential.

5. **Forest Policy** :-

The forest policies of 1894 and 1952 had provided for raising plantations of industrial timber for meeting the future needs of woodbased industries. Some efforts, however inadequate, had been made in the five year develoipment

plans upto the VIth five year plan for raising such plantations The shift in the plans of forestry development to social forestry commenced in the VIth five year plan and intensified in the VIIth five year plan It can be seen from the provisions of VIIth five year plan that "Forest Conservation Development and Regeneration" got an outlay of Rs. 485 million only out of a whopping Rs. 7970 million assigned for forestry and wildlife. This neglect of forest management and increasing productivity is reflected in the National Forest Policy of 1988 and the Forest (Conservation) Act of 1988.

5.1. **1988 Forest Policy** :-

Supply of timber to Defence, Construction, Communications and Industries has been totally removed from the main objects. Forest based industries are advised to tieup with farmars for the needs of raw-material and that too by using only marginal farmlands. In terms of productive capacity, our marginal faramlands are poorer than degraded forest lands, and are scattered in small uncertain bits in the rain-shadow and drought prone districts of the country. Such lands can be utilised only for highly subsidised tree-planting schemes to meet needs of rural population, with no regard to commercial viability of such investments. Other suggestions of substitutes for either raw-material or finished product and imports to meet our country's needs are impractical and shortsighted

6. Industrial Plantations :-

The only practical method of meeting the needs of raw material consists of raising high-yielding plantations of required species. Such plantations can become viable if technological advances in production forestry are practiced so as to optimise inputs and raise output per unit area of best quality raw-material. Countries like Brazil and Congo have raised their productivity of industrial plantations from hardly 15 M^3 per ha. p.a. to 70 M^3 per ha. p.a. already in two decades and are hopeful of reaching 120 M^3 per ha. p.a. within 10-15 years. This will mean that the requirement of raw-material can be met in 15 to 20% of the area required 2 decades ago. Higher productivity can produce raw-material in excess of the needs and give room for expansion of industry and exports of either raw-material or finished products

6.1. Land for Industrial Plantations :-

The fragmented low-capacity marginal farmlands call for highr investment, dispersed supervision, higher cost of harvest, transport, inability to apply modern technology, larger extents of land to meet the gap in availability, problems of legal arrangements with the owners for supply of raw-material, difficulty in flow of credit, higher supervisory and protection costs etc. India cannot afford to divert better farm-lands for tree-crops for fear of shortfall in production of agricultural products. The best available natural resource for such insustrial plantations is therefore, degraded forest land. Available statistics show that

we have over 292 million ha of such lands over which investments for productivity have reduced to nothing due to [a] shift in the forest policy [b] emphasis on social forestry in our national plans and [c] resources crunch for such investments.

6.2. **Extents needed** :-

Demand projections of all kinds of timber and pulpwood for the year 2000 A.D as projected by National Commission on Agriculture is 37.5 million M^3 p.a for timber and pulpwood put together. Even with a modest increment of about 15M^3 per ha. p.a. The land required for such production target is 2.5 million ha. p.a. This much extent is available from degraded forests leaving all other kinds of fallow lands, permanant pastures and marginal farmlands etc for social forestry schemes.

6.3 **Species** :-

The species to be chosen for such industrial plantations have to be [a] capable of being good quality rawmaterial [b] high productivity [c] capable of using technological advances and [d] practicable to use. The proven species all over the world are Pines, Eucalypts, Wattles, Gmelina arborea, Casuarina, Poplars, Acacias, Peelable woods and Bamboos. Gmebina, Poplars, many peelable species like silk cotton, bamboos etc., are highly prone to damage by cattle and fire, protection from which is very expensive costing Rs. 2000/- to Rs. 3000/- per ha.extra in the early years of plantations. Species

with least damage from cattle and fire are therefore preferred to ensure lower initial investment and better results.

6.4. **Investment** :-

At the present wage rate of about Rs. 15 to 20 per day, the investment on such plantations will be about Rs. 8000/- to Rs. 12000/- in the first year and about Rs. 800/- to Rs. 1200/- in the second year and an average maintenance cost of Rs. 400/- per ha. p.a. till harvest.

7. **Role in Wasteland Development** :-

All lands irrespective of ownership, which are not in use for economic productive purpose should qualify for wastelands. Degraded forests, degraded pastures, marginal farmlands, lands left fallow for any reason qualify as wastelands. The existing growth on such lands is neither of productive nature nor provides adequate protection to soil to assist in water conservation, industrial plantations cover the land quickly and protect them from evil-effects of erosion Since the trees of industrial plantations also absorb carbondioxide and release oxygen, they are no worse than nonindustrial plants from ecological point of view If the normal leaffall is allowed to get mixed with soil to form humus, the biodegradation improves the soil structure and fertility without exception. The crown and root system help in per-colation and moisture conservation.

7.1. Since wood as industrial raw-material has higher value than fuelwood, it is more likely that output in the

form of small timber and industrial raw-material has better chance of viability of projects in wastelands than mere fuelwood or crop of minor forest produce. Hence it is possible to attract investment from user industries and financial institutions in case of industrial plantations on wastelands. such investments can help in rapid afforestation of wastelands to produce quicker goods and services, while providing ecological protection to air, land water and nearby agricultural crops. Moreover, higher quantitative output and quicker return can be expected from industrial plantations which are better incentives to afforestation than doles and subsidies being pumped into social forestry projects. If due regard had been given to the reports of various expert committees since 1976 to 1986 for making available part of available wastelands for industrial plantations, the future prospect of supply of raw-material at least to pulp and paper industries would not be as dismal as it is today Less than 5% of available wastelands can fulfil the needs of industry. Neither environmentalists nor policy makers should grudge diversion of such small extent to high-tech-high yield industrial plantations, whether by monoculture or polyculture.

8 **Relation to Biodiversity** :

Biodiiversity on wastelands is a myth. Biodiversity in Nature is available in well protected ecosystems. Biodiversity is totally lost in case of wastelands mainly due to adverse biotic factors including overuse of natural

vegetation and abuse of the soil that supports it. Since both flora land fauna, including microflora and microfauna of wastelands is badly destroyed, any vegetational cover including industrial plantations, is an improvement over existing stage of degradation. Though it is possible that biodiversity will restore faster if the wasteland is clothed with a careful mixture of natural vegetation and protected, the cost involved in raising and protecting any plantation of mixed species is much higher than benefits derived therefrom It is therefore financially unwise to increase investment for a poorer return, as financial resources of a poor developing country like India, are always under heavy strain. It is always possbile to use some ground vegetation in an industrial plantation in initial years for quicker build up of biodiversity as in the case of leguminous covercrops.

9. Quality of life of rural people :-

9.1 Main requirement :-

The most important need of the rural people in India is gainful employment opportunity Both the land owners aswelas landless rural folk find that the agricultural activities including dairy, polutry, horticulture etc. provide partial and seasonal employment. Continuous gainful employment opportunities in rural areas are lacking. Occasional Government works like road-making or maintenance, minor-irrigation works, famine relief works etc., attract hundreds of villagers. It is also true that agriculturists and rural labour migrate to urban

construction sites, project sites, seasonal works in estates of cash crops etc., in search of employment. The plantation of treecrops provides large employment opportunities for raising nursery seedlings, transport of seedlings, site preparation, pitting, planting, weeding, technical inputs like application of fertiliser and pesticides, soilworking, tending and harvest of crops almost for most part of the year. Many of these works donot need physical or educational qualifications and can be done even by children and handicapped. Every ha. of plantation generates about 400 mandays in the first year and an average of 40 mandays per ha. in the subsequent years. If about 2.5 million ha. are to be planted up each year about 100 million mandays are generated annually. Such employment generation is helpful in creation of assets which in turn provide labour and useful material, besides ecological benefits.

9.2. **Fuel Wood** :-

In most harvesting operations, whether for timber or pulpwood, an average of 35% to 45% of above ground harvest comprises of bark, small-wood twigs etc. With an estimated 15M^3 per ha p.a as increment, about 6m^3 per ha. per annum comes out as fuelwood, which is in eternal short-supply in India. for 2.5 million ha, the annual fuelwood output is 15 million M^3 which is about 5 million tonnes. Since the user industry can afford to pay for the timber or pulpwood, the fuelwood resulting as felling residues is available free for

collection by the rural poor, which is the practice prevailing already In case of species like Eucalyptus, the annual natural fall of biomass is estimated at 2 M.T. per ha. p.a. This is available as fuelwood on a continuous basis, for those who are prepared to accept the relevance of industrial plantations whether on government or private lands. The districts of Kolar, Tumkur and Bangalore in Karnataka, Khammam and Godavari districts in Andhra Pradesh provide the best examples. The entire rural population here is getting Eucalyptus or Casuarina or Bamboo twigs free as fuelwood Besides, the pot maker, brick maker, smithies etc are entirely depending on fuel from such plantations. All the rural private fuelwood sellers in these districts sell bark, twigs and even wood chips and saw-dust separately in their depots for the small towns in the area.

9.3. **Agricultural Needs** :

The branchwood from most fellings is used for fencing, stakes or support for agricultural crop, for agricultural implements, tool-handles etc. Eucalyptus sticks and bamboo arms are used as stakes for tomato, grapes, other creepers like cucurbit in rural Karnataka and Andhra. Sericultura is depending on woven bamboo articles.

9.4. **Housing** :-

Casuarina Eucalyptus and bamboo are used extensively in rural housing, cattlepens and sheds, small

industrial sheds etc. In Punjab, Haryana and Uttar Pradesh, over 60% of housing timber including doors, windows, rafters, wall-plates, purlins etc. is made of Eucalyptus. The sports-goods industry in Jalandhar and Hoshiarpur is using Eucalyptus wood. Scaffolding, centering, soil-stabilising, roads, bridges, communication lines are all depending on Casuarina and Eucalyptus in many states of India both in rural and urban sectors. Woven bamboo is used for partitions, ceiling, roofing, furniture, packaging of vegetables, fruits, glass and so many other items of manufacture.

9.5. **Cottage Industries** :-

Even the left over of industrial fellings or small portions can help rural industries. Bamboos and wood are basic raw-material for several handicrafts, domestic articles etc. A small tahsil place like Malur in Kolar district supports over 35 brick and tile manufacturing units, all of which use lop and top of Eucalyptus fellings. Pot makers and country tile makers in the dry districts of Karnataka use Eucalyptus foliage for burning them. The foliage is swept from the Eucalyptus plantations, bundled and carried in several head -loads, donkey-loads or cart-loads by these small manufacturers. Woven bamboo can be used for matboards for which the mats can give continuous employment to rural poor as is evident from the work organised by the Kerala Bamboo Corporation in Tichur District of Kerala.

9.6. **Insurance**

In the dry districts of Karnataka, Eucalyptus and Casuarina are grown by private farmers in a portion of their lands as insurance for covering marriage expense, capitation fees or education expenses, house contruction or repair work and against calamities. Whenever some heavy investment or expenditure is involved, the industrial plantation is sold as pulpwood and fuelwood to cover the need. There are politicians who take out periodic election expenses from such plantations.

9.7. **Grazing, Fodder** :-

Village cattle need place for grazing and villagers have to collect grass for thatching and feeding cattle. Eucalyptus and Casuarina Plantations are used for the purpose. Even in the Government wastelands leased for industrial plantations in Karnataka, the clauses in the lease agreement provide for [a] raising of 5% fodder species [b] 12.5% of produce during harvest as lease rent to meet the needs of villagers and [c] bark and smallwood to be allowed for free-collection by the local villagers. Considering the fact that wastelands neither have even one M^3 or tonne of biomass today per ha. These clauses provide for 6-7M^3 or tonne of biomass p.a. at the investment of the industry for free use by villagers.

9.8. **Rural Upliftment** :-

Production of industrial raw-material and some

finished products like packaging material, bricks, tiles, dairy products, poultry products, agricultural products etc., encourage good communication services to our villages by movement of goods, vehicles etc Roads and buildings improve; earning capacity of rural folk improves by provision of employment at their doors. Such two-way movement between urban and rural centres gradually bridges that gap in the availability of goods and services which is one sure way of stopping urbanisation in a developing country.

Conclusion :-

Industrial plantations on wastelands and degraded forest lands should be treated as National obligation to

[a] meet shortages of raw-material to industries to improve their working for continuous supply of goods at reasonable prices and services to the people.

[b] provide employment opprotunities to rural folk

[c] reduce shortage of fuel to release cow-dung as manure and bio-energy

[d] pave the way for all round development

[e] besides, provide aesthetic and ecological benefits to land, soil, water, agricultural crops, air etc., and

[f] produce wealth from waste

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2	Report of the raw-material Committee	Development Council of Pulp and Paper	1983
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DEVELOPMENT OF SOCIAL FORESTRY : SOME SECOND GENERATION CONCERNS

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Emerging Concerns

The environmental as well as socio-economic crisis emanating from deforestation has activated the initiative for afforestation programmes since early eighties, of which Social Forestry has been an important development programme with distinct set of objectives, activities and management style. The chief objective of the programme has been to produce fuelwood, small timber, fodder, fruits and other minor forest products in public and private lands in order to make people self-sufficient in their forest produce needs. Added to this has been the objective of making afforestation a people's movement and thereby of making it a participatory development programme.

The basic objective of the present paper is not to examine the social Forestry Development record of the country, and to compare what has been accomplished with that of what has been expected of the programme. The focus of the paper is to identify some second generation concerns which have surfaced in the development process during the last one decade or so. While doing so, the paper is also an attempt to be suggestive of options for meeting some of these concerns. The concerns which are identified are detailed as below:

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- Both in formulation and implementation of Social Forestry Programme, more emphasis has been placed on technical and administrative aspects and fulfilment of physical and financial targets, and less on socio-economic aspects of the programme.

- People's participation in executing plantations under community land has been limited, and these plantations have been mostly departmentally executed ones.

- Proper distribution of development benefits could be the major propellant for drafting people into the development orbit of the programme and thereby to sustain the programme with their participation in creating, managing and protecting public plantations.

- There are inadequacies in development support provided to farm forestry in terms of extension, credit, marketing, and product development.

- Provision of development opportunities for women, small and marginal farmers, and landless rural poor under the programme has to be streamlined so as to see that they do not continue to be deprived.

- Shift the project-orientation from meeting only subsistance needs of fuel wood, fodder and timber to tapping tree farming as an instrument for socio-economic development of villages.

- Multi-agency model is perhaps a prospective for exploiting vast opportunities available for wasteland development. But the specific and complementary-collaborative roles of different agencies need to be delineated.

- Effect a shift of emphasis from either fuelwood oriented or timber-based plantations to multi-product forestry plantations by the choice of appropriate species and technologies.

- How adequately has been bio-diversity goal accomplished under public and private plantations?

- Ones the international support for the programme expires, how prepared or unprepared we are to sustain the programme.

There are many more concerns which one could catalogue. All these second generation concerns are not meant to discount the accomplishments of Social Forestry Programme, but to indicate the need for meeting them so that qualitative changes in the programme could be effected.

Participatory Development Model - Operational Feasibilities

In formulation and execution of various development programmes, participatory development model appears to have provided a basic rationale for involving people at the project command area. The experiment at Sukhamajri Village of West Bengal (Manchan Chopra et.al 1990) has provided a major message that participatory development model is much more important when management of common property resources is involved. Since one of the main objectives of Social Forestry programme has been to support people in creating, managing and protecting their own forest and tree resources, it has a rural development focus and social development aspects are implied in it. Hence the programme is heabily dependent on active participation of people. But it has been conceded (NWDB 1990) that the programme executed on public lands,

especially on degraded forest lands, has had very little people's participation and the activities have been mainly departmental efforts. Hence the need for evolving strategies for meaningful participation of people in planning and implementation of community plantations is well sounded.

It is argued (Aiyasamy, 1990) that involvement of the people is necessary right from the programme formulation stage where decisions are taken regarding selection of sites and species, mechanism of maintenance and protection, and distribution of benefits and marketing of forest produce. The basic step for any participatory development programme is to build up awareness among people about the programme, responsibilities of the village community in the matter of planning, creation, maintenance and protection of community plantations, and benefits which the programme would confer on them. To promote this kind of comittment among people, a strong ~~pa~~ Social Forestry Extension Education is required. More on this later. Wasteland development through people's participation at Chengunta village situated about 20 Kms from Mehaboobanagar of Andhra Pradesh represents one such attempt in strong extension education (Nareddi, 1990).

What would really motivate people for participation in community plantations is brought out well in a recent study conducted by Gandhi Gram Rural Institute (1990) in three districts - Tanjore, Pudukotta and South Arcot - of Tamil Nadu. It is argued that Social Forestry should be related to the social purpose of becoming an instrument of village development, and economic emancipation of target groups, instead of a programme for securing revenue to the Government and profits for the contractors. The factors that have motivated people of the study villages to help the Forest Department in maintaining the department plantations are their awareness about the advantages of the programme in terms of revenue to their

Panchayats, generation of fertile tank silt, availability of fuel wood, grazing facilities in matured plantations, and development of community plantations without affecting facilities for grazing. All these have engineered the programme acceptance by the people, and their cooperation in managing and protecting public plantations.

Microplanning (NWDB, 1987) offers opportunities for implementing participatory development model in Social Forestry programme. The key word in microplanning process is consultation with the people of different segments of rural society to arrive at a concensus for developing a technological plan of action for implementation jointly by people and technologists. The planning process involves consideration of various factors such as people's needs, labour availability, institutional financial support and marketing avenues, in addition to site characteristics and other agro-climatic features. This supports an imperative to treat micro-planning as a major process to be followed in programme execution. It is much more supported when it is realised that micro-planning as an action plan is local resource based, need based, technologically feasible and socially acceptable.

Provision of development support in terms of supply of seedlings, technical guidance, and infrastructural facilities for processing and marketing to forge farm-industry nexus has provided impetus for the development of farm forestry. But the second generation concern that has emerged in this regard is that certain segments of the rural society such as women, small and marginal farmers, and rural poor have not adequately participated in the Social Forestry programme. This paper is concerned with an examination of various development opportunities available for women to participate in Social Forestry Programme and to benefit from it (NWDB, 1989). The accent on making Social Forestry

programme a people's movement places more responsibilities on and opportunities for women, because of their stronger links with fodder and fuel collection activities. Social Forestry Development components such as decentralised nursery scheme, the grants-in-aid scheme for voluntary agencies, margin money scheme for bankable projects, and tree-patta scheme are the major avenues available for women to participate. But lack of effective coordination among Social Welfare Department, Forest Department, and Departments of Revenue, Rural Development and Institutional Credit appears to reduce these opportunities for participation of women in Social Forestry Programme and to experience a feeling that their participation in the programme is not merely as labourers byt also as development partners.

Interface Forestry For Developing Degraded Forests

The preceeding section has focussed mainly on ways and means of implementing participatory development model in Social Forestry programme. The present section is intended to provide a concrete illustration of people's participation under Interface Forestry Model adopted in Tamil Nadu for developing degraded reserve forests (Forest Department, 1990). The Phase II SIDA - Aided Social Forestry Project implemented in Tamil Nadu with effect from 1988-89 has several innovative elements - technical, economic and social - of which the concept of interface forestry is one such innovation.

- The Interface Forestry Development Programme, implemented on a limited scale since November,1988, is designed to reforest degraded reserve forests focussing on interface areas situated next to villages.

- Development unit under this programme consists of two types of land viz, reserve forest area and buffer zones consisting of private land and Government revenue land, forming a compact unit on watershed basis. As a part of land treatment activity, soil and moisture conservation are given due importance by constructing check-dams, gully plugging, percolation ponds and contour walls.

- The major objective of this programme is to ensure benefit flow from the interface forestry to associated communities of the command area. While making choice of species for private and community land, the preferences of land owner and of the village community respectively are considered. On the reserve forest areas, species that generate fodder, fruit and minor forest produce are planned to be planted. In addition to accrual of benefits to community in buffer zones interms of forest produce, the programme is to provide employment throughout the year to one person from each of the families of the villages situated in the watershed area.

- The project design also makes provision for developing drinking water facilities (for people as well as cattle), fodder banks, Mahila Mandrams and Child Care Creches, and facilities for medical aid, adult education and training in development skills in collaboration with other development agencies.

- Awareness about the programme benefits is designed to be accomplished through interface Forest Committees at the Village level.

It is too early to be conclusive about the the performance of the interface Forestry programme approximating what is expected of it; but the programme is designed with a premise that conferment of economic benefits is a major propellent for people's participation. It is reported (Forest Department, 1990) that villages in Tiruvalluvar Interface Forestry Division have been motivated to dispose off their goats to save the forest, and there has been a reduction in the number of goats from 6000 to just 85.

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Distribution of Development Benefits

Given the basic philosophy of Social Forestry Programme, the need for involving largest number of rural population is well recognised as a part of participatory forestry development model. Perhaps, the basic motivation for people is pay-off; from such participation either in farm forestry or community forestry. People tend to participate in farm forestry programme if they are convinced that net benefits either tangible or intangible (as perceived by them) exceed those from alternative use (including allowing land to be fallow) of their land. Their participation under this programme could be facilitated if appropriate development support package (comprising of provision of seedlings, technical guidance at different levels of tree husbandry and market support) is extended to them.

When it comes to participation of people in creating maintaining and protecting public plantations, the major motivating factor is accrual of "benefits" to them as a result of their participation in such development programme. Ecological and esthetic dimensions of tree growing are not likely to be such strong propellents. To illustrate the distribution of developments benefits to people from community plantations, a brief exposition of distribution patterns prevalent in the States of Karnataka (Gaonkar, 1990), Kerala (Chand Basha, Dece.1990), and Tamil Nadu (Forest Department-SF 1990, and Department of Economics, 1990) is in order.

In Karnataka (as per 1986 Government Order), 50 per cent of the produce from the block plantations raised on Gomal lands, C & D class lands and tank foreshores under World Bank/Overseas Development Agency - Aided Social Forestry Project is given to the Panchayats, and the remaining 50 per cent is retained by the Forest Department which sells this

at seignorage rates fixed by the Government. Of the quantity received by Panchayats, 50 per cent may be sold to marginal, small and landless labourers at concessional rates. The Panchayats may sell the remaining quantity directly or sales may be entrusted to Forest Department. Obviously, apart from fringe benefits (interms of fodder and fuel from public plantations) and employment the development gain is acrrued to weaker sections of the rural community, if and only if they can afford to buy the produce sold by Panchayats at concessional rates.

The distribution pattern of produce from community plantations in Kerala is that: (a) Poles are to be disposed of in public auction; (b) Seventy five percent of the fuelwood is to be sold through open auction; and (c) Twenty five percent of the fuelwood is to be sold at 75 per cent of the price fetched in public auction, through Depots to be established by Forest Department. Apart from fringe benefits from public plantations, the question is whether this distribution pattern would confer "enough" benefits on the needy rural people to develop "vested" interest in the creation, maintainence and protection of public plantations.

Tamil Nadu represents a different distribution pattern, under which 50 per cent of income realised through public auction of produce from community plantations is given to Panchayats (within whose limits the plantations have been raised), and the Forest Department retains a moiety of 50 per cent to meet expenditure on raising and upkeep of plantations. This 50 per cent of sale proceeds given to Panchayats are remitted to general funds of the Panchayats, and no separate account is maintained on expenditures met from accrued revenue from public plantation. However this revenue share has enhanced the capabilities of Panchayats to undertake more development

activities such as road repair, tube lights for streets, drainage, construction of office building and TV and Radio sets for the community halls. Apart from this development gain, the study by Department of Economics (1990, P.65) reports that the direct employment generation on account of Social Forestry Project execution and the indirect employment generation thanks to the development activities sponsored from out of Social Forestry Project revenue shares to the Panchayats seem to be fairly appreciable. Further, another facet of accrual of benefits to people is interms of free fuel (loppings, twigs, nails and other types of left-over). But the study makes another important observation (p.138) - The development of infrastructure by Panchayats with the help of revenue share accrued to them would meet community needs in general. But the poor households receive less benefits. The argument of supply of cheap and adequate fuel to the poor which is one of the specific objectives of Social Forestry Project is hardly achieved by the current system of revenue sharing. The harvest contractors do not spare much twigs and brush woods on plantation site to be "freely" gathered by the local poor. Hence under the above circumstances, it may be socially rationale to earmark a portion of the Social Forestry Project revenue for distribution among the weaker sections which may take care of their basic needs, including fuel and others. But the question is whether the issue of equity under Social Forestry is stretched too much.

Multi-Agency Model and Role Delineation

As discussed already, participation of people is one of the major philosophical building blocks of Social Forestry programmes, and the programme could be one of the instruments for socio-economic transformation of rural areas. People's participation in this programme is possible through their associations with the institutions which are involved in the programme. Infact, institutional innovations are to be considered as much important as technological innovations for promoting and sustaining a programme like this. In general, one of the major lessons of development efforts piled up across the developing countries is that innovations in technology perse would be far from adequate for effective wide-spread development, unless technological innovations are accompanied by institutional innovations. Further, institutions innovations have to go through the process of selection, trial and error i.e. by a process of adoptive research similar to the manner in which new varieties of crops are evolved.

Hence, "appropriate" institutions are as much required as "appropriate" technologies for supporting the promotion and sustenance of Social Forestry Programme. Emergence as well as branching of multiple institutions into the area of Social Forestry development programme has become quite perceptible during recent years, giving rise to multi-agency model. Multi-agency model appears to be favoured as an appropriate institutional arrangement for tapping the vast potential available for the development of wasteland. There are three institutions viz. Panchayats, cooperatives and Voluntary Agencies which have connections and associations with the local communities and which have emerged as major ones, apart from other institutions like village level Forestry

Committees, with a role to play in this development programme. But one of the issues which needs to be sorted out in this context is what could be the specific role and complementary - collaborative role of each of these institutions (RCPMESFP, 1990).

Panchayats, the nodal institutions at the village level, have to play key role informulation and implementation of this development programme. Their role could comprise of various facets such as creating awareness about the programme through Gram Sabhas, participating in the choice of site and species for community plantations as well as in managing and protecting them in association with Forest Department, and raising directly plantations on community land. Further Panchayats in some States (e.g. Kerala) are also involved in helping Forest Department in assessing species -wise seedling requirements for their area, in identifying voluntary agencies or individuals for operating decentralised nurseries, and in seedling distribution to people. Added to all these is the move for gradual transfer of community plantations to Panchayats so that they can manage and protect these plantations with the cooperation of people, and revenue realised by these plantations could be used for building community assets. Yet another move is to allow Panchayats to raise plantations of their choice in irrigation tanks. These moves for more direct involvement of Panchayats in Social Forestry Programme are steps forward in comparison with revenue share accrued to Panchayats from public plantations which has already been discussed.

Branching of Voluntary agencies into the area of Social Forestry development is relatively new. A recent study (Firdausi and Shivamohan, 1990) conducted in Andhra Pradesh, Kerala and Tamil Nadu reports that the

principal activity of most of the Voluntary agencies is welfare-oriented and directed to the problems of rehabilitation of the uprooted and assistance to the oppressed and service to the sick, and plantation activity is new to them and their technical capabilities for this work are not adequate. But the factors which favour their positive role in the Social Forestry Programme are their commitment and their ability to motivate people for participation. Due to their better skills in social mobilisation, these agencies could play an effective role in target group identification, in providing links to people with other organisations involved in providing development support to Social Forestry Programme, and in participating at the stage of site and species selection for community plantations.

Farm forestry covers nearly 50 per cent of the total coverage under afforestation programmes in the country. Hence farm forestry has emerged as the flag bearer of the programme, and a complement to agriculture providing it sustainability leading to optimal land use patterns with proper crop combinations. While offering scope for growing trees beyond the boundaries of official forest reserves, farm forestry provides opportunities for farm families to build tree growing activities so as to meet their multiple goals. There are many directions in which appropriate development support is required for farm forestry, and this has been illustrated from the experience of Gujarat and Punjab (Shyam Sundar and Parameswarappa, 1990). It is generally accepted that group action through cooperatives is the proper solution for providing development support to decentralised farm forestry sector. Cooperatives offer several possibilities such as tree growers' cooperatives, cooperative credit and Marketing Societies with facilities for credit (to meet the financial requirements of members during gestation period), technical guidance on tree husbandry

and for processing and marketing to ensure remunerative returns to farmers. Further these multipurpose cooperatives gradually could also establish chip board and pulping units to enhance returns to farmers through Value-addition to the raw produce from farm forestry sector. More on this later.

Forest Department, with its capabilities in technology of tree husbandry, could be effective in providing technical guidance to Panchayats, Voluntary Agencies and Cooperatives. For inducting more sustainability into Social Forestry Programme, it is imperative to recognise the role of Panchayats as nodal agencies at the grass root level, skill and committment of voluntary Agencies for Social mobilisation, the role of Cooperatives in providing development support to farm forestry, and the ability of Forest Departments in providing technical guidance. If Social Forestry Programme is to get transformed into a programme for socio-economic development of rural areas, a proper "role convergence" of the "development capabilities" of these institutions is the basic requirement.

Transition to Multi-Product Plantations

It is recalled that one of the second generation concerns is the need for shifting the emphasis dominantly from fuel-wood and timber orientation plantations to mixed species plantations to cater to multiple socio-economic requirements. Fodder development is one specific area where emphasis has been awfully inadequate. Infact, fodder development has been stated as the secondary objective of Social Forestry in Karnataka. It is communicated* that

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* Communication from Chief Conservator of Forests (SF), Government of Kerala, Trivendrum on Feb.1, 1990.

Social Forestry Wing in Kerala has not undertaken any massive attempt to fulfill the grazing needs. Considering the present urge to provide more fodder, massive pasture development schemes are on their way of implementation during the coming years.

A brief presentation of results from recent micro-level studies (RCPMESFP, 1991) conducted during 1989-90 in Karnataka and Andhra Pradesh on fodder balance is in order. In the study areas of Karnataka fodder deficit is estimated to be as high as 55 per cent, and in Andhra Pradesh as high as 52 per cent. In Karnataka, grass from all sources formed about 51 per cent of available fodder, percentage share of straw was 48, and a negligible 1 per cent contribution was from leaf fodder. Obviously, the fodder balance situation both in Karnataka and Andhra Pradesh reveals that greater attention should be paid to develop Gomal lands and tank foreshores for plantation of fodder species.

It is against these perspectives, that the concept of multi-product system of plantations under Social Forestry assumes importance (Bisalian, 1990). Multi-product system has been under way in the degraded forest areas of Thekkumpadam (near Trichur) and Othekal (near Trivandrum) in Kerala. The basic premise underpinning this model is appropriate choice of species and technology with an emphasis on meeting people's needs, the major goal of Social Forestry Programme. Multi-tier cropping with fodder, fuel and timber species coupled with V-ditch technology is the development design suggested to ensure not merely quick flow of produce to meet peoples needs but also to avoid soil erosion and land degradation.

Social Forestry Extension : A New Concept*

As stated already, inadequate attention to Social Forestry Extension as a programme component has emerged as one of the second generation concerns. Some of the opinions and judgements in this regard are detailed as below:

- Two of the observations (Nair, 1990) of the World Bank Mission on Social Forestry Project of Kerala area: (a) There is not adequate extension input in the farm forestry sector;

  (b) There is hardly any social involvement by people in raising and maintaining Department plantations, even though these plantations technically are fairly well executed.

- There is no denying the fact that most of the old forestry staff is conservation oriented and gives higher priority to the "protection" aspect of the forests rather than the "promotional" aspect of forestry. Their attitude still remains to be more of "authoritative" nature and the job orientation lacks democratic outlook. The liaison work and the publicity angle is usually neglected (Singh, 1990).

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* This section is based mainly on Bisaliah (1990), and the discussions at the workshop on "Social Forestry Extension: Present Status and Needed Changes", organised by Regional Centre For Planning, Monitoring and Evaluation of Social Forestry Programmes. UAS, Bangalore during October 25-26, 1990.

- Training in forestry was mainly oriented towards forest protection, maintenance, logging and other administrative matters. Social Forestry Wing was formed out of the existing staff of the Forest Department, and so the change in attitude has not comeup to deal with the changing scenario of people's participation (Chand Basha, 1990).

- Social Forestry Extension Programme can only be successful if it has an inbuilt system of adequate extension methodology supported by the institutional system. The present forest organisation is not able to serve the purpose as it is primarily meant for protecting and policing the forest; but Social Forestry Extension Programme has to be considered as an educational process and needs more contact and pursuations of local people. The personnel working in the Social Forestry Extension System must have adequate training in extension, educational process and in techniques of dealing with rural communities (Kishore, 1990).

- The concept of Social Forestry Extension has to go much beyond providing technical messages for tree planting and growing (Bisaliah, 1990).

Hence, there appears to be a general concensus on the need for effecting appropriate changes in organisational set up, focus and methods of Social Forestry Extension. As between developing adequately a separate cadre of Social Forestry Workers in the Forest Department and grafting social forestry extension work component into the present agricultural extension system, which one could be justified? Whether establishment of separate Vana Vijnana Kendras, as done in Tamil Nadu, could be

treated as superior to grafting the component of training programme in Social Forestry into the programme charts of Krishi Vijnana Kendras? How far Forest Departments could go in involving NGOs in their Social Forestry extension activities? Added to the need for resolving these issues are other important dimensions - provision of proper type of "bureaucratic" leadership in the department, orientation to staff in new philosophy and concepts of Social Forestry, and education methods and extension methodologies. Above all is to realise that the Social Forestry extension involves not only the provision of technical support to farm forestry, but also a social mobilization process wherein prople are to be motivated for involvement in choice of species, planting, after care and distribution of produce under community forestry.

Development Supportive Marketing System*

It is perhaps true that the main objective of social Forest Project is to produce fuelwood, small timber, fodder and other minor forest produce in public and private lands to make rural people self-sufficient in their forest produce requirements. Further, profit-maximization is expected to be subservient to welfare objectives of the programme. But the following concerns are indicative of the need for examining whether Social Forestry Project has reached a stage, wherein a critical look at making problem has become absolutely necessary.

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* This section is based mainly on the discussions at the workshop on, "Marketing and Processing Strategies For Disposal of Social Forestry Produce", organised by Regional Centre for Planning, Monitoring and Evaluation of Social Forestry Programmes. UAS, Bangalore during December 27-28, 1990.

- The large scale afforestation programme has resulted in the increased availability of forestry produce from both public and private lands. This has created great stress on the existing marketing system, requiring the need for appropriate marketing support for gearing up with expanding production (Ravi, et.al. 1990)

  In Karnataka production of Eucalyptus has out-stepped the deficit faced by the pulp industries. It is feared that its price would come down drastically, if adequate measures are not taken for finding alternative uses such as..... ..... (Shyam Sundar and Parameswarappa, 1990)

- There is a "feeling" that Social Forestry Project orientation has been on subsistance needs of forest produce, ignoring potential for increasing rural income. Hence, Social Forestry Project is to be conceived as an economic programme in case of farm forestry, with other goals of afforestation as secondary. Any economic programme must be in a position to offer tangible economic returns to farmers.

These perspectives indicating the need for developing appropriate marketing support to promote as well as to sustain the Social Forestry Programme give rise to other related concerns. How is the adequacy of the existing marketing arrangements for produce from private and public plantations? Is there not enough justification to promote different marketing models for public and private plantations, given the differences in their :

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goals? Is the policy of price support for produce from private plantations justifiable and operationally feasible? Further, is the marketing system evolved for produce from territorial forestry appropriate for produce from public plantations under Social Forestry? In case of farm forestry, the concept of decentralised production coupled with centralised marketing (through multi-purpose cooperatives) appears to be favoured. Alternatively, Social Forestry Wings could enter into the field of marketing produce from farm forestry, using the existing Forest Department Marketing outlets or establishing seperate depots for social forestry produce. (Chand Basha, December 1990). All these concerns about appropriate marketing models for produce from public and private plantations appear to be unresolved at present.

But Value-addition (especially to timber) through vertical integration (AMUL model) of production, collection and processing through group action (Gopalaswamy, 1990), wood treatment by preservatives for increasing service life (Rajan, 1990), diversification in product development and utilisation to expand market, Social Forestry Extension to comprise of education to farmers on marketing and dual pricing of the produce from public plantations to favour rural poor are some of the promotional and supportive measures favoured for evolving development-oriented marketing system for Social Forestry.

Species Composition and Bio-diversity

One of the major concerns well articulated especially by ecologists is how "adequate" has biodiversity been under Social Forestry Programme. For a critical assessment of this concern, one could formulate certain pertinent issues. First, what do the empirical evidences suggest about the composition of species under Social Forestry, and have there been "desirable" shifts in species composition over a period of time to decern something definite about the trends towards bio-diversity? Second, has the species composition under community forestry been different from that of farm forestry, and how different has been the relative share of a given species under these two broad types of Social Forestry? Third, have different models of community forestry "exhibited" differential species composition?

An attempt is made in this paper to evaluate the issues outlined above, using the data base provided by a study conducted by the Indian Institute of Public Opinion (1990) in Karnataka. With respect to the first issue, the results presented in Table-1 suggest that:

- Out of 23 million seedlings planted in sample regions/areas during a period of five years in Karnataka, Eucalyptus (36.37%), Casuarina (6.61%) Babul (4.16%), Sheesham (2.23%) and Subabul (2.05%) formed over 53 percent of total seedlings planted, apart from about 31 per cent comprising of miscellaneous species.

- Relative shares of different species have altered over a period of time. Eucalyptus had suffered a decline in its share from about 47 per cent in 1983-84 to about 24 per cent in 1987-88, and the species that had experienced an increase in their

share over a period of time are Teak, Casuarina, Tamarind, Subabul, Neem, Sheesham, Babul, Bamboo and other miscellaneous species.

The second issue of differential species-composition as between community and farm forestry is evaluated, using the results presented in Table-2. It could be seen from these results that:

- Under Community forestry, Eucalyptus accounted for about 30 per cent of total seedlings planted, Teak 12 per cent, Casuarina 7 per cent, Babul 5 per cent, Sheeshum 3 per cent, and 2 per cent each in case of Subabul, Neem and Bamboo, with miscellaneous species forming about 34 per cent.

- Under farm forestry, the relative shares of different species are obviously different with Eucalyptus alone forming 72 per cent, Casuarina 6 per cent, Subabul 4 per cent, Tamarind 2 per cent and miscellaneous species 11 per cent.

It is also reported (HWDS 1990) in a study conducted during the year 1988 in the States of Gujarat, Karnataka, Tamil Nadu and Uttar Pradesh that 82 to 90 per cent of the trees grown under Farm Forestry Programme continued to be Eucalyptus with Casuarina, Subabul and Babul as other popular species.

Yet another way to analyse species composition is to examine whether there is any substantial difference in the shares of Community and farm forestry in given species. It could be observed from Table-3 that:

TABLE-1 : Species Composition Under Social Forestry in Karnataka.

Sl. No.	Species	Percentage share in total seedlings Planted (1983-84 - 1987-88)	Percentage share of different species in total seedlings planted during				
			1983-84	1984-85	1985-86	1986-87	1987-88
1.	Eucalyptus	36.37	47.10	46.65	33.42	27.35	23.58
2.	Casuarina	6.61	5.40	4.71	8.25	7.09	8.27
3.	Tamarind	1.36	1.77	0.75	0.96	1.30	2.48
4.	Subabul	2.05	1.18	1.35	2.04	3.58	2.07
5.	Neem	1.96	1.72	1.80	1.72	2.04	2.70
6.	Sheesham	2.23	0.77	1.53	2.67	2.35	4.33
7.	Babul	4.16	1.61	5.71	3.41	4.65	5.05
8.	Teak	10.18	5.05	12.76	7.96	13.47	10.44
9.	Bamboo	1.66	0.64	1.02	1.63	2.55	2.71
10.	Arjun	1.55	1.53	0.73	1.46	1.77	2.69
11.	Black Siris	0.25	0.13	0.20	0.39	0.29	0.25
12.	Prosopis	0.39	0.31	0.70	0.23	0.28	0.35
13.	Silk Cotton	0.09	0.01	-	0.35	0.08	-
14.	Sandal	0.19	0.05	0.01	0.67	0.22	-
15.	Israeli Babul	0.03	-	0.05	0.04	0.03	0.01
16.	Kanji	0.02	-	0.00	-	0.11	-
17.	Others	30.90	32.73	22.03	34.80	32.84	35.07
	TOTAL	100.00 (23.0)	100.00 (4.3)	100.00 (5.6)	100.00 (4.6)	100.00 (5.0)	100.00 (3.5)

NOTE: Figures in brackets are the total number (in millions) of seedlings planted, as per the sample Survey conducted by the Indian Institute of Public Opinion (1990).

Table-2 : Species Composition Under Community Forestry and Farm Forestry In Karnataka ; 1983/84 - 1987/88

(Percentages)

Sl. No.	Species	Composition Under community Forestry	Composition under Farm Forestry	Composition under All Forestry
1.	Eucalyptus	30.04	71.59	36.37
2.	Casuarina	6.63	6.50	6.61
3.	Tamarind	1.30	1.71	1.36
4.	Subabul	1.72	3.87	2.05
5.	Neem	2.06	1.40	1.96
6.	Sheesham	2.60	0.15	2.23
7.	Babul	4.84	0.39	4.16
8.	Teak	11.96	0.24	10.18
9.	Bamboo	1.94	0.12	1.66
10.	Arjun	1.55	1.54	1.55
11.	Black Siris	0.28	0.07	0.25
12.	Prosopis	0.38	0.42	0.39
13.	Silk Cotton	-	0.57	0.09
14.	Sandal	0.23	0.02	0.19
15.	Israeli Babul	-	0.19	0.03
16.	Kanji	0.03	-	0.02
17.	Others	34.44	11.22	30.90
	TOTAL	100.00 (19.5)	100.00 (3.5)	100.00 (23.0)

NOTE: Figures in brackets are the total number (in millions) of seedlings planted during five-year period, as per sample survey conducted by the Indian Institute of Public Opinion (1990).

Table - 3: Percentage Share of Community Forestry and Farm Forestry in Total Seedlings Planted In Karnataka : species-wise Analysis.

Sl. No.	Species	Community Forestry (%)	Farm Forestry (%)	Total Seedlings planted during Five Year Period
1.	Eucalyptus	70.00	30.00	100.00 (83,69,737)
2.	Casuarina	85.01	14.99	100.00 (15,20,232)
3.	Tamarind	80.80	19.20	100.00 (3,13,291)
4.	Subabul	71.26	28.74	100.00 (4,71,932)
5.	Neem	89.14	10.86	100.00 (4,50,916)
6.	Sheesham	98.95	1.05	100.00 (5,11,555)
7.	Babul	98.57	1.43	100.00 (9,58,144)
8.	Teak	99.64	0.36	100.00 (23,41,954)
9.	Bamboo	98.89	1.11	100.00 (3,82,235)
10.	Arjun	84.79	15.21	100.00 (3,56,005)
11.	Black Siris	95.78	4.22	100.00 (58,175)
12.	Prosopis	83.52	16.48	100.00 (89,254)
13.	Silk Cotton	0.74	99.26	100.00 (20,238)
14.	Sandal	98.60	1.40	100.00 (44,826)
15.	Israeli Babul	-	100.00	100.00 (6,660)
16.	Kanji	98.00	2.00	100.00 (5,510)
17.	Others	94.47	5.53	100.00 (71.09,264)
	TOTAL	84.76	15.24	100.00 (23.0)

NOTE: Figures in brackets are the total number (in millions) of seedlings planted, as per the Sample Survey conducted by the Indian Institute of Public Opinion (1990).

- Out of 23 million seedlings planted during the period of five years, about 85 per cent was under community forestry and 15 per cent under farm forestry. In the case of Casuarina, Tamarind, Neem, Arjun, and Prosopis almost the same percentage share was recorded as between community and farmforestry.

- With regard to Eucalyptus and Subabul, the shares of community and farm forestry were about 70 and 30 per cent respectively.

- In case of species such as Sheesham, Babul, Teak, Bamboo, Black Siris, Sandal, Kanji and other miscellaneous varieties, the community forestry had a share of over 94 per cent.

The third issue that is outlined for examination is whether different models of Community forestry have "exhibited" differential species composition. As could be seen from Table 4:

- Under woodlots, Eucalyptus, Babul and Casuarina formed over 60 per cent of seedlings planted.

- Eucalyptus, Sheesham, Neem and other miscellaneous species formed about 90 per cent of total seedlings planted under strip plantations.

- Under Forest Department Land, Eucalyptus, Teak and Casuarina alone formed about 50 per cent of total seedlings planted, with miscellaneous species accounting for about 36 per cent.

Table-4: Composition of Species Under Different Models of Community Forestry in Karnataka.

(Percentages)

Sl. No.	Species	Wood-lots	Strip plan-tations.	Forest depart-ment Land	Others	Aggregate
1.	Eucalyptus	38.89	32.40	26.80	55.61	30.04
2.	Casuarina	8.23	1.04	6.52	-	6.63
3.	Tamarind	1.81	1.66	1.10	0.63	1.30
4.	Subabul	2.47	0.69	1.56	-	1.72
5.	Neem	1.87	5.37	1.89	0.63	2.06
6.	Sheesham	3.42	6.96	2.01	0.18	2.60
7.	Babul	13.46	1.75	2.19	2.17	4.84
8.	Teak	0.06	0.50	16.84	-	11.96
9.	Bamboo	0.61	-	2.53	-	1.94
10.	Arjun	-	0.05	2.18	-	1.55
11.	Black Siris	0.47	0.77	0.19	-	0.28
12.	Prosopis	0.28	2.48	0.27	-	0.38
13.	Silk Cotton	-	0.02	-	-	-
14.	Sandal	-	0.99	0.25	-	0.23
15.	Israeli Babul	-	-	-	-	-
16.	Kanji	0.12	-	-	-	0.03
17.	Others	28.31	45.32	35.67	40.78	34.43
	TOTAL	100.00 (4.6)	100.00 (1.0)	100.00 (13.8)	100.00 (0.1)	100.00 (19.5)

NOTE: Figures in brackets are the total number (in millions) of seedlings planted, as per the sample survey conducted by the Indian Institute of Public Opinion (1990).

Results on percentage shares of different community Forestry models in a given species are presented in Table-5.

- Out of 19.5 million seedlings planted under community forestry during a period of five years, 71 per cent was under Forest Department Land, 24 per cent under Woodlots, and 5 per cent under stripplantations.

- Between 60 to 70 per cent of Eucalyptus, Casuarina, Subabul, and Neem, and over 90 per cent of Teak, Bamboo and Arjun were planted under Forest Department Land.

- About one-third of Eucalyptus, Casuarina, Tamarind, Subabul, Sheesham and Black Siris, were under woodlots.

- About 6 to 13 per cent of Eucalyptus, Tamarind, Neem and Sheesham were under strip plantations.

The analysis performed so far suggests that farm forestry has exhibited a different species-preference pattern compared to that of community forestry in Karnataka, and the results are suggestive of the inference, that numerical dominance of species such as Eucalyptus has declined over a period of time. However, no attempt is made in the present study to test the proposition whether the species composition recorded under Social Forestry Programme in Karnataka has generated a type of bio-diversity that is "agreeable to those who argue intensively for it.

Table-5: Species-wise Distribution of Total Seedlings Planted Under Different Models of Community Forestry In Karnataka.

Sl. No.	Species	Total planted	Percentage share of Different models				
			Wood-lots	Strip-plan-tation	Forest Depart-ment land	Others	Total
1.	Eucalyptus	58,59,051	30.72	5.57	63.18	0.53	100.00
2.	Casuarina	12,92,395	29.49	0.81	69.70	-	100.00
3.	Tamarind	2,53,146	33.05	6.61	60.20	0.14	100.00
4.	Subabul	3,36,305	33.99	2.05	63.96	-	100.00
5.	Neem	4,01,941	21.53	13.46	64.92	0.09	100.00
6.	Sheesham	5,06,188	31.29	13.86	54.83	0.02	100.00
7.	Babul	9,44,433	65.95	1.87	32.05	0.13	100.00
8.	Teak	23,33,575	0.13	0.21	99.66	-	100.00
9.	Bamboo	3,77,982	7.42	0.01	92.57	-	100.00
10.	Arjun	3,01,850	-	0.17	99.83	-	100.00
11.	Black Siris	55,722	38.67	13.91	47.42	-	100.00
12.	Prosopis	74,544	17.44	33.54	49.02	-	100.00
13.	Silk Cotton	150	-	100.00	-	-	100.00
14.	Sandal	44,200	-	22.62	77.38	-	100.00
15.	Israeli Babul	-	-	-	-	-	-
16.	Kanji	5,400	100.00	-	-	-	100.00
17.	Others	67,15,828	19.51	6.79	73.36	0.34	100.00
	TOTAL	1,95,02,710	23.73	5.16	70.82	0.29	100.00

The experience of Kerala (Chand Basha and Zachariah 1990) is also suggestive of the inference that the relative importance of different species has altered over a period of time in response to opinions and judgements. It could be observed from Table-6 that the percentage share of "objectionable" species such as Casuarina, Acacia.A, and Eucalyptus had experienced drastic decline within a span of three years, and the percentage share of multipurpose and fruit-bearing trees had considerably increased.

Table-6: Shifts in Shares of Different Species Under Social Forestry Programmes In Kerala.

Species	Percentages		
	1986-87	1987-88	1988-89
Ailanthus	25.10	24.53	28.43
Casuarina	20.00	6.66	7.07
Acacia Auriculiformis	10.00	8.58	0.76
Eucalyptus	2.00	1.54	0.14
Tectona Grandis	5.00	3.54	6.03
Subabul	3.00	2.60	1.78
Mahogony	3.00	4.38	7.03
Silver Oak	4.00	7.19	14.54
Fruit Bearing Species	6.00	5.41	12.69
Flowering species	21.90	29.28	20.32
TOTAL	100.00	100.00	100.00

Bankability and Choice of Species

The present section is intended to illustrate the proposition that choice of species is also governed by bankability of a Social Forestry Development Programme. One of the development supportive assistance extended by NWDB to promote Social Forestry is Margin Money Assistance Scheme (NWDB, 1990). There is one major premise underpinning this scheme - a number of socially beneficial afforestation and wasteland development projects are non-bankable, because they are not fully economically viable. The scheme is designed to provide financial support to make marginally non-bankable, but socially beneficial projects economically viable to meet the viability criterion of NABARD so that institutional funds flow into such projects. Institutional funds will obviously reduce the burden on central and State Government Budgets. Yet another development premise Governing the scheme is that the choice of species and the technology should be such that returns are available in short rotation and the project should be capable of repaying the loan.

Karnataka cashew Development Corporation has been operating a Fuel Wood Project under the Scheme in the Districts of North Kanara, South Kanara and Chickmagalur since 1987-88 (RCPME SFP, Nov.1990). In its project proposal, the corporation had indicated 11 individual species and fruit yielding trees like Mango, Jack, Jamun, Cashew etc., The NABARD had approved the planting of casuarina and Acasia, in addition to retaining the existing tree growth and planting of miscellaneous species like Mango, Jack, Jamun, Hopea, Cashew etc., to the tune of 10 per cent of the species composition. The point that emerges from this illustration is that choice of species tends to be restrictive, when bankability criterion has to be met. Added to this is the need for ensuring compatability of public policies and of the mandates of different public institutions.

Concluding Observations

The paper has been an attempt to examine some of the second generation concerns of Social Forestry Development programme, and to indicate the options for meeting these concerns. The pertinent question is why we failed to anticipate these concerns and get "well" prepared to meet them. In this context three development dictums (Bisaliah,1991) could be examined to place this question in proper perspective.

- First, we tend to assume that because a certain goal is desirable it must be feasible as well. The pursuit of the desirable may often be infeasible, wasting scarce resources. Further, we are not to assume that because a certain goal is feasible it must be desirable as well. Opting for programme components simply because they appear to be feasible is likely to preclude the search for other more productive options.

- Second, the intellectual cogitation approach assumes that we are equal to the task of thinking through solutions to the problems. Comprehensive planning is a form of intellectual cogitation that is arguably desirable, but wholly infeasible.

- Third, the social interaction approach is skeptical of our capacity for comprehensive planning as stipulated under intellectual cogitation approach, and it relies on acting out solutions through social pressure of bargaining and other interactive techniques. But this tends to ignore the dictum that what is feasible is not always desirable.

It follows that the point of convergence of desirable and feasible is difficult to hit at. Perhaps this is much more so in the case of Social Forestry Programme under which the goals of participant actors are not likely to converge. The emerging concerns could be attributed not merely to our inadequate attention to intellectual cogitation, nor merely to our "let us get going attitude", but also to inevitable "learning by doing" process involved, while formulating and implementing a project like this. Hence interactive acting-out approaches are inevitable to meet the second generation concerns of Social Forestry Programme. In this regard, the key role of institutions in making interactive acting-out approaches effective needs to be kept in view. Added to this is the need for admitting that "appropriate" institutions like "approriate" technologies are to be evolved through trial and error to meet the emerging concerns of the programme, and there are always lags in institutional innovations.

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THE LOCAL SELF-GOVERNMENTS OF INDIA AND THE GEOMETRY OF BIODIVERSITY CONSERVATION: THE ROOTS OF THE INCOMPATIBILITY.

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THE LOCAL SELF-GOVERNMENTS OF INDIA AND THE GEOMETRY OF BIODIVERSITY CONSERVATION: THE ROOTS OF THE INCOMPATIBILITY.

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Conservation of bio-diversity is today a global environmental concern. The international community is steadily inching towards a global convention for the conservation of the unique variety of the biological resources of the planet. Notwithstanding the international concern, for *in situ* conservation of bio-diversity to be a reality, its local human conservers ought to be 'socio-ecologic communities' inhabiting an 'ecological' space.

This paper analyses why such local conditions do not obtain in India and why the 'modern' local self-governments of India do not capture the 'ecologic' geometry of bio-diversity conservation.

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THE LOCAL SELF-GOVERNMENTS OF INDIA AND THE GEOMETRY OF BIODIVERSITY CONSERVATION: THE ROOTS OF THE INCOMPATIBILITY.

During the recent Gulf war while the world was anxiously following the course of the massive oil slick in the Persian Gulf, an office-bearer of an international voluntary organisation proclaimed the possibility of the war producing another ecological holocaust - the destruction of the two largest gene banks of the Middle East viz. Tel Aviv in Israel and Alleppo in Syria. Explaining the significance of these gene banks, Renee Velve of the Genetic Resources Action International (GRAIN) proceeded to state "The world has depended on the Middle East farmers for a long time. The crops and semi-wild plants that they grow and use contain unique forms of drought resistance that will be useful to maintain farming systems against the impact of rain failure and expected desertification. Let us hope that the farmers survive to sow these future seeds".[1] Fortunately for the world, the gene banks of the Middle East survived the Gulf war. Less fortunate have been the gene banks of India. The historical subversion of the traditional ecological communities and their local governing authority by the State in the pre-British and the British periods and their replacement by non-ecological communities and 'statutory' Panchayat Raj Institutions, conceived in an non-ecological space, largely explains the steady erosion

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of India gene - banks. In a world which is gradually inching towards a global agreement for conserving the biological variety of this planet, the absence in India of local self-governments, sensitive to the geometry of biodiversity conservation is an incongruity.

This paper attempts to explain why India's present-day local self-governments cannot conserve the country's bio-diversity, unlike their traditional predecessors. The paper begins by bringing out the geometrical essence of bio-diversity conservation and the local conditions necessary for capturing the 'geometrical' essence. The paper proceeds to explain why the traditional Panchayats or the local governing units of India were adept to the conservation of the variety of nature. The paper then traces the systematic deconstruction of local space attempted in India by the centralised State both during the pre-British and British periods which not merely served to destroy the traditional 'ecological' local governing entities of India, but in their substitution by 'non-ecological' local self-governments, indifferent to the natural variety of plant life in the country. The concluding part of the paper surveys how the present-day Panchayat Raj Institutions in India conceived largely within the 'non-ecological' space, created by the British are inadequate to the task of conserving the bio-diversity of the country.

The Geometry of Bio-diversity Conservation and the Traditional Local Governing Bodies of India.

THE GEOMETRY OF BIO-DIVERSITY CONSERVATION:

All natural resources are distributed in space- so are human communities. Human communities appropriate natural resources for their day-today energy requirements. Appropriation of natural resources is mediated by the social order. Social mechanisms regulate the nature and pattern of appropriation on natural resources. In the traditional agricultural communities all the energy needs were met endogenously. Similarly the conditions of social production of these communities were dictated by the natural limitations. The social space of such agricultural communities, consisting of the exploiting and exploited classes, was dependent upon the sustainable use of natural resource since this was crucial to the reproduction of the social order. The socio-economic order existed in a symbiotic relationships with its natural resource base, one serving to reproduce the other.

Human Communities which have a symbiotic relationship with their natural resource base are socio-ecological communities (or "Eco-system people" as Dasmann puts it[2]) existing in a socio -ecological "space". Since, as we have pointed out, such communities derive all their needs in situ, they attempt to draw all their needs of food, fodder, energy and medicines from their own natural resource base. It was natural

for these communities to have a vital stake in conserving the natural variety of biological resources for satisfying their multiple needs. Therefore, socio-ecological communities are pre-requisites for the conservation of the diversity of biological resources.

The ideology of a socio-ecological community is "natural heterogeneity". It is this ideology, which cha racterises the "space consciousness" of such communities both within and outside its boundaries. The social division of labour is conditioned by the natural variety of the ecological space. Different classes or social groups relate themselves differently to different natural resources for their economic reproduction. Since the community cannot survive without the survival of its social division of labour, the local community organisations not only upheld the ideology of natural heterogeneity but also enforced many regulations and controls to ensure that the diversity of natural resources was protected. The ideology of natural heterogeneity was emphasised by socio-ecological communities in inter-community relationships. Socio-ecological communities were separated by their natural or ecological differences. In turn, the natural or ecological difference between communities served to reinforce their identity as autonomous natural resource users within their respective niches.

It follows that the geometry of bio-diversity conservation is a complex concept which is based on the objective and subjective existence of a local socio-ecological community in an ecological space. We now

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take a look at how the geometry of bio-diversity conservation was captured by the traditional Pancha yats of India.

THE TRADITIONAL LOCAL SELF-GOVERNMENTS OF INDIA:

There exist no systematic account of the history of Panchayats in India. There are even disputes amongst historians regarding the unit of local self-government in India in the ancient and pre-medieval periods. In view of these information deficiencies about traditional Panchayats and disputes regarding their jurisdiction in the distant past, a picture of traditional Panchayats can only be framed on the basis of the available historical material on rural societies of India in the ancient and pre-modern periods.

Sociologists, historians and administrators speak of the existence of caste Panchayats (these exist even today in State like Uttar Pradesh and Haryana), an assembly of the ruling body of a given caste meant to regulate the social mores and customs of its members.[3] In mono-caste communities, it is likely that the caste Panchayats exercised administrative, economic and ecologic functions in addition to their regular social functions. Other than caste Panchayats, studies on Indian Society speak of "Panchayats" as local bodies exercising administrative, economic, political and natural resource management functions-in short all functions necessary to maintain the well-being of the community covered by it.[4] And there is evidence to show that in all these functions, the traditional Panchayats

were autonomous and no interfered with, by the higher level of political - administrative organisation, except perhaps for fiscal or political purposes.

As regards the jurisdiction of traditional Panchayats, we do not once again have any definite evidence. This is because historians do not agree on the basic unit of local self-government in ancient and pre-medieval India. Thus the traditional historical view that local self-governments were village based has been by and large questioned by recent historians and for valid reasons. Recent historical studies establish that villages were not "Republics" as Metcalfe assumed and that in fact, social and economic reproduction occurred in a larger area than a village (say a group of villages or a micro-region).[5] Logically this view also considers units of local self-government to be larger than an area covered by a single village. It also follows therefore, that Panchayats need not have been confined to a village. A traditional Panchayat could have embraced a group of villages.

But what is significant to us is the criterion on which historians on both sides have sought to determine the unit of local self-government in ancient and pre-medieval periods. The criterion was "self-sufficiency". And this criterion of self-sufficiency was not merely "social"or "economic", but also "ecological". Thus those historians who considered a village to be a self-

sufficient "Republic", supposed it to be not only "socially complete" (in terms of all castes) "economic self-reproducing" (in terms of economic activities) but also more fundamentally "ecologically self-contained" (in terms of having all ecological regimes necessary for economic and social self-sufficiency). This would be evident from the stylised Vedic descriptions of a village as consisting a central inhabitation place, followed concentrically by plough lands, grazing lands, and forest and water sources.[6] That such geographical description underlined the significance of "ecological self-sufficiency" goes without saying.[7] Given the natural resource - based pastoral and agrarian economics of the past, it also needs no emphasising that it was this ecological self-sufficiency which underlay the economic and social, self-sufficiency of the autonomous local communities irrespective of whether these communities were contained in a village or extended to areas larger than that of a village. Thus even the refrain of those historians who questioned the notion of village self-sufficiency was like-wise "ecologic". These historians were of the view that villages were not socially and economically self-sufficient as they had to share in the use of common natural resources (such as water, forests etc.).[8] It does not require more arguments for the fact that a unit of local self-government in the historical past was based on "ecologic properties" in which management of all natural resources including common natural resources including common natural resources was considered vital

for community reproduction. Panchayats, the traditional unit of local self-government thus had a "natural resource dimension" as they existed in an ecologic based "social space". It also followed that the jurisdiction of traditional Panchayats coincided with ecological boundaries and that "economic and social self-sufficiency" was conditioned by ecological self-sufficiency.

Now we examine how the ideology of natural heterogeneity operated in the case of the Traditional Panchayats of India. As we have pointed out, there are two levels at which the ideology of natural heterogeneity can be deemed to operate for socio-ecological communities viz. internally and externally. We take the internal dimension of natural heterogeneity of Traditional Panchayats first.

In ancient India, the social reproduction of endogamous castes was upon conditioned by their relationship to the natural resources. Different castes related differently to natural resources and to different natural resources.[9] This is evident from some of the ethno-ecological studies conducted for some parts of India. Gadgil and Iyer, referring to the traditional societies in Uttar Kannada District of Karnataka, bring out how different caste groups specialised in utilising different natural resources. They also mention how it was the task of traditional village councils to ensure that this social segregation of the natural resources was observed by the community. As is clear from the study, the knowledge of the biological and physiological properties of natural

resources acquired by the respective user castes pl yed an important role in the careful husbandry of natur l resources,[10] while the local community organisatio s ensured that natural resources meant to be used by . e caste was not appropriated by others. Since, as we have pointed out, traditional local communities of India were largely self-sufficient and depended on their own natural resource base for meeting their diverse needs, their stake in protecting bio-diversity was much greater.

Coming to the external dimension of natural heterogeneity studies by Stein (1980)and Karashima (1985) indicate that the local communities of India were ecological territories, separated by ecological boundaries. The prevalence of myriad soil classification and land revenue assessments systems and the autonomous control exercised over management of common lands and forests by traditional local Panchayats, all point to local management of natural resource use, by local level organisations of the socio-ecological communities in India in the distant past.

Obviously this geometry of traditional communities was not compatible with the centralised State order which the imperial dynasties of India and the later the British Colonial State aimed to foist. The task of these imperial powers was not only to subjugate these autonomous local communities, but also to de-construct the local space of India, so that local communities would be mere appendages of the centralised State.[11]

We now examine how the historical process of local

space deconstruction in India.

THE DECONSTRUCTION OF LOCAL SPACE IN INDIA:

Historical information is lacking on the precise nature of the changes wrought on local socio-ecological communities by the State. However historical studies on the agrarian societies in the pre-medieval and medieval periods throw some light on the changing geometry of these communities. Thus Karashima, in his study of South Indian history and society, traces the deconstruction of local ecological space in South India to the middle period of the Chola Rule when powerful Chola Emperors like Raja Raja I, Rajendra I and Kulottunga I, attempted to establish a centralised administrative network by "destroying the barriers between "nadus", the fundamental ecological units of the local communities. Coming to North India, some evidence of the "deconstruction of local communities" is provided by Habib in his survey of the Agrarian Society of the Sultanate period.[12] Habib describes how from the period of Alludin Khilji the "Khots' and "muqaddams", the head-men of rural communities, were faced with severe restrictions on their revenue raising powers by the State. Habib also points to the role of the "iqtas" (an instrument of the Sultanate Kingdoms for transferring agrarian surplus to the ruling class and its soldiers) in making inroads into the autonomy of the local communities. As Habib describes "with the establishment of the Sultanate, conditions largely remained the same, but a gradual process seems to have begun

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that ultimately converted what were autonomous principalities into real "iqtas".[13] Gradually during the Lodi period, the system of iqtas was replaced by "Sarkars" and "parganas" (somewhat equivalent to the modern District) which were territorial power-centres in a revenue space. This continued during the Mughul period.[14] From all these descriptions, it is evident that the local ecological space of peasant societies was sought to be replaced by a 'fiscal-cum-administrative' space. However, despite the attempts at a new spatial order, the old "ecological space" was not totally deconstructed in pre-British India except for some erosion of the traditional fiscal powers of total communities.[15] This could have been due to the frequent change in dynasties denying a continuity to the process of centralisation of State power.[16] As Stein (1991) notes rural communities in India, even as late as the 18th century, continued to exist as coherent and unified entities in resisting the unjust demands of the centralised State. Clearly there is no evidence to show that the geometry of the socio-ecological communities was substantially disturbed during this period.

The British Raj in India, however, systematised the process of the centralisation of State power, through a fundamental deconstruction of India's local space. For each province the British established a system to govern them in accordance with the colonial interests. Since land revenue was to be a major source of income for the British Empire in India, a system to collect land revenue had to be set-up. Accordingly in Bengal, parts of Madras and the

United Provinces and in the Central Provinces, the highest class of intermediaries, standing next below the Government (the Zamindars) were accepted as payers of revenue. In Bombay, Assam, Burma and the larger part of Madras, land revenue was collected from the "ryots", while in the remaining parts of the United Provinces and in Punjab, representatives of the village communities were chosen as intermediaries (the Mahalwaris). But irrespective of the existence of intermediaries, the structure of British Administration was similar for all these provinces.[17] The territory constituting a Province was repeatedly sub-divided to form Administration units. The most important of these units was the "District" headed by a Collector. Though his specific nature of duties varied according to the character of land tenure system, the Collector's basic responsibility was towards land-revenue collection.[18] The "District" was a large "fiscal-space" and imposed itself on the traditional local socio-ecological spaces. The sub-units of the District viz., the Sub-Divisions, or the Taluks were established from the fiscal point of view. The District Collector personified the new "power centre" and his subjects were not "communities" but tax-yielding "intermediaries" or "ryots". The cadastral survey of a District which yielded a "cadastral map" or a cadastral "record" was primarily a fiscal record prepared to identify the persons under the fiscal power of the State.

The real proof of the fact that a "District" was structured as a non-ecological local power centre by the

State, lies in the "main circuit system" of land survey introduced by the British in 1830. Whereas the erstwhile "Parganas" or "Subhas" was an aggregate of a group of villages, the main circuit system was based on a top-down approach whereby main traverses run down from the District were connected with the triangulation enclosing areas of 100 to 200 sq.miles. These enclosed areas were then sub-divided by minor traverses to artificially determine village boundaries.[19] Obviously this system which was designed for the "convenience of revenue administration" could have resulted in the tampering of traditional ecological boundaries of local socio-ecological communities.

More was to follow when the British Colonial State decided to "rationalise" or "standardise" the system of land revenue assessment. Soil classification followed a standard pattern, so also land revenue assessments. The introduction of a centralised "top-down" survey and settlement system not only resulted in lessened [illegible] the local communities in collection of revenue but also in the extraneous influence in their crop husbandry systems.[20] Even worse for the local communities was the fact that this centralised survey system brought the gaze the British State to the immense potential of the wastelands adjoining Ryotwari villages and Zamindari estates. Several restrictions were imposed on their use by communities.[21] By the mid-19th century, on a further realisation that wastelands contained tree growth and plant wealth of immense value to British industries back home, the Colonial State embarked

upon a massive programme of appropriation of large tracts of common land by constituting/reserving them as State Forests.[22] This denied a vital ecological regime of great importance to the traditional socio-ecological communities. These State Forests were to be for use by the State with certain rights, concessions and privileges thrown to the users. But here again, while according to the users certain rights, concessions and privileges, the Colonial State recognised only individual rights. This further served to undermine community rights and community organisations such as the traditional Panchayats. The concept of the "community of users" (i.e. the socio-ecological communities) was effectively exercised.[23]

The de-recognition of community rights to forests and common lands and their substitution by "individual" rights had an interesting social implication. The principal of "individuation" which was introduced for the erstwhile community natural resources sowed the seeds for the "free-rider" phenomenon to these community resources. The selective social predation of natural resources (referred to by us in the first section) was replaced by an "anarchic" mode of exploitation, which led to the over-exploitation of those natural resources open to the users by the State.

To sum-up the "deconstruction of local space" systematically effected in the British period had the following implications on the traditional socio-ecological communities in India.

(1) It destroyed the natural inter-community differences.

(2) It successfully removed the sources of natural heterogeneity from the control of socio-ecological communities.

(3) The traditional social structure of natural resource use (i.e. social diversity in natural resource control and use) was un-settled and undermined. The cumulative consequence of all these processes was that the "natural heterogeneity" of the traditional local communities was eroded. But the inauguration of the new local community in India based on the ideology of non-natural homogeneity, had to wait for Lord Mayo and Lord Ripon.

III. THE EMERGENCE OF A NEW IDEOLOGY OF LOCAL SPACE:

While the depradation of the traditional socio-ecological communities was going on in the matter described in the previous section, Lord Mayo in 1870 and Lord Ripon in 1883 introduced[24] their famous resolutions for establishing local self-government in British India. This neat fitting of the newly, created local Panchayats into the administration space of the "District" is very well testified by a well-known British administrator as a "reconstitution for new purposes and on an altered foundation of a body which had formally a traditional authority.[25] (emphasis added). The "new purposes" adverted to above was th e dissemination of the new ideology of "non-natural homogeneity". The type and list of functions delegated to the newly-created Local self-governments in British India amply bears out

our assertion. Thus the District Boards, the Union Boards and Panchayats were entrusted with the functions of dealing with village lands , ponds and wells, drainage, public health and education.[26] For each of these functions, the State prescribed elaborate but 'standaridised 'guidelines such as for example, uniform sanitation, education and public health norms.[27] The distinctive traditional practices of dealing with these matters by individual local community organisations was lost. All the same, by delegating only the aforesaid functions or by defining what a Panchayat "could do" the State was in effect conveying what these local bodies could not do. The net result was that Panchayat Raj Institutions were structured to function within the administrative space of the District for carrying out certain activities "prioritised" by the State. These activities were by nature "standardised" ones aimed at effacing the natural heterogeneity of local communities.

Even in the post-independence period, though Panchayats were enshrined prominently as Directive Principle in the Constitution of India,[28] the structure of local self-government was conceived, once again within the administrative space conceived by the British. Thus the fulcrum of political decentralisation in independent India has been the "District". To be fair to the architects of Panchayat Raj Institution in Independent India , they did attempt to secure a break from the administrative geometry of the district. The Balwantrai Mehta Committee recommended the community development block (a group of 100 to 160 villages) and not the

"sub-division" or "taluk" as the middle-tier of the Panchayat Raj structure. But the block was not an ecological entity - it was merely a development unit.[29] Much later, the Ashok Mehta Committee, emphasised on a change from the "Block" to the "Mandal" as the middle - tier entity. But this proposed change was again on purely development concerns that from the view-point of ecological contiguity and community boundaries. Thus the present-day Panchayat Raj Institutions still continue to be operationalised within the foundation of the "administrative" space of the District. But equally significant is the functional re-orientation that accompanied the geometrical change. While the traditional Panchayats was based on a total identity with the community of users of common resources and impliedly for the discharge of community - oriented functions, the new Panchayat institutions are functionally oriented to the dissemination of standardised services of the State in the realms of education, public health and rural technology, all aimed at effacing the community identities and promoting instead "a non-community identity". In the scheme of functions which devolved on these Panchayats community management of common natural resources did not find a place, as compared to the traditiona l period when it was practised as the most significant function.[30] The structuring of Panchayat Raj Institutions in India, thus continue to be on the same non-ecological foundations as in the British period.

These Institutions are still perceived as the carriers and disseminators of State-designed programmes and technology. The success or failure of Panchayat Raj Institutions are adjudged in terms of their efforts in successfully carrying out agricultural practices, afforestation programmes and other measures as guided by the State.

IV. PANCHAYATS AND THE GEOMETRY OF BIO-DIVERSITY:

Today, the threat to India's bio-diversity comes from two sources. (1) The spread of modern agriculture technology, which is slowly replacing the natural genetic material indigenous to the country, by the exotic high-yielding varieties of crops. (2) The rapidly spreading malaise of the degraded common lands which has resulted in the devastation of these gene-reservoirs. The second source is by far more potent as its spread has not been socio-economically constrained as the first. For instance Jodha [33] in his survey of about 82 villages drawn from 7 major States of India mentions about the abject deterioration of common lands in the majority of the surveyed villages. Barren, common lands are the rule in India and this is mainly due to the indifference of Panchayats towards these invaluable resources. Here and there we do come across stories of the successful "participation" of Panchayats in the re-afforestation programmes of sponsored

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by Government Departments, aimed at raising fast growing tree species for accelerated supplies of "fuelwood" and "fodder". But there are indeed very exceptional cases, where Panchayats in India have taken up the management of common land for conserving their bio-diversity, without any "extension" programme of the Government Departments.[34] On the contrary, we have before us, stories of the Chipko Andolan in the Uttar Pradesh Hills and the Kusnur Satyagraha in Karnataka where the non-Panchayat grassroot environmental movements have played a stellar role for the protection and conservation of bio-diversity.[35]

Clearly the negative trends in bio-diversity conservation noted by us above are the results of or reactions to the "deconstruction of local socio-ecological space" attempted by the centralised State power in India in the historical past. Apart from the negative effects of the non-natural resource functional structure, Panchayats in India physically operate in truncated ecological spaces. It is not un-common to find a group of villages with an ecological contiguity (by virtue of their location "says" in a watershed) being "administratively" distributed amongst different Panchayats resulting in their inability to come together in the management of the natural resources of the watershed. Alternatively, there are situations in our country where a village community which is ecologically self-sufficient finds itself swamped in a Panchayat which may consist of other villages not

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necessarily having "ecological properties". It is natural under the circumstances for the Panchayat concerned to be indifferent to the bio-diversity conservation in the "ecological village". These situations could be traced to the administrative principles of local space organisation initiated during the British period.

To conclude the thrust of this paper is to stress on the fact that the present-day local self-government organisations in India do not capture the geometry of bio-diversity conservation. For bio-diversity to be judiciously conserved, local organisations ought to operate in an ecological space and function as representatives of the ecological communities. They ought to embody the principle of natural heterogeneity. The present-day Panchayat Raj Institution in India have been established in an administrative space and have been structured by the Centralised State power, to function as disseminating 'local' points of 'standardised' "non-natural" technologies of the State. Indeed the philosophy of 'standardisation' implicit in these local organisations constitutes the very anti-thesis of 'diversity'. The specificities of local knowledge, local skills and social diversity in natural resource use, have therefore no place in the scheme of the present-day Panchayat Raj Institution in the country. It is no wonder that the task of conserving the diversity of biological resources in India has been progressively

taken over by the voluntary grassroot environmental mo ements in certain parts of the country- movements wh ch transcend the "administrative territories" of th local self-governments and seek to mobilise the latent "socio-ecological" potential of the rural population.

(The views expressed in this paper are personal and do not purport to be that of the organisation for which he works)

N O T E S

1. See news-item "Plant Gene Banks in Gulf threatened by war", Economic Time, 23rd February, 1991. The concept of Bio-diversity can be seen in terms of two 'differences'. (1) The difference between the biological variety of natural eco-systems and the homogenity of 'constructed' ecosystems. (2) The difference between local, or endogenous biomaterials and exogenous and/or genetically-contrived biomaterials. In this paper, we are mainly considering the first 'difference' and that too only in relation to botanical variety.

2. Dasmann (1974) distinguishes between "eco-system people" (the local ecological communities) from "biosphere people" tied to the global technological civilization. The means of reproduction of biosphere people are thus drawn from a larger spatial system than from narrow community boundaries.

3. See Strickland (1938) in Blunt (ed) (1938, p.365). Caste Panchayats were basically an assembly of the ruling body of a caste. Among the superior castes such Panchayats were impermanent, meeting only when summoned, but in a great majority of the castes the "Panchayat" was a standing body ruled by a permanent Committee since most of their functions related to breaches of social/customary laws such as marriage laws, etc. It was more or less a jury for awarding penalties/punishment (see Edward Blunt 1938, p.53-55 and p.77).

4. Burton Stein's use of the concept of "peasant ecotype" to define local self-governing entities (the Nadus) in Medieval South India is illustrative of the significance of local ecology and its management by peasant "local governments".

A similar notion is suggested in the concepts of "fragmented" or "framentation of" local power employed to define Indian feudalism in the period before 1200 A.D. (See CEHI, Vol.I, Chapter I and III, p.9-14 and p.45-52).

5 This controversy is well discussed by Karashima (1984, page 40-43). The notion that Indian Villages were miniature republics can be traced to Charles Metcalfe's minute of 1830. H.J.S. Maine and Karl Marx had also implicitly accepted that concept. As Karashima mentions the myth of 'Village Republics" was exploded by the many village studies conducted in India in the 1950's which revealed that not all villages had the social or economic conditions for independent existence, as assumed by Metcalfe and others.

6 Cited by Amita Ray (1964, p.25) from the Rig Veda. Ray also cites Panini to suggest that village boundaries were marked by natural boundaries such as forests, thickets, rivulets, ponds, jungles.

7 Going by the features of a village as described in the Rig Veda, it should have a variety of ecological regimes (agriculture land, ponds, rivers, forests and pastures) to enable feed its population with foodgrains, animal proteins and energy-in short all the "ecological conditions" for its survival without any outside dependence.

8 Stein (1980) by considering a peasant ecotype to be of a larger unit (the "Nadu") than a village

and Karashima (1985) by pointing to the sharing of tanks and water regimes by a group of adjoining villages, have questioned the notion of the "ecological self-sufficiency" of villages as assumed traditionally by historians and administrators.

9 Not all castes relate to their physical environment in the same manner. The upper castes of Indian society did not engage themselves directly in appropriating and using natural resources. But each caste had a stake in specific natural resources. For instance, the castes in Indian society engaged in carpentry had a stake in conserving the wood resources relevant to their profession. Similarly the upper castes had a stake in conserving the "sacred groves" of the community since the existence of these groves was germane to the ideology of the "sacred".

10 See Gadgil and Iyer (1988) and more recently Gadgil (1991).

11 The advent a new social order, heralds a "re-assertion of space" (Soja, 1989). This "re-assertion" is achieved by "deconstruction and re-constitution" of space. "Spatial deconstruction" means the reinscription and resituation of elements in space and ascribing of new meanings to the space changed thus.Reconstitution of space is achieved on the foundation of a deconstructed spatial order.

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Reconstitution is what provides the institutionalisation of the new social order. The imperial dynasties of India and later the British Raj deconstructed the local space of India by destroying the local organisations of the autonomous socio-ecological communities. This was performed by removing their powers and privileges and fusing them to the new but more centralised centres of power. Side by side these imperial powers also created the conditions for effacing the ideology of natural heterogeneity. This was achieved by tampering the ecological boundaries and the ecological space of the traditional socio-ecological local communities. As we shall show in the paper it was on the foundation of the deconstructed local space that the British Raj reconstituted the Panchayat Raj Institutions.

12 See Karashima (1984, p.xxvi, Introduction) with regard to South India and Habib (1982) for North India during the Sultanate period. Habib mentions how Allaudin Khilji prohibited the Khots (the local ruling peasant aristocracy) from levying their own cesses on the villagers.

13 See Habib (1982, p.69). "Iqtas" were a mechanism devised to collect land revenue from the peasantry and for distributing it among the members of the ruling class. The "Iqta" was a territorial assignment.

14 Habib (1982, p.24-25).

15 As Habib (1982, p.56) states "even when the authority of the Sultanate over the country asserted more vigorously, and an arbitrary tribute was "replaced" by a land tax assessed on the peasants, the older aristocracy still had a place". Elsewhere Habib substantiates the proposition, while referring to the changed fortunes of the "Khots" and "Muqaddams" in the post-Allaudin Khilji period. Thus he mentions how Ghiyazuddin Tughlaq did not persist with the hard measures against the khots and muqaddams and in fact "exempted them from paying tax on their cultivation and cattle", a concession earlier denied to them by Allaudin (p.55). The same was the situation during the Lodi period. Clearly all these observation go to prove the fact that centralisation of State power was not an irrecovable trend in the pre-British period since imperial dynasties/rulers varied in their strengths.

16 See Stein (1991, p.16). In fact, as Stein contends it was only after the period 1828 to 1834 i.e. after Lord William Bentinck, that social relations in India were transformed due to the invigorated thrusts of British capital in India. This in turn was facilitated by the "modernisation"in transport and banking. Until 1828 the Indian countryside still consisted of thousands of communities whose historical development provided each with characteristics that were not unique, but in their detailed and specific forms did not extend

beyond narrow locales. In addition, there was a consciousness of place that was marked in several significant ways....."(Stein, p.5) (emphasis added). Clearly the imperial dynasties of pre-British India did not make much headway in "deconstructing the local socio-ecologic space" as the British Raj were to accomplish later.

17 See "The Indian Empire (Vol. IV, Chapter VII, p.204-241).

18 That the District was a product of a centralised State apparatus is best exemplified in the following description of the British administration set-up-"the system of administration in both regulation and non-regulation provinces is based on the repeated sub-division of territory, each administrative areas being in the responsibility of an official who is subordinate to the officer next in rank above him". (The Indian Empire, Administration Vol. IV, page 48). Clearly the ecological boundaries of erstwhile local self-government did not have any significance in the organisation of administrative territory unless it happened to coincide with the administration space. The elements of the Administration Space were the revenue-yielding estates or lands held by the Zamindars or ryots or a Lambardar and not "local communities" or the "ecological space" occupied by these communities.

19 See for a description of this top-down survey method,

"The Indian Empire, (Vol.IV, Chapter XV, p.481-507)".

20 See "The Indian Empire" (Chapter VI , p.211).

21 See Baden - Powells' "Forest Law" (1893). As Baden - Powell states, "at first, for some years, the Government took no notice of the waste, which adjoined already occupied estates. People seized on it and encroached and settled on it as they pleased .....Gradually the Government realised the value of wastelands and rules began to be made for their disposal by lease or sale to the intending cultivator....." (cited by W.A. Gordon, 1955, p.322).

22 For a detailed discussion on the nature of different categories of forest lands created by the Indian Forest Act, see Damodaran (1990).

23 The Indian Forest Act of 1878 and 1927 did not recognise any rights, concessions or privileges for any community. Rights were individually settled by the Forest Settlement Officer. Similarly concessions or privileges were granted to an individual and not to a community. Clearly it was not the intention of the British State to recognise the traditional local communities or their collective rights.

24 The Resolution of Lord Mayo was originally aimed at developing a self-government of the local people to ensure more effective local interest in supervision/ management of funds devoted to education, sanitation, medicine, charity and local public works. Mayo and Ripon are credited with the formation of municipalities in Indian cites. (See "The Indian Empire, Vol.IV, Chapter-IX).

25 Strickland op.cit(p.365).

26 Ibid (p.364).

27 In 19[illegible], the British Government in India formulated a sanitary policy. Similarly a Central Advisory Board of Education was set up the British colonial State to ensure that modern education was provided to the villagers in India in the appropriate media of instruction. All these initiatives were aimed at standardising health, sanitation and education in order to overcome the "squalor and dullness" of village life on account of "their non-contact with the outside world" (see Blunt (ed.)(1938, p.257).

28 Reference is to Article 40 of the Constitution of India.

29 The constitution of community Development Block for integrated rural development was the offshoot of the agricultural-based development strategy of the First Five Year Plan. The concept of "Block" was recommended by the Balwantrai Mehta Committee.

30 For example one of the observations of the Balwantrai Mehta Committee on Panchayats were as follows:-

> "We do not refuse to contemplate the possibilities of charging these bodies with certain other functions such as the maintenance and development of small forests, ..."

But as the Committee proceeded to add, "only after the government are satisfied that these bodies are functioning as efficient democratic institutions should they consider the transference to them of some or all of these extra duties and responsibilities....." (cited by Ramachandran, 1988).

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31 The additional functions which devolved on the Panchayat Raj Institutions in the country (following the recommendations of the Balwantrai Mehta Committee) included development of agriculture, improvement of agricultural practices, minor irrigation works, animal husbandry and disaster management.

32 It is well-recognised that the spread of the high-yielding varieties in India under the Green Revolution has been uneven both regionally and socially.

33 See Jodha (1985 and 1990).

34 At least the author is not aware of any such case. Even the much-talked about Araberi example in West Bengal where the offic ially - constituted Forest Protection Committees is considered to have played an active role in the natural regeneration of Sal forests, this was due to the fine extension efforts of the State Forest Department and due to many economic incentives offered to the user-population notably right of the user community to sell Minor Forest Produce.

35. See Chandi Prasad Bhatt (p.1-11) in National Wastelands Development Board (1990) and Ajit Bhattacharya (p.17-30) in Samaj Parivartana Samudaya (1988)for detailed descriptions of these grassroot environmental movements.

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CONSERVATION OF GENETIC DIVERSITY OF FOREST TREES AND ITS LINKAGE TO RESTORATION OF DEGRADED AGRICULTURAL LAND - SOIL SITES

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INTRASPECIFIC genetic variation is common in forest tree species. Genetic diversity found within a tree species in nature accumulates during millions of years of its biological evolution. Selections from genetic variation found within wild populations are used for plantation and genetic tree improvement work. This biodiversity intra- and interspecific in trees provides a buffer against changes in the climate and environment: and is also essential for maintaining the stability and biological balance of the biosphere.

Man causes massive disturbances to natural environment. Human activities during the ages, and, more so in the present era, have disrupted the environment on a scale that does not allow nature to re-establish the balance. For example, there has been a strong trend to convert the best forest sites into agricultural lands. The forest cover of the Indian sub-continent has therefore decreased to a dangerously low level. There are thus over 93.6 million hectares of wastelands available for growing trees of which 40 million hectares can be classed as

cultivable wastelands. In the non-cultivable lands there are about seven million hectares of barren sites with high salt-content soils. These are the result of intensive agricultural activity which has converted these sites into saline or alkaline wastelands. This account deals with the methods of finding species adapted to these sites and conservation of adapted germ plasm of tree species on these sites for future afforestation and tree improvement work. Thus restoration of alkali soil sites can be linked to conservation of tested germplasm necessary for bringing these sites under tree cover.

Alkali Soil Sites

Of the total salt affected areas in India about 40% are alkali soil sites known as usar lands. These are scattered in patches amidst agricultural lands in the plains of Northern & Central India. High content of sodium carbonate and bicarbonate in these soils give high pH value. A high exchangeable sodium (ESP above 15%) on the exchange complex of these soils leads to physical deterioration of soil structure of these sites. The high pH (8.2 to 10.6 on our site) leads to break down of soil structure. Such soils therefore have poor soil-water-air relationship. These soils become plastic and are sticky when wet. On drying they turn hard and eventually crack from surface downwards. They are

associated with the existence of a hard clay- pan in the form of a bed of calcareous concretions (kankar) situated at a depth of .75-2.0 m. Additional concretions also occur above it in the form of different sized grains or hard pellets of calcium carbonate, iron or mangenese oxides. These concretions form mechanical barriers to normal growth of root system of trees. The roots also encounter physiological stress during growth because of lack of air and water in these soils. The high osmotic pressure caused by excessive concerntration of salts; high alkalinity; lack of moisture availability; and inadequate aeration due to poor permeability; salt toxicity; reduced microbiological activity; and nutritional disorders associated with alkali soils are the main factors that inhibit tree growth. These usar sites are therefore devoid of trees. Growing trees on them is a challenging task. Only specially adapted species can survive and grow on sodic sites. These must be identified through experiments with seed origins from natural populations of different species that are able to grow on these type of sites.

APROACH

The success of afforesting bare areas consisting of acidic and sodic soil sites depends upon identification and selection under standard environment of adapted species and their provenances, varieties, races or genotypes. Net adaptive value of a provenance or population of a species is determined by many components. These may work independent of each other or they may be correlated. They may become effective either during shorter or longer phases of tree growth. Replicated species-site trials in well laid out designs are therefore necessary to indentify adapted species. Once the choice is made, the successful species performance can be improved further through special silvicultural practics, selection, breeding and tree improvement. The success of tree improvement is based on careful selection from genetic variation present within the species. Wild tree species exhibit natural variation at different levels: (i)among species; (ii) among geographically separate groups (provenances) within species; (iii) among stands within one geographical area; and (iv) within stands at individual tree level. Some of this variability is phenotypic while other is genetic because it gives rise to consistent inherent differences between taxa. Within species

genetically distinct genetic populations , selected for superiority, differ from the average in the frequency of superior gene combinations. Superior provenances provide the basis for selection and breeding because they have an established natural adaptational (genetic) and environmental background. Inter provenance variation needs conservation because seeds can be collected from conserved stands of known genetic quality. It is this type of genetic variation therefore that needs immediate attention because of the high rate of provenance and individual tree depletion within the species. This can be done on usar sites on a large scale through creating ex situ seed collections and demarcating seed production stands or areas if plantations are large enough, and trees are unrelated and highly heterozygous. Vegetative clone gardens can then be maintained for multiplication (cloning) of superior indivudials. Furthermore seedling seed orchards and clonal seed orchards can be layed out for seed production. The present account gives the results of 8 years of field experimentation on growing and studying twelve species in a large RBD trial and 27 species and their taxa in small preliminary sample plot trials in which conservation of successful populations (gene pool) or individuals (genotypes) was the main objective. These were further converted into seed stands by thinning and removal of inferior trees. It also includes the first silvicultural selection of the best seed trees. Cloning of the best genotypes like thornless selections from Prosopis was also attempted.

Field trial design and lay out

The field trial using 12 species on a 10 ha area was laid out at NBRI Biomass Research Centre site at Banthra near Lucknow. This alkali soil site experiment is a R.B.D. trial in which 36 large 40x40 m plots were used for 12 species with 625 trees of each per plot replicated in three blocks. The central measurement area excluding border rows in each plot was of 20 m x 20 m size and it contained 196 trees which were used for biomass estimation measurements. Destructive sampling of 3 trees of each of higher frequence classes was confined to border rows. Standard spacing was kept at 1.5 x 1.5 m for all species. Pit sizes and other silvicultural techiniques used were kept constant. Irrigation is provided once per month in winter and twice per month in the stress periods of dry summers. No other ammendments were used. In addition to the main RBD trial of 12 species, preliminary sample plot trials were also laid out for 28 exotic and indigenous species. (Table 3). The sample plots of each taxa contained 100 trees in which a single outer row was kept as border row and 68 as central trees for taking measurement. Some of these sample plot were replicated (see Table 1).

CONSERVATION TECHNIQUE

In the main R.B.D. trial the highest above ground biomass was produced from 8 years growth (1981 - 90) by Prosopis juliflora (Swarz) D.C. and Acacia nilotica (L) Willd ex. Del.

followed by T. arjuna, A. auriculiformis and Dalbergia sissoo. The productivity of others was insignificant. In general Prosopis species showed high survival rate and growth when compared to others and they showed difference at species and provenane level (Figs. 3,4). At provenance level, variation in growth parameters viz. height and diameter (Figs. 1,2) were observed in Acacia nilotica. Other speices like T. arjuna showed high survival rate but not high productivity. Leucena leucocephala and Azadirachta indica were complete failures in the main experiment (Table 1). Table 2

Outstanding plus trees were selected on phenotypic basis for growth vigour, good tree form and disease resistance in the best performing species i.e. P. juliflora and A. nilotica. Selection intensities were kept high. For example, in Prosopis juliflora out of 1567 trees observed from the RBD trial only 12 were phenotypically selected after 5 years of growth. Single tree progeny tests were laid and preliminary nursery performances were observed for 12 mother trees out of which only 4 were selected on the basis of their progeny performances. Progeny test with 8 replications was laid out on the site to select the best mother trees on the basis of progeny performancs for computation of heretibility and genetic gain. Selections from this test are proposed to be cloned for plantation.

Forest tree species often show intra-specific variation occurring within and between populations in the species distribution range. This type of variation was demonstrated in field trials of Acacia nilotica (Figs. 1,2). In general,

widespread species like Acacia nilotica are more variable than species showing restricted distribution. A. nilotica is classified into 9 sub-species of which 5 occur in Pakistan and India. They are cupressiformis, indica, stringens, hemispherica and subalata . These have arisen from variation and intepsecific hybridization (Ali & Quaiser 1980).

Genetic diversity is normally conserved through in situ and ex situ methods of conservation. High pH soil sites (8.0 to 10.75) do not have enough trees for in situ conservation. Most of these sites are treé-less. It is therefore necessary to try species adapted to these sites and select the best ones on the basis of best performance in terms of tree establishment (Table 2), tree growth and biomass production or other desirable triats. Genetic variation present within the best performing species is collected, tried and conserved at provenance, variety, race and individual tree level. Selections are converted into breeding and seed production blocks after tree mortality and removal of poor performers. The outstanding trees are progeny tested cloned and conserved in vegetative gardens.

LAND RACES FOR STRESS SITES

A population of best adapted individuals showing high performance in tree establishment and growth on specific regions is called a land race. When a species is tried on a bad site nature sorts out the best trees through natural selection for their high adaptability. Development of a good land race depends

upon the quality of the original trees, the selection intensity, population size, breadth of its genetic base and the severity of the new environment on which trees are grown. Thus a land race development is feasible when the species is reasonably well adapted to the environment (like alkali-soil site in subtropics) in which it is planted.

Use of land races is therefore the easiest and the best way to restore degraded sites by testing, conserving, multiplying and using germplasm adapted to stress sites. The naturally selected trees give rise to seed or germplasm which is reused to replant the area. It is the best adapted individuals that give rise to the land race. In experimentation removal of inferior trees by thinning of stands is frequently carried out and poorly adapted individuals are eliminated. Land races develop from the genetic variation present in the successful species. The best land races evolve from large heterozygous populations after several generations of selection under the stress environment. Land race is thus a population of individuals related by common descent that becomes adapted through natural selection to a specific environment/site. It is to a specific territory or site environment to which a race is adapted. Land races can thus be developed for restoration of sites.

Land races are important because on the stress environment their performance is better than that of the original population from which the race is developed. Characteristics that determine different races are more frequently physiological than

morphological. Intesive testing selects the best physiological races because physiology is related to survival, growth and reproduction. A highly adapted tree is mostly a better formed and a faster growing tree. On a stress site adaptability may not be correlated with productivity or tree form. A genetically prostrate tree form may perform better in wind-hit areas. Trees with specialy evolutionary adaptations of foliage, dwarf sized, deep root systems and modified phyllodes enable them to withstand drought and stress better. Selection on the basis of field-trial performance of adapted germplasm conservation, multiplication and use of land races is an effective way of restoring degraded wastelands.

Conservation of breeding population and their size

Funds and land resources for conservation of perennial trees are always limited. The number of trees required for conservation must be kept to a minimum, however, this is often debated. Nam Koong et al, (1980) proposed a minimum of 50 trees sample to provide security against gene losses and to preserve gentic variance and we used a minimum of 100 trees per taxa. For stress sites the basic number of trees used initially has to be very large and the seed origins (provenances) and individuals should be selected from widely separated areas (alkali soil sites) to avoid genetic relatedness. In our main RBD trial, the base population was kept at a minimum of 1875 trees (3 replications of 625 trees in each plot) per species, variety or provenance. In the preliminary sample-plot trials a minimum population of 100 trees per taxa was kept . After 8

years of survival, growth and tree establishment of 11 species in the main trial a minimum of 400 trees were conserved per species out of original 1875 trees. In the preliminary sample plot trials 50 trees were kept as minimum from an original population of 100-400 trees. These were kept as a breeding populations for seed production. Future land races adapted to alkali soil sites for each species will be developed from such seeds.

Conservation of individual tree characteristics

Outstanding individual trees are conserved if they have characteristics of major importance in relation to the objective and the site. For example thornless trees of Prosopis species are important for cloning for fuelwood. Such trees have been selected and cloned for larger clonal trials.

Exotics

Exotics are sometimes highly successful where other species fail. Species of Eucalyptus, Acacia, Prosopis, Casuarina are therefore widely used. Gene conservation of adapted races is most important when exotics are tried. Here variation amongst provenances and gentic variability within provenances need to be linked to the development of specific land races. Conserving and maintaining a broad genetic base is therefore most important for exotics because germplasm used has a narrow and undefined genetic base.

The exotic species of Prosopis, Acacia, Casuarina, Sesbania and others shown to be hardly on these sites are given in Table 16. Security of seed supply of promising exotic species and their provenances, necessary for plantation and tree improvement programmes, can be assured by conservation of adapted races and by broadening their genetic base. A broad genetic base must be built up after the species has been tested and its races selected for the site. This is being done at NBRI for the highly successful genera Prosopis and Acacia. First generation forest tree seed orchads and ex situ stands have also been established.

Indigenous species

In India gene conservation of indigenous tropical forests assume special importance. Our natural ecosystems are fragile and the degradation of forests has resulted into depletion of gene pools. Moreover there are a large number of species in the mixed forests of tropics whose biology is not understood. The job of gene conservation in these is vital. Gene conservation is one of the most pressing needs of forestry. Most of the good land area is under the agricultural crops. Large tracts of wastelands are however available for establing tree cover. Specific types of wastelands like the alkali soil sites can be used to develop and conserve special land races adapted to these sites for their afforestation.

CONSERVATION OF ADAPTED NITROGEN FIXING TREE SPECIES AND THEIR MICROBE AND MYCORRHIZAL ASSOCIATIONS

Conservation and testing of outstanding nitrogen fixing tree species for example species of Leguminosea are of special importance for wastelands. Their genetic base needs to be widened for use on wastelands. Nitrogen fixing microbes associated with the root-nodulation of nitrogen fixing trees like Rhizobia & Frankia and particularly the strains adapted to salt affected or other bad sites need to be isolated, cultured and conserved. This has been done for alkali soil sits in our experiments (Table 4). Nitrogen fixing microbes adapted to the experimental site have been isolated, characterized and are being investigated for their physiological responces. In vitro and in situ cultures are maintained for conservation.

Site and species specific mycorrhizal associations of tree roots also need to be identified, isolated, cultured and conserved. Symbionts like mycorrhizae particularly endomycorrhizae play a vital role in establishment of tree species on degraded sites. They help in nutrient uptake and establishing a sound root-soil microbe relationship. Associated fungi specialized for alkaline soils and forming endomycorrhizae with species under trial have been identified (Table 5) for isolation, mass multiplication and conservation.

Tree-Soil-microbe-interaction.

Tree cover ameliorates the soil by biologically mediated decomposition of litter and roots. Humus formation varies considerably among plant communities as well as within a community. Floristic variation and site (soil) characteristics reflect the spatial pattern in humus formation on a site. Organic residues, either separate from, or intermixed with, mineral materials, interact with soil fauna and result in the formation of a humus form which is specific to every community. This is all the more significant in degraded sites like alkali soil sites which are usually devoid of soil fauna and are poor in organic and inorganic constituents.

Biomass trials at Banthra (NBRI) provide a unique system of investigating humus formation in experimental and controlled conditions (Table 6). Litter is collected in specially kept trays ~~and~~ for study of the microbial mediated decomposition and humus formation. Soil amelioration can thus be studied and predicted by chemical analysis of soil.

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TABLE 1

Conservation of tree germ plasm at species & racial level on alkali soil sites (Banthra Research Station, NBRI, Lucknow)

Species	NFT	Exotic/ Indigenous	Trial Status +	
1. Acacia auriculiformis A. Cunn ex. Benth.	Yes	E	PSPT	RBDT
2. Acacia nilotica (L.) Willd. ex. Del.	Yes	I		RBDT
3. Acacia nilotica ssp. cupressiformis	Yes	I		RBDT
4. Acacia farnesiana (L.) Willd.	Yes	E	PSPT	RBDT
5. Acacia catechu Willd.	Yes	I	PSPT	
6. Acacia pennatula (Schlect. & Cham.)	Yes	E	PSPT	
7. Albizia lebbek Benth.	Yes	I		RBDT
8. Albizia procera Benth.	Yes	I		RBDT
9. Cassia auriculata (L.)	Yes	I	PSPT	
10. Caesalpinia species	Yes	E	PSPT	
11. Azadirachta indica A. Juss.	No	I		RBDT#
12. Broussonetia papyrifera Vent.	No	I	PSPT	
13. Casuarina equisetifolia (L.)	Yes	I	PSPT*	RBDT
14. Casuarina glauca Sieber.	Yes	E		RBDT
15. Casuarina obesa Miq.	Yes	E		RBDT
16. Delbergia sissoo Roxb.	Yes	I		RBDT
17. Derris indica Bennet.	Yes	I		RBDT
18. Eucalyptus hybrid	No	E		RBDT
19. Leucaena diversifolia (Schlecht) Benth.	Yes	E	PSPT	
20. Leucaena leucocephala (Lam.) de Wit	Yes	E	PSPT	RBDT#
21. Leucaena shannoni Donn. Smith.	Yes	E	PSPT	
22. Parkinsonia aculeata L.	Yes	E	PSPT	
23. Pithecellobium dulce (Roxb.)	Yes	E		RBDT
24. Prosopis alba Griseb.	Yes	E	PSPT	
25. Prosopis cineraria (L.) Druce	Yes	I	PSPT	
26. Prosopis chilensis (Molina) Stuntz.	Yes	E	PSPT	
27. Prosopis glandulosa (Torrey)	Yes	E	PSPT	
28. Prosopis juliflora (Swartz) DC	Yes	E	PSPT	RBDT
29. Prosopis pallida (Willd.) H.B.K.	Yes	E	PSPT	
30. Prosopis pubescens Benth.	Yes	E	PSPT	
31. Prosopis velutina (Wooton)	Yes	E	PSPT	
32. Senna atomaria(L.) Irwin & Barneby	Yes	E	PSPT	
33. Sesbania formosa	Yes	E	PSPT	
34. Syzium cumini (L.) Skeels	No	I		RBDT
35. Tamarindus indica Linn.	Yes	I		RBDT
36. Terminalia arjuna Bedd.	No	I		RBDT
37. Zizyphus nummularia (Burm. F) Wight & Arn	No	I	PSPT*	

E-Exotic; I- Indigenous

\+ PSPT - Preliminary sample plot trial

RBDT - Randomized block design

* Replicated sample plot trials

\# Failure

TABLE 2

TREE ESTABLISHMENT WITHIN SELECTED TREE SPECIES

Species		SURVIVAL % 1989	SURVIVAL % 1990	SURVIVAL % 1991
Syzigium cumini	R1	84.18	95.41	47.96
	R2	84.18	96.94	86.22
	R3	73.98	97.96	90.31
Casuarina equisetifolia	R1	92.86	91.84	61.73
Casuarina obesa	R1	77.55	75.00	32.65
	R2	69.39	68.37	58.16
Casuarina glauca	R1	96.94	96.94	96.94
	R2	93.88	93.37	85.71
Prosopis juliflora	R1	100.00	98.47	93.37
	R2	98.98	99.49	98.47
	R3	98.47	98.47	95.92
A. nilotica ssp. cupressiformis	R1	87.76	87.76	77.55
	R2	98.98	95.92	69.90
	R3	79.08	79.08	70.92
Tamarindus indica	R1	98.00	98.00	98.00
	R2	98.00	96.00	96.00
	R3	94.00	95.00	95.00

Experiment laid out in 1987
R = Replication
Data computed on 196 plants (Central measurement area)

Experiment laid out in 1987

TABLE 3

PERFORMANCE OF SAMPLE PLOT (PRELIMINARY) TRIALS OF SELECTED TREE SPECIES FOR ALKALINE SOIL SITES

SPECIES	SURVIVAL %	DIAMETER (cm)	HEIGHT (cm)
Casuarina equisetifolia(R1)	85.56	4.78	542.68
C. equisetifolia (R2)	95.56	4.95	632.38
Sesbania formosa	61.43	8.69	974.50
Senna atomaria	100	2.08	276.40
Parkinsonia aculeata	100	1.93	234.64
Leucaena leucocephala (R1)	83.33	4.32	463.51
L. leucocephala (R2)	83.33	2.73	303.28
L. leucocephala (R3)	92.86	2.20	256.66
L. leucocephala (R4)	85.71	1.07	154.26
L. diversifolia	72.22	1.70	214.25
L. shannoni	97.62	2.58	298.65
Acacia farnesiana (Oxford)	97.78	0.95	142.79
A. nilotica	76.67	3.45	284.56
A. nilotica (provenance I)	90	4.35	303.05
A. nilotica (provenance II)	100	2.72	283.90
A. nilotica (provenance III)	55	3.50	361.81
A. nilotica (provenance IV)	85	3.37	335.25
A. deamii	60	1.78	161.50
A. catechu	26.25	1.10	107.14
Acacia species	43.75	1.98	219.08
Prosopis juliflora (Oxford)	93.33	0.63	114.04
P. juliflora (R1)	96.03	3.36	403.07
P. juliflora (R2)	24.70	1.07	142.30
P. alba NSPL (Phaltan)	64.44	2.46	252.98
P. alba (Phaltan)	66.25	4.32	376.16
P. alba	65.28	0.61	115.01
P. alba(thornless selection)	82.67	1.14	148.68
P. velutiana	51.11	2.51	226.54
P. cineraria	92.22	2.33	183.92
P. pubescence	73.55	1.88	207.19
P. glandulosa (Phaltan)	66.67	1.59	191.22
Cassia auriculata (R1)	71.11	1.70	207.70
C. auriculata (R2)	57.78	1.36	153.92
C. auriculata (R3)	76.39	2.33	253.63
Zizyphus nummularia (R1)	75.31	1.48	192.16
Z. nummularia (R2)	95.55	0.90	121.46
Z. nummularia (R3)	73.33	1.73	193.69
Caesalpinia species	80	1.78	161.5

R = Replication
Phaltan = Seed source, NARI, Phaltan, Maharashtra
Oxford = Seed source, OFI, Univ. Oxford, U.K.

TABLE 4

RHIZOBIA ISOLATED FROM ALAKLI SOIL SITE TRIALS
(NURSERY SEEDLING AGE - 4 to 6 MONTHS)
(MEDIUM -YEAST EXTRACT MANNITOL AGAR)

	SPECIES	RHIZOBIUM STRAINS
1.	Acacia nilotica	NBRI - 2
2.	Acacia farnesiana	NBRI - 4
3.	Albizia lebbek	NBRI - 8 NBRI - 11
4.	Prosopis juliflora	NBRI - 3
5.	Pongamia pinnata	NBRI - 9
6.	Leucaena leucocephala	NBRI - 6
7.	Dalbergia sissoo	NBRI - 5 NBRI - 13
8.	Sesbania formosa	NBRI - 1 NBRI - 10
9.	Sesbania aculeata	NBRI - 7
10.	Prosopis alba	NBRI - 12

TABLE 5

Vesicular-arbuscular mycorrhizal (VAM) fungi from fuelwood tree species on trial on alkali - soil site - Banthra, Lucknow.

Tree Species	G. fasciculatum	Glomus sp.	G.australe	G.intraradices	G.gigantea	S.calospora
A. auriculiformis	+	ND	ND	ND	ND	+
A. nilotica var. cupressiformis	+	ND	ND	ND	+	+
A. nilotica	+	+	ND	ND	+	+
C. siamea	+	ND	ND	ND	ND	+
L. leucocephala	+	+	ND	ND	ND	+
P. aculata	+	+	ND	ND	ND	+
P. juliflora	+	+	ND	ND	+	ND
T. indica	+	ND	ND	ND	ND	+
P. deltoides	+	ND	ND	+	ND	ND
C. equisetiflia	+	+	ND	ND		+
C. obesa	+	+	ND	ND	+	+
C. glauca	+	+	ND	ND	+	+

(+) forms mycorrhizae (ND) not detected

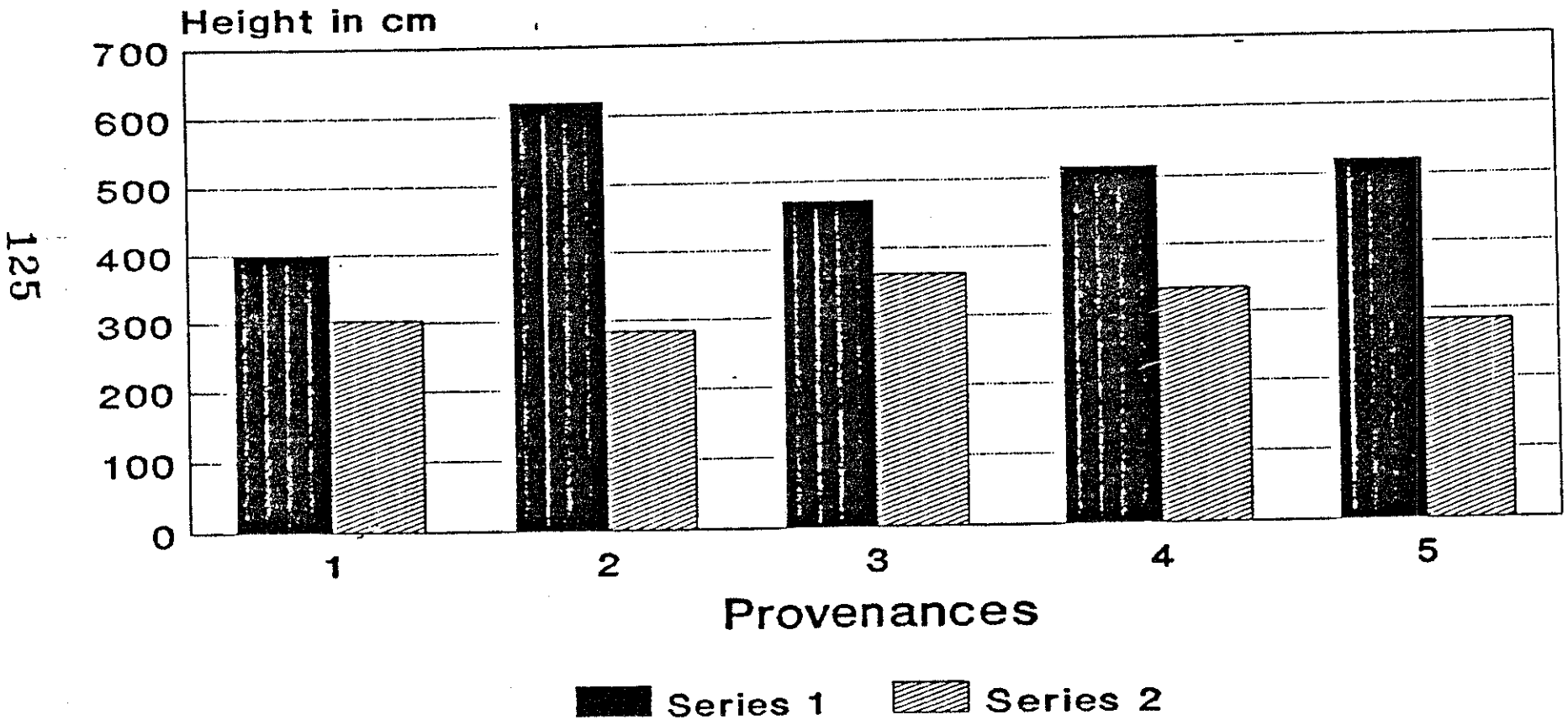
TABLE 6

Performance and litter output of Selected Tree species on alkaline Soil sites (Banthra, NBRI, Lucknow)

	Species	Performance	Litter fall	Litter decomposition
1.	*Acacia auriculiformis*	Medium	Heavy	Slow
2.	*A. nilotica*	Outstanding	Heavy	Moderate
3.	*A. nilotica* ssp. *cupressiformis*	Very good	Moderate	Good
4.	*A. farnesiana*	Very good	Moderate	Good
5.	*Albizia lebbek*	Medium	Moderate	Good
6.	*Albizia procera*	Medium	Moderate	Good
7.	*Azadirachta indica*	Poor	Poor	Good
8.	*Casuarina glauca*	Good	Moderate	Moderate
9.	*Casuarina obesa*	Poor	Poor	Moderate
10.	*Dalbergia sissoo*	Medium	Good	Fast
11.	*Derris indica*	Medium	Good	Fast
12.	*Eucalyptus* hybrid	Medium	Good	Slow
13.	*Pithecellobium dulce*	Medium	Good	Moderate
14.	*Prosopis alba*	Very good	Good	Good
15.	*Prosopis juliflora*	Outstanding	Very good	Fast
16.	*Terminalia arjuna*	Very good	Good	Good

FIGURE 1

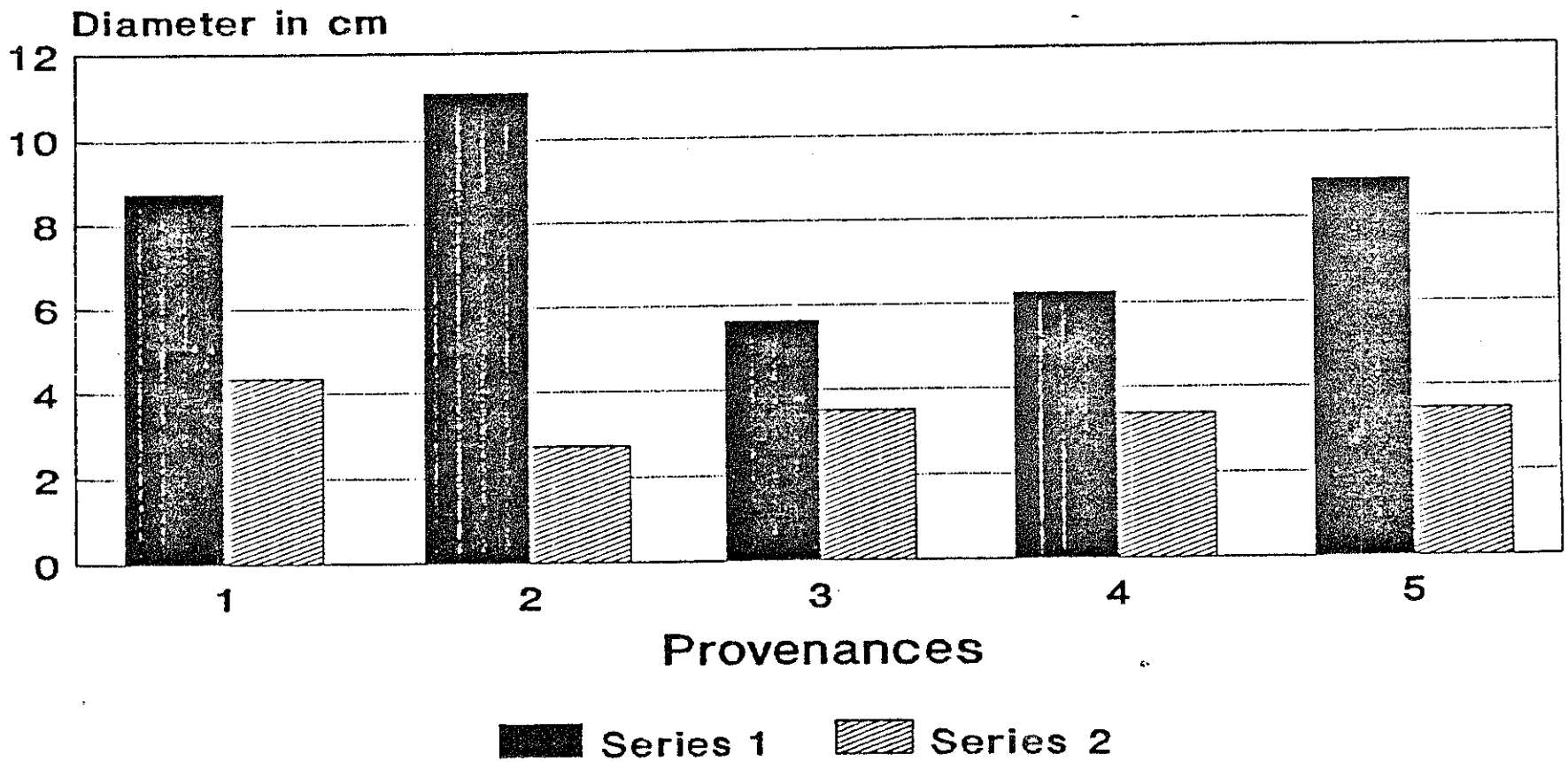
Acacia nilotica
Provenance trial



Series 1= Max ht; Series 2= Avg ht

FIGURE 2

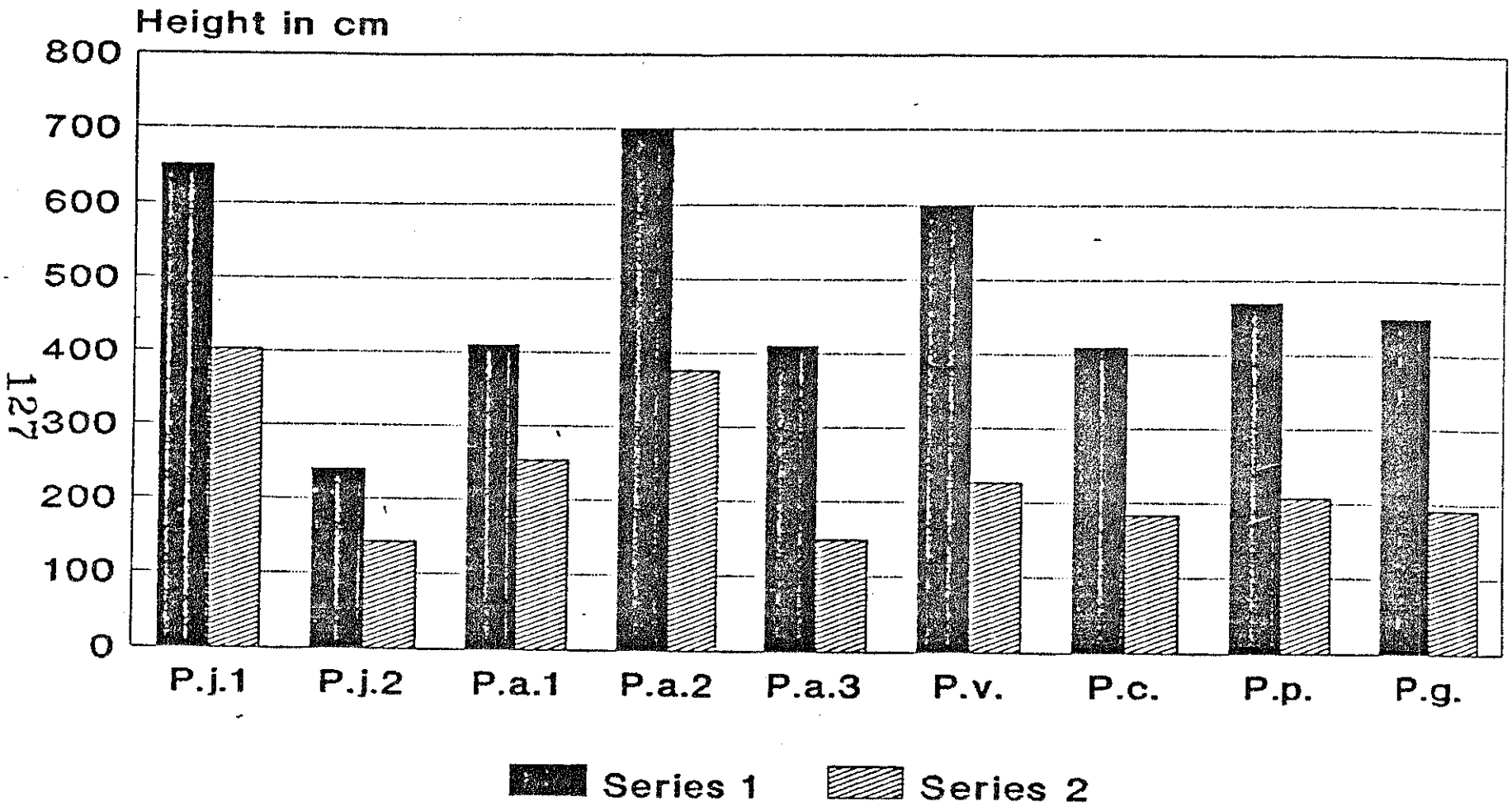
Acacia nilotica
Provenance trial



Series 1-Max d Series 2-Avg dia

FIGURE 3

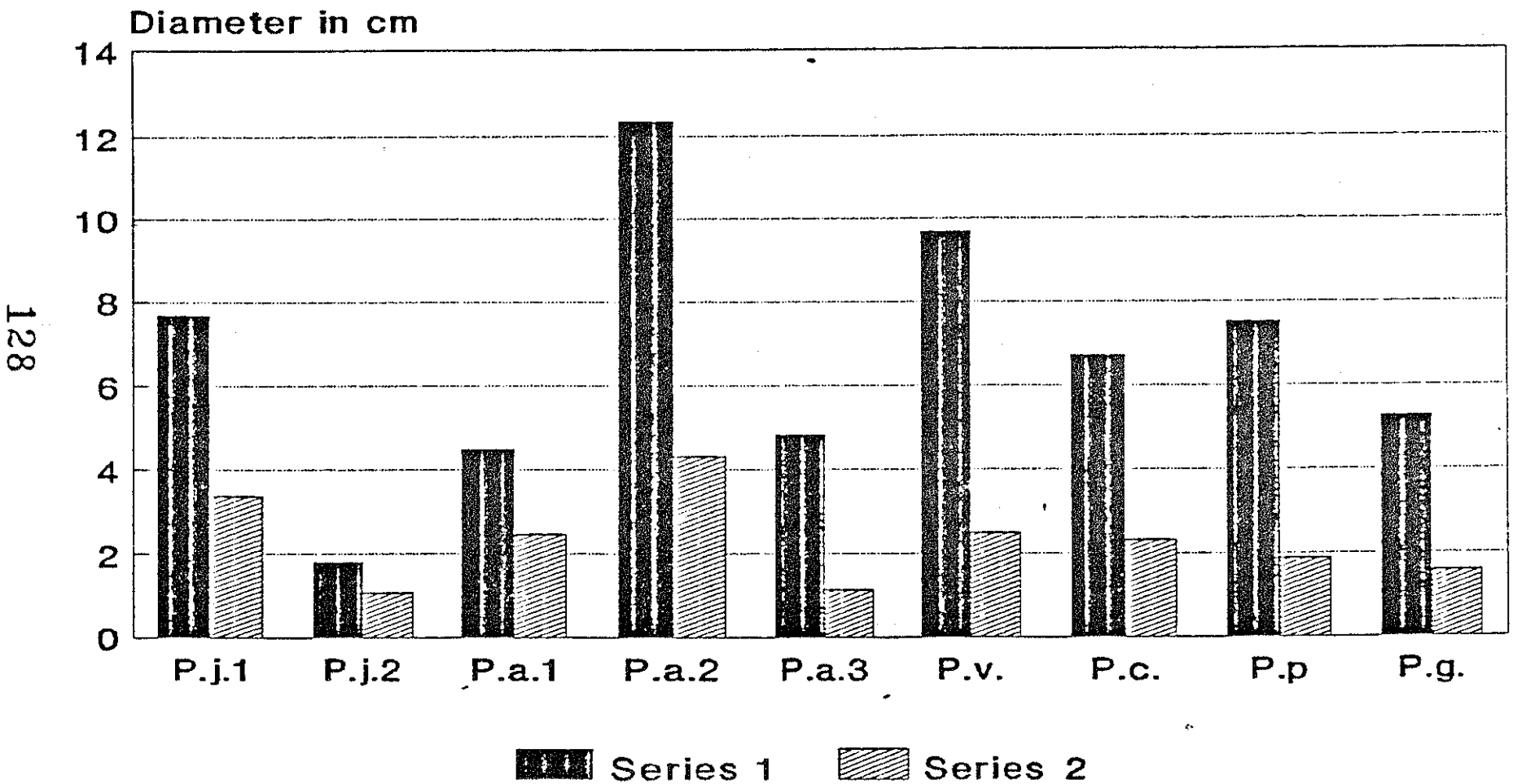
PROSOPIS



Series 1-Max Height; Series 2-Avg height

FIGURE 4

PROSOPIS



Series 1=Max dia; Series 2=Avg dia

LEGENDS

Figs 1,2 Acacia nilotica, conservation and comparison of growth, (height and diameter) among five provenances with seed origins from alkaline soil sites.

Figs 3,4 Prosopis, conservation of Interspecific and intraspecific variation and comparison of growth (height and diameter) performances among species of Prosopis (P.j, P. juliflora: P.a. P. alba: P.v. P. velutina; P.c, P. cineraria; P.p, P. pubescence: and P.g, P. glandulosa: 1,2,3, different provenances)

5. ROLE OF THE MASS MEDIA IN PROMOTING ECOLOGICALLY SUSTAINABLE DEVELOPMENT POLICIES

By

Rusi Engineer

Over the last two decades the mass media have played an important, indeed crucial, role in bringing environmental problems into public awareness. It is now becoming evident, however, that the environmental movement is in the process of entering a new phase in which the focus of attention is beginning to shift from highlighting problems to articulating workable solutions. This new phase will confront the mass media with qualitatively different challenges. This paper looks at the nature of these challenges in the Indian context, at some basic factors in the present situation which are inhibiting or delaying the media's response to these challenges, and ends by outlining some concrete steps that need to be taken.

The first phase of the environmental movement, which began in the late sixties and early seventies, was characterised by a growing public awareness of the damage being caused to the environment and to life-support systems by a variety of human activities. It is a measure of the success of this first phase that there is now widespread recognition, both on the part of people as well as governments, that we confront an environmental crisis which is posing a serious threat to human survival and well-being.

At the same time, it is now becoming evident that we have reached the end of this first phase. A fairly widespread awareness of the symptoms of the problem has been achieved,

along with a popular desire to do something about it; but the ability to translate this desire into action and to articulate and operationalise workable solutions has not yet taken concrete shape. That, precisely, is the challenge before us as we stand at the threshold of the second phase in the evolution of the environmental movement.

During the first phase of the movement, the mass media* played an important and vital role in bringing environmental issues into public awareness. It needs to be noted, however, that during this phase journalists were called upon to perform what was primarily a descriptive or reportorial function. Reporting events as they occur has always been the staple of journalism, and environmental journalism in this phase essentially represented a further extension of this traditional journalistic approach to a new category of 'environmental' actors and events. The fact that the same period also saw the entry of a new breed of idealistic young people into the lower rungs of the journalistic profession certainly helped. These young people sensed, without necessarily being able to systematically articulate it, that the environmental crisis was the manifestation of a major malfunction in the existing social, economic and political system which had left them feeling disillusioned and alienated, and they resonated

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* Since this discussion focusses on the Indian context, the reference throughout is to the print media, since state-controlled T.V. has by and large steered clear of environmental issues which invariably involve some element of conflict or controversy.

with instinctive sympathy for the environmental issues that were being thrown up.

Thus, beginning in the mid seventies, newspapers and magazines began to carry a spate of dramatic stories : about industrial pollution of air and water, about deforestation and its consequences such as land degradation, drought and acute scarcities of water and fuelwood faced by the rural poor, about pesticide poisoning and chemical contamination of food-stuffs, about radiation leaks and exposure of nuclear plant workers to higher than "permissible" levels of radiation, about dams and hydel projects like Silent Valley which threatened to submerge virgin rainforests, and the untold suffering and mass destruction of industrial disasters like Bhopal. There were also the efforts of urban-based conservation organizations and citizens' groups which lobbied or litigated their way into the news, and there were grassroots struggles against displacement or deprivation caused by large-scale development projects or state-sponsored ~~development~~ commercial activities, the most famous example of the latter being the Chipko movement.

The point to note is that this extensive media coverage was facilitated by three factors : (1) the presence of a small but significant number of motivated young reporters in the ranks of the journalistic profession, and a climate of opinion relatively favourable to environmental causes within major media establishments; (2) the fact that the events which became major stories by and large (though

there were significant exceptions) called for straightforward descriptive reportage; the nature of the reporting did not demand an exceptional level of technical competence or conceptual sophistication on the part of the journalists and therefore did not stretch their capabilities beyond prevailing levels; and (3) background information needed to do stories on unfamiliar environmental subjects was becoming more readily available, most notably in the form of the two Citizens' Reports on The State of India's Environment published in the early and mid eighties by the Centre for Science and Environment, New Delhi. The relatively [illegible] effectiveness media exposure received by environmental issues was due to a combination of these three factors.

If we now turn to the situation prevailing today, at the beginning of the nineties, we find a rather different state of affairs. A certain staleness now characterises the media's [illegible] environmental coverage. The reading public too is becoming a little weary of being presented repeatedly, year after year, with the same sorts of events -- yet another river being fouled up by the discharge of untreated industrial effluents, yet another forest area being submerged under a man-made [illegible] reservoir, yet another government agency which has failed to discharge its environmental responsibilities, and so on and on -- and sensing this, editors in major newspapers are no longer enthusiastically supporting their staff reporters who want to do such stories. Serious journalism which attempts to look

at what needs to be done is conspicuous by its absence. All in all, it is becoming evident that the mass media are today out of touch with the leading edge of the environmental movement.

It is important to understand what is happening and to identify the reasons for this state of affairs. Descriptive reportage was quite appropriate so long as the environmental movement itself was in its first phase -- a phase of symptomatic awareness -- which may be compared to a man who wakes up to discover that he is experiencing pain, palpitations and the malfunction of various bodily systems, and needs to urgently go and see a doctor. The patient requires no special equipment or training to accurately describe his symptoms or to recognise the seriousness of his condition. But arriving at a correct diagnosis of the illness, and prescribing an effective line of treatment and successfully carrying it out, obviously requires knowledge and skills of an altogether different order. In much the same way, the environmental movement today is in the throes of entering the second phase of 'diagnosis and treatment'. The mass media today appear out of step because they have not yet grasped that the environmental movement has changed gears, as it were, and is in the process of shifting into a second phase; nor have they understood the nature of the new demands that the second phase will make on them.

This can be seen from two current examples which illustrate the gap between the leading edge of the environmental movement and the mass media. The first concerns the media cover-

age of the controversial Sardar Sarovar Project on the Narmada. The case against the project is multi-dimensional and complex. Substantial grounds now exist to provide a prima facie justification for a comprehensive review, but the mass media have succeeded in presenting to the public no more than a caricature of the anti-dam position. Some of the anti-dam movement's leaders and active sympathisers are highly conscious and articulate individuals who have been raising disturbing and profoundly significant questions about the project itself and about the kind of 'development' it typifies. Yet, one would look in vain in our mass media for any substantial analysis or discussion of these questions, for in-depth interviews with the project's leading critics, or serious investigative reports on any of the several contentious and disputed issues.

Thus, the media have failed to take a close look at the doubts raised about the economic viability of the project and the cost-benefit analysis on which it is based; the alleged failure to plan for and make acceptable arrangements for the resettlement and rehabilitation of oustees; the alleged violations of the terms and conditions not only of the Central Government clearances, the Narmada Water Disputes Tribunal Award and the World Bank loan agreement and hence the impugned legality of the project, but also and more importantly, the alleged violation of human rights and the Constitutional right to life of the oustees; questions of distributive justice concerning who will benefit from and who will pay for this project; the extent to which

the project will really benefit the chronically drought-prone and semi-arid areas of Gujarat; whether there is a prima facie case for a reduction in the height of the dam if this could achieve a substantial reduction in the forest area lost and the number of villages displaced due to submergence; and finally, whether optimising the vast potential of alternative small-scale decentralised approaches to water resource development might not make it possible to replace this mega dam by a much smaller, and therefore ecologically and socially much less destructive, dam.

Our second example concerns the single most important environmental problem facing this country, viz. deforestation, or to put it more positively, the problem of devising realistic strategies, policies and institutional mechanisms for regenerating our terrestrial ecosystems and enhancing the biological productivity of the land. Official policies have undergone significant changes during the four decades since independence, but they continue to remain confused and contradictory, and therefore unsuccessful in achieving their stated objectives. Once again, media attention has focused primarily on the fact that deforestation is proceeding apace and has not been checked; but there has been hardly any analysis of why official policies are failing and what sorts of alternative policies are needed. For instance, there has been little or no attempt on the part of the media to investigate and explain to their readers why the National Wastelands Development Board, launched

with much fanfare in 1985 to spear-head a major attack on the problem, failed to produce the expected results and has now been quietly sidelined.

This is particularly unfortunate at the present time when, at long last, a broad consensus seems to have emerged concerning the kind of forest policy that is needed. For the first time, it has become possible to articulate a policy framework based on the lessons of past failures and capable of reconciling the claims of ecological protection, rural subsistence needs and urban-industrial demands. Such a policy framework was briefly outlined by Prof. Madhav Gadgil in "Deforestation: Problems and Prospects", his 1989 Foundation Day Lecture under the auspices of the Society for Promotion of Wastelands Development. A similar approach has been further developed in "To the Hands of the Poor: Water and Trees" by Robert Chambers, N.C.Saxena and Tushaar Shah (Oxford and IBH, 1989). Both these publications, which constitute something of a breakthrough in the evolution of forest policy thinking in this country, have gone virtually unnoticed in the mass media.

Once again, as in the case of the Narmada controversy, the issues being thrown up are complex, unfamiliar, and call for fundamental changes in existing social, economic and politico-administrative structures. It turns out that afforestation and ecological restoration, far from being a simple matter of planting more trees, presuppose some drastic changes in our basic collective arrangements. The changes required include a willingness on the part of the State

to reverse the historic process of acquisition of village common lands by the State, and to grant ownership and/or usufructory rights to village communities that have been progressively taken away from them over the last 150 years; the creation of viable institutions of local self-government which could undertake the rehabilitation of village common lands and then manage them productively, sustainably and equitably; bringing about a drastic change in the administrative culture of forest departments which are required to shed their traditional custodial and policing orientation, to invite genuine participation of village communities in the afforestation of degraded forest lands, and to begin to function as a people-oriented extension agency; the willingness to bring some order into land records and to undertake the major task of bringing them up to date; and mustering the political will to resist the vested interests of the politician-forest official nexus and abolish the laws, rules and regulations which restrict the cutting, transportation and sale of trees grown on private lands.

If, as these examples suggest, there is a significant amount of new activity which has so far found no echo in the mass media, we can now begin to see why. The focus of activity in the environmental movement has shifted from symptomatic description to action research, analysis and policy formulation, and media establishments are at present simply unable on their own to muster the new and diverse technical skills or the conceptual equipment required for responding adequately to the emerging situation.

Nevertheless, in as much as this shift of focus is a nascent, still-emerging phenomenon, it would be unfair to blame the media for not having instantly reflected it. The environmental movement on its part has done very little to facilitate communication and information dissemination through the media. If we consider for example the movement against the Sardar Sarovar Project, we are forced to conclude that while some of its prominent leaders and critics have much to say that is important and worthwhile, they have hardly done enough to make any of this publicly available, in print. The case against the dam is indeed formidable, but the anti-dam movement has so far failed to produce a basic document which marshalls all the evidence and makes this case rigorously and effectively for the mass media as well as the general public.

That being the case, the mass media should not be expected to take the initiative on its own to champion new ideas and new ways of thinking. These have to originate and come to maturity outside media establishments, in social and intellectual movements, and when they are sufficiently well-defined and gain sufficiently wide currency, then we may expect them to be reflected in newspapers and magazines. The onus is therefore on the environmental movement to articulate its message, to communicate new developments effectively, and to make this communication easily accessible to the mass media, to decision-makers and to the general public. So far, the environmental movement -- which is now being transformed into a movement for equitable and ecologically sustainable development -- has not even begun to do this.

Indeed, the problem today lies precisely in the fact that the individuals and groups who are concerned about and working towards a new model of equitable and sustainable development are scattered, uncoordinated and fragmented, and lack the organization and coherence required to constitute a true 'movement'. The problem is complicated by the fact that ecologically sustainable development encompasses such diverse sectors, disciplines and areas of expertise : there are individuals and groups working in the areas of forestry, land and water resource management, agriculture, energy, industrialisation and industrial pollution, urbanisation, the impacts of mining and tourism, rural development, science and technology, species and ecosystem conservation, protected area networks, and so on and so forth. Without a common, organised focus, the separate efforts of these individuals and groups are not being as effective as they deserve to be, and the messages emanating from them remain diffused and unconnected, failing to generate the critical minimum thrust necessary to make an impact on public consciousness and on the mass media.

Thus, if we wish to see our concerns about equitable and ecologically sustainable development enter the mainstream of public discussion and be adequately reflected in the mass media, creating some sort of an organised focus -- or more than one organised focii -- needs to be at the top of our agenda. We have reached a stage in the evolution of the movement where further progress is being hampered by the absence of a more organised and coordinated effort to pull

together and systematise the new knowledge and experience arising from the work of diverse individuals and groups. The movement today has no effective process of networking among such individuals and groups, no journal where new ideas and experiences can be expressed, discussed and debated, nor any organization(s) formed explicitly to promote and disseminate a new approach to development based on equity and sustainability. The creation of such organizational forms is the crucial next step on the movement's route to maturity. This would enable the movement itself to achieve a new level of vigour and effectiveness, and its ability to argue its case and put across its views coherently and convincingly will be enormously multiplied. Once this happens, the mass media too will find it much easier to respond sympathetically and with understanding.

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Workshop on "Linkages between Wastelands and Biodiversity," Centre for Ecological Sciences, Indian Institute of Science, Bangalore, 14 15th March, 1991.

Forests and the State of the Tribals Today

Walter Fernandes

Comparing the socio-economic situation of the tribals as presented earlier by Verrier Elwin and his own studies in the 1940s and 1950s with their state in the 1970s, the well known anthropologist Christoph Von Fuer Haimendorf (1980: 1-2) asks: why do

> populations who for millennia persisted in a state of almost complete self-sufficiency, having developed their own way of life and cultural individuality without any need for outside assistance, have now to be protected and aided by government? This question appears to be all the more pertinent as only one or two generations ago many tribal communities enjoyed the advantages of a well balanced ecology fully in tune with the natural resources of their environment and could boast an overall quality of life superior in many ways to that of large sections of the Indian rural population. Adequate food supplies, a non exploitative social structure, freedom from indebtedness and other forms of dependence on non-tribal outsiders, equality of the sexes and a remarkable tolerance in all interpersonal relations were outstanding characteristics of such tribal societies.

This is a question that persons involved in work among the tribals continue to ask today. The studies of researchers among them indicate a great amount of impoverishment. At the same time, the experience of activists as well as of scholars indicates that the process of their impoverishment has intensified during the last four or five decades. Their experience also shows that among the tribals themselves there has been a transition from constructive to destructive dependence on the natural resources in general and forests in particular. They had, till a few decades ago a culture that treated the natural resources as renewable, meant to be used according to need and preserved for future generations. Today one notices among them, dependence on destructive practices for survival (Fernandes, Menon and Viegas 1988).

Moreover, this process of transition is not specific to Indian tribals. Studies of indigenous populations elsewhere in the world,

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share a similar process of their transition. Speaking about the Native Peoples of Canada, for example, Comeau and Santin (1990: 2) say:

> Native Canadians die, on average, ten years sooner than other Canadians..... They are barely better educated today than they were two decades ago. They are jailed at rates that far exceed their numbers..... And they destroy themselves at a phenomenal rate, through violence, accidents, and by choosing suicide as a way out of their misery..... But it has not always been this way. Long before the white settlers came, Canada's aboriginal people had created a cooperative social structure, complete with a hierarchy of political power and a fully functioning justice system.

Control of Resources

Most analysts attribute this marginalisation to the struggle for the control of the natural resources in which the regions inhabited by the indigenous populations are rich. Modern development is based on industrialisation i.e. exploitation of these natural resources in order to render them productive in the formal economic sense. This is true not merely about the rich countries that overconsume the resources, but also in poor countries of the Third World whose development has been stunted by a century of colonialism. In their belated effort to free themselves from poverty, these countries view industrialisation as

> a means not an end. But considering the need for initiating the process of creation of and more rapid progress in subsequent plans, it becomes almost an objective in itself (Planning Commission 1956: para 16).

The natural resources were a crucial component in what was considered by the planners, the road towards progress of every community in the country.

> Because of its natural resources, India has very important advantages and considerable potential for industrialisation. Its known reserves of iron, manganese, bauxite are extensive. There is considerable coal, mica and atomic materials such as thorium or [illegible] India's famous rivers have a potential for hydro-electrical power (Planning Commission 1961: 10)

We can thus see a conflict arising in the approach of planned particularly the tribals in whose areas most of these resources were found. Their life had to be destabilised in order to render the resources productive. In fact, the planners were all along aware of

this tension between productivity and equity. The very first plan document, for example, had mentioned this dilemma. It stated that redistribution alone cannot eliminate poverty nor can raising productivity by itself achieve it.

> Only a simultaneous advance along both these lines can create conditions in which the community can put forth its best efforts for promoting development (Planning Commission 1951: 8).

In reality, however, the intention of combining these opposite interests remained what a former member of the Planning Commission has called the poetic chapter of objectives. "Having once gotten over this poetic preamble, the operational part got down to the serious business of ensuring the subversion of every one of them" (Gadgil 1983: 111). What is true about the weaker sections in general is much more so concerning the tribals for whose development many schemes were initiated. But the productivity of the natural resources, most of which were found in areas inhabited by them, remained a priority in planned development (Planning Commission 1969: 14-15).

In this paper an attempt will be made to study this contradiction which, to our understanding is not merely a dilemma implementing good intention. We view it as a conflict between two mutually opposing interests--the powerful formal economy represented by the State and the corporate sector, and the powerless natural resource and traditional knowledge system-based communities belonging to the informal system. The struggle is for the control of the natural resources between two groups with unequal power. The powerless section loses and is further marginalised. This is the process we are attempting to study in this paper. Here we limit our analysis to the tribals alone.

Formal versus Informal Economy

One thus notices that though an attempt is made to put tribal development and equality together with productivity and industrialisation, there is an inbuilt conflict and contradiction between the two. As a result, the thrust has been mainly towards

productivity and industrialisation and much less in favour of the tribals. Consequently, as most studies indicate, their situation has deteriorated. That in itself was inevitable because planned development is a transition from the informal to the formal economy. They are two systems with different foundations. The informal system of economy and political organisation on which the tribals depended traditionally is based on an oral tradition and word of honour. The member of an informal society keeps the word of honour, trusting others to do the same. Truth in this is unambiguous, not evidential as in the formal system. Its economic base is the resource which is controlled by the community and is used by individuals and families in the name of the community. It is used according to need but is preserved for posterity. The crucial factor in all these aspects was acceptance by the community.

The formal society in general and economy in particular, depend on the individual and the written word. This difference is probably best understood by looking at a social system like marriage. Among many tribes, as soon as a boy and a girl exchange a promise they are allowed to live together though the formal ceremony of marriage may come much later. What is required is recognition by the community. The second step is seen in the Hindu marriage where only the word of honour of the two persons is insufficient. The boy and the girl are not allowed to live together till a formal ceremony of marriage is performed in the presence of the community. But a written document is not essential. The third step is the formal system represented by the civil marriage. It has to have an individual witness as well as a written document. The witness and legitimation by the community are of no avail to it. Only individuals and written material are recognised (Sharma 1978: 13-14).

The difference can be seen much more clearly in the concept of property rights. The concept of property as understood today was absent in the traditional tribal society. Land, for example, is today understood primarily or even exclusively as an object of agriculture

and construction. This is a capitalist view of property owned by the individual who has an absolute right over it. To the tribal whose life was centered primarily around land and forests, it was not property in that sense but a community resource. The descendants of those who first cleared the forests and founded a village had some special rights known as khuntkatti among the Hos and by other words elsewhere. Otherwise land and other resources were held by individuals only in the name of the community. Common lands, wastelands, forests, ponds, gardens etc. were a common property resource. The individual had only usufructuary rights over it (Pathy 1988: 84-85).

Some Implications

The informal economy and society had some implications both for the life system of the tribal community and for the natural resources. First of all, because land, forests, water etc. were community-based, and not individual property, their society was conservation-oriented. Secondly, their was an equitable society. Thirdly, women though not equal to men, had a higher status than their counterparts in caste societies and other communities considered advanced.

1. Conservation Orientation

The first implication of a resource was that it was conservation-oriented. The tribals got most of their food, all their fodder, fuel, small timber etc. from the forest. Their dependence on this resource as well as on land was total. Thus there was in them a vested interest to ensure its continuity.

This, they did by building a whole set of religious customs, traditions, myths and social control mechanisms to ensure that a balance was kept between human and environmental needs. To ensure this, most tribal communities accorded total protection to a few ecosystems. One can refer particularly to the forest where teenager tribal boys were trained into adulthood (known in Chotanagpur as sarna), the dancing ground where young men and women met and chose

their future partners (known as a:hara) and the burial ground (known as sasan). No sickle or axe could be used in any of these ecosystems. Only its fruits and flowers and dry branches that could be broken with one's hands were allowed to be eaten.

Outside these ecosystems, similar protection was accorded to a few economically crucial trees, animals and birds. This was done by linking them to the origin of the tribe or clan and through myths of creation. It was often given the form of the totem which could be eaten only on the annual day of renewal i.e. the spring festival. Most tribes had myths that spoke of their ancestors being born of sal (shorea robusta) or other wood, fruits, animals etc.

Another set of trees (e.g.mango, jack fruit etc.) that were economically important but not as crucial as the former, were declared sacred and accorded partial protection. They could be cut only for specific purposes such as house construction and agricultural implements.

Finally, the species that were not accorded such protection could be cut under strict rules of conservation and distribution which was controlled by the village council. Such rules existed also for the use of other resources like water, shifting cultivation land, pasture and other common property resources (CPR) (Fernandes 1990: 38-40).

Briefly, one notices a conservation orientation in their culture. The resource was treated as renewable, meant to be used according to need and preserved for generations to come. Many such conservation mechanisms of CPR existed also in many settled agriculture and property owning communities elsewhere in India. The Nagaranya (serpent's grove) of the Karnataka and Kerala coast of Devaranya (God's grove) of Maharashtra would be examples of this (Gadgil and Vartak 1974). The difference among the tribals is that they linked the preservation of the natural resources with the continuity of the tribe.

This was the case, for example, with the ecosystems to which they

accorded complete protection. The sasan was the abode of the ancestral spirits. The sarna was the training ground of the present. Warriors and as such the gods of the tribe lived there. The akhara represented the future since the couple that would give birth to children met there. The sacred trees too were linked to the origin of the tribe or clan. Briefly, the message given by these myths and traditions was that if the forest was destroyed, their tribe itself would be destroyed.

2. Egalitarian Society

The second implication of the informal economy and the culture linked to it was that theirs was an egalitarian society. This is a consequence of the communal character of the resource as well as the social control mechanisms that ensured proper distribution. As mentioned earlier, land and other resources were held by individuals only in the name of the community. Strict rules guided its distribution. For example, in parts of Orissa, every family member was allowed one headload of firewood per week. In most of Eastern Madhya Pradesh and Western Orissa, it was one cartload per family per month (Fernandes, Menon and Viegas 1988: 166-168). Shifting cultivation land was allotted according to the number of persons in each family. Besides, if a family did not have adult workers, the one that had an excess had to help it.

The way in which the community availed of the resource differed from tribe to tribe. What was common to all the shifting cultivation ribes was that the title to land was not hereditary. Only the right to select the plot was inherited by one of the daughters in matrilinear tribes like the Garo and Khasi and by the son in patrilinear tribes (Nair 1987: 27-29). Among most tribes, particularly settled agriculturists, some privileges were accorded to the descendants of those who first cleared the forest and founded a village. These privileges were known as khuntkatti among the Ho of Bihar and by other words elsewhere. For all the others, it was a resource which

individual families could use for cultivation or construction only in the name of the community. Common lands, wastelands, forests, ponds, gardens etc. remained common property resources (CPR) over which the individual or the family only had usufructuary rights (Pathy 1988: 84-85).

This communal character was true not only about their land, forests and other natural resource management but also about their social and political structures. The democratic pattern of society and the communitarian character of resources is found in most societies ranging from the Bhuiyan, Kond and Saora of Orissa, the Gond of Madhya Pradesh, the Ho, Munda and Santal of Bihar and Bengal , the Bhil of Rajasthan, the Warli of Maharashtra, the Cholanaickam, Mullakurumba and Kurichan of Kerala and others elsewhere (Roy Burman 1987: 402-406). This democratic tradition still remains somewhat strong among the north-eastern tribes but has been weakened among many others that have been exposed more than the others to the formal economy.

In many cases, as for example among the Garo, Jaintia, Khasi and Lushai, the chief was the nominal owner of the land. Each family availed of this resource but the method in which it was done differed from region to region or even tribe to tribe. Common to all is the continuity provided by the community. In shifting cultivation, for example, each family selected and used a plot for a fixed length of time and it reverted to the community once cultivation stopped. Even in tribes that practised only settled agriculture legitimacy was provided by the link with the community. Among the Oraon of Chotanagpur, for example, an ancestor's tombstone in the village burial ground was the only "document" a family required to assert its right to cultivate land there (de Sa 1975: 45).

Since forests, land, water etc. were resources meant to be used for a living and not property to be processed as a raw material, their distribution was equitable. One does not mean by this that, inequalities did not exist among the tribals. There certainly was a hierarchy with greater honour and power in the hands of the Chief,

(Elwin 1936: 41). In most cases he even combined in himself the offices of the judge, chief administrator and the head of the army. Precisely because of this, many tribes introduced the Council of Ministers elected by the villagers to keep a check on his power and ensure that he played the role of a father balancing sectional interests rather than that of an absolute monarch (Horam 1980: 19-20).

3. Implications for Women

The fact of tribal egalitarian ideology and community control of resources was important for women's status. Land was allotted to each family according to the needs of all its members and did not depend on the man alone. The plot belonged to the whole family and the woman worked as part of the whole group. In that sense it was not owned by the head of the family, almost always a man. However, one cannot argue from this that the woman had equal control over the resource. It remained under the control of men. But when he selected the plot he did it as a resource for the family economy (Sharma 1978: 25-27) which was the woman's sphere. Most tribes had division of spheres. The woman had the decision-making power within the family and the man represented the family in the social sphere. She controlled production and work management within the family and its economy. The man rarely interfered in it as he did in caste societies. But he controlled the resource and provided continuity to the community. As such he also controlled reproduction since the continuity of the tribe was closely linked both to the economic resources and to reproduction.

Also the conservation-orientation of their culture was crucial for womens's workload. In the traditional tribal economy, as in the rest of India, the woman was responsible for ensuring the supply of food, water, fuel, fodder and other domestic needs. A conservation-orientation was essential for ensuring her regular access to these resources and for a balanced diet (Fernandes and Menon 1987: 77-85).

Given this context of an egalitarian ideology, the division of work based on it, respect for the material resources, and a

conservation-oriented culture, the tribal woman's status was somewhat high compared to her counterpart in the Hindu caste society. Once again one has to insist that they did not have total equality except in matrilineal tribes. But even in patrilineal communities, women had a bigger decision-making role in the family than in some caste societies.

That in itself was not surprising because the social position of a person reflects, among other, his/her economic worth, particularly as a worker. This value is reflected in the social status of tribal women. Economically, they not only contributed more work but also had greater control over the domestic economy than men did. Their worth was also reflected in their rights such as freedom of movement, choice of mate, divorce, widow and divorce remarriage etc. which are all but non-existent in Hindu caste societies. Girls as well as boys chose their own partners. This was true not merely about matrilineal tribes of the north-east but also about the patrilineal tribes like the Kond and Saora of Orissa who chose their life partners during the annual festival of dhangara-dhangari. After this in most tribes the decision within the family accepting the match rested with the mother of the boy and girl (Elwin 1955a: 53-56).

However, in the social sphere, her functions were extremely limited. In marriage, for example, within the family the woman gave the approval for the boy and girl to live together. But the final social approval was given by the village leaders, all of them men. The woman's opinion was sought on most social matters and usually taken into consideration in the final decision. But she could not speak at the village meeting. If she attended the meeting, she had to sit behind men. In most religious functions, she prepared the food and other items required for the ritual. But she rarely played a leading role in the rite itself, except in matrilineal societies (Fernandes and Menon 1987: 116-119). This higher status was true primarily among the shifting cultivation tribes. But even in settled agriculture

tribes like the Oraon, the woman's role remained higher than that of her counterpart in the Hindu caste society (Bhagat 1983: 4-6). One can however, assume that the woman had a low status in the hunting societies in which even domestic consumption depended on the man. But we are excluding these tribes here.

Because of the important role played by women, tribal economy has often been called 'female economy" (Boserup 1970: 18). While the conservation-orientation of their culture reduced the workload of the woman and her decision-making role conferred a higher status on her, the reverse too is probable. The predominant role of the woman in the forest economy was a major factor in the conservation-orientation of their culture. Because she was responsible for the regular supply of food, fodder etc., she had a bigger vested interest in a balanced diet and in the conservation of the resources for posterity than men did. That may also be the reason why, as some studies show, women are more aware of their ethnic identity than men do (Pathy 1988: 179-189). Tribal cultural, economic, religious and social systems are closely linked to forests and other natural resources. As such, the woman to whom the sex-based division of labour assigned the role of dealing directly with the resources, was able to identify herself, more than the man did, with the ethnic identity and culture than men did. A deeper analysis of shifting cultivation would bring out these aspects much more. But we are excluding it here (for details see Fernandes and Menon 1987).

The Formal System: Power and Powerlessness

It is in this context that the formal system has intervened in their lives in the form of national development, used as they were to the word of mouth and community-based society, they were suddenly exposed to the formal system that has a totally different set of criteria. It recognises only individual rights emanating from a written document. Its economic basis is property, not a community resource.

The tribals have not been exposed to this system but are suddenly forced to deal with it since the State that guides planned development accepts only the formal system. In fact, the State symbolises it through its litigation-based legal system, patta-based property rights and written document industry-based development schemes. Such a system intervened among the tribals with their very high rate of illiteracy and dependence for their survival on the natural resources that were being transferred to the corporate sector to render them productive. When the formal system first intervened in their area, most of them belonged to the second and in many cases the first generation of monetary economy. The only outsiders who depend on the word of mouth in their dealings with the tribals are the moneylender and merchant both of whom have accompanied the industrial agent with the specific purpose of exploiting them. In an illiterate community the former uses his knowledge of the monetary and the formal financial system to ensure their indebtedness and eventual land alienation and bondage. In a community not exposed to the monetary economy-based marketing system and its weights and measures, the latter uses his links with the formal system to deprive them of their resources by controlling their commercialisation (Sharma 1989: 8).

One can thus see that the encounter between the formal and informal systems becomes a conflict between power and powerlessness. In other words, the economic development of tribal areas involves interaction between and clash of two unequal groups. The powerless group cannot resist the powerful one. In this unequal struggle, one would have required special protection of the tribals. That is what State schemes of poverty alleviation and scheduled area protection acts attempted to do. But they were introduced in a productivity-based industrialisation involving building the infrastructure of heavy industry that would feed the consumer sector. This would have to depend on the natural resources in which the tribal areas abounded. Higher productivity in agriculture depended, among others, on

irrigation for which major and medium dams were planned, most of them in the tribal areas. Forests were to be used as a raw material for several industries and industrialisation itself was to be encouraged in what were called backward areas to which category most tribal regions belonged. The consequence has been their marginalisation as can be seen through an analysis of industrialisation, displacement, deforestation, land alienation and women's status.

a. Industrialisation

A few years after the Rourkela, Bokaro, Heavy Electrical Corporation, Ranchi and many other industrial plants were built in the tribal areas, one noticed a cultural revival among the Chotanagpur ribals. Bhupinder Singh (1983: 97-99) attributes this to the destablisation caused by the uprooting of thousands of families, often without resettlement; land alienation and other ill effects. The reaction of the tribals to their destablisation and the break up of the traditional ties with their community and environment was to resort to a cultural revival. As mentioned above, the relationship between industry and the tribals is one of power and powerlessness. Overwhelmed by the powerful external factors, the tribals at first revolted against their exploitation and when this was suppressed, closed themselves in through religious or cultural revival. This revival and reaction of the tribals is a consequence of the nature of industrialisation in a Third World country like India.

> In contrast with urban concentrations in industrial countries such enclaves have only very tenuous links with their environment because the economic activity prevailing in them is derived from an exogenous impact. The coalfield is only one instance of this kind. There are many types of enclaves, e.g. a port serving as an entrepot for international trade, a military base maintained by a foreign power etc. The relation of such an enclave with its hinterland will be determined only by the demand for local labour and food. In exceptional cases even this relation may not exist if labour is recruited elsewhere and food is brought in from abroad. The disappearance of such an enclave would not make much of a difference to the economy or its hinterland. If the enclave does have an impact on its environment this may not necessarily be a positive one, leading only to a distortion of the economy of the hinterland without generating economic growth (Rothermund 1978: 1-2).

In other words, the area was materially developed but the beneficiaries were outsiders. For example, when iron first began to be used in the colonial areas it was not the soft and malleable iron traditionally produced with charcoal but hard iron for which coal was required. This involved replacement of the traditional technology and marginalisation of those who depended on it. Moreover, coal and iron were produced according to the need of the steam engines and textile mills owned by the colonialists and not according to local requirements. Hence, the mines developed as an enclave that did not really result in any major change in the hinterland. As an example one may mention that though a great amount of electricity is produced by the thermal plants, with the coal mined in the Dhanbad district of Bihar, in the district itself electricity stops a few metres after the coal fields end (ibid: 1-3).

The same trend has continued also after independence. Though raw material is taken from the tribal areas, local inhabitants themselves get little or no benefit from it. Most well paid jobs in the industries require skills and literacy which the tribals do not possess. The areas were opened up suddenly for economic activity but education was slow in coming partly because of official neglect and partly because of lack of motivation among the tribals. In itself education may help mobility. But given the neglect and the low standard in these areas, the children who go to school lose out in the competition for jobs. The few who managed to get jobs, find themselves in a new world with socio-psychological barriers which they cannot always cross. Hence, they are misfits both in their society and in their relationship with the outsiders. As a result, given the alienating nature of the present form of education and lack of opportunities even afterwards because of their powerlessness, very few tribals are motivated to send their children to school. Consequently, all the new economic opportunities in the region are absorbed by migrants who are in touch with the mainstream outside for whose benefit the area is exploited. Moreover,

contractors, middlemen and moneylenders accompany the outsider. As a result, the tribal slowly loses his land and other resources to the individual and written document-based formal system which enters the area where classes have not been formed, land is cultivated by the family according to its needs and legal rights according to their present understanding have no meaning in a society based on trust and the word of mouth and legitimacy by the community (Sharma 1978: 27-30).

That if such a clash of interests is not allowed and the tribals are prepared in advance to meet the onslaught, there is a possibility of their getting some benefits is seen from a comparison between the north-east and middle India. There certainly is a great amount of exploitation also in the north-east and it may even increase in the future. But many more protective measures have been taken in the north-east and it has remained insulated for a relatively long time. Besides, missionaries have introduced inputs such as education and health facilities that have put the tribals in a better position than those in middle India. As a result, the tribals in Nagaland and elsewhere have been able to retain most of their land and tribes like the Apa Tanis have been able to take over local trade, join civil and defence sevices and use the protective measures in their own favour (Haimendorf 1980: 3-6).

It is not merely skilled labour that comes from outside the region. Even unskilled labour is not necessarily recruited from among the local population, not even from among those displaced by the project or whose land has been alienated. When local labour is recruited, it is because of the possibility of giving them low wages. The local population in their turn is forced to accept these conditions because of lack of any alternatives.

> Recruitment of the tribals as industrial workers is a necessity experienced by both the sides concerned--the employer-industrialist and the members of the tribal community. The industry requires such unskilled and semi-skilled workers who can work for low or minimum wages. The tribals, in many cases, are also ready to offer their labour at this rate of wages because in rural area they cannot get even this much wages. The tribals, in

many cases, are also ready to offer their labour at this rate of wages in spite of hard and longer duties to be performed in the firm (Kabra 1987: 34-35).

b. Development and Displacement

To begin with most mines are located in the tribal areas. For example, out of 498 coal mines existing in the country in 1983, as many as 463 (92.97 per cent) were in the tribal districts of the five States of Andhra Pradesh, Orissa, Madhya Pradesh, Bihar and West Bengal. Of the remaining 35, 22 (4.42 per cent) were in Maharashtra, almost all of them in the tribal areas. Briefly, more than 95 per cent of the coalmines were in the tribal areas (Fernandes, Das and Rao 1989: 66-67). It is not merely mines that are located in these areas but also other industries. Because of the closeness of the minerals, two out of the four major steel mills opened after independence are located in the tribal area itself and the remaining two (Bhilai and Durgapur) not far from it. The same is the case with the major dams. Apart from the development projects, the wild life sanctuaries that are meant for environmental protection are mainly in the forests of the tribal areas.

A major result of the location of these developmental projects and infrastructure is displacement. A few distinguishing features of involuntary displacement by development projects since independence can be given. The first is that despite the immensity of the problem, an adequate data base is lacking. Not even official figures are available concerning the extent of displacement. Only a few case studies can be found. By extrapolating these figures and making a very conservative estimate, we came to a low figure of 145 lakhs displaced by development projects during the last four decades. 17 lakhs among these have been displaced by coal and other mines, 110 lakhs by dams and canals, 10 lakhs by industries and 6 lakhs by sanctuaries and parks (Ibid: 80).

The second aspect is the predominance of the tribals, dalits and other landless categories among the displaced. While tribals form

about 7 per cent of the country's population, because a very large number of the biggest displacing projects like mines and dams are in the tribal areas, the percentage of tribals among the displaced is very big. Estimates put their number at not less than a third among them and probably it is much more (Government of India 1985: 18-21). What is much more important is the fact that the trend is increasing. More and more wild life sanctuaries are being planned in the tribal areas. While they may not physically displace a large number, many inhabitants of the area are what can be called Project Affected Persons (PAPs) since their life support system is taken over by the sanctuary. Of approximately 12 lakh persons to be displaced by 20 major dams that are being planned or under construction, data concerning the percentage of tribals are not available for three and one will not have any tribal. The remaining 16 dams will displace more than 6 lakh tribals. In other words, more than 50 per cent of those to be displaced are tribals (Fernandes, Das and Rao 1989: 84-85).

A very large number of the others to be displaced belong to the category of dalits and other landless persons. For example, of the 19,271 families (106,000 persons) displaced in Maharashtra between 1968-69 and 1970-71, as many as 5,703 families (31,000 persons or 29.62 per cent) were dalits and 9,264 families (51,100 persons or 48.21 per cent) were tribals (Singh 1989: 93).

What one notices in this process is the struggle for another natural resource viz. land. Because the land in the tribal areas abounds in water and minerals, more and more of it is being alienated to the classes that are getting all the benefits of development at the cost of the marginalised. What one notices here is

> a series of changes in the use of land which are exclusive, that is, it is put to such uses that access to it as a resource is denied to those who enjoyed it earlier, either customarily or through legal entitlements. These changes in land use are the result of economic or state development and their outcome is not to intensify the use of and access to it as a resource, but to reserve it for exclusive use so that access to it is curtailed (Mankodi 1989: 139).

The tribals also happen to be the forest dwellers, the only

people who do not have property rights in India. "There are two types of citizens in India: those governed by tenancy laws and those governed by the forest laws" (Singh 1989: 92). The tribals belong to the latter category. While others who occupy revenue land eventually become tenants and owners, those living in the forest areas do not get any right even after several generations. They can be displaced for public purposes (whose meaning has not been defined till now) and can be uprooted without any compensation. The dalits, on the other hand, are by and large landless but depend on the village as a unit by rendering their service much more than the landowners do. In other words, in the agricultural economy land

> is not only a site--it is the prime means of production. As such it supports the owner, his servants, the village artisans, the merchant who buys the produce and a host of others. When the cycle of agriculture is disturbed all these activities are disrupted and the livelihood of all the landless endangered. The Land Acquisition Act does not provide for such people (NCHSE 1986: ii).

The third aspect that stands out is that fewer than 30 per cent of those displaced by development projects during the last four decades have been rehabilitated. Compensation, obviously, has been given only to those who owned land while most of the tribals and dalits at most had a homestead. Resettlement has for all practical purposes been non-existent (Hansda 1983: 22-23).

It is in this context that displacement has to be understood. Those who pay for what is called national development are the assetless rural poor, a very large number of them tribals and the rest dalits. The displacing agency is also the one put in charge of their rehabilitation. Pressure on them is great to complete the project in as short a time and at as low a cost as possible. They are judged according to the cost-benefit analysis of the completion of the project and not the extent of rehabilitation of the displaced persons. As a result, they have little or no motivation to rehabilitate the displaced persons. This seems to be one of the reasons why the cost-benefit analysis is biased and does not take the social costs into

consideration as can be seen in the present Narmada controversy (Paranjpye 1989).

An obvious consequence of this situation is what Areeparampil (1989: 19-26) calls the dispossession of the indigenous peoples. They are deprived of their land and their very identity in order to support the development of a small minority outside their area. They are dispossessed of their land, their culture and of their community. It is not merely the infrastructure or the dam that displaces them. Whatever industry or other development project that comes into the area begins a much bigger process of dispossession which continues through many other modes.

Impoverishment and bondage are an obvious consequence. Such impoverishment begins the process of indebtedness, further land alienation and bondage. More exploitation follows. For example, a study of the 1.5 lakh workers on the Asian Games construction projects in 1982 revealed that around 30,000 of them were bonded labourers, all of them tribals displaced by deforestation and development projects from their habitat in Orissa and Chattisgarh in Madhya Pradesh (Fernandes 1986: 269). It is estimated that more than half of the 5 million construction workers in the country are tribals, mostly bonded labourers, displaced by the same processes.

Those who do not become construction workers and are bonded, cope with their displacement without rehabilitation by further destroying their environment. In our sample of 272 families in 16 villages of 6 districts in Orissa, 77 lived by selling firewood in 1983. Thirty years earlier hardly ten of them were selling firewood and their number had gone up to 18 in the 1960s. What is more important is that about 80 per cent of those living on the sale of firewood were persons displaced by the Hirakud, Salandi and other irrigation projects and not rehabilitated (Fernandes, Menon and Viegas 1988: 95-96). In other words, as a result of displacement without rehabilitation, one notices a transition from constructive to destructive dependence on the forests. Deprived as they are of their livelihood and since they lack

any other economic or employment alternative in the area, they have no choice but to depend forests for their survival. Physically, they continue to be in the forest but they have been alienated from it since they have lost a sense of belonging to it as they did in the past.

The situation of dispossession is in itself not surprising. The very fact that even after 40 years the country lacks a data base on a crucial issue of this type is in itself a sign of lack of concern of the decision-makers concerning the groups that pay the price for the development of the urban upper classes. That the situation itself has not changed becomes clear when one studies the condition of preparation for future displacement as well as past resettlement. Studies of the victims of the Pong dam, the Tehri dam and others have found that till almost the moment of submergence, the persons to be displaced did not have any information concerning either the area to be submerged, the number to be displaced and the type of rehabilitation planned (Thukral 1989: 41-42). That the situation is similar also in the projects that are being planned, including the Narmada Valley, is obvious from several studies. To begin with the number of persons to be displaced, according to official estimates, Sardar Sarovar which is one of the 30 major dams to be constructed, will displace 45,000 persons (Verma 1985: 38) while according to another study (NIUA n.d.: 6) it will affect 1,08,118 persons.

The same type of callousness is noticed also in multiple displacement. In some cases, the host population where they are resettled does not accept them and they have to return to their native place as it happened with the Pond dam oustees. But in their case it turned out to be a second displacement. The members of their own group saw them as rootless since they had lost all their assets and were not able to settle down somewhere else. Hence, they had to leave the place once again. In many cases multiple displacement is caused by lack of official policies or proper planning. The same group is sometimes displaced by different projects. Such, for example, is the case of the Rihand dam oustees. In the early 1960s, 30,000 of them were displaced by the construction of the dam. Coal was discovered in the 1960s in the Jayant area where they were resettled and they had to move out again. In the 1970s, the government decided to have thermal plants around the coal fields and they had to leave the resettlement area once again. More were displaced when other industrial units or roads came up. In other words, many of them were displaced three or even four times in a 20-25 years span (Thukral 1989: 47-48).

c. Development and Deforestation

The link between the tribals and forests is often referred to as symbiotic. This relationship has all but disappeared today and tribals now have made the transition from constructive to destructive dependence on the forest. In other words, while in the past they treated the forest as a renewable resource in whose use they kept a balance between human and environmental needs, today they cut trees for sale as firewood and as wage earners under contractors. In other words, they survive on the forest not by preserving it for posterity but by destroying it. The forest policy geared to industry has to be considered responsible for this transition. It is a purely growth-oriented strategy that speaks only of production without equitable distribution and sustainability. This lopsided strategy that focuses

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only on production and not on enhancing their flow to the entire population, ends up by organising the flow of resources from the periphery to the few islands of prosperity created by this model of development (Gadgil n.d.: 4-5).

This model of development has turned the number of industries into the main criterion of progress. Industrial production was expanded without counting the environmental and human costs. Extra efforts were made in States that were considered backward, particularly if they were mineral and forest rich. Such, for example, is the case of States like Bihar, Orissa and Madhya Pradesh where many forests and mineral based industries came up. Chattisgarh in Madhya Pradesh, for example, only had a few saw mills and no other industry worth the name at independence. In 1980 it had 1,361 small and medium industries, 541 of them forest-based. This does not include major industries like Bhilai and big mines like Dalli-Rajhara. Besides, it has several major dams and 12 new major dams are being planned in the 7 districts with a catchment area of 10,000 sq.kms (Fernandes, Viegas, Menon and Chandy 1988: 147-151). All these enterprises cause deforestation. In fact, the destruction of the forests begins even before an enterprise goes into production, with the building of the infrastructure in the form of roads, irrigation and hydro-electrical dams, townships, railway lines etc. It is continued once the industry begins production since many of them use bamboo, timber etc. as raw material. What is important is that this material is highly subsidised.

> The widely accepted notion that industry must be encouraged at all costs was translated in practice into prescription that industry must be subsidised in every possible fashion. But this subsidy perforce has to be at somebody's cost (Gadgil 1989: 15).

An example of this subsidy would be bamboo. In Orissa, in 1983, industry paid around Rs.400 per National Tonne (NT i.e. 2,400 running metres of industrial bamboo) and in Chattisgarh around Rs.430 (Fernandes, Viegas, Menon and Chandy 1985" 106). In Karnataka, in the early 1960s the West Coast Paper Mills of Dandeli in Uttar Kannada

[illegible] was awarded bamboo at Rs 1.50 per tonne when the commercial price was around 1,100 (Gadgil 1989: 35). In 1983, the price of bamboo given to the people in Orissa was around Rs.1,800 and in Madhya Pradesh around 1,500 per NT. Similar statements can be made also concerning subsidies given to timber and other raw material used by industry.

These subsidies and the profit orientation of industry ensure the destruction of forests. The first aspect of this profit orientation is what is called sequential exhaustion of resources. The industrialist begins by a spatial sequence of accessibility. He clearfells the forests that are the closest to the village since they are accessible at least by a bullock cart. Once they are exhausted, they go to reserve forests further away and finally to protected forests from which the people get the rest of their small needs like bamboos, fodder and medicinal herbs. Then comes the sequence of distance. Once the forests in a given area are exhausted, they go to the next district or even the next State and finally to far away areas. For example, the forest-based industries of West Bengal that have depleted the resources in their State now extract more and more of them from Bihar, Orissa and the north-east. The industries of Andhra Pradesh depend to a great extent on raw material from Orissa and the Bastar district of Madhya Pradesh (Fernandes, Menon and Viegas 1988: 189-195). The two paper mills of Karnataka began by removing bamboo from the most accessible block, then built a road to the next block and continued the process. After thus exhausting all the resources in the State, the West Coast Paper Mill went to the neighbouring State of Andhra Pradesh and finally to the distant areas of Garwahls in Uttar Pradesh and to Assam, Nagaland and Arunachal Pradesh in the north-east (Gadgil 1989: 16-17).

Then comes the sequence of the type of materials used. Once bamboo is exhausted, the paper mills acquired rights to other soft wood and later to hard wood. The plywood factories began by exhausting desirable species like mango and later the more accessible deciduous

[illegible] and some of the evergreen forests and finally they have gone [illegible] to exploit other species (Fernandes 1990: 42-43). The third aspect of profit orientation is the type of techniques used. Traditionally, the tribals and other forest dwellers used techniques geared to coppicing. For example, normally they cut a few bamboos from each clump, at a certain angle and a few centimetres above the ground, to ensure that the thorny cover of short branches formed at the base of each clump was not disturbed and thus prevented grazing in order to ensure the regeneration of bamboos. Usually, they cut only one or two culms from each clump (Fernandes, Menon and Viegas 1988: 188-189). The paper mills, on the contrary, follow what are considered economically viable methods prescribed by "scientific forestry". They clearfell the area by removing a much larger number of culms from each clump and do not leave the thorny cover for protection since the techniques would be too expensive for them. The removal of the thorny cover from the base exposes the tender shoots to grazing by cattle, pigs, monkeys etc. Regeneration is thus prevented. Thus the overexploitation of existing resources and prevention to regeneration ensures the process of depletion. At the same time, given the subsidies, the industrialist lacks the motivation required for reforestation since it is more expensive than the material he gets. As a result, deforestation is ensured.

As far as the tribal is concerned, this begins another vicious circle in his community. The village is deprived of its food from the forest that was the closest and has been clearfelled by the industrialist. The impoverishment that results, pushes the people into the hands of the moneylender who accompanies the forest contractor and industrialist. Land alienation and often bondage are the consequences. Given their impoverishment and absence of any economic or employment alternatives in the region, the tribals who had till then preserved forests for posterity are forced to overexploit it. First of all, the shifting cultivation plot is overexploited and the

[illegible] fallow period cannot be observed since they have been deprived of their other NFP and cultivable land. In Orissa jhum has been reduced to a 6 year cycle and in the north-east to about 12 years and it seems to be as low as 3 years in Western India. Deforestation and soil erosion are the consequences. At the same time, the tribal is forced to cut trees as wage labourer under contractors or for sale as firewood. With the transfer of these resources to the corporate sector, begins competition within the tribal community for the few resources that are still available to them. Consequently, their community breaks up and individualism sets in. This further deprives them of the mutual support they enjoyed in moments of shortages and that helped them to survive in times of droughts, floods and famines. The tubers, roots and other "famine food" disappears with the forest and the community that sustained every family gets weakened. Thus, the tribals are deprived both of the material and the human base that supported them in times of shortages. Hence, with every shortage and drought their situation deteriorates much more than that of the others (Fernandes 1987: 432-435).

d. Consequences on Women

While all the tribals are thus impoverished, women are the worst affected since their role was crucial in the traditional economy. Interdependence was greater between women as a group and ecological conservation, than between men and their environment. As a result, the deterioration of the environment affects women much more than men, though both are impoverished and alienated from their culture, economy and ecology. The consequences are felt at different levels by all the three categories of tribal women affected by these developmental viz. (a) women of tribal families that continue to live in their village but have been impoverished by environmental deterioration, (b) women whose husbands emigrate either to tea gardens or to the urban areas, in many cases as bonded labourers leaving their families behind; (c) families that migrate to the urban areas and fill their slums. Though

the situation of all the women deteriorates, there is considerable difference in the manner in which the consequences are felt by the three groups.

i. Tribal Women in Rural Families

The immediate consequence felt by the rural woman is the deterioratin of her physical condition and of her status in the community as a whole. This status change is effected in four stages which form a continuum. (a) The first is the increase in the workload of women because of the decline in the resources and the distance of forests from the village. Linked to this is the change in the nutritional status and the health of the family in general and of the woman in particular. (b) At the social level one witnesses the transition from shifting to settled agriculture with implications for ownership . (c) At the same time, competition begins for the scarce resources and the community as such breaks down. The consequences of individualism are felt more by the woman than by the man. (d) Finally, at the cultural level there is sanskritisation in the strictest sense as enunciated by M.N.Srinivas. As part of their upward mobility the upper classes among the tribals adopt what are considered superior caste customs, with deleterious effects for the woman.

The change in the type of work they do and in the workload itself is caused firstly because of the shortage of land and other factors that result in some cases in transition from shifting to settled agriculture. Its implications are felt only marginally in the pattern of ownership but much more in the type of work. To begin with ownership, settled agriculture is primarily on patta land owned by an individual. As such it is the man's property. The woman thus becomes only a subordinate worker under her husband, the owner. Given the nature of settled agriculture, the main decisions are taken by men, particularly at present when the trend is more and more towards commercial crops or towards HYV seeds controlled by the commercial sector. The woman has very little say in these decisions partly

[illegible] as most of their crops are meant for domestic consumption and partly because the technology employed is beyond her comprehension (Fernandes forthcoming). She only becomes a worker in a system in which the division of work is clearer and more unequal than in shifting cultivation. The man does what is considered strenuous work and the woman does all the back breaking tedious jobs (Gulati 1975).

Even when the changeover to settled agriculture is not effected, the woman's workload increases considerably. Because of soil erosion and loss of soil fertility caused by overexploitation of the plot, the woman who does most of the work has additional work to do to make the stony land and make a less fertile plot viable (Fernandes, Menon and Viegas 1988: 251-253).

Together with it there is increase in the distance of forests from the village. The consequence on women is additional workload. Apart from diminution in the resources available, the distance of forests from the village increases with the sequential exhaustion of resources. In Orissa the average distance of forests had increased from less than one km from the village in the 1950s, to 1.7 km in the 1960s and 7 km in the early 1980s. In the Chattisgarh area of Madhya Pradesh, the distance had increased from 1.6 km in the late 1960s to 4.1 km in the early 1980s (Fernandes and Menon 1987: 70). As a result, the woman has to walk additional 5 to 10 km or even more everyday or once in two days to collect food, fuelwood etc. Moreover, when forests were close to the village, all the women and children used to join the housewife in NFP collection. Today, with the distance increasing, the young and middle aged women have to go alone. Thus their workload has increased from every point of view (Menon 1987: 378-384).

The shortage of resources as well as the additional workload have implications for the nutritional and health status of the tribals in general and of women in particular. To begin with cultivation, studies have indicated that where there has been transition to settled agriculture, efforts are being made to motivate the tribals to switch

over to horticulture or other commercial crops like cotton. The consequence is that they are deprived of the pulses and cereals which they grew on shifting cultivation plots. On the assumption that they will be able to make enough money by cultivating cotton to buy staple food, they neglect growing cereals and pulses. At the same time, they are not exposed to the market forces. Consequently, they have to depend on the merchant both to buy their food and to market the cotton or other commercial crops.

Exploitation is a consequence. Secondly, the moneylender takes control of his life since he controls the forward and backward linkages to which the tribal does not have access. Consequently, what was meant to be a mode of freeing the tribals from the moneylender becomes one more mode of control over their community (Reddy 1987: 38-47).

The situation remains equally bad even when the shift to settled agriculture has not been effected. Because of the depletion of forests, and the consequent overdependence of the tribals on shifting cultivation, the plots are overexploited. Its fertility declines and much less food than in the past is made available from it. This combined with the distance of forests and the consequent lower collection of food, reduces the food available to the family while increasing the woman's work.

What matters here is not just the physical deterioration of economic impoverishment but the fact that all these factors come together to intensify the degradation of the woman. The first of these is competition for the scarce resources between individuals in what was once an egalitarian society. As a result, the mutually supportive community breaks up and class formation follows. A few powerful tribals are prepared to collaborate with the external elements of the formal economy such as moneylenders, merchants and middlemen. They try to appropriate for themselves as big a share of the scarce resources as possible in the process depriving the majority of what is due to them. Consequently, exploitation is continued by these few tribals who manage to join the exploiting class. They take control of the most fertile shifting cultivation land, of the trees on the common land and of the non-wood forest produce (NFP) such as fruits and flowers that can be found very close to the village (Fernandes, Menon and Viegas 1988: 102-109).

This weakening of the community is crucial for women. They, more than men, depend on community support and mutual assistance in case of shortage of humanpower and in moments of disasters. Such community support was an integral part of their life as well as in times of

disasters such as droughts and famines. Today, with the deterioration of the environment the material resource base has been weakened. With class formation and the break up of the mutually supportive community, she has lost the social infrastructure. Now every family and sometimes even every individual, has to fight for a share in the scarce resources (Fernandem 1987: 434-435).

It is in this context that Sanskritisation or upper caste (non-tribal) customs by some of the tribals has to be situated. They change their culture and accept that of the exploiter with upward mobility in view. Not all the tribals adopt every upper caste custom. It is only the upper classes among the tribals who have to be accepted by the middlemen, moneylenders etc. belonging to the Sanskritised caste society. They are also the ones who adopt aspects such as the purdah since they can afford to isolate their women while the lower class women have to work outside for their very survival (Menon 1987: 384-386). Later, however, pressure mounts on the lower classes to adopt many such customs (Fernandes 1990: 45-47). Crucial to Sanskritisation is the ideology of women's subordination which seems to take hold of all the classes. This is crucial in the context of nutritional deficiency. Some studies have, indicated that in the context of food shortages, another aspect of the Sanskritic subordination of women takes over. It is taken for granted in this system that men do the most tedious work and as such have to be better fed. The woman has to deprive herself of food in order to feed the man first. The continuity of the family depends on the son. As such, he has to be better fed than the daughter. As a result, the housewife feeds her husband first, then her sons followed by her daughters and finally herself. When the shortage is greater than usual, she starves herself (Chen, Huq and D'Souza 1981: 57). In our study in Orissa, we found a few instances of this in a sample in the Kalahandi district that was more exposed to caste society than those in the Ganjam district that had retained the egalitarian tribal culture more than the others. We saw this

among women with greater intensity among the urbanised tribals.

Deterioration of their health status is a natural consequence. Apart from higher workload and lower nutritional intake, one should also remember that with deforestation, the herbs and other forest produce from which they got their medicine have disappeared. On the other hand, environmental diseases have increased as a result of ecological imbalance and malnutrition. At the same time, what is considered allopathic medicine is not accessible to them because the tribal health centres are open during the day when women have to be working at home or in the forest. Besides, they are situated at a distance of anything between 10 and 20 kms from the village. Consequently, they do not go to the dispensary except in extreme need when the disease may be beyond cure. Moreover, often pregnant women continue to work till about a week before their delivery and are up on their feet within a week after it (Agarwal and Narain 1985: 302-305).

Even among those who are less exposed to the external forces than the Kalahandi sample, divorce and widow remarriage is beginning to be looked down upon. Arranged marriages are coming to be accepted as the norm. Dowry often takes the place of bride price which has implications for women's status (Fernandes and Menon 1987: 121).

The situation gets much worse when the man, impoverished by deforestation or displacement, migrates away from the area, leaving the woman behind. Her powerlessness is often exploited by outsiders. Besides, the husband absorbs female subordination values in the place he migrates to. Often he takes on a second man. When he returns he expects the woman to be subordinate completely. Moreover, he also absorbs many commercial values and spends most of his money on clothes, trinkets and other non-essential items since they help him to raise his social status (Fernandes and Menon 1987: 105-106).

There had been very little tribal migration to the urban areas in the 1970s. However, our study in the Delhi slums shows that deforestation and displacement have forced many tribals to migrate in the 1980s and 1990s. Out of our sample of 81 tribal migrants, only 5

[illegible] per cent) had migrated before 1970. Most migrants belong to the late 1970s and early 1980s and had come as a result of environmental deterioration in their area or displacement by development projects. Here they are thrown into a completely new atmosphere because of their lack of exposure to urban life. Because of lack of exposure to life outside their region, their aspirations from urban life were very low. They did not know what to expect of the city. On the other hand, labour contractors had made promises of good jobs and houses. They had believed the labour contractors and had come to the urban slums without any negotiating power of their own and had expected the government to provide them with all the facilities. We, therefore, noticed in our study that the tribals were the most marginalised in the urban slums. While around 55 per cent of the dalits and others lived below the poverty line, among the tribals their proportion was about 50 per cent (Fernandes 1990a: 79-92).

In our earlier study among the tribals in the forest areas we had noticed that the situation of the tribals had deteriorated as a result of deforestation but that the dalits were worse victims of development than the tribals were (Fernandes, Menon and Viegas 1988: 56-58). The major cause of this difference seemed to be that the tribals have resources in the rural areas while the dalits have skills. In order to come to the urban area, the tribals sell whatever they have in the village since the labour contractor demands some money from them. Its result is that they are totally assetless in the urban area but do not have any skills needed in the city. As a result, their men take up the lowest paid and the most exploitative daily wage jobs. Consequently, the family becomes more dependent than in the past on women's salaries to supplement this income. However, because of lack of skills, they are not able to get anything more than the lowest paid part-time jobs. They are forced to take to what are called low caste occupations such as sweeping the streets. In a context where the caste values of untouchability are absorbed and most others view them only within the

[illegible] tribal women tend to be viewed as untouchables (Fernandes 1990: 112 155).

Finally, all the Sanskritic influences absorbed in the village remain with the tribals when they come to the slums. However, unlike in the village where only the upwardly mobile classes practised them, in the city all the tribals irrespective of their class accept them. We noticed among them, changeover from bride price to dowry, child marriage has become the norm, in many cases vegetarianism is adopted and some form of purdah accepted. Their nutritional has deteriorated more than that of their rural counterparts. As many as 164 (41 per cent) of the respondent families have only gruel several times a week for their food. In many of these cases women take only gruel after giving better food to the remaining family members. While the proportion is 41 per cent for the whole sample, among the tribals they were as many as 90 per cent. In most of these cases what we have said about the woman eating last is a sign of her subordination is practised in the urban slums. Briefly, the woman is left without any material support. The cultural support she had is taken away from her in the name of the upward mobility of the family which turns out to be that of the man.

e. Agriculture and Land Alienation

It is in the context of the impoverishment of the tribal community that one has to search for alternatives. And one realises that the tribal areas have been neglected as far as economic and employment alternatives are concerned. This is what forces them to depend on the forests in a destructive manner as against their traditional constructive dependence. As mentioned above, the tribal areas are used as sources of forest raw material and of water for the major dams. However, studies indicate that as far as agricultural development is concerned, they are among the neglected areas. Take, for example, the case of Chotanagpur where the tribals are different from those in the rest of India. Today they are settled agriculturists

not practise shifting cultivation. They own on an average 5 acres or more of land. Except for the Ho tribals, they do not have communal ownership today. Studies have indicated that they are open to new agricultural practices.

However, in reality they do not have access to these inputs. For example, the Chotanagpur plateau which has many major dams, has only 9.2 per cent of its cultivated land irrigated as against 25.4 in north Bihar and 67.5 per cent in the south Bihar plains. Availability of agricultural credit is 23.4 per cent in Chotanagpur as against 35.2 and 65.8 respectively in north and south Bihar plains. The composite demonstration plots are 11.46 per cent in Chotanagpur as against 19.4 and 18.55 per cent respectively in north and south Bihar plains (Bhagat 1983: 11). Apart from lack of infrastructural facilities, the high cost of the new tecnology makes it inappropriate for the poor tribal farmer. Hence, many tribals dilute the inputs such as fertilisers since they cannot afford the full quantity suggested. The diluted amount cannot deliver the results.

Moreover, most lands in the tribals talukas (of Gujarat for example), belong to what are called D & E categories i.e. infertile. Thus, the poor quality of land, lack of infrastructural facilities and increasing drought ensure that the tribal does not get enough to eat from his land (Iyengar 1983: 27-32).

Moreover, it is normally assumed that commercial crops raise the standard of living of a farmer. But this does not necessarily happen in the case of small and marginal farmers to which category most tribals belong. One can see it from the tribals inthe Adilabad district of Andhra Pradesh. Most Gond tribals in this district have taken to cotton cultivation and the area under cotton has increased from 5,702 acres in 1921 to 38,724 acres in 1971 and to 60,000 acres in 1981 while paddy is cultivated in around 11,000 acres of tribal land. Nearly half the tribal cultivated land comes under cotton. On the assumption that they will be able to make enough money by

[illegible] cotton, they do not produce enough cereals and pulses for their own consumption. This forces them to depend on the merchant for half of their food as well as to market their cotton. That is where exploitation begins. Most tribals take jowar on credit from the merchants at lean season prices and repay in peak season prices. Thus, the tribal who grows cotton on about 2 acres gets about Rs.1,800 for 4 quintals he grows there. But around Rs.900 have to be paid for jowar. As the need for cash increase, the tribal grows more cotton with the hope of getting more cash and the area under food crops comes down. Moreover, cotton requires external labour inputs while food crops can be grown by the family. Briefly, as in other cases, also in commercial crops, the tribal does not have access to the forward and backward linakges and has to depend on the same moneylender. Consequently, even what could have freed him from the moneylender becomes one more source of [illegible] (Viegas July 1987: 39-47).

One notices once again the consequences of the transition from the informal to the formal economy without adequate preparation. Also land alienation has to be situated in the same context. Apart from the fact that the private ownership of land which is usually in the hands of men has lowered the status of women, the transition from the informal to the formal economy has resulted in a great amount of land alienation. The process began with the introduction of muttahdars or jagirdars and finally zamindars. The process is getting intensified today because of indebtedness as well as the close link between the administrator and the vested interests. For example, at the time of the land settlement in 1968-69 in Orissa, the tribals were unaware of the manipulative tactics employed by the sundis (liquor merchants) to whom they were indebted. Large tracts of their land was transferred to the non-tribals while the tribals, the original owners and cultivators, were rendered landless because of the collusion between the moneylenders and the revenue officers (Viegas 1987: 338-339). Similar cases are found in all the tribal areas as many other studies [illegible].

The Lack of Exposure to Modern Inputs

It is in this context that one has to study the lack of exposure of the tribals to the tools of modernisation such as education and health. They are exposed to be exploitative elements of the formal system without any preparation. As a result they end up only as suppliers of low priced raw materials and cheap manual labour to the benefit of another class that gets all the benefits. The few who have received formal education do not get enough of its benefits. On the other hand, a comparison between the north-eastern States and middle India shows that the former remained isolated for a relatively long time and at the same time they were provided opportunities of education and health services. As a result, many more tribals in the north-east have got the benefits of development than those in middle India (Fuchs 1980: 175-177). Education, together with the new frame for personal and social behaviour provided by the missionary as well as his relative isolation seem to have combined to help the tribals in the north-east to cope with the transition from the informal to the formal economy.

> This bouncing back of the educated is sociologically a serious problem. As formal education fails to provide a new frame of references he (the tribal) becomes aware of the low economic condition of his group, particularly the scanty clothing and different social mores. This creates a psychological schism and he is torn between the two worlds. If a youthful group loses respect for its own elders and is shy of its own social extraction, it cannot play the role of a catalytic agent for the healthy socio-economic change of a community.
>
> It may be useful to contrast this state of rootlessness and non-belonging with social change initiated as a result of educational effort by missionaries. They provide him with an alternative--a new frame for his personal and social behaviour, not only that, they also provide the young with a new ideal, viz., recasting of his social group in the image of the new religious ethic. This perhaps creates greater schism between him and the original group but he gets the care and the warmth of a new group and an ideal to work for, if he so wishes (Sharma 1978: 30).

Studies have indicated that except for the north-east and some areas like Ranchi district in Chotanagpur, in the rest of India literacy among the tribals is very low. The situation is much worse

what it concerns women, particularly in the rural areas. As against more than 60 per cent literacy among urban upper class males, only 8.04 per cent of the rural Scheduled Tribe women and 24.52 per cent men were literate in 1981 (Fernandes 1985: 19).

Briefly, what one notices here is not merely impoverishment in the past but the certainity of further deterioration in the future because of the lack of exposure to the reproductive inputs like education of the formal system. The resources on which they depended, particularly forests and land are being alienated from them. At the same time, their culture is being devalued and they are deprived of their self-respect. Most anthropological and nationalist literature looks at the culture of the minorities from the majority viz. ethnocentric point of view. That every culture has its own autonomy is forgotten and as a result the tribals who belong to a subordinate culture are not allowed to grow autonomously. They are deprived of the resources they have, alienated from their culture and are asked to join the mainstream without providing them with the exposure required to join it as equals. The result is that they join the mainstream as subordinate bonded and wage labourers.

It is not surprising then that most recent tribal movements have been around their culture and land and forests. The Jharkhand movement for example, stresses the ethnic identity of the tribals when the reactionary nationalist groups try to Hinduise them (Pathy 1988: 161-165). Given tribal alienation from land and forests and from their culture, it is not surprising that

> Behind almost all the tribal agrarian armed struggles the causes are interference of the British in their traditional cultures, exploitation of the tribals by the non-tribal traders and moneylenders, creation of Forest Policy imposing restrictions on the exploitation of forest resources and finally the loss of tribal agricultural land to the non tribals, perhaps the most crucial factor which adversely affected the economic life of the tribal communities. Further the creation of Zamindari and Jagirdari systems made the tribal land owners tenant cultivators. Alienation of the tribals from their basic productive resource i.e. the agricultural land and the oppressing conditions created by the feudal system and its inhuman treatment of the tribals could not but lead to protests through armed struggles..... The same in every tribal area of the country during the British period was almost the same, interference with the internal and

> traditional affairs, oppression and inhuman treatment, alienation from their basic productive resources like land and forest was the order of the day. In all the cases of tribal insurgency or armed struggles during the period, the tribal insurgency or armed struggles during the period, the tribals chose rebellion or revolt as a last resort having failed to attract attention of the authorities through repeated appeals and even representations (Reddy 1987: 6-7).

A Colonial Economy

We do not need to go into the solutions attempted by the government. They have taken forms such as the Integrated Tribal Development Programme which have not made any impact and have in fact resulted in the further impoverishment of the tribals and Scheduled Castes (Pais and Singh 1987: 38-42). What is important to remember is that the economy in the tribal areas has a colonial character which is continued and intensified by the post-independence government. This intensification can be seen in the Forest Policy. In 1854 when the first document on the forests was drafted, the tribals were given some rights in their traditional forests. In 1894 the Forest Policy turned them into "rights and privileges". The post-independence government would have been expected to undo the harm and give more rights to the tribals. In reality, however, the policy promulgated on 12th May, 1952 changed this to "rights and concessions". Already in 1961, the Commissioner for Scheduled Castes and Tribes complained in his report that more and more rights were being taken away and only concessions were thought of. Though this was not accepted by the government, the National Commission on Agriculture officially suggested in 1976 the taking away of all rights and retention of only a few concessions according to the will of the State.

What is important to note is not merely that words have changed but the reality of colonisation has been intensified. One would notice this if one were to compare the analysis of the official Indian delegation at the UNCTAD VII with the reality in the tribal areas.' At the UNCTAD VII Conference, the Indian delegation functioning as the voice of the Third World, complained about the unjust international economic order. They identified the following features of the

international economy:

a. the low price of raw materials on which the economy of most Third World countries depends and the refusal of the rich countries to fix their floor price for them.

b. protectionism and its bias against any processed product coming from the Third World by taxing them and allowing in only raw material.

c. refusing to deal with any cartel such as OPEC and dividing the Third World countries against one another.

d. what is due to the Third World in the form of higher prices is given to them by the rich countries as foreign aid which is in fact a loan that enriches the donor country at the cost of the receiver. What the Third World needs is better trade conditions and not aid.

When one studies the situation in the tribal areas, one notices that it is identical to the relationship betwen the Third World and the rich countries. First of all, like rich countries that do not give a good price for its raw material, the tribals to whom the forest is a source of survival, are deprived of a little income they could get by selling their produce at a decent price by the commercial-industrial interests that try to make as much profit out of their misery as possible. The Tribal Development Cooperative Corporations whose declared objective is to improve the status of the tribals by functioning as conduits for the commercialisation of MFP are in fact sources of exploitation of the tribals and of revenue to the State. They are dominated by the same middlemen and other commercial interests (Fernandes, Menon and Viegas 1988: 139-142). Secondly, like the rich countries that use the Third World only as a supplier of raw materials without giving it the opportunity of processing raw material, also the upper classes in India treat the tribal areas only as suppliers of raw material for the enrichment of other classes. For example, tendu leaf is sold to the bidi makers outside the area and

the tribal is used only as a cheap wage labourer. The TDCC that in 1983 bought sal seeds from the tribal at a less than Rs.100 per quintal, sold them to industry at around Rs.1,500 per quintal. No processing was undertaken in the tribal areas themselves. The same can be said about bamboos, timber and other products.

Thirdly, India complained about the rich countries dividing the Third World by not accepting any cartel like OPEC. The same happens in the tribal areas. Bamboos, mahua and other MFP are controlled by the non-tribal middlemen when in fact the State should have encouraged tribal cooperatives. At present the tribals in the Gadchiroli district of Maharashtra are demanding that they be allowed on a cooperative basis to use their traditional techniques of cutting bamboo and growing it and supply it to the paper mill that is coming up. But this is not accepted by the State since the middlemen and contractors are in control. The State deals only with individual tribals and not with their community thus weakening them further.

Finally, India complains that the rich countries deprive the Third World of their resources by not giving them good trading terms and compensate for this injustice by giving aid. The same happens in the tribal areas. Nothing is done to improve the terms of trade in the commercialisation of MFP, in wage labor and the whole economic system that renders them further powerless. Instead, after rendering the tribals powerless and impoverishing them, official poverty alleviation policies like IREP and IRDP are introduced. Because of the tribals' lack of exposure, most benefits of these schemes meant for them go to the outsiders.

Conclusion

It is at this level that the policies have to change to suit tribal needs. A world in which poverty and inequality are endemic will always be prone to ecological and other crises. Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better

> Living standards that go beyond the basic minimum are sustainable only if consumption standards everywhere have regard for long-term sustainability. Yet many of us live beyond the world's ecological means, for instance in our patterns of energy use (WCED 1987: 43-44).

One has to speak about the sustainability of the forests. Today their use is not within their sustainable limits be it for grazing or for raw materials (Gadgil 1983: 113-334). We have seen the same happening to shifting cultivation, firewood and the environment in general. This results in shortages and competition. In the context of these shortages begins the competition for scarce resources between the powerful and powerless classes. Obviously, the powerful corporate sector wins against the powerless tribals.

This process has to be reversed. The tribal has to be trained to face the formal secotr. At the same ti me, .the formal economy has to be adapted to the needs of their community. At this stage space does not allow us to make all the suggestions in this direction. Suffice it to say, the meeting point of the two economies has to be not the individual but the community of the tribals. Their cooperatives have to be encouraged and they have to be built not on the system of the formal economy but on the tribal community. Their techniques have to be studied and updated and education geared to meet their needs. It is only by beginning with what the tribal has and updating it that their community can be helped to resist the negative impact of modernisation. Ultimately, the present type of modernisation that further impoverishes the already weak has to be questioned.

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BACKGROUND PAPER FOR THE WORKSHOP ON LINKAGES BETWEEN BIODIVERSITY AND RESTORATION OF DEGRADED LANDS

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PART - I

1.1 India qualifies as one of the top twelve megadiversity countries in the world, because of its tropical and subtropical climate, its great variety of environmental regimes, and its position at the junction of African, Palaearctic and Oriental regions. It is also a part of a secondary, diffuse centre of domestication of plants and animals. Conserving its heritage of biodiversity is a major challenge, given the large human population with its subsistence needs, and the growing resource demands of the urban-industrial sector.

1.2 This effort must consider biodiversity along many dimensions and on many scales of organisation, ranging over the genetic, species, ecosystem, landscape and regional levels. At any of these levels, we must consider the relative value of the different elements; after all, we set a higher conservation value on elephants and tigers than on the smallpox virus. In general, the rarer elements would be valued higher, as would elements of greater economic promise such as the wild relatives of cultivated plants. Other aesthetic, scientific and moral considerations would also enter into setting conservation priorities. In

particular, if a major justification for conservation is the "transformative value" of wilderness, i.e. its value in moulding human attitudes towards the environment as a habitat for humanity, then we would decide in favour of the biodiversity being widely dispersed rather than concentrated in a few large reserves.

1.3 India has a great diversity of environmental regimes. In the northeast it can boast of areas with the highest levels of annual precipitation in the world; at the same time parts of Thar desert may see no rain for years on end with the annual average being below 300 mm. Its northern plains may experience temperatures of 50 degrees C in the summers, while the higher reaches of Himalaya remain perpetually snow-bound. It includes the largest mountains of the world and tiny coral islands in the Indian ocean. Its river systems include the mighty Ganga and Brahmaputra with their huge flood plains and the short and swift west flowing rivers discharging from the Western Ghats into the Arabian Sea. In consequence, India's natural vegetation ranges over tropical evergreen and mangroves to dry deciduous and desert scrub.

1.4 To a conservationist the landscape and waterscape of India today present food for much thought. In a country where 70% of the people continue to depend on agriculture, it is not surprising that over half the land is under cultivation; a fraction larger than for most other nations of the world. Less than a third of this land is irrigated; an even smaller fraction of about a fifth is under intensive green revolution agriculture. A substantial number of rivers have been dammed to provide this

irrigation, as well as power. Nevertheless the bulk of India's population remains dependent on rainfed agriculture for most of their subsistence needs. These people are also too poor to afford to rely on the market to purchase most of their requirements, and therefore must depend on the natural vegetation for fuel, small timber and a number of inputs to agriculture and animal husbandry such as fodder, agricultural implements, mulch and leaf manure. The landscape of much of India is the habitat of this peasantry. It is characterised by overuse of agricultural lands, and overuse of vegetation from the surrounding non-cultivated lands. Even the sacred fig trees that used to dot the villages are beginning to disappear. There are of course notable exceptions as in the Bishnoi villages of Haryana and Rajasthan with their lush growth of Khejadi trees and herds of antelopes.

1.5 The extent of forest cover of India has been a matter of some controversy; however, the availability of satellite imagery has cleared up the matter to a considerable degree. The forest departments legally control some 75 out of 320 million ha of the country's surface. Of this around 45 million ha is under some level of canopy cover, 30 million being good canopy. The best close canopy forests are in areas difficult of access and hence not subject to commercial utilisation. These include smaller islands in the Andamans and steep escarpments of Eastern Himalayas and Western Ghats. All areas readily accessible for commercial utilisation have been depleted by a combination of industrial harvests with fuel headloading to towns by landless village people.

1.6 About 3% of the country's surface is under nature reserves; not all of this is core areas under strict protection, but also includes areas from which timber harvests may be continuing. The nature reserves have also tended to be managed in the interests of the more spectacular larger mammals like deer and tiger; although now there are reserves focussing on other groups such as orchids. The philosophy underlying the management of these reserves has included exclusion of hunting by all segments of the population, and exclusion of subsistence demands by the local rural and tribal populations. The latter has often included shifting of long settled people out of nature reserves, leading to damaging conflicts as in Kanha. The formal state sponsored conservation effort has also been indifferent or inimical to traditional practices such as sacred groves and protection to monkey populations.

1.7 Little state sponsored effort has gone into conservation of biodiversity outside of the nature reserve system. Indeed the management regimes prevalent outside of the land category of reserve forests has been an open access regime in which no segment of the society has a long term interest in sustainable resource use. A whole range of development policies have also tended to promote exhaustive use of resources; in reserve forests and outside them. Two elements that seem to be particularly significant in this context are: high levels of subsidies to the resource users, and the lack of accountability on part of resource managers. The pros and cons of doing away with resource

subsidies, injecting responsibility in actions of resource managers, including possibilities of participation in management by groups outside of the state bureaucracies, and finally transforming the open access regimes currently responsible for the tragedy of the commons are key issues that must be debated widely.

1.8 The current emphasis on nature reserves as the tool of biodiversity conservation to the exclusion of all else flows out of the overall development strategy. This strategy has equated development with intensification of subsidized flows of resources to urban-industrial-irrigated agriculture sector. These sectors have therefore increasingly come to acquire a larger and larger share of the economic and political power within the society to the exclusion of the majority dependent on rainfed agriculture and the small tribal population dependent on forest resources. It is these latter "ecosystem people" that relate directly to natural environments and depend on a diversity of biological resources for their personal well-being. On the other hand, those in power are well shielded from any direct negative consequences of all forms of environmental degradation including loss of biodiversity. At the same time, they successfully monopolise most of the benefits flowing out of developmental activities. For them, therefore, environment and development often appear in contradiction; with environmental interests being naturally the ones to be sacrificed. Biodiversity conservation tends to be low on the priorities of development strategy moulded by them; restricted to nature reserves with a recreational appeal

for the elite. Often these nature reserves too are sacrificed in the interests of development. This development strategy explicitly attributes all environmental problems to the population pressure of the large masses of the subsistence level people directly dependent on the natural resources of their immediate environment for meeting a variety of their basic needs. Therefore the exclusion of these people from nature reserves by the official machinery of the state becomes the focus of all state sponsored conservation effort.

1.9 An examination of the adequacy of this approach is an appropriate starting point for our discussion. This may be looked at from two perspectives. From the perspective of biological processes, the focus on nature reserves means that eventually all land/water areas outside this system are likely to be reduced either to highly degraded desert like vegetation or or to monocultures of just a few species such as Eucalyptus, Acacia auriculiformis, or a small number of high yielding varieties of crops like rice, wheat or tobacco. There may additionally be a few water bodies dedicated to the production of carps or shrimp. The net result would be the persistence of a few species rich fragments of a restricted range of habitats in the matrix of a biologically poor land-and water- scape. Ecological theory tells us that such fragments are bound to lose a large proportion of their species in the long run. Such loss is all the more likely in the event of a global warming that may materialise over the next few decades. It may be important in this context to strive to maintain,or better still recreate a biologically richer

overall matrix in which the species rich fragments of nature reserves will be embedded. This would enhance the possibilities of long term persistence of biodiversity in two ways. Firstly, this matrix, which may include upto 40% of the country's land surface under natural vegetation in various stages of degradation through human intervention could on its own support a fair diversity of species of either commercial or subsistence value; this could easily run into several hundred species of trees, climbers, shrubs, herbs and grasses. These economically valued species will in turn support a large number of other species, especially invertebrates and smaller vertebrates. In addition, a small proportion of land in such a matrix, perhaps 5%, could be devoted to biodiversity conservation in form of species rich islands such as individual fig trees or groves of a few hundred m^2 to few ha in size to constitute a system of highly dispersed patchy refugia.. This could end up adding another 2% of the country's land surface to the nature reserve system. Such a matrix would also be of value in facilitating the dispersal of many species restricted to the larger nature reserves from one reserve to another. Ecological theory tells us that long term persistence of species in any given locality is related to the rate of immigration of individuals of the different species present in the overall species pool into that locality. Such immigration would become all the more critical if global warming sharply increases rates of local extinctions. All in all, the maintenance of a biologically rich matrix with a dispersed system of small refugia serving as stepping stones for dispersers would be a highly desirable complement to the system of nature

reserves.

1.10 The cultivated lands and human habitations could also play a useful role in the maintenance of biodiersity through offering very small refugia such as the traditional banyan and peepal trees that dot our villages and towns. Farm bunds, stream and river sides, canal sides, roadside avenues could all contribute towards the maintenance of a biologically friendly matrix.

1.11 The second important issue to be explored is how the society could organize the maintenance of biodiversity in the system of nature reserves, as well as in the matrix of non-cultivated vegetation in which the nature reserves would be embedded. The current approach is one of all technical decisions as well as policing being in the hands of the state apparatus. One may, in this context, ask three questions:

a) Does this apparatus have at its disposal the information needed to make appropriate decisions?

b) Is this apparatus adequately motivated to maintain biodiversity?

c) Is this apparatus competent to effectively carry out the task of regulating human interventions in the interest of maintenance of biodiversity?

There is room for questioning the adequacy of state apparatus on all three scores. The personnel of this apparatus primarily derives from the Forestry services. The bureaucracy in

general, including the Forestry services have monopolised the collection and interpretation of information on natural resource management in India. However, this has been done in a most casual and unscientific fashion, so that the scientific competence of this whole apparatus is in grave doubt. Moreover, ecological systems are exceedingly complex systems. The behaviour of such systems can be predicted only to a very limited extent on the basis of general principles. At the same time historical observations of the system behaviour are a valuable input into predicting the outcomes of human interventions in specific systems. This implies that knowledge of folk ecology available with the local people may compare and even exceed in value the knowledge base available with the official apparatus. Secondly, no member of the official apparatus has a personal sake in the maintenance of biodiversity in any given locality. The local people may or may not have such a stake depending on how different elements of biodiversity affect their personal well-being. If they either receive direct benefits from maintenance of biodiversity for themselves (for instance, through supply of wild fruit or herbal medicine or protection of stream flow) or if they are rewarded by the larger society for ensuring maintenance of biodiversity, they are far more likely to be motivated to maintain the biodiversity of the localities to which they are intimately attached. Finally, the state apparatus is quite ineffective in discharging a policing function unless it has full local co-operation as has been strikingly brought out by the experience of the failure to apprehend the notorious sandalwood and ivory smuggler of Karnataka, Veerappan. There is therefore

every reason to believe that the system of biodiversity conservation could become much more effective by (a) utilising the local folk ecological knowledge (b) by creating a stake for the local population in conservation of biodiversity , if necessary by suitably rewarding them, and (c) involving local people in guarding biodiversity.

1.12 Creating a vested interest for the local people in conservation of biodiversity would also help a more careful and objective evaluation of different development options that may be inimical to biodiversity. As matters stand today, the forest bureaucracy cannot effectively lobby for biodiversity conservation since it is a part and parcel of the larger apparatus that has a vested interest in development that often tends to be non-sustainable.

1.13 The landscape of India has of course been greatly transformed by humans. About 50% of its land area is under cultivation, most of its parceled out into small family holdings comprising individual plots of well under a ha. Another 10% or so of the land is under human habitation, roads and reservoirs. Part of the remaining uncultivated land of India includes snow bound peaks or sand dunes that are biologically totally unproductive. Of the remaining uncultivated lands dedicated to biological production, the largest single controlling authority is the forest departments of the various states and union territories, responsible for some 75 million ha or 22% of the country's land. The forest lands belong to two major categories,

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reserve and protected. The former tend to be lands away from human settlements, and are dedicated to conservation and commercial production. The nature reserves including National Parks, Wild life sanctuaries, Tiger reserves, Biosphere reserves, bird breeding sanctuaries, marine reserves, all embrace land classified as reserve forest. Reserve forests however do include tribal habitation, and may occasionally come very close to farming villages as well. Many reserve forest areas are therefore subject to some degree of fuelwood and small timber extraction and grazing on an unrecorded basis by the tribal and village populations. They have also been subjected to quite heavy levels of commercial exploitation, and to conversion to plantations, largely of teak and Casuarina in earlier periods, and of Eucalyptus and Australian Acacias in recent decades. Some highly degraded, or even desertified areas also continue to be classified as reserve forest, a legal and not a biological category. The second category of protected forests are lands close to human settlements and set aside for meeting the biomsass needs of the tribal and rural populations. Under state management these are treated as open access lands with no institutional structures to ensure regulated, sustainable harvests. In consequence, the protected forests are very often in a highly degraded state. There are some form of special categories of protected forests that are under some private or community control, for instance, soppinabetta lands of Uttara Kannada district of Karnataka with restricted access to one or a small number of households. These are in many cases much better managed and in a less degraded condition.

1.14 Some forested areas continue under community control. There are particularly large areas of this type in the north-eastern hill states owned by tribal councils. Other examples include civil or swayam forests of Kumaon Himalayas and village forests of Uttara Kannada. In some of these community control has resulted in disciplined, sustainable use. In others, incursion of market forces coupled to a breakdown of cohesion within local communities has meant exhaustive use as in other open access protected forest or other public lands.

1.15 Some of the public lands are under control of state agencies other than the forest department, such as revenue, minor irrigation, public works and railways. These lands serve a variety of functions such as grazing lands, catchment areas of tanks, places for public meetings, markets and roads. All these tend to be treated as open access lands with no institutional structures for their sustainable management and their vegetation cover is by and large in a degraded state.

1.16 Corporate entities, either from the public sector, such as Forest Industries or Forest Development Corporations, or private industries including mining concerns have had varying levels of access to non-cultivated lands of the country. In case of the forest department corporations the management has been little different from that of the reserve forests; with overexploitation to fulfill commercial demands a regular feature. Private industries enjoying concessionaire rights have had varying levels of control over forest lands, often resulting in conflicts with

the local population, since they try to exclude traditional local uses much more vigorously than the forest department. In recent decades there have been instances of not merely reserved, but protected forests being turned over to corpoate control, as in the case of Karnataka Pulpwoods Ltd and these too have led to serious conflicts. Lands under such corporate control have also tended to be used in an exhaustive fashion.

1.17 Lands of India have provided a wide range of services to different segments of the country's heterogeneous population, as well as to people from other countries, especially the industrial countries which have either directly or indirectly been controlling a great deal of what has happened in India over the last two centuries. Such services by non-cultivated lands may be divided into three major categories; namely, environmental services, services to the tribal and rural populations, and services to the elite comprising urban- industrial- intensive agriculture sectors. The traditionally recognized environmental services include soil and water conservation, and conservation of biodiversity. To these has recently been added sequestration of carbon to counteract the continual addition of carbon to the atmosphere of the earth through the burning of fossil fuels. Services to the tribal and rural population include fulfillment of their own subsistence needs such as fuel, fodder, thatch, agricultural implements, baskets, leaf manure, small timber for fencing, house construction and so on. This sector also derives income from the non-cultivated lands either through the support such lands provide for agriculture or animal husbandry, or

through artisanal activities like basketry, or by sale of fuelwood or other forest produce like fruit or resin, or through employment in timber harvest or other commercial activities. Finally the larger economy of the elite derives wood as well as non-wood produce for use in construction and industrial processing for production of paper, polyfibre, plywood, turpentine, drugs and so on. Additionally, the control that this sector has over the forest lands also results in significant levels of concealed income through either unrecorded harvests or extortion from the village and tribal populations.

PART - II

2.1 India's green mantle along with its heritage of biodiversity is undoubtedly in grave trouble today. While the Forest Conservation Act 1980 has largely halted the process of alienation of land from control by the Forest Departments of the various states and union territories, that has not put a halt to the attrition of the country's vegetation cover. This is a consequence of the whole social system of use of forest resources that was developed during the colonial times and that has been further elaborated during the drive for industrialization following independence. This system forces India's large rural population to meet their subsistence biomass needs from protected forests, revenue wastelands or other categories of public lands as open access property resources. Consequently nobody is responsible for good management of this resource base that continues to suffer the tragedy of the commons. Even the forest lands under control of tribal councils in the northeastern states are subjected to exhaustive use as the tribal leaders newly entering the market economy and the cut-throat marketplace of politics are hungry for quick cash incomes. The state controlled reserve forests are faring no better. While in theory the state machinery should be motivated to use this resource base sustainably in long term national interests, in practice these resources have been liquidated to ensure quick, large profits to commercial interests. Indeed the state policies of encouraging industrialization in every way have been distorted to imply that industry should be subsidized to incredibly high levels. Forest

resources have therefore been made available to the industry at throwaway prices - as extreme as the supply of bamboo to paper industry in Karnataka for as little as Re. 1 per tonne while on open market basketweavers were paying over Rs. 3000 per tonne. Given these high levels of subsidies, the industry has been tempted to adapt a strategy of making quick profits and then getting out. Indeed a manager of a plywood mill once told me that they were in the business of growing money, making plywood was only a temporary device before they may turn to something else. The industry has therefore been responsible for rapid exhaustive use of resources of reserve forests. This whole process provides little benefits to the local inhabitants, so they too have no stake in prudent management of reserve forests. They extend little co-operation to forest departments and their legal or often illegal activities further contributes to the depletion of forest resources. In effect, no segment of the Indian society today is motivated to sustainably use, let alone replenish India's wealth of tree cover.

2.2 But this is only one side of the picture. India is a vibrant democracy in which there are built in corrective processes which are already triggering many positive measures to overcome these problems. Beginning in late 1970's, these have gathered considerable momentum in 1980's. These include :

(a) Beginning with the Fifth Five Year Plan of 1975-80, it is compulsory for all major development projects to carefully prepare an Environmental Impact Statement and to provide for

compensatory afforestation in the event of loss of any forest cover.

(b) The Forest Conservation Act 1980 prescribes that no land should be alienated from control by forest department without consent of the Central Government. This has largely halted all such alienation. This is why the official statistics indicates an essential halt to the process of deforestation. While, unfortunately, this is not entirely true, the Act has definitely made a positive contribution towards decelerating the processes of deforestation.

(c) Beginning in late 1970's the absurdly high levels of subsidies enjoyed by the forest based industry have been gradually reduced, thereby helping to motivate the industry to use the resources more carefully. Thus in Karnataka the supply rate for bamboo for paper mills has been hiked from Re. 1 per tonne to Rs. 600 per tonne, although this is still well below the market price.

(d) Beginning in 1970's the farmers have been encouraged to take to tree crop production and many industries and farmers have developed healthy links for fulfilling the needs of forest based industries.

(f) Beginning in 1970's with the Village Forest Protection Committees of West Bengal, local tribals and villagers are being given an economic stake in the well being of local forest resources. The response has been most encouraging. A major step has been taken in extending such systems to other states through

a circular of the Ministry of Environment and Forests, Government of India in June 1990. Motivated by this circular many state governments including West Bengal, Haryana and Gujarath have initiated measures to create village community based management systems for involving the local people positively in sustainable use and restoration of the local forest resources.

(f) Beginning in late 1970's with the state of West Bengal and mid 1980's with Karnataka many state governments are decentralizing political decision making. The village and district level political authorities that have thus been created are far more motivated to ensure prudent use of local resources - including forest resources. Other states are expected to follow suit in decentralization of power creating more favourable conditions for better management of forest resources.

(g) The National Wastelands Development Board created in 1985 has taken novel initiatives in decentralizing integrated planning of the use of natural resources and is spearheading efforts at restoring the vegetation cover of vast stretches of degraded lands by meaningfully involving the local people.

(h) The amended National Forest Policy, 1988 is a major step in recognizing the primacy of the need to fulfill the subsistence requirements of local people.

2.3 What is now needed is to take this process further and implement it more vigorously at the ground level. A comprehensive package of policies to accomplish this has been spelt out in

Tables 1a, b, c. These policies aim at :

(a) Transferring in phases all wood production for commercial purposes to privately owned lands. India has some 150 million ha of land under cultivation, but the bulk of food production comes from some 20 million ha of intensive agriculture in Punjab, Haryana, Western Uttar Pradesh and Andhra Pradesh. A good proportion of these 150 million ha is hilly terrain or land in tracts of low uncertain rainfall that would be far better put under tree cover. The experience of tree production on such land is that it is far more efficient than tree production on Government controlled forest lands. Thus in Karnataka the annual productivities of Government Eucalyptus Plantations are as low as 1.5 to 2 tonnes / ha; those on private lands are 10 to 15 tonnes / ha. At these levels only about 3 to 6 million ha, less than 4% of all cultivated land would be adequate to meet the total commercial timber needs of less than 30 million tonnes per year of the country. By eliminating the need for any wood harvesting from 60 million ha of reserve forest lands, whose current average productivity is just 0.5 tonnes / ha this switch would permit very substantial build up of tree cover on the state owned reserve forest lands. Even while generating wood for commercial pourposes on private lands, it would be possible to use promising species like bamboos which can yield large, sustained production of excellent raw material for paper and polyfibre industries without clearcutting the stands.

(b) The subsistence biomass needs of tribal and rural populations could be met from a network of community lands such as village hamlets with 50-100 households. These user groups need to be properly empowered and helped to establish regimes of replenishment and sustainable use over small, specifically assigned pieces of public lands drawn from revenue wastelands, protected forests and reserve forests. Such community lands would develop a vegetative cover of a diversity of species which would be harvested in the traditional mode that involves use of leaf and branch loppings, fallen and dead wood, grass and fruit collection, but no tree felling. A very substantial tree cover could be built up on some 10-20 million ha of lands under such a management regime.

(c) The remaining 50-60 million ha of reserve forest lands should be brought under a regime of production restricted to non-wood forest produce of commercial value. The diverse tropical forest cover of India is exceedingly rich in species yielding such produce; in some cases as with leaves of Diospyros used for making country cigarettes or beedis the revenue accruing to the state far exceeds timber revenue from the same localities. Today these non-wood forest produce are managed poorly; collected by auctioning off rights to contractors who have no stake in long term sustenance of the produce and who pay local tribals and villages extremely low rates for collecting the produce. We need firstly to systematically encourage and enrich the bulk of India's forest tracts by species that yield such non-wood-forest-produce. Secondly we also need to create management systems that

will generate a genuine economic stake for local inhabitants in ensuring that forest stocks do get replenished by such species and that they harvest, process and market the produce through institutions that bring to them the full value of the produce. This is certainly feasible, and when implemented would lead to very large gains in terms of sequestration of carbon in enhanced tree growth.

Table 1

Proposed changes in patterns of forest resource use that would simultaneously benefit the weaker segments of India's tribal and rural population especially through generation of self employment as well as promote greater sustainability, enhance environmental services, and lead to conservation of biodiversity.

	a
Land category	Hill slopes/very arid lands under cultivation
Current ownership status	Privately owned or illegally encroached government land
Current dominant usage pattern	Subsistence agriculture responsible for continuing degradation of land, vegetational resources and biodiversity
Proposed management pattern	Privately managed with links to urban-industrial consumers, special incentives for conserving biodiversity and maintaining large standing biomass
Expected vegetation cover	Mono- or poly-cultures of trees or pastures in small pieces forming a rich mosaic, high population of protected trees like Ficus and small sacred groves
Expected economic services	Supply of wood to urban-industrial consumers at prices fair to tree growers
Potential for employment generation	Properly organized, tree production would be an economically far more profitably activity. However tree and grass production employ less man days/unit area than agriculture. Special strategies will therefore have to be adopted to augment employment generation
Expected benefits for biodiversity conservation	Sacred trees like Ficus, many small sacred groves, ponds
Other environmental services	Maintenance of tree cover on hilly, arid lands; better watershed protection, higher levels of carbon sequestration

b

Land category	Non-cultivated lands adjoining human settlements
Current ownership status	State owned, often with user privileges but no rights of regulation assigned to local people; occasionally owned privately
Current dominant usage pattern	Unregulated biomass harvests by local people and their livestock, encroachment for cultivation leading to degradation of land, vegetation and biodiversity
Proposed management pattern	Well organized community based management with land ownership vested in the state, special incentives for conserving biodiversity and maintaining large standing biomass
Expected vegetation cover	Good standing crops of indigenous multiple use trees, shrubs and grasses with nuclei of protected forests
Expected economic services	Fulfillment of biomass needs of tribal/rural population; surplus if any, for urban-industrial sector
Potential for employment generation	Considerable labour inputs would be called for in the development, proper maintenance and utilisation of community woodlots
Expected benefits for biodiversity conservation	Protected, species diverse nuclei of community woodlots, sacred trees and small sacred groves
Other environmental services	Maintenance of tree cover on non-cultivated lands near human settlements, better watershed protection, higher levels of carbon sequestration

c

Land category	Non-cultivated lands away from human settlements
Current ownership status	State owned with few or no user privileges and absolutely no rights assigned to local people
Current dominant usage pattern	Non-sustainable harvests to fulfill urban-industrial demands at highly subsidized rates not only from outside, but sometimes from within nature reserves, all out attempts to exclude local people
Proposed management pattern	State managed with active involvement of local communities in sustainable use of non-wood-forest-produce and in conservation of biodiversity
Expected vegetation cover	Good standing crop of indigenous tree species enriched with a variety of species yielding non-wood-forest-produce, larger strictly protected nature reserves
Expected economic services	Non-wood-forest-produce for industrial needs; support to tribal/rural economy
Potential for employment generation	Substantial additional employment in harvesting, processing and marketing of non-wood forest produce
Expected benefits for biodiversity conservation	Larger nature reserves protected well with local co-operation and removal of commercial pressures, much more diverse composition of forests generating non-wood-forest-produce
Other environmental services	Maintenance of natural vegetation with good cover on all land away from human settlements, better watershed protection, higher levels of carbon sequestration

PART III

ACTIONS CALLED FOR

4.1 A long term commitment to biodiversity conservation would call for a wide range of actions by many different people and organizations. These actions would entail new policy initiatives, building up of institutions, redeployment of resources, generation and application of technologies, scientific research, training and spread of awareness. Such actions would need to be initiated by the national state and local governments, by the industry (including transnational corporations), by the scientific community, by the rural elite and the poorer sections of the rural community, and by the voluntary sectors. Actions also need to initiated at the international level by agencies like UNESCO and IUCN, by international financial institutions like IMF and World Bank and at the level of agreements such as the Montreal protocol and GATT. Summarized below are a series of such biodiversity-friendly action points.

4.2 State apparatus

(a) Policy: Devolution of power down to the level of local user groups in tribal and village hamlets; Reduction in the powers of bureaucratic machinery rendering them publicly accountable down to the local level; scrapping official secrets act and facilitating a free flow of information; Elimination of subsidized supply of natural resources to the urban-industrial-intensive agriculture sectors. (b) Institutions: Mechanisms for

public discussion of environmental consequences of actions being contemplated by the state and the corporate sector, Mechanisms for redressal of effects of environmental degradation suffered by citizens, Mechanisms for involving local user groups in management of natural resources, Mechanisms for financially and otherwise rewarding local user groups for conserving biodiversity, Mechanism for ensuring free flow of information regarding all actions by corporate and state sector impinging on the environment.

(c) Resources: A cutback in the resources being consumed in providing subsidies to the elite and by the bureaucratic apparatus especially in a regulatory function, Making these resources available on a more decentralized and accountable fashion to groups down to the level of local user groups.

(d) Technologies: Promote technologies relating to conservation of natural resources, sustainable utilization of a wide diversity of biological resources.

(e) Research: Decentralized monitoring of the status of environment, Incorporating folk knowledge of ecology in environmental management, Social institutions promoting sustainable use and conservation of biodiversity.

(f) Training: Exposure of political, bureaucratic, scientific, voluntary sector personnel to social and technical issues concerning sustainable use and conservation of biodiversity.

(g) Awareness: Overall social awareness of issues relating to

sustainable use and conservation of biodiversity.

4.3 Industry

(a) Policy: Willingness to pay true costs of use of natural resources, Emphasis on reliance on environment friendly technologies.

(b) Institutions: Internal mechanisms to monitor environmental impacts of industrial activities, Mechanisms for communicating environmental measures adapted to society at large.

(c) Resources: Redeploy resources to develop environmentally friendly technologies.

(d) Technologies: Focus on developing environmentally friendly technologies.

(e) Research: Developing environmentally friendly technologies.

(f) Training: Exposure of business leaders and employees to social and technical issues of how the industry impinges on natural resources/biodiversity.

(g) Awareness: Employ a part of industry's resources to spread awareness of environmental issues.

4.4 Scientific community

(a) Policy: Emphasize the value of work on indigenous, locality specific problems relating to natural environment, Involve a

large cross section of scientific community in work on natural environment, Recognize the value of folk knowledge of ecology.

(b) Institutions: Build up decentralized banks of environmental data, perhaps in undergraduate colleges in the different districts of the country; Mechanisms to inject scientific inputs into a decentralized process of planning the use of natural resources.

(c) Resources: Redeploy resources to foster widely dispersed research on locality specific problems relating to natural environment.

(d) Technologies: Develop technologies of managing and utilizing locality specific environmental information to feed into a decentralized process of planning the use of natural resources.

(e) Research: Promote research along lines suggested in policy prescriptions above.

(f) Training: Train scientists from various basic disciplines to work on problems of natural resources.

(g(Awareness: Design special programmes to spread awareness of environmental issues and opportunities for scientific research on environment from a variety of disciplinary backgrounds.

4.5 Rural elite

(a) Policy: Willingness to pay true costs of use of natural resources such as water, minerals; Willingness to retain use of

village common lands to meet subsistence requirements of rural poor.

(b) Institutions: Village level user groups to plan, manage local natural resources, conserve local biodiversity with a greater weightage to the needs of rural poor.

(c) Resources: Use resources of Zilla Parishats and village panchayats to sustainably manage local natural resource base and conserve biodiversity.

(d) Technologies: Promote use of environment friendly agricultural technologies including tree farming based on a diversity of species.

(e) Research: Participate in research on developing environment friendly agricultural technologies as mentioned above.

(f) Training: Training for farmers in environment friendly agricultural technologies.

(g) Awareness: Expose rural elite to social and technical issues of sustainable use of natural resources and conservation of biodiversity.

4.5 Rural poor

(a) Policy: Planning and management of local natural resource base and conservation of biodiversity should be made the responsibility of rural and tribal people dependent on this resource base for their own well-being.

(b) Institutions: Small scale, socially and economically homogenous groups of users to plan, manage and conserve local resources; higher level local governments to co-ordinate the resource use amongst different user groups.

(c) Resources: Resources should flow to local user groups to reward them for good management of local resources/conservation of biodiversity.

(d) Technologies: Local user groups should be involved in developing locality specific technologies of good management of natural resources/conservation of biodiversity.

(e) Research:

(f) Training: Provide training to local level user groups in sustainable management of natural resources/conservation of biodiversity.

(g) Awareness: Using traditional media such as folk theatre to enhance the awareness of rural poor in value of their positive involvement in sustainable management of natural resources/conservation of biodiversity.

4.6 Voluntary Agencies

(a) Policy: Focus on working with local user groups in sustainable management of natural resources/conservation of biodiversity as a worthy activity.

(b) Institutions: Participate in building up the strength of

local user groups to plan and manage local resource base/conserve biodiversity, participate in developing decentralized environmental data bases.

(c) Resources: Participate in bringing national/international resources to positively reward local user groups for good management of natural resources/conservation of biodiversity.

(d) Technologies: Serve as a bridge between scientific community-local user groups in developing technologies for sustainable use of natural resources/conservation of biodiversity.

(e) Research: Participate in research on social institution appropriate for sustainable use of natural resources/conserving biodiversity as well as on folk knowledge of ecology.

(f) Training: Organize training of voluntary agency workers to participate in tasks outlined above.

(g) Awareness: Voluntary agencies should play a key role in spreading awareness of environmental/biodiversity issues in all strata of the society.

4.7 International Agencies

(a) Policy: Support fairer terms of trade for natural resources/biological resources from Third World countries; Support local level user groups to take good care of local resources and conserve biodiversity.

(b) Institutions: Build institutions to tax nations proportional

to their per capita demands on natural resources of the earth and to use these funds to provide incentives for local user groups to conserve biodiversity.

(c) Resources: Generate resources by taxing nations proportional to their per capita demands on natural resources of the earth.

(d) Technologies: Encourage development of widely dispersed location specific technologies which incorporate folk ecological knowledge to sustainably use local natural resource base/conserve biodiversity.

(e) Research: Promote scientific research on complex natural systems, including processes involved in maintenance of biodiversity on a widely dispersed basis throughout the world; Promote human ecological research on society - biodiversity interaction.

(f) Training: Promote training on a widely dispersed basis throughout the world to generate knowledge on the working of local ecological systems.

(g) Awareness: Create awareness throughout the world on global environmental issues and responsibilities of people making the highest levels of demands on resources of the earth.

9.

WWF - INDIA
COMMUNITY BIODIVERSITY CONSERVATION MOVEMENT

Tara Gandhi

The depletion of our biological wealth which has had serious repercussions on the lives of people, has brought to light the age -old truth that human life is inextricably linked with nature. Like all other life-forms on earth, mankind's continued existence depends upon the uninterrupted functioning of the cyclic processes of natural ecosystems, and ultimately upon all the myriad species of flora and fauna that constitute biodiversity.

Whenever biodiversity is lost, human life is in some way depleted. The first to suffer are the people who are entirely dependent upon living natural resources for their lives and livelihood. Some of the most under-privileged segments of our population live in areas of great biological wealth, and are the most vulnerable to ecological degradation.

Failure to live in harmony with nature and unsustainable, exploitative utilisation of biological resources has led the critical situation in which the extent of biological impoverishment in India has now reached alarming proportions. As an attempt to arrest and reverse this trend, WWF-India launched the Community Biodiversity Conservation Movement in Nov 1989. Since it has become increasing clear that for any successful conservation work to take place, the people of the area have to be fully involved, and their needs taken into consideration, the main emphasis of the programme as the name indicates, is to conserve our precious biological wealth through community participation. All projects in this programme are carried out entirely through cooperation with NGOs and voluntary groups working in the field. Drawing from the expertise of NGOs & voluntary organisations that have established a good working relationship with local populations of tribal or rural communities, WWF-INDIA is now conducting small conservation projects in different parts of the country. The CBCM programme hopes to promote <u>awareness through action</u> in partnership with such agencies, and by involving local community groups in active conservation and restoration work in their own surroundings. Projects are formulated with the aid of detailed guidelines set out for the programme, and a grant for project im-

plementation is provided. Active conservation work has highest priority, and community participation is mandatory.

The CBCM is guided by a National Steering Committee headed by the President, WWF-INDIA. All projects undertaken are referred to the Steering Committee members for assessment, and for scientific inputs and advice. A corps of volunteers for conservation is being recruited to undergo training in various aspects of conservation work before being posted in field project locations. To provide technical support to the programme, WWF-INDIA has established a Conservation Monitoring Centre at this Headquarters in New Delhi with the financial support of the Ministry of Environment and Forests, Government of India. The National Steering Committee supported by its secretariat staff and consultant experts identifies critical areas to be taken up for protection and enlists partner institutions, NGOs, and community groups who assist in project implementation.

The main emphasis of the CBCM is conservation of our biological wealth of flora and fauna, paying particular attention to rare or threatened species and their habitats, and to fragile ecosystems.

The priority areas for conservation projects have been broadly delineated as follows:-

1. Conservation of rare or threatened plant or animal species through <u>in-situ</u> habitat conservation: Species vulnerable to local extinction, though abundant elsewhere, are also included in this category.
2. <u>Ex-situ</u> conservation of rare or threatened plants and animals such as in small botanical gardens or zoological parks established for propogation of indigenous varieties and breeds.
3. Conservation of economically valuable plants such as medicinal plants and herbs.
4. Conservation of fragile ecosystems:
   Degraded portions of erstwhile stable ecosystems such as grasslands, forests, wetlands, etc. requiring active restoration or protection.
5. Conservation of coastal flora and fauna mangroves and coral reefs.

6. Conservation of biodiversity-rich wilderness areas near human habitations:
   Forests, scrub jungles or even water bodies in the proximity of villages, towns or cities are included.
7. Conservation of areas traditionally held in reverence such as sacred groves or pilgrim sites located at significant natural land marks.

All the project under this programme are on a very small scale and entirely localised. Through this kind of effort, we hope to make a difference at least in small pockets of our country, which will help to conserve or restore biodiversity, while at the same time benefit the people of the area.

An illustration of some of WWF-INDIA's on-going projects conducted in partnership with NGOs and field workers would give a clearer picture of the kind of work being carried out under the CBCM programme.

Some of our work is in the fringe areas of national parks & sanctuaries. The people living in these areas are still heavily dependent upon the biological resources of the sanctuaries. Many are oustee villages originally from within the sanctuary core area, that suffer inumerable problems on account of not having been provided with adequate infrastructure or facilities to substitute for the resources that they had been accustomed to utilising. As a result there has been acute improvishment of the land leading to their own impoverishment and resultant hardships.

The Ranthambhore National Park is one such example where there is an astonishing contrast between the core area of the park and the surrounding areas. With constant pressure of fuelwood gathering and overgrazing by cattle the once lush fringe areas are now reduced to desertified conditions. The situation is so bad that the village women and children who go out to collect fuelwood, resort to digging out root-stock which completely precludes any hope of natural regeneration.

The Ranthambhore Foundation has established a nursery of forest trees which is intended for distributing saplings to several villages in the fringe areas, many of which are relocated villages

from the core area. With continuous interaction from the Foundation, the villagers have been persuaded to grow trees in the land around their villages so as to cut off their dependence on fuelwood from the national park. They have also been persuaded to encourage natural regeneration of grasses and other vegetation by cattle trenching.

The Chandaka Elephant Sanctuary is another protected area where villagers from within the core area have been recently relocated to the sanctuary fringes. The Nature and Wildlife Conservation Society of Orissa has undertaken a project to tackle the problem at an early stage in order to stem the onset of bio-diversity degradation. Ecodevelopment work in conjunction with an awareness programme is being carried out and a management plan for conservation of natural vegetation in the allocated land is being formulated. Advice on sustainable and ecologically sound agricultural practices is being imparted, and plans for growing fodder and for use of alternative sources of energy are also being made.

Though there are many similarities in the problems encountered in protected areas, no standardised formula can be applied by way of a solution. Another related project is an analysis of people/wildlife conflicts in 8 tribal villages in the Bhimashankar Sanctuary in Maharashtra, the habitat of a sub-species of the Indian Giant Squirrel which is restricted to this area. The project includes an extensive socio-economic study and quantification of pressures on the sanctuary, as well as estimates of damage caused by wildlife to the village. A management plan is being prepared in coordination with the park authorities and local government agencies, in which the people's own recommendations will be incorporated, and provision made for their participation in its implementation.

The major portion of our work is in areas that have no link with the protected area network. These projects are intended for restoring the biodiversity of land where the original natural vegetation has disappeared due to a variety of causes. In South Andaman island, extensive areas of rich tropical forest have been cleared for agriculture. The consequence of this is inevitable in such evergreen forests where the soil productivity is entirely dependant on vegetative cover. Soil depletion takes place rapidly,

and even agricultural crops fail, with the land ultimately becoming a fallow wasteland. Soil erosion and run off from these degraded lands has far-reaching consequences, badly effecting the precious coral reefs, which are a most valuable biological resource of the islands. Corals are dying out on account of siltation of coral beds, which in turn leads to an entire sequence of degradation in the marine ecosystem.

Indigenous forest species are being grown in a nursery on South Andaman island, by the ANET. Ecologically and economically important species like Padauk, Gurjan, and Red Bombway are being grown, and will be distributed to farmers and land owners to plant on their fallow lands. Through an awareness and education programme, for the local population, the blank areas in forests will also be planted with saplings from the nursery. The aquatic and terrestrial ecosystem interlinkage is so vital in this coral islands that work of this nature eventually could contribute towards conservation of both.

Similar projects are being undertaken in Andhra where land degeneration has resulted in the dissappearence of many medicinal plants and useful trees that the local people relied upon for their requirements. With the guidence of the Population and Environment Education Centre, A.P., local inhabitants grow and propogate multi-purpose trees and plants which were once abundant in the area, but are now on the verge of local extinction.

In India we are singularly fortunate that there is a great respect for nature inbuilt into our ethos which now needs to be strenghthened. An important aspect of the CBCM work is in the protection of natural areas that are traditionally held in reverence. Sacred groves and other such cultural or religions sites that were once repositories of a wealth of flora and fauna on account of stringent protective measures imposed by the people themselves, have now lost much of their pristine quality. Some, as in the case of the Arunachala Hill at Tiruvannamalai, have become completely degraded. The sacred Arunachala Hill which has been worshipped for centuries as the Kailash of the South and abo e of Siva was once a richly forested hill with abundant flora and fauna. Natural springs flowed from the hillsides, and pilgrims had ample shade

and water when they rested during their arduous climb to the top of the holy hill with their offerings. The hill is now barren and dry with exposed rocks and eroded soil, which has affected the town's water supply.

To restore the hill's natural vegetation, the Annamalai Reforestation Society has initiated a massive regreening programme in close coordination with the Tiruvannamalai temple authorities and with the local residents. Old temple records, gazetters and other texts will be studied to select tree and shrub species for planting, and emphasis will be given to natural regeneration to ensure that the original vegetation is restored as far as possible.

In recognition of the fact that genetic diversity is of great importance for our food security, a Community Seed Bank Project is being conducted through the Swa-Sahyog Sanstha a voluntary organisation based in Rajasthan. Thousands of genetically distinct varieties of major food crops were once in existence, which were developed by our ancestors to suit a variety of ecological conditions. But today much of the diversity is being lost and these unique varieties are gradually becoming extinct on account of the wide-spread introduction of modern hybrids. A genuine need is now being felt for traditional varieties, which are drought tolerant, disease resistant, and often highly nutritions. Through the seed bank project, surveys will be carried out in 3 districts of Rajasthan Tonk, Sawai Madhopur and Jaipur to collect rare traditional varieties of grains, vegetables and fruits, that are of importance culturally and economically to the local people. The seeds will be stored in simple moisture-proof jars which do not require refrigeration. Frequent "grow-outs" will be conducted to ensure the viability of the seeds. The project is a farmers' cooperative effort, which will enable exchange and development of valuable seeds and protection of common interests, while at the same time considerably enrich the local crop plant biodiversity.

Our only ex-situ conservation project so far is on an island within the Mulshi reservoir in the Western Ghats near Pune. Here indigenous rare plant species including trees, palms, creepers, and shrubs are being grown in an attempt to conserve and propogate these varieties. The project is being conducted by the Pune-based Four Eyes Foundation. In order to make the project more effective, the

Adivasi families living on the island have been persuaded to give up destructive practices of slash and burn cultivation, and to participate in the plant conservation programme. Some of the Adivasi residents who are botanical experts and very knowledgeable about medicinal plants assist in identification and propogation of these valuable species. As a proposed plan for the future, it is hoped to expand the nursery so that saplings of indigenous plants from this nursery can be used in afforestation programmes in degraded portions of the Western Ghats. With efforts such as these WWF-INDIA hopes to achieve some measure of conservation work which will serve the dual purpose of biodiversity conservation, along with benefits to the people of the area.

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INFORMATION GAPS FOR LINKING DEGRADATION OF WASTELANDS TO CONSERVATION OF BIODIVERSITY

Outline of presentation by WWF-INDIA to the Workshop on Linkages Between Wastelands and Biodiversity

Indian Institute of Science
March 15-20, 1991

Tara Gandhi
Ajay Kastogi
Thomas Mathew

INFORMATION GAPS FOR LINKING DEGRADATION OF WASTELANDS TO CONSERVATION OF BIODIVERSITY

Ecological aspects

Information gaps can be identified on the causes and processes of loss of biodiversity leading to the creation of wastelands as well as in the approaches involved in restoration regeneration of wastelands to a state of biological productivity.

1. There is considerable lack of information on ecological interlinkages that 'hold' ecosystems together. Dynamics of the natural cycle and interdependence of floral and faunal species are not adequately studied.

   (a) Keystone species upon which a large variety of species and ecological processes depend.

   (b) Indicator species for monitoring onset of biodegradation.

2. Fragmentation and shrinkage of forests. Their effect on wildlife, other fauna. Also on floral species. Minimum viable population. Minimum critical area for conservation of representative ecosystem.

3. Causative factors of coastal ecosystem degradation are not known. For instance, silting up of Himalayan rivers and additional silt loads deposit in continental shelf causes salinity changes, physiological stresses and changes in chemistry that result in loss of mangrove species, particularly the more sensitive species. Therefore, a once multi-species mangrove ecosystem becomes a monospecies mangrove.

4. There is not enough knowledge on successional stages of forest regeneration. Plantations often fail because climax species are attempted to be grown first. Plant associations are not adequately studied from the point of view of planting.

5. Not enough work has been done on growth rates, planting, germinating technique for indigenous species. Indigenous quick growing species need to be identified in different regions. Normally slow growing species in the wild can exhibit fast growth under good conditions if properly cared for.

6. Natural regeneration is another area where very little information is available. Projections on what species are likely to grow in an area, if given protection, are not available. No data on presence and viable life of root stock.

7. Little is known about provenance - i.e. different characteristics exhibited by a tree species under varying ecological conditions or different climatic zones.

8. The effect of exotics on other life forms -- other plants, wildlife and birds, soil organisms -- is poorly recorded. In sanctuaries and protected areas, the effects of invasion of exotic weeds and introduction of exotics have not been adequately studied.

Planning and Management

1. Government schemes often have an adverse effect on biodiversity since they have standard national-scale prescriptions. This has affected traditional food crops, resulting in loss of genetic diversity of cereals and other food crops.

2. Mining, road building activities, the latter particularly in the hills cause extensive biodiversity loss. No knowledge of far reaching and long term consequences. The effect of mining on the immediate surroundings is well known, but the long term effects are unclear.

3. Information not adequate to facilitate choice of species for planting in wastelands. Due to the lack of information and data on indigenous varieties, exotics are often chosen for plantation because their properties are already well researched and documented.

4. Not enough 2-way communication between farming community and scientific community. Application of ethnobotanical knowledge in large programmes has not been done.

5. No proper management system has been developed for village community lands and unallocated revenue lands. No clear assignment of responsibility for conservation or protection of these lands.

6. The impact of pollution of land and water by agricultural chemicals on biodiversity is not adequately monitored.

7. Scientific studies need to be carried out on sustainable removal of MFP.

8. There are very few records of historical background of the biodiversity that used to be present in areas that are now wastelands. Systematic records need to be made by interviewing 'elders' in adjoining habitations.

9. Information on biodiversity loss due to jhumming are poor. Damages to the successional stages is not recorded adequately. The effect of forest fragmentation on account of jhumming needs to be studied.

10. Information on the value of traditional food crops is lacking. For instance, tribals in Bastar use 80 varieties of tubers of which only 10 have been analysed for nutritive value. Inappropriate crops like potatoes have been introduced into the area, instead of promoting the local varieties.

11. Documented information on traditional conservation practices is insufficient. Such data would be of great value for formulating conservation strategies.

WWF - INDIA Community Biodiversity Conservation Movement

1) Drawing from the expertise of NGOs and voluntary organisations that have established a good working relationship with local populations of tribal or rural communities, WWF- INDIA is now conducting small conservation projects in different parts of the country. The CBCM programme hopes to promote awareness through action in partnership with such agencies, and by involving local community groups in active conservation & restoration work in their own surroundings.

2) The priority areas for conservation project include:-

(a) Ecosystems that are under threat of degradation both inland and coastal.

(b) In situ and ex situ conservation of rare or threatened plant and animal species. Medicinal plants & other useful varieties are also included.

(c) Biodiversity rich wilderness areas near human habitations and areas traditionally held in reverence such as sacred groves.

3) The CBCM is guided by a National Steering Committee headed by the President, WWF-INDIA. A corps of volunteers for conservation will be recruited to undergo training in various aspects of conservation work before being posted in field project locations. To provide technical support to the programme WWF - INDIA has established a Conservation Monitoring Centre at this Headquarters in New Delhi with the financial support of the Ministry of Environment and Forests, Government of India. The National Steering Committee supported by its secretariat staff and consultant experts identifies critical areas to be taken up for protection and enlists partner institutions, NGOs, and community groups who assist in project implementation.

WHY DOES POVERTY PERSIST IN REGIONS OF HIGH BIODIVERSITY?: A CASE FOR INDIGENOUS PROPERTY RIGHT SYSTEM[1]

By

Anil K Gupta[2]

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The main objective of the working paper series of the IIMA is to help faculty members to test out their research findings at the pre-publication stage.

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Why does poverty persist in regions of high biodiversity? :a case for indigenous property right system[1]

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Abstract

The extent of rural poverty has been noted to be unusually high in the Vavilov centres of genetic diversity. Be it rice in Orissa, India or potato in Peru, the cultivator preserving genes for diversity are unable to benefit from newer technologies. The regions of specialized cultivation with mono crop or very low level of diversity and low risk conditions provide markets for mass consumption of external manufactured inputs. Paradoxically, this is possible precisely because genes for resistance to diseases/pests are available from high risk gene diverse environments.

In view of the recent upsurge of global interest in indigenous knowledge system, it is necessary to analyse ethical, scientific, political, economic, ecological and cultural implications of extraction of surplus from biodiverse regions.

Paper addresses following questions:

(a)What are the institutional, organizational and public administration aspects of high deprivation among people managing high biodiversity? (b) If biodiversity is sustained through cultural diversity, is 'modern' concept of state in a capitalistic society inherently unsuitable for cultural pluralism? (c) If cultural diversity implies different images of good life, how does one compensate a non-demanding, non-articulate but disadvantaged community maintaining biodiversity? (d)Should one do pediree analysis of major commercial hybrids and other seeds, trace the sites of genetic sources and attribute proportionate profits to these communities/societies? Should insistence of intellectual property right by western society be accepted by developing countries so that claim for indigenous property rights (IPR) could be exercised? (e) In what forms and through which fiscal and organizational instruments, the compensations be routed back to the preservers of biodiversity? (f) How should public resource transfer and budgetary mechanisms be designed so that people living in biodiverse regions have incentives to stay on instead of migrating out? (g)If biodiversity in perhaps majority of niches can be maintained only through (and not without) human interference (selection pressure, cultural or ritual compulsions for different types of tasks/cultivars), how should conservation policies be designed in a culturally compatible manner? (h) What are the ethical dilemma that scientists working on IPRs face while earning individual career and professional rewards and doing advocacy for the communities whose lifestyles continually deteriorate in the meanwhile? (i) What are the legal possibilities for codifying claims of different communities over IPRs and value adding recombinations of genes preserved through IPRs.

The paper provides argument for changing the nature of discourse. The existing epistemology relies excessively on the language of such elites whose own record of sharing their rent with

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providers of knowledge is not very honourable? I argue that such a code of conduct should be developed which disqualifies such professionals/scientists from participating in the debate on IPRs who have not demonstrated some way of sharing rents with the providers of knowledge.

I believe that valid and authentic institutions for protecting IPRs will emerge only if the nature and arena of discourse is radically altered.

The paper is divided in six parts. In first part-1, I present discussion on diversiy and deprivation. Part-2 deals with Cultural diversity and rise of modern bureaucratic state. In part 3, I discribe ways of compensating local communities and individual farmers for preserving diversity through breeding, selection and institutional development. In part-4, legal, organizational and fiscal instruments for routing compensation for preservers of bio-diversity are detailed. Part- 5 includes arguments on the need for redefining Indian position on intellectual property rights. In part-6, the ethical dilemma in conducting discourse on bio-diversity are mentioned and paper is summed up in the end.

Part-1

Diversity and Deprivation

Diversity in ecological endowment is much higher in high risk environments compared to the low risk environments. The variability in edaphic, climatic and resultant bio-mass complexity is high in drought-prone regions, hill areas, flood prone regions, cyclone prone regions and forest areas. The soil fertility, structure, sub-soil characteristics, and groundwater availability and quality vary a great deal at short distance in these regions. With the variability in the soil and climate it is obvious that the human choices with regard to technological possibilities also get modified.

People inhabiting the regions have enriched the variability through their own mobility. Either through pastoralism or through seasonal migration people have had to move to regions providing employment and subsistence. These movements provide opportunities for transmitting and/or embedding ideas, tools, seeds, practices from one region to another. The so-called rational and logical way of exploring nature and resource use does not permit apparently absurd experiments. If society were to survive only through logical organization of technology and institutions perhaps the civilisation would have become extinct long time ago. It is in art, culture, theatre, music and other folk idioms like proverbs, riddles, and adages that we learn about human ability to combine the opposites or the non-comparables.

The absurd experiments became possible when people tried things out of fun, adventure, carelessness or just plain mischief. Through cornucopia of such experiments emerged diversity which became available for selection by people - men, women and children, over time. Pursuit of oddity and search for means of survival,I have recently argued in portfolio theory of household survival provide some understanding of the resultant bio-diversity (Gupta 1981,1984, 1985, 1991).

It is impossible in high risk environments to survive by relying only on crop, livestock, trees, labour or craft activities. Within crop no one specie or variety of that specie can suffice given the variability in soil and climatic conditions. One needs crops and varieties which may suitable if rains were early or too much or too little or too late. Diversity thus was inherent in the nature of endowment and human need for survival. Cattle mortality was higher in the dry periods while sheep mortality was higher in the rainy periods. Nature had provided for contra-variance among various biological systems to guarantee conditions of survival at certain level of demand.

The variation in demand of various resources is a function of monetised and non-monetised exchange relations mediated through markets, kinship networks or other systems of exchange. The cultural institutions generated an ethic for survival collectively rather than individually. Thus information about various edible and non-edible species, movements of wildlife and anti-dotes for various noxious plants and insects or niches for bee hives or other useful sources of nutrition was shared among social groups or kinship linkages. Emergence of variability in human capabilities to process this information was recognised always. Emergence of experts thus was inevitable. However, the expertise so generated was often premised on knowledge as a common property.

Culture, institutions and diversity: Emergence of common property institutions for resource management and knowledge management through cultural codes were two major steps taken by our forefathers that helped in linking diversity with collective survival. Recognizing the danger of too much reliance on utilitarian logic, moral boundaries were created around human wants and needs through cultural and religious mechanisms. The concepts of sacred groves, different deities in different 'auran lands'(the land left for

gods and goddesses) or mountain peaks were evolved to generate spheres or protocol of retribution in case of offense. Sometimes the characteristics of deities also provided clue to the nature of diversity in a particular mountain or forest range. For instance, certain plants or animals found in abundance in particular niche were also considered the favoured foot or abodes of these deities. The rituals were institutionalised to honour, preserve and in fact reproduce the diversity through various kinds of offerings of different grains, meats, or other provisions to these deities not only when alive but even when people died. In fact remanants of some of these offerings in the graves have been an important source of information about the nature of diversity in past. As if our forefathers knew that some day we would need that information for reconstructing the path through which we had evolved. Studies by national research council of USA on the less known plants have shown the potential that indigenous folk knowledge has for providing means of survival even in future.

Why has deprivation then been a consequence of this ethics of diversity inherent in high risk environments. Part of the answer lies in the nature of ecological endowments. And part in the economic and political institutions. To some extent even the learned behaviour through social approval contributes to this process.

Even if ecological explanation is considered a kind of ecological determinism, I do not think we should feel shy in acknowledging the limits nature imposed on our choices and often in our own interest. The second explanation could be that markets and states always found it difficult to deal with diversity. Standardised cropping patterns through centralised irrigation system made possible the extraction of rent in a bureaucratically administered manner. The possibility of collecting rent in kind so variable in taste, shape, use etc., that converting equivalence would become almost impossible or difficult would have been an enathema to any state- feudal or capitalist. The generation of exchange value as against use value was one means by which resources were transferred from high risk to low risk environments.

The learned helplessness may contribute to lack of protest by the disadvantaged people inhabiting bio-rich environments. The oppression of these people does not always make media headlines.

When persistent protest does not invoke popular sympathy or responsible response from the state, people realize the futility of protest. But not always. There are many bio-rich regions which pose continuous 'law and order ' problems to the state. Many of these so called insurgency movements are actually protest against the destruction of their habitat. Some times declaration of certain forests as sanctuaries also leads to tensions with the people who either resided there or grazed their animals there or collected various forests products. We have argued elsewhere that diversity and human interactions are closely linked. Even on the issue of forest fires, there have been debates for last two hundred years but expert opinion seems in favour of allowing this practice to continue (Gupta and Ura, 1990). It is the market oriented interference in the forests and other such regions which causes destruction. And local people become part of it often only when other avenues of survival are exhausted or they find the resources being depleted regardless of their conservation efforts.

The rate of capital accumulation and nature of its investment and distribution depended upon the nature of institutions which were established to collect various kinds of tributes or taxes or reward services or loyalty to the state. People living in harsh environments have always been headstrong, obstinate and difficult to be tamed by any centralised authority. There are any number of examples when these people struggled but were tamed. Over a period of time they lost their ability to protest or became dependent for their survival on the mercies of the state.

The more able individuals particularly the males often migrated out in search of better opportunities and got assimilated in the culture of high growth- low risk environments. Some of these peoples were an important constituent of armies and thus provided institutionalised mechanism for showing their chivalry. However, those who were left behind realised that their knowledge of diverse resources and their skills of reproducing or maintaining this diversity were not in demand in the market place. Local festivals and rituals required certain types of variety and therefore some of these were maintained for cultural reasons. Sometimes the urban demand for some of the low productivity but better taste varieties also stimulated maintenance of some of these varieties. But mass production of uniform quality outputs amenable to centralised procurement, marketing and distribution or decentralisd procurement but concentrated consumption. This implied that market would not support diversity as a commercially viable strategy.

Wherever market did support, for instance, the demand for French wine extracted out of grapes grown in specific patches of soil but having unique flavours in great demand by the urban consumers, the diversity was in fact perpetuated . It appears that slowly a demand for organically produced irregularly shaped but tasteful fruits and vegetables is also growing in the West. The tragedy is that in the tropical developing countries which caught on the development path rather late, the vision of the future is often moulded by the local elites in the model of western consumerism. The emergence of organic agriculture or preference for diversity is dismissed as an aberration rather than a pointer to a future trends. Thus the markets and state militate against diversity in farming systems or in forests. The diversity thus becomes a source of deprivation because the skills and resources are discounted by both-the markets and the state-in the process.

The organisations responsible for developing these backward high risk regions often find it difficult to develop procedures and norms for catering to demand for resources or credit for sustaining highly diversified portfolios of enterprises Studies on banking systems in India have shown that banks in their anxiety to finance short-term low risk activities specialise their investment portfolios. This specialisation implies availability of easier finance for certain activities and lack of availability of finance for other activities. Given the shorter time frame even in the preferred activities the choice of technology is often capital intensive because of low rates of interest. On the other hand, people managing apparently high risk activities unable to borrow from banks either borrow from informal sources at high rate of interest or prefer to shift their portfolios towards labour intensive and responsive enterprises(Gupta 1986, 1988). The high growth rate of sheep, goat or local breed of cattle or cultivation and grazing in the marginal regions - all the activities employing labour intensively- provide illustration of such an strategy of survival through destruction of diversity and impairment of ecological balance.

The organisational strategies and preference for standardise bureaucratic systems in most developing countries may give a sense of control to the ruling elites but these also provide a setting for future catastrophe. In the contemporary history we find evidence of peasant protests generally in the cash crop growing uniformly endowed low bio-diversity regions. However, increasing instances of violence around grazing lands by the migrating pastoralists and emergence of fissiparous or separatist movements in the backward regions clearly indicate that future is going to be different.

The cultures in these regions withstood the loss of bio diversity but seems to be unwilling to suffer loss of cultural diversity. Many of them are realising now that the loss of cultural diversity was inevitable with the loss of bio-diversity.

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Part-2

Cultural diversity and rise of modern bureaucratic state

Few people have realised that bio-diversity was maintained in no small measure through cultural diversity. Not only thousands of gods and local dialects of different languages signify the cultural diversity but also a whole philosophy of life, nature, existence and co-existence of different claimants of natural resources living, dead or to be born. Insistence on common language or common culture often implied dominance of one social or ethnic group over another. Since democratically such a dominance was difficult to be organised, the coercion by state was an unavoidable instrument of ensuring compliance. Sometimes the cultural diversity was controlled by confining the stubborn cultures in clearly identified and enclosed regions. For example, the Indians in America or aborigines in Australia. Sometimes new states were created cutting across cultural boundaries such that same ethnic group got divided into population of different states, for instance, Bengalis in India and Bangladesh, Kurds in Middle East, Arabs in Maghreb or Saharawi regions or large number of states in Africa or Latin America. Celebration of five hundred years of Spanish Conquest in Latin America may be a matter of pride in Europe but is a matter of terrible shame, guilt and agony in the conquered countries. With rise in the power of unified state and the dominance of any particular group, the bio-diverse regions like forests also become the sanctuaries of rebels. The conservation of diversity has often been seen to be high in the regions where local populations is often unresponsive to state control. For instance, in Jhabua - a tribal region of Madhya Pradesh, Central India, one finds forests intact only in those pockets which had most ferocious and 'uncivilised ' tribals. Similarly, in northern Burma and southern Nagaland the regions of high gurrilla activities are also the regions of high genetic diversity.

The paradox is that modern state would like to benefit from the knowledge of the deviant and non-submissive cultures but at the same time would use such educational system or developmental strategies which will make the survival of these cultures more and more difficult. Even if they are educated, they are taught to reduce their pride in their local folk practices or ethics of survival. The progress is defined according to the parameters on which they are rated as low. Once an inferiority complex is institutionalised, cultures can work towards their own destruction. Cutting forests or excessive exploitation of medicinal plants becomes completely defensible when social recognition, status and esteem are available mainly on the basis of accumulation of wealth, no matter how.

The professional developers belonging to whichever discipline have contributed to the contempt of the cultural pluralism while analysing it in an etic perspective. For instance, anthropologists and ethnobotanists would help in identifying useful plants which can provide greater vigour to the modern state and its instruments. However, very few ethnobotanists would ever ask for greater control of the local people over their knowledge and its products. There is a need for rethinking about the nature of state being created and recreated through the hegemony of international power politics. It is not in the interest of long-term survival of people in the developed part of the world, if cultural diversity and the consequent bio-diversity is curbed or annihilated through support by international superpowers or multinational corporations or even UN institutions. A good instance of United Nation's contribution to reduction of cultural pluralism is the method and approach used for developing national conservation strategies. Almost in every country these strategies were developed through bureaucratically organised expertise comprising people who often had shown no professional sensitivity to cultural pluralism. They had never communicated their work in local languages to the people from whom they had collected data for their analysis and growth of expertise. Even these strategies

were never discussed in the countries that I am aware of, among different political, cultural or religious groups. Very often expatriate consultants at an extraordinary cost indulged in polemic and rhetoric of the most banal kind. Even when some of these experts emphasised the need for pluralism they failed to build upon the work of native genius often unavailable in English language. This experience is true not only small countries like Bangladesh or Bhutan but also of large countries like India or may be Brazil.

Occasionally a genuine concern has been expressed about the need for cultural pluralism and growth of bio-diversity (McNeely, 1989). However, the development which "tends to destroy the only cultures that have proved able to thrive in these (forests, deserts and other isolated environments) environments" (McNeely, 1989:5); is made possible through an non-sustainable system of governance. For instance, I am not aware of any example where a project financed by UNDP has ever been discussed in local language with the people likely to be affected by the project. In fact the project document is often a classified document not available to indigenous people even in English, of course never in local language. The articulation of cultural pluralism through structures of the accountability which are seen to be responsive to the urges of the local cultures is necessary. United Nations organisations and particularly FAO with its very explicit bias in favour of agri-business has not learnt any lesson from the concerns expressed by IUCN. It is not enough for world conservation strategy to say that traditional communities, "often have profound and detailed knowledge of the ecosystems and species with which they are in contact and effective ways of ensuring they are used sustainably." The strategy should have tried to link the efforts of national governments to balance their books of accounts through borrowing or exports disregarding ecological balance. Neglect of biological resources of limited current value was inherent in such a ' new world order'.

The issue essentially is how the quality of life is defined in a given society and what methods are followed to ensure reasonable availability of good quality of life to most disadvantaged people. The cultural diversity also influences the concept of quality of life and attendant mechanism for achieving the same through various technologies and institutions.

Part-3

Compensating Local Communities and Individual Farmers for Preserving Diversity through Breeding, Selection and Institutional Development

It is not a paradox that the people who conserve biological diversity best are the ones whose expectations from life are minimal. It is not that they lack entrepreneurship or adventurism necessary for technological transformation of local ecological environment. But the range of disturbance which is permitted by the given culture to manipulate ecological parameters is well defined. There are traditions of leaving three rows of crop (known as Akkadi - one run of a drill) in the field for birds/animals etc.(Talwar,1991) Likewise first bearing of fruits in mangoes was forbidden for collection. Perhaps different norms of sharing have evolved as a part of bioethics. The sharing could be guided by at least three set of factors:

(a) Whether the act of sharing is compensatoryin nature (I have scared birds all this while, I have denied food to so many cattle trying to stray into my field etc.), or conciliatory (I have offended different gods using owls, other animals as their abodes, I need to have peace with nature, sacrificial (I must offer some thing I need most to placate god, nature force - prakriti - invite helpful insects/birds etc.);

or just conformity (to what others do, have no particular reason to deviate)....

(b) Whether the sharing is a conscious effort to restore the ecological chain needs to be enquired into.

(c) To what extent religion, culture and other collective institutions sanction such behaviour.

The ability to extract more but willingness to extract less than the permissible limit of resource use is guided by very strong cultural norms. How does one compensate the communities practicing shared and restrained use of resources.

It is being realised world over that the task of maintaining bio-diverisity is not just a technical or a biological process. It also involves institutional development for enabling individual and community responses to the need for bio-diversity. Some of the alternative ways for compensating farmers and communities could be the following:

Alternative routes for Compensation

(1) Valuing biological diversity of potential future use: It is always a difficult question as to how much value one should assign to a resource of which current value is either low or nil. Several common property resources suffered not only because institutions managing these resources were weakened over time. But also because the local perception of these resources often did not match with the external or governmental or global perception of these resources. The conventional norms, boundaries and institutions regarding common property resources must be respected. Recent fight in Canada between the state(Quebeck) and local Indians (Mohawks) is a case in point. The indigeneous population respected a particular region because it had graves of the important deities and respected people of the community. The local government authority wanted to make a golf course on this land - undoubtedly very rich in biological diversity. There are similar cases almost in every country. In India, government wanted to build a missile testing range in Balliapal in Orissa which finally had to be given up due to strong protest by local population. Silent valley project in Kerala, south India is another instance when government had to abandon a power project because the local people protested against deforestation of a rich and biodiverse tropical rain forest. It is often argued that development can not be achieved without a price. The issue is why this price should be paid always by the marginal populations in disadvantaged regions.

Two implications follow:

one) the conventional boundaries of common property resources were first violated during the colonial era in most developing countries. Even after independence the violations continued. The state control proved in many cases worse than the feudal control. Can these boundaries be reenacted to the extent possible? Can state allow local communities to evolve norms for governing these resources and renew their biological diversity? It is possible that the hegemony of local powerful people would assert itself. The answer to that would be setting up of environmental courts supported by jury comprising affected populations in greater number.

atives and decisions to farmers themselves. Its potential to promote living diversity is highest; however, its effectiveness may vary significantly according to the granted incentives" (Tapia et al 1990).

In 1956, in the 16th All India Cattle Fair, a committee comprising various former rulers of princely states in India and chaired by Union Minister for Agriculture, prizes were given for bets buu and cow of diferent breeds found in various regions. Such fairs unfortunately became less important with the onset of 'Operation Flood' and other such internationaly funded dairy programmes. The focus got shifted from preservation and improvement of local breeds to large scale cross breeding. The results are well known. Thus there is a need for EEC and other international agencies funding programmes like Operation Flood that they insist that a significant energy and resources are spent on building upon local knowledge about bio diversity.

(3) There is a clear trade-off in maintenance of genetic diversity through grass root level efforts and through global or international research centres in collaboration with multinational companies or otherwise. Alttieri cites example of Columbian NGOs who were concerned after being informed by a CIAT researcher that it was abandoning work on bean varieties destined for marginal conditions (Diaz in Altieri, 1991). However, the cost and management aspects of decentralised grass root conservation centres either in the form of botanical gardens mentioned above or as informal research centres have to be carefully looked into. There will be a definite harm done to the cause of maintaining bio-diversity if state and corporate sector disown its responsibility because the NGOs are supposed to be engaged in the task. The danger becomes all the more serious if these NGOs are large and funded by international agencies without any explicit accountability to local communities. In South Asian context, it is not uncommon to find large NGOs which are as inefficient in resource use as perhaps some of the state organisations may be. Also the programatic preferences of NGOs keep changing with the preferences of the donor agencies. Obviously, a long term commitment to conserving bio-diversity is unlikely to emerge in such NGOs.

(4) There is a view that farmers rights should not be considered as an intellectual property system. Instead farmers should be compensated for the work that they do for the conservation and breeding of various species (Altieri, 1991). The problem with this view is that the task involved becomes a very diffuse category so much so that it involves almost all aspects of survival. Accordingly the demands for farmers rights would incorporate the political economic aspect of the very governance by any state. It is possible that the farmers who do not maintain diversity because they produce high yielding varieties ask for compensation at par with those who do because they may claim that the lack of diversity at their farms is a consequence of conscious decisions by the state. Once the boundary of claimants is expanded, every individual or collective claim becomes weak. We do not wish this to happen. Accordingly, the intellectual property of the peasants, pastoralists, horticulturalists, fishermen and women etc., would need to be properly recognised and honoured. The fact that diversity and economic backwardness co-vary, what one is demanding through this argument for farmers rights is a new criterion for allocating fiscal and other physical resources to high risk low employment and low income regions from national and international agencies. The only difference is that only those communities are sought to be compensated which have maintained diversity despite all odds. Two problems may arise in operationalising such a system of compensation: a) isolation of human contribution to maintenance of diversity from the ecological contribution may not always be easy. There may be some sights inherently more diverse and not amenable to

uniformity in biological endowment. The human contribution in such a case is that of refining and value adding to the existing base of diversity; Also by generating an ethic which advises stay in those disadvantaged regions having the burial grounds or cremation sites of their elders, rather than migrating away, people may have contributed to the diversity. b) the institutions for maintaining diversity may be dominated by the local power lords. Routing compensation through them may make the marginal population even more marginalised.

There are no easy answers. However, we have come across cases where individuals have decided to go against the current and use methods of farming or resource management which aid bio-diversity. For instance, Haribhai in Baglu village of Junagadh district, Gujarat, Western India, decided seven years ago to stop total application of pesticides in his fields. He observed very closely the relationship between birds, toxicity in the pests killed by the pesticide and eaten by the birds with the disastrous consequences. The non-violent ethic generated by his religious beliefs further created dilemma in his mind. To his pleasant surprise he found that his yields were as good or in fact better than the neighbouring farmers who used pesticides. In addition, he had a larger variety of insects and pests, birds, frogs, earthworms, etc. in his field than any other field in the village. He didn't do it to maintain or enhance bio-diversity. He did not claim any special price for his product unlike organic farmers of western countries. When we met him and asked about his motivations, it was obvious that his religious and cultural beliefs seemed to have played a greater role in his decision to pursue organic farming than any so called rational economic considerations. He did acknowledge, however, that his cost of cultivation was much lesser than the rest.

How do we compensate carriers of bio-ethics of this kind. Do we compensate them by according social esteem and providing opportunities for further experimentation? Or do we price this ethics at all?

My suggestion is that we need to use four kinds of incentives i.e. material and non-material and specific and non-specific vis-a-vis a community of farmers or an individual. A material - specific incentive is like royalty payment or patent fee. Material non-specific incentives refer to resource transfer for institution development favouring maintenance of bio-diversity. The debt swap and special concessionary finance for investment in backward regions may also help. Non-material specific incentives include honours, awards, media coverage, special privileges etc., to specific communities or individuals. Non-material non-specific incentives refer to the privileged access of the countries doing most to preserve bio-diversity in-situ conditions to the genetic resources of other countries.

In the above case it will be useful to honour Haribhai and give him due acknowledgement while pursuing research programme on non-chemical based pest control. He should also be given opportunity to visit other farmers in different parts of the world pursuing similar goals. As far as the religious and cultural ethics is concerned, tolerance and appreciation for such values may be the major means of positive reinforcement. It will be improper to suggest that any one religion can only generate such an ethic.

Part-4

Legal, Organizational and Fiscal Instruments for routing compensation for preservers of bio-diversity

The estimates of the value of drugs derived from plants found in tropical rain forests in developing world have ranged from dollar 43 billion to 1468 billion per year (McNeil & McNeil, 1989).

Legal Framework:

The legal arguments about bio-diversity being a common heritage and possibility of value addition only after making huge investments in education, equipment, research, infrastructure, testing of products etc., have been derived from locke's (1690) theory of ownership. McNeil & McNeil (1989) further add that community's own investment in developing indigenous knowledge is quite large. They suggest that assymetric transactions "may sometimes be sufficiently one sided as to be immoral or illegal or both". They refer to the international Bill of Human Rights, Article 27 of which says, "everyone has the right to the protection of the moral and material interests resulting from any scientific, literary or artistic production of which one is the author". The American Convention on Human Rights (Williams, 1981) signed but not ratified by the United States says in Article 21, "no one shall be deprived of his property except upon payment of just compensation". The property law, contract law and tort law, McNeil & McNeil observed should be applied to protect the intellectual or tangible property. Transfer of benefits ought to be set aside if unilateral mistake is established and recovery based on fraud or misrepresentation is established.

The authors after citing various property theories observe

> Information which was derived by a group after generations of experience; treated by the group as important, essential, or perhaps eve sacred; and useful to the group in meeting the demands of their environment would reasonably fit within the trade secret definition (McNeil & McNeil, 1989:33).

While referring to the case of constructive trust, they observe(1989:34)

> This also might provide a theory of recovery, since the money acquired by the wrongdoer's actions might be seen as the product of improperly taking advantage of indigenous people "incompetent" to transact business beyond the confines of their culture.

> Our conclusion is that many immoral and illegal transactions may have occurred and that the original owners of cultural information may have a just and legal claim for compensation. Perhaps more important, we need to search for new and modified institutions which will reduce the likelihood and severity of future unjust transactions and provide for a more fair distribution of wealth generated.

Kloppenburg(1988) prefers a multilateral approach over market oriented competitive approach for third world countries to claim compensation for their genetic wealth. He prefers this because he fears that a market approach would generate competition among the third world countries and isolate them rather than encouraging a collaborative effort. He suggests a FAO managed International Plant Gene Fund that would "support plant genetic conservation, construction of gene banks, and the training of plant breeders in the

third world'. Money to this fund was to be paid by the advanced industrial nations which have free access to the international germ plasm banks. Size of this payment was to be determined by the "size of the national seed industry, value of the national agricultural production, and frequency and size of drafts upon the FAO's global gene bank".

Organizational structure:

While I agree with the spirit of Kloppenburg's suggestions, I have less faith in some of the multilateral UN institutions. Not only their establishment cost is extremely high but also they are often less cost effective in undertaking various training and other support functions. For instance India has trained manpower in most of the relevant fields and can provide support to most third world countries at costs which would be fraction of what it would be if FAO did the same functions. However, political interests of some of the super powers may not accommodate the idea of India or other such countries providing such a support. This contradiction becomes apparent also when one looks at the conduct of International centres of agricultural research. My preference therefore is for a multilateral institution with a low cost profile, small size and very clear ethical and professional norm of accountability to be set up in collaboration with FAO, IUCN and third world institutions. The professionals from the western countries like Kloppenburg, Warren, Paul Richards, McNeil, Wilson, Farnsworth, McNeely, Ashton, Altieri, Mollinson etc., can be involved in the structure of governance. Third World centres of expertise like ACTS(Kenya), NBPGR(India), IIM-A etc., can also be involved. The FAO, IUCN and CGIAR would need to support it through existing institutional channels. A consortium of legal experts will have to be formed to provide legal advice for TRIPS and GATT negotiations such that the issue of farmers' rights does not get obfuscated again as in past.

I agree with the suggestion of McNeil and McNiel(1989) that international aid agencies have also to do a lot of homework to modify their sensitivities on the subject. Perhaps this modification will not take place unless pressure on these agencies is increased. One way to increase this pressure would be to perform social and ethical audit of these agencies from the point of view of protection of intellectual property, biodiversity and farmers rights.

There is also a need for global network of activists, professionals and NGOs engaged in preservation, developemnt and enhancement of biodiversity. Organizations like International Work Group For Indigenous Affairs (Denmark) should be involved in the discussion. They have rightly pointed out in the context of the wild life issues that many times the restrictions which are put on commercial loggers and users of forest resources are imposed on the native forest residents too. Cutting a tree for their livelihood or killing an animal for their subsistence becomes a crime. At the same time state claims inability to provide them basic necessities at the places where they live and at the price which they can afford. Thus new sources of subsistence are not added while old sources are denied. In any cases much of the diversity, domestication and development of the natural reserves in past was done by these very native people. Organizationally, IWGIA has provided them a voice which other international organizations have failed to do so far. IWGIA does not accord as much attention perhaps for good reason to biodiversity related issues as may be necessary. Once they are involved, they may do it.

It is true, as I said earlier, that many national governments are no more sympathetic to the interests of the disadvantaged people living in the bio-rich but poverty ridden regions than the international development organizations. Swiss constitution perhaps is an exception that it provided for its aid to reach the poorest in the host countries. In actual practice it may not happen in many cases but certainly such provisions do help. Routing resources for bio-conservation through national government in many cases will be necessary despite these limitations. But local committees and structures can be created to ensure

proper accountability of the concerned public institutions. Any organization (public, private or non governmental) must share its balance sheet with the people for whom the resources are being received. It is not enough to compensate people in the developing world for their contribution in past. It is also necessary to protect their experimental ethic and cultural and technological skill of nurturing bio-diversities.

Part- 5

Intellectual Property Rights and need for Redefining Indian Position

Indian Patent Law has reflected Indian variety of patriotism with its usual contradictions. For instance, import of wheat has always been considered a blow to our dignity, but import of edible oil and milk powder did not bruise our ego. Even though the specific laws are yet to be enacted in India to deal with the peculiarities of bio-technology, the December, 1990 issue of Bio-technology and Development Monitor (NR.5) published by Ministry of Foreign Affairs, The Hague and The University of Amsterdam, The Netherlands has summarized the Indian case given below very precisely.

> India's patent system has been much criticized by the developed countries because of Indian refusal to accede to Paris Convention and become a member of UPOV (The international convention for the protection of new varieties of plants).
>
> Under Indian patent law, 'the methods of agriculture or horticulture' and 'processes for the treatment of plants to render them free of disease or to increase their economic value or that of their products' are excluded in the Patents Act. Even though there is no explicit exclusion of animal or plant varieties or other bio-technological products, the patenting appears doubtful.
>
> In the food, pharmaceutical and chemical sectors, only processes are patentable. The products are excluded.
>
> The duration of Indian Patent is relatively short, i.e 14 years compared to 17 to 20 years in industrially advanced countries.
>
> The conditions for granting compulsory licence are considered too broad.
>
> The Indian Patent Law permits granting of 'automatic licence of right' in food, pharmaceuticals and chemical sectors.
>
> The Indo-US science and technology initiative in force in 1982 has been postponed twice. In October 1988, 'an agreement was signed to extend the initiative, after India agreed to start bilateral discussions on Intellectual Property Protection(IPP). Since May 1989, India was placed on American 'priority watch list' following 'special 301 provision of the US Omnibus Trade and Competitiveness Act of 1988'. Although most 'priority' countries have been removed to the less critical watch list, India was placed on the Priority Watch List for the second time in 1990.
>
> India has consistently refused to deal with IPP under GATT and instead preferred discussion on this issue in World Intellectual Property Organization (WIPO). It has opposed the attempt of US and European community to harmonize patent laws all over the world. Brazil is the only other country among relatively developed low income countries which shares India's concerns. The ASSOCHAM

suggests that the Indian government should sign the Paris Convention and standardize the life Indian Patents for all substances to 14 years.

On the other hand, organizations like Indian Drug Manufacture Association (IDMA) and the Punjab, Haryana and Delhi Chamber of Commerce and Industry urge the government not to change the patent system lest it gives a blow to Indian pharmaceutical industry. It may be mentioned that more than 60 per cent of the drugs marketed in India have been found to be non-essential and in many cases redundant for the purpose for which they are marketed.

Government of India had set up a National Working Group on Patent Laws in 1988. This working group argues that Indian Patent Law has served the Indian interests very well. This group intends to keep bio-technology outside the purview of Patent Law.

The debate on the germ plasm conservation between IBPGR (dominated by the Europe and USA), and FAO sponsored Plant Breeders Right has at long last accepted the concept of farmers' rights although the precise mechanism of enforcing these rights have not been spelt out. Although some of the alternative ways have already been reviewed in this paper.

The Breeders Right in Europe are being extended in such a manner that in future any company will be prevented even from incorporating a small part of the patented germplasm. The EEC directive on patenting of life form "seeks to end both these exemptions. Article 12 of the directive seeks to extend patent protection to the product initially obtained by the patented process, but also the identical or differentiated products of the first or subsequent generations obtained therefrom. Similarly Article 13 stipulates that the patent would be applicable to all products in which genetic information pertaining to patented product has been incorporated ....." (Economic Times, Feb 13, 1990). The small European companies would find it difficult to compete with large European and American Seed Companies. In a conflict of this kind both the large and the small Indian seed companies might suffer. It is a case where India and other developing countries may find allies in the small European seed companies.

Unless India Patents the germplasm available in India and provides a similar facility to other developing countries there is no way the Indian seed companies and R & D institutions can withstand the onslaught of western multinationals. Indian position, I argue, should be to respect the patents and simultaneously apply IPP to all the wild and domesticated plant and animal resources. India must insist that all seed companies using genes from the parents collected from India directly or through CG Centres (Consultative Group on International Agriculture Research) pay royalty to India and other developing countries as the case may be. The argument that land races i.e. varieties and breeds selected by the farmers are a 'common heritage' of man kind will not then wash. Indian subsidiaries of large seed multinationals might be able to transmit germplasm or part of it to the parent companies without any hindrance under the present laws. Unlike the repatriation of the profits, the repatriation of germplasm or genes was far more easier. However, thanks to the efforts of the scientists like Dr Lalji Singh, India is perhaps the only developing country which has entirely indigenous technology on DNA fingerprinting. It is possible thus to trace the transfer of genes illegitimately from one country to another. India can extend this expertise to most other countries and international agencies can help defray this cost.

India like many other tropical countries has a very high genetic diversity. In collaboration with the countries like Bhutan, Nepal, China and some other African countries, India can insist on a very major income transfer from the European and Western Seed compa-

nies to the developing countries. At the same time, the returns to research on this subject would improve and Indian companies in private and public sector may be able to compete with the best in the world.

I suggest that Indian Government revises its policy on the Law of Patent as it applies to Bio-technology and germplasm if we have to harness the comparative advantage we have in our natural endowment of genetic diversity and institutional capacity of building upon this knowledge.

The argument of drug companies that most of them would not be able to stand the competition with the MNCs is valid. It is also true that the price of many essential drugs would increase if the same had to be imported or made by the subsidiaries of the MNCs. But in a way it will be good. Ayurvedic and other alternative therapy systems will get a chance to survive. It is a pity that a very small fraction of national resources is spent on research on these systems with in developing countries. This is the case when more than eighty percent of the human and about ninety percent of animal health is still guided predominantly by the indigenous health system. It is not without significance that

Part-6

Ethical dilemma in conducting discourse on bio-diversity

Very often public spirited professionals face a paradoxical situation while advocating on behalf of the disadvantaged communities. They have to seek support from the agencies whose policies they do not approve of. In my view there is no way one can avoid this issue. My personal belief is that the rulesof the game should not be different for the academic professionals and other interest groups. However, in some cases one cannot insist on complete agreement before deciding to work with a particular organization. Some of the normative principles which may guide one's choices are :

a) The data and its possible uses after compilation must be shared with the communities or the individuals from whom data on bio-diversity was collected.

b) One should follow the same norms of acknowledgment of intellectual properties as one follows while dealing with the oral or written works of professional colleagues. In a recent newsletter viz: Honeybee, I have followed this principle. It will call for communication in local language.

c) The organization from which one seeks support should be persuaded to accept the concept of cultural and institutional context of indigenous knowledge system.

d) Wherever difference of opinions exist the same should be made explicit.

e) If a professional gets an award, honour or remuneration by working on the indigenous knowledge systems, a share of the same should be made available in the direct monetary form to the providers of knowledge. Or a proportionate time out of one's personal quota should be spent in advocating on behalf of the indigenous people and their rights.

The nature of intellectual discourse should be such that the espoused and in-use values do not diverge too much.

There is no justification for distinguishing the theory and the praxis completely. It has to be admitted that the professional strength for pursuing a case steadfastly cannot be achieved without sharing spiritual and cultural concerns of the people who have main-

tained bio-diversity forgoing some of the privileges to which we are accustomed.

In each developing country traditions exist about indigenous thinking on the subject. In India ancient texts like Vriksha Ayurveda, Krisi Parasar (Majumdar, 1925), 'Gospel of Dirty Hand ' (Munshi, 1950), Indian Science and technology in eighteenth century (Dharmapal, 1972), indigenous animal husbandary knowledge (Verma and Singh 1969) etc., are some of the early references. If the conservation ethic has to be revived, there is no escape from building upon these traditions in each country. Any other approach will be non institutional and even unethical. Many well meaning scholars commit this mistake not realizing how cultural memory(ignored for long) erupts like a volcano at certain critical moments in history and wipes away all the false edifices.

Summing up

Several modern technologies including DNA fingerprinting, recombinant DNA, tissue culture etc., have generated a false hope that genetic diversity can be preserved entirely by laboratory methods. I do not share this optimism. In my view bio-diversity is not a static concept. People living in bio-rich and economically poor environment keep on making selections of one kind or the other to enrich the given diversity. Therefore the need for institutional mechanisms that safeguard the ability of these people to continue the process of enriching bio-diversity. Given the fact that most of the poor people in these environments have to out migrate seasonally or permanently to cities or other high growth rural regions proves that most countries do not value bio-diversity properly. In view of the unequal terms of exchange and misguided tariff and taxes policies, most developing countries have a very precarious balance of payment position. They are dependent upon developed countries. Elite in developing countries aspire for the same life style that their counter parts in developed countries use. The policy planning system is often manned by the same elite. Thus it is not going to be an easy task to reorganize institutional and policy framework to sustain bio-diversity.

At the same time there is a global concern that something has to be done to prevent very fast loss of genetic diversity. I have argued in this paper that the persistence of poverty in the bio-rich regions is not accidental. It clearly shows the low value that various national and international bodies place on the efforts made by local people in producing and reproducing this biodiversity. This is not a technical problem alone. It affects the whole political economy or political ecology of generating wealth through agri-business approach of standardization in ariculture.

Sustainability of this approach is being questioned even in the developed world(see recent report of National Research Council of Us on Alternative Agiculture). But most of the devloping countries have still to realize the value of what they possess. It is not being sufficiently realized that the genes for disease resistance, stability and survival in harsh environment are available only in tropical, Himalayan and Andean environment. If global climatic changes are likely to be even half as serious as these are being made out to be, the skills of reproducing biodiversity under harsh conditions are going to be in great demand. I would not be surprised if the pastoralists , forest people and the mountain communities become the dominant cultures. But the global efforts do not have to wait that inevitable eventuality.

In a recent issue of newsletter viz: Honey Bee aimed at documenting indigenous knowledge of survival through local technical innovations, Ihav esuggested two lessons we ought to learn form the behavious of Honey Bee. First that Honey bee does not impoverish the flowers while picking pollen from them. Secondly it does comnnect one flower with another through pollination. I am not sure that the academics participating in the discourse on biodiversity take care of these concerns. Do we extract knowledge of people (as ethnobotanists do) without ensuring that they

do not become poorer because of not inspite of this extraction. Further, do we link one group of people with another ?

Once we have found a satisfactory way of conducting discourse on biodiversity, I think we would have also discovered a way of operationalising our concerns through grass roots oriented action plans.

The disadvantaged communities have become a source of cheap 'unskilled' labour for infrastructural projects. National Commission on development of Backward Areas (Palnning Commission, Government of India, 1981) in fact went to the extent of cautioning against too much effort in stemming migration from the backward regions, lest the supply of cheap labour is affected adversly. Such a perspective is at the root of the problem.

During a very severe drought in 1987, about 20 lakh cattle and their rearers were in the cattle camps of varying quality. Even though an effort was made to catalogue the good breeding bulls at our insistence (Gupta nad Kumar, 1987) nothing much came of it. Africa is under the spell of another drought. How many more land races would vanish because the people are too poor to maintain the seeds or save the pastures, only time will tell.

Unless the discussion on maintainance of property rights about genetic resources includes the stakes of the communities (farmers, labourers, fishermen, pastoralists, hunters and gatherers etc.,) , I do not know if we would be able to even conceptualise the design of proper institutional mechanisms.

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LINKAGE BETWEEN WASTE LANDS AND BIODIVERSITY
CREDIT AND MARKETING FACILITIES NEEDED TO PROMOTE WASTE LAND DEVELOPMENT EFFORTS BY FARMERS

K.M.HEGDE[1] AND GANESH S.BHAT[2]

Introduction: The term 'Waste Land' is having a wider meaning. In general it is considered that the land which is remaining as barren is a waste land.(8) A land which is fully of vegetative cover cannet become a waste land by overnight. It is obvious that there will be different types of waste lands depending upon the degree the lands which are not fully utilized to its maximum potentiality. This can be called waste land. (10) And if a slopy land which is less suitable for economical cultivation is used for agriculture, there might be xome vegetative cover on these lands when there are crops standing, this also may have to be considered as wasted land. The land which is brought for improper land use system also can be catagorised as wasted land.

HOLDING PATTERN AND TYPES OF LAND

In India more than 74 percent agricultural land holders are coming under small and marginal farmers groups. (9) In future this number may increase because of further fragmentation in land holding. There-fore the only way of making these small holdings as economically viable, one has to attempt to make the maximum use of the potentiality of our agricultural lands. The existing unutilised farm BUNds, fence or boundary lines can also be utilised for growing diversified crops.

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There is also good scope to add many short duration crops, sidecrops and the intercrops in many of our agricultural, horticultural and plantation cropped area. Now, the time has come to consider for proper land use planning from starting silviculture in the top of the hill to aquaculture in the bottom of the river. (13)

Under the category of these underutilised lands, there are differences according to the ownership of the lands. (10)

1. Privately owned or managed farm lands and lands assigned to the farmers as a privilege and to be managed by the farmers.
2. Community lands owned by panchayats, temples, educational institutions tribal councils etc.,.
3. 'C' and 'D' class revenue lands set aside for grazing, fuelwood supply etc.,.
4. Village common lands under forest departments control bu the local people haveing privileges to use these lands for fuel, fodder, grazingetc.,.
5. Protectd and the reserve forest areas near the habitats which are under various stages of degradation.

Vast area owned or encroached by the farmers which are brought under plough for the cultivation of the crops which are having short duration and requiring small investments are not ecologically suitable or economically viable. These lands are unfit for agriculture if we consider the productivity and the sustainability of these lands.

Many of hill slopes are made barren to take short benefits. some coastal parts of the western ghat hill slopes are bing used for groundnut cultivation without undertaking any soil conservation measures. After 4-5 year these lands are becoming most unproductive and the low lying fields and cannels are being silted up. In the

hill zone of the same district, pine-apple cultivation was started about 10-12 years back, on comparitively plain but fertile lands owned by the farmers or on the forest lands leased to the farmers for the cultivation of this remunerative fruit crops. Now just after a decades time the land has become unfit for the cultivation of any crops become of over utilization of the nutrients with a greed for more production without considering the sustainability of this new cropping system.

For improvement of the waste lands, it is agreed by the experts that growing of tree crops is the only solution. With the recent concept of people's participation in forest development and waste land development schemes, there is very good scope for improving the production of forest produce.

Classification of forestproduce:

Depending on the end use of the forest produce, they can be classified into following categeries. (9)

1. Wood

A. Fuel	: Fuelwood : Briquettes : Charcoal
B. Timber	: Poles : Boxes, Construction, Carpentary, : Chip boards, hard boards, : Carving wood : Soft wood : Ply wood
C. Plug	: Paper plup : Rayon pulp
2. Fodder	: Green fodder, : Hay leaf meal : Feed concentrate

3. Food: Vegetables, fruits, Nuts Honey/Syrap.

4. Farm Needs: Green manure, Fencing materials, mulch materials, Tool and implements, Baskets, boxes, cane and bamboo materials.

5. Medicinal herbs: Direct house hold use, raw materials for industry.

6. Artisan requirements: Sandal wood, rose wood etc.,. material for mat weaving, basket weaving.

7. Oil and cake: Non edible oils, Edible oils,

Oil cakes : Animal feed, manure, pest and disease control.

Others : Gum, Wax, Resin lac, soap substitutes, perfumes etc.,

8. Local needs: Fuel wood through head leaders requirements of local artisans carpenters, blacksmith and gold smits etc.,.

With such vide range of products, it is naturally expected that the people would takeup production of forest produce on a large scale.

DEPENDANCE OF AGRICULTURE ON FOREST

Our agriculture is presently and even in near future would be highly depending upon the natural resources like nutrients water, climate etc., on the surrounding forest. Even it is feared that the boom of the exploitative intensive agriculture of the west it short lived (9)

The beneficial effects of the surrounding forest cover in controlling floods, increasing water infilteration, proper climatic control, providing wind belt, soil and water conservation etc., cannot be quantified. From farmers point of view these indirect services rendered by the surrounding forest cover is much more than the direct productive benefits.

For the sustainability of his agricultural production also the farmer is very much indebted to the surrounding forest with diversified plant species. Though all the living beings on this earth are directly or indirectly depending upon the forest

resources, it is more so for the rural population.

Industrial rawmaterial users may use only few species on large scale but a farmer has to use many diversified plant species in small quantity. A paper industry may prefer to get more bamboo culms, a plywood industry man may like to have a few soft wood tree species and a pulp industry may prefer to have fast growing Eucalyptus species in large quantity.

But, for a farmer the situation is entirely different. In fact in rural areas the people have to look towards the forest products in different stages of their life from craddle to cremetorium. In agriculture from root to fruit, all the parts of a plant have to be used. It was observed in a survey conducted in a small village in the Western Ghat area, 85 species are being used by the farmers from the near by forest for fourteen different purposes. (1)

For a crop-land owned by a farmer for his survival the surrounding forest is the nourishing mother for his land. Now the pressure on our agricultural land as well as on the surrounding forest land is also increasing day by day. Because of our scientific developments the dependance on the natural resources had to be reduced. But irony is that our dependancy is tremendously increased because of not only our population growth but also due to our changed life style which is the result of our scientific development .

Now in the last decade of this century the farmer is at the cross roads. He wants to know from our scientists whether it would be possible to reverse this trend by using the same scientific tool, to reduce our dependancy on the surrounding forest cover to conserve it for the benefit of his sustained agriculture in future.

Most of our agricultural commodities are coming from the cultivated lands though they have initially originated from the forest. Because of our scientific developments we have been able to achieve "green revolution" in agriculture to attain self sufficienty . Under Indian condition livestock management is also a part and parcel of our agriculture and it is also highly depending upon the natural resources, and to a great extent on forest resources.

INTERDEPENDENT TRIO

To succeed in agriculture a farmer has to manage land labour and inputs efficiently. In our country we cannot easily seperate agriculture, livestock management and forestry from each other. All these three are interrelated and inter dependent. It is highly intricated to understand the influence of these three on each others survival and development and co-existance. A garden has to seek its nutrients supply from the surrounding forest. A paddy field has to get nourished by the green manure brought from the near by forest. A common cultivator has to maintain few animals for milk, manure, draft or energy, power etc. These animals have to go for grazing to these forests and the farmer has to lop the fodder trees for maintaining these animals. In the course of his continuity of his agriculture and livestock management practices, if he tries to exceed the limit of the natural balance he has to ultimately suffer by becoming unable to maintain the productivity of his farm lands in a sustainable manner.

Therefore, unless we consider our agriculture-livestock management and the forestry in an integrated approach we will not be able to succeed in any of these fronts.

PRINCIPLE OF EQUITY:

As stated earlier (table-1) most of our farmers are not much above the poverty line. We therefore have to give more importance to the equity in sharing the appretunities in utilizing the natural resources also. To approach the goal of integrated balanced development of our agriculture, livestock management and forestry we have to tread the path through productivity, sustainability and equity, which are mainly related to technical, ecological and social angles respectively. Our overall developmental strategy should be to increase the productivity according to the increased demand for the products but at the same time we should be careful about maintaining the sustainability of these products in long run. And we should also see that these efforts will be helpful to improve the level of the living condition of our small and marginal farmers to achieve the equity in sharing the benefits.

The didiversified plant resources use in the rural areas can very effectively be used to achieve this goal.

If the forest is the mother of agriculture, the natural forest is the mother of mankind. The agriculture and livestock management are directly consuming the products of the forest. Diversity is the law of nature. The sustain the life on this earth we have to maintain the diversity. To maintain the diversity we have to maintain our natural forests. Unless we reduce the pressure on forests for our various requirements we cannot maintain these natural forests. Though there are various restrictions and

regulations, the present utilization is neither sustainable nor equitable. In many cases even it is against the principles for increased production.

PRESENT MARKETING SYSTEM

Forest produce has become synonymous with timber alone. Various other forest produce; are either neglected or given least importance. From the revenue earning point view timber and fuelwood becomes the major forest produce and rest are considered monor forest produce abd are called by the same name.

The marketing system evolved so far is for getting better price for the timber which is generally being auctioned at government depots. ~~[illegible]~~ This covers the timber harvested by the forest department either directly or through contractors and other seized material. Timber proposed to be sold by individuals, grown on private land is still at the mercy of middlemen called 'malki contractrs' in karnataka. Lengthy and rigid procedure laid down for this purposes makes it inevitable for the individual cultivaters to sell the material at very low prices to the malki contracters.

The "Minor forest produce" is generally being auctioned by the forest department on area basis. The contractor who secures the right to collect these produce by paying a lumpsum royalty from forest area, engages the local tribals and other labourers for collection. He pays nominal charges for cállection work and ~~[illegible]~~ earns huge profits.

In certain places local co-operative societies are being awarded the contract of collection work. In practice, this work is again passed on to some individual contractor or the society

itself acts like a middleman. Thus the benefit does not reach eithe the people or the government treasurey.

The present system of marketing is better explained through the following examples.

Because of improper way of bamboo harvesting, once considered as inexaustible stock of bamboo in Uttara Kannada has now become as a scarce commodity. And now the West Coast Paper Mill in Karnataka is bringing the bamboo from far away distance like Assam and Nagaland.

Minor forest products are being auctioned through the tender system, by just collecting some royalty to the Govt. In this system the contractor will not have any interest in the production of these minor forest products in the future years as there will be no guarantee of his getting the contract again. So he will not bother about the careful harvesting of the produce. In some cases they just cut the branches of the mango trees for "appe midi" or tender mango nuts used in pickle making. In Western Ghats curry leaves are collected without any consideration for its future growth. Moreover these collection works are undertaken by poor and unorganised people. They are just getting the daily wages for collecting these forest produces. They even do not know where it will be transported. Though the middleman gets the higher profit these people are only entitled for their wages. Thus in the present system none of the goals of productivity, sustainability and equity can be achieved. In this way neither the poor gatherer nor the poor consumber is having any incentive for achieving sustainable production and utilization.

A cooperative society is formed in Uttara Kannada District to encourage the rural artisans to take up basket weaving works

using cane. There is very good market in this locality as different types of baskets are used in agriculture for different farm operations.

The artisans have to pay royalty to the government for the canes used. The rate of royalty is so high that the society cannot compete with other sellers who are not raising any bills. In this way they evade the taxes and the royalty and can sell the products at 50 percent cost, than the society price. Now the society has stopped functioning. Because of this, government is also loosing the royalty and the smugglers are indirectly being encouraged. For farmers, it is unavoidable to purchase these baskets to carry on their agricultural business. The middlemen, sumugglers are making money. And neither the artisans nor the consumers are able to get the benefit. Secondly farmers are being forced to purchase the commodities which are sold in illegal manner. Unless there is a single agency to coordinate different activities from production level to consumption level, we cannot organise this trade effectively.

Problems of present marketing system available for forest produce can be summerised as follows.

1. Non existance of organised marketing avenues.
2. Lack of facilities for drying, storing etc.,
3. Lack of efficient processing units in rural areas.
4. Involvement of several middlemen at varieus levels.
5. Low and non remunerative prices for the produce.
6. Lack of extension facilities and efficient technology, market information etc.,
7. Restrictions on the movement of forest produce.
8. Imposition of avoidable taxes, royalities etc.

THE FUTURE:

The man who was living as hunter gatherer in the dense forest just like other wil animals has been converted as a shifting cultivator after many centuries,. In this way he has become the semi settler and started the primitive system of agriculture. He also domesticated some of the snimals according to his changed needs and the life style. He has tread a long path in becoming the present day permanent settler and the agriculturist. Even now in many places in our country we cannot seperate livestock management activities from agriculture. Only in those places where seperate marketing network is developed the livestock management had become a seperate enterprise. Thus the original hunter gatherer has become the present agriculturist and the herdsman.

In early sixties we were facing the problem of supplying the food grain to feed our people. But in nineties we are facing the problem of supplying fuelwood to cook the food though sufficient food grain is available in the country.

In late sixties we have been successful in achieving green revolution. In seventies we have attempted for while revolution. In eithties we have started crying for eco-restoration. But the real challange before us is how to achieve the eco-revolution in nineties and before the end of this century.

It is clear that to save our planet, we have to save our natural forest by conserving it under natural condition, in spite of our growing demand for innumerable products of the mother nature coming through the natural forests. Here again we have to look back to the history ofthe man. There he has changed himself from historical gatherer to the present day producer.

And we also have to switch over from the present collection system to the future cultivation system for the various forestry products, based on the demands.

Sofar forestry is mainly confined to the collection of the natural growth. We are collecting from few hours old crops, like fungus grown in the Western Ghats in rainy season, to the trees more than hundred years old. Except few departmental plantations trees crops cultivation by private people in their own lands is of recent origin.

Technically speaking most of our waste lands except few rocky hills, desert areas and saline and alkaline areas are merely wasted lands. By using our vast research knowledge it is possible to clad these barren lands with green cover. In India against the recommended forest cover of 33 percent of land area only 13 percent area is under vegetal cover spread over to 40 million hectares. Since the last decade the rate of deforestation had been on an average of 1.5 M.ha. every year and yet the government is unable to meet the fuelwood demand. (9)

VAST POTENTIALITY:

By the turn of the century the demand for fuelwood alone will be around 200m^3. If the fuelwood has to be substituted for half the quantity of the dung burnt, the fuelwood demand may increase to 230 m^3. With the industrial demand added to this it may go upto 300M^3. To get this much yield 20 to 30 M hats.of matured plantations have to be harvested. The statistics of wood demand and supply not only hint at the future fuelwood crisis but also suggests the future ecological disaster if massive afforestation programme is not undertaken.

About 93.69 M ha. of non forest area in the country has been identified as waste land. In addition to this area half of the forest area, about 35 to 40 M ha. is needing immediate afforestation. The afforestation programme can also be extended to some of the under utilised agricultural fields spread over 600000 Kms.^{2} where the crop output is less than 25 percent of the average yield under rainfed condition. Taking all these areas into consideration we have about 175 M ha. half of the total land area which is more than the area under agricultural production (140 M ha.) available for afforestation. In addition to this there is also possibility of to takeup forestry crops as side crops or intercrops without harming the main crop. Most of these under utilized lands are owned by poor farmers who are under employed in non agricultural operation seasons. Both the land and the labour are being under utilised. And because of cultivating agricultural crops on unsuited lands, the area is becoming more and moredegraded wihin the span of a few years. Therefore, the continuation of the present trend is not suitable considering economical, ecological or the socials aspects of the situation. Because of severe degradation of the surrounding forests, needs of the agriculture cannot be met by the village common lands, unless scientific efforts are made to produce more from these lands. And the old system of open access for every-body to collect their needs without any responsibility of developing these leands have to be switched over for joint forest management system. (6)

MARKETING STRATEGY:

Unlike agricultural and othertype of produce, forest produce comes from privately owned lands; common land and also from government owned lands. As such the marketing

strategy has to take into consideration the type of ownership and also the mode of production of these produces.
The forest land in each village or in a wastershed area has to be divided into the following four zones where both the department and the joint forest management committees have play different roles for each zone.

1. Conservation zone: Ecologically sensitive areas like steep hill slopes, catchment areas of the water points, pavitra vanas (sacred grooves) can be catagerised in this zone. These areas should be strictly conserved. This should be the responsibility of the department as well as the local people.
2. Protection zone: The present reserve forest areas can be brought under this group. Here the local poor people may be allowed to harvest he non-wood forest produce in a sustainable fashion under the control of the joint forest management committees. These committees also should take the responsibility of protecting these lands against the fire, grazing and smuggling. (4)
3. Common lands zone: This zone has to be demarcated according to the actual need ~~fa~~ of the locality, based on the scientific studies. And the JFMC can under take the responsibility of the management of these lands i.e., development, harvesting and distribution in an equitable and sustainable manner considering the bonofide needs of the locality and also to increase the MFP in this zone for outside market.
4. Development zone:- Privately owned and managed lands can be grouped in this catagory. Here all the encouragements should be given to develop these lands to meet out the external bulk requirements of industries, fuelwood, timber etc., by undertaking the cultivation of different forestry crops on a scientific way considering the out side demands.

.....15.

The forestry products which are required in a relatively small quantity can be collected from the zone II without harming the vegetative growth. And the III and IV zones can be used for the actual cultivation of forest crops. While switching over from collection to cultivation system, care should be taken to safeguard in the interest of the poor people who are presently engaged in these works. Many women in coastal areas are earning their daily livelyhood by just transporting the fuelwood to the villages and towns on head loads by collecting them from the nearby village forests and in some cases from reserved forests. And many other poor families are engaged in collecting the MFP from the forests.

In the first stage harvesting can be regularised, by involving the JFMC and these poor people may be involved in a systematic harvesting and transporting of it. Employment may also be generated for them by taking up the afforestation programmes in the barren common lands. After 5-7 years these fuel plantations can be harvested rotationaly involving these poor people in addition consumber co-ops. can help in distribution. This system should definetely workout cheaper than the present departmentaly run depot system and plantation management. For bulk purchases of the fuel-wood can be met through the departmental depots.

For MFP collection controlled access is needed. The list of the MFPS may differ from place to place. As mentioned in Anubhuta yoga sangraha, more than 650 species used for medicinal purpose out of which 90 percent of the species are from forest only. Different parts of these plants are having different medicinal properties. As per the report of Mr. Deepak Sharma (2) it is possible to harvest the following categories of MFP from

the Uttara Kannada forest. 1. Fibres and flesses 2. Bambee and canes 3. Essential oil producing materials. 4. Oil seeds 5. Plant materials required for tans and hydres 6. Gums and resins 7. Drugs, spices, poisons and insecticides 8. Edible oil plant materials 9. Honey etc. 10. Misellanious products like beedi leaves, soap nuts etc.
The full details of MFP are available in Indian forest utilization vol. II (3)

Local Distribution: If the local poor people are encouraged to harvest these crops in a sustainable manner and if they are provided with their stake in the conservation of these produces it is possible to increase the production of there commodities. Instead of present MFP tender system these poor people may be allowed to harvest these products under the supervision of the local JFMC.

Efforts should be made to identify these collectors and train them in the proper way of collecting these products. Instead of present free access, some controlled access can be initiated by introducing licences to these trained collectors. They may also be trained in simple processing of these products wherever it is possible. By introducing these two systems of controlled harvesting and imparting training it is possible to ensure more productivity, equity and sustainability than the present system. This simple system of marketing i.e., collection and distribution at local level can be introduced effectively wihout much financial investment and administrative set-up.

Marketing on Commercial Scale

For regular cultivation and out side marketing of the bulk forestry products we have to consider for a seperate but integrated mechanism on the lines of the different marketing networks available for agriculture and livestock products.

The farmers should get the following incentives to takeup afforestation programmes in their ownlands on a commercial scale.

1. Technical guidance 2. marketing and financial linkage 3. Legal simplification 4. Remunerative price 5. Linkage among the producer, transporter, processor, consumer and controller. Because of the variety of products produced in different regions, and processed and consumed in different parts of the country, it is essential to have a coordinated body to establish proper linkage in all these activities. Unlike other common agricultural crops these products are easily available in many parts of our natural forest. So while encourageing the marketing of these products we should also ensure that, this step will not encourage the smugglers. Therefore simple but effective way of controlling sale of these products should be thought of complexity of the problem necessiates the presence of a single agency to co-ordinate different activities from production level to consumption level and introduction of pooling system of marketing.

The present waste land development Board can undertake this responsibility in the lines of coffee board and spice board etc., utilising the present cooperative marketing net work. They can also provide proper financial assistance to the needed persons for production, transportation and processing at the local level utilising the present banking system.

In this Board, to discharge its duties of technical guidance, providing marketing and financial linkage, simplifying legal control system etc., it should have the representatives of the following groups.

a. producers b. researchers c. processors d. bulk and retail consumers e. controllers f. financers.

The board should have the following aims along with other existing objectives:-

RESEARCH:

a. Identifying suitable forestry crops in less productive agricultural lands of the different agro climatic condition b. Finding out the possibilities of introducing forestry products with the agricultural crops especially in horticultural and plantation cropped areas as intercrops or mixed crops c. using bunds, roadsides, canal sides, boundary lines etc., for growing forestry crops d. finding out the suitable crop combination of shorterm and long term forestry crops for degraded lands.
e. Introducing multi-purpose and multi-storeyed forestry cropping pattern considering different seasons of the different agroclimatic zones using tree species, bushes, shrubs, plants, creepers etc.,.

Seperate research programmes can also be undertaken to take up different cropping system and farm management system and the distribution of the products in an equitable manner in the village common lands and other community managed lands.

Local education institutes and the universities can be used for this purpose.

Extension: Based on the above research activities massive extension programmes in each village have to be launched to encourage the farmers to switch over to forestry cultivation system. Local Joint Forest Management committees can play an important role in organising these extension camps. Researchers can take part in these extension camps to some extent to have a dialogue with the growers about various aspects of growing these new crops which are new for their lands but not new for their lands but not new for their surreunding forests.

Marketing: A small farmer cannot cope with the present beaurocratic set up for marketing of his forestry produce of small quantity thourgh the government agencies. Even to sell a single bamboo culm he has to visit the forway department office several times.

Secondaly a farmer cannot compete with the government as the later is selling its collection of the forest produce at throwaway prices to the bulk purchasers without considering the cost of production. The bulk pruchaser wants it on a large scale at one centre, secondly he, quotes a lesser price as the farmers quantity of produce is much less than his requirement. A grower can sell his highly perishable cocoa pod without any difficulty threugh his co-op. society but he cannot sell his non perishable bamboo clum so easily.

Therefore unless we develop a non-governmental marketing agency it is not possible for a farmer to market his forestry produce on easy terms. The existing cooperative net-work and the APMC systems can be involved in marketing of these products also. Wherever this system is not in good working condition approved dealers can be entrusted to undertake this job. By introducing this approved dealership system it would be possible to simplify the controlling also.

The producers also should have the awarness about the outside demand for various short and long duration products. This can be achieved by the extension programmes and also by sending news letters to the Joint Forest Management Committees, informing the demand and prices of different commodities. Though there is a good demand and high price for honey in the city market the poor producer in the village cannot get this benefit. This type of exploitation can be avoided by introducing this system. And

people also can understand the demand for various products in different parts of the region.

This will also help to have a linkage between the producer, processer and the consumer and actually the producer at the rural artisans will also be benefited.

There are many seasonal and highly perishable products like, fruits condiments and spices, medicinal plants etc. If once market linkage is established between the producer and the consumer these products can be sold as the present horticultural products or through milk marketing network.

If once the coordinating agency like the proposed board comes into existance it can identify the potenial production regions, processing centres and the consuming localities. Based on these three aspects they can advise the financing agencies to help the growers and encourage them to undertake the production and also regulate the collection from open access; to controlled access model.

UNIFORM PRICE STRUCTURE

If the forest produces are allowed to be marketed freely, there are chances that individuals and even the societies can engage in mixing up produce from government owned land with that of theirs. As such restrictions are to be imposed. The present restrictions on the movement of forest produce makes it cumbersome for individuals to carry to different places where better price can be obtained for the commodity.

These problems can be overcome by implementing pooling system of system of marketing. All identified forest produces are to be sold at fixed places. The purchasing agency could be the JFMC or any other cooperative agency to be selected by the Board looking after these affairs. The producers of an area should be be paid similar prices

te the preduce depending en quality. This will aveid individual cultivaters betheration ef running frem place te place. The local agency should be entrusted with the responsibility ef grading, precessing and transperting ef the preduce either te a bigger market er te consumer ceeperative societies. Since the mevement will be takenup by societies; restrictions impesed by ferest department te curb smuggling, will net become a hindrance. The present system ef purchasing, precessing and transperting ef cecea peds by CAMPCO in Karnataka can be considered.

FINANCE: Financéng ef agreferestry activities nseds te be taken -up en a large scale with the new impetus en develepment ef waste lands.

Waste lands er wasted lands are generally ewned by peer farmers. If we just ask them te takeup highly profitable long-duratien creps like teak, sandlewood etc., he cannet ~~affix xxixgix~~ afferd te ge fer such a cropping pattern. Se we have te ~~mix~~ mix beth short and ~~x~~ long duratien creps and the creps required fer different purpeses like fer his ewn consumptien as fuelweed er fer his cattle as green fedder er fer his farm as green manure etc.

Therefere, credit facilities should be flexible according te the local needs. Fer each agre-climatic zene, and fer different types ef creps combinatien lean granting schemes have te be chalked eut, involving the department efficials, researchers, producers and financing institutions.

The existing financing institutions can effectively participate and take the responsibility ef providing timely and adequate finance fer these activities.

Details of cost of cultivation are to be worked out before fixing up scale of finance and repayment schedule.

Recovery: Recovery of the financial assistance ~~of~~ granted to forestry activities can easily be linked with marketing agency. Under a single agency setup and pooling type of marketing, cent percent recovery is assured under normal circumstances.

CONCLUSION:

In this manner it is possible to change our farmers and rural people from traditional caonsumers of forest products to scientific producers of forest crops in a sustainable manner.

This will also help the owners of the small farms, and the agriculturaly unproductive land holders to be converted as ecologically friendly and economically desirable producers of multiple forestry crops. By developing hese waste lands or degraded marginal lands we can minimise the pressure on our natural forests for local as well as external demands. At the same time we can provide more organic manure to other agricultural lands by using the organic materials coming out from these degraded lands, and increase the production potentiality of our agricultural lands. Which are facing the serious threat of inadequate organic matter supply. Side by side, we can ensure the harmless way of collecting MFPS from our forests through the village level Joint Forest Management Committees and the trained personnel.

This may ultimately help us to achieve the three goals of productivity, sustainability and equity among the rurak people and also cause a good harmony among agriculture, forestry and livestock management. We hope that this approach will be one

of the objectives of eco-revolution for the next decade to be adhieved as a challange before the end of this century.

For the success and commercial viability of the agroforestry and wasted land development programme, the following strategy is suggested .

1. Presence of single agency co-ordinating production-research, extension, marketing, finance, and other activities connected with forest produce.
2. Introduction of pooling type of market system to ensure
   i. Uniform price structure
   ii. Curbing of smuggling activities,
   iii. Avoid hoarding and middlemen,
   iv. Protect the interest of consumers and producers,
3. Assurance of minimum support price.
4. Assurance of ready market for the producer,
5. Establishing and linking producers and consumers organisation in cooperative lines.
6. Establishment of processing units, provision of streage facilities etc.,.
7. Evolving distribution marketing strategies for bulk biomass, products for agri. needs fuelwood, artisans requirement and industrial requirements.
8. Provision of adequate and timely finance.

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TABLE-1:- Size distribution of the operational holdings in India: 1980-81.

Category	Size of holding (ha.)	No. of holdings (Million)	Percentage of total holding	Total area operated (Million ha.)	Percentage of the total area	Average area operated holding (ha.)
Marginal	Below 1.0	50.5	56.49	19.8	12.16	0.39
Small	1.1 - 2.0	16.1	18.1	23.0	14.13	1.43
Semi-medium	2.0 - 4.0	12.5	13.98	34.6	21.25	2.76
Medium	4.0 - 10.0	8.1	9.06	48.3	29.67	5.97
Large	Above 10.0	2.2	2.46	37.1	22.79	17.24
	Total:-	89.4	100.00	162.8	100.00	1.82

MAINTENANCE OF BIODIVERSITY IN THE NATIONAL PARKS AND SANCTUARIES OF INDIA

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India's vast network of wildlife protected areas (approximately 465 national parks and sanctuaries at the latest count)* is an impressive attempt at conserving the diversity of its natural habitats and wildlife. Though clearly there is a need to focus as much on areas outside national parks and sanctuaries as within [Gadgil 1991], given the fact that all together they constitute less than 4% of our land mass, there is no denying the fact that these legally protected areas are amongst the last repositories of several endangered habitats and species in India. Management aimed at their long-term conservation is therefore a critical input into the protection of India's biodiversity.

Though covering a wide range of biogeographic regions and flora-fauna species, this network is still far from truly representative of the country's biological diversity. The Wildlife Institute of India has reviewed its representative character, and suggested a number of further steps to fill up gaps, including modifications in the boundaries and legal status of existing areas, as also the addition of new ones [Rodgers and Panwar 1988]. However, this exercise has been done primarily from the ecological point of view, and has not taken within its purview the 'management viability' of the existing network, or of the new areas being proposed. By 'management viability' I mean the feasibility of protecting the essential ecological characteristics, or other important natural values, of the area, within its social, economic, and political context. In a country like India, with the great majority of its habitats being used by humans in one way or the other, this context becomes a critical determinant of the long-term viability of the natural ecosystem itself.

In the following, I shall attempt to discuss the critical management issues relating to national parks and sanctuaries in India, and suggest broad ways of overcoming the various shortcomings that still exist. A lot of fine-tuning will obviously need to be done before the recommendations can actually be put into practice. In many states this effort has already begun, in many others there is serious

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* An all-India survey [Kothari et.al. 1989] which used data verified with each state government, came up with a figure of 445 by early 1989. Since then, several states, notably Gujarat, U.P., and Tamil Nadu, have declared more areas. An exact total is not yet available, but the jump from a 1960 level of about 65 parks and sanctuaries to about 465 now, is quite remarkable.

reconsideration along the lines suggested. Unless otherwise mentioned, the data used below emerges from an ongoing study being undertaken at the Indian Institute of Public Administration, the first results of which were published in 1989 [Kothari et.al. 1989].** Most of this data is of the period 1979 to 1984, and is culled from information from 249 of the 293 parks and sanctuaries that existed uptil December 1986. It is therefore somewhat dated, and covers only about two-thirds of the number of protected areas today (excluding the 85 tiny island sanctuaries of the Andaman Islands declared in January 1987). However, subsequent studies at IIPA [Singh et.al. 1990; Kothari et.al. 1990; Mehta et.al. 1991; Pande et.al. 1991; Kothari et.al. 1991] and at other centres has indicated that the results obtained from this sample remain by and large true even today.

CRITICAL PROBLEMS IN THE PROTECTION OF BIODIVERSITY IN NATIONAL PARKS AND SANCTUARIES OF INDIA

All is not well with our national parks and sanctuaries. Protected on paper, most of them continue to face human pressures of various kinds, suffer from neglect at the hands of their creators the state governments, and are hoisted with destructive 'development' projects. Narrow and biased management strategies have alienated the human populations inside and around them, turning even previously conservationist communities hostile to the idea of wildlife protection.

For the sake of academic clarity, these issues can be classified into three categories, each of which is briefly discussed below:

A. LEGAL STATUS

A.1. Non-completion of legal procedures: Under the Wild Life (Protection) Act of 1972, national parks and sanctuaries have to go through a series of steps (Sections 19 to 35) relating to the settlement of rights which exist in the area prior to declaration. Interestingly, there is a difference here between a national park and a sanctuary. An area can only be intended to be a national park before these steps are taken, and is legally a national park only after all rights have been settled. A sanctuary, on the other hand, is legally a sanctuary as soon as it is declared as such by the state government, and settlement of rights comes subsequently.

By 1984, only 21 (40%) of the 52 responding national parks and 16% (8%) of the 209 responding sanctuaries had completed their legal procudures. Significantly, this means that at that time, only 40% of the so-called national parks legally existed, the others were only 'intended' as so. The sanctuaries formally existed, but with non-completion of procedures they are subject to all sorts of pressures. The most blatant of late was the denotification of the Darlaghat Sanctuary by the Himachal Pradesh Government, under the plea that since settlement of rights of villagers inside had never been

** The present paper essentially emanates from the 1989 publication, which was written jointly with Pratibha Pande, Shekhar Singh, and Dilnavaz Variava. Given greater time for consultation, they would probably have been co-authors of this effort also.

completed, the area's notification had lapsed. This is of course a legally invalid argument, since the Wild Life (Protection) Act of 1972 does not allow for any such 'lapsing'. But non-completion of procedures gave the Himachal government an excuse to obliterate a sanctuary from its record books, conveniently hiding the fact that the denotification was actually done to make way for a cement plant proposed to be set up inside!

I must point out that the responsibility for determining, acquiring, extinguishing, or otherwise dealing with rights in parks and sanctuaries lies with the Collector or an officer appointed by the state government for the purpose. Delays in completion of legal procedures appear primarily to be taking place at this stage, the reasons for which need to examined.

A.2 Control of the Wildlife Wing: The Wild Life (Protection) Act specifies that control of national parks and sanctuaries must lie with the Chief Wildlife Warden of each state (Sections 33 and 35). However, in many states, control over some of these areas remains with the Territorial Wing of the Forest Department, or even with other agencies like Irrigation Boards. Even in areas controlled by the Wildlife Wing, portions may be the jurisdiction of other agencies, such as the roads under state PWDs. The result of both these situations is a tussle over differing land uses advocated by various governmental agencies, with the relatively powerless Wildlife Wing often being prevailed over. Conservation of biodiversity is hardly the worry of most governmental departments, even, sadly enough, of the Forest Department. So, to give one example of an activity which continues despite its obvious negative impact on biodiversity, the Forest Department till 1984 carried out commercial forestry activities in at least 20% of the 188 sanctuaries for which information was available.

B. HUMAN ACTIVITIES

B.1 Rights, Leases, Concessions, and other Legal Activities: Human presence is far greater in national parks and sanctuaries than the popular perception of them would have us believe. As many as 18 (56%) of the 32 national parks and 100 (72%) of the 138 sanctuaries responding had human settlements within their boundaries. *Ten of these had human densities higher than the national average!* The vast majority of protected areas also have human populations in the immediate vicinity, often depending for survival on their resources. Rights, leases, concessions, and permits for a variety of activities --- fuelwood collection, grazing, agriculture, habitation, etc. --- were reported from 19 (43%) of the 44 responding national parks and 128 (68%) of the 187 responding sanctuaries. This situation is unlikely to have changed substantially in the last few years, given the delays in completion of settlement procedures and the understandable reluctance to displace people.

It would of course be inaccurate and distortive to *ipso facto* term all these activities as 'problems'. There is no doubt that a considerable amount of the traditional activities inside what are now parks and sanctuaries were ecologically compatible, i.e. they did not cause irreversible damage to the area. Indeed, some communities

helped in the conservation of the area, or at least in the protection of certain of its components, such as sacred groves, sacred species, economically valuable species [Chandran and Gadgil 1991].

On the other hand, ecosystems are also known to overstressed due to human presence, especially traditional activities like grazing and agricultural expansion, and modern 'developmental' activities like dams, roads, tourism, etc.

B.2 Illegal Activities: Activities which are classified as offences under the Wild Life (Protection) Act or other Acts are commonplace in national parks and sanctuaries. People previously dependent on these areas for their survival and suddenly denied access (e.g. Keoladeo Ghana National Park in 1980) have no option but to carry on illegally, even if they are henceforth treated as 'criminals'. Activities by local people (grazing, fuelwood and MFP collection, causing fire, etc.) are perhaps the most common offences in protected areas. But there is also organised poaching, habitat destruction, illegal entry and other such offences committed by outsiders, which a seriously understaffed and underequipped (see below, C.2) wildlife wing cannot hope to control. In our study, 31 (69%) of the 45 responding national parks and 96 (56%) of the 172 responding sanctuaries had recorded offences. This, of course, is far less than the actual incidence of illegal activities, since much of the latter never get recorded.

B.3 Impacts of the Protected Area on Local People: In the past, an exclusively wildlife-oriented approach has caused serious problems for the people in and around parks and sanctuaries. Not only has their access to resources been severely curtailed, they are forced to become mute bystanders when wild animals destroy their crops, property, livestock, and sometimes even fellow human beings. Herbivores and predators, their populations increasing as a result of protection, have impinged on the survival of human communities, much the reverse of what was earlier the case. Not only is this a serious infringement of fundamental human rights, but the resultant hostility cannot be conducive to the protection of the park/sanctuary itself. Even previously conservation-oriented communities, such as the villagers around the Velavadar National Park in Gujarat, are turning hostile.

C. ADMINISTRATIVE SHORTCOMINGS

C.1 Planning: This must be amongst the poorest aspects of the management of national parks and sanctuaries in India. Any protected area in India is set within a much larger administrative and biogeographical region; internally, too, it may contain diverse social and biological zones. Planning, both external and internal, is an essential prerequisite to its conservation, unless it happens to be one of those rare areas which are totally devoid of any human pressures and would benefit from simply being left alone.

Unfortunately, for all but a handful of areas, planning is almost completely missing. As far as I know, no protected area in India is set within an overall land-use plan for the region around it. There is therefore no coordination or synchronisation between the

myriad activities going on within and around it, often leading to a clash of interests. The Marine National Park in the Gulf of Kutch, Gujarat, is a classic case: while the Forest Department promotes it as a repository of marine ecosystems which need protection, the Industries Department declares its coastal area as an industrial zone! This is not an isolated example, similar stories can be recounted for the majority of our parks and sanctuaries. Even the so-called biosphere reserves, launched with the objective of integrating land use planning over an area much larger than a single national park or sanctuary, have so far failed to receive detailed planning inputs.

But internally too, planning is weak. The Central Government has repeatedly emphasised to the state governments the need to build up detailed management plans for their protected areas. Such a plan would identify the major conservation values of the area, present basic data and analysis, suggest strategies for protection and management, and indicate the infrastructure needed. Yet many of our parks and sanctuaries do not yet have management plans. By 1984, 26 (50%) of the 52 responding national parks and only 65 (31%) of the 208 responding sanctuaries had such plans. The situation is today likely to better in terms of quantum, especially since the Central Government has made the preparation of plans a condition to releasing funds to state governments under certain schemes. Yet in quality there is probably only a marginal improvement; most of the management plans made are still scanty documents which are not very much more than glorified budget proposals. Karnataka is a case in point: almost all its protected areas have management plans, but most of these contain only short statements of fact (often the same for more than one area!) and one-liner management strategies [Singh et.al. 1991].

C.2 Management Infrastructure and Implementation: Protection and management of most parks and sanctuaries require trained staff, equipment, budgets, and other infrastructure. The level of such facilities is an important indicator of the priority that a state government gives to the protection of its biodiversity. In most cases, parks and sanctuaries are amongst the most neglected areas, the exceptions being a handful of high-profile areas in the country.

The available figures on staffing tend to hide this fact. By 1984, 45 (90%) of the 50 responding parks and 171 (87%) of the 196 responding sanctuaries had staff positioned for them. However, though no comprehensive analysis on this has as yet been done, most areas also reported that they were seriously understaffed. One indication of this is the density of staffing, i.e. the number of personnel per hectare of protected area. Of the 216 areas which reported presence of staff, only 27 had a density of over 0.01 per ha., or 1 person for every 100 ha. Admittedly, of course, the adequacy or inadequacy of this level of staffing is determined by a number of other factors: type of terrain, amount and kind of disturbance, level of training, availability of equipment, etc.

Figures of equipment and budget are more revealing. By 1984, 27 (68%) of the 40 responding parks and 79 (50%) of the 159 responding sanctuaries had equipment, while 34 (67%) of the 51 responding national parks and 116 (57%) of the responding sanctuaries had a separate budget. The situation is likely to have improved since

then, but again, more in quantity than in quality. Relative to most other sectors and land uses, protected areas still get meagre funds, and specialised equipment, notably vehicles, are still in short supply. On the basis of the responses received (from 17 states and union territories), it appears that in 1982-83 the average expenditure on parks and sanctuaries in these states was a mere 1.46% of the forest department budget, and in 1983-84 it increased marginally to 1.54%. The situation today is not much better. It is no wonder that biodiversity protection is last on the mind of the forest guard who, underpaid and underequipped, has to patrol his [illegible] beat without even a bicycle.

C.3 Research and Monitoring: A certain amount of research is necessary to accurately identify the critical conservation values of an area, and to arrive at feasible strategies to protect these values. Monitoring is subsequently needed to identify changes, analyse the success or failure of management strategies, glean trends in wildlife populations, and obtain other information for the long-term protection of the area.

Available data on research and monitoring within and around national parks and sanctuaries is shocking. Only 16 (42%) of the 38 responding national parks and 38 (23%) of the 166 responding sanctuaries reported that research was being carried out within their boundaries. Monitoring was reported from only 9 (20%) of the 46 responding parks and 21 (11%) of the 193 responding sanctuaries. While these figures are revealing enough, they conceal an even more serious situation regarding the quality and adequacy of the research and monitoring being conducted. In many cases, both these activities were restricted to single species (such as the tiger), or simply consisted of sketchy inventories of birds and mammals. There is very little research, as far as I know, on the biodiversity values of parks and sanctuaries, and therefore little solid ground for any biodiversity conservation strategies.

The above discussion, brief and simplified though it is, should suffice to show that declaring park after park and sanctuary after sanctuary, as has been the wont of many a state government, is just not enough. Much still needs to be done to ensure the conservation of these areas.

FIVE STEPS TOWARDS THE MANAGEMENT OF NATIONAL PARKS AND SANCTUARIES

1. Identification of the areas to be declared as national parks or sanctuaries, on the basis of their ecological value and their management viability; restructuring of the existing network accordingly.

1.1 The formulation of specific categories of protected areas with specific criteria for their creation and management.

At present, the Wild Life (Protection) Act of 1972 mentions four types of protected areas which have legal status and legally enforceable provisions : namely "national parks", "sanctuaries", "game reserves" and "closed areas". Of these, only national parks and sanctuaries have detailed legal provisions.

Neither on the basis of the Wild Life (Protection) Act, nor by usage and convention, has a uniform set of criteria been defined and applied throughout the country for classification of a specific area as a national park or sanctuary. As a result, sometimes an area of purely local importance may be classified as a national park, while an area which perhaps contains highly endangered species may be classified as a sanctuary; even though under the Act the former would get greater protection. Certain areas, which are no more than large zoos, are today classified as national parks or sanctuaries. There are also classifications such as "biosphere reserve", and "tiger reserve" which are being increasingly used to focus on certain management objectives, but which have no corresponding legal status.

Areas may be set aside and afforded legal protection for a wide variety of reasons : as representative ecosystems; as important habitats of threatened, rare or endangered species; for their genetic richness, aesthetic value, ecological importance; or for their research, educational or recreational potential. The IUCN has as many as 10 classifications, from "scientific/strict nature reserves" prohibiting all human interventions except research, to "managed resource areas" where a multiplicity of uses are envisaged.

Recommendation: A committee consisting of representatives of the Central and State governments, non-governmental organisations and individuals, should be set up to evolve a protected areas classification which identifies the different categories of areas, the specific management objectives and legal status for each category, and a uniform set of criteria to be applied throughout the country for placing areas within each category. An effort should be made to apply this scheme to existing areas, wherever possible, so as to rationalise their legal status. All new proposals for declaring protected areas must adhere to this classification.

1.2 The Formulation of a Land Use Plans

The appropriate growth and maintenance of a protected area network requires long term strategies to divert the biotic pressures that most such areas are increasingly facing. Such strategies can only be developed in the overall context of a land use plan.

Recommendation: A detailed and long-term planning exercise needs to be initiated to work out conservation-oriented land use plans for various administrative levels: *gram sabha* and *panchayat*, *tehsil* and district, state and region, and the country as a whole. This is of course a very ambitious undertaking. A manageable start can be made with certain national parks and sanctuaries whose zones of influence are limited and identified. But overall, the task would involve:

i) The identification of national, regional, and local zones as independent units for planning, based on the distribution of natural resources. A river basin, for instance, could become such a unit, since the ecological processes in it are intimately intertwined.

ii) A determination of the optimal land use pattern for each zone and region, demarcating those areas that need to be protected as national parks and sanctuaries, setting them apart from areas meant for agriculture, urban expansion, mining, industry, and other activities.

2. Formulation and implementation of management plans, based on the requirements and objectives of each protected area and its surrounds.

2.1 Planning

a) As discussed above, a management plan is a prerequisite for adequate management of a protected area, yet a large number of parks and sanctuaries do not have them.

Recommendation: An assessment of the various problems in the preparation and approval of management plans is necessary. This effort should include:

i) Drawing up detailed guidelines for the formulation of management plans, specifying among other things the objectives of the area; the management strategies required; and the staffing norms based on the size of the area, its objectives, its biogeographic characteristics, and the pressures and disturbances it is subjected to. Reference should be made to the report of an earlier committee set up for formulating such guidelines [Government of India undated].

ii) Recommending steps which could facilitate the preparation and approval of management plans.

iii) Examining the desirability of training management planners.

b) A detailed management plan for a park or sanctuary should include an appreciation of the pressures from within as well as the surrounding areas. Such a plan should be based on a survey of both the natural resources, as well as of the socio-economic profile of the human population, in and around the protected area. It should therefore contain realistic and workable schemes for conserving and using the natural resources, including the diversion of human pressures from the protected areas, if necessary.

For example, where an area is considered ecologically very valuable but has significant negative human pressures on it, funds must be committed in advance of setting up the park or sanctuary to develop alternatives for the local people. Where such alternatives have a long gestation period, they must be initiated before the final notification of the area is completed. If access to an area is to be denied to the local people for 'national interest', then the 'nation' should adequately compensate them and find alternatives for them.

However, whether in most of these cases the human use has remained sustainable or not needs to be assessed. There is very little research into this aspect: it is as if people are stuck at two poles, those who believe that all human presence in these areas is bad and must be eliminated, and those who believe that being 'a part of the landscape',

people must be allowed to stay. As in most things, the middle path is perhaps the one to tread.

As an example of the kind of approach required to tackle this urgent problem, the different types of biotic pressures that our parks and sanctuaries are facing can be ordered in terms of their socio-economic justifiability and the difficulties anticipated in their control. One way of ordering is given in Appendix 1.

c) These management plans should, of course, also include an assessment of the staff and funds required, the type of skills that the staff should possess, their job requirements and the equipment and facilities that they would need. Periodic reviews and revisions of the plans would also be necessary.

It is obvious, but nevertheless needs to be stressed, that such a management plan would need to be worked out by a team which is inter-disciplinary, which could adequately assess the ecological and socio-economic characteristics and requirements of the area.

Recommendation: Such teams be set up by state governments to develop management plans for each proposed protected area, as well as for each existing protected area for which management plans do not already exist or are inadequate by the above standards.

d) A management plan should also cover activities related to park interpretation, tourist education and extension education for the local communities. Past and present efforts on this have been generally inadequate in protected areas in India. Such efforts are necessary to re-orient the casual or even destructive tourist towards helping in conservation, and to develop a sense of pride rather than resentment and hostility among local people.

This is an area where non-governmental organisations and individuals can play a very significant and effective role in supplementing the efforts of wildlife personnel.

Recommendation: Education and interpretation programmes should be greatly stepped up in each park and sanctuary which has tourist pressure and/or local human population. It would be important to emphasize not only the intrinsic value of the area and its biodiversity/genetic value, but its relevance to the local population in terms of combating drought, floods, landslides and other natural problems which affect their own survival and well being.

Also recommended is a policy which gives local people the opportunity to earn a livelihood in these education and interpretation programmes, e.g. as trained guides, like the rickshaw pullers at Keoladeo Ghana National Park who have gradually become experts at bird identification.

Reference needs to be made here to the National Wildlife Action Plan of the Government of India [Department of Environment, undated], and to a report of the Indian Board for Wildlife on gaining public support for wildlife conservation: [Indian Board for Wildlife, 1983]. Both these documents give very valuable suggestions for involving the people in wildlife conservation, and what is needed now is to develop and add to these suggestions and to start implementing them.

f) A management plan must also include clear and just procedures for compensating the local community for injury or damage to crops, livestock, and humans. This resentment has been greatly exacerbated when compensation is not paid, as seems to be the policy or practice in the case of many of our parks and sanctuaries.

Recommendation: The policy of compensating the loss suffered by a local person in or around a protected area should be extended to the whole of India and that the range of rates payable be uniformly fixed for the whole country, subject to minor modifications relating to local conditions. Where doubts exist on whether damage or injury has been caused by wild animals, the benefit of doubt should be given to the owner of the livestock affected.

2.2 Research

Most of this planning is possible only if adequate information is available regarding the relevant biological and socio-economic parameters. Given the current paucity of data, we feel that immediate steps should be taken to commission research on various aspects concerning the setting up and management of our protected areas. Biologists and social scientists will need to work together to obtain a holistic picture. NGOs, independent institutions, and individuals should gear themselves up for this work, design multi-disciplinary studies, and approach the government for the requisite funding; conversely, the government must approach and fund organisations and individuals. Some of this is already happening, much more needs to be done.

At least three types of research studies need to be urgently taken up:

i) Studies aimed at developing the geographical and ecological profile of each of the protected areas. This would involve developing a listing of flora and fauna, a recording of other bio-geographical features including climate and water resources, and building up of maps for the area.

ii) Studies recording the incidence, frequency, distribution and cause of various natural and human-caused occurrences in the protected areas. Fires, droughts, epidemics, floods, and pollution are some among the many such issues that need to be looked at in detail.

iii) Studies to determine the impact that various activities and occurrences in the national parks and sanctuaries have on the ecosystem.

b) The existing facilities available for undertaking these studies are quite inadequate. Only 24% of the national parks and 9% of the sanctuaries surveyed by 1984 indicated the availability of research facilities.

Recommendation: Each park and sanctuary should be provided at least the basic equipment to collect regular climatic information. The question of building up further research facilities in some selected parks and sanctuaries must also be urgently examined, and priority must be given to the appointment of research officers to major parks and sanctuaries.

It is further recommended that the Government of India along with the state governments urgently constitute a research advisory committee and earmark funds for sponsoring research into some of the more important parameters relevant to the setting up and management of protected areas.

This committee should be given the task of identifying priority research areas, of locating individuals and institutions interested and able to do the required research, and of periodically reviewing the state of research.

3. Commitment of adequate financial and managerial inputs to make the management plan workable.

Closely related to the shortage of equipment mentioned above, is the lack of management aids like maps. While 88% percent of the national parks and 76% of the sanctuaries surveyed by 1984 reported the availability of maps, it was also seen that in many cases these were merely outline maps filled in with the barest of details. Even Survey of India toposheets were not available in many places. Only 57% of the national parks and 21% of the sanctuaries responding reported the existence of literature on the protected area. The availability of adequate numbers of staff was also a problem, as mentioned above. Much of this stems, of course, from the very low quantum of funds made available for the management of national parks and sanctuaries.

Recommendation: The allocation of funds for wildlife management in a state should be a realistic reflection of the funds required by the state's protected areas to implement their management plans, and to procure the infrastructure and equipment required by them for the purpose. The Government of India should also review the central assistance schemes in order to help achieve this objective.

4. Initiation and completion of the legal procedures required to constitute these areas into national parks and sanctuaries.

a) Given the fact that most of our parks and sanctuaries have not completed their legal procedures, and that rights and leases continue to exist in them, there appears an urgent need to determine the reasons behind the non-completion of the legal procedures, and tackle these causes.

Recommendation: The Government of India should urgently constitute a working group which can quickly and in detail look at the reasons behind the delays in completing the legal procedures for protected areas, and recommend the measures required to solve the problem. Representatives from state governments may be included in this working group.

It is further recommended that the working group not only critically examine the existing laws and procedures pertaining to the notification of parks and sanctuaries, the identification of rights and their settlement, but also, through a sample study, understand the problems in the field. This group should also be asked to evolve methods of fixing responsibility for delays and perhaps of building up a mandatory time schedule for the various prescribed steps and procedures, something that the Wild Life (Protection) Act does not contain.

It is also recommended that this group examine the question of whether some parks and sanctuaries have been set up in such locations that the prevailing human pressures do not allow a proper completion of prescribed procedures, and if so, what remedial measures in terms of pre-conditions for setting up protected areas should be recommended.

b) The Forest Act of 1927 prescribes procedures for setting up a reserve forest which are identical in their relevant portions to those prescribed in the Wild Life (Protection) Act for setting up a national park or sanctuary. This is one reason why Forest Departments do not bother to go through the steps once again under the Wild Life Act, taking the plea that all rights would already have been settled. Though this is legally invalid, it is a justified position.

Recommendation: The Wild Life (Protection) Act should be modified to exempt those areas that were reserve forests prior to their declaration as sanctuaries or parks, and have no rights or leases existing within, from having to go through the procedures relating to the identification and settlement of rights (sections 19 to 26 of the Act; see Annexure 2).

c) As mentioned above, there are considerable delays in issuing the final notification for national parks, as specified in section 35(4) of the Wild Life (Protection) Act, and the subsequent legal embarrassment in controlling ecologically destructive activities in areas for which the intention has been declared to constitute them into national parks.

Recommendation: The Act should be suitably amended to give "intended " national parks the legal protection accorded to sanctuaries till the final notification has been done. (Reportedly, the new amendments to the Act, passed by the Rajya Sabha and awaiting Lok Sabha clearance, include some such provision, but this has to be confirmed.)

d) Section 55 of the Wild Life (Protection) Act states that "No court shall take cognizance of any offence against this Act except on the complaint of the Chief Wild Life Warden or such other officer as the State Government may authorise in this behalf." This denies private citizens *locus standi*. Considering the need to constantly monitor our protected areas and the Government's avowed policy to involve NGOs and NGIs in wildlife conservation,

Recommendation: Section 55 should be deleted and full access be given to each citizen to avail of the Act. (The recently proposed amendments to the Act, reportedly provide *locus standi* to citizens.)

5. Monitoring of the protected areas to help progressively improve their management, and adapt management practices to new or changing requirements.

Protected areas and the management activities therein need to be continuously monitored. It is also apparent that at present, given the inadequacy of staff, facilities, and training, the government departments and agencies concerned with wildlife management are not capable of doing this monitoring entirely by themselves. Only 20% of the national parks, and 11% of the sanctuaries responding reported the existence of monitoring programmes.

Recommendation: Non-governmental individuals and organisations should be formally involved in monitoring programmes. NGOs and NGIs would be especially effective in monitoring programmes which aim at reducing the local conflicts between wildlife preservation and human welfare, where such conflicts exist.

It would of course be necessary for the government structure to be more open than it has some times been in the past, to the involvement of people and organisations outside of it. This would include, for instance, giving easier access to information and documents available with the government.

In this connection it is encouraging to note that the Government of India has recently set up a committee to do some of the monitoring mentioned above (the 'Protected Area Network Monitoring Committee', set up in September, 1988, by the Government of India).

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Appendix 1

A Classification of Human Pressures on National Parks and Sanctuaries, and Ways to Tackle Them

[Source: Kothari et.al. 1989]

The different types of human pressures that our parks and sanctuaries are facing can be ordered in terms of (a) their socio-economic justifiability and (b) the difficulties anticipated in their control.

Type		Activities	Justifiability	Ease of Control
A	1	Environmentally destructive tourism (including inappropriate group treks)	Low	High
	2	Environmentally destructive research (e.g. large-scale collections)	Low	High
B	1	Use by Government agencies for irrigation, hydro-electricity, mining, roads, timber extraction, extraction of other forest produce, habitation, etc.	Medium	High
	2	The above activities by licensed contractors	Low	Medium
C	1	Illegal grazing, poaching, felling, collection of other forest produce, etc. by local individuals	Medium	Medium
	2	Similar activities by outsiders	Low	Medium
D	1	Traditional habitation, cultivation, grazing, cutting and collection of timber and other forest produce, religious rituals, fishing, trapping, etc. by local communities, whether legal or illegal	High	Low

Recommendation: The above pressures could be dealt with in the following ways:

i) For category A it is necessary strengthen the management of the parks and sanctuaries and either to ban these activities or closely monitor them to see that the negative impacts are kept to the minimum.

It must be stressed that controlled and appropriate research, and tourism, can in fact contribute significantly to conservation efforts. What is urgently needed is a study of the carrying capacity of each protected area. Based on this, park managers should determine what sort of research activities would be permitted, and evolve detailed tourism plans which specify the quantum, type, and distribution of tourism which can safely be allowed. This would include the creation of special tourist zones, the delineation of areas where tourism would be completely prohibited, and the type of facilities needed for tourists which would also be in consonance with wildlife protection values.

ii) For category B it is necessary to evaluate the ecological impact of these various activities and to ensure that, as far as possible, such activities are phased out from parks and sanctuaries and alternate sites are found. In those rare cases where it is imperative to allow such activities, the greatest care would have to be taken to minimise their ecological impact.

It is further recommended that the Government of India urgently constitute, in consultation with the state governments, a high level committee to closely examine the existing activities in parks and sanctuaries by government agencies and their licensees, and to rationalise them.

The Chief Secretaries of states should be special invitees to the meetings relevant to their respective states. This committee should also prescribe detailed procedures for screening proposed activities in protected areas. State wildlife wings are often overruled by the state government in their objections to ecologically disturbing activities within protected areas. Whatever administrative and legal safeguards are designed should take this into consideration. The possibility of covering ecologically disturbing activities in protected areas under the Forest Conservation Act of 1980 should also be seriously examined.

iii) For categories C and D it seems necessary to evaluate properly the reasons why the concerned persons are indulging in these activities. Where there are no justifiable reasons, like often in the case of outsiders who come in for illegal hunting, it is necessary to strengthen the implementation of the relevant laws. However in those other cases where the circumstances are justifiable, as in the case of fuelwood collection for domestic use by local villagers, there is a necessity of finding alternatives. This can be best done by properly planning out the utilisation of the natural resources in the region, as has been suggested above. The idea of demarcating buffer zones and developing them for use by local communities has still to be fully explored in India; it needs to be urgently worked on.

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Biotechnology and Biodiversity

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Background paper for a workshop on "Linkages Between Wastelands and Biodiversity" March 15-20 1991 at the Centre for Ecological Sciences Indian Institute of Science, Bangalore, India

1. Introduction

For millions of years humans depended on biological materials- plants, animals and microorganisms- for their food, medicines and industrial products Over the years- particularly during the last few decades- this important capital stock on which human life depends, has been subjected to irreplaceable loss Ironically these losses occurred, unnoticed and unappreciated, by the very development and progress that human societies achieved Biological material reproduces, unlike other resources, but what cannot be easily reproduced is the variety, of life forms originated and sustained by a process of natural and social selection- and their inter-relationships.

Scientific and technological advances have provided us an understanding of both these phenomena- the utility and destruciton of biodiversity In this paper I will outline the implications of one of the latest technologies- biotechnology- on biodiversity Due to my limited understanding in a very small area of this discourse, I wish to limit my exposition mostly to plant biotechnology and its impact on plant biodiveristy- also called germplasm Biodiversity refers to inter-relatedness of genes, species and ecosystems Although maintanence of individual species identified as endangered would amount to conservation, it would, by itself, be not sufficient to maintain the inter-relatedness of esecosystems- physical and biological- which exists in a dynamic, and evolutionary state A recent report by the Office of Technology Assessment (OTA, 1987) identified biodiversity, for analytical purposes, at 3 levels, namely (1) ecosystem diversity, (2) species diversity and (3) genetic diversity My paper would focus mostly on species and genetic diversity and only marginally on ecosystem diversity, because biotechnology's role on biodiversity is made evident mostly at these two levels.

2. Issues in Biodiversity

There are broadly two issues relating to biodiversity (1) Conservation and (2) Control, which have a bearing on biotechnology's role Conservation refers to efforts to maintain or enhance biodiversity- particularly the plant species and control refers to access to this diversity- maintained either *in situ* or *ex-situ* for various research and development programs, including plant breeding

In situ conservation referes to preservation of the genetic resources within the evolutionary dynamic ecosystems of their original or natural environment. The *ex-situ* conservation entails removal of germplan resources (seed, pollen, sperm, individuval organisms) from their original habitats and preserving them in botanical gardens (Zoos or aquaria) gene/seed bank etc (Reid & Miller, 1989) The application of biotechnology is useful in *ex-situ* conservation although this method entails the following disadvantages

- long-term integrity of germplasm remain in question A recent report of the Associated Press (A P) which conducted a study of U S National Seed Storage Laboratory at Fort Collins, Colorado (USA) has found that of the 232,210 seed samples tested only 28% were found healthy,- leading some critics to label this laboratory as a 'gene morgue' rather than a "gene-bank" (Anonymous 1989)
- high rates of mutation among the *ex-situ* stored plants
- evolution of species would be frozen, since no further adaptation to environmental or biotic stresses at take place *ex-situ*

- the *in-situ* conservation of biodiversity also enables to preserve the knowledge of farming systems- in short the biological and social knowledge. The *ex-situ* conservation, on the other hand, divorces the biological from its social context (Reid and Miller 1989)

Human intervention through centuries for food, fibre and medicines has altered the dynamic relations among the various ecosystems. However, the most profound and irreplaceable changes that occurred is the acceleration of rates of exintion of species, caused by human colonisation, extension and intensification of agriculture, and industrialisation. Apart from some "critical ecosystems" (where certain species may be endemic, with smaller populations, with poor dispersal and colonisation ability etc.) the rates of extinction is believed to be high for the entire world during the current century. Tropical deforestation at the current rate, may eliminate between 1990 and 2020 somewhere between 5 to 15 percent of the world's species. Given the current estimate of about 10 million species in the world, these rates would translate to loss of 15,000 to 50,000 species per year or 50 to 150 species per day (Reid and Miller 1989). Since the prospects of species extinction is forever-with or without human intervention-the best preparation for future uncertainties is to conserve as many gene pools, species and ecosystems as possible, whether they have actual or potential utility to humankind (Prescott-Allen and Prescott-Allen, 1986). The erosion in biodiversity is caused by a multiplicity of factors, such as:

- losses, fragmentation and degradation of habitats
- introduction of alien species into an ecological niche,
- overharvesting of species-such as trees for timber-beyond the levels of natural regeneration
- pollution, in various media which sustain the biological nutrient cycles in ecosystems. Included in the category is the effects of global warming, of which not much is known. There is an anticipation, however, that global warming may cause shifts in agricultural crops, across the biogeographic regions, necessiating the maintanance of biodiversity, *in-situ* as well as *ex-situ*

Technological advances in agriculture, particularly the green-revolution, has further eroded the plant genetic diversity. As the high-response (yielding) varieties spread spatially, many biogeographic regions were depleted of the varieties in land-races and cultivars. The first inter-national Survey of Plant Genetic Resources (1964-72) under the auspices of the FAO, reported that till 1970, about 5000 varieties of rice were being cultivated in India, of which 700 were cultivars or selected mostly from local stocks (Frankel and Hawkes 1974) but currently about 500 varieties are grown of which 10-20 may be covering a large part of the country (Jain and Banerjee 1982). Apart from the narrowing of genetic diversity, through extensive monocropping, green revolution contributed indirectly to loss of biodiversity through its soil mining. Through heavy use of fertilizers, chemical inputs and irrigation, agricultural crops relying on green revolution technology have rendered the soil sub-fertile and in some cases, inhospitable to other species.

Biotechnology- the recent high technology- promises the potentials to enhance biodiversity as well as prospects to further endanger the biodiversity. There are two aspects of biotechnology which need to distinguished analytically-technique and institutional aspects. Biotechnology, particularly plant biotechnology, is yet to achieve substantial success as a technology. The science on which this technology is based is poorly understood, particularly certain aspects like metabolic processes that mediate between the genotype and its phenotpic expression (Riley 1985 and Krikorian 1988). Biotechnology is a double-edged sword, it can be used or abused for

conservation of biodiversity The precise direction of the utility of biotechnology lies in the social control of its location - the institutional aspects In the following section a brief outline is presented of the various 'techniques' in plant biotechnology, which have a bearing on biodiversity While biotechnological applications to conservation is recognised (Peacock 1989, Plucknett et al 1987), the historical and instiutional aspects of biotechnology limit the scope for conservation-in what is referred to above as 'control' The issues relating to control on genetic diversity, owing much to biotechnology's historical and institutional embedding are discussed in the section 4 The last section concludes with summing up of this paper

3. Biotechnology- techniques:

Biotechnology is a Janus-faced technology- standing, as it were, between the "old technologies" like fermentation plant-breeding, etc, and the "new technologies" of genetic engineering, tissue culture etc Biotechnology is defined broadly as "the application of scientific and engineering principles in processing of materials by biological agents to provide goods and services (Bull et al 1982 see also Richardson (1988) on defining biotechnology).

The importance of germplasm to biotechbology is its utility, such as

- improvement of crops either through traditional breeding or through the use of tissue culture
- raw materials in genetic engineering for agricultral or industrial purposes and commodities (such as seeds, gentic sequences etc) to be traded under various restrictive conditions such as patents or plant varietal protection etc.

3.1 Tissue-culture

The ability to induce morphogenesis and regenenate whole plants by culturing a few cells or tissues is called tissue culture This technique can be applied to mass produce carbon-copies of a selected (elite) plant whose agronomic characterstics are known The advantages of tissue-culture are

- rapid rates of multiplication under controlled enviornmental conditions
- assured health status of plantlets
- screening against biophysical stresses among the plantlets
- early maturation, e g in forest tree spp.
- production of artificial seeds
- achievement of stable mutations either in somatic tissues (somaclonal variation) or in gametes (gametoclonal variation)
- culturing and fusion of inter-or intra-specific protoplasts
- transformation of nuclear and cytoplasmic structures of plant cells through insertions of foreign DNA etc. (r-DNA technology)
- production and transformation of useful natural compounds in fermenters (biosyntheses/ biotransformations)

Techniques such as micropropagation can used effectively to rapidly multiply and store *ex-situ* of species which are endangered- particularly those which fall below "minimum viable populations" (although this condition is rare among plants) Somaclonal and gametoclonal variations can be used to achieve diversity among the species, particularly in shorter periods than through conventional breedings (Evans 1985 Snowcroft et al 1985) Recent advances in tissue culture technologies have brought down the cost of plantlets such as through automated equipment (Levin et al 1988). Tissue culture is useful in inducing early maturation of some of the most slow-growing spp or in achieving flowering such as bamboo, whose growth rate is slow (Nadgauda et al 1990). A useful review of tissue-culture of forest and plantation species is provided by Mascarenhas and Muralidharan (1989), and Mascarenhas et al (1988).

3.2 Germplasm storage and transport

Biotechnology's application lay directly in the storage of germplasm, *ex-situ* either as seeds or in some other vegetative/genetic materials, in gene-banks A good account of the role played by gene-banks is given by Plucknett et al (1987). Plant tissue culture technology has been used to preserve or transport genetic material, to be used for plant breeding and improvement programs.

At present there are two methods to preserve plant materials (seed,meristems or isolated cells) namely (1) slow growth and (2) preservation in liquid nitrogen (cryopreservation) In the slow growth method, the plant tissues are stored at temperatures ranging from 4 degree celcius (for pears) to 15 degree celcius (bananas, potatoes etc) Addition of mannitol at concentration of 0 2 mol facilitate the process This method is suitable for shoot-tip cultures/plantlets and that too only for a few days.

In cryopreservation the plant material is stored at -196 degree celcius using liquid nitrogen for infinite periods There are two routes to achieve the lowering of the temperature, (1) in slow freezing, cells are first cooled at a controlled rate of -30 degree celcius and then stored in liquid nitrogen, and (2) in rapid freezing, cells are immersed directly into liquid nitrogen, after adding dimethyl siulfoxide (DMSO)or glyserol as cryoprotectant to prevent frezeeing and thawing injuries to cells. The survival rates of cryoprotected cells lie around 50 percent, and that of meristems from zero to hundred percent (Ahuja 1986)

The germplasm that is stored *in vitro* should be periodically monitored and evaluated to ascertain the genetic stability. There are a number of techniques to monitor the genetic stability-morphohogical assessment, cytology, isozyme analyses, use of DNA probes, restricted fragment length polymorphism (RFLP) and gas chromatography (Withers 1989)

4. The Control of germplasm, and the new biotechologies

There is an historical assymmetry in the distribution of plant species,-the locus of diversity. What are now called variously as industrialized, developed North countries are historically 'gene-poor" while the developing, South countries are "gene-rich". In historically-past centuries, much of the plant diversity was concentrated between the two tropics with very few plant species in the Continental Europe or in the New World.

Juma (1989), Kloppenburg and Kleinman (1987) have documented the historical development in which the colonial powers, and later the American government have exercised their efforts to systematic securing (plundering?) of plant material from countries, now known together as developing countries The best known such introductions of plant species to new enviornments was the so-called Columbian Exchanges in 1493, when Columbus introduced wheat, chickpeas,

onions, radishes, sugarcane and citrus fruits to America Since that time the mercantile capitalism played an important role in the exchange of food-crops and industrial crops. Increased utility of plant products-for food, industrial and medical purposes- had lead to increasing control of germplasm by the colonial powers- the beginnings of hegemony which was to re-assert decades later enshrined within legal sanctions (such as plant breeders rights and patents). The Dutch, for example, destroyed the nutmeg and clove plantations in the Moluccas near Indonesia, leaving untouched those areas in which they could assert their power.

Over the years, the present day developed countries have benefitted not only in acclimatising these plant species for their food fibre and medicinal needs but also improved the productivity of these through periodic infusions of genes from regions of genetic diversity One estimate of the inter-dependence among regions of genetic diversity and regions of crop productivity, assessed that the contribution of present day developing countries (through plant exchanges) amount to 96 percent of world s tonnage in food crops (Kloppenburg and Kleinman 1987)

Ironically, the regions once identified as centres of genetic diversity (or Vavilov centres) have suffered from the loss of these very genetic diversity, when high response (yielding) crop varieties, through technology transfer from developed countries, were grown extensively in these countries. The narrowing of genetic diversity, and its flip-side,, the extensive monocropping led to vulnerability to diseases and pests. Losses worth 2 million tonnes of harvest occurred in 1977 in Indonesia when brown planthopper infested on rice Natural predators of planthoppers such as wolf-spiders were eliminated from the ecosystem by use of pesticides on rice (Conway and McCauley 1983)

The need for continuous improvements in cultivars through selective breeding led to search for useful genes, often located in wild relatives Along with the establishment of such *in situ* collections , such as botanical gardens, seed banks (also known as Gene Banks) came to be established Starting with the pioneering attempt by Nikolai Vavilov, who set up a germplasm collection in the USSR in 1920s the modern day gene banks were established soon in USA in 1940s There is an assymetry in the distribution of gene banks.Of the total collections accessed into the gene banks nearly 41 percent are held in gene banks located in North America and West European countries, USSR and East European countries hold about 14 perecent, China 3 percent, the various IARCs (located in developing countries) 14 percent and other developing countries together hold 28 percent. While much of the developing world s genetic diversity has been lost under the jaggernaut of green-revolution, the developed coutries and their allies, Trans National Corporations(TNCs) have mustered enormous stocks of this invaluable genetic stocks. The first ever survey of plant genetic resource was initiated by FAO under the International Biological Program during 1964-1972. As a consequence of this survey, the International Board for Plant Genetic Resources (IBPGR) was established in 1974 with the mandate to systematically collect, preserve and exchange the plant germplasm. The IBPGR has its secretariat at FAO and has a network of 38 institutions located in 28 countries. All these institutions have gene banks, they conserve triplicate collections of germplasm. The IBPGR functions under the aegis of Consutative Group on International Agriculture Research (CGIAR)- one of the 13 units under CGIAR- which in turn is co-sponsored by World Bank, FAO, Rockefeller and Ford Foundations. A CGIAR report in 1977 notes that great research strength lies in the field of genetic improvement facilitated through IBPGR which collects, stores, evaluates and utilises the germplasm collected all over the world (CGIAR 1977). Through the past centuries scientists and plant breeders in the developed countries have used the germplasm collected from the developing countires- often freely and sometimes through the use of force- for improvement of the crops. Such unrecompensed extraction was legitimised through the ideology of defining plant germplasm as the 'common heritage of humanity, or as a "public good" which needs no payment. At a time when

the developing countries needed capabilities and resources (located in gene banks) to improve their crops, these countries faced the demands to 'pay' for the germplasm, or improved varieties.

In the FAO's 22nd biennial conference in November 1982, an international agreement was sought (1) to set up an international gene bank under the control of FAO and (2) to adopt a draft international convention on the sharing of plant resources. This resolution was met with a stiff opposition from the developed countries. At the heart of the conflict was the definition of plant germplasm that was employed in this resolution (No 8/83 of FAO) which reaffirmed that all plant resources are the heritage of mankind and consequently should be available without restriction. Plant breeders, TNCs and the governments who have enacted various forms of plant varietal protection acts have opposed this definition- which included special genetic stocks (which enjoy the rights of protection). The developing countries insisted that if their wild varieties are defined as common heritage of mankind so should be the special genetic stocks. Some developing countries, such as Ethiopia (Coffee germplasm) have banned any export of plant material from their borders, what is termed as "genetic OPEC". Thus, the advent of "Seed-wars" was begun (Paul 1984, Fowler and Mooney 1990).

The genesis of these struggles lay in structural changes that occurred with the development of biotechnology. Broadly two features of these structural changes can be discerned- although these are analytically treated separately, they are interwoven in complex relations. They are

- Reductionist orientation in research and development
- Privatisation of technology

4.1 Reductionism:

Modern or 'new biotechnology' owes its genesis to the program of conceptualisation and institutionalisation of molecular biology through the efforts of Rockefeller Foundation and other's support (Fuerst 1982, Abir-Am 1982). The general thrust of molecular biology in its research program was a form of reductionism- understood as a belief in explanation of biological phenomena wholly in physical and chemical terms. Often this reductionism also implies abstaining from seeking to define the concept of life. The consequences of such a reductionist program is articulated in (1) the pre-occupation of the components rather than with the understanding of the whole system or processes, for example, 'genetic engineering' of useful genes, but not their expression/stability, nor its interrelationship with other genes and its environment. (2) lack of understanding of wider impacts of these technologies on society, for example, efforts to gain productivity at the risk of environmental and social costs. Regine Kollek argues, for example, that the reductionstic understanding of biological phenomena and empirical findings lay behind the origins of environmental risks associated by the release of genetic engineered organisms (Kollek 1990). (4) acquisition of technology rents- through patents and varietal property rights in plant breeding- signifying commodification of life forms (Yoxen 1985) and (5) transformation of life into a new form of productive force- not as labor, but as raw material (eg. microorganism in a fermenter) signifying a manipulative attitude to life.

4.2 Privatization of technology:

The innovations in agriculture, during much of the modern plant breeding programs have arisen from public research institutions- be they the agricultural universities, experimental farms or IARCs. Such innovations, carried in the realm of public institutions were theorised variously as 'induced' (Binswanger and Ruttan 1978) or "directed" (Burmeister 1987). On the contrary the

innovations in biotechnology, are usually termed as Schumpeterian innovations (Kenney 1986) In the Schumpeterian scheme the entrepreneurial activities play a key role in the technological innovations Kenney s account of biotechnological innovations- as they occurred in the U S and Western Europe- captures the alliance built by 4 distinct categories of corporate actors, namely (1) enterpreneur (2) scientist (3) manager and (4) capitalist which is some cases can be clubbed to yield 3 categories (1) scientist entrepreneur (2) manager and the (3) capitalist This alliance is reflected in the macroeconomic space as, University- New Biotechnological Firms (NBFs)- Government and/or Transnational Corporations (TNCs)

Although these historical developments in biotechnology represent more the american situation, than the rest of the world, they do have a bearing on the developments and implications of biotechnology For instance, lack of venture capitalists in both West European countries and developing countries have led to strong interventions by the state (Sharp 1987) In the case of Japan, a concerted efforts of both private interests as well as the state intervention have made that country strong in biotechnology capabilities (Fransman 1990) Indian biotechnology benefited by a strong stae intervention- starting with a creation of a government department (DBT), increased fundng to public research institutes and to a limited extent to private firms(Govt of India(DBT) 1989 Mehrotra and Tandon 1989) However it remains that much of the state-aided biotechnology in India, has an american model for its development, eg venture capital, private innovations, technology transfer from west etc

In another sense the american model of historical development of biotechnology has had its influence on biotechnology else where That is through the influence of a very large number of american-based TNCs which trade with and use extensive resources from other countries

Privatisation refers to a variety of processess which result in a resource, a product or a technology being moved from out of the public domain and into the control (and often the ownership) of private hands, be they individuvals or corporate entities (Dembo et al 1984) Privatisation results in either total inaccessibility or accessibility under restricted conditions which are complex and costly Privatisation is enforced through a variety of means such as (1) technical incorporation of a trait in the product which makes the users dependent on suppliers- such as hybridisation (Buttel and Belsky 1987) (2) legal enforcement by obtaining patents and other proprietary rights and (3) through use of lobbying to stifle public and/or national R&D capabilities or use the funds and other incentives to redirect the flow of results away from public domain (Read 1989, Knudsen 1990, and Kloppenburg 1988)

In the following paragraphs brief outlines of the various 'means' to privatisation in biotechnology are presented, particularly their effects on biodiversity, namely, (1) privatisation of research capabilities (2) hybridisation and packaging of products and (3) intellectual properties

4.2.1 Privatisation of research capabilities

Traditionally agricultural research was sensitive to signals generated by articulate, organised segments of the society- such as plant breeders associations One evidence of this association is that much of the agricultural research concentrated on cash-crops, such as cotton- the technical bias' in agricultural research (de Janvry an Dethier 1985) The gradual ascendency of the private interests on public research in the U S is documented by Buttel and Belsky (1987) and Kloppenbrug (1988) They portray the way American Seed Trade Association (ASTA) began influencing the public research institutes to gain profits First success was achieved in 1924 when ASTA pursuaded the U S Congress to end free Federal distribution of seeds This was followed by establishing a "Committee on Experimental Stations" by ASTA to monitor the Land-Grant

Universities (LGU) activities and foster a favourable division of labor with private sector. This was followed by successful commercialisation of hybrid corn starting in 1926 (although ironically, the hybrid corn was the result of LGU research endeavours) ASTA's efforts made the public breeders to withdraw release of hybrid corn completely by 1950- a process which was followed for other crops since then.

Soon a horizontal social division of labor was demarcated, where public research was expected to cater to basic/technical research needs of private sector. This division of labor- basic research in public and applied research in private sector was viewed either as one of symbiosis (Knudsen 1990) or as parasitic Knudsen (1990) using the case study of the developments in the innovation/commercialisation of semi-dwarf and hybrid varieties in wheat, in the U.S., argues for a complementary role of public sector R&D, to private sector R&D When market forces do not supply the right signals to innovations, public sector R&D is expected to play a major role in the applied R&D. Henry Etzkowitz, (1983) remarks that the business community has cane to regard universities not merely as source of training and expert advice but as "factors of production" Pollock (1982) writes that 'research to produce biotechnological products no matter how advanced they are, is not basic research. The decision to shift resoruces and faculty towards industry linked research is *ipso facto* decision to deemphasise basic research and directed to "to-make" not "to-learn". Variants to such clear cut division of labor are (1) investing of intellectual rights by the public universities (pioneered by Stanford Universtiy and University of California for the first gene splicing method developed by Herbert Boyer and Stanley Cohen) (2) governments' efforts to establish public research institutes with the sole aim of doing 'patentable" commercial biotechnological research eg., U.K.'s Celltech, (3) disinvesting of public research institutes to privatise them, eg Plant Breeding Institute, at Cambridge, U K,. (Webster 1989)', and (4) engaging of scientists, technologists located in public research institutes through consultanicies, sponsored research projects etc, to work on products and processess of interest to transnational corporations

The most immediate consequence of privatisation of research capabilities is the weaning away of biologists from working on larger systemic connections The hype of biotecchnology may lure away the individuval scientists, as well as public research institutes from reseaching in areas like biodiversity, ecological implications of new technologies etc, According to one estimate, the number of systematists to document the entire biodiversity in tropics, would need be to increased to five-fold from the then current 15000 trained professionals in 1980 (National Academy of Sciences, 1980) Profit/exploitative motives may replace the preservation/conservation motives in biological research

4.2.2 Hybridisation and packaging

The profit-earning/exploitative motive of the private corporate interests results in, among other things, technological incorporation of dependence One such incorporation is the'hybrid-vigor' in plant varieties. This technical means of privatising the technology is sought to overcome the tendency of the farmers to save their own seed for sowing in the next crop season. The hybrid vigor is usually lost, when such varieties are planted, in the next generations, yielding 15-40 percent lower than the parental yields Thus the farmers are forced to seek the seeds again in the market

Yet another form through which dependence is incorporated through technical means is "packaging of products". One such expression is the development of "herbicide-resistant" varieties of tomatoes by Monsanto in the U S Such packaging' increases dependence of the farmers to use the specific proprietary-brand of herbicide produced and marketed by the same

company that sells the seeds. One of the commercial firms in the U.S. 'Consulting Resources" predict that among the genetically engineered plants, herbicide-resistant varieties would be the first to spread in the U.S. market, by mid 1990s, with a total value of US $75 million.

Hybridisation and selective packaging of products would have a two-fold effect on biodiversity. Due to their high response (yield) characterstics, hybrids tend to displace the variety in cropping- leading to narrowing or erosion of genetic diversity. And when such high response (yielding?) varieties are packaged along with such chemicals like herbicides and pesticides, the extensive use of such chemicals, although unharmful to genetic-engineered plants, may have deleterious effects on other biota - endangering the biodiversity.

4.2.3. Intellectual Property Rights

The use of legal means to enforce privatisation of technology- such as patents and plant breeders' rights- have their origin in the very system of American R&D to tranform agriculture into a "business and science". This leitmotif in agriculture was articulated in the establishment of such institutions as American Seed Trade Association (ASTA) and its co-existence with public funded Land-Grant Universities (LGUs) system which served both the farmers and the business establishments, such as ASTA. This co-existence soon turned into a tenable situation to ASTA when proprietary rights were granted to plant varieties- Plant Patent Act of 1930.

Similar moves in the European countries have resulted in the Paris Convention of 1961 in which the International Convention for the Protection of New Varieties of Plants (UPOV) was conferred. At that time the existing patent system in the field of chemicals and pharmaceuticals was considered inappropriate to extend such rights to new varieties developed in plants. The criteria for establishing new varieties were distinctiveness, uniformity and stability (known as DUS criteria) and considering the unique nature of life-forms, the final arbiter in the legal conflicts were, for the UPOV, the plant material itself, because the written specification, as it exists for patents, were deemed practically impossible for reproducible processes associated in breeding a new variety. However, this condition gave an advantage to plant breeders- they needed only the developed 'hybrids" to be deposited rather than the parental lines through which such hybrids were achieved and parental lines were kept secret. The UPOV rights were subscribed by 20 European and North European countries, but not by developing countries (except Mexico).

The benefits accruing by UPOV rights were limited to (1) production for sale and (2) sale of reproductive material with the intention that it be used as such, eg. seed for sowing. UPOV does not cover the right to save the seed by the farmer from current crop for sowing it a later season. The farmer can also use the protected variety for producing and selling the products. The UPOV does not prevent use of the protected variety in order to create yet another variety- unless the commercial production of latter variety requires the repeated use of the first protected variety (Crespi 1982,1985).

The developments in new biotechnolgy have led the plant breeders and biotechnologists to feel uneasy with the rights covered by UPOV. The Strasbourg convention of 1963 and the European Patent Convention of 1973 have clearly distinguished biological process involved in higher plants and animals, from those that are involved in the microorganisms. For microorganisms, these Conventions ratified patent law as proprietary rights, while limiting UPOV to higher plants. UPOV Convention also stressed that in countries where both patents and plant varietal rights exists, the benefit of both should not be conferred to the same speices or genus, thus drawing the lines between these two types of intellectual property rights.

The U S. Supreme Court s land mark judgement in the case of Diamond Vs Chakravarthy in 1980 allowed human-made genetically engineered bacteria a patentable material. This land-mark judegement opened the flood-gates to similar requests for patenting life products and processes- not just to micro-organism but also to higher forms of plants and animals. Thus the lines of demarcation between the UPOV-type of rights and patent rights got blurred. In the U.S now the plant breeders and biotechnologists can obtain either intellectual protection rights a under Plant Variety Protection Act (PVPA) or under Patent Act for their innovations.

Indian Patent Law of 1970 does not recognise biological processes and products as patentable. But of late there has been efforts to pursuade India, along with other deveoping countries to change their patent laws in accordance with UPOV and/or the American Patent Law. The ambit of General Agreement of Trade and Tariffs (GATT) was enlarged to include Trade Related Intellectual Property Rights (TRIPS) with a pursuasion that the developing countries change their patent laws, suitable for investment and trade by and to the Transnational Corporation (TNCs). There is still no consensus reached on the TRIPs and therefore India still does not recognise UPOV nor the patenting of life forms.

The consequences of existence and strengthening of intellectual property rights in biological forms and/or processes on biodiversity is one of the issues for debate in a recent Keystone Dialogue at Madras (Jan 29 - Feb 02, 1990). The general consensus of the participants of this Dialogue - who represented academic institutions, governmental agencies and transnational corporations- is that intellectual property rights (IPR) decrease the genetic diversity (The Keystone Center 1990). This erosion in biodiversity is acceleraed by enforcing intellectual property rights through (1) the imposition of the ideology of common heritage to land races and cultivars in developing countries, therefore traded freely, while the vareities protected by various IPR regimes as 'priced'- leading to exploitation of biodiversity endemic to developing countries (2) conservation of only tradable genetic stocks ex-situ (particularly in gene banks) with the neglect of regional varieties, or those that are deemed worth-less (3) concentration of tehnology where large firms, often TNCs take-over the small firms (NBFs particularly) or develop com-plementary and external linkages (Arora and Gambardella 1990 Granstrand and Sjolander 1990). Such acquisitions by large TNCs of smaller firms may result in having the technology concentrated in one or few firms only, as in the case of oil-palm tissue culture, monopolised by Unilever (Mooney, 1984)

5 . Conclusion

This paper has attempted to link the potentials of plant biotechnology with biodiversity. Erosion of biodiversity was aided and abetted by the very developments and progress in science and technology- the latest being green-revolution. The advent of biotechnology has raised both promises (Brand and Bodewitz 1989) as well as fears (Mooney, 1983, Hobbelink 1987) on its effects on biodiversity. The argument advanced in this paper is that while the techniques of biotechnology has the potential for enhancing and/or preservation of biodiversity, the institutional context in which this technology gets embedded, would determine its potentials. Just as Rapetto's (1988) study has brought out the relevance of macro economic policies on deforestation, the policies of favouring afforestation notwithstanding- this paper too argues that the specific strategies and policies which guide biotechnology in India would determine what and how much impacts this technology would have on biodiversity. Two broad issues were identified and discussed- the reductionism, along with its implications on risk, and privatisation of technology. As yet Indian governmental policies do not seem to have articulated effectively on these issues. Nor have the public been sensitised to these issues, and on their effects on biodiversity, perhaps one of the richest resources we have.

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Common Property Resources in Relationship to Bio-diversity, Politics and Poverty

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The focus on redistributing lands, has tended to overlook that resources, which are in the custody of the State and local bodies such as the Panchayats have not been protected and harnessed for the benefit of the poor. A combination of adhoc policies of accommodating with pressures from the privileged people to gain access to these resources on the one hand and a mentality of alienating people from these resources on the other has resulted in a situation were the common property resources have suffered both decline in area and productivity.

This paper tries to argue that an approach to these resources needs to combine within it elements that are simultaneously less populist (politically expedient) and yet more responsive to the needs of the people. The sanctity of common property resources whether vested in the panchayats or owned by the State should be safeguarded; encroachments should be stopped and where necessary vacated. Simultaneously local communities should be given rights over the products of CPRs and their cooperation enlisted in the regeneration and maintenance of these resources.

The ideas generated in this paper are derived from the situation observed in the Southern Aravallis. The crisis of CPRs is ofcourse wider, but the points raised in this papers flow from experience gained while working with an NGO doing rural development in this region. Common property resources in this paper refer to all natural resources that are not privately owned. In particular this refers to lands that are vested with the Panchayats, the forest department and the revenue department.

The hilly tracts of the Southern Aravalli are the habitat of predominantly poor tribal peasants. Historically the local people eked out a living based on subsistence agriculture and products derived from the forests. The population density was low and there appears to have been a stable, albeit low level equilibrium, between the carrying capacity of the local natural resource and what was taken out from the resource base by the people inhabiting the area. Compared to the situation as it exists today, the non-degraded state of the environment provided the underpinnings of a relatively more healthy soil and moisture regime for the region. Moisture retention and productivity of the soil was such that farmers were able to get atleast two crops annually under rainfed conditions; mill yields were higher because fodder availability was better and nutritional levels of the people were significantly supplemented by a host of products found in the forests. All this is not to imply that under the earlier fuedal system deprivation in political and economic terms was absent. One cannot overlook that social services in the field of modern health and education were virtually non-existent.

The production relations underlying this natural economy could be defined by two co-existing but inter-penetrating systems. The fuedal state and it associated satellite authority structures formally controlled most of the natural resource endowment of the region. They levied taxes on the local people and appropriated what little surplus was generated by the local peasantry. But due to historical reasons and the difficult access to these hilly and forested areas, the actual extent of the control and authority exercised by the fuedal state was in practice severely constrained. As a result, the local communities enjoyed considerable autonomy and had their own system of managing their property resources.

Despite the propensity for the fuedal state to extract the maximum surplus from the peasantry they nonetheless had a stake in maintaining and protecting the natural resources from getting destroyed or excessively used. One reason for this was that the fuedal economy, right uptill the 1930's was not fully incorporated into larger economic grid of the colonial state; forest resources had not got commercialised in these parts in the same way as in the lower Himmalayas and other rich forest areas where timber was extracted at a rapid rate. Another apparent reason for the commitment of the fuedal state to the protection of these resources was their psycological and cultural identification with forests and wild life as a source and symbol of their status as rulers and as a martial race.

From the side of the people, who because their livelihoods were so critically dependent on the natural resource base, appear to have had an appreciation for the need to maintain these resources in a state of good health. The combined result on the one hand of the Fuedal State having an interest in the protection of the environment and on the other the organic relationship of the local communities to the land, water and forest resources of the region, meant that a certain stable equilibrium existed between the carrying capacity of the resource base and what was extracted to satisfy the needs of the people and the State.

After Independence, the equilibrium got disturbed. The integration of the local economy with the larger economy of the country resulted in rapid exploitation of forest by contractors and the state government. The increase in demographic pressures also resulted in more demands being made on the resource base. Apart from biomass needs, the demographic factor inclined people to clear forests to start

new settlements and bring new lands under cultivation. The absence of the provisions for alternative means of securing their livelihood made this a compelling necessity. In consequence the nature of resource base began to change. Forests were cut for a variety of reasons and simultaneously other resources began to get privatised. There were steady encroachments made on the Panchayat Forest Department and revenue lands.

With growing extraction of forest resources by the larger economic system and the growing bio-mass needs of the people, resulted in eroding the carrying capacity of the resource base and degradation in the quality of land. It resulted in depressing the productivity levels of these lands below their potential. With encroachments, the size of the common property resource was steadily reduced.

The trend towards adhoc and indiscriminate privatisation of CPRs, alienation of access to the resources by the forest department and the general productivity decline of has had significant adverse implications for the poor. It is a documented fact that the poor households in the rural economy are significantly benefited from common property resources. The overall environmental degradation compounded the loss of productivity of the resource base as a whole. Reduced recharging of water tables as a result of poor vegetative cover, siltation of existing water bodies and general scarcity of biomass resulted in squeezing the margins of subsistence of the poor.

To get over the impasse is a challenge to Panchayats and voluntary organisations working at the grassroots. It is crucial to eschew populist options while attempting to rebuild a sound management structure for the development of common property resources. People and institutions working with the people need to create awareness in favour of opposing

encroachments and the privatisation of common property resources. In the absence of this consciousness and practice mere advocacy of rights to CPRs will only result in the further privatisation of these resources. For people to resist the temptations of encroachments is not easy given their situation. Programs need to be created which will provide employment and income generating opportunities so that the necessity to resort to harmful sub-optimal practices is minimised. Just a one dimensional programme aimed at regenerating wastelands and protecting the status of CPRs, it is not likely to be effective because it will not win the confidence of the people. A multiplicity of interventions that have synergy must be made so that people can see the wisdom of allowing their collective resource base be restored and operated up to its carrying capacity.

The challenge is manifold. The state authorities have to be firm in protecting the status of CPRs, but responsive to the concept of allowing people to share in the benefits that accrue to CPRs. It has to substitute populism (accommodating to privatization) with responsive responsibility. It also has to explore possibilities of creating income and employment - generating opportunities that will dissuade the people, specially the poor to undertake activities that are destructive of the productive capacity of the resource base.

On the side of the people, and institutions that are working to articulate their enlightened self-interest, the challenge would be to get people to internalise the discipline necessary to allow common property resources to remain undespoiled. Social fencing, eschewing over-grazing, equity basis in the utilization of scarce resource such as water, are some of the things that need to be institutionalized at the grassroot level.

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15.

INTE[illegible]ING BIODIVERSITY MOVEMENT IN MOUNTAIN RUR[illegible]EVELOPMENT - PROBLEMS AND PROSPECTS

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ABSTRACT

The concern of biodiversity conservation is most recent for the Indian sub-continent and is usually expressed in "motherhood" statements of national policy but details of how this concern will be addressed at grassroot level need to be worked out. This communication attempts to integrate the movement of biodiversity conservation in rural development in the mountain ecosystem and suggests some guidelines for making it the country-man's activity.

INTRODUCTION

Mountain areas in India belong to sub-tropical to tropical environments and the mountains in Himalaya represent all kinds of climate along an altitudinal gradient. In the past, these areas were covered with thick forests, bushes and meadows, but after long-term human activities, most of the forest vegetation has been destroyed and only limited area is now available under close forest category (>60 crown density). In central Himalaya, for example, only 4.4 percent land is available under good forest category (Tiwari et al. 1985). Erosion of biodiversity has been experienced by the local farmers as the loss of valuable wild species, native landraces of agronomic crops and change in species composition in natural forests as early as 1960. This paper attempts to integrate the biodiversity movement with the development of the economic activities of the local small farmers in the mountain ecosystems so as to make it a programme of each country-man.

THE RURAL ECOSYSTEMS AND BIODIVERSITY

The human ecosystems in rural environment represent a series of derived human-use systems developed by modifying the natural ecosystems through technology by the human beings to produce food, fibre or other agronomic products.

The animals are used as agents for transforming organic matter in the ecosystem. Thus, the agronomic sub-system is the prominent component of the rural human - use system to provide the agronomic yield and by-products and also the employment. These may be regarded as true cybernetic systems whose goal is increased social value.

In the mountainous environment, where the human - use systems are traditional, natural forests and wildlands are the major sources of energy while in areas indicating transformation of traditional style to modern farming, fossil fuel and agrochemicals are the prominent sources of energy in the system. Like the ecological systems they replace, agroecosystems are often structurally and dynamically complex but their complexity arises primarily from the interactions between socio-economic and ecological processes. Although it is easy to identify the political boundaries of a rural ecosystem, identifying natural/functional boundaries of a village ecosystem is sometimes appear to be no more than random clusterings of weakly interacting populations.

In the transformation, the great diversity of wildlife in the original natural system is reduced to a restricted assemblage of crops, pests and weeds. The use of modern agricultural technology, i.e., cultivation of high yielding improved genotypes, application of agrochemicals, etc.,

further narrow the biodiversity in the agroecosystem. There is strengthening of the bio-physical boundary of the system, a bund is created around the rice field, for example, which makes the boundary less permeable. The basic ecological processes - competition, herbivory and predation - still remain, but these are overlaid and regulated by the agricultural processes of cultivation, subsidy, control, harvesting and marketing. Consequently, the system boundary acquires a socio-economic dimension (Conway 1987).

A number of cultural explanations have been proffered (see Conway 1987) as have hypotheses which suggest agriculture a response to pressures of an adverse period of climate or of population growth. The crucial advance of agriculture, both swidden and settled, over hunting and gathering (primitive nomadism) was its greater productivity and stability. There were consequences though for sustainability and equitability. In some parts of the irrigated lands, there was a rise in water table and salinity while in rainfed situations continuous cultivation on the same unit land and lack of environmentally - sound cultivation practices accelerated soil erosion turning arable land to wasteland. These changes also caused adverse impacts on biodiversity in agroecosystems.

BIODIVERSITY EROSION : SOME EXAMPLES

The extra-ordinarily diverse bio-resources of India, in general, and in mountains in particular, are under increasing pressure of humanity and domestic cattles. Several

studies have indicated signs of gene erosion in parts of the country (Mehra and Arora 1980, Khajuria 1980, Mahajan 1985, Uma Melkania et al. 1988, N.P. Melkania 1989, Biswas et al. 1990).

Among the rare and endangered species of natural vegetation in the north western Himalaya are : Aconitum deinorrhizum, a herb of medicinal value, Cypripedicun cordigerum, a highly ornamental orchid (commonly known as "Lady's slipper"), Dioscorea deltoidea, Drosera burmannii, Hedysarum cachemirianum, Lavatera kashmiriana (Kashmir Hollylock), Sausurea bracteata, S. graphaloides, and S. lappa. In the central Himalayan sector, Cypridium macranthos, Didicea cunninghamii, Helmithostachys zeylanica, and Olax mana are noteworthy rare species. Among the rare species of the north eastern Himalayan region are : Abies delavayii, Arachanathe catachartii, Dendrobium densiflorum and Dipteris wallichii.

Among the primates three of the Felidae, the lynx (Felis lynx), Palas' cat (Felis manul) and snow leopard are confined to the higher Himalaya, and clouded leopard (Neofelis nebulosa), marbles cat (Felis marmorata), and the golden cat (Felis temmincki) generally to the east Himalaya. Tiger (Panthera tigiris) occasionally ascends to 200 m but is now rarely seen west of Jamuna, whereas the panther (Panthera pardus) is widely distributed, but has been trapped

and shot excessively during recent years. Himalayan black bear (Selenarctos thibeianus) occurs throughout the lower elevations. Capra falconeri, once abundant, is now seldom seen. The tahr (Hemitragus gemlahicus) is found throughout the Himalaya but in reduced number. Of the antelopes, Himalayan serow (Capricornis sumatrensis) and ghoral (Nemorhaedus ghoral) are more common, but Tibetan antelope (Pantholope hodgsoni) is rare. Among the deer family, Kashmir stag (Cervus elaphus hanglu), barking deer (Cervus muntjac), and sambar (Cervus unicolor) occur throughout the lower and middle Himalaya. Musk deer (Moschus moschiferus), which used to be common in the higher Himalaya, has been mercilessly hunted for its muskpod. Of the Himalayan fauna, 16 mammals, 6 birds and 2 reptiles are listed in the IUCN Red Data Book.

In context to mountains, the factors prominently responsible for gene-erosion are : clear felling and unplanned shelterwood felling of the prime forests, replacement of primitive cultivars by high yielding varieties, extensive use of weed control measures, (especially in the foot hill regions and valleys of mid-mountains) thereby eliminating related wild species that might be needed in future and "development" of the areas rich in biological wealth through industrialization, mining and river valley projects which inundate significant habitats, conversion of biologically

rich wetlands to shrim farming and other uses; encroachment of plantation agriculture and subsistence farming out hither to intact natural forests and remote wildlands and industrial pollution (in the foot hill region) which render ecosystems unproductive and contaminates the atmosphere. Behind these proximate causes lie economic policies which have encouraged over exploitation of natural resources, land tenure systems which push people out marginal land and otherwise use up bio-resources.

BIODIVERSITY CONSERVATION : CONSTRAINTS

The concern of biodiversity conservation is most recent for the real rulers - politicians - who have not understand the concept. Concern for the biodiversity is usually expressed in "motherhood" statements of national policy, but details of how this concern will be addressed..... are generally lost or embryonic in the volume of (economic) development prescriptions. Nevertheless, it is increasingly evident that erosion of the bio-resource base will limit the prospects for (economic) development in India as it does elsewhere in the developing world.

The basis constraints to effective biodiversity conservation are the institutional disarray and lack of primary data, skills, finances and political will. Limited people have formal training in natural resource management

and operational research, community development and nature interpretation. Much divided bureaucratic responsibilities also delay the implementation of the programmes on the site. Many times government policies, as indicated above, of the sector, such as agriculture, trade, military, tourism and land tenure policies most likely impinge on bio-diversity conservation. Further, biodiversity issues are often disregarded by the ambitious enterpreneurship.

DEVELOPMENT PLANNING AND BIODIVERSITY

When a development project is undertaken, it becomes a component of the rural ecosystem in the project area. It will affect and be affected by other components. Therefore, it will be useful to identify the ecosystem of the project area.

In general, in any village, two kinds of ecosystem are identified - natural (forests, grazing lands, water bodies, etc.) and man-made (agroecosystem and horti-agroecosystem). The boundaries of the natural and man - made ecosystems overlap. In development, both kinds of ecosystems need to be considered. Unfortunately, however, planners/administrators tend to take into consideration the administrative unit and selected components only. This has led to many difficulties. For example, agriculturists change the landuse in marginal lands for cultivation ignoring the land capability and

terrain characteristics. Emphasis is also given for cultivating national crops rather than the indigenous cultivars of local crop species. Animal husbandry personnels advocate goat keeping as the most economic and productive enterprise for marginal and landless farmers ignoring the adverse impacts of such practices on the carrying capacity of the ecosystem. Foresters, on the other hand, often ban the local use of the forest and forest land and encourage for raising industrial species like chir-pine (Pinus roxburghii) rather than multi-purpose broadleaf species oak (Quercus spp.), etc. The sectoral approach of development planning to quick fix the economic gains has, thus, contributed to ecosystem disturbances leading to loss of landraces. Unless this approach is changed/minimised, the problem of bio-resources erosion will further increase.

A SUGGESTIVE APPROACH FOR INTEGRATION

In rural development, we should identify the village as an ecosystem consisting of components as human habitation, cropland, the forest and the river, each of which can be sub-divided into smaller sub-components according to the need. The components may differ from place to place. Such a model will indicate the nature and significance of interactions between certain components and, hence, of the potential impacts of a development project. Whether or not an impact will actually occur in any of the components,

depends on many factors, such as the magnitude and duration of the disturbance analysis, each component can be broken down into its sub-components, e.g., the forest into the autotrophs, the heterotrophs - secondary producers and decomposers, the soil and water, etc. This scheme will require coordination/integration in the planning process. Since the establishment of an industry on village land or integrating biodiversity movement in rural development, for example, will potentially affect the village, the landuse and potential, coordination needs to be sought amongst the agencies dealing with industry, biodiversity conservation, village affairs, water and forestry. Such an approach is in contrast to the current practice, which deals with sectorally.

The specificity and diversity of ecological problems confer great deal on regional and local development planning. Decisions made at the state or central level should not be permitted to inhibit the freedom of action necessary at local and regional levels to take the ecological processes into account effectively. Emphasis should be given on suggesting practical avenues to achieve the biodiversity conservation at village level. The process must be linked to rural development efforts, if the conservation of biodiversity is indeed to succeed among small farmers that give equal importance to local bio-resources. Any attempt at <u>in situ</u> genetic conservation must struggle to preserve

the indigenous practices and traditions in which these resources exist and are conserved. But this can not succeed if not tried to the maintenance of the socio-cultural organization of the local people. The conservation efforts must utilise autochthonous knowledge and resource - efficient technologies emphasis in the use of landraces of crop germplasm, firewood resources and essentials like medicinal plants; and be based on self-contained villages and the active participation of the farmers. It behooves the developed nations or states/cities to provide fair subsidies to the farmers for their ecological service of maintaining native germplasm.

The integrated participatory planning must distinguish three levels of change at which incorporation of environmental considerations must be sought : (i) changes in development styles at the level of social demand for and supply of goods and services, (ii) changes in regulation of socio-economic system so as to introduce new controls and tighten up inadequate ones, and (iii) changes in social and institutional structures, particularly, with respect to distribution. A farmer-curator system should be allowed for *in situ* conservation of biodiversity, in agriculture in particular, and should have the liberty to continue to grow a limited samples of endangered landraces native to the region. Areas where native agronomic cultivars are still cultivated should be identified as agronomic conservation gardens and the

farmers be provided with adequate technical support and reward for their conservation activities. A reciprocal exchange of seeds with gene banks is possible which they can tap if they lose their remaining seeds. Education programmes including information for elders on significance of biodiversity conservation and measures to conserve it, should be established. In brief, following steps are suggested for integrating biodiversity conservation in rural development planning.

- recognise village as an ecosystem and use ecosystem approach in development planning,

- consider biodiversity as the key for stability and sustainability of the human - use systems,

- study indigenous knowledge system of conserving biodiversity and suggest the technological package, including indigenous and recently developed one, for conserving biodiversity,

- adopt a farmer curator system for in situ conservation of biodiversity and provide incentives and rewards to the successful farmers for their ecological services to humanity, and

- develop local genetic nurseries in schools/colleges (village level), community gene banks and gardens (block level), conservation centres for micro-

organisms and soil - fixing organisms and community National Parks (district level) and consortium of people's organizations for biodiversity conservation (state level).

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Government of India

National Wastelands Development Programme

GUIDELINES FOR MICRO PLANNING

National Wastelands Development Board
Ministry of Environment and Forest
'Paryavaran Bhavan', CGO Complex
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CENTRE FOR
ECOLOGICAL SCIENCES

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FOREWORD

One of the generally accepted defects of the planning process is the compartmentalisation inherent in the bureaucratic structure responsible for planning and implementation. The other major defect has been the inability of the structure to help evolve mechanisms for meaningful people's participation in the planning and execution of development programmes. The wastelands programme too has suffered on this account. At the time of restructuring of the National Wastelands Development Board (NWDB) in June, 1990, its mandate was specifically revised to include responsibility for "enlisting people's participation, harnessing science and technology and achieving inter-disciplinary coordination in the planning and implementation of the Wastelands Development Programme".

In order to carry out the mandate and to evolve mechanisms for integrated development of wastelands through systematic planning and implementation, the National Wastelands Development Board formulated a scheme entitled 'Integrated Wastelands Development Projects Scheme'. One of the primary objectives of the scheme is the undertaking of pilot projects to help develop appropriate methodologies for preparing village level action plans called micro plans'. The process of preparing these micro plans is described in fairly general terms in the scheme. Multi-disciplinary teams are to be constituted to help draw-up action plans aimed at checking land degradation, on the one hand, and reclaiming wastelands, on the other.

The preparation of micro plans was initiated in 8 districts in 1989-90 itself and a workshop was organised in July, 1989, at NWDB's instance at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore, to help orient officers of the selected districts to the micro planning process. As a follow-up to the workshop, it was decided that guidelines detailing the methodology to be followed needed to be set down for the guidance of the State Governments and the multi-disciplinary teams. Accordingly, the NWDB commissioned Prof. Madhav Gadgil and Dr N.H. Ravindranath of the Centre for Ecological Sciences, Indian Institute of Science, Bangalore, to draft the guidelines for micro planning. The draft guidelines were discussed in a workshop held at New Delhi on 6th and 7th February, 1990. The opening session was presided over by Union Minister of State for Environment & Forests, Smt. Maneka Gandhi. Members of the Planning Commission, representatives of the concerned Central and State Government Departments, NGOs, experts, etc. participated in the workshop. The draft was revised and subsequently discussed further with the representatives of State Governments, NGOs and other experts on 6th July 1990. The revisions were incorporated in the draft guidelines. The end result is the present publication.

In its present form, the guidelines are meant for use at the Central, State and District levels by the concerned Government Departments and the NGOs. In one sense, these guidelines are still in the process of evolution and it is expected, and indeed hoped, that as the body of experience grows, more and more insights would be available for incorporating in a revised set of guidelines.

The guidelines need to be further supplemented by field level documentation and other audio-visual material. Admittedly, this is the more difficult part of the exercise. It will also require substantial inputs at the local and regional levels. The NWDB has, however, tentatively commenced an exercise aimed at producing the requisite material and it is hoped that this will help meet the gap that exists at present.

I take this opportunity to place on record the dedicated voluntary effort of Prof. Madhav Gadgil and Dr. N.H. Ravindranath of the Centre for Ecological Sciences, Indian Institute of Sciences, Bangalore, who drafted the guidelines and patiently incorporated the many suggestions that were received from the Central and State Government Departments, NGOs, and other experts who took keen interest in the whole exercise.

Thanks are also due to all those who participated in the workshops and meetings organised to bring out these guidelines and to Shri S. Vijay Kumar, Director and Shri Rajeev Kumar, Under Secretary, NWDB who helped bring out the guidelines in its present form. Needless to add, the National Wastelands Development Board welcomes suggestions, particularly from those engaged in the micro-planning exercise, which could be utilised to enrich the guidelines in its subsequent edition.

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EXECUTIVE SUMMARY

1. The National Wastelands Development Programme focuses on lands that are yielding far below their potential; degraded public lands controlled either by forest department or other agencies such as revenue department, village panchayat etc., as well as privately held degraded lands.

2. These lands provide a whole spectrum of ecosystem services such as catchments of tanks, as sources of fodder, leaf manure, fuel or small timber. Such services are critical to the maintenance of quality of life of a significant proportion of India's population.

3. An important reason for the degradation of these resources is the divorce between usage and management. The weaker sections of rural population intimately dependent on such lands have no say in how these are used or developed. Consequently these *no-man's-lands* are subject to serious abuse.

4. In spite of serious intentions of making afforestation a people's movement, the National Wastelands Development Board has so far had limited success in meaningfully involving local people in wastelands development.

5. The National Wastelands Development Board has therefore decided to strive to develop appropriate institutions and methodology of functioning to correct this major deficiency. It has also decided to broaden its focus to enhancing ecosystem services to the weaker sections of the local population.

6. Planning for wastelands development must relate both to the organization of land/water use in terms of watershed and of society in terms of hamlets and villages. Since people's participation is the most critical input, the basis of planning should be a hamlet/village in which people are in regular face to face contact. The cultivated land of such a hamlet/village along with the non-cultivated lands and waters from which people derive many services also act as functional ecosystematic units.

7. These social considerations need to be combined with the watershed approach so that individual micro-watersheds of a hamlet/village serve as the primary unit of planning. Such microwatershed plans must then be co-ordinated with plans for micro-watersheds of adjoining hamlets/villages through appropriate mechanisms.

8. The entire assembly or village community of a hamlet/village should ideally be the ultimate authority in planning and managing the use of natural resources of any locality. Any other agency implementing the programmes such as a village natural resource management committee, forest panchayat, youth club, a milk producers' co-operative or an NGO should be accountable to the village community. It should liase with the group gram panchayat as well as the district level multi-disciplinary team overseeing the programme.

9. The district level multi-disciplinary teams would initiate the micro-level planning exercise by selecting a few compact clusters of villages representing the different agro- climatic zones of the district for implementation of the programme. The 1 : 50000 scale wastelands maps prepared by NRSA may provide a useful basis for the selection of these villages.

10. The process of planning should begin with a participatory ecoservices appraisal involving representative local villagers along with a few outsiders such as Block Development Officer, Extension Officer or Range Forest Officer, School and College teachers, technical experts or workers from voluntary sector. Some of the teams may also include members of the district level multidisciplinary team and other technical experts. This team should review

the services that different components of the local ecosystem provide to the residents, the difficulties being experienced in connection with these services and identify opportunities for overcoming the problems and enhancing the services. The options considered should not only include physical/biological measures such as check dams and plantations, but also the social institutions required to put the programme into effect. The team should discuss the issues with the entire village community as well as with different social groups in the village. Its suggestion should be finalised on the basis of consensus arrived at in the village community. This exercise should also initiate the functioning of a suitable village level institution for good management of natural resources.

11. Members of the district level teams should selectively participate in a sample of village level microplanning exercises. They should also consider issues such as :

- How should the management of the natural resource base of this district be related to the plans developed with respect to the different agro-climatic regions within the country ?
- What are the priority needs common to villages in different agro-climatic zones of the district ?
- What technical support would be needed to carry out important development programmes common to many villages ?
- What would be the quantum of funds required for different sectors ?
- What are the village level institutional mechanisms that would function most effectively in different parts of the district in enhancing, sustainably using and equitably sharing the natural resources ?
- What are the improvements required in the planning process, creation of awareness, training of staff for betterment of this programme ?

12. The district level multidisciplinary teams would co-opt a few members active in village level natural resource management agencies, local voluntary organizations, college teachers and technical experts from Universities and Research Institutes to constitute a district level natural resource management co-ordination committee. Such a committee should liase with the village level institutions, the Government departments and NGOs and oversee the NWDB programmes in the district.

13. The suggestions of the district level natural resource management co-ordination committees should be considered by the village communities of all villages. Taking these into account the village communities should have the full authority in deciding the priorities for an action programme for their own locality. NWDB should lay no rigid schemes or guidelines to be followed, but commit itself to supporting the action programme so developed at the grassroots so long as it is compatible with the broad objectives of enhancing ecosystem services including fuelwood and fodder supply, especially to the weaker segments. Linking water harvesting with the rest of the programme may be particularly effective.

14. Special attention must be paid to clarifying how the benefits that will flow will be shared on an equitable basis and building institutions to take good care of local natural resource base. Appropriate measures (including legal provisions) should be devised to ensure that all categories of land and water - private, public (controlled by forest department as well as other agencies) are brought under good management.

15. The NWDB action programmes may be implemented in a flexible fashion by one or more of a number of different agencies; by panchayats through the village level natural resource management committees or youth clubs, by NGOs or by Government agencies. The whole thrust of the programme is however to empower people and the Government agencies and technical experts should ultimately come to serve as facilitators and provide technical assistance. It is vital to ensure fully free flow of information as to the development programmes and what is happening with them at all levels down to village community.

16 Real success of microplanning calls for concurrent evaluation procedures that will transcend mere monitoring. Serious effort is therefore required to set up viable institutional mechanisms and the methodology for participatory mechanisms which would undertake such evaluation. Village level natural resource management agencies, panchayats, schools, colleges and Government agencies would all have to involve themselves appropriately in establishing such participatory mechanisms.

17. Microplanning has to be a continuous process, a kind of rolling micro-plan to take account of changing technologies, changing base of natural resources and emergence of new social institutions as the process of empowering the people gathers momentum. Establishment of effective mechanisms of concurrent evaluation would be vital to securing the basis for such a continuing process. This would enable appropriate mid-course correction; people's organizations, in particular the village community should play a significant role in ensuring the implementation of such mid-course correction.

1. INTRODUCTION

1.1 Ours is a biomass-based civilization. A significant majority of Indians depend on biomass, either gathered from natural vegetation or produced through low input agriculture to meet their basic needs. These include not only food and fuelwood, but fodder for livestock and manure for agriculture, small timber and thatch for houses and cattlesheds, wood for agricultural implements, as also a whole variety of plant materials used for drugs and pesticides, or for fabricating ropes, mats, fishing implements, and decorative articles. The people depend on their surroundings not only for biomass, but also to meet many other needs. They construct their huts with local mud and stones, and they and their livestock use the water of natural streams and rivers. Their low input agriculture depends critically on whatever little irrigation that can be locally organized and on dung and leaf manure. The quality of life of a significant majority of our people is thus intimately dependent on *ecosystem services*.

1.2 It has been our endeavour since independence to transform this situation. Our development efforts have focussed on promoting irrigated, high input agriculture and industry. These efforts will undoubtedly continue. It is clear, however, that only a minority of our people have been and in the foreseeable future will be involved in these modern sectors. The rest would continue to depend on dryland agriculture, village grazing lands, forests and other public lands. Our tragedy has been a complete neglect of these people and the eco-services that sustain them.

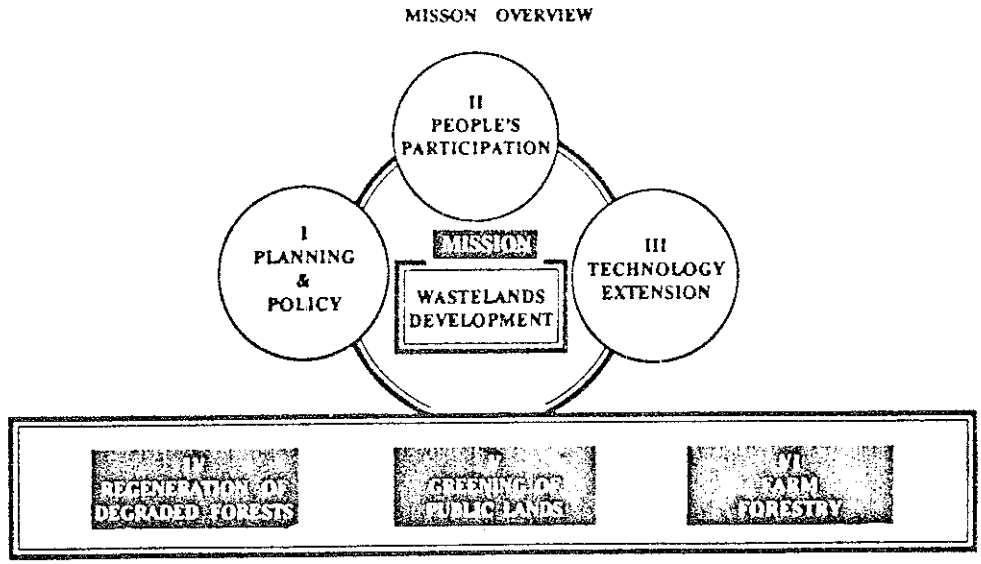
1.3 Securing and enhancing eco-services for these people ought to be an important focus of our development efforts. But the pattern of development adopted by us has had precisely the opposite effect. Four decades after independence we are confronted with the spectre of eroded hill slopes and silted up tank beds, depleted forests and overgrazed pastures, polluted rivers and lakes choked by water weeds. In turn this implies longer and longer trips to fetch water or fuelwood, burning dung instead of adding it to the farmlands, stagnant production in dryland agriculture; and many other ways in which the quality of life of the bulk of our people is being depressed.

BOX 1

IF STATUS QUO CONTINUES
1. More and more forest and grazing lands would be encroached upon for agriculture and other purposes
2. Vegetation cover of non-cultivated lands would be depleted further
3. Thorny, unpalatable species would replace good grass species due to excessive grazing pressure
4. Soil erosion would continue to accelerate because of an ever depleting vegetation cover
5. Ground water recharge would be reduced; streams and reservoirs would be silted; floods would worsen even as more and more perennial streams go dry in the summer
6. Scarcities of all types of biomass - used as food, fuel, manure, thatch, small timber etc. will mount
7. Landless, tribals, artisans like basket weavers and women will suffer most as a result of ongoing degradation

1.4 An important reason why such deterioration of eco- services has gone on is that the local people who depend intimately on these services are impoverished, disorganized and with no control over the development process. This, of course, has been increasingly realized; hence the call for "developing a people's movement for afforestation", the commitment to decentralized planning by the Government and the pride of place to people's participation in the programmes of the National Wastelands Development Board.

1.5 It is then broadly accepted that the local people who have a genuine stake in the health of the local resource base must effectively participate in the development of natural resources. This however is not an easy matter for the presently available institutional structures all promote a centralised, sectoral, top-down process of development with



no authority for the local people over the resource base of their own localities. Serious efforts must therefore be made to create appropriate institutional structures if we are not to repeat the mistakes of the last five years; for grossly inadequate participation by people has been recognized as a major shortcoming of our ongoing wastelands development efforts. As the review of National Wastelands Development Board 1985-1989 stresses, a cornerstone of the new initiative will therefore have to be "to develop capability at the village level of bodies like gram panchayat, village community or any other appropriate village level organisations to ultimately take over the responsibility of management".

1 6 It is against this background that the main elements of the wastelands development programme for the 8th Five Year Plan have been identified as follows (Ministry of Environment and Forests, 1989)

- Building of land use planning capability, specially at district and village levels, aimed at integrated use/management of wastelands,
- Conservation of selected ecologically fragile areas/ watersheds,
- Reclamation of special problem lands,
- Regeneration of degraded forest areas,
- Grassland and fodder development,
- Production and conservation of fuelwood,
- Promotion of agroforestry/farm forestry,
- People s participation at all stages and a conscious effort to involve small and marginal farmers and agricultural labourers.

Box 2

CURRENT LAND USE IN INDIA

Resource Devpt * Region	Cultivated Land (%)			Forest Area (%)			Wastelands (%)		Habitation
	Total	Net	More than once	Closed	Open	Other	Productive	Non-productive	(%)
1	12.09	8.00	4.09	15.82	2.11	0.00	16.18	55.24	2.65
2	20.04	15.52	4.52	39.42	8.36	4.75	23.31	3.87	4.77
3	91.69	66.29	25.40	1.80	0.46	0.36	15.12	0.60	15.36
4	91.15	64.55	26.29	4.10	1.20	0.00	17.04	2.60	10.50
5	94.57	70.11	24.46	1.69	0.14	0.00	10.92	8.17	8.97
6	111.08	78.12	32.95	0.19	0.23	0.00	6.48	7.06	7.92
7	37.38	32.59	4.78	23.54	7.76	0.00	31.21	0.42	4.48
8	50.70	44.24	6.30	7.37	3.45	0.00	32.72	6.93	5.30
9	69.84	63.80	6.04	2.46	2.14	0.00	25.42	2.84	3.34
10	48.71	45.24	3.47	9.42	2.38	0.00	33.79	2.56	6.60
11	57.11	45.03	12.08	10.15	3.32	0.25	28.00	2.28	10.97
12	43.18	35.19	9.78	24.31	5.34	0.05	27.62	1.64	5.86
13	52.47	48.27	4.20	3.50	1.03	0.20	28.84	12.83	5.34
14	40.01	38.84	1.18	0.08	0.07	0.00	6.95	51.31	2.76
15	4.28	4.12	0.15	30.37	0.24	26.70	36.97	0.00	1.60

1.7 In light of the objectives thus defined, the National Wastelands Development Board has embarked on a new programme comprising integrated land use planning, preparation of village level action plans and implementation of multipronged programmes for developing and upgrading wastelands. The experiment has begun as a Central Scheme for Integrated Wastelands Development Projects with planning for 7 districts in 1989; this is now being expanded in phases. The programme is being implemented by multidisciplinary teams of district level officials of agriculture, forest, animal husbandry or other concerned departments and headed by the district level heads of the development machinery such as District Collectors. Other agencies may also find it useful in devising appropriate methodologies suited to their circumstances. A further set of materials is being prepared for use of the field staff including the district level multidisciplinary teams as also village level functionaries, voluntary sector workers and others who may become involved in various capacities.

* Resource Development Regions :
1. Western Himalayan Region, 2. Eastern Himalayan Region 3. Lower Gangetic Plain Region 4. Middle Gangetic Plain Region, 5. Upper Gangetic Plain Region, 8. Central Plateau and Hills Region, 9. Western Plateaus and Hills Region, 10. Southern/Plateaus and Hills Region, 11. East Coast Plains & Hills Region, 12. West Coast Plain & Ghats Region 13. Gujarat Plains & Hills Division, 14. Western Desert Region, 15. The Islands Region.

2. THE APPROACH

2.1 The overall goals of the National Wastelands Development Programme are to:

- Check land degradation
- Put wastelands to sustainable use
- Increase biomass availability - especially fuelwood/fodder
- Restore ecological balance

To meet these goals, NWDB has adopted a mission strategy which focusses on:

- People's participation at all stages, specially through panchayats
- Integrated land use planning on watershed basis
- Village level action plans
- Conservation and natural regeneration
- Fuelwood, fodder and timber production
- Technology extension; and
- Resolution of relevant policy issues.

2.2 It is the purpose of this document to suggest ways of operationalising this strategy. This has to be attempted in the context of the following serious shortcomings of the National Wastelands Development Board effort as identified at the time of the review of the programme.

- People's participation has been very limited
- Relevant policy issues have not been resolved
- The management structure created is inadequate
- The planning methodology has not been worked out
- The action programme has been rather limited in scope in that it has been restricted to tree planting.

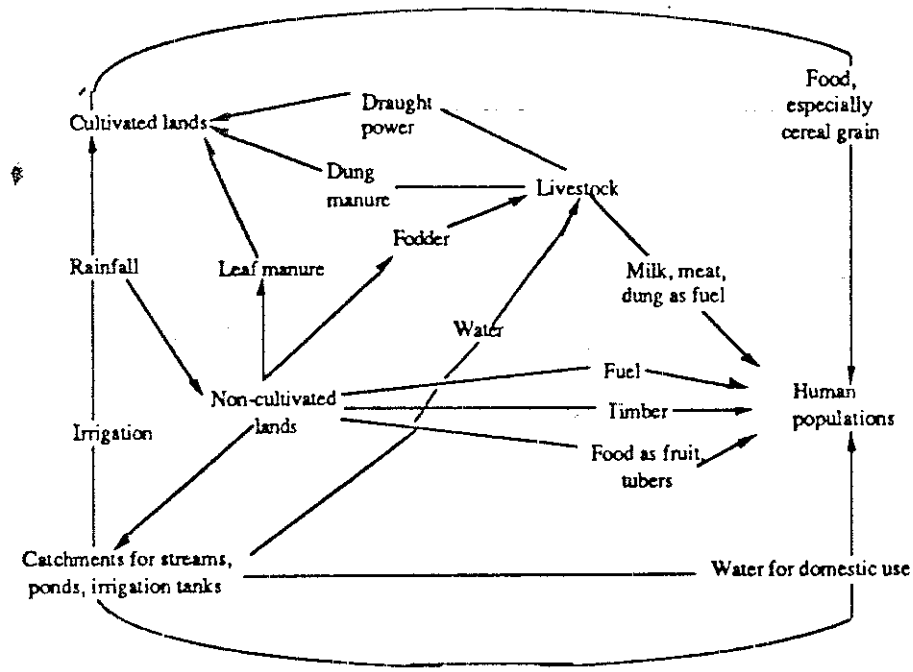
BOX 3

SHORTCOMINGS OF EARLIER PROGRAMMES OF WASTELANDS DEVELOPMENT
1. Neglect of linkages of wastelands with other components of village ecosystems
2. Excessive emphasis on raising tree plantation
3. Little attention paid to the variety of rural biomass needs with the result that the programmes often end up merely generating fuel and timber for the urban market
4. Poor plant species choice; failing to take local needs, soil, rainfall conditions into account
5. Critical issues of who would manage the resources and how the usufructs would be shared in relation to the legal status of the land left unresolved
6. No involvement of local community in planning, implementation, protection, sharing the benefits
7. No independent monitoring, concurrent evaluation
8. Well-developed guidelines/methodology not available to the field staff

2.3 The most important task therefore is to suggest appropriate institutional structures that would ensure effective peoples participation with focus on securing development of wastelands in service of the local people and ensure equitable access to eco-services therefrom.

3. VILLAGE ECOSYSTEMS

3.1 An American wheat or dairy farmer today is really a worker in an agrobusiness He acquires from the market a whole range of inputs, tractors and combine harvesters, fertilizers and pesticides, seeds and animal feeds. In turn he sells his produce almost wholly on the market. He is simply one of the global community of consumers. On the contrary, India's countryside is inhabited by ecosystem people, by small farmers and landless labourers, tribals, shepherds, and artisans who are intimately related to their local ecosystem. Of course they do acquire some materials and energy sources from outside their immediate environment, and do export some produce out of their locality. But the bulk of their needs of water, food, fuel, manure, fodder, herbal medicines, wood for implements, carts and boats, fencing and construction material, thatch, baskets, ropes and mats are met locally and their production consumed close to home. Typically, such a system comprises cultivated lands, next to it clusters of houses and tracts of non-cultivated lands. The non- cultivated lands serve as catchment for streams and ponds, they provide fuel, construction material to the people and grazing to the livestock. The livestock are linked to both non-cultivated and cultivated lands. They graze on the former; they also derive fodder from crop byproducts. In turn they provide draught power and dung to manure the fields. The people too are intimately linked with these ecosystem components, gathering their produce and contributing labour to mould them (Fig).



3.2 It is the many linkages within the village ecosystem and the manifold services that different components provide that render a system perspective meaningful. The details of the linkages and the nature of ecoservices of course vary tremendously over our heterogeneous country across the various agro-climatic regions. After all rural India stretches from tribal hamlets of Bastar to camps of shepherds in Lahaul-Spiti, from settlements of fisherfolk in Lakshadweep to villages of Punjab in the forefront of the green revolution. Within the rural society too the ecoservices valued by large farmers would be very different from those valued by basket weavers or river fisherfolk.

3.3 These may be best brought out in terms of services that each ecosystem component provides to or demands from other components.

(a) *Cultivated land* : Services rendered include supply of food, fuel, thatching material, fodder; services demanded include water, leaf and dung manure, human and animal labour.

(b) *Non-cultivated land* : Services rendered include fuel, fodder, small timber, bamboo, stones, mud and other constructional material, manure, food such as tubers, fruit, meat, regulation of water supply as catchment of streams and ponds. In past there have been little inputs into these lands.

(c) *Streams and ponds* : Services rendered include water supply for human and livestock consumption, irrigation for agriculture, fish; services demanded include labour input for construction of checkdams and for desilting.

(d) *Domestic animals* : Services rendered include supply of draught power, milk, meat, dung; services demanded include fodder and feed, human labour.

(e) *Human population* : Services demanded include food, fuel, structural material for construction of shelter, implements, drugs; services rendered include labour input into cultivation, maintenance of livestock, maintenance of ponds.

3.4 Different agro-climatic regions of India of course differ dramatically in the relative significance of the different ecosystem services. Thus in tribal regions like Gadchiroli in eastern Maharashtra, non-cultivated lands not only furnish fuel, fodder, timber, manure, but even food in the form of tubers and wild animals for several months a year. On the other hand in intensively cultivated districts of Punjab the only services availed of non-cultivated lands may be as sites for roads and habitation. Similarly livestock may provide not only draught power, milk, meat, dung but other highly valued products such as wool and be the mainstay of the economy as in Western Rajasthan; elsewhere, the services it provides may be utterly insignificant as in some intensive paddy cultivation tracts of Kerala or tribal states of northeastern India.

3.5 Indian rural society is also highly differentiated, and the different segments may greatly differ in the services they demand of the different ecosystem components. In tribal societies such differentiation is relatively little; in such societies all depend heavily on non- cultivated lands. In the agrarian villages, especially where irrigation based on large dams and highly chemicalized cultivation is prevalent, the landowners may depend little on other ecosystem services; indeed their interests may lie in devoting non-cultivated lands for the production of Eucalyptus for sale instead of providing ecosystem services to the local poor. On the other hand, landless labourers may still depend to a substantial extent on non-cultivated lands. Indeed a study of 21 semi-arid districts in 8 states of India has shown that poorer families derive 14 to 23 % of their total income from non- cultivated lands, while such lands contribute to only 1 to 2 % of the income of landholding households (Jodha, pers comm.). By and large the weaker segments of Indian village society continue to depend significantly on non-cultivated lands as well as water bodies. Tribals, nomadic shepherds and cattlekeepers, artisans like basketweavers, or fisherfolk depend even more heavily on such lands and waters.

4. SOCIAL INSTITUTIONS

4.1 The Indian rural society is highly segmented and inequitous. Nevertheless, in pre-colonial times the different segments in a village were linked together in a web of mutual obligations. This society enjoyed a large measure of autonomy and control over the local land and water resources. It had elaborated a number of strong community institutions that promoted good resource use. Such for instance were mechanisms for community management and sharing of water from village ponds and biomass from village woodlots. Many such institutions were destroyed during the British rule when community ownership of resources was derecognized and the state took over their control. The state then admitted only privileges of use, but no rights of regulation for local communities. In consequence, the state deliberately created a situation of no-man's-lands-and-waters; of open access property which is abused. This situation worsened after independence with politicisation of rural society and creeping in of factionalism. Examples of still surviving systems of community based management are therefore very rare indeed, as is inevitable given the adverse circumstances. Nevertheless, they exist and include traditional systems like irrigation pond management systems of Karnataka and Andhra Pradesh, the Ban Panchayats of Almora established some 60 years ago and the tribal and district councils of northeastern India. There are also more recent systems of considerable promise; these include village forest protection committees of West Bengal and hill resource user groups of Haryana.

4.2 *UNIT FOR PLANNING* : It is now necessary to make a radical break with the existing situation and establish community based systems of natural resource management throughout the country. This experiment must of course be linked to the experiment of decentralizing power through the Panchayat raj. However the spatial and population coverage of a panchayat is too large to constitute an effective unit for management of natural resources. For this purpose the social basis has to be that of a human community in regular face-to-face contact. This would be an individual hamlet or village; a relatively compact human settlement with the cultivated and non-cultivated lands and water bodies on which the people depend intimately. This need not necessarily correspond to a revenue village either; it could be smaller than one,especially in sparsely populated districts. The entire population of such a unit, the village community, should then be the body responsible for the natural resources of a territory appropriately defined for it.

BOX 4

UNIT OF MICROLEVEL PLANNING AND RESOURCE MANAGEMENT
1. Physically, natural resource planning should relate to watersheds
2. But major watersheds are not necessarily appropriate social units They may embrace many villages and too large a human population
3. A panchayat or a revenue village may also be too large and too heterogeneous socially to serve as an effective unit
4. A village/hamlet with its cultivated and non-cultivated lands over which the livestock and people range constitutes a functional ecosystem
5. Such a village/hamlet in which all human beings are in face- to-face communication is the ideal social basis for micro- level planning and resource management
6. This village based approach may be fruitfully combined with the watershed approach by using micro-watersheds within a hamlet/village as the basic units of microlevel plans
7. Such micro-watershed based plans would have to be properly linked to micro-watershed plans for adjacent village/hamlets through appropriate mechanisms

4.3 *VILLAGE COMMUNITY - THE SUPREME BODY* : It is the village community comprising of adult members of the village that should be the local decision-making body with respect to management of natural resources. This body should meet at least twice in a year to approve the plan for development as well as priorities and review the progress when implementation starts. This is because it is the body most likely to reflect the real will of the people and least likely to be captured by vested interests, be they local landowners, contractors, officials or politicians. The elected Panchayat is unfortunately more likely to be unduly influenced by the powerful interests and ignore the needs of the weaker sections. Therefore, while the Panchayati raj institutions would undoubtedly come to play a significant role in natural resource management, these should pivot around the Village Community.

4.4 In practice of course the Village Community would need to be assisted by other smaller, more organised agencies to focus on these activities. One possibility is that this be a specially constituted group of people representing every segment of the village population including landless, artisans and of course women and called the Village Natural Resource Management Committee. The members of such a committee could be nominated/elected by the Village Community. Other possibilities include ban panchayats, village forest protection committees, youth or women's clubs, primary milk-producers' or other co- operatives or voluntary agencies. It would be best to leave the decision as to the form and constitution of the appropriate agency (hereafter referred to as Village Natural Resource Management Agency - VNRMA) to the concerned Village Community.

4.5 The VNRMAs would be accountable to the Village Community; they would also have to interact with the Panchayat as well as the district level multi-disciplinary teams overseeing the NWDB programmes. In order to enable the multidisciplinary teams comprising Government officials to interact more effectively with local people, it is suggested that the District Collectors constitute District level Natural Resource Management Co-ordination Committees. These should include all official members of the multidisciplinary teams, a few technical experts from Universities, Colleges or Research Institutes working in that district, a few representatives of the voluntary agencies involved in wastelands development, and a few representatives of the village level natural resource management agencies. This committee should meet at least once in three months and would discharge the following functions:

(1) Establish proper liaison between village level people's agencies, technical experts, voluntary organizations and Government officials
(2) Ensure proper linkages on a watershed basis between individual village/hamlet micro-watershed level plans
(3) Resolve any intervillage issues such as demarcation of areas assigned to management by different villages, and management of larger areas not immediately adjacent to any village
(4) Relate the natural resource base planning within the district to the broader framework of planning on the basis of agro-climatic regions.
(5) Arrive at a district level view of priority needs of villages in different agro-climatic zones of the district
(6) Identify and organize technical support needed to carry out programmes common to several villages
(7) Work out sector wise financial and staff requirements
(8) Organize district level training programmes for Government field officers as well as technical experts, voluntary agency workers and people involved in VNRMAs
(9) Review the methodologies of planning, implementation and concurrent evaluation process and suggest ways of improving their effectiveness.

4.6 To ensure accountability, at the district level and the block level, Government officials should be identified and made as nodal officers responsible for ensuring that the decisions of the District Level Committee are implemented and that the micro planning process at the village level is being carried out according to the guidelines. These officials would also be responsible for ensuring the proper utilisation of funds and the maintenance of accounts as per the requirements under the various Schemes

BOX 5

PROPOSED INSTITUTIONAL STRUCTURE FOR NATURAL RESOURCE MANAGEMENT

Spatial unit	*Institution*	*Membership*
Village	Village Community	All adults
Village	Village NRMA	Depends upon the nature of agency
District	District Natural Resource Management Co-ordination Committee	District Collector (or Chief Secretary of Zilla Parishad etc.), District level officers of Agriculture, Forest, Animal Husbandry and other concerned departments, some technical experts from local colleges, Universities, Research Institutes, workers of Voluntary Agencies, representatives from VNRMA.

BOX 6

FUNCTIONS AND RESPONSIBILITIES OF VILLAGE COMMUNITY
It should meet once every three months

1. Select programmes for implementation and set priorities
2. Decide on mode of programme implementation
3. Decide on criteria for sharing the benefits.
4. Suggest and implement mid-course corrections to programmes being implemented.
5. Seek detailed information on programmes and monitoring reports and participate in a concurrent evaluation process.
6. Ensure that there is no misuse of resources or benefits.

4.7 *MANAGEMENT OF WATER-WASTELAND SYSTEM* : Water is the most critical input for crop, grassland and tree productivity. Water is always in demand in most villages for crop production. At the same time, wastelands often serve as catchment for water harvesting systems like farm ponds, check dams and minor irrigation tanks. Water thus collected could be used for giving critical irrigations to crops. Many experiences, old and new have shown that water is a potent force for uniting the community. Farmers are generally prepared to come together for obtaining irrigation water. Often they also organize to share the water resource. Hence it is desirable in certain cases to link afforestation and water harvesting programmes, since wasteland management by itself may not excite the farming population in any village. Furthermore, proper water harvesting and utilization would lead to reduction of soil erosion and increased biomass production in the village.

4.8 Water so harvested could be sold to the farmers or bartered for labour or biomass. Hence the scope of the Village Community and VNRMA should be enlarged to include management of wastelands, water harvesting systems and biomass production and conservation programmes. The chances of success would greatly improve if the management of community resources is thus linked with benefits to farmers.

5. THE PLANNING PROCESS

5.1 Planning should be a process of identifying opportunities for fulfilling important development objectives. For the National Wastelands Development Board the objective is securing and enhancing certain eco-services for the local people, and ensuring that they have equitable access to these resources. Planning should therefore focus on determining :

(a) What eco-services are valued by the local people, especially the weaker segments more directly dependent on such services ?

(b) Whether such services appear to be on decline and if so, why?

(c) What possible ways there are of halting the decline of eco- services, and of enhancing their quality, availability, sustainability and efficiency of use ?

(d) What are possible ways of ensuring that the ecosystem services are not cornered by a small elite - either from outside or within the local society ?

BOX 7

AIMS OF PLANNING
Meeting local natural resource needs, especially of weaker sections: - In a sustainable and environmentally sound fashion - Such that equity is promoted - Through local participation in planning, implementation and management - Leading to an increase in quality, availability, sustainability and efficiency of use of natural resources : biomass, water, soil, energy

5.2 In this perspective it is clear that planning would have to be a flexible process sensitive to local context and intimately involving local people. It should not at all be restricted, as it often is today, to drawing up rigid schemes for Government departments to incur expenditure, each on its own. Instead it should be concerned with working out location specific ways of enhancing eco-services on basis of priorities suggested by the local people. It should of course reflect the broader framework of resource planning especially with reference to the different agro-climatic regions of the country. However, it should not restrict its perspective to physical treatments such as gully plugs or community biogas plants, but also give full consideration to establishing appropriate social institutions for good management of natural resources. Ideally in this process the outsiders, namely the Government functionaries, the technical experts and the voluntary sector workers should all serve as facilitators and technical advisors with the actual prioritisation required for decision making, implementation and monitoring passed on to the local people. This, of course, is the ideal; it would take time to accomplish. However, the National Wastelands Development Board could make a significant beginning. Given this perspective, planning would follow the steps indicated in Box 8.

BOX 8

STEPS IN PLANNING
1. Formulate development objectives, social, economic and environmental
2. Identify and define compact clusters of villages where wastelands development programmes are to be implemented
3. Carry out rapid exploratory surveys to decide on ecosystem services that are of particular significance in the selected localities
4. Define the list of problems relevant to different social groups in the village
5. Assess current resource usage patterns and their possibly adverse impacts on resource capital
6. Identify the set of measures from the local community (different segments), local knowledgebles - relevant to problems of ecosystem services
7. Present the whole picture of the status of ecosystem services and the priorities as to physical/biological measures and institutions along with the perspectives of the different social groups to the village community. Identify and initiate the functioning of a suitable Village Natural Resource Management Agency
8. Prepare a village level micro-watershed-based plan based on the consensus of the village community for the district level Multi-disciplinary team/ Natural Resource Management Co-ordination Committee
9. District level group to arrive at its own suggestions based on an assessment of village plans and an overview of the district level situation in the context of agro-climatic region based plans
10. Suggestions of the district level group to be passed to all concerned village communities
11. Village Communities to decide on the final priorities as to physical/ biological measures and the functioning of Village Natural Resource Management Agency
12. Preparation of final proposal and its technical scrutiny followed by the competent agency
13. Prepare detailed action plans for implementing the decisions of the Village Communities through further specific investigations as necessary
14. Implement the development programmes
15. Organize a process of participatory evaluation of developmental programmes as they are being implemented and their social, economic, environmental fallouts
16. Make mid-term corrections as and when they seem appropriate as an on- going process so that the whole operation becomes a kind of rolling micro-plan This implies going back to steps 12, 7 or even earlier ones as appropriate

6. PARTICIPATORY ECO-SERVICES APPRAISAL

6.1 People's participation ought to begin at the beginning, that is with the identification of problems and opportunities for tackling them. We therefore suggest that local people- representing all the various segments of the population - must be actively associated with the initial survey of the localities in the village clusters included under the National Wastelands Development Board programmes. Such a survey should be organized on village/hamlet basis with microwatersheds comprising lands under cultivation and the non-cultivated lands regularly used by the villagers in deriving various eco-services constituting the basic unit for planning. Several local people, representing big and small farmers, landless agricultural labourers, forest produce collectors, artisans, shepherds and fishermen etc. depending on the occurrence of various occupations, and preferably including at least a few women should be associated with the initial survey. The remaining survey team common for each village cluster may include: Block Development Officer, agricultural extension officer, Range Forest Officer, school teacher, some technical experts from colleges/Universities/ Research Institutes and workers of local voluntary agencies. Obviously, with their multifarious duties the Government officials may find it difficult to devote enough time to these exercises. Hence, while the BDO ought to initiate them, a team of local school and college teachers, voluntary agency workers and others should be established to do justice through full participation in these appraisals. Funds should be earmarked and other procedural problems worked out to make this possible.

BOX 9

FEATURES OF EXPLORATORY ECO-SERVICES APPRAISAL

AIM	- To identify ecosystem services relevant to different social groups - To identify problems associated with these ecosystem services - To identify opportunities for enhancing ecosystem services - To initiate a process of dialogue between villagers and outside agencies
TEAM	- Block level officials - B.D.O., Agricultural Extension Officer, Range Forest Officer - School teachers, Technical Experts from Colleges, Universities, Research Institutes - Voluntary agency workers - Village Community members representing landless, women, artisans, farmers - Total : 5 - 10 outsiders + village community members
METHODS	- Collection of secondary data, maps - Visual observations - preparation of field maps, charts - Group discussions - Interview of key persons - No detailed statistical sampling/analysis - minimal quantification
TIME	About 5 days
TARGET GROUPS AND AREAS	- Different social groups-landless, women, artisans, farmers - Land area - crop, non-crop, wasteland, forest, roads - Livestock, Fisheries - Water bodies - stream, tanks, wells

6.2 The exercise of this team, expected to occupy 5-10 days should include the following elements :

(a) Acquisition of secondary information about the village, including statistics and maps.

(b) Initial exposure meeting with Village Community.

(c) Village mapping - maps for soil variations, land use, water resources (on the surface and underground), main categories of trees in public and private lands.

(d) Walking through all the hamlets making up the village, inviting and organizing local participation in the survey.

(e) Discussing the secondary data, including maps with the team thus constituted, incorporating corrections suggested by them.

(f) Identification of the microwatersheds, listing the landscape elements, i.e elements of the village ecosystem, as well as classification of seasons including locally significant periods.

(g) Walking over the entire territory with as many members of the team as possible, holding small group discussions, mapping the occurrence of all landscape elements, eco-services rendered by them, discussion of changes in the recent past, current usage patterns and problems associated with each element at different seasons, and occasional years of special difficulty and listing of opportunities for enhancing the eco-services by enhancing resource quality, availability, sustainability and efficiency of resource use. These opportunities pertain not only to physical / biological measures, but also to establishment of appropriate social institutions. Preparation of charts summarising the important suggestions arising in this fashion.

(h) This exploration should lead to two sets of more detailed discussions, firstly with different social groups in the village and finally with the entire village community.

(i) Presentation of the maps, charts and other conclusions as to problems and opportunities to the Village Community. Revision of the material in light of inputs from the Village Community.

(j) Identification and activation of a village Natural Resource Management Agency; discussion as to its functions, duties, responsibilities and the authority it may wield.

(k) Preparation of proposal and its technical scrutiny.

(l) Passing on the prepared material to the District level Multidisciplinary team and the District Natural Resource Management Co-ordination Committee.

6.3 *SECONDARY DATA* : The secondary information of relevance to be collected would include : human population, different communities, land and livestock holding and occupation patterns, livestock composition and total population, land use and cropping pattern, cottage industries, rice mills and other industries, irrigation facilities, streams, rivers, ponds, sea coast, rainfall at nearest station, transport, communication, schools and colleges, drinking water, sanitation and medical facilities, social institutions such as youth and women's clubs, co-operative credit societies, milk-producers' co-operatives etc. Maps are particularly useful. NRSA wastelands maps however have lost much value because they show no contours and few landmarks. Survey of India toposheets are often not available. Emphasis has therefore to be on village cadastral maps. These statistics / maps may be outdated. For instance, there may have been releases of revenue land or encroachment for cultivation on village grazing lands. As a first step therefore this information should be cross-checked with villagers and the local revenue officials.

6.4 The first task after putting together the secondary data and getting to know the terrain is one of recognizing the main elements of the system. With focus on the relationship between human population and ecosystem services, this exercise has to address itself to constituents of the human society as well as components of the ecosystem. The appraisal team must therefore begin by listing (a) Social groups and (b) Eco- elements.

6.5 The human population will have to be classified into main social groups on the basis of following householdwise information :

(i) Holdings of agricultural land
(ii) Access to irrigation sources like streams, canals, ponds, well
(iii) Land under subsistence crops / cash crops
(iv) Ownership of irrigation pumps, tractors etc.

(v) Livestock holding and composition
(vi) Involvement in household industries such as handloom, beedi making, tractor repairs
(vii) Involvement in fishing, ownership of fishing craft and gear
(viii) Involvement in forest produce collection
(ix) Involvement in artisanal activities such as carpentry, goldsmithy, masonry
(x) Employment in unorganized sector as farm labour, maintaining livestock
(xi) Involvement in migration out of village for employment as unskilled/skilled labour.

6.6 It is not required to conduct detailed household by household census to collect this information. The objective is only to recognize the main social groups based on their holding of productive resources, skills possessed by them and dependence on various ecosystem components. This could be accomplished through a discussion with a group of local people as to the main castes / communities in the village, their occupations and their land, livestock and other holdings with the help of the checklist of the points mentioned above. Given this information, it should be readily possible to group the families into appropriate categories. In a small fishing hamlet there may be just one: all may be engaged in fishing on their own catamarans. On the other hand in a larger agricultural settlement it may be necessary to recognize several social groups; for instance (i) larger land-holders with some irrigated land producing cash crops on part of the land, crop by-products meet most of their fuel, fodder needs (ii) small land-holders with no access to irrigation producing rainfed crops for domestic consumption, supplementing their income with some farm labour, dependent on non-cultivated land for fuel and fodder (iii) landless agricultural labourers dependent on farm labour for cash income and non-cultivated land for fuel (iv) landless shepherds living in the village during the rainy months grazing sheep on non-cultivated lands, also dependent on non-cultivated land for fuel; migrating in the dry season with sheep to other tracts for grazing sheep on stubble (v) blacksmith-cum-carpenter fabricating/maintaining agricultural implements; (vi) basket weavers partly dependent on farm labour; dependent on non- cultivated land for bamboos, fuel etc.

6.7 Apart from such householdwise classification, men and women generally relate quite differently to the natural resource base. For instance collection of water for domestic use from a stream, and fuelwood from forest areas may be entirely women's responsibilities. These responsibilities may be especially relevant in case of landless labourers, shepherds, basketweavers; the farmers may be able to obtain water from their own wells and fuel from crop by-products. Women from the weaker sections of the community must therefore be recognized as a separate social group.

6.8 This exercise of listing social groups has to be complemented by a classification of the ecosystem components - the landscape elements. This classification of landscape elements will have to be based on :

(i) *Topography and water regime*: The different microcatchments within the village boundary. Upper catchments, river valley or stream channels, ponds, reservoirs, wells etc.

(ii) *Plant cover*: Natural or man modified plant cover such as closed canopy forest, tree savanna, scrubland, grassland, Parthenium patch etc., as well as husbanded vegetation such as cereal crop, tree crop, ornamental plants in house compounds etc.

(iii) *Social control* : Land / waters under private ownership, under legal dispute consequent on enactment of land reform, being cultivated by a tenant farmers, under control of revenue department being treated as open access grazing land, under control of forest department being treated as open access land for grazing and fuelwood collection, under control of forest department with very restricted access to villagers etc.

(iv) *Eco-services performed* : Land / water element serving as a catchment of a tank, for cultivation of crops for export of commodities such as cotton, cultivation of crops such as bajra for domestic consumption, grazing of livestock, fuelwood and small timber collection, collection of minor forest produce such as resin and bark, roads, provision of irrigation for cultivation, bathing and drinking water for cattle and buffaloes, drinking water for domestic use, house building sites etc.

6.9 It is possible to go on finely distinguishing a number of landscape element types and of course individual patches of each type, just as it is possible to differentiate social groups in a finer and finer fashion. A very exhaustive and detailed classification is not necessary for the purpose of micro- planning. What would be useful is to recognize 5 - 20 or so major landscape element types along with the 1 - 5 or so microcatchments that may be involved. It is important to note the local terms used for describing different landscape elements.

6.10 A main focus of the appraisal exercise is to look at the eco-services, the problems plaguing them, and opportunities for enhancing the eco-services. The next task would therefore be to inventory the eco-services significant to the population of a given village. For this purpose, a preliminary checklist such as follows may serve as the starting point.

(a) Cultivated land

(i) Soil as a substratum for plant production
(ii) Moisture for supporting plant production
(iii) Plant produce as commodities for market
(iv) Plant production as food for domestic consumption
(v) Crop by-products as domestic fuel
(vi) Crop by-products as fodder
(vii) Crop by-products as construction material
(viii) Crop by-products as thatch
(ix) Crop by-products as organic manure
(x) Crop by-products for other uses eg. banana leaves as plates

(b) *Non-cultivated land*

(i) Catchment for streams, rivers
(ii) Catchment for irrigation tank
(iii) Source of leaf manure
(iv) Source of fuelwood
(v) Source of fodder for grazing livestock
(vi) Source of tree leaf fodder for livestock
(vii) Source of small timber
(viii) Source of minor forest produce such as resin, nuts, tendu leaves, medicinal herbs
(ix) Source of food such as wild mangoes, tubers, meat like hares and porcupines
(x) Source of plant material like bamboo, cane for basketry, mat weaving, rope making
(xi) Paths, roads
(xii) Building sites

(c) *Water courses such as streams, canals*
(d) *Stagnant water such as ponds, reservoirs*
(e) *Sea*
(f) *Wells*

(i) Irrigation for crop production
(ii) Drinking water
(iii) Bathing, washing clothes, vessels
(iv) Fish production, shell fish production
(v) Drinking and bathing domestic animals

(g) *Domestic livestock*

(i) Dung as manure
(ii) Draught power
(iii) Milk and meat
(iv) Leather, wool, hooves, horns.

6.11 An inventory of the ecosystem components including especially the locally prevalent categories should be complemented by an inventory of the major seasons as perceived by the local people. These seasons would depend on rainfall, temperature, cropping cycle, cycles of grazing, cycles of fishing, periodic migration of local people in search of grazing grounds, employment etc. Local names for the seasons and major landmarks in the calendar eg. initiation of harvesting operations, communal hunt etc. should be recorded.

6.12 Armed with this inventory of elements of landscape, water bodies and seasonal cycle the team should physically cover the entire village territory. While thus covering the terrain the discussion should focus on :

(a) eco-services provided by each landscape element in different seasons
(b) significance of these eco-services to different social groups
(c) any signs of decline in these ecoservices in the recent past
(d) problems of inadequacy of such eco-services due to physical/biological degradation or disabilities of social institutions
(c) opportunities for enhancing the ecoservices through physical/biological treatment or improvement in social institutional setup.

6.13 An illustrative list of eco-services on which the present programme would focus, the kinds of problems of physical / biological degradation and options of physical / biological treatments that may be considered is shown in Box 10. This is only a partial list meant to indicate the possibilities. There are undoubtedly many other well known as well as locally adaptive traditional solutions. Furthermore this list only focusses on issues of particular relevance to NWDB programmes; other problems and treatments outside of this frame of reference may of course be very significant in a variety of other contexts. A chart on the lines of Box 10 (See following page) would be an important product of the appraisal team for each village. The appraisal team should also prepare another chart of seasonal changes in the village ecosystem including the crop calendar, patterns of fuelwood collection and grazing, labour availability and unemployment.

6.14 *PREPARATION OF MAPS AND CHARTS :* Maps and charts would be other important products of the appraisal team's survey. Where NRSA or village cadastral maps are available the information collected may be superimposed on them; there should be a hand drawn sketch map prepared as well. In addition, one or more schematic cross-sections indicating the land use pattern in relation to the topography and water bodies should be prepared. Both the map and corss sections should indicate water courses, ponds, patches of irrigated and dry land, wasteland, forest land etc. For each of these may be given an indication of problems and treatments. This material would then be presented firstly before the different social groups and ultimately before the full village community. The consensus reached in theVillage Community should form the basis of the first draft of the village microplan.

6.15 It would be desirable to explore in depth during these discussions the possibilities of choosing a wide diversity of plant species; trees, bamboos, shrubs, herbs, grasses for inclusion in the proposed treatments. The villagers should be encouraged to recall the whole range of plant species uses, from fuel to construction of implements to medicines with which they are familiar and to consider the possible role of a variety of species in the wastelands development programmes. It should be suggested that they also consider the possibility of earmarking an area of a few hectares preferably in the centre of the largest patch of public lands to be stocked with a wide diversity of indigenous species and to be totally protected and maintained as a reservoir of plant resources for the future. It may be explained that such a system is widely prevalent in the state of Manipur, where the village woodlot (locally called "supply forest") is associated with a fully protected sacred grove (locally termed "safety forest").

6.16 *NATURAL RESOURCE MANAGEMENT AGENCY* There is abundant evidence that the physical / biological treatments considered above, while necessary in many cases, are by no means sufficient to solve the problems. The problems equally, or even more urgently, require proper social organization for a variety of purposes. It may be neccesary to :

BOX 10

ECOSERVICES - PROBLEMS AND TREATMENTS

S. No	Eco-service	Problem	Treatments
1.	Soil as a substratum for plant production	Soil erosion, landslides	Contour bunds, planting khus grass
		Chemical pollution of soil by mine tailings	Planting tree species tolerant to mine wastes
2.	Availability of moisture to support plant production	Rapid run-off, formation of lateritic hardpan, low organic matter	Nala bunds, plantation of hardy tree species
3.	Water as a source of irrigation for cultivation	Lack of irrigation to raise a second crop	Improvement of water availability by constructing a check dam
		Silting up of tank, pond	Desilting
4.	Water as a substratum for fish production	Water pollution	Industrial effluent control measures
5.	Water as source of drinking water	Fecal contamination, microbial pollution of village pond	Sanitation, treatment of drinking water
6.	Water for bathing, drinking, for live stock	Drying up of village pond in summer	Soil/water conservation mea sures in pond catchment
7	Wild fruit as a source of nutrients/income	Depletion of forest trees	Planting of fruit trees along roads
8.	Woody matter as domestic fuel	Non-availability of village woodlot	Installation of fuel efficient chulhas
			Biogas plants
9.	Natural grass growth as fodder	Overgrazing of village gomal leading to replacement by non-palatable species	Planting of fodder trees like Subabul along farm bunds
10.	Leaf manure for agriculture	Depletion of tree growth in protected forest	Afforestation with appropriate tree species
11	Bamboo as raw material for basketry	Over-exploitation by paper industry	Bamboo plantation around village pond
12.	Woody material for agricultural implements	Depletion of tree growth in protected forest	Afforestation with appropriate species
13.	Palm fronds as thatching material	Depletion of palm growth along water-courses	Treatment of thatch to improve its life
14.	Dung as a source of nutrient for farmland	Pressure to use dung as fuel	Installation of biogas
15.	Stones for house construction	Depletion of stones from nearby quarries	Compacted soil-cement blocks as construction material

(a) Impose proper restraint on in-group members to ensure that renewable resources are not overharvested, eg. fuel extraction from village woodlot is maintained within limits. This is for instance accomplished in well run Ban panchayats of Almora.

(b) Exclude out-group members who might overharvest renewable resources, eg. harvest timber at too early a stage from the Sal regeneration areas under protection by village forest protection committees of West Bengal.

(c) Contribute labour to maintain a community asset, eg. guard village woodlot, or undertake periodic desilting of village irrigation ponds as has been the tradition with many south Indian villages.

(d) Carry out routine timely maintenance of community assets such as check dams.

(e) Organize equitable sharing of the benefits such as irrigation water from ponds as has been accomplished by the Pani Panchayats of Western Maharashtra.

(f) Ensure that Government department / outside contractors undertaking any physical / biological treatment such as construction of bench terraces or raising a bamboo plantation carry out the task as stipulated. Today there is no such independent monitoring function; and this needs to be introduced.

(g) Organize local labour to take up treatments locally to the extent possible, eg. in construction of percolation tanks or raising tree plantations. Some local level organizations of this type have developed in connection with the employment guarantee scheme in Maharashtra; etc.

6.17 That the management structure was inadequate, and the planning methodology was not properly worked out were two of the identified shortcomings of the earlier Wastelands Development Programme. For the purposes of microplanning, the effort to make good these deficiencies translates into setting up or re-vitalising village institutions to plan and implement programmes. This has now been explicitly recognized and the new programme of the National Wastelands Development Board would have to make this a thrust area of its activities. The appraisal team should therefore not only address itself to physical / biological problems and treatments, but also to the appropriate form of social institutions required to carry out these tasks. It is therefore necessary that the details of the constitution and function of the village level natural resource management agency (VNRMA) should be discussed first with the different social groups, and finally in the Village Community. A consensus should then be arrived at, and an initial VNRMA set in motion.

6.18 As a part of the initial data generation and through discussions with the different social groups the team should collect the following information :

(a) What are the traditional resource related community decision mechanisms in the village ? Do villagers now, or have they in recent past been making collective decisions regarding issues like use of panchayat land, grazing on village gomal land, desilting of the village tank etc ? If so, can the group thus making decisions be transformed into an effective VNRMA with some changes ? If so, what are the changes required ?

(b) Is there any other co-operative decision making institution in the village such as a co-operative credit society ? If so could this become a starting point for a VNRMA ?

(c) Can the yuva mandals or mahila mandals working in the village serve as, or contribute to the establishment of, a VNRMA ?

(d) What are the likely constraints in the functioning of a VNRMA? These could be partly internal, eg. factionalism within the village. What are the ways of overcoming such constraints and ensuring that the interests of the weaker sections are protected?

(e) What are the likely constraints in the functioning of the VNRMA resulting from its interactions with outside agencies such as a panchayat or the state forest department ? What assurances as to its rights and authority should these outside agencies give to ensure that VNRMAs function effectively ?

(f) What authority would the VNRMA need to ensure that it can exclude outsiders from destroying the village's natural resource base ?

(g) What authority would the VNRMA need to ensure that it can enforce discipline on in-group members ?

(h) What authority would the VNRMA need to successfully resolve any conflicts that may arise with neighbouring VNRMAs ?

(i) What checks and balances are required to be set up so that the VNRMA functions effectively and does not mismanage the resources? In particular how can the full Village Community monitor the functioning of the VNRMA ? Also how can the District Natural Resource Management Co-ordination Committee fruitfully interact with the various VNRMAs in the district ?

6.19 *PREPARATION OF OPTIONS SET BASED ON PERCEPTIONS OF THE COMMUNITY :* Since independence all the developmental plans, and programmes are worked out and funds allocated in Delhi or the state capital. Even the number of villages to be covered, number of households to be covered as beneficiaries, area to be covered, the technique to be used, the mode of implementation and monitoring, in fact every aspect is sometimes finalized by the central or state level officials. In this process there is no scope for any traditional systems or technologies to figure in the programmes. As a result inappropriate technologies, approaches and systems are often forced on the rural community. History is littered with such failed schemes or programmes. Happily now there is a greater appreciation of traditional technologies (like water harvesting or afforestation systems) and traditional management systems (e.g. forest panchayats).

BOX 11

PREPARATION OF OPTIONS SET AND PRIORITY LIST OF THE COMMUNITY

AIM	- To generate options set for the problems relevant to each social group by eliciting their opinions - To get some idea of the implications of each option - To prepare priority list for each social group
TEAM	- Village community members - Block level officials - Voluntary agency worker - School, college teachers, technical experts
METHOD	Group discussion with different segments of the village community - using the maps, diagrams, data collected during the exploratory survey
TIME	5 to 10 days
TARGET	Discuss separately with landless, women, farmers, artisans, forest produce gatherers etc.

6.20 Even for a given problem the solutions will vary for different social groups in the village. For example, to overcome cooking fuel scarcity a biogas plant may be appropriate for a large farmer and inappropriate to a landless person who may own no cattle. Similarly species choice for a village forest would vary for artisans and large farmers. Thus there is a great need to give scope for the opinions of different social groups especially the weaker sections before arriving at a consensus in the Village Community.

6.21 It must be stressed that even if many suggestions as to options have been thrown up during the exploratory walk by the appraisal team around the village, it is worthwhile for the team to have discussions with each group in the village using the data collected and maps/diagrams prepared. Each social group could be probed on the implications of the option they suggest. As a result of this exercise, the appraisal team will prepare a list of options suggested by different social groups for each problem. It may so happen that different groups may suggest totally differing or conflicting options for a given problem. For example species for the community forest may differ for landless, artisans and large farmers.

It is necessary to inform the village community that there will necessarily be constraints especially of a financial nature. Hence each social group should be asked to provide their list of priorities with respect to the options set. The priorities of different communities may vary

PROBLEM	COMMUNITY	SOLUTION SUGGESTED
	Women Landless Artisans Farmers	

PRIORITIES OF DIFFERENT COMMUNITIES			
Women	Landless	Artisans	Farmers

6.22 The end of discussions with the different social groups would bring on the next phase, namely, discussion with the assembly of all adult members of the village or Village Community. It is desirable that in NWDB programmes the Village Community comes to play a vital role as it does today in the Panchayat raj system of Karnataka State. In Karnataka the Village Community meets at least once in 6 months along with all the Panchayat members, Pradhan and the Government officials. The Village Community should similarly meet at the initiation as well as the end of the work of the appraisal team with the Government officials available for explaining the financial and procedural framework within which the options set should be identified. Ideally a voluntary agency worker or one of the villagers who has actively participated in the appraisal should conduct the proceedings. These would involve an explanation of :

- *methods followed in appraisal,*

- *methods followed in preparing the options set and the priority list,*

- *the problem set and options set suggested by the team and the options sets selected by different social groups,*

- *the social economic and environmental implications of the options set,*

- *the constraints especially financial within which decisions have to be taken, right at the beginning.*

The meeting should:

- *allow time for discussion,*

- *raise various questions regarding the implications,*

- *specifically raise the issue of need for institutional set up required for implementing the selected options set,*

- *finally let the Village Community make the selection of options set as well as the priority set,*

- *prepare a list of options selected and institutions suggested for tackling each problem by the Village Community.*

6.23 The work of the initial appraisal team, which may appropriately be termed "participatory eco-services appraisal" would then culminate with the Village Community providing its consensus on the physical / biological treatments and the social institutions it considers appropriate, as well as the Village Community's perception of priorities. The approach outlined here follows in many ways the experiments at Participatory Rapid Rural Appraisal in Gujarat as carried out by the Aga Khan Rural Support Programme (India) *(McCracken, 1988)*. Its distinctive features are a focus on ecosystem services, the emphasis on involving local people and addressing with care the issues of appropriate social institutions

6.24 A major issue to be discussed in the Village Community at the time of deciding on the nature of the Village Natural Resource Management Agency is that of equitable sharing of the benefits expected to accrue. The first step would be to decide on the criteria of sharing of benefits. Often, under social forestry schemes, community plantation programmes are undertaken without any guidelines for sharing of produce. This has serious negative consequences. Hence, in the wastelands development programmes it is essential to decide on the guidelines right at the beginning on sharing of benefits;especially of biomass and water

BOX 12

CRITERIA FOR SHARING BENEFITS

1. Certain trees (like tamarind, pongamia) yielding useful products should not be felled - only seeds or leaves and fallen things to be used.
2. Local demands must first be met. Any surplus could be marketed outside - decision by Village Community.
3. Distribution of produce - depending on the contribution to resource generation, household requirements. One possible solution is :

Fuelwood	:	per capita basis, extra share for house-holds participating in watchman duty
Fodder	:	per animal basis
Timber	:	per house basis
Leaf manure	:	per ha basis
Water	:	per ha or per capita

4. Another option is to distribute everything on per capita basis, equitably among all ; even landless will get water which they can barter to farmers
5. The final decision should be left to the Village Community.

Some guidelines for sharing of the benefits could be suggested but the Village Community should take the ultimate decision. The thrust should be on meeting the needs of landless, artisans and marginal farmers and on appropriately rewarding those accepting some responsibility such as watchman duty. However to avoid social conflict it may be desirable to adopt an equitable distribution on per capita or even per livestock basis.

6.25 *PREPARATION OF MICRO-PLAN* : This finalisation of the priorities to be accorded to different possible physical/biological treatments and the constitution, functions and responsibilities of the Village Natural Resource Management Agency with the Village Community will set the stage for the preparation of the microplan by the appraisal team. Such a microplan would include:

(i) A brief description of the physical setting of the village. Topography, geology and soils. Climate especially rainfall. Water regime, microwatersheds, streams, rivers, ponds, sea-coast. Land use and cropping pattern. Animal husbandry. Grazing practices. Household level and other industrial activity. Transport. Communication. Educational institutions. Youth and Women's clubs. Co-operative credit society: Milk-producers Society. Other social institutions.

(ii) A list of major ecosystem elements and the significant eco- services obtained from each.

(iii) A sketchmap of locality showing major landscape elements.

(iv) A cross-section of locality showing major landscape elements/other ecosystem elements.

(v) Human population. Major social groups. Characteristics of each social group in terms of land ownership, access to irrigation, mechanization of farming, cropping pattern, involvement in any local industry, household industry, artisanal or service activity, fishing, collection of forest produce, education, other skills possessed, under-employment or unemployment problems, sources of water for various uses, sources of biomass for use as fuel, fodder, small timber, thatch, medicines, raw material for agricultural implements, baskets, mats etc.

(vi) A table indicating seasonal patterns of agricultural, animal husbandry, fishing, artisanal activities, employment opportunities, outmigration, availability of water, fuelwood, fodder, other biomass needs.

(vii) A table of interlinkages between different ecosystem components.

(viii) A table indicating ecosystem services of special significance for the different social groups.

(ix) A discussion regarding the various traditional systems of natural resource management in that village and their present status.

(x) A discussion of changes in the status of different eco- services in recent years, current usage patterns affecting the services, problems relating to the services.

(xi) A statement of the priorities accorded by different social groups to various treatments for enhancing eco-services.

(xii) A chart indicating the priorities arrived at as a consensus in the Village Community to various treatments for enhancing ecoservices. If no consensus seems possible on some issues, an indication of the divergent viewpoints should be provided.

(xiii) A discussion of the proposed constitution, functions and responsibilities of the village level natural resource management agency as arising out of the discussion in the Village Community.

6.26 This document must be in the local language so as to be accessible to the local people. One or more local school teachers and if available, workers of voluntary agencies should be associated with its preparation. One copy of the proposed microplan should be deposited with the village school, one copy with the concerned panchayat office and one should be forwarded to the office of the District Natural Resource Management Co- ordination Committee. Sections xii and xiii of this document would be of particular interest to the local people. Several copies of these should be made available to them.

7. CRYSTALISING DISTRICT LEVEL PLANS

7.1 The initial surveys would intimately involve local people, school teachers, block level Government functionaries as well as some college teachers, voluntary agency workers and other technical experts Each such group of outsiders would therefore be responsible for one compact cluster of villages. Such survey could therefore be launched all over the district simultaneously. Supposing that each initial survey takes 6 - 10 days of field work and 2 - 3 days of final report preparation, a cluster of villages could be covered in 3 - 4 months.

7.2 The village microplans thus generated should be further looked into by the District Natural Resource Management Co- ordination Committee. Such a committee would comprise the district level Multidisciplinary team headed by the District Collector (or other District Head of development machinery), and a group of technically competent Government officials representing sectors like forest, soil and water conservation, fodder development, non-conventional energy sources, along with some technical experts from colleges within the district and Universities and Research Institutes concerned with the district plus representatives of voluntary agencies working and some school/college teachers. Members of such district committees would also have participated in the preparation of a few village microplans themselves.

7.3 The district level team would be in a position to take a district level overview in terms of :

(a) Implications of the national framework of agro-climatic region-based planning for management of natural resources within the district
(b) Priority needs common to villages in different agro-climatic zones of the district
(c) Areas of possible surplus and deficit within the district,
(d) Variety of inter-village disputes as to boundaries between villages, ways of managing areas away from habitation but utilized by people from several different villages etc. that may arise and best ways of resolving them,
(e) The interactions between the rural and urban populations within the district and best ways of organizing these,
(f) The impact of commercial - industrial demands, originating both within and outside the district, on the eco-services for the rural people and the best ways of alleviating any negative impacts; and
(g) Technical support required for the major development programmes in the different village clusters.

7.4 It will be the task of the district level team to synthesize the district level information and with the superior technical knowledge at its disposal, provide broad guidelines as to the physical / biological treatments and institutional structures appropriate to the district, as well as suggest ways of best resolving a number of possible conflicts that may arise. We believe that it is important that there should not only be no rigidly formulated schemes at the all-India level, but not even at the district level. At all India level it makes no sense, for instance to lay down that one hectare of afforestation work should include certain standard components and cost around Rs. 5000. After all the daily wage rate prevalent in the drought prone districts of Karnataka is as low as Rs. 4 in off season; while that in Kerala is over Rs. 30. Furthermore the hilly, hard rock terrain of Kerala requires a very different kind of effort compared to the undulating plains of Karnataka. We believe that the same principle extends to the district level; and no rigid guidelines are called for. Instead each Village Community and village Natural Resource Management Agency should be indicated the general nature of programme formulated at the district level, the quantum of money available from state / central level and after indicating additional options available due to technical developments that the villagers may not be aware of, left to decide on the programmes The Village Community should be the ultimate authority to select the programmes to be taken up in each village.

7.5 The technical departments would have to furnish the required knowhow and other assistance at this stage in finalizing the precise details of physical / biological treatments, which may range over

(a) exact location and structure of nala bunds,
(b) tree species appropriate for growing on panchayat land,
(c) exact location and design of a community biogas plant, and so on.

7.6 This may involve some further data collection for the specific purpose. Apart from technical personnel, local high schools and colleges could be most fruitfully involved in this exercise. Examples of data to be collected, methods to be used and who could possibly collect the data are given in the next few pages. A ready reckoner of data to be collected and methods to be adopted could be prepared for each scheme or programme and provided to the local official teams as a part of further material to be prepared for use by field level implementers.

TREATMENT : - *CONTOUR LINE TRENCHES*

INFORMATION	SOURCE	AGENCY
Area of the patch	Field survey of the land	Technical Team
Contour line map	Contour line survey using Tilting level method Tube method (Simple)	
Labour required for digging contour trenches	From forest department From labour contractors	
Local labour availability for digging trenches	Survey of representative households	
Cost of trench preparation	From forest department	
Man days or time required for completion of trenching	Labour contractors	

TREATMENT : *FARM POND*

INFORMATION	SOURCE	AGENCY
How much water to be stored or required	Number of irrigations required from farmers or experts	College/School Students
Area to be irrigated	If for nursery find out water requirement from forest department	
Area of catchment	Land survey	
Area of catchment	Farm map Land survey	

TREATMENT : *COMMUNITY BIOGAS PLANT*

INFORMATION	SOURCE	AGENCY
Biomass requirement estimation	- Fuel, fodder, timber, leaf manure requirement for the community could be estimated by considering data from various agencies in that zone	Data to be provided by the technical experts
	-Biomass requirement of artisans could be estimated by conducting sample survey of different artisans and census survey of number of artisans	Students
	-Number of houses built per year could be estimated by	

TREATMENT: *COMMUNITY FOREST FOR BIOMASS NEEDS*

INFORMATION	SOURCE	AGENCY
Human population householdwise	Household survey	Census
Cattle population householdwise	Sample measurement	School students
Dung yield using spring balance		
Biogas requirement	Studying the biogas consumption per head from family biogas plant in the nearby village with known volume	

8. IMPLEMENTATION

8.1 The process of planning cannot be divorced from that of implementation and monitoring. Instead it should be a dynamic process continually receptive to feedback in the course of implementation and open to mid-course correction. We must continually seek ways to promote such adaptive learning.

8.2 Box 13 indicates some of the possible options for implementing the NWDB programmes. The last route has by and large been the one followed so far. It has failed to deliver the goods and the time has come to explore other options such as the first four given in Box 13. While the aim should ultimately be to move to option 1, it may be necessary to temporarily adopt options 2 to 4, while attempting to switch over towards options closer to 1.

BOX 13

OPTIONS FOR IMPLEMENTING THE PROGRAMME
1. Place all funds and authority at the disposal of Village Natural Resource Mmanagement Agency which would execute the programmes.
2. Place all funds and authority at the disposal of the Panchayat which would organize the implementation with the help of its constituent Village Natural Resource Managment Agency.
3. Place all funds at the disposal of a Voluntary Agency which would liase with the Panchayat / Village Natural Resource Management Agency and implement the programmes
4. Place all funds at the disposal of various Government departments which would liase with the Panchayat/Village Natural Resource Management Agency and implement the programmes
5. Place all funds at the disposal of various Government departments which would implement the programmes on their own

BOX 14

GUIDELINES FOR IMPLEMENTATION	
VNRMA	- should ideally come to implement all programmes at the field level
PANCHAYAT	- should liase with VNRMAs
GOVERNMENT DEPARTMENTS	- should provide all necessary technical backup for the programmes being implemented.
VOLUNTARY AGENCY	- it could work with VNRMAs especially in motivating people and creating awareness. Alternatively it could take up the implementation on its own.
SKILLED LABOUR	- First option is to train local people If local people not interested - only then hire outside labour
MANUAL LABOUR	- First preference for local labour
CONTRACTOR	- Avoid as far as possible If unavoidable,hire contractor from within panchayat
DISPLAY OF INFORMATION	- It is necessary to periodically display the receipt of funds, expenditure of funds, quantum of work completed at VNRMA and panchayat offices
PRESENTATION TO VILLAGE COMMUNITY	- Periodically, say once in 3 months, call aVillage Community meeting and inform community of the progress made, funds spent etc.

8.3 *FLOW OF INFORMATION* : Generally when government funded schemes are implemented, the village community and often even the panchayat members are not informed about the funds sanctioned and funds spent under different heads. One way of ensuring efficient and proper use of funds is to provide full information on each of the government as well as panchayat funded programmes implemented by Government departments, Voluntary Agency or Village Natural Resource Management Agency to the community. This could be achieved in two ways; firstly, by informing the Village Community of details of the programme, the funds allocated, contractor assigned, time schedule given, funds spent periodically etc. Secondly, this information should be displayed on the notice board of the VNRMA and panchayat offices. This would enable the people with a real stake in the success of the programme to gauge the extent of work done and the corresponding expenditure of funds and to correct any distortions. Display of such information is necessary for all programmes of NWDB.

9. CONCURRENT EVALUATION

9.1 Lack of people's participation and lack of monitoring/evaluation independent of the executive machinery are two of the major shortcomings of many current development programmes. The two are closely linked and the institutional structures proposed above for peoples' participation could play a very useful role in the evaluation process. The process would consist of evaluation of technical, social and financial aspects of programme implementation.

9.2 Monitoring and evaluation is relevant in several contexts :

(a) Ensuring that the physical / biological treatments are effectively carried out.
(b) Ensuring that the institutions expected to be set up are actually in place.
(c) Ensuring that social benefits reach the groups of people for whom they were intended.
(d) Ensuring that funds are not misappropriated.
(e) Continually devising better ways of achieving better results in the light of experience.

BOX 15

MAJOR FACTORS TO BE MONITORED : SOME EXAMPLES		
1.	PHYSICAL PARAMETERS	- Number of trenches dug - Survival rate of seedlings
2.	FINANCIAL PARAMETERS	- Money spent to prepare land/ha. - Wages paid / man / day
3.	SOCIAL FACTORS	- Functioning of institutions - Who is receiving the benefits
4.	FLOW OF BENEFITS	- Quantities harvested - Sold or used locally

9.3 As of today only the function of financial monitoring is performed, unfortunately rather ineffectively, by audit procedures. These undoubtedly will continue. What is more essential however is to fulfill the other function. We believe that this could be accomplished through a series of checks and balances involving the Village Community, the Village Natural Resource Management Agency, the Panchayat and the District Level Natural Resource Management Co-ordination Committee. If all these levels have completely free access to information as to funds earmarked for various purposes, the treatments planned, institutional structures proposed to be set up and the actual performance under field conditions, then their interaction ought to promote effective performance.

9.4 Currently when the programmes are implemented senior officers make cursory visits to the site and auditors only scrutinize the accounts papers, long after the work is executed. What is required is participatory monitoring. Only those who have a real stake in the programme would monitor the implementation effectively. Two questions that arise are what to monitor and how to monitor ?

9.5 It is of course necessary to define the parameters to be monitored for each programme and precise methods to be adopted for concurrent evaluation and for bringing about mid-course corrections. The Manuals to be prepared for the field execution of these programmes would provide the pertinent details. The intention is to ensure continual evaluation of the performance at the two levels of the Village Community and the District Natural Resource Management Co-ordination Committee. The suggestions emanating in all Village Communities should travel to the DNRMCC. On the basis of these, and its own observations, the DNRMCC should suggest improvements in the vil-

lage microplans. These would obviously become more and more necessary as the field situation changes due to changes in the resource base, technological advances and as the Village Natural Resource Management Agencies gather experience and strength. The village level microplans should therefore function as rolling microplans, with continual adjustments and continual transfer of more and more responsibility from Government departments to people's agencies.

10. THE WASTELANDS DEVELOPMENT PROGRAMME AND MICROPLANNING

10.1 In the earlier sections,the broad outline of the NWDB's programme for wastelands development were described. Since wastelands development can include a variety of measures comprising physical and biological treatment, soil and water management etc , a number of Government programmes with varying objectives related to wastelands development are carried out by a number of different departments. For instance, the Central Department of Agriculture & Cooperation administers schemes for tree planting and soil conservation with a view to increase food security The Central Department of Rural Development operates programmes in drought prone and desert areas in order to develop land and water resources and to provide employment and incomes in rural areas. In addition, State Governments operate a number of programmes and projects for tree planting and afforestation in order to bring wastelands into productive use and to meet rural needs for biomass, incomes and employment.

10.2 It is not the intention here to go into the details of programmes of the other Central Departments or of State Governments However, it is considered necessary to describe the schemes operated by the NWDB as activities under these schemes may form part of the micro-plan. The NWDB operates 8 schemes The details of these schemes are given in *Annexure I*. These schemes cater to various facets of the NWDB programme and are implemented by State Government Departments, Voluntary Agencies etc. One of these schemes, namely the Integrated Wastelands Development Projects Scheme includes, as part of its activities, preparation and funding of micro plans prepared through the micro planning process. The selection of districts for microplanning is done inter-alia on the following basis:

* The districts should be mapped under the National Wastelands Identification project.
* The districts should be well spread out from point of view of agro-climatic considerations
* The districts selected should represent a cross section of the different categories of wastelands
* The districts should preferably have NGOs and institutions providing technical inputs.
* The State Governments should give their consent for the initiation of microplanning in the selected districts.

A list of the districts selected so far is in *Annexure II*

Once the districts are selected, dialogue is initiated with the district administration for formation of Multi-disciplinary teams, selection of project areas, training of personnel, association of NGOs, technical institutions etc. so that the microplan can be prepared in an integrated manner. To enable the expense of microplanning (survey, preparation of documents etc) to be met, NWDB gives a grant to the DRDA. NWDB also facilitates the organisation of training for various level of staff.

10.3 The microplan is expected to be a detailed document for the micro-watershed/habitation unit, proposing a comprehensive treatment under all relevant disciplines. It is expected that funding of those portions of the microplan which do not relate to wastelands development would be done under the relevant sector from other central or state schemes. Funding of activities directly related wastelands development will be undertaken by the NWDB under one or more of its schemes. The intention behind preparing the micro-plan is to ensure that the

development activities are integrated suitably and at the same time sufficient flexibility is available to take into account location specific problems.

The microplan is also not perceived as a one time exercise. As the microplanning skills develop, more and more areas can be taken up. The NWDB's preference is for intensive coverage of selected districts rather than to spread the available funds too thinly. However, since the principles of microplanning can be applied as part of normal implementation of projects under the programmes of NWDB as well as other schemes and by governmental as well as non-governmental organisations, it is hoped that is these guidelines will be useful in a wide variety of circumstances.

Annexure I

SCHEMES OF THE NATIONAL WASTELANDS DEVELOPMENT BOARD*

From 1990 onwards, the NWDB is operating 8 Schemes, 5 of them exclusively through State Governments. The following is a brief description of the Schemes :-

1. *THE INTEGRATED WASTELANDS DEVELOPMENT SCHEME*

The Scheme is implemented mainly by State Governments, but NGOs with requisite capability may also execute projects. The basic objective of the scheme is to enable the start of pilot projects at the field level in the States : These projects embody an integrated approach to land management and wastelands development, based on *village/micro-watershed level plans* prepared after taking into account land capability, site conditions and local needs. It is thus hoped to promote optimal landuse for both ecological and socio- economic needs.

The scheme also aims at enhancing the content of public participation in the wastelands development programme through mechanisms for people's involvement at all stages and by providing the modalities for equitable and sustainable sharing of benefits arising from such projects. (In particular the Ministry of Environment and Forests' guidelines of 1st June, 1990, regarding involvement of village communities in regeneration of degraded forests can be usefully applied here – these guidelines are reproduced in *Annexure III*)

State Governments would be assisted on 100% grant basis through the Centrally sponsored component of the scheme. Autonomous bodies, Corporations, Voluntary Agencies, Cooperative Societies and other registered institutions would be assisted with 100% grant under the Central sector component of the Scheme. As the programme would be based on area specific planning, any particular project may well involve different categories of wastelands. However, scope is sought to be provided to adopt different techniques and mechanisms to implement the programme in the project area, depending upon the ownership of the land and the model adopted in each case.

Main Activities

The Scheme, being multi-faceted and multi-disciplinary, would attempt the preparation of integrated wastelands management plans at the local level on watershed basis in the 147 districts for which detailed wastelands maps have been prepared and on the basis of available thematic information in the other districts. A list of the 147 Districts is given in *Annexure IV*. The plans could include the following:-

i) Conservation of selected ecologically fragile watersheds of the Upper Catchments through protection, afforestation, pasture land development, soil and moisture conservation, measures etc. Catchments in the Himalayas need to receive special attention
ii) Extension of technologies for special problem lands (private and public) like saline/alkaline soils, ravines, arid and desert areas, mined areas, the Aravallis and the Western Ghats
iii) Regeneration of degraded forest areas principally through natural regeneration but supplemented by plantation, where necessary. Focus will be on raising diverse and indigenous species as well as on providing fuelwood, fodder, small timber, minor forest produce, fruit and fibre to the local communities.

Projects could also include measures such as

i) In situ soil and moisture conservation measures like gully plugging, small check dams, water harvesting structures, and vegetative barriers.

* Based on schemes approved for 1990-91. For more details it is best to consult the offical guidelines issued by the NWDB specially with regard to cost norms which may change from time to time.

ii) Soil conservation measures for eroded lands.
iii) Planting and sowing of tree, grasses, shrub and legume species as well as fodder production and pasture land development.
iv) Promotion of agro-forestry and horticulture, sericulture etc., as appropriate.
v) Scientific animal husbandry and fuelwood conservation measures, etc.

Area selection

Under the National Wastelands Identification Project, detailed wastelands maps showing the location, extent, and different categories of wastelands with reference to village and forest boundaries have been prepared in respect of 147 districts in 19 States of the country*. As decentralised planning for integrated management of wastelands at the village and watershed level is to be the basis of projects under the Scheme, it is necessary to concentrate activities for pilot projects in these districts, where the incidence and location of wastelands has been established through the aforesaid maps. However, in certain districts where the State Government or other project proposing agencies have adequate information on the availability of wastelands which could be taken up under the Scheme, proposals from outside these 147 districts would also be considered. This is necessary because there could be areas having certain special problems for historic reasons, where the size and degree of the problem justifies immediate action even though wastelands maps may not have been prepared. This Scheme would, therefore, encompass all the States in the country with primacy being given to the 19 States and 147 districts for which wastelands maps have been prepared.

Project Management

Where the State Government is taking up project preparation and implementation, it is expected that at the district level an appropriate mechanism would be created. This could be in the form of a multi- disciplinary team (including voluntary agencies where feasible) coordinated by the representative of the Department preparing the project and headed by the Collector, the District Development Officer, Chief Executive Officer, Zila Parishad, or any other such officer that the State Government designates as the overall head of Development Administration in the District. While the line department will assume administrative responsibility for the project and would be accountable for its execution and proper rendition of accounts under the Scheme, it is expected that the district-level multi-disciplinary team would be constituted into a management committee for the project and similar projects in the district.

Projects prepared and submitted by Autonomous Bodies or Voluntary Agenices would be implemented by them but in consultation with the same District Level Management Committee mentioned in the preceding paragraph which is responsible for monitoring other such projects under the Scheme. In case there is no such committee constituted, the DRDA may take up this role.

Utilisation of Usufructs

With regard to forest areas, the projects under the Scheme should ensure the following :-

i) The beneficiaries should be entitled to a share of usufructs to the extent and subject to the conditions prescribed by the State Government in this behalf. The Voluntary Agencies/NGO should not appropriate usufructory benefits for its own use.
ii) Access to forest land and usufructory benefits should be available only to those beneficiaries who get organised into a village institution, specifically for forest regeneration and protection. This could be the Panchayat or the Cooperative of the village, with no restriction on membership. It could also be a village Forest Committee. In no case should any access or tree pattas be given to individuals.

* Annexure IV gives the names of the Districts - for more details regarding the Wasteland Identification Project Please consult NWDB publication : 'Description, Classification, Identification and Mapping of Wastelands' (1990)

iii) The beneficiaries should be given usufructs like grasses, lops and tops and branches, and minor forest produce. If they successfully protect the forest, they may be given a portion of the proceeds from the sale of trees when they mature

iv) The benefit of people's participation should go to the village communities and not to commercial or other interest which may try to derive benefit in their names. The selection of beneficiaries should, therefore, be done from only those families which are willing to participate through their personal efforts.

v) The implementing agencies should in no case use the forest produce for any commercial purpose.

Cost Norms :

i) Under the decentralised planning component, assistance to the State Government would be provided for framing the district micro-plans at the rate of about Rs 1,00,000 per 10,000 ha of project area.

ii) For the Upper Catchments, the expenditure would be restricted to Rs.10,000 per hectare of area to be covered under protection, afforestation, pasture land development, soil and moisture conservation, etc.,

iii) For technology extension on problem lands, the financial assistance from the Central Government under the Scheme would be restricted to Rs.12,000 per hectare of the area to be covered.

iv) For the regeneration of degraded forest areas, Central assistance would be provided to those projects which give primacy to natural regeneration and the expenditure will be restricted to Rs 8,000 per hectare in case of planting and Rs 3,000-4,000 in case of natural regeneration.

2. *SCHEME FOR FUELWOOD AND FODDER PROJECTS:*

The Scheme is implemented through State Governments only, who are expected to bear 50% of the costs

The main objective of the scheme is to promote integrated development of identified watersheds by combining activities like tree planting, agro forestry, silvipasture development, horticulture and soil and moisture conservation with a view to:

(i) Checking land degradation and regenerating degraded lands/wastelands;

(ii) Augmenting production of fuelwood, fodder and forest produce specially from community and degraded forest lands

(iii) Involving the village community/local people in the programme and promoting fuelwood conservation and substitution.

The State Forest department or other State Government agency will identify suitable watersheds to be covered under the scheme. In the process of identification and selection of such watersheds, gram panchayats or other village level bodies will be actively involved. Each project may comprise at least 200 ha and a particular site selected for treatment should not be less than 10 ha. in area.

While preparing a project, the Agency/departments concerned will consult the other concerned Departments like Forest, Agriculture, Rural Development, Animal Husbandry, Horticulture, Soil Conservation, Revenue etc. to eliminate chances of overlapping or duplication of efforts in the identified watersheds. The role of village level bodies will be defined in each project, specially with regard to the management and distribution of produce/benefits from the treated public/community lands

The funding pattern in case of public/community lands will be 50% from Govt. of India(NWDB) and remaining 50% from the concerned State Government.

Cost norms

Central assistance to the extent of 50% from the NWDB will be limited to a maximum of Rs.1500 per ha for soil

conservation works Rs.3500 per ha. for agro-forestry, silvipasture development, horticulture and fuelwood conservation measures and Rs.4000 per ha for tree planting. The overall cost per ha. will not exceed Rs.10000 for the combined activities including the cost of establishment. The cost of establishment and contingencies should not exceed 15% of the total cost.

3. *PEOPLES NURSERIES SCHEME :*

The scheme of Peoples Nurseries is intended:-

(i) To bring nursery raising into the peoples' sector and provide sustained self-employment in rural areas, specially of the rural poor, women and disadvantaged sections individually and through organisations including schools, cooperatives etc

(ii) To make available locally, good quality seedlings of the desired species in requisite quantities within reasonable distances by building up a network of peoples' nurseries.

(iii) To encourage farm forestry etc. as an economically remunerative activity especially on degraded farm lands thereby increasing employment potential and income generation.

The idea is that this will create a peoples' movement for afforestation and produce seedlings to meet fuelwood, fodder, timber and other biomass requirements of local communities; it will also give a stake to the people in local afforestation activities by utilising seedlings produced from such nurseries.

State Government agencies and large NGOs can implement the schemes through grants from NWDB. The modalities for implementation are as follows. Where the NGO can provide the services suggested for the Forest Deparment, it may, with the consent of NWDB, do so as part of the implementation programme.

Main Activities

(i) *Preparation of Block level Plans*: The Forest Deptt. in collaboration with the Block level authorities and Panchayati Raj Institutions at the Block level would prepare a demand supply scenario for the Block and NGOs should be actively associated with the entire exercise. The plan would indicate the requirements of seedlings of various kinds, specially fuelwood, fodder, fruit, small timber, and others for planting on private lands/common lands/revenue lands/forest lands, etc. The choice of species to meet the above requirements should match with the site conditions and local preference.

(ii) *Selection of Nursery Persons*: The nursery persons will be selected by the Forest Department in consultation with village level bodies, preferably in open meetings of the Gram Sabha in a manner similar to identification of IRDP beneficiaries. NGOs should also be associated. Preference should be given to small and marginal farmers etc. as nursery persons. Suitable groups like Mahila Mandals, Youth Groups, NGOs may also be allowed to raise nurseries as group nurseries. The nursery person, once selected will be retained for atleast three years, so that he acquires the requisite skill to raise quality saplings. A nursery man will produce between 25000 to 50000 containerised seedlings; in the case of Group Nurseries, a nursery may produce upto 1,00,000 seedlings.

(iii) *Provision of services and quality control* : Material inputs and requisite extension service for production of quality planting stock will be provided by the Forest Deptt. staff to the nursery persons. The Forest Department will ensure that quality seeds of the requisite species in accordance with the species mix brought out by the Block level plan is available and distributed to the nursery persons. Timely production of the seedlings in the nursery will be ensured by the local panchayat as well as the Forest Department. The Forest Department will also prescribe the quality norms for the seedlings raised and check seedlings supplied by the nursery persons to ensure that standards are met.

(iv) *Disbursement of subsidy*: The nursery person will get the amount of subsidy (in kind or cash) from the Forest Department at suitable intervals, for seedlings of good quality; the Central assistance admissible to State Government shall be limited to a maximum average rate of 45 paise per containerised seedling. (This is likely to be increased from 1991-92).

(v) *Selection of species*: Selection of species must ultimately be dependent on local needs and preferences However, due regard should be paid to need for fuelwood, fodder species, multipurpose species capable of meeting a variety of needs as well as species capable of producing timber for the market. Fruit seedlings can also be raised for mixed planting.

(vi) *Marketing*: Nursery persons should endeavour to sell as many seedlings at their level as possible. If the Forest department feels it necessary, it may fix a sale price for a particular category of species for the nursery persons in the area. The Forest Department should, on the basis of its own planned requirements, lift a percentage of the seedlings from each nursery, predetermined in consultation with the nursery person. However, the seedlings which are still surplus should be handed over to the Forest Deptt. within one month from the commencement of the monsoon/planting season.

The Forest deptt. and the concerned panchayats/village level bodies will strive for proper utilisation of remaining nursery stock raised by the nursery persons in their areas. The Forest department and Panchayats/NGOs will also make all possible efforts to educate local people in order get them to plant more seedlings, thereby increasing demand and making the nursery economically more viable.

(vii) *Making nursery growing sustainable*: In order to make nursery raising economically worthwhile, the following steps will be taken under the scheme:

(a) There will be no free distribution of seedlings by the Forest Deptt. in areas where peoples' nurseries are set up. For this purpose the unit will be the Development Block. State Govts. must specify this in their proposals for Central Assistance.
(b) The Forest department should provide adequate material and technical support so that seedlings raised are of a quality capable of commanding a price in the market.
(c) Since economies of scale operate, in addition to raising seedlings for meeting demands of individuals, Forest Departments own requirements in the local area must also be met through Peoples' Nurseries to the maximum possible extent. To achieve this, no temporary nurseries should be raised by the Forest Department in Development Blocks where Central Assistance is sought for Peoples Nurseries.
(d) Commercial Farm Forestry must be encouraged and fostered through provision of technical, extension inputs,marketing services etc. so that seedlings produced in Peoples' Nurseries can be marketed profitably and in adequate quantities for meeting commercial Farm Forestry requirements.

4. *MARGIN MONEY SCHEME :*

The principal objective of the Scheme is to encourage flow of institutional finance for Forestry Projects by extending Central assistance to projects which need to be brought within the economic viability criteria of NABARD.

A number of socially beneficial Projects especially those with community participation are non-bankable because economically they are not fully viable. The Central Assistance is designed to provide financial support to make marginally non-bankable, but socially beneficial projects economically viable so that institutional funds flow into such projects. Also Institutional funds will reduce the burden on Central and State Govt. budgets, and the implementation of the Scheme will increase peoples participation in wastelands development and reduce pressure on forests.

Organisations/institutions eligible for assistance will be (a) Govt. and semi-Govt. (Central and State) Corporations (b) Urban Development Authorities, Municipal Corporations and public autonomous bodies (c) Cooperatives registered under Multistate Cooperatives Act, 1984(Act 51 of 1984) and Co-operative Institutions registered under State Co-operatives Acts etc.

Cost norms :

Under the Scheme, upto 25% of the project cost will be given as grant (margin) by the Central Government (NWDB) provided:

(i) an equal matching contribution is given by the eligible Govt. institution/State Govt. Subsidies available to individuals under poverty alleviation programmes and other Schemes will be eligible for consideration as matching contribution. (In exceptional circumstances matching contribution amount may be relaxed).
(ii) at least 50% of the total project cost is financed by a financial institution.

The grant amount will be based on the amount needed to make a project bankable. In order to be eligible for assistance, the project should be appraised by the lending bank or institution and after it is accepted in principle, the Board will consider the project for margin money.

Project lands :

Projects to be eligible, should take up lands out of one or more of the following categories :- (1) Revenue or forest waste/degraded lands transferred for use for the project; (2) Wasteland belonging to or leased in favour of the eligible organisation; (3) Private waste/degraded lands belonging to Scheduled Castes, Scheduled Tribes, small and marginal farmers and those identified as below the poverty line;

Preference will be given to projects which involve small/marginal farmers and those belonging to disadvantaged sectors

Choice of species and technology :

The basic requirements laid down under NABARD guidelines for project preparation and financing viability would be followed, with optimum inputs and techno-managerial capability. The choice of species and the technology should be such that returns are available in short rotation and the project should be capable of repaying the loan.

5. *SCHEME OF CONSERVATION OF MINOR FOREST PRODUCE INCLUDING MEDICINAL PLANTS :*

Conserving the natural heritage of the country by preserving the remaining natural forests having a vast variety of flora and fauna, which represent the remarkable bio-diversity and genetic resources of the country, is one of the basic objectives of the National Forest Policy. The preservation and improvement of the minor forest produce is an integral part of any conservation strategy. Minor forest produce provide sustenance to the tribal population and other communities residing in and around the forest. The scheme aims at the conservation and development of minor forest produce including medicinal plants for the benefit of the tribal people and others living in and around the forest areas. The scheme is to be implemented by the Forest department and the main objectives are as follows:-

i) Conservation and improvement of the minor forest produce, including medicinal plants, through effective protection and appropriate silvicultural practices.
ii) Increasing the production of and replenishing of the minor forest produce and the medicinal plants, specially for meeting the needs of the rural people.
iii) Providing employment and income to the tribals and others living in and around the forests

The tribals and other people living in and around the forest are dependent on minor forest produce for their daily needs. Plants of medicinal values are used in the indigenous/traditional systems of medicine. However, due to shrinkage, destruction and degradation of many forest areas on the one hand, and increase in cattle and human population on the other, availability of minor forest produce like bamboos, canes, myrobolan, grasses and medicinal plants, etc has diminished considerably. A proper strategy for conservation and development of the Minor Forest Produce, including medicinal plants, will help in meeting the needs of the tribal people and others living in and around the forests. This will also help in the improvement of the bio-diversity and genetic resources of the areas, which is an ecologically desirable strategy

Main Activities

The Main Components and Activities under the scheme are:-

i) Survey and documentation of the potentially rich areas for minor forest produce and medicinal plants.
ii) Conservation and improvement of existing minor forest produce and medicinal plants by protection and appropriate silvicultural operations.
iii) Sowing and planting of minor forest produce, including medicinal plants as well as their protection.

Block plantations and inter-cropping of minor forest produce, including grasses and medicinal plants, can be undertaken in the degraded forest areas and on other wastelands. The sites for such plantations must be chosen carefully, taking into account the agro-climatic requirements of each individual species and the available package of agro-technologies for each crop. To ensure a remunerative price for the produce, arrangements need to be made for collection and marketing depending upon the prevailing conditions in each area.

The work in the forest areas will be done by the Forest Department/Forest Development Corporations. In other areas, the beneficiaries may take up the activities under the scheme on their own lands though funding support from the State Govt.under the Scheme. These areas shall be predominantly tribal areas. Project proposals should be submitted by the State Govt or concerned implementing agency. The species having local demand will be preferred. Activities include:

- Plantation of bamboo etc.
- Plantations of tendu under a light canopy of trees
- Plantations of Cane
- Cultivation of medicinal plants like Rauaofia spp, Dioscorea spp ,Digiltalis spp., viola spp., etc.
- Cultivation of rosha, lemon and khas grass etc.

Cost norms

100% central assistance will be provided to the States as grant under this Scheme. The cost of raising plantations may vary between Rs.2000 per hectare to Rs.10,000 per hectare. In the case of underplanting of canes it is expected that cost per hectare may be about Rs.2000 whereas the cost of planting certain varieties of medicinal plants may be upto Rs.10,000 per hectare. Plantations of other species are expected to cost Rs.4000 to Rs.8000 per hectare. *In addition*, Central assistance upto Rs.1 lakh per State would also be admissible for carrying out survey and documentation of minor forest produce and medicinal plants of the State.

6. *SCHEME OF AERIAL SEEDING:*

The Scheme of Aerial Seeding is meant for various agro-climatic conditions in the country, primarily to counter

the aggravating problem of ecological degradation and also to augment the biomass production for meeting the increasing demand of fuelwood, fodder and small timber in the rural areas

The main objectives of the scheme are:

i) To study the effectiveness of the aerial seeding technique of afforestation/revegetation for regenerating difficult and inaccessible areas.
ii) To standardise and upgrade the various operations involved in aerial seeding.
iii) To assist the State Govts. in building up the capability of operationalising the technique and to help the States in rapid and large-scale afforestation/revegetation of vast or large extents of areas being reduced to wastelands through various processes of degradation.

The technique of aerial seeding is considered to be a method for revegetating difficult and inaccessible areas in a quick manner and at a reasonably low cost. It has been considered particularly suitable for tracts like hills/mountains, ravines, deserts and areas which are ecologically fragile. The real relevance of aerial seeding lies in the fact that new and innovative strategies and techniques are essential to accelerate the pace of afforestation, specially in degraded, difficult and inaccessible areas which are also ecologically fragile and which are only partly covered in the afforestation programmes.

Main Activities

Under the Scheme, the State Governments will prepare area-based projects. Selection of proper area, suitable combination of species, adequate availability of the required seeds and measures to withstand predation and stress should be given prime importance.

Like any other revegetation/afforestation techniques, protection from biotic interference of the areas covered by aerial seeding will be a critical factor for success. In order to achieve this, appropriate grass roots level organisations will be involved from the beginning and at all stages. Proper extension and communication methods must also be used to mobilise cooperation of the local people.

The Agro-aviation Wing of *Vayudoot* will act as the agency for undertaking the actual aerial operations under the scheme. It will also be associated in organising awareness and training activities and preparing the operational manual. This agency would provide suitable types of aircraft, seed dispensing and other equipment required for the actual work. The expertise of the agency will be availed of for reseeding the areas covered and also for developing appropriate follow up schedules.

Cost norms

The scheme provides for 100% central assistance as grant. The maximum Central assistance admissible under the scheme will be Rs.1000 per ha. plus the actual charge for hiring the aircraft(including helicopters) for the operations

7. *SCHEME FOR DEVELOPMENT OF FOREST AND PASTURE SEEDS:*

A critical factor for the success of any afforestation and wastelands development activity is the ready availability of quality seeds of tree species required for propagation. Therefore, introduction of systematic methods of production, certification, storage and distribution of seeds and having an organisation in each State to ensure a continuous supply of quality seed required for planting activities is an essential requisite for any large scale plantation programme.

There is at present no assured source of pasture grass and legume seeds for silvipasture programmes and other programme for development of wastelands, degraded forests, grazing lands, etc. The objective of the Scheme is to equip the state forestry organisation adequately so that it can produce, process, certify and handle selected tree and pasture grass/legume seeds for meeting afforestation and pasture development programmes.

The scheme therefore, has the long term objective of developing the necessary programme of seed production in the country for meeting the growing demand for quality seeds of forest species as well as pasture seeds. The short term or immediate objective is to support the ongoing efforts of the States and help build up the required infrastructure for seed processing, testing, certification and storage, etc. including support for supply of all necessary equipment. The States will ensure engagement of the required staff and also install the machinery for seed processing.

The ICFRE/ICAR will lay down standards of seed certification of different forest species, tree/pasture species, prescribe standard procedure for seed collection, processing, storage, testing and certification and assist in arranging training to the personnel engaged in various technologies of seed development.

Main Activities

The scheme has the following essential elements:

(i) Creation of a Seed Development Divisions which will have the following functions:
   (a) Identification and improvement of phenologically superior seed stands and carrying out of all improvement operations.
   (b) Collection of quality seeds from seed stands, processing, testing, certification, storage and distribution.
   (c) Seed production of pasture grasses and legumes, including selection of superior stands of endemic grasses, their collection, processing, testing, certification, storage and distribution.

(ii) Maintenance of seed processing and grading facilities, and Seed Testing and Certification Laboratories.

(iii) Certification of Seeds

(iv) Training in Seed Technology

The substitution of ordinary seed by requisite quantity of good quality seed is expected to result in:-

i) Higher germination percentage which is estimated at about 30 - 40% higher than in case of ordinary seed. The average germination viability of ordinary seed is 50 - 80%.
ii) Minimising the financial loss which accrues every year due to the non-germination of the ordinary seed and mortality in the nursery stock/plantation.
iii) Higher production per unit area from the resultant crops and reduced rotation period of the crop.
iv) Annual supply of grasses legume seeds now in short supply. The wastelands development programme is greatly handicapped due lack of grasses/legume seed suited to different edapho-climatic conditions. Even seeds of common *Cenchrus Ciliaris* is not available in adequate quantities. Assured supply of seeds of different grasses and legumes for different regions will greatly help in accelerating the greening programme of wastelands, pasture lands etc.

The scheme will be implemented by the State Government through the State Forest Department/Forest Corporation, which will be declared the seed certification agency.

Cost norms

Central assistance will be admissible for capital expenditure on laboratories, equipment and machinery, one

time grant for training, survey of seed producing stands and preparation of seed production areas and recurring grants for staff salaries

8. *GRANTS-IN-AID SCHEME:*

Grants-in-aid under the scheme are available to registered voluntary agencies, cooperatives, Mahila Mandals and Yuva Mandals and other similar organisations for undertaking work directly or indirectly connected with afforestation and wastelands development. The work could include actual implementation of small programmes, awareness raising, training and extension, organisation of people for regeneration, protection etc. Implementable projects can be taken up on public as well as private lands. Projects with a higher degree of voluntary contribution and people's participation will be preferred. Similarly, projects involving utilisation of funds under various schemes for different components of an integrated project, and tapping of institutional finance will also be given preference. Funds are released directly to the voluntary agency.

The following are the indicators generally taken into account while considering proposals for greening of wastelands:

(i) Raising of seedlings as a part of the project will be preferred. Nursery costs should not exceed 45 p per surviving seedling in the case of 3-6 months nurseries and 75p per surviving seedling in the case of nurseries where the plants are to be kept beyond six months. This cost includes cost of polythene bags, site development of nursery, weeding, watering, pesticides, fertilizer etc. and the wages thereon.

(ii) The plantation cost including and development, pit digging, weeding, pesticides, fertilisers, fencing, wages etc and maintenance over a 3 year period including casuality replacement should not exceed Rs 5,000 per ha or Rs 3 per plant whichever is less.

(iii) The sum total of expenditure on account of awareness raising salaries and overheads should not exceed 15% of the cost on account of nursery and plantation in a 'greening' project.

(iv) Normally for protection of plantations, NWDB will not finance use of barbed wire. However, NWDB would be willing to consider funding other methods of fencing such as cattle proof trenches, trench-cum-mounds, live fencing etc.

(v) Supplementary efforts to include soil and water conservation measures where water supply for plantations are inadequate will be considered. In case of soil conservation measures of contour trenching, nala plugging, deep pitting etc, an additional amount not exceeding Rs 1000 per ha. may be allowed subject to justification.

(vi) The project proposal shall not include requests for assistance from NWDB for purchase of Jeeps and Cars, or for construction of buildings.

(vii) As far as possible species should be local indigenous species with emphasis on fuelwood and fodder species. Monoculture may be avoided in case of large block plantations.

(viii) Preference will be given to projects where some contribution of Voluntary labour by beneficiaries is given.

(xi) Wastelands development projects other than those involving tree planting are likely to consist of activities similar to that mentioned in the Integrated Scheme. In such cases, the costs mentioned in that Scheme may be used as a guiding factor.

Annexure II

DISTRICTS TAKEN UP FOR MICRO-PLANNING DURING 1989-90 & 1990-91

Sl.No.	State	1989-90	1990-91
1	Andhra Pradesh		Ranga Reddy
2.	Bihar		Palamau
3.	Gujarat		Surendranagar
4.	Haryana		Hissar
5.	Himachal Pradesh		Kangra
6.	Karnataka	Bellary	Kolar
7.	Kerala		Palghat
8	Madhya Pradesh	Datia	Raipur
9.	Maharashtra	Nasik	Pune
10.	Manipur		Imphal
11.	Orissa	Sundargarh	Ganjam
12	Rajasthan	Dungarpur	Jodhpur
13	Tamil Nadu	Madurai	North Arcot
14.	West Bengal	Purulia	Bankura
15.	Uttar Pradesh	Almora	Balia
			Mainpuri

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Annexure III

COMMUNITY PARTICIPATION IN FOREST REGENERATION

Guidelines issued by Secretary, Ministry of Environment and Forests to Chief Secretaries of all States vide letter No. 6-21/89- F.P.dated Ist June, 1990 regarding involvement of village communities and voluntary agencies for regeneration of degraded forest lands.

The National Forest Policy, 1988 envisages people's involvement in the development and protection of forests. The requirements of fuel wood, fodder and small timber such as house-building material, of the tribals and other villagers living in and near the forests, are to be treated as first charge on forest produce. The policy document envisages it as one of the essentials of forest management that the forest communities should be motivated to identify themselves with the development and protection of forests from which they derive benefits.

2. In a D.O. letter No 1/1/88-TMA dated 13th January, 1989 to the Chief Secretaries of all states, the need for working out the modalities for giving to the village communities, living close to the forest land, usufructory benefits to ensure their participation in the afforestation programme, was emphasised by Shri K.P. Geethakrishnan, the then Secretary(Environment and Forests).

3. Committed voluntary agencies/NGOs, with proven track record, may prove particularly well suited for motivating and organising village communities for protection, afforestation and development of degraded forest land, especially in the vicinity of habitations. The State Forest Departments/Social Forestry Organisations ought to take full advantage of their expertise and experience in this respect for building up meaningful people's participation in protection and development of degraded forest lands. The voluntary agencies/NGOs may be associated as interface between State Forest Departments and the local village communities for revival, restoration and development of degraded forests in the manner suggested below:

(i) The programme should be implemented under an arrangement between the Voluntary Agency/NGO, the village community(beneficiaries) and the State Forest Department.

(ii) No ownership or lease rights over the forest land should be given to the beneficiaries or to the Voluntary Agency/NGO Nor should the forest land be assigned in conversation of the provisions contained in the Forest(Conservation)Act, 1980.

(iii) The beneficiaries should be entitled to a share in usufructs to the extent and subject to the conditions prescribed by the State Government in this behalf. The Voluntary Agency/NGO should not be entitled to usufructory benefits.

(iv) Access to forest land and usufructory benefits should be only to the beneficiaries who get organised into a village institution, specifically for forest regeneration and protection. This could be the panchayat or the cooperative of the village, with no restriction on membership. It could also be a Village Forest Committee. In no case should any access or tree pattas be given to individuals.

(v) The beneficiaries should be given usufructs like grasses, lops and tops of branches, and minor forest produce. If they successfully protect the forests, they may be given a portion of the proceeds from the sale of trees when they mature. (The Government of West Bengal has issued orders to give 25% of the sale proceeds to the village Forest Protection Committees. Similar norms may be adopted by other States)

(vi) Areas to be selected for the programme should be free from the claims(including existing rights, privileges, concessions) of any person who is not a beneficiary under the scheme. Alternatively, for a given site the selection of beneficiaries should be done in such a way that any one who has a claim to any forest produce from the selected site is not left out without being given full opportunity of joining.

(vii) The selected site should be worked in accordance with a Working Scheme, duly approved by the State Government. Such scheme may remain in operation for a period of 10 years and revised/renewed after that. The Working Scheme should be prepared in consultation with the beneficiaries. Apart from protection of the site, the said scheme may prescribe requisite operations, eg. inducement to natural regeneration of existing root stock, seeding, gap filling, and wherever necessary, intensive planting, soil-moisture conservation measures etc. The Working Scheme should also prescribe other operations eg. fire-protection, maintenance of boundaries, weeding, tending, cleaning, thinning etc.

(viii) For raising nurseries, preparing land for planting and protecting the trees after planting, the beneficiaries should be paid by the Forest Department from the funds under the social forestry programme. However, the village community may obtain funds from other Government agencies and sources for undertaking these activities.

(ix) It should be ensured that there is no grazing at all in the forest land protected by the village community. Permission to cut and carry grass free of cost should be given so that stall feeding is promoted.

(x) No agriculture should be permitted on the forest land.

(xi) Along with trees for fuel, fodder and timber, the village community may be permitted to plant such fruit trees as would fit in with the overall scheme of afforestation, such as aonla, Imli, mango, mahua etc. as well as shrubs, legumes and grasses which would meet local needs, help soil and water conservation, and enrich the degraded soils/land. Even indigenous medicinal plants may be grown according to the requirement and preference of beneficiaries.

(xii) Cutting of trees should not be permitted before they are ripe for harvesting. The forest department also should not cut the trees on the forest land being protected by the village communities except in the manner prescribed in the Working Scheme. In case of emergency needs, the village communities should be taken into confidence.

(xiii) The benefit of people's participation should go to the village communities and not to commercial or other interests which may try to derive benefit in their names. The selection of beneficiaries should therefore, be done from only those families which are willing to participate through their personal efforts.

(xiv) The forest Department should closely supervise the works. If the beneficiaries and/or the Voluntary Agency/NGO fail or neglect to protect the area from grazing, encroachment or do not perform the operations prescribed in the Working Scheme in a satisfactory manner, the usufructory benefits should be with drawn without paying compensation to anyone for any work that might have been done prior to it. Suitable provisions in the Memorandum of Understanding (MOU) for this purpose should be incorporated.

NB: Orissa and West Bengal had issued orders even before the Ministry s circular of 1-6-90. Consequent to the circular, State Governments of Rajasthan and Bihar have issued Govt. orders. Many other State Governments are expected to follow suit.

Annexure IV

STATE-WISE LIST OF DISTRICTS AND WORK CENTRES UNDER THE NATIONAL WASTELANDS IDENTIFICATION PROJECT

S.No.	State	Work Centres involved	Address	Districts
1.	Andhra Pradesh	Institute of Coastal & Offshore Research, Vishakhapatnam,	Director Institute of Coastal & Offshore Research, Vishakhapatnam-530003	Kurnool, Anantapur, Nizamabad, Vizinagaram,Karimnagar, Chittoor, Cuddapah, Visakhapatnam, Mahaboobnagar
		All India Soil & Land Use Survey	Project Officer All India Soil & Land Use Survey, IARI Building, New Delhi	Prakasam
		National Remote Sensing Agency	Director National Remote Sensing Agency Balanagar, Hyderabad-500037(A.P)	Ranga Reddy, Medak, Nalgonda and Nellore
2	Assam	National Remote Sensing Agency	As in Sl.No.1	Haflong and Diphu
3	Bihar	Bihar Council of Science and Technology	Bihar Council on Science and Technology "Shyama Bhawan" West Boring Canal Road Patna-800001(Bihar)	Nawada, Siwan, Hajipur, Muzaffarpur
		Survey of India	Surveyor General Survey of India(SOI) Hathibarkala Estate Dehra Dun-248002	Rohtas, Palamau, Aurangabad
		All India Soil & Land Use Survey	As in Sl.No.1	Dhanbad
		Orissa Remote Sensing Application, Centre	Chief Executive Orissa Remote Sensing Application Centre Plot No.26/A, Unit-4, Bhubaneswar-751001	Singhbhum
4	Gujarat	Space Application Centre	Director Space Application Centre, Jodhpur Tekra Ahmedabad-380053	Panchmahal, Surendranagar, Gandhinagar, Bhavnagar, Kheda, Ahmedabad, Mehsana
		Survey of India	As in Sl.No.3	Rajkot
		National Bureau of Soil Survey & Land Use Planning NBSS & LUP	Director National Bureau of Soil Survey and Land Use Planning	Jamnagar and Junagadh

			Amravati Road Nagpur-440010	
5.	Haryana	Haryana Remote Sensing Application Centre	C/o Director Deptt. of Science & Technology Govt of Haryana 30, Bays Building Sector 17-C, Chandigarh	Sirsa, Kamal, Hissar, Jind
		Survey of India	As in Sl.No.3	Gurgaon
6.	Himachal Pradesh	All India Soil & Land Use Survey	As in Sl.No.1	Hamirpur, Kangra
		Survey of India	As in Sl.No.3	Chamba
7.	Jammu & Kashmir	Survey of India	As in Sl.No.3	Udhampur
8.	Karnataka	Karnataka State Forest Department	The Principal Chief Conservator of Forest Karnataka State Forest Deptt. Aranya Bhawan, Malleswaranm, Bangalore-560003	Belgaum, Raichur, Bellary, Chitradurga, Hassan
		Survey of India	As in Sl.No.3	Tumkur
		National Natural Resources Management System	C/o ISRO, Bangalore	Bangalore
		NBSS & LUP	As in Sl.No.4	Kolar
9.	Kerala	Kerala State Land Use Board	Commissioner Kerala State Land Use Board, Vikas Bhawan, Trivandrum- 695003	Kasargod, Cannanore, Palghat, Vyanad, Idukki and Malapuram
10.	Madhya Pradesh	Madhya Pradesh Council of Science & Technology	Director General Madhya Predesh Council of Science & Technology E-3/3 Arera Colony Bhopal - 462016	Bhind, Raisen Narsingapur, Indore, Shajapur, Ujjain, Mandsaur, Tikamgarh, Raipur, Rajgarh, Rajnandgaon, Ratlam, Durg, Guna, Datia, Vidisha, Dewas
		Survey of India	As in Sl.No.3	Rewa
11.	Maharashtra	Maharashtra Engineering Research Institute	Maharashtra Engineering Research Institute Dindori Road Nashik-422004	Nasik, Satara, Sangli
		Survey of India	As in Sl.No 3	Ratnagiri
		NBBS &LUP	As in Sl No.4	Ahmadnagar, Kolhapur, Jalagaon

		All India Soil & Land Use Survey	As in Sl. No. 1	Dhule
		Centre for Studies in Resources Engineering	Head Centre for Studies in Resourses Engg. IIT, Powai Bombay-400076	Pune, Thane
12	Manipur	Indian Institute of Remote Sensing	Head Indian Institute of Remote Sensing, 4, Kalidas Road, Dehra Dun-248001	Karong, Central District
13	Nagaland	Survey of India	As in Sl No 3	Kohima,Mokokchung, Zunhebote
14	Orissa	Orissa Remote Sensing Application Centre	As in Sl.No 3	Ganjam, Cuttack, Bhubaneshwar, Dhenkanal, Sundergarh, Bolangir
		Survey of India	As in Sl.No.3	Kalahandi
15.	Punjab	Space Application Centre	As in Sl No.4	Sangrur, Kapurthala
		Survey of India	As in Sl.No.3	Bhatinda
16.	Rajasthan	Central Arid Zone Research Institute	The Director Central Arid Zone Research, Institute, Jodhpur, Rajasthan.	Pali, Tonk, Jodhpur, Churu, Ajmer
17.	Tamil Nadu	Institute of Remote Sensing, Madras	Director Institute of Remote Sensing, College of Engineering Anna University, Guindy Madras-600025	Dharamapuri, Salem, North Periyar, Tiruchirapalli, Madurai North Arcot,
		Survey of India	As in Sl No 3	Ramanathapuram
18.	Uttar Pradesh	Uttar Pradesh Remote Sensing Application Centre	Director, RSAC Govt. of Uttar Pradesh B-19, Sector - A Mahanagar Lucknow	Fatehpur, Allahabad, Jalaun, Kanpur, Agra, Varanasi, Lucknow, Gazipur, Sultanpur, Jaunpur, Azamgarh, Pratapgarh, Hamirpur, Unnao, Mainpuri, Etawah, Jhansi, Lalitpur, Rae Bareli, Farukhabad
		Indian Institute of Remote Sensing	As in Sl.No 12	Etah, Aligarh,
		Survey of India	As in Sl.No. 3	Bulandshahar
19	West Bengal	National Atlas & Thematic Mapping Organisation	Director National Atlas & Thematic Mapping Organisation, 50A, Gariahat Road, Calcutta-700019(W.B.)	Midnapur Purulia
		Survey of India	As in Sl.No 3	Bankura

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ROLE OF INDIGENEOUS SPECIES IN RESTORING DEGRADED LANDS AND SUSTAINING BIODIVERSITY IN REVEGETATION PROGRAMMES

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INTRODUCTION :

The present paper is an attempt to highlight the messages from past experiences of employing indigenous tree, shrub and grass species to restore the degraded areas and to develop strategies for restoration. The paper emphasises the need for institutional support at the organizational [village], technological [Forest Departments] and the administrative [Governments] levels.

1. Degraded Areas : Magnitude and Nature :

The extent of degraded lands in our country has been estimated to be in the range of 99,627 to 2,23,526 sq.km. [Annexure-1]. These are characterized either by inadequate regeneration or where regeneration is totally absent [where crown cover is less than 10%].

Gadgil and Meher-Homji [1986b] have given a detailed account of the extent of degraded areas by vegetation types under thorny, decidious, semi-evergreen, evergreen, dry evergreen, Himalayas, mangroves and Andaman & Nicobar forests. The same information is also provided for different vegetation types in different states (Gadgil and Meher-Homji 1986a). In both the papers the authors have tried to guage the magnitude of degraded areas and the remedies to be undertaken for reversing the degradation by way of conservation of biodiversity.

The extent of degradation has been put at 8-10 m.ha by Deol [1983] and he suggests protection of degraded vegetation supplemented by afforestation as an approach to restore the degraded lands towards meaningful productivity.

Degraded forest areas have been estimated to be of the order of 35.89 m.ha (NWDB report on fodder and grasses) and the addition of existing wastelands would add another 60.0 m.ha to the most important task of regenerating these lands using indigenous species.

The inferior species composition of the degraded lands in dry miscellaneous forests which are the principle source of fuelwood is reported to be about 36% of the basal area accounting for about 4-14 m^2 /ha [Singh, 1981]. In extreme cases species which are invaders such as Lantana, Carissa, Dodonea, Partheneum, Eupatorium have taken over these degraded lands rendering them unfit for higher productivity.

2. CAUSES OF DEGRADATION :

The unprecedented level of human demands on the resources of our planet suggest that, we are likely to lose about half of the 10 million species of living organisms by the end of this century [Gadgil and Meher-Homji, 1986b].

2.1 Fuel wood demand :

It is realized that about 90% of the wood produced in the developing tropical countries which account for more than half of

the world's forest resources is used as fuelwood largely for cooking, a basic need. The productivity on the otherhand accounts for less than half of wood output and only 1/5th of the total output of Industrial wood. The growth rate of 2.6 % in population in these developing countries, implies the operation of a vicious circle involving low productivity and greater deforestation. The pressure on these forests confirm the degradation or destruction to the tune of 11.5 m.ha and 1 m.ha annually for the world and India respectively [Shah, 1991].

2.2 Density of livestock population :

The present estimate of cow units equivalent to grazing in the forests is put at 99 m. cow units and the matching forest area to accommodate this grazing pressure is put at 165.0 m.ha which is more than twice the recorded forest area in the country [Lal, 1990]. The situation becomes even more alarming considering the projected livestock population by the turn of this century.

2.3 Shifting cultivation :

About 43.5 lakh ha of forests are subject to this practice.

2.4 Unauthorized fellings :

Unauthorized feelings are done in the vicinity of semi-urban and urban centres of consumption to meet the fuelwood needs of urban poor.

2.5 Development programmes :

River valley projects, rehabilitation of people displaced by projects, mining, road construction and establishment of industries contribute to the process of degradation.

2.6 Uncontrolled fires :

2.7 Failure of regeneration in harvested forest areas :

2.8 Plantations of Exotics :

Planting short rotation monocultures in regular forest areas has led to the degradation of existing vegetation by way of soil erosion.

3. INDIGENOUS VERSUS EXOTIC SPECIES :

3.1 Indigenous Species :

Use of indigenous species mix on degraded lands has the merits of diverse output, cheaper regeneration, higher survival percentage, low incidence of pests and diseases, higher adaptability to adverse climatic changes and finally they form an integral part of ecodevelopment programmes.

Several studies oriented on floristic diversity of specified regions like the ones on Eastern Himalayas [Rao and Hajra, 1986], and on Western ghats [Nair and Daniel, 1986] and many more that are not listed here give a detailed account of the indigenous species of trees, shrubs and grasses. Besides such works of pure botany, some special studies have been taken up to identify the

indigenous species used in restoring degraded lands. [Singh, 1981; Singh and Khanduja 1984; Negi et al., 1985; Maithani et al., 1988; Jain and Shanker, 1977; Dogra, 1989; Varmah, 1977; Deb, 1978; Ghate, 1990].

Sclerophyllus nature of the indigenous species helps them to withstand drought, frost, fire and wind. The low nutrient requirement of these shrubs and trees and elevated root-shoot ratio makes them more suitable [Maithani et al., 1988]. Plantation of these shrubs in large areas create favourable conditions for tree growth and they are of high economic importance in terms of fuelwood and fodder.

In India, shrubs have not been cultivated for firewood though with a potential biomass for fuel. Cajanus cajan extensively used in rural homes is on par with other potential shrubs like Tamarix dioca, Carissa spinarium, Adhatoda vasica, Dodonea viscosa and Vitex negundo which have the good combination of adaptability, biomass production and burning qualities of wood. Shrub biomass production offers the advantage of short rotation fuelwood crops than trees [Khanduja, 1987].

3.1.1 Fodder resources :

It is estimated that there are 13 m.ha of permanent pastures and grazing lands in India. An additional 43 m.ha of waste areas are used as grazing grounds. Vast areas under forest also provide forage grasses. Though 90% of the livestockk of India susbsist on natural grasslands the country does not have a tradition of

grassland farming comparable to that of either Newzealand or Australia [Jain and Shanker, 1977].

Deb (1978) has listed a number of plants yielding fodder and also grasses in Tripura. A similar list provided by Hole, (1913) gives an insight to the indigenous component of grasses and some positive measures to sustain their productivity and distribution.

3.2 Exotics :

Present plantation technology has limitation in respect of grasses and shrubs in addition to the predominance of non-browsable tree species. These have augmented the biomass resources but have failed largely to fulfill the lacunae created by the degradation of forests.

Afforestation programmes have hitherto been taken up in a majority of the cases with monocultures of exotic species because of their commercial importance, the ease with which they can be raised and established and by their higher growth rates. However, such exotic plantations have only resulted in disturbing the natural vegetation and ecobalance of Kodaikanal and Palni hills [Gupta, 1960].

Nair and Daniel [1986] also report that the monocultures of Cinchona, Eucalyptus, Pinus, Acacia etc. occupying large areas have degraded the tropical forests of the Western ghats.

It has been the general observation that the monocultures of exotics have deleterious impact on soil physical, chemical and biological characteristics of soil leading to faster rate of land degradation. Hence, the problem of afforestation using exotics need to be addressed on an ecological perspective [Byju, 1989].

4. CASE STUDIES : SOME MESSAGES :

4.1 Identification of indigenous species :

A programme of desert afforestation and pasture development was launched in Rajasthan for the first time in 1979. The focus is on Silvi-pastoral plantations, mixed plantations, village fuelwood and fodder banks. Species suitable for different site types [based on performance in experiments conducted at CAZRI] have been included in the programme [Mathur, 1985]. Considerable stress is laid on providing vegetative mulch of local bushes viz., Crotolaria burhia, Leptodenia pyrotechnica, Zizyphus mummularia, Caligonum polygonoides and Aerva pseudotomentosa. Grass seeds of Lasirus and Cenchrus are sown along mulched lines before monsoon. Based on the experience of five years, Caligonum polygonoides and Zizyphus mummularia are found to be highly successful. These shrubs in addition to other trees like Azadiractata indica, Albizzia lebbek and Tecomella undulata have proved to be a favourable combination. Silvi-pastoral combinations of A. indica, Dichrostachys nutans and Cordia rothii have also been found useful. Cenchrus ciliaris and C. setigerus when grown with trees have been found to properly utilize the site. The existing trees, shrubs and grasses in the

forest vegetation listed by the author serve as a guideline in restoring the degraded lands in Rajasthan.

Ghate et al., [1990] have described 38 indigenous species of Western Maharashtra along with their fuel characteristics. Negi et al. [1985] have prepared an exhaustive list of indigenous species of Garhwal Himalayas with their ethnoeconomic importance. While conducting a survey of shrubs for hastening the process of reclamation of ecologically vulnerable areas of Central Himalayas, Maithani et al. [1988] have successfully identified a list if colonising shrubs along with their economic importance.

Discussing the vegetation types in North-West Himalayas, Hajra and Rao [1990] have provided a list of indigenous species of high fodder value. An exhaustive list of trees and shrubs for different regions by Vermah [1977] serves as a benchmark in conducting systematic studies.

Species like Tamarix dioca, Carissa spinarium, Acacia calycina, Adhatoda vasica and Dodonea viscosa serve the purpose of firewood biomass in short rotation in North India (Singh and Khanduja, 1984). Gupta and Bagchi [1986] have emphasised the need for vegetative multiplication of fuelwood species to maximise wood production. The stress is on the list of fuelwood species presented zonewise including some exotics.

A report of the committee on fodder and grasses by NWDB in 1986, contains a list of suitable grasses and legumes for

different climatic zones and also the fodder tree species with their silviculture techniques. Singh [1982] in his book on "Fodder trees of India" has given a detailed account of the indigenous species with reference to silvics, propagation and fodder value.

Pilot projects on planting of shrubs of high economic importanrce and indigenous sclerophyllous nature should be taken up [Maithani et al., 1988]. Khanduja [1987] suggests that the shrub biomass production offers multipurpose use and may prove far more satisfactory for village fuelwood silviculture than trees.

4.1.1 Grasses :

A critical survey of the entire range of species in Annexure-2 leads to two important conclusions. It has been found that there are only a few grasses in each zone which have some recognized forage value. Secondly, these grasslands are marked by almost total absence of any dominant legume species. This is largely responsible for the low protein content and low quality of these forages [Jain and Shanker, 1977].

Hole [1913] has given a detailed account of chief fodder grasses of Indian forests. Tbe distribution of these species is also given. He has stressed on the lack of information on the nutritive value, yield per unit area, the area occupied by them, their tendency to grow in pure stands etc., which play a decisive

role in choosing the suitable grass species for an ecological zone. The author recommends periodic closure of forests to retain the palatable species and to cut back coarser species once or twice during the growing season so that they are converted into hay.

Identification of indigenous grass species is the need of the hour because exotic species introduced fail to compete with the local dominant species. The selection of superior type and improved agronomic practices increases the productivcity. Application of fertilizers and management of grass lands though appear to be out of place in the Indian context but may become imperative after a decade like it happened with green revolution [Jain and Shanker, 1977].

Reseeding of the dominant species is suggested for improving the grass lands [Deb, 1978].

4.2 Evaluation of Indigenous Species :

The importance of shrubs in reclaiming the degraded slopes of Himalayas and Shiwaliks have been discussed by Maithani et al., [1989]. It is concluded that the shrubs provide an immediate answer on account of better adaptability, early establishment, fast growth, short rotation and yield of multiproducts. Information on seed production, germination potential and suitable nursery practices are of immense value. The results are encouraging in identifying the indigenous species

with respect to their performance in nurseries and in the field, and, can be extended to other climatic zones.

Studying the wood properties of some firewood shrubs in Northern India Singh and Khanduja [1984] have characterised the firewood shrubs with respect to density, per cent ash, silica, Nitrogen and Carbon, biomass to ash ratio and moisture percentage. An evalution of this pattern can be handy while identifying the potential species in other ecological areas.

The essential screening steps to enhance the fuelwood production as suggested by Dogra [1989] would be:

1. Identification of species, clones, varieties or provenances that perform best on known site types;

2. Species comparisons and selection for biomass productivity on the basis of species-site trials;

3. Selection within the species or provenances for further improvement and multiplication;

4. Cloning of outstanding genotypes for site adaptability, productivity, coppicing ability, disease and pest tolerance;

5. Establishment of seed stands;

6. Progeny testing and

7. Seed orchard establishment for short rotation intensive culture [SRIC] under different climatic regions.

Developing a rating index to evaluate the local species for revegetation programmes holds good promise [Singh, 1981]. Nursery and planting techniques for grasses and fodder legumes should be effectively employed [Ramprasad and Chandhar, 1988].

4.3 Merits of mixtures of Indigenous and Exotic Species :

Lal [1990] reports that the natural forest with greater diversity, larger organic structure, and balanced energy flow is more resistant to distubrances and consequently more stable than an immature community of plantations in a semi-natural forest. But immature communities are more productive and are as important to man as matured communities of natural climax forests. An adequate mixture of these natural and man made communities provide a stable as well as productivive environment.

Singh and Pandey [1985] suggest mixture of indigenous taxa and exotic having identical environmental conditions to afforest Rajasthan deserts.

Identification of plant species under the prevalent ecological stress is the new technology needed to be developed. The administrative frame work needs to be re-oriented to allow the local people to gain control over the management of minor forests. A suitable technology from the department of forests and

a suitable mixture of exotics and indigenous species appears to be appropriate [Gadgil, 1988].

The need of the hour is not dropping all development projects and doing away with industries but to have a compatible marraige between conservation and development so that the biological diversity remains undisturbed and the ecological balance is maintained. Reintroduction of native species in their habitats is a positive step in this direction. Tree planting and wood production for local use with the genuine participation of public at large is duly emphasised for conserving the floristic diversity of Western ghats [Nair and Daniel, 1986].

A combination of species to sustain the life style of the beneficiaries is under testing at Datia, Madhya Pradesh [Bajaj, 1990].

4.4 Management, Local Participation and Planning :

The involvement of local communities in managing the resources towards higher productivity must be made on a micro-watershed basis [Vohra, 1988]. Regenerating degraded areas should gain favour in view of the diverse output , low cost and combating ecological degradation. The strong negative correlation between per capita forest availability and degraded forests support the contention that local factors have a determining influence on forest health and the process of regeneration cannot be achieved without regulation and control over the use of forest by communities. Cognizance must be taken

of the extent to which forests are a local resource used to meet local needs. Hence, an appropriate management system must be designed.

As an alternative management system, the first step is an extension of action along the West Bengal lines, granting people unrestricted rights to minor forest produce, twentyfive per cent of share to the local community in return for protection of degraded forest areas; The management and the land would remain with the forest department (Bajaj, 1990).

Indigenous species region wise need to be evaluated with reference to wood density, calorific value, growth rate, period of harvest, ability to coppice, smooth burning, nitrogen fixing capability etc., which strengthen the afforestation as a supplementary measure to protection. Village level initiatives at spreading the message of protection goes to Gamtalao, a village with 90 households in Mandvi taluk of Gujarath State. It has a forest area of 180 hectares which was clear felled during the year 1978-79. Though subsequent plantations failed, the rootstock remained intact. The village adopted about 90 hectares and organised protection by confronting the migrating graziers from Saurashtra. The village committe also improved and enriched the degraded area by employing the indigenous species. The department of forests provided the technology. Similar are the experiences of Chansar village, Lunavada Taluk of the Panchamahal District in Gujarath State, Arbari experiment in Midnapur

District of West Bengal, the NGO initiatives in Karnataka [Gramvikas] and the Orissa peoples initiative [Shah, 1991]. Concluding his study he envisages bringing people, closer to the concept of managing their resources; The NGOs can organise such village communities, the Government support is needed for administration and finally the focus of management should be on ecologicaly important non wood products.

Micro-level resource planning with a systems approach based on operational research programme for integrated development in Western ghats of Karnataka has proved to be worthwhile [Gadgil, 1988].

5. BIODIVERSITY IN REVEGETATION PROGRAMMES :

Sustaining Biodiversity has been attempted under 3 different situations in the tropical rainforests of Western ghats, namely:

1. Well stocked forests with abundant regeneration which responds to chance openings in due course by way of judicious opening encouraging natural regeneration;

2. Degraded forests with removal of 5 trees/ha or larger openings are restocked by tending the natural regeneration or supplementing it if necessary; and

3. More degraded areas are restocked by intensive protection from fire and biotic interference followed by silvicultural treatment in addition to reforestation with the local species [Rai,1990]. The results indicate that

only the main species of these forests eventually succeed though their rate of growth is slow.

Natural regeneration of multiproduct sal coppice system [MSC] (Rs.250/ha) at Arbari [West Bengal] as against the higher investments on plantations of single products namely quick growing, cashew, tasar, fodder[Rs.5000/ha] is a case for replication in other degraded areas [Bajaj, 1990]. Raising their income by regeneration will generate a sense of belonging amongst the beneficiaries.

Retention of existing tree growth though in its degraded state and supplementing it by artificial means to the extent of 10% of the composition under the fuelwood plantations operated by the Karnataka Cashew Development Corporation in the three districts of Karnataka namely South Kanara, North Kanara and Chikmaglur is a sure step towards sustaining biodiversity.

The revegetation programmes undertaken by the Palani Hills Conservation Council [PHCC] with indigenous species upto 25% of the composition along with other multipurpose species and a fraction of exotics like A. auriculiformis and Casuarina and the establishment of a permanent nursery with a seed store is an outstanding example to be followed by others.

A zone with natural regeneration and afforestation should be promoted around existing natural resources from the conservation point of view [Prins, 1987].

6. CONCLUSIONS :

Regeneration and revegetation programme should emphasise the use of indigenous species of trees, shrubs and grasses. These are to be identified region-wise after systematic evaluation. We must plan programmes of utilizing such species on the basis of micro-catchments. A suitable mixture of indigenous and exotic species provide a stable as well as productive environment. Natural regeneration supplemented by planting native species sustains the biodiversity. Involving the local people for better management of the resources is the right approach.

These programmes can be effectively organised by the NGOs with the forest department providing the technology and the government providing the administration.

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ANNEXURE-1

Zone/State	Regeneration Status Absent/Inedequate (Sq. km.)	Open Forest as per landsat Imagery (1989) (Sq. km.)
1. Eastern Zone Bihar, Orissa, West Bengal	22,55	36,728
2. Western & Central Zone Goa, Gujarat, Madya Pradesh	24,910	48,064
3. Northern Zone Haryana & Punjab, Himachal Pradesh, Jammu & Kashmir, Uttar Pradesh	18,690	18,986
4. North East & Andaman Arunachal, Assam, Manipur, Meghalaya, Nagaland, Andaman & Nicobar	26,481	58,806
5. Southern Zone Karnataka	6,631	7,351
Total	99,627	1,69,931
6. Unsurveyed States* A.P., Kerala, Maharashtra, Tamilnadu, Tripura	--	53,595
G. Total	--	2,23,526

Note:- For states with forest areas of good regeneration potential but no ground surve data collected by F.S.I.
Source : Bajaj, 1990.

ANNEXURE-2

Different types of grass covers of India showing important grasses, areas and status covered and species of recognised value (after Dabadgha and Shamkarnarayan, 1973).

Grass cover type	Area covered in sq. km.	State of India covered by each type	Important Grasses	Grasses of recognised forage value
Schima/ Dichanthium	1,740,000	Gujarat, Maharashtra, Orissa, Madhya Pradesh, Mysore, Andhra Pradesh, Bengal, Southern, Bihar & Southern hilly portion of Uttar Pradesh	24 Species	Gynodon detylon, Chloris
Dichanthium/ Cenchrus/ Lasiurus	436,000	North of Guiarat, Rajasthan, Western Uttar Pradesh, Delhi State & Haryana	11 Species	Cynodon dactylon, Cenchrus cyliaris
Phragmites/ Saccharum/	2,800,000	Manipur, Assam, Iripura, Delhi State, West Bengal, Bihar, Haryana and Uttar Pradesh	19 Species	Imperata cylindrica
Themeda/ Arundinella	230,400	Manipur, Assam, Punjab, West Bengal, Uttar Pradesh Himachal Pradesh, Jammu and Kashmir	16 Species	Cynodon dactylon (for some area only)
Temperate Alpine type	--	Tehri-Garwhal, North-Garwhal, Jammu and Kashmir, West Bengal & Himachal Pradesh	14 Species	Dactylis glomerata, Phelum

(After Dabadghao and Shankarnarayana, 1973).

The role of Forest Department in maintenance of bio-diversity on lands falling outside the nature reserve system

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Introduction

Life commenced on earth billions of year's ago and since then evolution has generated new species and extinction has eliminated them. The biological diversity has thus been a dynamic function of time. Extinction of species is not new to nature -- one such example being of dinosaurs which disappeared "suddenly" about 65 million years ago. One theory even suggests that the diversification of mammals and ultimate evolution of human beings (Homo sapiens) may have become possible due to the ecological space vacated by the dinosaurs. Replacements lead to a new mix of bio-diversity which may be no less richer than the one it has just replaced. However, the delicate balance between evolution and exinction has been adversely affected by the growing pressure of human population. As a result, the various eco-systems are fast disappearing, thereby creating the crisis of maintenance of adequate bio-diversity. This irreversible trend has to be stopped. The just concluded decade of the 80's has shown increasing awareness amongst people, their political representatives, governments and enlightened NGOs about conservation of the rich natural heritage in terms of the bio-diversity. This has led to the emergence of a new ethics in managing the natural resources cautiously.

Deep Ecology and Development

Of late, a new concept of deep ecology, which questions the anthropocentric view of human superiority over other living things, has been advanced in the United States (Nation, 1988). This may make an interesting conversation in advanced and developed countries, but in a developing country the forests have to subserve the well-being (?) of human beings and the foresters have to speak the vernacular of demand and supply of forest produce to the local people.

Local resistance to the locking up of vast tracts of forests as protected areas (PAs) for wildlife conservation, and aximotacially bio-diversity has led to naxalite disturbances in prestigious reserves like Indravati Tiger Resrve and even forcible occupation of lands in Manas Tiger Reserve, which is a World Heritage Site (Panwar, 1990). Such social conflicts are becoming commonplace in other reserves also and a serious note of this tendency has to be taken while recommending appropriate forest management practices which should result in mutualistic symbiosis between conservation and economic development (Norse, et al, 1986). People's participation has to be the corner stone of any new strategy of bio-diversity conservation which otherwise would severely limit the (mis)use of natural resources by the people in their immediate vicinity.

The Present Scene

The Indian Forest Act (1927) and the Wildlife Protection Act, 1972 have been important legislations in conservation of forests and the bio-diversity. To further enhance the authority of the central government,the subject of "forest and wildlife" was brought on the concurrent list of the constitution of India in 1977. Another landmark legislation in conservation in the country was promulgation of Forest (Conservation) Act, 1980, which has curtailed the powers of the state government to divert forest lands to non-forest purposes without prior permission of the central government. This has often been described as a "draconian" legislation and dubbed anti-development but it has considerably reduced the diversion of forest areas. India is also a signatory to all major international conventions on conservation of areas and species (CITES; Ramsar-Wet Lands; World Heritage; Whaling).

The National Forest Policy (1988) also inter alia envisages:

- maintenance of environmental stability through preservation and restoration of ecological balance
- conserving the natural heritage of the country by preserving natural forests which represent remarkable biological diversity and genetic resources in the country
- increasing the productivity of the forests to meet essential national needs

It may be relevant to note that that the policy formulators have envisaged a balance between bio-diversity conservation and increased productivity from the forests.

Protected Area Network

The decade of the 70's marked an epoch in the conservation history of the country in as much as :

- concrete ecological restoration was initiated by a blanket ban on the hunting of tiger
- Wildlife Protection Act was enacted in 1972
- Project Tiger was launched in 1973*

*(The number of Tiger Reserves now stands at 18, total area : 28017 Sq Km; core area : 12,364 Sq Km)

Emboldened by the remarkable success of the Project Tiger, Government of India launched a National Wildlife Action Plan (NWAP) in 1983. It inter alia laid stress on the setting up of a bio-geographically representative network of protected areas (PAs) in the country. A detailed study was conducted by the Wildlife Institute of India (WII) to scrutinise the adequacy of existing network of PAs, identify gaps and suggest additional areas for filling up the gaps. In all, ten bio-geographic zones have been identified which were further divided into 26 biotic provinces. Within each province, biomes were identified. The report has suggested a network of 148 national parks and 410 sanctuaries. The protected area coverage would increase to about 15 mha of which national parks would extend over 0.5 mha. In terms of % of geographic and forest area, the coverage would come to 4.6% (existing 3.97%) and 20% (existing 13.19%) respectively.

Working Plan Code

The Government of India has laid out clearcut guidelines for incorporation of bio-diversity conservation in the working plan documents through :

- laying down that a minimum of 4% of the geographical area shall be allotted to Protection Working Circle, thereby excluding any commerical fellings.

- enjoining that Botanical Survey of India and Zoological Survey of India will be associated while preparing the working plans to ensure that endangered/rare species in the tract get pinpointed and are given adequate protection while drafting the working plan prescriptions.

Need for Conserving bio-diversity

Often questions are asked, particulay in the developing countries, that while there is so much of poverty and land hunger, why should one care about reduction of biological diversity. After all the "green" revolution on the food front has come about through propogation of extensive "monocultures" of geneticlly superior foodgrain species. But now doubts are being raised whether this can be a sustainable proposition due to fuel-subsides (for farm machinery, chemical fertilizers, pesticides, for transportation to the market) inherent in the energy costs of the agro-systems. Moreover, there are large pollution costs. As it has been aptly expressed, the present agriculture production is "partly made of oil" (Odum, 1975). It is also known that practice of agriculture has essentially been domestication of wild species and primitive varieties grown by the rural people. Will it be wise to "kill the hen that lays the golden egg'?

The important considerations for ensuring biological diversity in nature are :

- as a food resource
- as a gene pool (eg. pest resistance, drought hardiness, nitrogen fixation, salt tolerance etc.)
- as source for biological control agents minimising the use of chemical pesticides.
- as rich and virtually unexplored resource of medicinal plants.
- as self-sustaining trophic relationships (food webs) for maintenance of the health of the various eco-systems, which are essential for life support on a global scale.

Broadly biological diversity can be at three levels ie., genetic, species and eco-system. It can also be floral (trees, shrubs, ferns, algae, etc.), faunal (mammals, insects, fishes, snakes, etc.) or even fungal, protozoal and bacterial. A forest manager has thus to look at a multiple resource while being acutely conscious of the fact that he has to provide for bonafide needs of the forest produce of the local villagers (live stock grazing, firewood, MFP & small timber) as well the vital national needs (defence, railways, industry, urban housing etc.).

Degraded forests and waste lands

The esclating population (both human and domestic animals) has resulted in unbriddled expropriation of the niches of the various organisms by the human being, there by denting or even breaking the vital food webs causing the forest eco-systems to collapse. The village forests and common lands, once the traditional areas for fire wood collection, herding and grazing have been brought under plough, there by transferring the entire pressure on the regular forests which have started showing signs of degradation or even become completely barren.

Faulty agricultural practices have also rendered large tracts virtually unproductive. Marginal agriculture has resulted in a patently faulty landuse by depriving it of the tree cover. Overall the forests have been relegated to comparitively remote and difficult locations (mostly hilly terrain). However, with quantum expansions in the communications net work, particularly the roads, even the remotest areas are being subjected to ravages of human need and greed. Even where the forest departments have been able to tenaciously hold on to the forest areas, their composition and density have degraded. And the worst is yet to come! The population boom (840 million - 1990 projected figures) is likey to continue, there by fueling the land hunger in general and the demand for food in particular.

One of the opportunities for increasing agriculture production can be through a vertical pathway of greater intensity of cropping and higher yields per unit area. This will require considerable scientific efforts. Despite the current talk of green revolution and self-sufficiency, the agricultural yields in

the country are one of the lowest in the world. The prospects of energy inputs for sustaining modern agriculture also do not seen to be too bright in the face of oil and foreign exchange crunch.

On a global level, FAO has estimated that even if the crop yields from cultivated areas were to increase by 72% , another 200 m hectares of land will have to be cleared to meet the food requirements of 6 billion people by 2000 A.D.(Swaminathan,1985) This will lead to vicious cycle of more biotic pressure on the forest lands on account of

- increased demand of forest produce per se
- greater intensity of biotic pressure on reduced forest area.

The scenario is thus quite bleak and there does not generate much confidence.

Future Stratigies

Degradation of forests and formation of wastelands can be directly linked to biotic pressure generated by centres of human conglomeration. The gradient of biotic pressure falls off with distance from the centre of consumption. Any eco-rehabilitation efforts on these degraded areas would have severe local conflicts and would ab initio need to be planned to sub-serve the interest of the local populace and speak the vernacular of meeting the bonaide requirements. This will severely restrict the choice of species as well as style of management. Speaking of bio-diversity concept in such programmes, as is the theme of the current deleberations, may be too elitist and may not be entirely acceptable to the people. To enlist people's participation, such a programme has to address itself to increased productivity of the kind of forest produce most in demand by the adjoining populace. This would call for advanced technology particularly for the refractory sites. The costs of these programmes may be initially very high, because high prouctivity cannot be derived from depleted sites. But in the long run it may offer the following advantages

- be locally acceptable
- ensure peoples' participation, thereby ensuring better success
- reduce pressure on the natural forests which will recuperate on their own.

The strategy has to be planned in manner so as to make bonafide requirements available as close to the centres of habitation as possible and thereby reverse the need of the people for raiding natural forests in remoter localities. Increased costs in rehabilitating the wastelands and adjoining degraded forests, will correspondingly reduce the costs required to protect and regenerate the natural forests which can then become reservoirs of bio-diversity. There is a strong evidence of resiliency amongst the tropical eco-systems to restore its

important functional attributes. A prudent management, which regulates the abuse of these forests, can lead to much of the bio-diversity coming back on its own. (Lugo, 1988)

Social forestry to the rescue of bio-diversity!

As has been emphasized earlier, reckless excising of forest areas for agriculture in the past has led to considerable areas having marginal cultivation. Also the village agriculture system has a substantial scope for integrating agro-forestry system in its ambit. Restoration of production of forest produce on the former forest lands, where food production is not sustainable, and through suitable agro-forestry practices will further reduce pressure on natural forests.

National Forest Policy (1988) has also laid a great emphasis on social forestry and farm forestry by encouraging individuals and institutions to undertake tree framing, growing of fodder plants, legumes and grasses. The forest policy has even gone to the extent of enjoining the forest based industries to grow its own raw material , preferably by establishing a direct relationship with individual farmers. It also envisages that woody species required by the industry may be grown along with fuel and fodder species on community lands and degraded forests by the Forest Department/Forest Development Corporations.

That a successful agro-forestry programme can lead to easing of pressure on the forests, can be gauged from the fact that Haryana and Punjab, which hardly have any natural forests, have sizeable wood surpluses and are supplying timber and charcoal to the adjoining states of Himachal Pradesh and J & K having considerable areas under good forest cover. Social forestry programmes thus can have importrant linkages with the success of the bio-diversity conservation in the natural forests through mitigating demands on them.

Amount of Biological Diversity

The magnitude of global bio-diversity is not yet listed. According to one estimate 1.4 million living species of all kinds of organism have been described (Wilson, 1988). Out of this 7,50,000 are insects, 41,000 are vertebrates and 2,50,000 are plants. The balance is constituted of invertebrates, fungi, algae and micro-organisms. It has also been estimated that the tropical rain forests alone may contain more than half the species in the entire world biota. The extraordinary richness of the tropical forests put an extra onus on the Indian foresters for bio-diversity conservation.

Minimum Area Requirement

In absence of detailed cataloguing of all the texa, the easiest empirical way of ensuring conservation of bio-diversity could be to maintain the representative forest ecosystems intact. A detailed study conducted by the WII referred to earlier, has

indicated that this can be achieved though bringing 15 mha of forest area, in appropirate bio-geographic zones, under PA network.

Extent of Forest Cover

According to the Forest Survey of India (1989), the position of the forest cover in the country is as under :

- areas with more than 40% density	36 mha
- areas with 10-40% density	28 mha

In a simplified model, it will be safe to assume that the entire 15 mha of PA network can be allocated in the more dense natural forests.

Forest Management and Harvesting

From the foregoing it is evident that even after setting aside the entire area envisaged in WII report, there will still be 21 mha of good natural forests out side the PA networking which can be available for harvesting, ofcourse subject to the guidelines laid down for preparation of working plans and the National Forest Policy (1988). But the inherent assumption would be that the State Governments are willing and would be able to give adequate protection to the areas which have aleady or will be notified in pursuance of the WII report. However, adequate funds and political will will be required to achieve this. People may have to be given socio-economic packages to mitigate their short run difficulties which they would feel as a result of protection/closure of PAs in their near vicinity.

It has also been brought out in the foregoing discussions that the entire forests wealth of the country cannot be "locked" but has to be tapped for meeting the bonafide need of the people as well as the vital national needs.

Silviculture as agent of change

Silviculture has been described as science and art of forest management. Death of an old growth large tree in a natural forest brings in a series of changes in the flora and fauna over the limited openings created by its death/fall. Silvicultural manipulations can similarly induce changes, depending upon the nature and the intensity of operations. Unevenaged management, while favouring the commercially more important trees, causes less disturbance than evenaged management under plantation forestry.The former infact attempts to mimic the disturbance pattern of the nature. (The Wilderness Society, 1989). The other silvicultural practices which have bearing on bio-diversity are weed control, thinnings, manipulation of light and retention of seed trees of favoured species. All these operations would, while maintaining bio-diversity to considerable

extent, mutatis mutandis deplete some of the species existing originally and thereby decrease the bio-diversity. However, exploiting of only old growth mature trees would not only maintain the forest productivity by preserving the site nutrient capital more or less intact but also provide good economic return by making large size premium timber available.

Thus it may be extremely useful to harvest the non-PA natural forests (21 mha)under ecological rotation without seriously jeopardising the maintenance of forest ecosystems and their inherent bio-diversity.

Production Strategies

A large chunk of forest area (28 mha) has already become degraded. Since these forests have an interface with peoples' requirement, these should be developed for high productivity. The potential productivity of the country's forests is abysymally low (~0.5 cum/ha/yr). Even if it can be raised to 5 tonne/ha/yr, the degraded forests alone could produce an annual increment of 140 Cum of wood. These areas would also provide the much needed buffer to the better stocked natural forests. This in conjunction with a people's oriented social forestry programme on wastelands and agro-forestry practices on farmlands, could completely eliminate biotic presures on remaining nautral forests, which could then be set aside for purely conservation needs (15 mha) and old growth timber production (21 mha).

Development of Corridors

Due to uneven dispersion of the forest areas in the country, at times some of the existing, or identified, key PAs may become "habitat islands". Cattle lifting and man-eating problems caused by large carnivores are an example of an "island" situation. Problems caused by migratory herds of elephants in north-east, central and soutehrn India are due to loss/absence of adequate corridors between potential habitats. Similar problem is being faced by northern swamp deer in Dudhwa National Park and adjoining (25 Km) Kishanpur sanctuary. Both PAs are now separated by habitations and agricultural fields which have sprung up in the last decade. The "corridor" of mostly swampy grasslands has been converted into "productive" plantations by the Forest Department. This has effectively destroyed the swamp deer habitat and its corrdior values. There are numerous such examples where concerted efforts are required to restore the degraded forests to provide for "corridors" between the PAs or develop the wasteland in a manner so as to provide for corridor linkages (Sawarkar, 1990). Of course, the solutions have to be more site-specific, both quantitatively and qualitatively. In such situations neither the degraded forests nor the wasteland can be taken up for high production but may have to be restored to as nearly the original forest eco-system as possible.

Conclusions

Need for bio-diversity conservation has been fully understood in the context of the forest management in the country. However, locking of the entire forest areas for conservation, per se, may be too elitist concept to be fully acceptable in a developing, poverty-ridden and land-hunger based economy of the country. Scientific studies have revealed that by setting apart 15 mha (20%) of forest area under a well connected net-work of Protected Areas (PAs), will be able to ensure conservation of the existing national bio-diversity.

It has been argued that better stocked old growth areas, beyond the extent required under PAs, can be used for production forestry under unevenaged, non-plantation forest management. However, the degraded forests and the wastelands need to be developed for high production forestry to produce the direct requirements of the adjoining village communities. This will curb/reduce the tendency of the villagers to get into the remoter forests which will, sans biotic interference, rehabilitate themselves ecologically on account of the great resilience of tropical forest eco-systems.

Social and agro-forestry practices need to be developed in a big way to localise the demands of forest produce (both bonafide and industrial) on either the village agriculture farming system or adjoining village commons.

A holistic and anthropocentric approach, can alone in the long run provide a realistic solution to otherwise serious problem of deforestation in general and fast depleting bio-diversity in particular.

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HOW CAN WE INVOLVE PEOPLE AT LARGE IN PLANNING, MONITORIG, FIELD ACTION RELATED TO DEVELOPMENT OF DEGRADED LANDS AND CONSERVATION OF BIODIVERSITY?

There is a general belief that people are responsible for the destruction of natural resources. Bureaucrats are under the impression that it is the poor which depend on biomass is wholly responsible for vanishing forests of our country. Though there is no data base for this belief, it is continued to be considered so. It is true that in his increasingly demanding efforts to utilize or modify the resources of nature so as to get the maximum production in agriculture, man unknowingly or knowingly started mutilating the environment. We may identify these as soil degradation, deforestation, over exploitation of water pollution, reclamation of transformation of crop land etc. But as Gadgil (1985) has rightly pointed out man's cultural traditions have always forced him to show ecological prudence, which basically make him conservation conscious. If man has become cruel to nature it can also be due to the consequence of development of modern science and attendant technogical revolution. It is high time that man is guided back to his ecological prudence so that people survive within a biomass based subsistence economy. Participating people at large in attempts of developing degraded land or conserving biodiversity is an effort on these lines.

Rober Chambers et al (1989) say that "Peoples' participation" has become a standard rhetoric in INdia today. Different actors interpret it differently. One view is that participation would be easy to achieve if secure private land rights are given (Chowdhry 1985). Staff engaged on project implementation understand participation as getting people to agree to and go along with a project which has already been designed for them, or to get support of a few leaders. The approach of government projects is "I manage, you participate". This evidently shows that peoples' participation has not been expressed in a manner which would establish their rights over land or its produce.

The FAD defines peoples' participation as "the process by which the rural poor are able to organise themselves and through their own organisation, are able to identify their own needs, share in the design, implementation and evaluation of the participatory action". This definition is adopted in this paper. Thus various elements of participation are decision making at various stages, control and management of funds, share in usufruct and final produce and ownership.

Like several other developmental efforts, the history of wasteland development projects also replete with unsuccessful stories. Well-conceived, scientifically planned, and carefully executed projects have either met with partial success or faded without bringing any considerable benefits. The primary cause has been the centralized, top-down approach which lacked involvement of people whose lives would be affected, were not taken into confidence and their participation was lamentably overlooked. Seldom has it been presumed that these people would themselves have a role beyond being passive recipients of the technology offered.

Whereever benefits are unambiguous people have on their own taken initiative to develop wastelands or to look after forests. There are many instances now on record of success stories of peoples' participation. Some of them are discussed below:

(1) Dasholi Gram Swarajya Mandal (DGSM)

Garhwal in the UP hills has a long history of poverty accelerated by increasing population with consequent destruction of village fuel and fodder resources. Food grain production was insufficient and the menfolk were forced to migrate to the plains for employment. The women look after the farming, livestock and collection of fuelwood, fodder and drinking water in addition to their household duties. The village Panchayaths did not pay much attention to women's issue of fuelwood, fodder and water.

The DGSM is a voluntary organisation founded by Shri.Chandi Prasad Bhatt in 1964 at Gopeswar, District Chamoli, Garhwal. The floods and landslides of 1970 in the Alaknanda Valley saw the DGSM engaged in relief work. The devastating deaths sharpened everyone's perception of the deteriorating environmental situation and the realisation that its major cause was deforestation of the hillsides. In 1973-74 under the leadership of DGSM the people started an agitation to save their forests. The Chipko movement led by DGSM played a significant role in saving the remaining tree cover in reserve forests from the area of the cultivators and the policies of the forest department. (Anil Agarwal & Sunita Narain 1990).

DGSM workers began to plant trees in degraded areas in 1975 with the help of concerned students. In 1976 the DGSM held a month long tree planting camp. Through the camp then drew the attention of the civic authorities to the increasing deforestation being caused by the military encampment above the town. As a result of their work, the UP Government set up a committee to investigate the ecological problems around the town. But there was limited involvement of the local people. The tree planting exercise only helped DGSM workers and local students in their own education. The survival rates of the trees were also poor.

Around that time there was a landslide near Pakhi Village which was used to show the local villagers the consequences of the growing ecological crisis. A camp was organised to take up tree planting to stabilise the landslide. This led to a dialogue with the local villagers and their involvement in tree planting. Soon women also began to participate, and simultaneously the survival rate of the planted trees increased. DGSM's contact began to grow with other villages, especially through the youth who had participated inthe campaign against the felling of the Reni Forest. The camps also began to become more than tree planting camps as villagers began to discuss their problems of health, roads, and the absence of various services. The

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afforestation effort spread to neighbouring villages. Today DGSM is working with some 250 villages along the Balkhills, Patalganga, Garuganga and Kalpganga rivers all of which are tributaries of the Alaknanda.

Following this experience, the DGSM approached the Government of Uttar Pradesh to undertake wall-building activities under the National Rural Employment Programme, with DGSM promoting plantation activities on a voluntary basis by the villagers. But the State Government did not respond to this suggestion. Having aroused the expectations of the people, the DGSM tried to support wall-building work from its own meagre financial resources.

In 1982, the DGSM received a grant from the Planning Commission to undertake the Garauganga watershed development project. Under this project, DGSM now has funds to assist 27 villages to take up afforestation work. The the project covers an area of 100 sq. km. with villages located at an altitude ranging from 3500 to 7000 feet. Organising eco-development camps and wall construction work have remained important parts of the afforestation work, but promotion of wood saving fuel technogies like efficient stoves and biogas plants has also steadily been taken up. By 1985, almost 16 Km of store wall had been built in these high mountains (Anil Agarwal and Sunita Narain 1990).

Saplings are supplied mostly from DGSM's own nurseries free of charge to the Mahila Mangal Dals (Women's organisation). By 1985 more than 250000 trees had been planted by these village organisations. The Mahila Mangal Dals look after the plantations. They regularly water, weed and manure the plants. Once or twice every month, the women gather to work on the plantations.

In each village, the Mahila Mangal Dals lay down new community control systems for use of the biomass from planted areas. There are not only equitable and sustainable but more importantly takes into account the most pressing needs of the villagers.

The afforestation work taken up by the Chipko Movement has helped the local communities in many ways. Fuel and fodder shortages have greatly eased and will ease further on the plantations grow and more land is brought under protection.

(2) The Bankura Story

Jhilimili, a small village in West Bengal's Bankura District is a vide swath of rolling hillis, with cover exploited land and water resources. Once the district had thick mixed forests of sal, neem, kendu. Santhal tribals of this area lost their wooded land to settlers from the plains. Traders and contractors saw in the forests the basis for supplying cities and 'developing' pockets with timber, forest products, and later agricultural produce from cleared patches.

Most tribals sold or pledged their land in return for a few sacks of grain. The loss of private lands was a keen set-back, but possibly a greater loss was the disappearance of forests which were their natural habitat, and their life-supporting system.

This part of Bankura district provided few opportunities for wage labour. So survival depended on migration to private farms in neighbouring Hoogly (200 Kms) and Burdwan (150 Km). Governments' ongoing employment programmes together generate about 3 weeks' work for rural workers per year:

The Delhi based research organisation called the Centre for Women's Development Studies (CWDS) entered the scene and acted as a catalyst in organising these women with a view to their upliftment CWDS representatives registered them as Gramin Mahila Saramik Unayan Samiti (GMSUS), one organisation each for the village clusters of Bankura. The villagers donated private land for plantation with arjun and asan, the host plants of the tassar silk worm. Rearing of tassar cocoons in the forests is a traditional occupation and the land would be used by the Samiti for cocoon production.

CWDS contacted the local Forest Ranger and he provided saplings. The Tribal Welfare Department of the Government of West Bengal sanctioned a grant of Rs.10,000 for plantation. Men cleared the land, women planted saplings. With help and guidance from CWDs the samities were able to procure more financial assistance from the Government. These funds met the labour and plantation costs and a part of the maintenance costs. Women then volunteered their labour to protect and maintain the plants, organising themselves into village based groups with a group leader.

With plants the spirit grew. The plants dotted their red hills, and then felt secure because these plants were not the property of the Forest Department or the Panchayath or village households. The villagers felt that the future of these plants depended on them and on the decisions they made together (Nalini Singh 1988).

Rearing of silkworm started in 24 months. Women organised a job sharing roster for 3 crops reared during the rearing period July to January. Then the samities decided to diversify to other income generating activities which matched the women's needs and skills; making of sal leaf plates, grass ropes, trading in mahua seeds and so son.

Samiti members can now survive without 4 yearly migrations to distant districts in search of work because they have created employment for themselves by expanding the production base of the local economy, incidentally by afforesting the barren land.

(3) The village of Sukhomajri

Sukhomajri is a small village of about 71 families, mostly gujars, in the lower ranges of the Sivaliks. The village has about 240 acres of land, half owned by individual families and the other half used as common land. The major portion of the catchment is owned by Forest Department, who lease it to the villagers for grazing. Not enough was produced either in agriculture or in the surrounding slopes to feed the people or their cattle. Many men found jobs in the nearby cement or machine tools factory or in Chandigarh.

The only available water in the village came from a muddy rainfed pond in the middle of the village and piped drinking water pumped from a nearby spring. The monsoon water often played havoc with the village. The village had no irrigation water, no electricity, not even a bullock cart. There were no vegetable plots, or fruit trees or fodder crops which required water that was not available. The wealth of the village was in their animals. While the village men tried to find employment outside, the women spent most of their energy searching the surrounding countryside for grass andtrees that could be cut for fodder and fuel (NWDB 1988).

Due to over grazing the consequent soil erosion in thecatchment area, the lake Sikhra in Chandigarh was silting up; the watershed of this lake had long been demarcated as government property and people of Sukhomajri had only restricted use rights. Theyc onsequently had no interest in protecting the watershed.

In 1974 the Chandigarh Centre of the Central Soil and Water Conservation Research and Training Institute (CSWCRTI) was asked to look into the problem of watershed management of the area.

In 1976, the CSWCRTI scientists built a small earthen dam to prevent further erosion of the watershed and fields by diverting water into a reservoir. This structure controlled a gully which has about 15 m deep; in just one year agricultural land 10 m in width had turned into a gully 10 m deep. The reservoir not only salvaged the agricultural land, but also saved water.

The following year was a bad year for the village. The rains failed and the wheat crop was withering. The villagers approached the soil scientists for permission to use the water in the reservoir. This supplemental irrigation from the stored water not only saved the crops of villagers close to the dam site, but even improved yields from 12 to 25 quintals per hectare.

A second dam was built in early 1978 with assistance from the Ford Foundation. An underground pipeline was laid to take water to the fields, and undulating terrain was levelled in order to maximise the benefits from irrigation, with farmers sharing the cost of levelling. So great was the felt need and perceived benefits that one farmer sold two goats on the spot to pay for the work. The only condition for the use of the water was that

served a hunting reserve of the local rulers. Due to deforestation the area was reduced to base and eroded hills. The local community which depended heavily on this forest was hard hit. Their economy was undermined.

The village headman called a meeting of the villagers in February 1973, and explained to them that the cause of their miserable plight lay in the destruction of forests in their neighbourhood and that the remedy lay in their hands only. The villagers resolved that in the name of Hindu religion the village forests should be protected at any cost. The community also decided that anyone felling a tree or damaging it in any way will face social boycott in addition to a heavy fine. It was also resolved to appoint a local watchman on a monthly honorarium raised by equal contribution from each household. These decisions were written down on a court paper to give it a legal status and authority enough to deter the villagers from violating it. One watchman was subsequently found inadequate to contain the Nayakas, a community notorious for thefts and hold-ups. The number was increased to two. In the case of an emergency notified by beating a drum kept in the local temple, the whole village would rush out. This show of unit and strength was enough to frighten and deter the Nayakas.

This experiment was successful. The protected patch recorded excellent growth. Enthused by this the local District Forester started afforestation works to help the villagers get more earning. He procured them a gun licence. He helped them solve their drinking water problem. By this goodwill he could get the villagers involved in the protection of the whole forest area. At his instance an Executive Committee of five persons constituted democratically through consensus. Each member was designated a leader of 10 persons of his neighbourhood. Each team would protect the forest for a week. Thus the whole village was involved and each household felt that it was a part of the decision making process also in its implementation.

This success story of Chansar village has travelled to the adjoining villages. In 1988, Mor, Balaji, Mirwada and Kantar villages adopted the Chansar model.

villagers had to stop taking their animals to graze in the watershed. Since their own vested interest in the dam was dependent on this prerequisite, the assumption was that grazing wound stop.

But grazing continued. Later it was found out that the benefit of the irrigation did not reach every one and so this resent. If the watershed was to be protected effectively, then the entire community which used the watershed for grazing would have to be given an equal share in the resources of the watershed.

The villagers then started a Water User's Association, registered under the Societies Act. Each family was represented in the Association. Under the rules of the association, a member whose cattle was found grazing in the watershed stood to lose the right to water. Landless and other households could make use of their share either by share-cropping or selling their water to others in the command area of the dams. With the assurance of benefit to each family, protection of the watershed was immediate. The village did not have to build a wall or a trench to protect the vast catchment area. Instead, voluntary closure, stopped people from taking their animals to graze.

Im 1985, after many years of insistence, the Forest Department agreed to give joint management of grass cutting rights to Sukhomagiris' village society against payment of a royalty. This means that the village society now controls the development of and the benefits from grass growth on its commonland.

4. Chansar Villagers initiatives

The Chansar experiment (Shah 1990) symbolises unique initiative by the local villagers independently and all by themselves in a locality which had acquired notoriety for destroying forests. Chansar, in the Lunawada taluke of the Panchamahal district, is a small village of only 80 families. Not long ago there existed a fairly dense forest of about 558 ha. consisting a mixed deciduous teak with profuse undergrowth. It was rich in wildlife and

5. Arabari Story

Chambers et al (1989) have documented another success story of peoples' participation. Vast areas of forests of the southern lateritic tracts of West Bengal have been virtually unproductive on account of commercial exploitation, unregulated fuel wood collection by poverty stricken people and grazing by village cattle. In the year 1972, the Division Forest Officer, Midnapur, West Bengal took over a block of 1272 ha. of denuded forest for rehabilitation. Until then, the stumps left in the area had thrown up vegetative shoots every year which local poor people used to cut down and sell in the nearby market for subsistence. The value of the forests in terms of commercial timber in 1972 was nil.

The rehabilitation scheme focussed on generating sustained productive employment in the forest area, so that people did not have to sell fuel wood in the market. The project also grew fuel wood so that people could get it on a token fee, at cost price and arranged cattle grazing on a rotational basis. The project permitted the people to raise paddy on forest lands, which was sold to the same people at cost price. Thus all immediate requirements of the people were taken care of. It was also promised that people would get 25 per cent of the final produce if the scheme succeeded. In the period 1972-85 peoples co-operation was nearly complete. Productive employment was created by maintenance of shoots that grew on stumps over 700 ha. and plantation of Acacia auriculiformis, eucalyptus hybrid, cashew nut, Sabai grass and sisal over about 560 ha. People received their fuel wood and plough pieces at cost price and rotational grazing areas for their cattle. The Government of West Bengal approved in March 1987, the distribution of 25 per cent of the usufruct to 618 beneficiary families in view of their exceptional co-operation in the maintenance and protection of these forests.

An erst while totally degraded government forest has now become a luxuriant forest, better than any found in the area. The success of Arabari experiment has lead elsewhere in West Bengal to the formation of 659 voluntary village committees, each promising to look after the forests in similar terms. By 1988 October it was estimated that over 68000 ha. of forest land was being protected by village groups.

(6) Village communities in Orissa

Orissa State with a high percentage of forest and of tribals in the population, is credited with some of the earliest successful initiatives directed by dedicated and selfless social workers. There are villages, where people had been actively involved in protecting forests even before the Social Forestry Projects started.

Kesapur village is a good example of such initiative by local people. A protection committee consisting of members from several villages has been functioning well in Keasarpur village of Keonjhar district. The situation had become quite acute in the late sixties as deforestation led to soil erosion and gully formation. A heavy landslide in a neighbouring village frightened the villages and made them think that immediate steps had to be taken to check erosion. The forest department proposed that plantation on the hills will be introduced if people agreed to do away with their goats. This was agreed upon and a couple of households who intially did not do so were fined by the community and forced to follow suit. Today, 13 villages around Kesarpur having 2000 families jointly protect about 1000 acres of forest land. (Chambers et al 1989). In addition plantation has been undertaken over an area of 120 acres. The hill now looks green with a variety of forests species and good undergrowth. Gully formation has been checked and the stream has again started flowing.

We have more and more examples of this kind throughout India. Eco-restoration of Sirsi in North Canara of Karnataka State, the Vankar co-operatives in Gujarat, Brahmano Ka Verde of Aravalli Hills, Seed near Udayapur are examples.

The logistics of involvement:

The various cases of success stories cited indicate different kinds of initiatives. No where in the world has a more successful community afforestation programme been organised than the one spear-headed by the Chipko Movement under the leadership of DGSM. The initiative here has been purely of local people, more specifically the village women of Gopeswar. It allstarted from the anger of the villages who realised that while they themselves are denied the use of wood of the trees for making their agricultural implements the Allahabad Sports goods factory are given the rights to cut and take away the same trees. When the contractors persisted, the villagers hit upon the idea of hugging the earmarked trees - "Chipko" being the Hindi word "to hug". The sports goods manufacturers returned empty handed. Since the initiative is purely from the beneficieries themselves the whole process took shape according to the design which their needs dictated. The village dals have slowly taken control of the community lands surrounding their villages. They protect these lands, plant treeson them and ensure fair distribution of the grass and fodder that becomes available in increased quantities from these lands.

The Chansar experiment is another case of peoples' own initiative. The motivation came from the villagers' realisation that the cause of their miserable plight lay in the destruction of forests in their neighbourhood and that the remedy lay in their hands only. The decision to protect the forests in the name of Hindu religion was a shrude one because religion is such a great force in the area that it can invoke commitment and action without any opposition. The action of the village community gave impetus to a local forest officer to start afforestation work and this supplimented the move of the villagers.

The Kesarpur case of Orissa is slightly different. Here the people had realised that some immediate steps have to be taken to check soil erosion and landslides which were consequences of deforestation. But the initiative came from the forest department. The villagers followed the instructions of the department and co-operated with plantation activities.

In the case of Sukhomajiri, the whole initiative came from Sri.P.R.Misra and his colleagues of CSWRTI. They identified the village and its catchment as the starting point in controlling the siltation of the lake. Then they built a small earthern dam which prevented further erosion of the watershed andfields by diverting water into a reservoir. The significance and usefulness of this was realised by the villagers during the following year when the rains failed and the wheat crop was withering. This made them co-operate with the scientists' programme, stopped grazing and finally succeeded in establishing an ecological infrastructure for village development in which economic growth has been based in biomass potential of both private and community village land and water.

The cases of Bankura and Arabari are still different in the sense that initiative came from outside agencies - CWDS in Bankura and a Divisional Forest Officer in Arabari. In both the cases the external agencies had to conceive of what action to be taken and both offerred schemes for providing immediate employment opportunities. The villagers rose to the occasion and succeeded in their respective areas of activity which ultimately helped afforestation of degraded land.

What is the success due to?

The following findings of Waquar Málik (1990) are applicable to the success of the projects in which people have participated:

(i) Local-community residents define their own goal and priorities and the extension agent and forester act as facilitators:

(ii) An extension agent often helps to take the interests of the farmers into account::

(iii) There is follow-through and flexibility, especially when the facilitators live in the community.

(iv) Extension agents and foresters behave like friends and mediators, not masters.

Thus it becomes imperative that the local people would themselves have a role beyond being passive recepients of the technology offered. This should be one of the cardinal principles in planning any project of wasteland development by peoples' participation.

Peoples' experience and rustic wisdom can be used in planning projects, often better than modern technology. Being victims of changes in firewood supply, people actively seek everyday solutions in locating and conserving fuel and thus become local experts regarding the burning of qualities of various local woods and firewood alternatives. They are familiar with successful local species and they know which plants survive where, because they are custodians of centuries old idegenous knowledge about climate, soils and other conditions. Therefore the local people, particularly indegenous knowledge-specialists, could be an asset in planning and management of wasteland development. It can be said that the success of any programme would rest in the hybridization of ideas of indigenous specialists with research specialists and the involvement of local residents even in the initial design of the project itself.

When will people come forward to participate?

Naturally the first answer to this question is 'when people are aware'. Awareness can be self generated or created. Self generated awareness is related to day to day life experience of people and can never occur through academic knowledge. When people becomes victims of environmental degradation they automatically develop this perception. But destruction has to manifest itself into more visible effects such as:

- destruction results in scarcity of drinking water
- destruction undermines the economic base of such scarcity of raw materials.
- destruction causes flood damage to crops, homes, cattle,
- destruction threatens survival itself

to enable the people to think of remedies to their maladies. Then they will come to action, all by themselves; the Chipko and the Chausar stories

are typical examples of this. In certain situations deliberate creation of awareness is required. The cases of Bankura or Arabari or Kesarpur or Sukhomajiri are examples where local people although had life experiences, were not capable of pushing themselves upto remedial action. They had to be got prepared. In such cases they should be made to understand what is at stake and how much they owe to existance of natural resources like forests. There should be dialogues on peoples' needs. Some times they have to 'see' to believe. SUkhomajiri is a good example. The scientists built a dam which demonstrated that reservoir is something people can depend upon when rains failed.

The story of the farmers of Karnal district of Haryana is worth mentioning. These farmers were once poor because their soils were alkali affected, having toxic salt contents. Now they are prosperous as their soils have been cured by scientific technology. But in 1974 when an operational Research Project for reclamation of alkalic soils was sanctioned by ICAR people were reluctant to take it. But when the field trials turned out to be successful and after 'seeing' bumper crops on demonstration plots, the farmers needed no goading. They reclaimed more than 2300 ha. out of a total 2500 ha. at their own cost! (Metha 1987).

It is always difficult to sell the idea of protection *per se* to the people. Take for example the case of the well known Silent Valley crusade. It was never a peoples' struggle to save the valley, because the local people were not convinced by the knowledge of nature conservation, which they had never experienced, (Prasad 1984). The Silent Valley Hydel Project was a symbol of the aspirations of the people of Malabar for a long period and mass organisations and political parties were committed to its implementation long before the ecological questions were raised by the scientists. The people in the locality were not adversely affected by the project, but onthe other hand people stood to benefit from the employment and income generated by the construction activities. It is true that Silent Valley is one of the richest biospheres inthe whole world, but it is also true that for the people of Malabar the question of energy, of irrigation, of employ-

ment and of development is more real, immediate and obvious than the necessity of protecting the unique biosphere of Silent Valley. This was the situation to be faced. People were to be mobilised to call for a halt of the project implementation. The protagonists of the project were campaigning on the benefits of the project. This made the task more stupendous. The Kerala Sastra Sahitya Parishath (KSSP) started a mass campaign, the most intense and prolonged single campaign in order to save the Silent Valley. Thousands of meetings and marches, hundreds of lectures and seminars, exhibitions and theatrical performances were organised. But in none of these the ecological concepts or importance of gene pools, or relevance of protecting endangered fauna and flora were used. KSSP made it a campaign to educate the public on role of forests in preventing floods and droughts, relationship between forests and rainfall, role of forests in regulating water cycle, importance of protecting natural resources, the idea of sustainable development etc. etc. The knowledge that the common man acquired through this campaign would have ultimately posed to him a question "should we not protect and preserve the Silent Valley then?" KSSP also dealt this issue in the context of socio-economic relations which made it easier for people to understand the perspective. Thus the Silent Valley campaign became, in fact, the mother of nature awareness campaigns in the country.

The next pre-requisite of enabling people to action is providing people secure rights over resources created - for instance, to cut trees on private land; to move trees and tree products freely without permit; to enjoy the usufruct of trees; to gather minor forest produce without harassement or need for bribes; to receive their access and equal share of fodder and tree products from communal forestry etc. WE have seen, the main reason why villagers protect their watershed is because they have an assurance from the forest department that they have the right to the usufruct of the land. In removing restrictions and assigning legitimate rights to the people there should be a campaign of information with political support.

It is onething to abolish a restriction or establish a right on paper, and quite another to enjoy the benefits. Those officials who stand to loose power and payments if the new freedoms are exercised may withhold information, pretend that old rules still apply, or make other threats to secure their customary tribute (Chambers et. al. 1989.)

This resistance has to be overcome by wide publicity using all available and possible media verbal, print and electronic by which information is on the fingertips of the people. NGOs can help, act as watchdogs, and support the poor in securing their rights.

Several laws will have to be changed to give people the right to improve and develop the village natural resource base. The legal frame work should clearly be such that people are encouraged to take initiative to develop their natural resource base and not wait for the government to act. No society can progress within a framework which allows the government to act but discourages the people to do so. (ANil Agarwal & Sunita Narain 1989).

The Strategy

The strategy for planning to involve people at large in development of degraded lands and conservation of bio-diversity should take into account the following:

i) People should be taken to have a positive role beyond being passive beneficiaries.

ii) The first step must be conscientisation including education, extension and communication.

iii) The programme should project tangible benefits and people should be made partners in management and profits. They should define their goals and priorities.

iv) Informed people must help design the project. No simple "peoples' programme" can be designed in any capital city and super imposed or dropped fullfledged on a community. Failure to include local people from the beginning often assures the failure of the project.

v) Local peoples' indigenous knowledge should be tapped in designing mass action.

vi) Wherever local leadership is lacking or too weak to initiate action a local NGO with established credibility should provide leadership. But this external agent must act only as facilitator.

vii) Ideas of conservation have to be delivered in the context of socio-economic-cultural relations. Tese aspects should therefore be studied thoroughly and various constraints and problems which are local in nature identified.

viii) People should be assured of their legitimate rights of possession and usufruct over resources created. Enabling legislation must be attempted by Government.

ix) Information on rights and previleges should be made available to participants, well in advance.

x) The facilitators must have orientation training in human behavioural sciences, which will offer a wide scope in bringing their attitudinal adjustments in line with the local community.

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CHAPTER 11

CONSERVATION LINKED WITH SUSTAINABLE DEVELOPMENT

INTRODUCTION

The estimate on the species number on earth varies from 5 to 30 million; no one doubts that the numbers are far higher than was thought until recently (World Resources Institute, 1988). With an estimated 15 to 33% loss out of the total wildlife by 2000 A.D., the extinction rate is becoming critical for human survival (Lovejoy, 1986). It is in this context that conservation science assumes considerable significance. Apart from a number of biological problems such as community equilibrium and fragility of ecosystems, there are many social, challenges that impinge upon peoples, perception of environment and development. However, it is only in recent times that efforts have been directed to build up the necessary and obvious contacts between ecological and social sciences.

In Chapter 10, we have considered in a comprehensive manner the question of ecosystem redevelopment in north-eastern India. Such an approach to restoration ecology in the humid tropics is important for an overall conservation

strategy design. However, many questions pertaining to conservation need to be considered. What is it that we wish to conserve? Is it possible or even necessary to conserve all the species that are likely to be lost and about which we may or may not even be aware of ? How do we ensure that our conservation strategies are effective? Which is sustainable development in the context of biological conservation? In this Chapter, we shall consider some of these issues and attempt to answer them using the experiences from the north-eastern Indian case study considered in detail in the earlier Chapters.

AGROECOSYSTEM CONCEPT AND CONSERVATION

The recent emergence of the agroecosystem concept provides a useful framework not only to design a relatively stable and productive system, as discussed in earlier Chapter, but also to design conservation strategies for plant species of food value. A human-manipulated ecosystem such as the agroecosystem in a traditional society is well harmonised with its ecological, socio-economic and cultural components and therefore reflects the coevolutionary aspects of culture and anvironment (Gliessman, 1989b). Therefore, an understanding of the ecological and social linkages as related to agroecosystem function would forum the basis not only for their management but for conservation of biological diversity.

Traditional agroecosystems and biological diversity

Jhum agroecosystem and conservation of biological diversity

The jhum farmer in north-eastern India, as elsewhere throughout the humid tropics, cultivate many local varieties of traditional and non-traditional crop species. As discussed in Chapter 1, the number of species in the crop mixture may vary from 4 or 5, to over 35 (Ramakrishnan, 1985c). The stability and sustainability of this and other traditional agroecosystems are based on crop diversity (Altierie, 1983; Ramakrishnan, 1984a, 1988a). The crop mixture and the varieties used are location-specific, native strains, differing in composition depending upon ecological, socio-economic and socio-cultural factors.

An important consideration with regard to the mixed cropping system is the optimal use of nutrient resources from the soil by appropriate changes in the crop mixture depending upon the length of the jhum cycle and the consequent high/low soil fertility levels. Thus, the jhum farmer emphasizes nutrient use efficient tuber and rhizomatous species under short jhum cycles in contrast with the emphasis placed on less efficient cereals under long jhum cycles (Ramakrishnan, 1984a). At higher elevations in north-eastern India, high acidity under pine forests, lower temperature conditions restricting quick vegetation growth, and slower nutrient release related to low temperature and

pine litter, all contribute to lower soil nutrient status. This would explain the farmer's emphasis on more nutrient use efficient tuber crops.

The organization of diverse crop species on a hill slope of 2 to 3 ha itself often follows a pattern. This is unlike a monocrop of a high yielding variety where modern man has tried to exploit the ruderal nature of crop species by genetic mainpulation of rice or wheat in order to maximize seed production at the expense of vegetative growth over the shortest possible time. Under jhum, the r-strategists with emphasis on seeds, such as cereals and legumes are combined with k-strategists with emphasis on vegetative growth, such as leafy vegetables. The aim of the farmer is to maximize production from the site through a mix of these two strategies. Most mixed cropping systems with cultivars of dissimilar reproductive strategies imitate early successional forest fallows following jhum.

During the cropping seasons under jhum, the soil on the steep hill slopes are highly heterogenous. The availability of nitrogen is uncertain, since this is a highly labile element. The microdistribution of C_3 and C_4 plants on a slope enables them to exploit nutrients from such a heterogenous soil. The C_4 species with a high nutrient use efficiency could occur in nutrient - poor microsites while C_3 species with low nutrient use efficiency are suited for

nutrient - rich microsites, as shown for early successional herbaceous jhum fallows (Saxena and Ramakrishnan, 1983a, 1984c). Such a C_3/C_4 strategy helps in coexistence of species through mutual avoidance. The positioning of the C_3 and C_4 crop species under jhum in north-eastern India imitates the local natural herbaceous communities with the more nutrient use efficient species being located in the nutrient-poor upper parts of the slope and less efficient species being at the base of the slope (Ramakrishnan, 1988a).

Sedentary agroecosystem and conservation

In many areas in the humid tropics where jhum is the chief landuse, attempts have been made to develop alternate landuse strategies. This has been necessitated, partly due to the rapid decline in the jhum cycle. Amongst these, sedentary terrace agriculture on hill slopes has been one of them. Such alternative systems are often energy intensive and ecologically inefficient. They are conceived as intensive production systems with emphasis on high yieling crop varieties. These have often been rejected by the traditional farmers. Their tendency to hold on to traditional landuse practices has to some extent contributed towards conservation of traditional crop varieties. Rice farmers of valley lands in Thailand often combine traditional varieties of rice during the monsoon season with

modern semi-dwarf vaeieties during the dry season, optimzing production and at the same time maintaining stability of the system (Grigg. 1974).

A variety of valley land agroecosystem types are available in north-eastern India. These agroecosystems, apart from showing wide variatious in economic and ecologic efficiences which are related to ecologic conditions and socio-economic and cultural differences between the communities (cf. Chapter 2), harbour many traditional rice varieties. Thus, for example, the Apatanis of Arunachal Pradesh who do one of the most efficient wet rice cultivation make effective use of their irrigated land by planting early and late ripening varieties. Early variety is sown farther away from the village where disturbance by animals and poorer irrigation facilities could be major constraints (Kumar and Ramakrishnan, 1990). Relatively poorer nutrient status of plots farther away from the village is another consideration in deciding upon the early variety. Late variety grown closer to the village where waste recycling from the domestic sector ensures nutrient-enriched soil, also allows pisciculture integrated with the late ripening rice variety.

The renewed interest of recent times on traditional agroecosystems has started contributing towards their

adaptation to modern times. The concept of home garden which is well developed in the humid tropics offers possibilities of maximizing production per unit area through tight vertical packaging of species as done by many tribes in north-eastern India (Gangwar and Ramakrishnan, 1989a; Maikhuri and Ramakrishnan, 1990a). With a mixture of annuals and perennials forming a multi-storeyed structure, they resemble a natural forest. An extreme example of this is the te'lom plots of about 6 ha maintained by the Huastee Indian farmers of north-eastern Mexico. With over 300 species in a te'lom plot, Huastee system is not only an alternative to land management in the humid tropics but provides protection for wild genetic conservation and contributes towards a combination of commercial and subsistence agriculture (Alcorn, 1984).

Lesser known plants of food value

Of all the 3000 plant species used as food at some time during human civilization, about 150 species are cultivated, of which less than 20 provide over 90% of the food needs (National Research Council 1982). In fact, just about three species (wheat, rice and maize) meet over half of the human energy needs. Reliance on such a small number of plants carries great risks, for monocultures are extremely vulnerable to catastrophic failures brought about by diseases or climatic stresses.

Over large areas of the humid tropics, genetic uniformity of a few varieties traditionally cultivated by the farmers (Wilkes, 1977). As the product of technology displaces the source upon which the technology itself is based, namely, the genetic diversity, short term solutions often become long-term irreversible liabilities. In fact, 75% of the world's lesser known crops are grown and consumed in tropical countries (National Research Council 1975). With depletion of genetic diversity of crop plants (Sasson, 1987), there is considerable interest in lesser known plants of food value for meeting the needs of increasing human population particular in the developing- world (National Research Council, 1975; Raven, 1981). There is a need not only to conserve them but also to improve upon the economic yield of the more promising ones. Such a diversification of the agroecosystem base would go a long way to meet the nutritional needs of the people.

Some important under - exploited food plants are the grain Chenopods (National Research Council, 1975; Risi and Galwey, 1984; Partap and Kapoor,1985), with a high protein value. These plants are presently cultivated in the Andes or in the Himalayas. Greater emphasis on cultivation, improvement and conseмption by the local communities would countribute to enhancement of the quality of life of the people concerned. With considerable similarity in the

preparation made out of many Chenopods by the Himalayan communities and their Andean counterparts (Risi and Galwey, 1984; Partap and Kapoor, 1985), possibilities exist for preparation of marketable products. Needless to say that there is much scope for improvement of the grain Chenopods.

The tribals of north-eastern India, endowed with a rich natural resource base and with a diverse socio-economic and socio-cultural background, depend upon a variety of under-exploited plants and animals. Four tribal communities of Arunachal Pradesh (the Nishis, the Hill Miris, the Sulungs and the Apatanis) alone use over 70 such plant and 12 animal species from the wild (Gangwar and Ramakrishnan, 1990). The plant species often come in handy during the lean season of the year when traditional food items are in short supply. With a large number of tribes in a small geographic area, each being highly insulated due to language barriers and socio-cultural differences, at the same time occupying diverse ecological situations, north-eastern India is a veritable ethno- biological treasure.

Many lesser known plants of food value are cultivated under jhum (Ramakrishnan, 1983c) and under sedentary agriculture and under fallow systems (Gangwar and Ramakrishnan, 1987a; cf. Chapter 2). Many tribes in Arunachal Pradesh, for example, cultivate Dioscorea spp. for

tubers, Amaranthus viridis for leaves, Chenopodium ambrosoides, Panicum miliaceum, Setaria italica and Coix lacryma-jobi for seeds, apart from many others (Gangwar and Ramakrishnan, 1990)

Flemingia vestita and Perilla ocimoides are two important lesser - known crops of food value under sedentary fallow system of agriculture of the Khasis of Meghalaya (Gangwar and Ramakrishnan, 1987a). Apart from the value of its tuber as a protein source, this legume considerably improves the nitrogen status of the soil through nodular fixation (Gangwar and Ramakrishnan, 1989b; cf. Chapter 2). With upto 250 kg ha^{-1} yr^{-1} of nitrogen fixed, such multi-purpose lesser known crops are important both for sustainable agriculture and for human nutrition.

Redeveloped agroecosystems and village ecosystems linked with conservation

As discussed in the foregoing Chapter, this multi-disciplinary study has led to a number of practical guide-lines for redeveloping jhum in north-eastern India, under very short jhum cycles. These guidelines noted below, and discussed elsewhere in much detail, would also contribute to effective resource management and conservation in north-eastern India. Such an approach to agroecosystem redevelopment would effectively link-up animal husbandry and

domestic sectors with conservation stategies so that local people needs are adequately taken care of.

- Vary species composition in the crop mixture under jhum so that economic returns increase and ecological efficiency improved (eg. emphasis on potato at high elevations, along with other species, compared to rice at lower elevations has resulted in many-fold increase in economic yield, in spite of low fertility of the more acidic soils at higher elevations, and at the same time ensured crop diversity through mixed cropping). With wide variations in the crop mixtures and in cropping patterns (cf. Chapter 1), the possibilities for agroecosystem redevelopment through transfer of indigenous jhum technology from one tribe to others exist.

- Redesign agroforestry systems incorporating ecological insights on tree architecture (cf. Chapter 9). The canopy form of tree species should be compatible with crop species at the ground level, by permitting sufficient light penetration and through fast recycling of nutrients. Species such as the Nepalese alder (Alnus nepalensis) is a multi-purpose agroforestry species of economic value to the tribals, building-up nitrogen status of the soil through fixation, synchronizing elegantly with a 5- year jhum cycle system becuse of adequate growth it makes density this period, and yet coppicing readily (cf. Chapter 1,5).

- Use bamboo and other fast growing native tree species as wind-breaks to check wind and water borne losses of ash and nutrients (Chapter 1, 5), so that biological diversity of the agroecosystem types as a whole is enhanced

- Redevelop vally land wet rice cultivation and improve other landuse systems such as home gardens by use of appropriate native crop species, transfer of indigenous technology from one area to another, and redesigned systems developed on the basis of traditional knowledge

- Strengthen traditional animal husbandry practices such as swine husbandry and poultry (cf. Chapter 3) so that more effective recycling of waste between this sub-system and the agriculture sub-system would result in improved agroecosystem types of greater conservation value.

- Introduce appropriate rural technology such as biogas units, energy efficient stoves, rainwater harvesting tanks mini-hydel systems for strengthening the village ecosystem function so that natural resource conservation could be argumented through their impacts. To cite on example, in some of the areas in the Himalayas, we have put up cheap rainwater haresting tanks (unpublished data). This single activity has direct value not only for a redeveloped agroecosystem but has also contributed towards restoration of a degraded hill slope. This tinkering with one component

of the village ecosystem could have tremendous impact on its other components and could enhance biological diversity through vegetation regeneration on hill slopes. This is so because, under the monsoonic climate, water often is a limiting factor in the Himalayan for a large part of the year

- Enecourge artisanal skills and products based on natural resources accessible to rural communities - products based on itmes such as bamboo and other woods, leather and other items. In Kapkot region of the Kumaon hills in central Himalayas, strengthening the locally available bamboo resource base through biological and technological inpacts has already contributed remarkably in restouring degraded hill slopes and thus helped in conserving locally perceived natural resource base and the biological diversity (P.S. Ramakrishnan, K.G. Saxena, K.S. Rao and B.P. Kothyari unpublished data).

This is not in any way to suggest, that agroecosystems traditional or redeveloped alone is to be emphasized. In situations such as that prevalent in north-eastern region, such an approach is desirable for conservation of biological deversity and in the absence of alternate viable technologies to meet atleast short-term developmental objectives. In any case, for agroecosystem redevelopment in

developing countries, an absolute priority should be given to soil conservation so as to give benefit to small farmers (Sasson, 1990).

RAINFOREST - A CRITICAL ECOSYSTEM

In recent times, ecological, evolutionary biologists and conservationists have facussed increasing attention on tropical rainforests. Though they cover only about 7% of the earth's land area, they harbour more than half the species of the world's biota. With rapid conversion of these forests, they will mostly disappear by the trun of the century, if the present trends continue. This would result in the extinction of a large number of species, many of them not even catalogued and understood by the tropical biologists. Besides, the tropical rainforests are amoung the most fragile of all habitats. Often conversion results in wet deserts (Ramkrishnan, 1985d,e; Ramakrishnan and Ram, 1988). because of highly leached infertile soils subjected to wash-out by heavy rain.

Much of the area under rainforests are red and yellow earths which are acidic and nutrient-deficient. With high concentration of iron and aluminium, phosphorus availability is restricted because of the formation of insoluble compounds. Patassium is highly labile and therefore is leached out quicqly (cf. Chapter 5; Toky and Ramakrishnan,

1981b; Mishra and Ramakrishnan, 1983c; Ram and Ramakrishnan, 1988b). With a weak soil base, a dense forest cover is supported because of a thick fine root mat located on top of the mineral soil which helps in tight recycling of nutrients released by the quickly decomposing leaf litter, even before the element could seep into the mineral soil (cf. Chapter 7). With a fine root biomass of upto 15 t ha^{-1} yr^{-1}, in the relatively undisturbed sacred-grove forest of north-eastern India (Khiewtam, 1986), any large-scale disturbance in this system would make it unstable and recovery difficult.

In north-eastern India, large-scale disturbance of the rainforest ecosystem has resulted in varied levels of degradation. During the last few decades, large-scale timber extraction for industrial purposes has cleared up vast areas of land for invasion by exotic weeds (Ramakrishnan, 1985; Ramakrishnan and Vitousek, 1989). Thus exotic weeds such as Eupatorium spp., and Mikania micrantha have taken over vast tracts, of cleared land along with native weeds such as Imperata cylindrica and Thysanolaena maxima. Once this large-scale invasion occured, the jhum farmer gatseven more limited by the land area avaialble for his jhum system of agriculture as he prefers to avoid sites of high weed density. Because of this and increased population pressure, jhum cycle has dropped drastically from a more favourable 20 years or more to an extremely short 5 years or even less.

Having no other option, in the absence of an alternate agricultural technology that is viable from an ecologic and social angle, the jhum farmer had perforce to resort to very short jhum cycles though the system operates below subsistence level and has caused further environmental degradation. Large-scale timber extraction and very short jhum cycles of 4 to 5 years have resulted in an arrested succession of weeds in north-eastern India. (cf. Chapter 8; Saxena and Ramakrishnan, 1984b).

Cherrapunji : an example of extreme desertification

Where climatic/edaphic conditions are less favourable further deterioration has occurred leading to extreme desertification of the site. Indeed vast tracts of land in the Khasi hills of Meghalaya are represented by totally balded landscape. In Cherrapunji in Meghalaya, desertification has been more rapid and sudden. The human factor was accentuated by the peculiar geology with nutrient deficient soil over limestone rock formations, with a network of underground tunnels with stalactites and stalagmites. The harsh climate with much of the annual average rainfall of 1150 cm (with a very high 2250 cm in an exceptional year as in 1974) coming down in about 4 to 5 months during the monsoon compunds the problem (Ramakrishnan, 1989e). For these reasons, the fragility of

the Cherrapunji forest ecosystem is highly exaggerated (Khiewatam, 1986; Ramakrishnan and Ram, 1988).

The sacred grove of Mawsmai that is protected for reasons of traditional religious beliefs is a sad reminder of what Cherrapunji looked like in the past. Though the forest is stunted because it is supported by an unbalanced soil derived from limestone, they do form a dense multilayerd canopy protecting the soil from the ravages of the extreme climate. Had it not been for the traditional belief of the Khasis that sacred grove is the abode of their Gods and the spirits of their dead ancestors, and therefore nothing should be removed not even dead twigs of the forests, even the sacred grove of Mawsmai would have disappeared long ago. Unfortunately, much of these groves which were part of every village in the Khasi Hills have already disappeared, with the advent of modern value system! With that, we have almost lost a unique way of preserving this national heritage of rainforest ecosystem.

The Cherrapunji ecosystem that now stands desertified due to deforestation inflicted sometimes in the distant past (Ramakrishnan, 1985e) now refuses to recover to its original state, as represented by the relict sacred grove. The fact that jhum around Cherrapunji is banned by the village council is suggestive of the part played by this landuse in creating the present landscape. The sharp boundary between

the sacred grove and the balded landscape indicates that the system will never recover through natural processes of revegetation. Artificially, the cost could be enormous.

Linked with this drastic loss in biological diversity is the human suffering which now is immense. Water is a scarce commmodity during the dry months in this high rainfall spot of the world, a contender for being the wettest spot on earth along with the nearby Mawsengram in the Khasi Hills of Meghalaya and with the far away spot in the Hawaiian islands of the Pacific. All the water flows away into the plains down below, as here there is no vegetation to hold the water and the soil, and there is no soil to recover the forest. It is a vicious circle ! What one sees now is stunted grassy growth protected within rock crevices like pock - marks on a rocky landscape. For fuelwood the tribal villager has to trek long distances. The ruins of villages all around remind one of the yester years and migrations of the past. The tribal, who is traditionally bound to the the land and forests has been forced to seek other avenues for survival.

Arrested bamboo forests and biological diversity

Even where jhum cycle could be maintained at a more reasonalable 10 to 20 years, because of large-scale pressures the secondary forests are largely bumboo forests

often maintained in an arrested stage partly because of constant imposition of jhum at this cycle length. Bamboo thickets often tend to be biologically least diverse, as they tend to form pure stands, particularly if perturbations occur at regular intervals.

An important contributory factor to stabilization of bamboo forests as arrested stages in succession is also the large-scale extraction of firewood by the tribal people (Ramakrishnan, 1985d). There extractions are small events leading to small size gap formations but over large areas. Such a disturbance regime results in invasion of the openings by bamboo. Indeed much of the firewood consumed in this region comes from secondary forests, with a small component coming from primary rain-forests. In India, as in many other parts of the world, it has been found that from the peripheral zones of the forest boundaries, about 70% of the firewood requirements are met with; beyond 10 km the entraction of firewood steadily decreases until at about 15 km it is almost absent (Myers, 1980). However, the increased population pressure and rapid depletion of primary forest cover in the region is rapidly changing this situation (Ramakrishnan, 1985d). In the absence of hardwood species in this region, even bamboo is used as a firewood species, apart from its export to Assam plains and elsewhere in the country (Rao and Ramakrishnan, 1987b). Small-scale clearings

of this nature that are not totally devastating as done by the tribals help in sustaining bamboo in an arrested successional stage with obvious adverse consequence to biological diversity in the region.

Rainforest restoration and conservation

The concept of succession offers the basis for meaningful restoration programme for conserving biological diversity. Early successional species with their diverse adaptive strategies offer an important basis for initiating restoration of balded and desertified landscapes (cf. Chapter 9, 10). The herbaceous species are either r-strategists and selected for greater reproductive capacity in more open habitats, or k- strategists and selected for greater ability to compete for resources, though at the cost of lower reproductive potential in closed habitats. Further, while some species emphasize upon sexual reproduction, others have extensive insulated underground rhizomes. C_3 versus C_4 strategy of herbaceous species offers the kind of variability to the early successional harbaceous community to adapt to nutritionally heterogenous soil environment. (cf. Chapter 7, 8, 10).

If one were to build biological diversity upon an arrested successional community of herbaceous community or bamboo forest, apart from bamboo species, one could consider

a variety of shrub species with diverse growth strategies related to light availability and nutrient status of the soil (cf. Chapters 9, 10). This could then be elaborated using the differential architectural features of early versus late successional tree species, for light capture and nutrient uptake and use. The resultant mixed plantation forestry systems and indeed other forestry systems based on a 'condensed succession' could help in ensuring some degree of biological diversity.

THE HUMAN FACTOR IN CONSERVATION

Rural development

In north-eastern India where a large number tribal communities of varied linguistic, social, economic and cultural backgrounds live in a geographical region, with communities often changing over very short distances, the human factor in conserving biological diversity is critical. This is apart from considerations related to ecological heterogeneity. We have seen, for example, as to how one has to deal with a variety of jhum systems (cf. Chapter 1), a variety of valley land agroecosystems, home gardens and other landuse systems (cf. Chapter 2). In these and other landuse -linked activities such as animal husbandry and domestic sub-systems of the village ecosystem (cf. Chapter 3), one comes across a rich biological diversity. This biological diversity should be conserved side by side with

conserving biological diversity in the natural rainforest ecosystem. Indeed, as much as one needs to restore/redevelop a degraded natural forest ecosystem through successional concepts, one also needs to redevelop the agriculture, animal husbandry and the domestic sub-systems village ecosystem in order to make conservation more meaningful for the local community. In such a strategy, traditional knowledge would form an important basis for conservation. We have considered some of these strategies for a redeveloped agroecosystem, earlier in this Chapter and in Chapter 10. In such a redesign of village based activities, social considerations are critical. Thus, even though we came up with a number of native species of agroforestry value based upon our tree growth and architecture analysis only one species, namely, the Nepalese alder (Alnus nepalensis) could obtain greater acceptability amongst the tribals for redeveloping jhum (cf. Chapter 1, 5, 7, 9) because this species was traditionally conserved by them wherever they occurred in their jhum plots. Therefore, the people concerned could relate this species with a value system with which they were already familiar. Thus, when the Nepalese alder was used for strengthening the jhum as an agroforestry system, it caught on rapidly, and now in a state such as Nagaland where it was taken up in a big way by the Governmental agencies (Gokhale et al, 1985) it is wide-

spread. A link-up between social and natural sciences is not only important to identify appropriate technologies for rural development, but even for identifying and appreciating remote linkages between introduced technology and its impact on other components of the rural exosystem, eg., the rainwater harvesting technology introduced in the Himalayas (discussed earlier) and its impact on restoration of a hill slope.

Biosphere reserves

When the Man and Biosphere (MAB) programme of UNESCO was launched by UNESCO in 1971, it was also envisaged to have biosphere reserves as representative ecological areas, as part of an international net-work. The chief objective was to demonstrate the value of conservation and its relationship to ecodevelopment with local participation. This approach to conservation sets apart the concept of biosphere reserves from all other conservation strategies. Realizing that we would have to depend more and more upon such biosphere reserves for conserving much of the biological diversity, we need to recoginze effective management strategies for not only the core and the buffer zone, but also for the interaction zone located outside the buffer zone and which gradually merges into the typical rural environment (Ramakrishnan, 1987f, 1989b). In developing countries, the buffer and the interaction zones

would obviously be under intense biotic stress from the humans living there even the core zone would not be free from it. Under these conditions, an integrated approach to management linking up environmental awareness with the food, fodder and fuelwood needs of the rural communities, and with diversified the economic activities that have input of appropriate rural technologies is important. Building upon traditional knowledge would facilitate peoples' participation and ensure that development is sustainable.

The sacred groves of the Meghalaya

The importance of sacred gorves such as the Mawsmai forest in the largely desertified Cherrapunji in Meghalaya, discussed above, handly needs to be emphasized. Apart from the Khasis, the gaintias of Meghalaya too have many well developed groves. These are often located on hill slopes. The third tribe of Meghalaya, namely, the Garos do not have this concept well developed, though they usually worship large monoliths placed along the periphery of dense foreste. However, the large Balphakram forest reserve extending over a few hundred km^2 and with extremly high species diversity is suggested to have religious value, as the departed souls of the local Garos are said to reside there (Kumar and Rao, 1985).

The Khasis and the gaintias of Meghalaya who too traditionally are animists like the Garos believe that their Gods representing natural forces responsible for creation of living beings and others like sun, wind and water live in these groves. They also believe that the good spirits of the ancestors also live in them and protect the village community. Therefore, removing any material from the groves is a taboo. The gaintia tribe of Meghalaya have many sacred groves' of which a few are upto about 2 km^2. In the Cherrapunji area alone, we have recorded (Khiewtam and Ramakrishnan, 1989) 21 such groves, some very strictly protected and others with varied levels of disturbance. The largest recorded grove, the Krymagah grove at Umwai village is about 12 km^2 though the average size of the rest of the 20 groves is about 185 ha.

Meghalaya from where alone detailed accounts of selected groves are available, starting with the floristic accounts of Bor (1942) and Hazra (1975), detailed ecosystem analysis have been done (Boojh and Ramakrishnan, 1981c, 1982f; Khiewtam, 1986; Khiewtam and Ramakrishnan, 1989). The rest of the region has not been adequately looked at from social and ecological aspects or the groves even catalogued. This needs to be done. Meghalaya with high species diversity and a high level of endemism has few parks, sanctuaries and reserve forests (R.W. Rodgers; personal communication).

Consequently. the sacred grove are important for conservation of biological diversity. The ecosystem organization in the relatively undisturbed ones and that outside with varied disturbance regimes provide the necessary basis for a meaningful ecosystem redevelopment programme relevant to conservation (Ramakrishnan, 1988c).

Since the management of these groves is under the control of the village community and the overall supervision of the village headman, the sacred grove concept is a good example of the sociological basis for nature conservation. As long as traditional value systems are supported rather than tampered with, the sacred grove concept provides a good basis for environmental education and for reviving awareness (Ramakrishnan, 1986b) amoungst the people in the region.

GENERAL CONSIDERATIONS AND CONCLUSIONS

The concept of biological conservation is closely linked with sustainable development. The launching of the world conservation stragey in 1980 was a significant turning point involving an integration of nature conservation with sustainable development of both human and natural resources.

This implies that ecological integrity is to be maintained not only to meet human needs but also to achieve equity with social justice and provision for maintenance of cultural diversity (Jacobs et al, 1986). Local peoples, participation in conservation is crucial and this could only be by ensuring that they have access to them to the natural resources developed on a sustainable basis.

Sustaining cultural diversity is an important mechanism to promote conservation. The wide variations found in the landuse, animal husbandry and domestic subsystems amoung the tribals of north eastern India based partly upon socio-cultural differences contribute to biological diversity in the region. The variety of crop germplasm of the conventional and non-conventional crop species thus conserved is remarkable indeed. Redeveloped agroecosystem types could also incorporate this biological deversity in them. Religion and culture are important for promoting conservation in traditional societies. The concept of the sacred groves, traditionally found in each tribal village of Meghalaya (Boojh and Ramakrishnan, 1983b; Khiewtam and Ramakrishnan, 1989) is a strong basis for promoting conservation issues amoungst many tribal societies. With tradional religious beliefs suggesting that the spirit of the cancestors and the Gods live in these groves, the tribals are deeply committed to conserving these forest

patches wich may be sometiee be a few km^2. There is an urgent need to revive these traditional beliefs since much of it has been lost in the name of modernity.

Realizing that conservation of all species known and/or as yet not catalogued is an impossible task, priorities have to be determined. The criticality from a conservation viewpoint may be defined both in terms of ecosystem fragility and biological diversity. In such a definition, diversity sustained through human activities, such as agriculture is also significant. The concept of the biosphere reserve provides the necessary frame-work for conservation, since the approach is based upon the people as the focal point, through their sustainable development.

What species is to be conserved would also depend upon the variety of ways in which the species could be used by the society. Thus a species such as Flemingia vestita cultivated by the tribals in north-eastern India (Gangwar and Ramakrishnan, 1989b) is not only a lesser known crop of food value used by the tribals during the lean season, but is also an important component of the jhum system and the fallow system of agriculture, useful for building up the nitrogen status of the soil. Many such multi-purpose species (National Research Council, 1979; Burley and Stewart, 1985)

that are under-exploited and that abound in the tropics (National Research Council, 1975) offer untapped potential for future use by mankind.

Fragility of an ecosystem should be an important criterion for conservation. We have seen how a tropical rainforest is extremely fragile leading to desertification of the extraordinarly high - reainfall Charrapunji region. Site desertification in a lesser form is also evident through weed invasion leading to arrested successional weed communities. There could be other levels of expression such as the arrested bamboo forests of north-eastern region or the arrested pineforests of the western Himalyas. These are all expressions of fragility and such ecosystem types should be conserved on a priority basis, before damage is done.

In north-eastern India ageiculture as a landuse is closely linked with other sub-systems of the village ecosystem function, and with forestry. Therefore, a holistic approach has a distinct advantage over all others for in situ conservation. It takes into account peoples perception of ecology and conservation at a human level and at the same time enables conservation of natural population at the sub-specific level (Ramakishnan, 1981). This latter aspect of biological conservation is particularly important because ecotype populations often could be as different between

themselves, as two distinct species of contrasing ecological characteristics. The ultimate objective should be to conserve biological diversity at specific and sub-specific levels and to integrate ex situ conservation with the existing or altered life styles of the human population.

WORKSHOP ON

LINKAGES BETWEEN WASTELANDS AND BIODIVERSITY

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Bangalore-560 012, India

ROLE OF NON-GOVERNMENTAL ORGANISATIONS IN WASTELANDS DEVELOPMENT AND NATURE CONSERVATION

BY

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The concept of people's participation is hardly new. Mahatma Gandhi, as is well known, emphasised this as a cardinal principle of reconstruction of Independent India. In his view, the village communities' control over and management of local resources can alone pave the way for all-round development of the nation. The Gram Sabhas and Gram Panchayats conceived by him were to be not merely advisory bodies but also decision-making and implementational agencies.

Gandhiji's seminal ideas were left by the wayside by Independent India's rulers. However, the intrinsic merit of his vision has been asserting itself from time to time, however blinkered the political regime. Gandhiji was far-sighted enough to comprehend that centralized planning is basically violent in nature. He described the State as "a soulless machine which can never be weaned from violence, to which it owes its very existence."

Successive governments - notwithstanding ever new vocabularies - have continued to be wedded to centralised planning and have hung on to it like a professional trapeze, no matter how much out of kilter it is with situational realities.

It is precisely this mindset which has hampered development and progress towards social justice. As one looks back at the developmental history of post-Independent India, one finds the periodical reiteration of the principle of people's participation and declamations of new programme formulations, only to be smothered by administrative apathy and lack of political will. Each new formulation can be said to be an admission of the failure of the earlier formulations.

The need for people's participation was recognised and stated even in the Seventh Five Year Plan, wherein government expressed its willingness to work with voluntary agencies.

The reason for the inability of the fruits of gigantic five year plans to trickle down to the countryside is the same as the reason for the failure of the community development programme of the early 1950s -namely the government's inability to attract people's participation.

The foregoing prolegomena has been necessitated by the renewed presence of the same scenario. While it has been amply proven (i) that afforestation and development of waste-lands merits priority in the present context, and (ii) that nature conservation is impossible without people's participation- the bureaucracy finds itself unable to outgrow its colonial legacy, the chief feature of which was to look upon the people as adversaries.

ANTI-POOR BIAS

It may be rather futile to think in terms of newer legal mechanisms, since the major problem has been the anti-poor bias in enforcement rather than in the regulations themselves. While a hundred laws and sub-clauses are cited to avoid granting of forest-land to local communities for nursery-

raising or tree-planting, the very same bureaucracy goes out of its way to lease away thousands of acres to industrial houses, often in stark violation of all existing legal and social norms.

The most glaring evidence of avoiding people's participation can be seen in the Social Forestry programme. In almost all the States, the Farm Forestry targets were exceeded many times over, while the raising of community woodlots did not take off. Between 1981 and 1988, the number of trees planted on private lands has been of the order of between 33 and 49% of the total plantings.

The participation of small and marginal farmers in Social Forestry programme in most States has been peripheral. But even this percentage is questionable because in numerous places, large farmers got classified as small farmers in order to attract the government subsidy.

The above is an instance of implementational failure despite the inclusion of the necessary provision in the plan and the availability of funding.

SITUATIONAL FLEXIBILITY NEEDED

The reasons which weigh in favour of big projects are the so-called economy of scale and the convenience of working with one big unit instead of with multiple groups and individuals. However, the experience has been that the intensity and efficiency of implementation are inversely proportional to the size of an operation. Considering that a certain amount of paperwork cannot be wished away in any case, there is much to be said in favour of afforestation through a large number of small groups. A decentralised approach may be said to be a prime requirement for effective afforestation.

The cost-effectiveness of working through small structures is yet another factor which may be borne in mind.

This approach also makes possible situational flexibility which may not be possible under a huge centralised plan.

While the Forest Department and financial institutions tend to provide support to established institutions, there is not much support available in the initial stages when it is needed most.

The lower cadres of the Forest Department appear to be more preoccupied with departmental nurseries than with people's efforts. It normally requires enormous pressure and influence to secure seedlings, plastic pouches etc or other support from the department. Most often, the species specifically asked for are not available in the departmental nurseries.

PEOPLE'S PARTICIPATION -A DYNAMIC PROCESS

People's participation has often been viewed by the bureaucrats as a mechanism. It is rather a process whereby the existing ~~are~~ potential beneficiaries control the implementation of developmental activities in a manner which would ensure increased income and greater self-reliance. Obviously, mere information-sharing does not constitute people's participation (though even information-sharing is often absent!).

A major drawback has been in directly responding to the demands of the rural poor and in enforcing accountability at the implementational level.

Nor should people's participation be construed as providing the needed labour for plantation activity.

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It should also be realised that regeneration of forest can itself generate employment much beyond the scope of present social forestry programmes.

INHIBITING FACTORS

It would be fruitful to analyse the factors which deter farmers from planting or protecting trees. The telltale insecurity of tenurial arrangements inhibits people's initiative.

The biggest hurdle in the way of people's nurseries is want of land - even when suitable vacant revenue or forest-land is available.

Unless policies and administrative arrangements are radically simplified to facilitate the availability of land for nursery-raising and tree-planting activities, there is no possibility of making people's afforestation a mass movement.

As in many other spheres, there have been in-built contradictions in governmental policies in regard to afforestation. For instance, while the National Wastelands Development Board argued for liberalising of regulations in regard to tree-felling, the Land Use Council pleaded for more stringent laws. Similar contradictions have characterised government's policies in regard to leasing of forest-lands to industries and contractors. Unless these problems are sorted out early, and unless the priorities are settled, there appears to be no prospect of afforestation becoming a people's movement.

It is this realisation which was behind the tree-patta scheme which was announced by the Union Government at the behest of the Wastelands Development Board. But due to the involvement of forest bureaucracy, even this scheme fell through.

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PRECONDITIONS FOR PEOPLE'S AFFORESTATION

While many are the reforms that may be suggested for making voluntary afforestation a people's movement, there are some minimal conditions which have to be ensured if government is seriously concerned about effective afforestation.

1. There should be security of land tenure - especially in the tribal belts, where forests are inextricably intertwined with the day-to-day life of the people.

2. The choice of species should not be imposed from outside but left to the decision-making of the community.

3. There must be legally recognised rights of usufruct - including unrestricted harvesting, transit and marketing.

It is only when these conditions are established that the farmers would have an incentive to plant or protect trees.

Since conventional approaches have consistently been found to flounder, it would be rational to attempt innovative approaches. In recent years, a considerable corpus of experience in people-based afforestation in many parts of the country has accumulated. It would be to government's advantage to build into its schemes the major learnings from these experiences.

What the constraints in the way of community afforestation are, may be inferred from the comparative success of the Group Farm Foresty Programme in West Bengal. The active interest of the people was a direct result of the allotment of ceiling-land to the landless and the assignment of pattas to the poor families which virtually conferred ownership rights on the beneficiaries.

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SOME PRIORITIES

Based on past experience, some measures which are inevitable for making afforestation a people's movement may briefly be indicated.

1. A major inhibiting factor has been the chaotic condition of land and forest records, part of the confusion being deliberate. Now that computerisation and related services are available, there can no longer be any justification for not putting the records into shape.

2. Community land and tribal land which has wrongly been classified as forest-land or government land should forthwith be restored to the control of the communities.

3. The thousands of land-related cases (many of which have their origin in bureaucratization and unimaginative implementation) should be settled within a reasonale time-frame.

4. The customary rights of local communities over grazing-lands, village forests and over adjoining forest-land in hill districts, should be accorded legal recognition and the Forest Department must be prohibited from interfering in people's access.

5. In view of the past history and performance of the Forest Department, any intended takeover of land should be subjected to the most rigorous examination at the community level.

6. Leaving the tenurial position of land assigned for afforestation delightfully vague as at present could hardly be expected to generate people's enthusiasm. Clarity as well as certainty must be built into the corpus of the relevant laws.

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7. Likewise, the usufructuary rights of the beneficiaries involved in afforestation activities must be clearly spelt out and placed above interference from the bureaucracy.

8. Needless restriction on the harvesting, transport and sale of trees in private land should be removed. Red-tapism in the issue of the requisite permits has led to much corruption in most States.

9. The monopoly of the Forest Corporations over the purchase of wood has itself been a deterrent in the way of people's initiative.

10. The inadequcies of Forest Departments in the area of extension services are well known. This is an activity which can increasingly be transfered to Non-governmental Organisations (NGOs).

11. The well-conceived tree-patta scheme deserves to be revived and pursued. Just when the State-level structures were becoming attuned, the scheme has been abandoned. Some of the major lacunae faced in the implementation need to be attended to through legislation if necessary. The major constraints felt during the brief period of the implementation of this scheme were -

(i) Insistence that the produce be sold only to the Forest Department;

(ii) Exclusion of forest-lands from the operation of the scheme;

(iii) Involvement of multiplicity of departments; and

(iv) Government's imposing its choice of tree-species on the people.

ROLE OF NGOS

While the ultimate objective is to transfer decision-making to local structures, this can only be achieved in stages. It is here that NGOs are is a position to act as liaison between government and the people.

NGOs' services can be utilised to identify suitable lands for afforestation activities through people's initiative.

NGOs are, in a position to help in co-ordinating the different components of the programme - such as identifying the species and quantities of seedlings for the ensuing season, the quantity and dimensions of plastic pouches which would be needed, etc.,

NGOs are in a better position to provide the educational inputs.

NGOs could provide the needed linkages with neighbouring regions and also with financing and marketing agencies.

NGOs offer a better alternatives in regions where there is domination of the elite in the Panchayat institutions.

NGOs can usefully be invloved in organising the produce-sharing schemes.

It is important that government realise the present increased capabilities in the NGO sector, in contrast with earlier days.

NGOs are almost the only source of feed back in regard to ground-level realities and problems in implementation.

DIFFERING PERCEPTIONS

However, not all NGOs have the same perception about afforestation. Some look upon afforestation as a purely economic activity, while others consider afforestation as a sine quahon for preservation of tribal culture. Bharateeya Agro Industries Foundation and similar organisations may be said to belong to the first category,

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while the second category includes a vast number of organisations like Kashtakari Sanghatan. Without going into secondary details, we may notice two main features:

(i) The degree of people's participation has been much more in the organisations of the second category than in those of the first.

(ii) Governmental and institutional support went almost wholly to organisations of the first category.

There are also a considerable number of organisations which fall somewhere in between the above categories - such as agencies emphasizing the need to meet fuelwood shortage.

If an agency has a considerable base among the local people, this factor itself virtually alienates the officialdom.

Neither the Forest Department nor the Revenue Department would like to lose the goodwill of the big landlords and other vested interests.

Habitually, government supports only such groups as do not question the present system.

Thus, what little government-NGO partnership has materialised so far, has served only to indirectly strengthen the anti-poor bias of ~~the~~ developmental planning.

VOLUNTARY INITIATIVES: CASE STUDIES

That NGOs have the capability to match the economic and social aspects in afforestation can be illustrated by several case studies.

During the last few years, due to the motivation provided by Arogya Vikasa Prakalpa and Seva Sagar Trust, there has been tree-

planting and nursery-raising activity on a sizable scale all over Sagar Taluk in Shimoga district in Karnataka. In one cluster of six villages, in 1989, six farmers raised 1,47,000 seedlings of local species, and earned Rs.36,750. Among features which have elicited good public response are gifting of saplings on auspicious occasions such as marriages, and presentation of saplings to students who achieve academic distinctions or athletic records. As a result of such multi-pronged thrust, several conservationist programmes such as surveying herbal wealth of the region, honouring practitioners of indigenous medicine, etc., have been initiated.

Yet another instance is that of Gram Vikas of Mulbagal in Kolar district of Karnataka, which has achieved noticeable success in nursery-raising by making its Balwadis the focal points. This project is significant in bringing to light an important feature of awareness-building. The villagers initially regarded the nursery-raising as a merely economic activity; but regular and sustained discussion among the villagers gradually brought home to them the broader aspects of afforestation. This resulted in considerable intensification of people's interest in the raising of saplings. People also realised that it is better and more economic to protect an old tree than to raise and nourish new seedlings.

REPLICABILITY

Whenever success of voluntary afforestation efforts is mentioned, the immediate reaction of bureaucrats is - "But is this replicable?". This is a rather stewed response-and perhaps a deliberately evasive ploy. Why need every programme be replicable? When problems, situations, environmental and social conditions are all diverse, the approaches have to be location-specific too. Diversity of experiences generates new learnings which would otherwise not be available.

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Governmental programmes too have fared comparatively better in regions where voluntary action has taken roots.

Let us hope that this co-existence will lead to fruitful collaboration.

Several poverty-alleviation programmes can be contracted to NGOs. Some three years ago, a massive World Bank aided housing programme was entrusted to a local NGO in El Salvador.

An NGO- run rural banking project in Bangladesh led to its being adopted by government as a major programme.

GREATER DEVOLUTION NEEDED

To summarize:

1. Some legal reforms would be needed to ensure the availability of land to the poor speedily and with in-built security of tenure and of the usufructuary benefits.

2. As to the ancillary services needed such as linkages, extension, awareness etc, the role of NGOs should be recognised and encouraged.

We have to repeat that what has hindered massive afforestation so far is not dearth of laws but basic policy contradictions coupled with an adversarial attitude to people, and the bureaucratic mindset. Till this makes way for a pro-people culture, more legal cosmetics and succession of newer programmes would be futile.

The role of NGOs has to be understood with some clarity. NGOs should not be regarded as basically performers-even though some or many of them are. NGOs are basically organisers and demonstrators, for whom the priorities are defending the rights of people over resources such as land, tree or forest, and providing the requisite liaison-links to the local communities.

NGOs should not be asked to provide alternatives to present structures. The most that they can achieve is to secure slightly greater devolution; and this they have achieved in some measure.

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LINKAGES BETWEEN BIODIVERSITY AND DEGRADED LANDS

(Background paper II)

and

DRAFT GUIDELINES FOR WORKING GROUPS

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In the background paper I several macro issues related to forestry, biodiversity and degraded lands and the relevant action plans are considered. In background paper II the following aspects are covered specifically focussing at biodiversity linkages to degraded lands.

Firstly, the need for considering village ecosystems (including private as well as community or government owned degraded lands) for Biodiversity Conservation (BD) is presented followed by a brief description of the proposed aims and approaches.

Secondly, various aspects of BD and degraded lands are considered under the following six sub-heads. Under each head the current status is discussed followed by some views on alternative approach required to achieve the desired goals and finally some possible barriers are listed.

I. Erosion of biodiversity and degradation of land
II. Current approaches / programmes on promotion of biodiversity
III. R & D and technology for promotion of BD and restoration of degraded lands
IV. Institutional and policy issues for biodiversity conservation and restoration of degraded lands
V. Biodiversity and degraded croplands
VI. Developing human resoruces for protecting and enhancing biodiversity in degraded lands

PLANT DIVERSITY IN VILLAGE ECOSYSTEMS

Why is there a need to look beyond forests and protected areas for promoting biodiversity ?

(a) In many regions large sections of villages have no forest near their habitats and thus they have to depend on village ecosystem lands for all their diverse requirements of plant biomass or plant diversity.

(b) Studies have shown that large percentage of villages have no community land and in the remaining villages the existing community land may be lost due to encroachment in the years to come.

(c) At the same time the rural communities dependence on the large diversity of plants and plant biomass remains and would only increase as population grows. A study in one semi arid village showed that in that village alone apart from food, fodder and fuel purpose, plant biomass was used in the manufacture or production of over 40 articles or products used in the village.

(d) Studies have shown that the rural community had a tradition of maintaining a large diversity of trees on the crop land bunds, near homes, along road sides, along stream banks, near threshing yards and so on.

(e) Field experiments have given indications that biomass productivity of mixed forests (multi-species, multi-tier), aimed at various biomass needs, could be higher than the monocultures. Thus even if one is interested in woody

biomass it may be desirable to go in for mixed cultures on community or farmers land.

(f) Degraded private land or marginal cropland is also a potential land category for promotion of biodiversity. Such lands are not suitable for crop production

(g) Village habitats consisting of crop land, non-crop land (private or community wasteland), livestock and water bodies function as an agricultural ecosystem with interlinkages among all these components.

(h) The land area potential available for tree planting in village ecosystems under various land categories is very large.

(i) Village communities in many areas had traditionally dedicated a patch of land as 'Sacred groves' and 'Temple gardens' within their ecosystems for plant diversity conservation, though on religious grounds. Thus the concept of conservation of biodiversity is neither alien nor radically new for the rural communities. Thus they could be willing partners in such programmes.

(j) Studies have shown that a large potential exists for planting trees without dedicating land to it; along cropland bunds, road sides, stream banks, near homes. Even farmers are ready to dedicate a fraction of own land for mixed tree cultures. This potential becomes crucial as many villages may not have any community land in their ecosystem or any

forest patch near by.

(k) It may be a cheaper option of promoting biodiversity as individual farmer or household and community could be involved in planting, protecting and sharing of benefits from the plant diversity. Through appropriate social institutional mechanisms it may be possible to undertake biodiversity programmes with little external (financial) assistance.

BIODIVERSITY AND QUALITY OF LIFE OF RURAL / TRIBAL COMMUNITIES

The village ecosystem community's quality of life depends on the availability and access to a large diversity of plant biomass. Thus any program on conservation and promotion of biodiversity in countries like India should centre around village ecosystems or human societies and must be linked to promotion of quality of life. Thus the biodiversity conservation programmes should focus on protected elements on all scales (from individual Ficus trees and small sacred groves and ponds to the larger nature reserves) as well as areas subjected to different levels of human usage outside the nature reserve system and village ecosystems could be central to this.

Approach to promotion of biodiversity in village ecosystems

The following aims and approaches are suggested for promoting biodiversity in village ecosystems.

Aims :

1. The goals of programmes of promotion of biodiversity should be aimed at meeting the large diverse biomass needs of community, there by equating promotion of biodiversity with promotion of quality of life in rural areas.

2. To initiate programmes to have small in situ plant diversity conservation programmes like sacred groves in every village ecosystem keeping the long term requirements of biodiversity.

3. Expand the scope of social forestry programmes to meet all the biomass needs of local communities in addition to fuel, fodder and timber needs and ensure a proper species-mix to achieve this.

4. To revive and strengthen past traditions of nature conservation.

5. To ensure effective community participation through awareness and education programmes. Special programmes are necessary to involve women and children.

6. Develop and empower social institutions to enable local communities to control, protect and manage all natural resources where plant diversity also becomes a resource for sustainable use.

7. To value BD and to reward the local communities for conserving or promoting BD in their ecosystem

Approach :

1. *Ecosystem approach* : An ecosystem approach is required where all categories land in an ecosystem, like common land, crop land, fallow land, crop land boundaries, road sides and home compounds, are considered in programmes on biodiversity.

(i) Villages with common lands : community land would become central to the biodiversity programmes and other land categories like degraded cropland, cropland bunds, road sides and stream banks would supplement the programmes.

(ii) Villages without common lands : all categories of land mentioned above would become central to biodiversity programmes especially degraded croplands.

(a) Community lands : To meet the diverse needs of local community promote multi-species forests. A small fraction of community land could be dedicated as a sacred grove. The elders of the local community could reconstruct the past diversity of that village.

(b) Crop land bunds, stream banks, near homes : Tree or shrub species of choice of farmer or housewife should be promoted. They are likely to prefer a large diversity of tree and shrub species.

(c) Degraded farm lands : There is a need to motivate and promote multi-species (tree, shrubs, grasses) and multi-tier forests on a small fraction (1/4 to 1/10 of their holdings) of every farm. Farmers could dedicate a marginal or degraded patch of their lands. So that the land could be protected from degradation and in addition provide biomass for the household and also a

stable source of income in all years, including low rainfall years.

Promotion of large diversity of plants necessitates that the seedlings of choice of community, farmer, women must be made available at the right time and right place.

2. *Research* : Research is necessary to identify suitable species-mix for different locations to meet the diverse needs of the community.

- There is a need to recommend, based on research, appropriate density or spacing and tier system that promotes natural regeneration in addition to optimising biomass productivity.
- Appropriate soil and water conservation measures have to be developed and adopted in the field to promote plant diversity and natural regeneration.
- Nursery and culture techniques for local traditional species have to be developed.
- Method to record the status of BD in vuillages and to give value to BD in different locations.

3. *Community participation* : Community participation is central to promotion of biodiversity. There is a need to empower the rural communities along the lines suggested by the National Wasteland Development Board (1991). Two institutions namely : (1) Gramasabha (assembly of all adult members) to take control of common resources and to take decisions on species choice, protection, management and sharing of benefits (ii) village

natural resource management committee; a body nominated by the Gramasabha to operationalize the decisions of Gramasabha.

4. *Biodiversity awareness campaigns* : Though traditionally communities are aware of the need for plant diversity, they have to be made aware of the cause-effect relationships of decline of biodiversity on quality of life in the long run and any new methods or techniques of promotion of biodiversity.

- Separate programmes are necessary to motivate and involve women as they are the main gatherers of biomass and thus going to be the real beneficieries of improved plant diversity
- Need to incorporate different aspect of biodiversity into the teaching programmes of schools.
- High school and local college students could be involved in monitoring the dynamics of biodiversity and the progress of programmes of biodiversity promotion.

5. *Policy changes* :

- Ban encroachments and stop legalization of encroached community land.
- Ban monocultures on community lands except under special conditions.
- Enact new acts to transfer all community land to the control of the Gramasabha and empower the Gramasabha to take and enforce decisions.
- Ban sale of biomass from community land till all the local needs are met.

- To ensure whole community participation, benefits from plant diversity programmes should be equitably shared by the ecosystem community.

6. *Voluntary agencies* : For biodiversity programme to become a people's movement voluntary agencies must play a crucial role in organising and enabling local communities and women to effectively participate in such programmes.

DRAFT GUIDELINES FOR WORKING GROUPS

PART I

EROSION OF BIODIVERSITY AND DEGRADATION OF LAND

1. Current Status

Land categories considered are village ecosystem land including common land, crop land and protected forest land (like minor forests). Reserve forest land is not considered here.

1. The village ecosystems lands have lost the vegetation cover (trees, shrubs, herbs, grasses) leading to;

(a) Loss of biological diversity - plant as well as animals

(b) Shortage of biomass for rural and tribal communities; fuel, fodder, timber, minor forest produce, medicinal plants etc.

(c) Increasing soil erosion and water run off leading to :

- loss of soil fertility and biological diversity
- siltation of water bodies
- reduction in ground water recharge

2. Causes for loss of vegetation cover;

(i) Excessive and non-sustainable removal of biomass and excessive grazing.

(ii) Encroachment of community land and conversion to marginal croplands i.e. loss of habitat.

(iii) Centralized or bureaucratic control of community land like taking over of community land by state revenue department and forest department

(iv) Erosion of local control or regulation systems and local institutions.

3. Invasion of non-palatable weeds (Lantana, Eupatorium, Parthenium, Euphorbia, sps.) due to excessive grazing.

4. Afforestation programmes in degraded lands are dominated by monocultures of a few exotics like Eucalyptus, Casuarina and Acacia auriculiformis.

5. Farm forestry programme is dominated by high density monocultures of exotics mainly for urban market.

6. There is no data base on the current status of BD in village ecosystems or degraded lands.

Proposed approach

1. There is a need to generate data base on the levels of BD in different ecosystems and components of ecosystems.

2. There is a need to understand the impact of different causes of degradation on BD.

3. Ban encroachment of community lands.

4. Regulate conversion of degraded land to crop production

5. Restoration and promotion of community control and regulation systems of plant resources. Creation of new soial institutions to promote regulated harvest of biomass.

6. Enforce sustainable harvest of biomass, control grazing through appropriate social institutions

7. Transfer control of common land and vegetation resources to community control.

8. There is a need to change the resource use pattern even in

rural areas; for example change from unregulated grazing to either complete stoppage of grazing (coupled with harvest of grass) or regulated grazing.

Barriers to the approach

1. Large and affluent farming households have no vested interest in the health of common lands and their biological diversity.

2. Politicians encouragement to encroachers through the promise and process of regularization of encroachments.

3. Vicious circle of low biological productivity - leading to shortage of biomass - leading to increased pressure on land - leading to overharvest of vegetation leading to further decline in biological productivity.

4. Low biological productivity and diversity does not enthuse communities to shoulder responsibility to control and regulate plant resource use or even to undertake revegation programmes.

PART II

CURRENT APPROACHES / PROGRAMMES ON PROMOTION OF BIODIVERSITY

I. Current programmes

1. Conservation of biodiversity is currently centred around protected area concept like sanctuaries, national parks and biosphere reserves.

2. Degraded village ecosystem land and protected or community forest areas are not covered under any BD promotion programmes.

3. The large afforestation programmes under social forestry and planting in territorial (forest department) areas are not specifically aimed at promoting BD.

4. Infact area brought under afforestation in social forestry as well as other programmes is dominated by one or two exotic species. Thus the revegetatin programmes may have reduced the plant diversity.

5. Community involvement in species choice is minimal or totally absent in all revegetation programmes.

6. Dependence of rural and tribal community on a large diversity of plants is neither recognised nor incorporated in to the programmes.

7. Land degradation and loss of BD continues as the extent of area brought under revegetation annually in very low compared to the extent of degraded land area waiting to be brought under vegetation.

8. Soil erosion continues in all the degraded lands.

9. Traditional knowledge and traditional practices of BD conservation are rarely understood and used in programmes of BD

promotion.

10. No value is given to BD conserved by local communities traditionally on their own, sometimes on religious grounds.

11. There is no integrated approach to promotion of BD. Linkage of BD to other components of village ecosystems is not considered.

12. The dominant end use of biomass from trees and shrubs is its use as fuel for cooking and heating bath water. However the revegetation or BD promotion programmes do ot include biomass conservation possibilities.

PROPOSED APPROACHES / AIMS

1. Recognise the dependence of quality of life of rural and tribal communities on the availability and access to a large diversity of biomass.

2. Recognise the need for conserving and promoting biodiversity for ecological reasons.

3. Broaden the BD conservation programme beyond the protected area concept to cover all degraded lands in the village ecosystems and away from the human habitats.

4. Incorporate the BD conservation concept into all revegetation and land development programmes as it is perfectly compatible with the social goals of promoting the quality of life of rural and tribal communities.

5. Involve local communities in species choice in all revegetation programmes to ensure a large diversity.

6. Increase the area brought under revegetation programme by many times the current rate to prevent encroachment and to check

land degradation.

7. Promotion of the concept of 'sacred groves', 'temple forests', 'safety forests' etc for conservation of BD through appropriate incentives.

8. Dedication of a small patch of community land for specifically nature or BD conservation where harvest of timber or wood is banned.

9. Develop a method of rewarding communities who maintain and promote BD both on their own traditionally as well as under an arrangement between the government and community.

10. Ban monoculture plantations on community lands and provide incentives to maintain large diversity.

11. Scarcity of biomass fuel from trees has forced rural communities to use all types of biomass (shrubs, herbs, climbers, young trees twigs). Thus it is necessary to consider the two following programes to reduce pressure on all plant types;

(i) fuel conserving efficient wood stoves

(ii) alternative fuels like - biogas

Barriers to the approach

1. Prepondarance of the commercial and fuelwood aspect in the forest department sponsored programmes.

2. Dependence of revegetation programmes on funding from western countries and international funding agencies which insist on economic or commercial aspects leading to monocultures.

3. Attitudes of the forest department staff governed by the centralized decision making process and target oriented approach.

4. Forest and environment policy makers and administrators view BD promotion through protected area concept for recreational and aesthetic purpose. Degradation of BD or biological productivity doesn't affect the planners, policy makers and administrators.

Part III

R & D AND TECHNOLOGY FOR PROMOTION OF BD AND RESTORATION OF DEGRADED LANDS

I. CURRENT STATUs

A. The status of biodiversity in not known for all locations especially for different human ecosystems.

B. Biodiversity is not valued and there is no method of giving economic or social value to BD in human ecosystem.

C. Currently there is no special programme or technique for promoting biodiversity in the revegetation or afforestation programmes.

D. The levels of biodiversity and biomass productivity for any given area is affected by the technologies used in silvicultural practices or programmes of conservation. Some of the silvicultural techniques which affect biodiversity are as follows:

1. Land preparation
2. Soil and water conservation measures
3. Nursery techniques
4. Species-mix or species choice
5. Planting pattern : tier structure, crown structure
6. Spacing or density
7. Protection, fencing
8. Natural regeneration practices

1. Land preparation : In majority of the revegetation programmes, land preparation involves digging parallel trenches of 2 to 3 meter length and a depth and breadth of 30-45 cms. In

some cases pits are dug at regular intervals.

2. Soil and water conservation measures : Soil and water conservation measures are rarely practiced in tree planting programmes. Even the trenches for planting seedlings are not often along contour lines. The current approach is least effective in conserving soil and water. Of late some soil and water conservation structures like contour bunds, check dams, vegetative barriers and farm ponds are being incorporated into afforestation programmes under the watershed development programmes.

3. Nursery techniques : Nursery techniques have been well developed for all popular exotic species and tree species of commercial importance. The most dominant technique is raising seedlings in plastic bags. Propogation techniques are inadequately developed or not known at all for majority of forest or native tree, climber and shrub species. Knowledge is also inadequate regarding many of the trees species traditionally raised in village ecosystems.

4. Species choice and species-mix : Afforestation on community lands or farm lands or degraded reserve forest land in most parts is dominated by monocultures of exotic or commercial tree species. In a given region the same species or a same mix of a few exotic species are planted in different soil, topography and water situations. Eucalyptus, Casuarina equisetifolia, Acacia auriculiformis and Poplar species dominate in different regions of India. The so called miscellaneous plantations (mixed) are

also dominated by 2 or 3 of the above species and local tree species account for less than 10%. The following relevant problems could be listed.

(i) Local biomass needs of the community are not considered in species choice

(ii) Performance data does not exist for most local and forest tree species in different regions.

(iii) Performance of monoculture and polyculture plantations with respect to biomass productivity, species regeneration, promotion of diversity is not known for different regions.

(iv) There is no compatibility between soil and water condition with species choice.

(v) Information on performance of multi-tier vegetation vs single tier is inadequate.

5. Spacing or plant density : The density of forest department promoted plantations on reserved forest land or community lands ranges between 1500 to 3000 plants/ha. The density of plantations on farmers land is generally higher, in the range of 4000 to 8000 plants/ha. The spacing of forest department promoted schemes or plantations do not seem to vary with changes in soil and moisture situation. The following technical issues are not considered and knowledge on these issues is also inadequate.

(i) Impact of density of trees on species regeneration

(ii) What should be the spacing for different purposes namely; firewood plantation, timber forest, multipurpose forest

(iii) Density for different soil and moisture conditions

(iv) spacing for different tiers in a multi-tier forest

(v) spacing for slow growing trees and fast growing trees

6. Protection of forest or plantation : The forest or plantation has to be protected from grazing to promote regeneration and biodiversity. Currently the techniques adopted are ;

- barbed wire fencing
- cattle - proof trench
- live hedge
- gaurding by watchman

In some areas like western ghats an expensive combination of cattle - proof trench + barbed wire + gaurding is adopted. Not much experimentation has taken place on live-hedging with different combinations of species though it is likely to be cheaper.

7. Natural regeneration : Natural regeneration (NR) as an approach to promoting biodiversity or for reclaiming wastelands or for growing the biomass needs of the community has not been adequately experimented or tried for different regions. The current approach of revegetation through raising seedlings in plastic bags, planting them in trenches and protecting them is an expensive option, and large areas cannot be covered. The current approach may neither promote biodiversity nor provide a variety of biomass required by the rural communities especially the requirements of tribal communities.

CENTRE FOR
ECOLOGICAL SCIENCES

SUGGESTIONS FOR R & D

A. The R and D in revegetation programmes should focus not only on increasing biomass productivity but also on promotion of biodiversity and conservation of soil and water. R and D strategy should be different for different categories of degraded land.

Community land near human habitations	Large diversity of trees, shrubs, herbs (medicinal) and grass to meet diverse biomass needs of community Conserve soil and moisture Promote biodiversity
Private degraded land	Increased biomass productivity Species-mix for providing multiple benefits, employment and income (wood, fruits, timber etc).
Reserve forest land	Regeneration of forest diversity
Bunds, avenues	Large diversity of economically valuable tree species

The following technologies or silvicultural practices have to be developed for all the above categories of land and objectives

1. Appropriate species-mix to increase biomass productivity and to promote BD in different locations (land categories) and different soil and water situations
2. Appropriate soil and water conservation measures for different locations to promote BD.

3. Optimum spacing and density for different types of locations to promote BD.
4. Nursery techniques for local species and forest species.
5. Low cost live fencing techniques
6. Impact of different silvicultural practices on biodiversity
7. Techniques to enhance natural regeneration under different regimes of protection.

B. Promote studies on :

(i) relationship between BD and cultural diversity

(ii) religion and BD conservation practices in different regions.

C. Develop a methodology to rank and value the BD in different land situations and ecosystems.

D. Study the impact of exotic weeds and introduced species on BD of different ecosystems.

E. Study the relation between levels of land degradation and BD.

F. There is a need to promote R and D;

- to study the exiting traditional medicine systems
- how they could be further developed
- to understand the kind of plant diversity required
- how the degradation of BD has contributed to decline in tradtional health care systems

POSSIBLE ACTION PLAN

R and D institutions with interest in developing revegetation techniques for promotion of biodiversity or even biomass production are very few and none exists in some ecological zones. The following action plan could be considered

(i) Identify one existing institution in each ecological or agro-climatic zone and further identify a centre or department with compatible interest.

(ii) Strengthen the man power and infrastructure on the condition that they would work on R and D issues jointly identified by the host institution and funding agency.

(iii) Training of the technical or research staff at advanced institutions is necessary

(iv) Time bound programme has to be initiated

(v) Field trial must be an integral component of any R and D project.

(vi) Requirement of funds has to be worked for each agroclimatic zone.

Barriers to technology generation

1. Long gestation period involved in generating information on performance of different combinations of trees, shrubs and climber species.

2. Shortage of funds and non-availability of land for field experiments.

3. Forest department's preference for

   - species which propogate easily

- species which are not grazed by livestock
- species showing initial high growth rates
- species with high commercial value or urban market

4. Lack of trained technical man power in research institutions.

Part IV

INSTITUTIONAL AND POLICY ISSUES FOR BIODIVERSITY CONSERVATION AND RESTORATION OF DEGRADED LANDS

I CURRENT STATUS

1. There are no social and political institutions empowered to promote diversity or to check land degradation at local level.
2. Ownership and authority of community lands rests mostly with the revenue department and forest departments.
3. Rural communities are not aware of their rights and powers with respect to community land and the rights on produce from such lands.
4. An integrated approach to local needs of biomass, BD promotion and conservation of soil moisture is absent.
5. Village communities are not provided with information on the forestry or revegetation programme implemented and its physical and financial aspects. There is no mechanism for the communication of information.
6. There is no local community involvement in level monitoring and evaluation of the programmes implemented by forest or soil and water management or irrigation departments.

APPROACH / ACTION PLAN

There should be a national policy on BD to support R and D, to remove any legal hurdles and to effect appropriate policy guidelines to promote BD and to integrate promotion of BD and

restoration of degraded land.

1. Enacting laws to facilitate formation of local social institutions like gramasabha and a Village Natural Resource Management Agency.
2. Enact laws to empower local institutions to take and enforce decisions on all aspects of BD, biomass generation and land improvement programmes;
   - species choice
   - mode of protection
   - mode of regulation of access and removal of biomass
   - mode of sharing of benefits
3. To formulate an integrated strategy to incorporate BD promotion concept into all revegetation programmes as access to large diversity promotes quality of life in rural and tribal areas.
4. To ensure community involvement in planning adopt microlevel planning method suggested by the National Wasteland Development Board (NWDB). It aims at an integrated approach to wasteland development through a participatory approach.
5. To study and identify what forms of social institutions promote biodiversity. This should be based on studies spanning the country to locate the past and present practices and traditions and to build on the experience.
6. An ecosystem or watershed approach is desirable. Here all land categories could be considered for promotion of BD and production of biomass namely; degraded government owned land, degraded private land, crop land bunds, stream banks,

tank fore-shore areas, road sides.

7. There is a need to develop a methodology for monitoring and evaluation all revegetation and BD promoting programmes.

8. A participatory monitoring system is essential. Local community which has a stake in the BD should have power to monitor and evaluate the programmes. A village natural resource management agency, consisting of community members, school teacher and if any NGO, could monitor. The village gramasabha should seek report from village agency as well as from governnment agencies periodically for review and recommendations.

9. NGOs could make a significant contribution at various stages starting from creating awarness and organising community to implementing and monitoring BD conservation programmes. The national programmes on BD should clearly define the role of NGOs and empower them to undertake different tasks like implementation or monitoring of the programmes. NGOs should have full access to all the information.

Barriers to the proposed approach

1. Unwillingness of bureaucracy and centralized administration to transfer powers to local communities.

2. Tendency of the officers to hide information from villagers on the financial allocation, location and physical progress to cover up inefficiency, delay and misuse of funds on all projects related to revegetation and soil-water conservation.

3. The fear among the policy makers that transfer of power to

local community would lead to domination and cornering of benefits by a few affluent powerful individuals in the village community.

4. Sectoral and target oriented approach where funds are allocated to each development department seperately and unwillingness among departments to work jointly.

Part V

BIODIVERSITY AND DEGRADED CROP LANDS

Status

1. About 60% of India's land area is in a degraded state. A large part of 140 m ha of net cropped area is subjected to soil erosion, water logging etc. The rainfed farming area accounts for nearly 100 m ha. The rainfed lands are characterized by undulating topography which promotes water runoff and soil erosion.

2. Even the lands along steep slopes of hills which are subject to severe soil erosion are also under crops (excluding terrace farming).

3. Annually about 24 m ha of crop land is left as fallow (current + permanent). Large farmers leave a part of their degraded lands as fallow due to several reasons like shortage of animal power and human labour. These lands are subjected to severe grazing and are in a highly degraded state. Such lands are not fit for crop production.

4. The productivity of rainfed lands, which are in a degraded state, are extreamly low for example; Bajra - 0.37 t/ha, Rabi Jowar - 0.75 t/ha, small millets - 0.40 t/ha, pulses - 0.51 t/ha.

5. Thus significant proportion of rainfed farming land is not fit for crop production but is under cropping for want of any other option.

6. The farmers as well as the village community as a whole are facing a severe shortage of biomass of all types.

7. Crop production is not accompanied by any soil and water conservation measures. In fact some practices like ploughing along the slope accentuate soil erosion and land degradation.

8. The village common lands were/are in a degraded state. Such lands are being encroached and converted to marginal agriculture. The productivity of such lands in extremely low. These degraded common lands are not suited to cereal or pulse crop production.

9. Farm forestry covers only a fraction of the potential land. But farm forestry is not often restricted to degraded lands alone. The farm forestry is dominated by high density monocultures of species like Eucalyptus, or Casuarina equisetifolia which inhibit all plant species regeneration due to high density.

POTENTIAL AND APPROACH

It could be safely assumed that nearly 25 to 50% of rainfed farming land (of about 100 m. ha) which is in a highly degraded state, would be available for cultivation of various combinations of 'trees, shrubs, climbers and grasses'. However due to inequitable distribution of land all farmers may not be having surplus land for tree culture even if the land is in a degraded state. However it is surely possible to motivate farmers belonging to all land holding sizes to dedicate a fraction of their degraded land for tree cultures. Some farmers with large

holdings could be motivated to convert all the degraded cropland as well as fallow lands to tree cultures.

1. Dedication of a fraction of degraded crop land and fallow land owned by each farmer for multi-tier and mutli-species 'tree-shurb-climber-grass' cultures.

2. Promotion of agro-forestry practices on crop lands. Area under bunds ranges from 3 to 10 % of land depending on size of plots and cultivation practices. A large diversity of trees could be promoted on the crop land bunds.

3. To study and promote the traditional practices of growing or retaining a large diversity of trees on farms in different regions.

4. Research to identify appropriate species-mix for different soil-moisture, biomass requirement and farm situations.

5. Agricultural policy is required to discourage farmers from growing crops in highly degraded lands for example hill slopes (excluding terrace agriculture).

6. Industry could depend wholly on biomass from private degraded lands. Thus industry could be expected to provide subsidy or incentive to farmers to grow trees on degraded lands. However there is a need to promote multiple-species forestry that not only increases biomass productivity (of say softwood species) but also promtes BD. This is possible with suitable species-mix, density and tier-structure.

Aims of converting degraded crop land to 'tree-shrub-climber-grass' cultures could be as follows.

(i) to grow plants to meet the various biomass needs of the household and farm (firewood, fodder, oilseeds, leaf manure, bamboo, timber, tamarind, fibre etc.)

(ii) to grow trees, climbers, shrubs, which lead to sustainable yearly income (like tamarind, jackfruit, Acacia consina, Sapindas laurifolis) even in low rainfall years,

(iii) to grow trees like Eucalyptus, Leucaena leucocephala and Albizzia lebbeck, which could be felled and sold for generating incomes to farmers especially in lean agricultural years.

(iv) to prevent further degradation of land and to enrich the soil with litter and legumes, and

(v) to promote plant diversity on farms and in village ecosystems.

APPROACH OR ACTION PLAN

1. Initiate field research to identify species-mix 'tree-shrub-climber-grass' for different regions and different farm situations - both for dedicated plantations as well as for planting along bunds.

2. Initiate research to recommend soil conservation measures to accompany tree, shrub, climber and grass planting in marginal crop lands.

3. Demonstration programme should be initiated in villages to show the advantages of going in for tree-shrub-climber planting in degraded crop lands.

4. There is a need to initiate programmes to motivate farmers

for dedicating all or a fraction of their degraded lands for 'tree-shrub-climber-grass' planting and also for planting trees on crop land bunds.

5. The state government or forest department could provide incentives to shift from crops to tree-shrub-climber-grass cultivation in degraded crop lands. The incentive could be in the form of some financial assistance for undertaking soil and water conservation measures (land preparation) and free supply of seedlings of their choice. The assistance should be restricted to only multi-species cultures.

6. Forest departments must initiate a programme to collect data from each village on the area that will be covered under the programme and the number of seedlings of each plant species required for planting. This data should be collected one year in advance.

7. Seedlings should be provided free in the villages at the right time for planting.

8. Farmers could be involved in raising seedlings at village level.

Barriers to promotion of BD on degraded cropland

1. Non-availability of seedlings or planting material for all the desired plant species.
2. Shortage of capital and labour for land preparation and soil correction measures.
3. Difficulty in protecting the seedlings in the initial years especially the palatable species.
4. Absence of information on the performance of mixed cultures

compared to monocultures with respect to biomass productivity and economic returns.

Part VI

DEVELOPING HUMAN RESOURCES FOR PROTECTING AND ENHANCING BIODIVERSITY IN DEGRADED LANDS

CURRENT STATUS

Degraded lands are under the control of farmers, village community, government (Revenue Department, Public Works Department, Minor-irrigation and Forest Department). Thus the actors involved are the individual farmers, village community, NGOs, foresters and government officials.

Farmers : Traditionally farmers were planting or retaining a large diversity of trees. Currently what is being observed is that the practice is on the decline and a slow shift from native tree speices to one or two exotics like Eucalyptus and Casuarina is taking place. Farmers have also started growing monoculture plantations of species like Eucalyptus mainly for commercial purposes.

Village community : The traditional systems of retention and protection of plant species, regulated harvest of biomass from near by forests or community lands and controlled grazing practices have all vanished. The new community leaders like the panchayat leaders are only interested in the short term gains and do not seem to have the interest of community at large and definitely not that of the poorer section or the long term interest of the community . Evidence is available to show that the community leaders have preferred exotics like Eucalyptus for their community lands and further these leaders prefer to sell

the whole produce to urban traders. The community at large is not involved in any of these decisions. Studies of preferences of village community on species choice have indicated that they would prefer multiple benefit yielding species and further prefer multiple species for community lands. Currently they have no say in these decisions. The new younger generation in rural areas are not aware of the traditional practices of tree planting or retention or enforcing local control on plant resources. The rural poor due to deprivation and increased inequities have lost confidence in their rights and capabilities. The community is also ignorant about the legal status of lands and their rights.

School and college teachers and students

Currently they are not involved in any of the revegetation or environment conservation programmes. The coverage in school syllabus of issues and concepts related to degradation of environment and conservation is very low or nonexistant. There is little or no focus on local BD. Students are not involved in conducting investigations in to local BD or environment status.

Forest Department Officials

The goals, priorities and targets of forest departments do not seem to be compatible with neither the needs of the community nor for promotion of biodiversity. Though the original goals of social forestry as recommended by the National Commission on Agriculture suggests that the local needs of biomass are to be met. Further the Forest Policy Document also suggests multi-species forests for community lands. The important issue is the absence of involvement of the community. This is mainly due to

historical reasons when forest department personnel were mainly involved in protecting the forests. Their mental makeup is that of a police force. Though it is changing slowly. They are not trained in the art of involving the community at various stages of revegetation programmes.

The forest department personnel may not be adequately knowledgeable about techniques of enhancing the biodiversity through the programmes of afforestation.

Voluntary Agencies : The voluntary agency workers may be motivated and knowledgable about the approaches to involvement of community but often may not be adequately trained in techniques of soil and water conservation, analysing the performance of species or in techniques of enhancing BD.

SUGGESTED PROGRAMME FOR HUMAN RESOURCE DEVELOPMENT (HRD)

The need for HRD among different actors has been highlighted. Here the aims of the programmes targeted at different actors is given.

Farmers

1. Aware of the past traditions of planting a large diversity of trees along bunds, crop lands bordering streams and roads and of conservation forestry (like sacred groves, temple forests).
2. Aware of the techniques of planting multispecies forest on a small fraction of their land and along cropland bunds and borders.

3. Aware of the need and advantages of dedicating a fraction of their land specifically a degraded patch for growing a mixed forest consisting of multiple species aimed at meeting the biomass needs of the family and to generate income and employment.

Community

1. Educate the community on the legal aspects of community resources like land and water and their rights with respect to usage of benefits and decision making.
2. Aware of the vegetation that was present in the past in the nearby forests and community lands especially the plant diversity aspects.
3. Aware of the interlinkages in village ecosystems among various components of the ecosystems : plant diversity, plant biomass production, water bodies, animal resources, non-crop land and crop land.
4. Aware of the harmful effects of status quo (overgrazing, land degradation, deforestation, non-participation in management of community resources) on the biodiversity, biomass availability and ultimately the quality of life of the community.
5. To educate the community on the cause and effect aspects of degradation of biological resources specifically the erosion or absence of community participation and community control of the land and vegetation resources.
6. Educate them on the technique and methods of conserving and enhancing the biodiversity, land and water resources.

7. Aware of the need for and how of the community participation in management of land, water and vegetation resources.

Forest Department personnel

1. Awarness regarding the cause and effect of degradation of biodiversity and vegetation resources and the interlinkages among the land, water, vegetation and human resource components.
2. To educate them on the microlevel planning approach for development of degraded land.
3. Educate them on the need for and approaches to achieve meaningful participation of the community in the conservation and development of soil, water and vegetation resources.
4. Aware of the techniques of enhancng the biological diversity even through the existing programmes (like social forestry) and any new programmes.
5. To make them to appreciate the traditional practices of plant resource regeneration and protection, and management of community resources like land, water and vegetation.

Voluntary agencies

1. Educate them on the alternate integrated approach to development of degraded lands especially the steps in microlevel planning.
2. Aware of the interlinkages between the land, water and vegetation resources and the importance of biodiversity.

3. Role of NGO's in creating awareness in community and in organising and enabling the community for participation in microlevel planning.

School and College teachers and students

In rural areas school going children are involved in activities that may contribute to degradation or protection of local environment. Even school going children work on farms, take cattle for grazing and gather firewood after the school hours and on holidays.

Students (high school and college) could be involved in generating data base on status of BD in their localities and monitoring any changes in the BD.

1. Create awareness regarding the components of their environment (plants, birds, soil, water etc.), interlinkages among the components, causes and effects of degradation, role of the components etc.
2. Communicate the concepts on environment, like biodiversity, efficiency, conservation, sustainability.
3. Expose them to local environmental problems and solutions.
4. Involve them in monitoring the dynamics of local environment and changes in BD.

Environment awarness campaigns could be focussed on primary and higher primary school students. College and high school students could be involved in monitoring the dynamics of local environment especially the status of BD.

Action plan and strategy

Farmers :

1. Prepare slides and video films of farmers who have planted a large diversity of trees along bunds and borders of crop land and mixed forest in a small patch of their cropland.

   Prepare charts and posters on advantages of planting trees on bunds and in marginal lands owned by them.

2. Activists of adult education programme or the voluntary agency could be involved in organising the communication programmes. Adult education programmes should include components of biodiversity conservation and conservation of soil and water.

3. Some demonstration farms could be set up and field visits could be arranged.

4. The methods should include demonstration, field visits, AV aids and discussion.

5. Training programmes have to be organized to train adult educators and NGOs.

Community

The rural communities are heterogeneous and thus it is difficult to organize any common programme for men and women or landless and large farmers.

1. Prepare small pictorial booklets in local languages on legal status of community lands and forest department lands,

rights of the community, existing programmes, microlevel planning steps. Distribute these booklets to all the literates in the community and the message will spread to some extent.

2. Prepare video programmes on successful community programmes in different parts of India on development of degraded land, revegetation, stall feeding, management of community resources like water, forests and grazing land.

3. Prepare charts on the steps in microlevel planning, powers and rights of the community and discuss them at community meetings.

4. Prepare audio-visual material on :

- linkages among the components of village ecosystems namely; water, community land, crop land, vegetation, livestock etc.
- advantages of stall feeding and controlled grazing on community lands
- techniques or methods of enhancing biodiversity
- methods or options for conserving biomass energy
- causes and effects of degradation of natural resources; land, water, vegetation.

5. Arrange field visits to any successful community managed programmes in operation in the nearby area.

6. Train both men and women educators for organising the awarness programmes

7. Integrate education on environment into adult education programme.

8. Identity or set up institutions to develop teaching/communication material.

9. Prepare visual material on past tradtitions of conserving biodiversity in different regions.

10. Prepare discussion material on why large diversity is useful taking local examples.

Community education programme could be organized in two phases.

Phase I : In phase I there should be a massive programme in a short period to inform and prepare the community for the more detailed education programme. The methods could involve street plays, processions, puppet shows etc. The main aim would be to inform them about the launching of conservation programme, need for participation by the community and the aims of the programme.

Phase II : In this phase each or each group of educators should be assigned group of villages.

- The programme could be organized as regular discussion meetings in the evenings say once or twice a week lasting one hour.

- A V aids like posters, charts, slides and if possible viodeos should be used.

- The programme could last for a few months.

School / College students :

Primary/higher primary : An activity based programme could be adopted. For each topic / issue students would carry out an activity, collect data or information, analyse the information and draw inferences. Some examples of activities are :
listing of trees in farms or in community land, survey of locations of gathering fuel and locations of livestock grazing, measurement of quantity of firewood used for cooking and dung yield.
Scheduling : One hour per week for discussing the findings of the activity and Students would carry out the activity after school hours and on holidays.

There is a need to prepare manuals for teachers. The teachers should undergo training on the issues as well as methodology.

College / high school students : These students could be involved in studying the changes in the status of plant diversity or environment and for monitoring the programmes on environment conservation and development. Simple scientific methods have to be developed for monitoring each environmental parameters.
A set of parameters and methods to monitor them have to be developed. Each week data on one parameter has to be analysed. Students would monitor the parameters, some periodically, after school hours and on holidays.
Reporting to village community : The findings the monitoring

could be reported to the community and used during discussions.

Preparation of teaching material and training :

There is a need to identify the parameters and methods for each region. Teachers of highschools and colleges have to be trained in conducting the programme.

Forest department personnel

1. Identify institutions that have the facilities and capabilities to organize training programmes on a periodic basis to forest department personnel in different zones.
2. The training programme should involve field work and field visits.
3. The forest department officials should be deputed to these institutions for periodic training programmes.

Barriers to promoting HRD

1. Absence of trained educators both at school and adult education level.
2. Non-availability of education material like films, videos, slides package, charts, posters.
3. Absence of infrastructure like place to meet, slide projector, video player, travel grants for educators and community.
4. Absence of appreciation among policy makers and administrators of the need for providing additional information to rural community and of the possibility of learning frm their experience.

23.

THE MANAGEMENT OF PROTECTED AREA BUFFER ZONES FOR THE MAINTENANCE OF BIODIVERSITY

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INTRODUCTION

This is a topical subject to write on as it forms the subject of a week long workshop on buffer zone management organised by UNESCO and the Wildlife Institute of India in February 1991 and for which I have been partially responsible. The workshop however had over twenty specialist inputs, here I try to distill issues into one short paper!

It is also a topical subject as conservation managers all over the world are increasingly realising that protected area or nature reserve management cannot take place within isolated, fortress like boxes in a sea of resource dependent humanity. There has to be a much greater integration of the protected area system into the rural environment. This integration will be achieved at the interface between the people and the core or central reserve, this interface is often called the buffer zone. The buffer is supposed to absorb pressure, assimilate the perturbations from outside and so protect the inner core. It is eighteen years since India highlighted the policy of core and buffer zones in its protected area network (eg Sahabis 1985), a policy at the centre of the Project Tiger philosophy (Panwar 1985). But it has remained a paper policy, there has been virtually no investment into buffer zone resources or buffer zone management for any of India's close to 500 wildlife protected areas (Kothari et al 1989).

For this discussion on the importance of managing peripheral buffer zones so as to protect biodiversity, I intend to establish five sets of ideas:

- The need for a protected area network and what a protected area should be and do
- A model showing the sorts of land use pattern that surround protected areas.
- The link between population, resources, development and conservation status
- The effects of commercial utilisation with in buffer zones.
- The effects of subsistence level utilisation within buffer zones.

From these five information sets I go on to discuss management options to reduce degradation and restore or at least maintain biodiversity.

Firstly, however, some definitions are necessary, especially as this is one of the very few papers to deal with protected areas in this workshop

Protected Areas There are no "nature reserves" in India. We have a network of national parks and wildlife sanctuaries which collectively form our protected area network. Nature Reserve is a term used by the IUCN for its highest category of protected area, one where there is no possibility of any unnatural disturbance or exploitation, (see table 1, and McNeely and Miller

1985 for a discussion on past categories and IUCN-CNPPA 1990 for a more recent version). Few of India's national parks are in the first two categories, as most are not fully constituted (see Kothari etal 1989) and still here considerable exploitation.

Degarded A controversial word to define as it has connotations of personal value judgement (Owen-Smith 1983, Ferrar 1983,). Two possible connotations exist for this paper. One is a reduction in biodiversity (simply loss of species) from the normal for that site. A productive plantation can be considered degraded in terms of the extreme impoverishment in species variety. The second connotation has to do with levels of sustainable productivity. A loss of productive potential can be called degradation. I discuss both in the paper, generally the latter.

Biodiversity The variety of biological life at community, species and genetic levels What is meant by biodiversity in discussing conservation issues is of interest. Conservationists are concerned with maintaining representative examples of natural levels, of biodiversity, (what Reid and Miller 1989 call characterstic biodiversity) and usually concentrate on those communities which are seen to have high diversity and endemism. A given site has a potential level of species and community richness, depending on biogeographical location and resource

(moisture etc) availability. Various human inputs then serve to reduce the potential natural level of diversity to actual levels by, for example, clearing or logging, overgrazing, soil and nutrient loss etc. New species may invade, possibly even raising species richness by an inflow of opportunists. Biodiversity can also be used to describe the variety of species, varieties and cultivars in man's agriculture. A high diversity gives some level of sustainbility in heterogenous environments.

Buffer Zone Buffer zones are defined in Saharia 1985, Oldfield 1985, McKinnon etal 1985 etc. Buffer zones can be part of the protected area themselves, for example a sanctuary which is adjacent to a park and which allows some resource exploitation, can be considered to be deflecting pressure from that park and so be acting as a buffer. A reserve forest with a high intensity of resource use around a sanctuary of lower exploitation is also functioning as a buffer. So is a protected forest around a reserve forest.

A buffer zone can also be a more conceptual zone, as for example land adjoining a protected area where extra compensation to people for crop loss by wildlife is paid, or alternative resources supplied or where conservation education is concentrated.

ISSUES AFFECTING BUFFER ZONES, DEGRADATION AND BIODIVERSITY

The role of Protected Area Network in Conserving Biodiversity.

This is highlighted in several recent publications (eg Mackinnon & Mackinnon 1985, Thorsell 1985, Mcneely & Miller 1985, Rodgers & Panwar 1988, 1991, Rodgers in press). Despite the past existence of many traditional indigenous cultural or societal initiatives to conserve natural resources (eg Gadgil 1991), these initiatives have broken down during the last two centuries of commercialism, urbanisation and population growth and have little real relevance for main stream biodiversity protection today. Globally, the answer to how best to conserve biodiversity, is seen in the creation of a network of protected areas. The controversy is not over the existence of such PAs, but as to how they are designed, utilised and managed (eg McNeely 1989, [illegible], Lucas 1990) and especially as to how they are integrated into surrounding land use practices (Western & Pearl 1989, Kothari & Mackinnon 1989).

I do not think it necessary for this paper to go into the necessity to maintain biodiversity, that is I think clearly proven (Wilson 1988, McNeely 1988), and forcibly stated for India in amongst others, Department of Environment 1987, Gadgil and Meher-Homji 1986, Ministry of Environment and Forests, 1990).

We cannot of course maintain all populations of all species all over the country. We are faced with a choice, a dilemma really, of which populations of which species, or which

communities of several species should be maintained. Conservation planning then tries, or should try, to locate the protected areas where they can be most efficient, i.e. by selecting areas of high diversity, high endemism, and viable or potentially viable populations of key species. Similarly, such planning should try to avoid areas of intense land use conflict and use locations where protected area status can provide other benefits, such as watershed conservation.

A network of protected areas seeks to cover the diversity of habitat and species within a country or region. Traditionally protected areas have been declared on an ad-hoc basis, often biased to the more spectacular large mammals. The network in India, despite some 500 protected areas totalling 4% of the land surface is still incomplete. Rodgers & Panwar (1988) and Gadgil & Meher Homji (1988) discuss the need for additional areas.

A further problem is that many areas are of inadequate size or shape to hold viable populations of their key species. The need for large protected areas has been seen as incompatible with the demands of adjacent resource dependent people. Many protected areas are considered as non viable or potentially non-viable due to such human pressures. This non-viability is based on perceived conflict. If on the other hand, there was discussion between competing interests and more sharing of resources using a pattern of core-buffer zone habitation and improved resource productivity, then there is a chance for long

term co-existence. The need for dialogue and resource sharing between park management and people has been seen as the singlemost important problem facing National Parks all over the world (Machis and Tichnell 1985). Dialogue and sharing resources, making protected areas more user-friendly with a conscious objective of building links with the outside world are the key elements of Ugalde's (1989) optimal parks system.

The protected area network therefore is evolving from a past isolated pattern of natural area islands, cut off from people, to a dual function, that of conserving biodiversity in the central core and showing conservation can be people-supportive in the peripheral buffer.

Pattern of Land Use Around Wildlife Protected Areas. Generally speaking India's protected areas have been developed in the least disturbed regions of the country, areas where natural vegetation (forest, scrubland, grassland or wetland) still dominates. By definition therefore such areas are located in regions of low development input and where people's lifestyles have received little supportive infrastructure. Rural communities have often been by-passed by the national development process.

There are exceptions of course. Some protected areas are situated within cities (Guindy N.P. in Madras, Borivili in Bombay, Van Vihar in Bhopal). Others are in highly productive agricultural areas which have received 'Green Revolution'

technology input. Keoladeo Ghana NP at Bharatpur is such an example, and the secondary problems of green revolution agriculture-pesticides, fertiliser residues in water inputs are now problems for park management.

Basically, rural communities around protected areas use agricultural practices with a diversity of cropping patterns and a high dependence on low productivity livestock, and on forest produce for sustenance (fuel, fodder and a cash income (tendu leaf etc). Such a land-use system makes considerable use of neighbouring forest resources (e.g. Pandey etal 1985 for a Himalayan example). Declining forest productivity suggests such use, and hence life styles are not sustainable. These rural communities are further marginalised by the creation of protected areas which reduces resource availability (in reality or potentially) and increases inter-and intra-community conflict and tension (Rodgers 1989).

Gadgil(1989) has presented an analysis of the changes in land-use pattern in the forested regions since the advent of British colonialism. He has shown how what was possibly a self-regulating and sustainable system of forest land-use was destroyed by the commercialism of British forestry, and that people have had no other option but to adopt present practices of over-exploitation of a dwindling resource in which they have no say in management or regulation.

Human Populations, Natural Resources, Development And Conservation Conservationists and resource managers already see major conflict between growing populations and resource availability. This is with today's population of 800-900 million people. Planners should consider the scenario of population demand-resource supply with the anticipated population of 1.3 billion by 2030 AD. Many of the extra 4-500 million people will be dependent on the nations decreasing and deteriorating natural resources.

It is not sheer numbers that causes the problem, it is also the increasing consumption pattern of the population. Changing life styles of urban and developed agricultural areas lead to greater demand for water, energy, and manufactured produce, all of which further impact the natural resource base (eg. Shekhar Singh 1989). The "omnivore" population to use Gadgil's (1991) phrase, is growing and continuing to receive natural resources at heavily subsidised prices, eg. bamboo for pulp for news print.

Commercial Forestry Operations in Buffer Zone Traditionally, scientific forest management in India has been directed towards the sustained production of commercial products, especially timber and commercial supply of fuel and pulp. Whilst production has been increasing over the decades since forest management began, there is growing evidence that such exploitation is not sustainable. Objectives of management are to maximise the

production of favoured items. Silvicultural practices were designed to increase the proportion of selected species either by clear felling and replanting or by "improvement" treatments which remove competing non-useful species from a semi-natural forest.

This management purposefully led to a reduction in overall diversity of tree species and such an impoverished and structurally uniform (even aged stands) forest would have fewer smaller plant species and fewer animal species as well. Timber management can thus lead to three very different end points.

- a single age structural, single(or sometimes two or three) species plantation
- an intensively worked and "improved" semi-natural forest which is dominated by commercial species and which has few or no old age individuals,
- a less intensively worked selection system forest of more natural size structure and species composition.

These end points obviously have major effects on overall biodiversity, specially when the more intensively used forests tend to have significant pressures of fire, grazing and subsistence resource use as well.

Management in this way can increase the density of many generalist wildlife species, such as spotted deer, by increasing habitat interspersion and by removing shrubby growth and increasing groundlayer species. Examples include Bori WLS,

Parambikulam WLS and Nagarhole NP (Rodgers 1991). But habitat specialist species, dependent on dense cover or on the niches offered by old or fallen trees, decrease and often disappear. This is well documented for evergreen forests of the tropics by for example Johns(1989) and for North America by Hoover and Wills (1987). In America concern for specialist species has led to the concept of managing forested lands for biodiversity by, amongst other things, keeping intact core areas, and a proportion of old growth in exploited areas (eg. Salwasser).

Subsistence Utilisation of Buffer Zones Like other pressures, the effects of subsistence exploitation will depend on the intensity and frequency of use. Most buffer areas have seen little successful attempt at resource regulation by either managers or by rural communities themselves. Such extreme utilisation has led to increasing resource degradation including loss of soil, nutrients, moisture retaining capacity and capability for regeneration.

Ocasional attempts at regulation have shown an improvement in resource availability, eg. by stopping grazing in the monsoon growing period. But such inputs have been sporadic and by inadequate involvement of local people have not proved sustainable.

However, where forest management has involved people in full participatory or joint management mechanisms which involve rights

to a share of the produce, then regulation does succeed. Clear examples are now available from West Bengal, Haryana, Gujarat (Poffenberger 1990). Their evidence shows that such regulated use by local people themselves can lead to increases in commercial products, biomass production and biodiversity.

Management Inputs. Two distinct sets of activities present themselves. One is to improve the productivity of the natural resources on which people are dependent, largely fuelwood and fodder. This can be done in the peripheral regions of the protected area, the legal buffer zone, or in the common property resources (CPR) of the village lands. The CPR may be extensive degraded forest areas or small road sides, hill-top areas etc, traditionally used as village commons. Management practices for commercial exploitation of the forested buffer zones could also be based towards improving biodiversity. The second approach is into providing alternative support systems, resources and income-generating activities so as to minimise dependence on the natural resources. This process is termed ecodevelopment.

Enhanced Resource Productivity in Buffer Zone. This has been one of the objectives of India's 'Social Forestry Programme' where village commons, CPR and private resources are the targets of afforestation.[3] Regular territorial division forestry activities have tried reafforestation of government forest land.

The National Wasteland Development Board (NWDB) has made major investments into both sets of activities. And yet in many cases these activities have failed (eg. Chambers, Saxena and Shah 1989, Saxena 1989, Vohra 1989). Part of the reason lies in the alienation of the resource dependent people from the schemes.

Recent initiatives in West Bengal (Malhotra and Poffenberger 1989) and Gujarat, Haryana and elsewhere in the country (Poffenberger 1990, Mannerjee 1990) and outside India (Wood 1990) have shown the great ability of joint management schemes which involves full village participation to regenerate degraded land. This approach is used successfully elsewhere in the tropics (Chambers 1990 Poffenberger 1990).

The NWDB has become involved in village participation programmes in regeneration forestry, and now is actively planning trial projects for such programmes in buffer zones for wildlife protected areas. Another example is the Agha Khan Rural Support Foundation development in the Gir forest buffer zone in Gujarat.

Resources in buffer zones must be developed in response to people's needs, not industry's needs, tens of kilometers away. Planting or selection must include the variety of food, fodder, fuel and other nontimber products that people want. There has to be considerable product diversity in both the input and the resulting forest itself.

Improved Forest Management in Buffer Zone Biodiversity can be enhanced by the manner in which forests are exploited. Many details are given in Rodgers (1987) for India and Hooper & Wills (1987) for North America. Greater emphasis on maintaining strips of natural forest along drainage lines, steep slopes, ridge-crests and between plantation blocks, can maintain populations of species which are dependent on natural forest and allow dispersal corridors. Examples of plantation design for biodiversity. The balance between increased production or increased protection can be altered by more conservative marking during selection and improvement felling activities. More old growth, "snag" trees (i.e. those with hollows, dead limbs, cavities etc.) and fallen trees can be retained to increase structural and niche diversity. Species selection can be altered to retain more keystone resources such as fruit trees, dry season flush and evergreen species etc. Above all, the concept of biodiversity as well as biomass production for local people must be built into working plan prescriptions.

ECODEVELOPMENT

Ecodevelopment can be defined as the process leading to sustainable development through integration of both human and natural resource components of [illegible] Ecodevelop-ment

is viewed as a potentially beneficial strategy to reduce over-exploitation of natural resources by the provision of alternative income-generating activities. The strategy has scarcely been tested in the wildlife-protected area context but does have similarity to other rural development schemes.

Ecodevelopment could involve inputs into improved agricultural practice by soil moisture conservation activities and better crop varieties. Marketing could be improved through cooperatives, better access, fairer prices etc. Livestock could be enhanced through better breeds, husbandry, and again provision market opportunities. Alternative incomes could involve sericulture, pisciculture and rural cottage industries.

At the core of the ecodevelopment approach is the concept of increased self-determination and participation in development activities by the people themselves. A first step is the understanding of present practices and needs. This would be followed by strengthening of village level institutions which would internally take up development tasks (PSU). Ecodevelopment inputs can be to private property resources (PPR), or into some types of CPR, as for example pasture improvement and fodder generation, or improved village-level soil & moisture conservation by micro planning, catchment improvement and bund construction.

CONCLUSIONS

The most important conclusion from [illegible] conservation initiatives is that the ultimate [illegible] for maintaining biodiversity is in [illegible] which are themselves protected by peripheral buffer zones. The buffer zone could be developed in one of two ways. Firstly, as a highly productive source of biomass for peripheral people. This high production could be brought about by intensively managed and used plantations and selection forest systems with an overall lowered biodiversity than natural forest. If this keeps pressures off the core, then fine, the buffer is working.

The second option is that of a less intensively managed or used habitat that structurally is close to natural and still maintains some of the original biodiversity.

In practice a buffer zone should probably have both inputs. I say 'should' purposefully, as we do not have well planned or functional buffer zones today. Planning issues are discussed in Rodgers (in press), which sees a buffer zone as a gradient of land use pressures from low at the edge of the core to intense management at the people's edge.

The second important conclusion is that the buffer zone is the place for sharing resources. There need to be people participation in joint-management schemes in buffer zone development is to work. The objective is rational planning (Rodgers in press), which considers people's needs as well as the requirements of conservation biology.

Restoration of Wastelands - Role of Academic and Research Institutions

Cecil J. Saldanha

The extent and annual increment of wastelands in India are matters of serious concern. Out of a total geographic area of 329 million hectares (mha), 175 mha were said to be affected by problems of soil erosion and soil degradation according to an estimate made in 1976. Subsequent estimates based on remote sensing imagery put the area regarded as wastelands even higher. The annual increment of 2.5 mha was to have been compensated by reclaiming 5 mha annually. The actual achievements, estimated on survival rates and other crucial parameters, is said to cover only 0.5 mha/yr. Thus the actual annual increase in wastelands is five times more than the area reclaimed (Agarwal, 1987).

The 1976 estimates have been broken down into some broad categories - 87 mha of eroded land and permanent pastures; 19 mha of forest lands; 8 mha of uncultivable non-forest land; 43 mha of land with special problems (saline, alkaline, deserts and ravines) (NWDB, 1989).

A closer look at these categories is instructive. The land available for grazing has been halved although the cattle population has increased enormously. The forest area was 75 mha at the time of our attaining independence. Today it is about half of this area - 35 to 40 mha. There has been serious degradation of all common and revenue lands due to several types of biotic pressures (Chowdry, 1987). Mangroves, plant communities admirably adapted to survive in the interphase between land and sea, are disappearing due to urban expansion, land fills and fuel extraction. Waterlogging and salinity because of wrong use of water is another way in which both water and land are lost and large investments rendered unproductive. In Karnataka water logging or salinity has occurred in 33,000 ha in the Tungabhadra, 16,000 ha in the Cauvery, 4,300 ha in the Bhadra, 2,466 ha in the Malaprabha and 2,000 ha in the Ghataprabha basins making a total of 57,766 ha (Rama Prasad, 1986).

Wastelands are areas where the natural ecosystems have broken down. Given the favourable conditions of sunshine, water and soil, the greater part of our land should have resulted in climax types of vegetation, each adapted to particular situations. This vegetation would have supported a reasonable fauna, ensured sustained land capability and water availability and contributed to the well-being of our people.

The few figures given above are indicative of the damage being done to our resource base and to the fruits accruing from this base. The abundant sunshine is wasted, good land rendered infertile and plentiful water made scarce. The long term consequences of such a situation are likely to be alarming.

This destructive trend has been recognised at several levels of our Government, administration and public consciousness. It was a

Prime Minister who set up the NWDB (Natural Wasteland Development Board). Smaller advisory groups have been requested to look into the priorities ennunciated in the earlier 5-year plans and to propose corrective action. In the non-governmental sector, citizens' groups have also come out with alternative strategies for sustainable development. The process of introspection and evaluation is an ongoing one and should lead to newer paradigms, altered priorities, effective implementation and we hope sustainable development resulting in benefits for the common citizen.

For this it is necessary to carefully and objectively review our efforts of the last forty years. The SAC-PM has made a basic observation that "our developmental efforts have tended to stress intensification of resource use without due regard for long-term sustainability and for concomitant degradation of other resources" (SAC-PM, 1988).

Surface mining in Goa is a striking instance of a skewed developmental initiative. Goa with its limited territory is exporting over 50% of the iron ore from India. The resource is intensively exploited. Being a non-renewable resource mining the deposits will be commercially viable for only a decade or two. What is left behind is a series of deep holes in the ground, enormous dumps of tailings and overburden which would need large inputs of money, manpower and technology to reshape and restore. In the process fertile fields are lost because of siltation. The productive estuaries of the Mandovi and Zuari are rendered turbid and incapable of supporting benthic fisheries (Parulekar & al., 1984). The employment of a few thousand mining workers will be terminated once the mines are exhausted. This is a typical example, one of many, where intensive exploitation is neither sustainable nor with any regard to concomitant degradation of other resources (Swaminathan, 1982).

Intensive exploitation of resources has been accompanied by a sectoral approach. Each user generally approaches the developmental programme from his own point of view rather than in a holistic manner. The agricultural departments for example have encouraged conversion of forest land into farm land without proper consideration of land capabilities and the coexistence needed between farming and forestry. The ratio between arable land and other types of land use is revealing. Over 51% of the land in India has been converted into arable land. This is exceeded in Asia only by Bangladesh. Nadkarni (1990) observes "even other asian countries with higher pressure of population on land have lower proportions of their area under cultivation 21% in S. Korea, 16% in Japan, 12% or 13% in China, 17% in Thailand, 26% in the Philippines, 28% in Sri Lanka and 22% in Pakistan". Nadkarni points out that "the extension of cultivation to marginal lands and the general neglect of land is also reflected in a high proportion of area subject to soil erosion and land degradation - 53% in India and 60% in Karnataka".

A reference has already been made to waterlogging and salinity in irrigated lands in Karnataka. At a national level, after having constructed 1,500-odd large dams and created reservoirs at a high cost of about Rs.10,000 crores, catchment area management has been

consistently neglected so that run-off is too fast, siltation accelerated and flood-prone area doubled (Agarwal, 1987).

While there is a general pattern in the processes that lead to the formation of wastelands, a realistic and effective programme for wasteland development has to be site specific. There has firstly to be an effort to identify a well defined area for action. This could be a water-shed or other naturally demarcated area logistically suited for proper intervention. Secondly, based on information generated for this area on availability of natural resources including soil and water, on utilisation trends, constraints and felt needs, strategies have to be worked out. Thirdly these strategies have to be prioritised in consultation with the local population, governmental agencies and non-governmental groups.

The phase of information and planning has to be supported by the decision makers, administrators and financial agencies. Proper budget estimates have to be worked out and funds generated which except for initial seed money must be generated locally. The man-power at the local level and at the scientific and institutional level has to be enlisted and financially supported.

The process of implementation has to be in close collaboration with the local community. Care has to be taken to integrate the different caste/social groups in the effort. As women form an integral and important part of the community their cooperation is indispensable. Common lands have often become No man's land. Building up local responsibility for common resources is however , a sine qua non (Agarwal, 1989).

The developmental effort has to be motivated and sustained by an awareness of problems, technologies and objectives. Suitable audio-visual and printed material has to be made available in the local language.

The success of the wasteland development effort will in the long run depend on the local community. To a great extent the decision making process must be theirs. The ownership of the basic resources should be vested in the local community.

There are success stories in several parts of the country where integrated wasteland development has been carried on with the cooperation of all concerned (Gadgil, 1987; Saifulla, 1988).

Role of Academic & Scientific institutions:

1. Identify an area and a community.

2. Create a data base on climate, topography, soil, water resources for the given area. Several studies have been carried out but the information is not easily available. There is therefore need for an organised information base.

3. Evaluate the resources, analyse their utilisation. Finding out land capabilities, local needs, evolve integrated strategies for sustainable and equitable exploitation.

4. Involve the local people, government and non-governmental agencies in a common effort based on consensus and common good.

5. Use the expertise available in Academic and Scientific institutions for an integrated effort. The Universities will have to pass on from a sectoral and subject based approach to an integrated and functional effort.

6. Help in interacting with funding and governmental agencies.

7. Evaluate the progress of the effort and help in arriving at participative decisions.

8. Prepare the required instructional materials e.g. hand books, visuals and other information adapted to local needs.

9. Help in the training of local participants as well as of specialised scientific personnel.

[Agarwal (1989, pp 34-36) assigns several tasks to Government Agencies in restoring our land. These could well be the tasks of Academic & Scientific Institutions as well].

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WASTELAND DEVELOPMENT BY WOMEN'S GROUPS: A CASE STUDY OF WORK DONE BY SARTHI IN SANTRAMPUR TALUKA OF PANCHMAHALS DISTRICT, GUJARAT

BY

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Note

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1. Summary

Wastelands development exclusively by women's groups has become one of SARTHI's (Social Action with Rural and Tribal Inhabitants of India) major programmes in Santrampur Block of Panchmahals District, Gujarat. The uniqueness and strength of the programme stems from the fact that it originated out of the women of Muvasa village themselves articulating the need to find some means of solving their acute problems of fodder and firewood scarcity. This was during the third successive drought year of 1987. Working with women's groups was not a component of SARTHI's wastelands development programme till then. It is to the credit of two field staff members of SARTHI, Champa Ben[1] and Vikram Bhai, that they were able to respond to the situation and lay the foundations of the present programme. As members of a small professional resource group, both the co-authors of this case study have been associated with SARTHI since 1983 and 1985 respectively. Some of SARTHI's staff attended our workshops with PEDO's staff in Mada and we conducted a number of planning and

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[1] Starting as a shy and apprehensive local women who had to be coaxed into travelling to Mada (3 hours away by road) to attend a chulha mistris (cookstove technician) training programme in 1984, Champa Ben blossomed into a wonderful, sensitive activist-cum-trainer. She became a key resource person for other women's programmes initiated by SARTHI. Sadly, Champa Ben died in December 1989 at the young age of barely 30. We, along with other staff members of SARTHI, would like to dedicate this case study to champa Ben's memory which continues to inspire all those who were privileged to work with her. We would also like to express our gratitude to Mr. Giriraj Singh, (Director, SARTHI), Nirmal Ben (Incharge, Women's Programmes) and all the Field Centre Incharges and field staff of SARTHI for all their cooperation during our recent field visit for this case study. We would also like to thank members of all the women's groups who gave us much of their valuable time during the peak sowing season and shared their feelings and perceptions with us.

review workshops on the wastelands development programme with SARTHI's staff during 1988 and 1989. It was after two training workshops in Mada in November 1987 and January 1988 that the Muvasa women's group was formed. We learnt about it a few months later. Both workshops were attended by Champa Ben, who played a crucial role in developing the concept of working with women's groups at SARTHI.

As described in the case study, there continue to be several unresolved questions, particularly, with respect to securing the groups' legal rights to the land. However, even the limited experience of two and a half years of working with women's groups seems to indicate that the processes of selecting the land as well as group members on the basis of consensus through open discussion with other villagers can be very effective in dealing with the normal resistance to women's involvement with land based activities. Similarly, enabling women to obtain social approval for taking group action to deal with a problem specifically affecting them has been a tremendously empowering experience for the women. They have been able to create a forum for themselves (non-existent traditionally) to meet regularly where, besides discussing development and management of their common resource, they are beginning to address several other problems affecting their lives.

2. The Socio-Economic Structure of Panchmahals District

SARTHI is based in Godhar village in Santrampur block of the Panchmahals district, Gujarat. It started working there in August 1980, as a sub-centre of SWRC (Social Work and Research Centre), Tilonia. In October 1985, it attained independent status as SARTHI. Its main area of work is Santrampur block although it also has a sub-centre in Savli Block of neighbouring Baroda district.

Panchmahals is the second largest district of Gujarat State. It is also one of Gujarat's most industrially backward districts with 89.15 percent of the total workers still dependent on agriculture and allied activities. Surprisingly, there was no change in this percentage between 1961 and 1981. Out of the district's total reporting area of 885,000 hectares, 473,200 ha (53.5%) is under cultivation. However, only 44,700 ha (9.45% of the cultivated area) is irrigated. The main source of irrigation continues to be wells. Thus, over 90% of the land under cultivation is rainfed. This leaves the district's economy highly vulnerable to crop failures due to deficient or untimely rains. About 84% of the district's main workers are cultivators compared to about 50% for the state as a whole. Most of them are small and marginal farmers. The district has the lowest percentage of agricultural labourers, only 4%, compared to 14.8% for the state as a whole.

The average annual rainfall in the district is about 1000 mm; 90% of this is received between June and September. However, variation in the annual rainfall is large and 6 out of every 10 years are prone to drought. The district gazetteer records major famines and droughts during the last and the present centuries.

The most recent drought years were 1985 to 1987 which brought acute misery to the people. Besides total crop failures, acute fodder scarcity resulted in heavy cattle mortality and forced large numbers of people to migrate to other areas in search of work. In fact, seasonal migration for wage work is common in the area as rainfed agriculture yields only one crop annually.

Some data about the district compared to the state as a whole according to the 1981 census is summarised below:

	Gujarat State	Panchmahals District
1. Total population	34,085,799	2,321,689
2. Population growth rate (1971-81)	+ 27.67	+ 25.58
3. Density of population (per sq. kilometre)	174	262
4. Sex Ratio (Females per 1000 males)	942	959
5. Literacy rate		
Persons	43.7	28.1
Males	54.44	40.79
Females	32.30	14.86
6. Percentage of urban population	31.10	11.09
7. Percentage of Scheduled Tribes	14.22	41.76
8. Percentage of Scheduled Castes	7.15	3.80
9. Area under forests	9.96%	25.5%

Thus, compared to Gujarat as a whole, Panchmahals has a much higher density of population, a much lower literacy rate (particularly among women), much less urbanisation and a much higher percentage of tribal population. The slightly lower

population growth rate and the more favourable sex ratio are possibly due to male dominated migration from the area.

3. The State of the Forests

The forests of the Panchmahals are historically famous. It was here that the Sultans of Ahmedabad and the Mughal Emperors used to come on elephant hunting expeditions. Its teak wood was (and is) much in demand. Among all the districts of Gujarat, Panchmahals boasts of the largest area (25.5%) under forests.

Unfortunately, little of the forests has survived the combined pressures of illicit felling, commercial exploitation, clearance for agriculture and uncontrolled grazing. With the continuing pressure of growing human and cattle populations, the remaining forests continue to get further depleted. Excessive grazing smothers natural regeneration and each drought year brings a fresh onslaught from a desperate population in search of fodder, firewood and a source of income. The district's grazing (gauchor) land is under similar pressure. Out of a total of about 50,000 ha of grazing land, at least 10,000 ha has been encroached upon by a land hungry population. The rest of it is in a degraded and unproductive state due to the absence of any regulatory or management system.

4. Santrampur block

Santrampur block falls in the semi-arid zone and its statistical profile is fairly similar to that of Panchmahals district as a whole. A major difference is that out of its total population of 323,268 as many as 66.4% belong to Scheduled Tribes and 2.8% to Scheduled Castes. Out of the block's total area of 1,36,075 ha, 52.8% is cultivated only 9.6% of which is irrigated. Wells are the main source of irrigation. Out of a total of 30,215

land holders, 19,667 (65%) are small and marginal farmers. The block has 380 inhabited villages out of which SARTHI has been working in 110.

About 16 percent of the block's area is supposed to be under forests although, as elsewhere in the district, the forests are now in a pitiable condition. Vast stretches of bare, rocky hills are visible which were reportedly covered with thick vegetation till just a decade or two ago. The dominant forest species is Teak (Tectona Grandis) interspersed with several other valuable species such as Dhawri (Anogeissus Latifolia), Aonla (Phyllanthus Emblica), Timru (Diospyros Melanoxycon), Bamboo (Dendrocalamus Strictus), etc. Mahuda (Bassia Latifolia) is another important local tree, particularly for the tribal population.

About 8.9% of the block's area is 'Revenue Wasteland'. Its present status according to records available with the Tehsildar is as follows:

Revenue Wasteland in the block	Area (ha)	Percentage
1. Total	12,154	100
2. Unauthorised agriculture	3.579	29.45
3. Agricultural land	1,023	8.4
4. Non-cultivable wasteland	3,256	26.8
5. Hilly, non-cultivable	4,254	35.0

Thus, almost twofifths of the block's revenue wasteland is already under cultivation (authorised or unauthorised) and what remains is degraded hilly or plain non-cultivable land. Even this is under constant pressure of encroachment. There is similar pressure on grazing lands by the land hungry people.

As a consequence, little of any land is considered 'waste' land by the people which is a major constraint for a wastelands development programme in the area. Due to the majority of cultivators being small or marginal farmers, a similar constraint governs availability of private wastelands.

5. The Status of Women and their Relationship with the Natural Resource Base

The status of women in Panchmahals, as elsewhere in the country, is low. Their workload is high. In addition to all the housework (cleaning, fetching water, gathering fuel, livestock care, cooking, child care and care of the sick and elderly) many women work on daily wages either on the fields of big land owners or on public works. Women of land owning families also perform substantial agricultural tasks. While men do the ploughing and marketing of the produce, women shoulder major responsibilities of hoeing, weeding, irrigating, harvesting and processing the produce. In the traditional division of labour between men and women in a predominantly subsistence economy, 'women's work' of collecting cooking fuel, fetching water and cattle care binds them more intimately with the natural resource base than men. It is they who have to pay the price for environmental degradation by having to walk longer distances in their daily search for fuel, fodder and water. With the tightening of control over forest lands, it is women who have to suffer humiliation by forest staff when caught collecting firewood. As a number of women of the area have said, Men just expect to be served cooked food. They aren't bothered about where the firewood comes from. That is our problem.'

Desertion, domestic violence, alcoholism among men (despite prohibition in Gujarat) and husbands bringing in second wives to

beget sons, are common problems of women of the area. On top of that, during drought years, they have to shoulder the responsibility of even men's work if men migrate in search of wages. Many women also have to migrate with the men to labour in more prosperous areas. As a consequence, women's lives are surrounded by a constant web of insecurity which gets reflected in any programme of working with women. This became abundantly evident during the improved chulha programme started by SARTHI in 1983. The programme continued to face a high turnover of trained women chulha mistris primarily due to the recurring personal crises in their lives.

Also, as elsewhere, women own little land or property. These are almost exclusively owned by men. Whether at her parental home or that of her in-laws, despite labouring hard in the subsistence economy, the woman's economic status is like that of an unpaid domestic labourer. Decision making concerning land is almost an exclusive preserve of men which makes wastelands development with women a particularly difficult task.

6. Evolution of SARTHI's Women's Programme

The process of evolution of SARTHI's women's programme has had a significant impact on the emergence of women's wastelands groups.

The improved Chulha Programme initiated in 1983 was SARTHI's first programme exclusively with women. Selected village women were trained as chulha mistris to build improved chulhas in and near their villages. They also provided regular follow up support to the new chulha owners. By 1987, a village based cadre of 30 chulha mistris and four supervisors had been built up. The four chulha supervisors were SARTHI's first full time women staff. As each mistri was in contact with at least 30 to 50

other women, for the first time, SARTHI established a large network of contact with local women. Through regular monthly meetings of mistris and supervisors, the organisation's understanding about women's problems in the area started increasing.

By 1987, with the third successive monsoon failure, the hardship of the local people had become acute. Through the mistris and supervisors, agonising tales of cattle dying, women's unending search for fuel, fodder, food and water and outbreaks of various illnesses and diseases exacerbated by nutritional deficiencies started pouring in. For the first time, serious thought started being given to developing a more holistic women's programme to address women's issues. In April '87, a group of village women and the women staff went to Mada to attend the women's mela there. They came back enthused and excited about the possibilities of organised action. In November 1987, the four women supervisors attended a training programme for women staff at Mada. Besides sharing their experiences as women, the participants discussed possibilities of women taking collective action to solve some of their problems. And, for the first time, the women participated in an exercise analysing the environmental crisis - its causes and what women could do to reverse the trend.

Although, till then, SARTHI still did not have a specific programme for involving women in wastelands development, the women supervisors started discussing natural resource management issues with village women during their field visits.

This was further reinforced by the 10 day intensive evaluation-cum-training programme held at Mada in January 1988. Eight staff members of SARTHI participated in this. The process of formation of the first women's wastelands group in Muvasa started soon after this.

In July 1988, SARTHI conducted a training programme for dais (midwives, both traditional and new ones) in response to the women's demand for access to improved health services. With this, a second cadre of trained village women was created. The dais were asked to hold regular meetings in their villages to monitor women's health problems and assist those whom they could not help themselves to get help from the government infrastructure.

Through these village meetings, acute nutritional deficiencies, particularly of Vitamin A leading to night blindness among children and pregnant women, became evident. This led to discussions on the relationship between health, nutrition and the environment. Integration of nutritionally important trees in SARTHI's wastelands programme started taking place. The trained dais have been extremely effective in increasing health awareness among local women.

During 1989, while initiating collection of local knowledge about local trees and shrubs to facilitate species selection for the wastelands programme, it became evident through the dais that there was a rich local tradition of using medicinal herbs and plants for dealing with women's health problems. Integrating species of medicinal value in the wastelands programme is likely to become yet another new facet of the programme. The forests of Santrampur block are rich in medicinal herbs and plants.

In May 1990, again in response to a felt need articulated by local women, 10 village women were trained to work as para-vets (called 'dungar dais'). With them, a third cadre of skilled local women has been created. Within a span of barely 2 months, the para-vet women have organised getting almost 3000 cattle vaccinated against the foot and mouth disease. Meetings of women's groups have become the forum for all these skilled women to interact with the others and increase their awareness and knowledge about various problems.

In between, a number of awareness generation and leadership development camps have been organised for selected women at Godhar. Camps on clean drinking water and the environment have been held in several villages. The midwives have been taken to a sister organisation for follow up visits and many women have been sent to melas, workshops and camps organised by other organisations on themes relevant to women's lives. Visits between members of different local groups have also been organised. Each opportunity for a village woman to step outside the village and interact with a large number of other women is in itself a very empowering experience for her. Besides acquiring new knowledge, she is able to shed some of her traditional shyness and inhibitions during each such experience.

Today, SARTHI's women's programme is beginning to look like the organisation's major programme. Due to women's positive response to each awareness raising exposure, SARTHI seems to be on the verge of switching over from individual beneficiary oriented projects to programmes geared to organising and mobilising women.

The development of the women's wastelands groups has to be seen against the above background. At least some members of the stronger groups have participated in one or more of the several camps, trainings or visits organised by SARTHI, and almost invariably, have been instrumental in helping the others overcome their suspicions or reservations about getting organised.

7. SARTHI's Initial Work on Private Wastelands

Each year from 1981 to 1986, SARTHI got a few thousand saplings of fruit and other plants raised in village nurseries and distributed them free of cost to several villagers. There was little feedback on what happened to the plants due to the absence of any effective feedback or monitoring system.

In 1986-87, with the availability of drought relief funds to generate badly needed daily wage employment for local people, planting was combined with the development of 'wasteland'. The organisation planted on 20 hectares of common land in its sub-centre in Baroda district.

Following the evaluation-cum-training workshop on environmental reconstruction held in Mada in January 1988, SARTHI defined some guidelines for developing private wastelands in Santrampur block. Funds for developing 20 hectares were made available by the National Wasteland Development Board and for another 90 ha by HIVOS. Norms for payment for pit and trench digging, digging of boundary trenches, planting, hoeing, weeding, etc. were clearly specified and the staff asked to identify interested small and marginal farmer wasteland owners in their respective field centres. The labour rates were kept a little lower than the minimum rates, the balance being justified as beneficiary contribution. There was limited discussion with landowners about protection after planting and no clear guidelines for their participating in the programme were specified. The general objective was to increase availability of fuelwood and fodder through planting appropriate species. There was no specific focus on involving women although the women staff were asked to encourage women's participation. One thing SARTHI made clear from the beginning was that it would not permit exclusive planting of Eucalyptus although some plants of the species would be supplied.

Review workshops with the staff in August and November 1988, after the planting season, indicated that several, almost bizarre problems had been experienced while implementing the programme. Some of these were:

- Although landowners agreed to participate in the programme, when earthwork started, many of them preferred working on government drought relief works instead of on their own lands. This was partly because SARTHI's staff demanded digging to specifications while on government works supervision was less rigorous. There was also a wide variation in the wage rates paid by the Forest Department, other government departments and SARTHI. People preferred getting higher wages than being paid a little less to develop their own land. As a consequence, many of SARTHI's field staff were forced to hire outside labour to work on the landowners' land!

- Although earlier the landowners had specified a wide range of species they wanted to plant, at the time of planting, most people demanded only Eucalyptus. One man threatened to sue SARTHI for damaging his land unless it planted Eucalyptus on it.

- A major reason for hostile reactions among many landowners was a rumour that the organisation would eventually take away both the land and the trees.

- Many plants were stolen from the nurseries. These included Eucalyptus, Acacia Nilotica, Khair (Acacia Catechu), Bamboo and Sewan (Gmelina Arborea). A sack full of stolen bamboo rhizomes was found in a villager's house. On being asked why he had stolen them, he said that if these were planted on the private wasteland nearby, he would have no place left to graze his goats!

- Once the planting season was over, few people took interest in protection or completing the boundary trenches.

It was clear that people were not sharing SARTHI's interest in helping them develop their wastelands into a long term asset. They seemed to equate the work with other government drought relief projects with an immediate interest only in earning wages.

It was during these workshops that work on four hectares of common land by a women's group was reported by the staff of Muvasa field centre. Although some conflict with residents of an adjoining village who were used to grazing their cattle on that land was mentioned, it seemed that much fewer problems of the type mentioned above were reported with the group.

The staff were encouraged to analyze why so many problems had been experienced with private land owners and to suggest changes SARTHI should make in its wastelands programme to make it more meaningful for the villagers. It was clear that it made little sense for SARTHI itself to get work done on privately owned land without the owners' participation. If the owners were not interested, the organisation should not get involved.

The staff was also asked to consider the pros and cons of working on common lands with groups rather than with individual landowners. Given the predominance of small and marginal farmers in the area, landowners having any 'wasteland' were likely to be among the better off members of the community. Thus, work on such private lands inherently tended to favour the relatively better off. On the contrary, the totally landless or very small farmer families, who most needed assured fodder and firewood supplies, were automatically excluded from benefitting from the programme.

Although the staff agreed with this basis for giving priority to common lands, most of them felt that very little, if any, such lands were available in the area. This is due to the

high density of population and unauthorised encroachment. Even so, some basis principles for working with groups on common lands were worked out and the staff asked to explore the feasibility of forming such groups. Two staff members were sent to PEDO to learn from its experience of working on common lands with groups The basis for working on private lands was also radically revised to avoid the type of problems described above.

8. The Shift to Working with Women's Groups

It was the response of the first women's plantation group in Muvasa to a crisis in February 1989 which ended SARTHI's field staff's ambivalence about working with groups on common lands In fact, without the organisation clearly defining such a policy shift, from that time onwards, all the field staff started organising women's wastelands groups.

The incident which inspired this change was the following. The Muvasa group had harvested its first grass crop from its four hectare plantation with voluntary labour. As the group had not yet decided what to do with the grass, it had all been piled up and left on the plantation itself.

One evening, while passing by, three drunken men from the adjoining village threw an unextinguished bidi stub on the grass All the grass went up in flames and the fire spread in the plantation damaging many of the young plants carefully nurtured by the women.

Initially, the mishap sent a wave of despondency among the women's group and SARTHI. The plantation was the best out of the previous year's effort. But the women quickly gathered their wits and called a meeting to discuss what to do. Were they going to permit the three men to get away with such an act of irresponsibility? Did their labour have no social value? If

ey did not punish the men, even their future efforts could be imilarly nullified. The women decided to demand compensation rom the three men. The value of the damage was discussed. It was decided that the men should be made to pay Rs. 1400/-. As they were likely to bargain, it was decided to ask for double this amount and agree on Rs. 1400/-.

Interesting dynamics took place within the group over this issue. One of the women members was related to the men. She tried pleading that they were too poor to pay such a large amount. The rest of the group told her clearly that their decision was final. If she did not agree with it, she could leave the group. The woman decided to stay in the group and accept its decision.

The men were summoned and told the group's verdict. Seeing the group's firmness and sensing the entire village's sympathies for it, the men paid the Rs. 1400/-.

When the Muvasa field centre (FC) staff narrated this incident during SARTHI's monthly staff meeting, the rest of the staff felt envious and inspired. The women's group's response was worlds apart from the bickering, irresponsibility and manipulations of private land owners.

From then onwards, all the field staff started striving to replicate the Muvasa group in their own areas.

9. Overview of SARTHI's Experience with Women's Groups

At present, SARTHI is working with nine women's wastelands groups in four of its field centres (FCs) in Santrampur block. Details about these are given in Appendix I. A few other groups were attempted, but either did not materialise or became defunct before they could be consolidated. Disruptive village politics

and the staff's inexperience in handling such situations seem to have been the major causes of failure.

The land being developed in all cases is either Panchayat Gauchor (grazing) land or Revenue Wasteland. Subsequent to the spontaneous development of the Muvasa group, initiation of women's groups in other villages has taken different routes. In some cases, SARTHI's field staff have first scouted around to find the necessary wasteland. They have then tried to motivate local women to develop it as a group. This has sometimes forced them to start work in villages where SARTHI has not done any work before and the villagers are totally unfamiliar with the organisation.

In other cases, seeing the work of the Muvasa group, some male village leaders have approached SARTHI asking for a similar women's group to be formed in their village, offering the necessary wasteland.

As may be expected, the experience with the groups has been variable. While some are developing well others are weak. Some have fallen apart in early stages of their formation. A complex range of factors influence each group's development. These include power dynamics within the village, competing interests in the common land, women's status and extent of exposure to the outside world, men's attitude towards women taking such initiatives, the skill, experience and leadership qualities of the field staff, particularly of the women staff, and the extent of fuelwood and fodder scarcity in the area.

10. Case Studies of Selected Women's Groups

In this section, we look at some of the groups in greater detail in terms of the process of group formation, the reactions of other sections of the community, particularly of men, to the

emergence of the group, the personal changes and benefits the women have derived through group membership and the role they see their wasteland playing for them in future.

10.1 Muvasa Women's Group

As already mentioned, this was the first women's group to come up in the area and has played a catalytic role in getting other groups going. Bringing women of newly formed groups to meet the Muvasa group has become a regular feature at SARTHI. These visits have seldom failed to impress new group members and have invariably facilitated new group formation. As the Muvasa group evolved through a unique and organic process, it is examined in greater detail.

10.1.1 Muvasa Village

Muvasa is a largish village of 550 families. It has six phalias (hamlets). The group members belong to the two phalias of Muvasa and Govalia Mahadev. These two phalias have about 300 families out of which 100 or so are Patels. The average landholding of the Patels is 10 acres. Economically they are the most well off. Patel women do not go out to work and most of their fuel and fodder needs are met from their own lands. If necessary, they purchase rather than collect these.

Out of the remaining 200 families of the two phalias, the majority are Adivasis (tribals) and others from backward classes. Their average landholding is 2 to 3 acres due to which both men and women have to supplement agricultural incomes with wage work. Some Adivasi men work as masons, carpenters or well diggers. About 10% work as agricultural labourers on Patels' land; 30 to 40% of the Adivasi women also do wage work, either on government public works or on the Patels' land.

10.1.2 Fuel and Fodder Scarcity and the Condition of Common Lands

Women of small and marginal farmer families face acute hardship in meeting their fuel and fodder needs. During years of good rains, they get adequate grass from their own lands during the monsoon and a few post monsoon months. Fodder scarcity is experienced during the summer, particularly from April to June. Several women then have to daily walk to a canal 4 kms away to fetch headloads of grass. Each trip takes approximately 6 hours- from 5 a.m. to 11 a.m.

Firewood has to be fetched from the forests about 10 kms away. Women in groups of 4 to 5 make daily trips starting at 3 a.m. and returning around noon for one week at a stretch and then take a break for about 10 days before resuming collection.

Scarcity of fuelwood and fodder is becoming more acute with further dwindling of the village's common land resources. Accurate information about the amount of Gauchor and Revenue Wasteland in the village is not readily available. However, much of it has been encroached upon. According to one estimate, there are about 60 hectares of revenue wasteland in Muvasa; 15 ha of this was allotted to eight families in 1982-83 for cultivation. They have encroached on another 15 ha. Another 20 ha seem to have been similarly encroached upon by other families. The Forest Department had planted on the remaining 10 ha some years ago but nothing survived. The limited land actually left for grazing is under such intense grazing pressure that it has become totally unproductive and barren. It is 4 ha of this land on which the Muvasa group has planted.

10.1.3 Formation of the Women's Group

In early 1988, SARTHI had initiated private wasteland development with a few families in Muvasa. Due to many families not working on their own lands, SARTHI staff had to hire other labour to do the earthwork. Most of this labour in Muvasa consisted of Adivasi women from the most disadvantaged families.

Coming together to work on a programme for which the organisation's goal was to increase fuel and fodder availability, the women talked about their own hardships due to their scarcity. They regretted their inability to participate in the programme as their own land holdings were too small. Champa Ben and Vikram Bhai, SARTHI's field staff, took a lead from this and started exploring the possibility of the women developing a piece of common land as a group. The women showed immense interest. Besides their long term interest in securing fodder and firewood supplies, they had an immediate interest in the daily wage employment the work would generate during a drought year. SARTHI was willing to pay for the land preparation and planting work on the same pattern as for private wastelands.

Impromptu meetings on the work sites resulted in some ground rules being worked out for the group. All those who became members would have to do the land preparation and planting work themselves. The group would have to accept collective responsibility for protecting the plantation. Each member would have a right to an equal share of the produce. All decisions related to the plantation would have to be taken collectively. Only women would be eligible for group membership as it is they who suffer due to fuel and fodder scarcity. All women interested in joining the group would be invited to join.

With the group beginning to come together, the Panchayat was approached to find out if it could make any land available to the group. The Sarpanch agreed to give 4 ha of what he thought was village Gauchor land for 10 years. The Panchayat gave a no objection certificate (NOC) to this effect with a commitment to renew the lease after 10 years and not claiming any share of the produce from the land. Interestingly, several months later, when the land's record was sought from the Patwari (village accountant), it was discovered that the land was actually revenue wasteland and not Gauchor land. This gives an indication of the prevailing confusion about the status of land in the area.

Some of the more active women then went from house to house enquiring from other non-Patel women whether they were interested in joining the group. A total of 29 women, all Adivasi, decided to become members. All of them come from the poorest families in the village, with some owning less than 1 acre of land. The village has about 30 other families with a similar socio-economic status. They expressed their inability to join the group either because of inadequate labour in the family, too much other work or other reasons. Due to this process, no conflict was generated due to some women feeling excluded from the group.

10.1.4 Dealing with Men's Suspicions and Initial Hostility

Even before the group started work on the land in April 1988, men of different castes and classes had started questioning why the organisation was working only with women. The husbands of some members objected to their attending group meetings. They felt that housework was suffering and the time spent in meetings was wasted. It seems that at the family level, each woman had to use a combination of assertiveness and diplomacy. As some of them said during a recent meeting, they started getting up earlier to finish their housework before going to work on the land or to attend a meeting. One woman said that her mother-in-law still

asks her every time why she is going for a meeting and she has simply learnt to say loudly and assertively that she has to go because her sisters have called her. The sisters-in-law of some women also resent their spending so much time on group work as they have to do additional housework.

SARTHI's staff dealt with the men's hostility by calling a meeting of the whole village to explain why they were working with a women's group. Women's increasing hardship due to scarcity of fuel and fodder was discussed and women having a greater stake in dealing with the problem was explained as the main reason for working with only women. Although this helped reduce the members' husbands' suspicions, other men continued spreading rumours that SARTHI would abduct the women, take away their jewellery, etc. Some men would stealthily listen to the group's discussions.

Slowly, with the group working steadily, the rumours and suspicions died down. SARTHI was also distributing cattle and deepening wells as drought relief work at that time. It had also organised environmental awareness camps. These activities had increased SARTHI's credibility and helped reduce men's resistance. The field staff also ensured some men's involvement with SARTHI's other activities so that they got better acquainted with the organisation.

10.1.5 Evolving a Management System for the Plantation

The group meets regularly on the 10th of each month. Many decisions about the plantation have been taken during these meetings. The first problem the group faced was getting the cooperation of adjoining Sadavra village in protecting their plantation. Some families of this village used to graze their cattle on the land before. This problem was solved with the help of Muvasa's Panchayat and persuading the concerned families.

Next, when planting on the land was started in 1988, some village men had spearheaded a demand that only Eucalyptus should be planted. They tried to pressurise the women's group to make a similar demand. On being reminded about their primary need for fuel and fodder, the women refused to succumb to this. A diverse range of species, earlier selected by the women themselves, were planted.

How the group dealt with the crisis of their first harvest of grass getting burnt in early 1989 has already been described.

In November 1989, with the second grass crop ready for harvesting, the women were asked how they were planning to harvest and distribute it. Surprisingly, most of them felt that it should be cut by voluntary labour and sold off. The money could be partly distributed among the members and the rest deposited in their common account. This led to an interesting discussion on the contradiction in this decision. How was it that although the group had raised the plantation for meeting their fodder needs, when fodder was becoming available from it, they were planning to sell it off? The women's initial response was that all of them had enough fodder from their own lands. Then why had they raised the plantation? Was their own fodder going to be adequate for the whole year? To this the response was that while some members would have enough for the whole year, others would run out by the summer. What would the latter do then? Buy from the market at a higher price than the price the group would get at this time? Or would they again walk 4 kms to the canal daily to fetch headloads of grass? Of what use was the plantation to such members?

The group had not given serious thought to these questions till then but they understood their pertinence quickly. It turned out that because the fodder scarcity was going to be

experienced a few months later, planning for it now would imply storing the grass till then. Grass being bulky, and one crop of it already burnt to ashes, the women were reluctant to consider storing it on the plantation from where it could also be stolen. Their private storage space was already full with grass from their own lands. Building additional space is expensive. Lastly, there was the tricky question of different members requiring different amounts of grass due to variation in both land holdings and numbers of cattle owned. In the fear of dissension cropping up within the group over some members getting more grass than others, the consensus was to dispose it all off through sale! The group was asked to decide on the matter after giving it further thought.

The group decided on a compromise solution. Members were invited to cut the grass on the basis of taking away half the amount they cut and leaving the other half for the common pool. Fifteen women cut the grass on this basis. As Dhaman grass seeds (a superior quality fodder grass) sown last year had taken root, it seems the women took away this grass as their share. They fed it to their cattle instead of storing it and felt it had improved milk yields. The poorer quality local Hukra grass, which is very prickly, was left for the common pool. This was sold to a villager at Re. 1/- per 4 bushels (the prevailing market rate was Re. 1/- per 3 bushels but the group's bushels were smaller and the grass of poor quality). The group earned Rs. 250/- from the grass. About 10 kgs of Dhaman grass seeds were also collected from the plantation.

At a recent meeting this July, the group was asked how many members had to buy grass this summer. Sheepishly, they admitted that every single member had to buy at least some grass and that too at the high rate of Rs. 3/- a bushel! They said they had understood the meaning of questions raised last year and that this year, the group would not sell any of its grass.

When asked similar questions about firewood, the women firmly assert that when firewood starts becoming available, it will definitely not be sold. They face firewood shortage scarcity all year round and fetching it is even more arduous than fetching grass.

During 1988 and 1989, the group had experimented with dibbling some seeds of beans like Arhar, Urad and Chaula in the plantation. Being nitrogen fixing, they improve the soil besides covering bare soil quickly during the monsoons. In addition, it was hoped some nutritious edible beans would get produced.

The women monitored the experiment with interest. There was some survival of Tuar. About 2 kgs of seed were planted and 15 kgs harvested. Besides, many women plucked green beans for cooking. However, Urad and Chaula were eaten up by rats and rabbits. This year, the women are planning experimental planting of a local fibre yielding plant called Bhendi. They expect this to perform better than the beans and also yield some quick monetary returns to the group.

The women also have a lot of knowledge about local trees and shrubs and their suitability for different uses. After compiling this systematically, SARTHI is planning to use this as a basis for species selection by different groups in the future. SARTHI has also started a Seed Bank for collecting seeds of useful local species for its nurseries. Some members of Muvasa's group have been earning some income by collecting seeds for the bank.

Protection of the plantation continues to pose a problem during the fodder scarce months. As the land is at some distance from where the women live, they cannot easily keep an eye on it while doing other work. The protection trench and the thorny plant fencing is not adequately effective yet. Most of the year,

other villagers respect the group's efforts and keep their cattle away. But, it seems, some people cannot resist the temptation of letting in their cattle during the dry summer months. This year, the group hired a watchman during the summer months and is planning to do the same next year.

After the training conducted by VIKSAT, it was decided to get the group registered as a Tree Growers Cooperative and then apply to the District Collector to allot the land to the cooperative. All except three of the members have already deposited their share money. SARTHI submitted the group's application for registration in August 1989. The cooperative has still not been registered.

In 1989, encouraged by their achievements with the first patch of land, the group approached the Sarpanch to give them the remaining 6 ha of vacant revenue wasteland for additional planting. Although the Sarpanch gave them an NOC on the basis of which the group started working on the land, this time getting the land did not prove so simple. This land was being used for grazing by 4 to 6 families who had earlier got some revenue land allotted to them and have encroached on some more. These families fear that if the group plants on the land, they might eventually be forced to give up the land they have encroached upon. They pressurised the Sarpanch to withdraw the NOC. On learning this, the women tried fighting back by calling a meeting of the whole village and asking why they were not being allowed to plant on government owned land. Work has had to be suspended for the time being. The women are hopeful that after registration of their cooperative, they will be able to get the land allotted to it and recommence the work.

Besides discussing plantation related matters, the group's meetings have become an effective forum for discussing other problems of the women and increasing their access to information

and knowledge. One member is a chulha mistri, another a trained midwife and a third one was recently trained as a para-vet Each of them provides guidance to the group in their respective fields.

Several members were provided buffaloes by SARTHI as a drought relief measure. These seem to have changed the women's lives significantly and are providing multiple benefits. Now the women get good organic manure besides having dung as an alternative fuel when they are unable to fetch firewood. Their agricultural production has increased due to the manure and they are also able to sell milk to the village dairy twice a day.

10.1.6 Income and Employment Benefits from the Plantation

Work generated by a small plantation on only 4 ha of land has made a surprisingly significant qualitative impact on the 29 group members' income and employment options. This has largely been due to three rules evolved jointly by SARTHI and the group:

1. That work on the plantation (although paid) will only be done by members of the group or, at the most, by members of their families. In Muvasa's case, almost all the work has been done by the women themselves.

2. Payment will be made on the basis of output (number of pits or trenches dug, plants planted, etc.) and not on the basis of daily wages. The group will monitor each member's work output itself.

3. Flexible work hours will be maintained. Women can vary the amount of work done in a day and their working hours according to their convenience.

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Work on the plantation, although diminishing each year, has been spread over 3 years so far. During the first year, earthwork and planting were done. During the second year, some additional planting and mortality replacement were done. And this year, the third one, strengthening of the fencing, mortality replacement, etc. are being done. If the group is able to get an additional 6 ha of land allotted to them, then work on this flexible pattern will be generated for another 3 years.

It needs to be noted that the work generated is only seasonal. However, earthwork can be done during the lean agricultural summer season. That is when small and marginal farmers dependent on rainfed agriculture are most in need of wages.

The women described the following changes in their lives due to the above. Before the plantation was started, many of them used to work on daily wages either on the Patels' land or on government works. This was done primarily during the lean summer months. On government works, they seldom got the minimum wages (due to the corruption) and work sites were often at considerable distance from the village (many of the women also worked on the Kadana dam several kms away 10 to 12 years ago). The Patels demand work from sunrise to sunset (at least 8 a.m. to 6 p.m.). Three years ago, they were paying Rs. 5/- per day plus 2 meals and 2 teas.

The problem for the women was that if they went for wage work on the above terms, they could not do any house work at all. Only husband or wife could go out to work as one of them had to stay behind to take care of the children, cattle and other domestic chores. Ever since the plantation work started in 1988, none of the group members have worked either for the Patels or on

public works. Now, they can go for wage work late in the morning after finishing their household work. They can easily earn Rs. 10 to Rs. 11 per day. On days they are able to put in more labour, they can earn much more.

According to the women, the Patels are suffering from labour shortage as a consequence and some of their land now remains uncultivated.

Another benefit of flexible work hours is that the women can go to the dairy to sell milk twice a day. The dairy's milk collection timings are fixed and conflict with full time daily wage work.

10.1.7 Women's Perceptions of Change in Themselves

Getting organised as a group and taking collective action has clearly been an empowering experience for the women. They feel that they have established their right to access to information and knowledge which was earlier available only to men. Collective action enabled them to break through men's initial hostility to women treading into a non-traditional domain. Individual members could deal with such problems at their individual levels knowing that they had group support behind them.

The women recall that initially, the husbands of some women would come and forcibly pull their wives away. Group condemnation of such humiliation of its members slowly reduced such behaviour among the men.

The group's strong stand over fining the three men who had carelessly started a fire in the plantation was generally supported and almost admired by the village men. Today, the husbands of many members genuinely feel that the women should get

more opportunities for acquiring new skills and knowledge. This is partly due to the change for the better within the members' homes since they joined the group. Some men are still not fully convinced about the desirability of women taking such initiatives. However, they do not openly object to the hope of getting personal benefits through SARTHI in the future.

The group clearly enjoys the leadership role it is playing for members of new groups brought to interact with them. Despite their busy routines and heavy workload, group members always make time for those visiting them. And their new found eagerness to learn and share is unfailingly inspiring.

10.2 Sadavra Women's Group

Sadavra is next to Muvasa and the three men who accidentally caused a fire in the Muvasa group's plantation belong to this village. Because of the proximity between the two villages, Sadavra residents have watched development of the Muvasa group from close quarters. This is a relatively small village of about 60, mostly Adivasi families, most of whom are small and marginal farmers.

Interestingly, the initiative to form a women's wastelands group in this village was taken by four male leaders. They approached SARTHI's FC Incharge to form a women's group similar to Muvasa in their village. One of them had already identified 4 to .6 ha of the village's Gauchor land for the plantation. In retrospect, it is clear that at least some of these men were more interested in personal gain than in having a strong women's group in the village. One of them, Mani Bhai, who was taking the maximum initiative, has already boycotted the group and SARTHI because he was not given the work of raising the nursery for the plantation. The group identified two of its members as more suitable candidates for raising nurseries! This tendency of men

trying to use women's groups for personal gain will need to be carefully countered by SARTHI.

It was this Mani Bhai who first discussed the idea with the village women. The women had already started thinking along the same lines observing the Muvasa group. They agreed readily.

Many village men also supported the idea probably due to the immediate attraction of daily wage employment being generated in the village. Others, however, are suspicious of SARTHI and unwilling to let their women go out for camps or training programmes.

To counter the men's suspicions, a joint meeting of men and women was called to explain the objectives of the programme and why a group of only women was being formed. It was clarified that all the produce would belong to the group and not to SARTHI. The villagers were also informed about other SARTHI or government programmes such as poultry farming, animal husbandry, etc. which could benefit the villagers.

Initially, 22 women agreed to join the group. They live closest to the land and are from the most disadvantaged families. The husbands of two of them obtained an NOC from the Panchayat and Patwari for the women's group to develop the land. The NOC does not specify any time limit for which the land is allotted to the group and does not demand any share of the produce for the Panchayat.

Sixteen of the 22 members did the land preparation and earthwork. Six women have neither worked on the land nor come for the meetings due to having too much other work. When asked whether they want to remain in the group, they continue to say yes. From 6 to 10 non-member labourers also did some work on the land. The 16 regular members have been attending all group

meetings and decided on the species they want to plant. These are mostly fuel and fodder species. The women are confident that they will be able to protect the plantation and have agreed to put aside a small percentage of their wage money for starting a group fund.

All the women used to work on daily wages for Patels or on public works before. This year, they only worked on the plantation. They said that they could earn Rs. 20 to Rs. 25 per day working on their plantation. The Patels pay them only Rs. 5 plus meals but demand at least 10 hours of work.

The group is still in the process of consolidating itself and the future of its plantation will depend on the extent to which it is able to handle a number of unresolved conflicts in the village. Some of these are:

1. A number of men still view the plantation as a means of earning easy wages without any accountability for work output. A husband and wife team of non-members was found to be digging pits and trenches of a much smaller size than required. When the FC Incharge pointed this out to group members, they asked the two to either do the work properly or stop working. The man was furious and left the work. His wife is interested in joining the group but the man has started talking against SARTHI.

When we met the group, this woman had also come to attend the meeting. Her husband came in search of her, and shouting loudly against SARTHI, pulled her away by force. The group watched the whole affair in embarrassed silence but did nothing. When asked what they had felt on seeing another woman humiliated like that, all women said they had felt very bad. The man was angry because his mistake had been pointed out. But didn't the woman feel that they should have supported the wife in her desire to attend the meeting? They all agreed that they should have

done so. However, it is likely to take them some time to develop the strength to provide group support to individual women.

Angry men like this one and Mani Bhai who did not get the nursery, can be very destructive for a women s group before it has found its feet.

2. It seems that the Gauchor land the group is developing is the only grazing land of the village. Although the women claim that only cattle of families living near the land (and most of them are members of the group) grazed on the land, it is likely that during the dry summer months, other families also leave their cattle there. The women members have already started stall feeding their cattle and even purchased fodder to do so. They are confident that their cattle will not graze on the land. But will summer scarcity bring out resentment of other families over their only grazing land being closed off? Only time will tell how this underlying conflict is resolved.

3. Some men from families of non-members continue to be suspicious of SARTHI and are spreading rumours that SARTHI will take away both the land and the trees. Among them are one or two who had an eye on the land. One of them had hired a tractor and ploughed a part of the land the group is planting on.

The Muvasa group faced similar problems during its initial stages but managed to come through with strength. How the Sadavra group is able to deal with them will determine its growth. The staff's skills in helping minimise conflict will play an important role. The absence of Champa Ben's leadership skills is being strongly felt in this FC.

10.3 Wankadi Women's Group

This group was formed early this year and has 26 members. The group is developing 10 hectares of village Gauchor land for which they have obtained an NOC from the Panchayat and Patwari. Wankadi falls in a different FC than the earlier two groups. Although still barely 6 months old, the group has attained a strong identity and many of its members display good leadership qualities.

Wankadi is a fairly large village with about 300 households. All of them are either Adivasis or belong to backward classes (Buxi Panch in Gujarat). The village has a number of fairly independent phalias (hamlets). Group members belong to two phalias which are quite close to each other.

The majority of families are small or marginal farmers practising rainfed agriculture. Some families have irrigation wells. Members of many families have to migrate during summer months in search of work.

The village is surrounded by hills which are totally denuded. As a consequence, there is an acute scarcity of firewood and fodder. This group's primary motivation for developing the Gauchor land is to reduce the members' hardship in scrounging for firewood and fodder.

Interestingly, 2 years ago, SARTHI had attempted organising its first women's group in another phalia of Wankadi. Men were allowed to attend the women's meetings. The venture was a total disaster. A male leader tried to exploit the organisation by insisting that it distribute goats to the villagers. When SARTHI refused, he instigated the yet to be consolidated group to stop cooperating with SARTHI.

Learning from that experience, this time, after the initial combined meeting with both men and women in which the reasons for forming a women's group were explained, the staff was careful in ensuring that only women attended subsequent meetings. This was accompanied by organising a number of educational inputs for group members in quick succession.

- All the 26 members were taken to meet the Muvasa group. This proved very inspiring and helped the women define rules for their own group's cohesive functioning.

- Two members of the group attended the training conducted by VIKSAT. They later took an active part in getting the Panchayat's NOC for the land and explaining the importance of group registration to other members.

- Another member attended a Women's Awareness Camp held at Godhar and a meeting of members of Women's Savings Groups held at Mada in May 1990.

- One member has been trained as a para-vet and has started treatment of common cattle ailments.

The growing strength and coherence of the group is evident from the following decisions and initiatives it has taken on its own:

- The women did most of the running around for getting the NOC from the Panchayat. SARTHI's staff only provided some guidance.

- The group has decided to get itself registered as a cooperative. Each member will get her share money deducted from the wages due to her. The women have also decided to

put aside a small share of their wages to start a group fund to pay for protection later on.

- Only group members themselves and some members from their families worked on the land. Later the group found that the men (even from their own families) were not doing satisfactory earthwork. The women told the men to stop working on their land! Now all the work is being done by the women themselves.

- Six of the group's members have migrated to an adjoining district due to economic hardship. People from the village go to harvest the Bajri crop there and get a share of the harvest as their wages. Before going, these six women discussed their compulsion for migrating for 2-3 months with the rest of the group and said they will pay their share of the group's savings on their return. The rest of the group has agreed to let them rejoin as members on their return.

- During our meeting with the group, an elderly man came and sat down at the other end of the room to listen to the proceedings. One of the group members firmly requested him to leave as in men's presence women have to cover their faces because of which they cannot participate in the discussions properly. The elder and three other men who were also listening hiding behind a charpoy meekly got up and left the room!

- The group has won the support of men of their families and of the Panchayat.

- They are very clear about the need to protect their plantation. Due to complete destruction of forests in the area, women now have to burn tuar stalks as fuel or scrounge around the hills to dig out roots.

- The group has itself selected the species to be planted. These are mainly for firewood and tree leaf fodder. They do not expect good grass as the land is poor and stony.

- The group has decided that a fine of Rs. 25 will be charged for anyone's cattle that gets into the plantation.

10.4 Gamri Women's Group

This group was also started early this year at the villagers' request. They had heard about the Muvasa group. Gamri is a predominantly Adivasi village in a relatively more interior area. As a consequence, there are few government services and the villagers are less exposed to the outside world.

Twenty-four women from two phalias of the village have decided to develop 4 ha of village Gauchor land. The forest department had planted on this land some years ago but little survived. The women are determined to protect their new plantation.

Soon after the group was formed, SARTHI's male FC Incharge found that only men from the group members' families were coming to work on the land. The men kept insisting that the group was a women's group but no women were coming for work! During our recent meeting with the women, it turned out that due to the stony nature of the land, the women had found digging very tough. They requested their men to do the earthwork on their behalf. Once planting started, the women had started working on the plantation again.

The women seem very keen and highly motivated to develop firewood and fodder resources near their homes. At present they have to walk 5 to 6 kms to the nearest forest for fetching firewood. However, it seems that the men are a bit wary if only

a male staff member comes to conduct meetings with the women. For these, more men than women show up. This has been happening due to Champa Ben's untimely death. The new woman staff member is not very experienced or confident yet. Ensuring the presence of a woman staff member during future meetings will be important for building up the group.

10.5 Relatively Weaker Groups

Most of the weaker groups have some male village leaders interfering with the women's group formation process and relatively inexperienced staff unable to deal with the situation. In some cases, relatively fresh staff with limited understanding about group development have taken inappropriate decisions.

The combined group of Kenpur-Wandariya falls in this category. Although the group was formed a year and a half ago and planted on their village Gauchor land in 1989, the group continues to be weak. At the time of the group's formation, the Sarpanch had insisted that some of his women relatives from Kenpur must be made members of the group. The land is closer to Wandariya. At that time, this being the first group in this FC, the staff agreed to this arrangement. Unfortunately, it has become a built-in constraint for the group. The women find it difficult to meet regularly as the villagers are far apart. If the meeting is fixed in Kenpur, many members from Wandariya don't show up and vice versa.

Surprisingly, there has been no problem with the plantation's protection despite the group's weakness.

Another new group which is likely to have problems is that being formed in Sarar village. It seems that from the beginning, the Sarpanch has insisted on playing a dominant role and does not really let the women have their meetings freely. An

inexperienced staff member got the plantation work started without the group really being formed.

10.6 Two cases of failure

It is also useful to mention two cases of groups which failed. These failures have provided useful learning for the future.

A group in Ladpur village was formed in 1989 and undertook planting the same year. Unfortunately, during a crucial phase of group formation, the FC's woman staff member was hospitalised. The male FC Incharge possibly relied too much on a powerful local male leader to help form the group.

Once the plantation was done, this man demanded that SARTHI instal a handpump on his private land. As this is against SARTHI's policy, he was refused. The man used his influence to prevent the group from cooperating with SARTHI. Protection of the plantation has become a problem and the group has become defunct.

In the second case of failure in Vajyakoot village, an inexperienced young staff member, who had just taken over, selected land in several pieces for planting by a group. Protecting of several land patches would have proved difficult in any case. But, higher caste Patel families were also in unauthorised occupation of this land. The Panchayat's NOC was obtained by the staff on their own without first forming the group. When work was started, the more powerful Patels obstructed it. Both the plantation and the group had to be abandoned.

11. A Synthesis of SARTHI's Experience with Women's Groups to Date

As evident from the above review of SARTHI's 2.5 years experience with women's wastelands groups, although it has been somewhat variable, sometimes lacking consistency, it indicates tremendous potential. Its strength lies in organising and mobilising women to take positive action to deal with one of their acutest problems, that of firewood and fodder scarcity. The responses of the stronger groups have to be seen in a context of continuing degradation of surviving forests and several government wastelands development programmes which yield few tangible results. The land on which most of the women's groups have planted had already been planted upon earlier either by the Forest Department or the Panchayat. It needed replanting because the earlier plantations had not survived. Although, it is probably too early to assume that the women's plantations will do any better than the government ones, there are strong indications that they will. This is because SARTHI's approach has not been restricted to simply getting a number of plants planted but working with a longer term perspective and helping the groups develop sustainable management systems for the plantations. This has had to be facilitated with a wide range of additional inputs to ensure women's genuine participation in every stage of the process.

The interest of rural women in the subsistence economy in sustainable management of forests and wastelands is clear. However, what is equally clear is that this does not automatically result in women taking initiative to reverse the process of degradation. Traditionally, they are kept too isolated and devoid of access to information to be able to do so. There is also no cultural tradition of women getting together to solve their problems. And then, decisions related to land are considered to fall in man's domain. Breaking through all these

barriers to successfully mobilise women is not easy.

Important components of the process evolved by SARTHI to overcome the normal obstacles to working with women include the following:

1. Seeking social consensus to work exclusively with those women most acutely affected by environmental degradation. Joint meetings of men and women are called in initial stages to explain the objectives of the programme and seek everyone's support for it. While this ensures that the participating women have a genuine long term interest in rehabilitating wasteland, it also helps reduce male suspicion and hostility towards work being done only with women.

2. Focussing on developing common instead of private land. Through this, the suspicions of individual land owners are avoided by enabling the women to gain access to a common land resource which is less threatening. Working together the women get an opportunity to break their isolation and develop collective strength. Taking decisions through group discussions helps build up group identity and accountability to the group. Efforts are made to dissuade men from attending or interfering in the women's meetings.

3. Eligibility to group membership is left open for all local women. All those interested in joining are welcome to do so. As it is made clear early on that membership would imply responsibility for working on the land and protecting and managing the plantation subsequently, women living far away from the land or not having the time to work on the land tend to stay out of the group. Patel and other higher caste women, who have too much work on their own lands and who are

socially not permitted to do manual work for wages also do not join the group. Through this non-conflict generating self-selection process, the women who tend to join the group are those from the poorest families owning the least land, interested in wage work and who face acute hardship in collecting fuel and fodder.

4. Seeking the women's long term commitment to sustainable management of the resource prior to starting any physical work. This involves their participation in planning what to plant (species selection) and evolving a management system for protection and distribution of the produce (equal rights linked to equal responsibilities and group membership being made conditional to each member conforming to these). The primary focus of the groups' activities has been to undertake plantation activities for meeting the women's subsistence needs of fuel and fodder and not generating commercial returns.

5. Facilitating building up the women's confidence through organising visits to other groups, sponsoring participation of some women for awareness generation and leadership development camps or other training programmes imparting skills of immediate relevance to their day to day problems. Maximising opportunities for women to go out of their villages and interacting with other rural women who have similarly broken through traditional barriers has been an extremely effective and empowering experience for the women.

6. Converting regular group meetings into a forum for discussing other problems affecting women and facilitating their participation in decision making in all relevant domains.

12. Differences between working with Women and Men

SARTHI's shift from working on individually owned private wasteland. to common lands has also involved a shift from working with men to women. We explored the difference SARTHI's staff has felt in working with the two.

Both the male and women staff feel that there is a qualitative difference in working with members of the two sexes. While working on private lands, it was extremely difficult to involve women in any part of decision making. The women usually wanted to consult their husbands first. Even if they took any decisions on their own, they were often overruled by the men.

The men, due to their greater involvement with non-domestic affairs, are more integrated in the growing culture of manipulation, corruption and bribery. They are more familiar with misuse of government funds and schemes for personal gain by individuals in positions of power (be they in the bureaucracy, local political institutions or local leaders). And most of them attempt doing the same whenever they get the opportunity. Thus, while doing wage work on public works, the effort is to get away with doing the least work possible. Pits and trenches are not dug to specifications, plants are dropped while carrying them from the nursery to get paid for more plants than those actually planted, and there is no commitment to longer term goals. There is a strong tendency to make the maximum money now. The future will take care of itself.

Similarly, the men here are definitely more interested in commercial species than those which will meet subsistence needs of fuel and fodder. In many respects, the staff's experience of working on private wastelands had some nightmarish aspects. Perhaps confusing SARTHI with the government the men tried bullying the staff to let them have their way, sometimes even

threatening them physically. Being asked to dig to the required specifications brought responses of anger and resentment. The women staff were scared to go alone in some areas due to fear of being assaulted by drunken men. They could not rely on any support from local women as they were barely involved with the programme.

The fact that SARTHI's work on private wastelands was primarily concerned with individuals with no accountability to a group also contributed to such a situation.

In contrast, working with women's groups has been totally different. Once a minimal group identity is created and the women have the opportunity to sit together and take decisions, they tend to stick to them. Commonly agreed upon work norms are adhered to and accountability of individuals to the group is high. There is a consistency in decision making. If they have decided to plant fuel and fodder species to reduce <u>their</u> problems, they cannot be swayed into demanding commercial species at the last moment. And given the opportunity to develop their self-confidence, they can throw out even their husbands who do not do the work to specifications (e.g. Wankadi group).

Beginning with the qualitatively different performance of the Muvasa Women's Group with visible achievements has also substantially reduced male suspicions about SARTHI's motives for working with women Whereas earlier, men used to pull away or even beat their women for wanting to participate in any of the organisation's activities, now they have started inviting SARTHI to come and start a women's group in their villages. With this, a new space has been created for women to take action and initiatives in fields earlier forbidden to them. SARTHI's staff have also learnt to deal with initial male suspicions and hostility and once this is overcome they try and support the women to demand that only women attend the women's group

meetings. This is to avoid men's playing a disruptive role by putting forward unreasonable demands or trying to manipulate the organisation for personal gain. In any case, women continue to feel inhibited in men's presence and as pointed out by a member of the Wankadi group, they have to observe Purdah (the tradition of seclusion of women) in men's presence which limits their participation. In many villages, the situation has changed to the extent that the men encourage their women to participate in other activities offering to do the housework in their absence.

A few amusing comments from men came to our notice during our field visit. These indicate the extent to which women's group meetings have started attaining legitimacy and respectability in the villages. While we were having a meeting with the Padri women's group, the men sat with the male staff at some distance. Apparently, they decided to maintain a safe distance from the women's meeting lest the women asked them to fetch drinking water for the group while its meeting was going on!

In another village, the men were overheard saying that it was best not to try and interfere in the women's meetings lest the women start demanding a right to attend men's meetings!

The male staff also mentioned that men feel much worse if a plant dies as it is they who do most of the caring for the plants.

13. Some Unresolved Problems related to Land

The biggest unresolved problem for the groups is related to land. Firstly, there is an acute scarcity of common lands available for development. The small patches the existing groups have got will be able to meet only a fraction of their fuel and

fodder needs, even when fully developed. Secondly, closing even these small patches to grazing will further reduce availability of grazing lands. Although a switchover from uncontrolled grazing to stall feeding is nevitable under changing circumstances, total absence of grazing land is likely to affect some families adversely. This could become a source of conflict in the future.

But the most difficult problem related to land is its ambiguous legal status. As mentioned earlier, even the village Panchayat of Muvasa thought a piece of Revenue Wasteland to be village Gauchor land till the Patwari's records were checked up.

For the women's groups, however, the matter of greatest concern is how to legally secure their rights to the produce of the land they are developing with so much effort. What is the legal validity of the NOC signed by the Panchayat and the Patwari? Can a new Panchayat overrule the NOC given by the earlier one? Can Gauchor or Revenue Wasteland be allotted to a women's group? If yes, what formalities must it complete for getting the allotment? Must it be registered as a cooperative, a society, a Mahila Mandal? Will it get the land on lease? If yes, for how long? It is extremely difficult to find helpful answers to these questions. No one seems to know.

A training programme by VIKSAT was organised by SARTHI to throw light on some of these matters. VIKSAT recommended that the groups should be registered as Women's Tree Growers Cooperatives and then an application be made to the Collector to allot the land to the groups.

SARTHI prepared the papers for the cooperatives on the lines recommended by VIKSAT and submitted applications for registration on behalf of four groups to the Registrar of Cooperative

Societies. Even after 6 months, the cooperatives have not been registered. Each time, there is a new query or a demand for another document.

Recently, we met both the Tehsildar (an important local revenue official) and the Collector to seek clarification on the matter. Both of them said that the state government discourages the allotment of Gauchor land for plantation purposes as there is already a scarcity of grazing lands in the villages. However, hearing about the increased grass production due to protection from the lands developed by the women's groups, the Collector offered to convert it into revenue wasteland and then allot it to the groups. But he would like the lease application to be only for 5 to maximum 10 years. That is too short a period for such a programme. Firewood and leaf fodder from the trees will barely be becoming available by that time.

As far as revenue wasteland is concerned, surprisingly, the Tehsildar was himself unaware of the procedure to be followed. He said his office had not received any application for allotment by a group.

The Collector, however, said that the state government had imposed a ban on allotment of any revenue wasteland in the district as this had been reserved for resettling people displaced by the Narmada dam. Any application for allotment of such land would first have to be sent to the Narmada Resettlement Department who would first check whether the land might be suitable for resettlement of the oustees.[2] All the land the groups have developed is stony, hilly, barren and in small

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[2] Oustees is the official term used in India for persons displaced by public works such as dams, parks, canals etc.

patches in the middle of villages. It is unlikely to be considered suitable for resettling dam oustees. But the procedure might take several months prolonging the uncertainty of the legal rights of the groups.

The Collector also recommended that the words 'Tree Growers' should be avoided in the names of the cooperative societies. Instead, greater emphasis should be given to fodder production which would make it easier for him to push for allotment of at least the Gauchor land to the groups.

Whatever the legal complexities, one thing seems clear. Due to the process by which the groups are being formed, especially given the social approval of the entire village for their long term goals, it will not be easy for any special interest groups within the village to displace them from their common lands. The stronger groups will fight against any such attempt. Securing the groups' legal rights is important, however, from the point of view of protecting them against stronger, outside powers such as the Narmada Rehabilitation Authority or provisions under the Indian Forest Act.

A more promising approach for the future seems to be to organise women's groups to rehabilitate forest lands. The Gujarat Forest Department has recently formulated a scheme under which villagers groups protecting forest lands will be given rights to collecting all minor forest produce (MFP) and also 20 percent of the income from sale of timber from the land.

14. Some Concluding Observations

One of the basic issues concerning women's involvement in wastelands development relates to their resourcelessness in terms of land ownership. Secondly, their secondary social status denies them opportunities to act equally in non-domestic domains.

SARTHI's approach of organising women's groups for developing common lands does not directly address the issue of women's land related resourcelessness. If the husband of a group member decides to throw her out, she cannot take her share of the common land with her. However, women's empowerment through working in groups is indirectly enabling them to gain the strength to fight against such injustices within the family. Not only that, they are gaining the knowledge and confidence to be more assertive in how the family's resources are managed. The wastelands groups are not just successfully developing wastelands but helping in creating a new social space for women which has traditionally been denied to them.

The process by which the groups are developed is of crucial importance. Staff skills play an important role in initiating the process. At present, that seems to be SARTHI's main weakness. It must work out mechanisms for imparting these skills to new staff members when the experienced ones have to leave for some reason.

APPENDIX I

Women Wastelands Groups Organised by SARTHI

	Year of formation	Name of Village	No of women members	Type of land	Area (ha)	Remarks
1.	1987-88	Muvasa	29	Revenue Wasteland	4	1st group formed, excellent
2.	1988-89	Vandariya/ Kenpur	18	Gauchor	15.53	Still a bit weak due to membership from two far apart villages. Good protection of plantation
3.	1988-89	Gara	21	Revenue Wasteland	11.35	Good potential, planted in 1989, discontinuity in guidance due to sudden departure of FC Incharge
4.	1989-90	Sadavra	16	Gauchor	4	Inspired by Muvasa. Still consolidating. Absence of strong woman staff member a constraint.
5.	1989-90	Gamri	30	Gauchor	4	-do-
6.	1989-90	Anjanwa	22	Gauchor	20	Weak group. Conflicts due to unauthorised encroachment.
7.	1989-90	Vankadi	26	Gauchor	11	Excellent potential.
8.	1989-90	Charad	52	Gauchor	38	Not fully formed yet due to interference by Sarpanch. Constraint of inexperienced FC Incharge
9.	1989-90	Padri	36	Revenue Wasteland	10	In process of formation. Good leadership by woman staff member.

Total:

Number of groups formed : 9

Number of women Members : 250

Number of ha (acres) : 117.88 (291.29)

A Case Study of Women's Involvement in Rehabilitation of Common Lands in Bicchiwara Block of Dungarpur District, Rajasthan by PEDO

by

Madhu Sarin and Chandrika Sharma

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1. Introduction and Acknowledgements

This is a case study of women's involvement in wastelands development based on the work of People's Education and Development Organisation (PEDO) in Bicchiwara block of Dungarpur District, Rajasthan.

PEDO started working in Bicchiwara block in June, 1980 as a branch of the Social Work and Research Centre (SWRC), Tilonia. It got independent registration as PEDO in 1986. During the last ten years, the organisation has initiated a wide range of development activities in the block. Some of the major ones have been eradication of guinea worm, installation of hand pumps for safe drinking water, digging and deepening irrigation wells including installation of community wells and lift irrigation systems, running schools for children, contour bunding of agricultural fields, soil conservation programme and a major environmental rehabilitation programme of degraded private and community wastelands.

Starting from training in handloom and durree production, PEDO's Women's Programme has developed into a major programme over the years with a shift in emphasis from project based activities to organising and mobilising women to deal with their problems. The first effort in this direction was to mobilise women to plant trees on private wastelands as a long term measure to counter the disastrous impact of drought. Hostile male reactions to PEDO's emphasis on working only with women on a land based activity led to a change in approach. Combined groups of men and women were formed to develop degraded village common lands. Despite women's greater stake in augmenting fuel and fodder resources, their participation in the combined groups remained limited till independent women's groups were formed which have empowered women to take greater initiative in village

affairs. This now includes their dynamic participation in the management of common lands in many villages.

As members of a small professional resource group, the co-authors of this case study have been associated with PEDO since 1983 and 1986 respectively. We are thus writing this case study not as outsiders but as participants of a rich learning process spanning several years.

We would like to express our gratitude to Devi Lal Vyas (Director, PEDO), Ramilla Vyas (Incharge of Women's Programme), Balraj Singh (Incharge of Environmental Programme), all the women staff, field staff and a large number of village men and women for all their assistance and cooperation for writing this case study.

2. The Area

Dungarpur district falls in the semi-arid belt of southern Rajasthan. Out of its total population of 682,845 (1981 census), 440,026 (64.4%) are Bhil tribals (referred to as Adivasis hereafter) and 30,828 (4.4%) belong to Scheduled Castes. The average annual rainfall in the district is 762 mm most of which falls during the monsoon months of July and August. The yearly variation in rainfall is large due to which the district is known to be drought prone. Historical records indicate several major droughts in this century. The most recent drought from 1985 to 1987 was the worst since 1891.

The terrain consists of low, rolling hills. In the local 'Wagri' language 'dungar' means a small hill from which the district probably derives its name.

Till independence, the district was heavily forested. Some were primarily teak forests and others mixed deciduous forests of

teak (Tectona Grandis), Tendu (Diospyros Melanoxycon), Dhawra (Anogeissus Latifolia), Bamboo (Dendrocalamus Strictus) and a few others.

During the four decades since Independence, the district has witnessed devastating deforestation combined with significant changes in land use patterns. The following statistics give an indication of the change:

	1943-44	1985-86
Total area	379,200 ha	379,200 ha
Population	286,000	682,000
Cultivated area	41,300 ha	130,097 ha
Forest area	332,348 ha	61,815 ha (area under dense forest only about 5,000 ha)
Uncultivated wasteland		77,614 ha
Pasture land		39,886 ha

More recent statistics are likely to be even more alarming as deforestation was further accelerated during the prolonged drought from 1985 to 1987.

3. Bicchiwara Block

Bicchiwara is one of 5 administrative blocks in the district. Out of the block's total population of 138,264 (1981), 81.5% are Adivasis (Bhils) and 2.3% belong to Scheduled Castes. The majority of the Adivasis practice rainfed agriculture on unterraced hill slopes.

Compared to an all India literacy rate of 36%, the literacy rate in Dungarpur district is only 18.52% and that in Bicchiwara block only 13.7%. The literacy rate among women in the block is a mere 3.84% compared to 23.9% for men.

The 1981 census put the forest area of Bicchiwara block at 5,436 ha (only 7.6% of the total area). It is estimated that at Independence, over 35% of the block was under dense forest cover.

4. Dependence of the Local Economy on the Natural Resource Base

The predominantly Adivasi population of Bicchiwara block historically subsisted by a combination of cultivation and food gathering from the forests. Even today, over 80% of the local population depends on agriculture, most of it rainfed. Agricultural productivity was intimately dependent on the health of the forests which ensured a healthy moisture regime with good replenishment of sub-soil water. This kept wells recharged even during dry periods and there were several perennial springs and streams. Leaf litter from forested slopes fertilized the agricultural fields below. People report agricultural yields several times those obtainable today. There was abundant grass and leaf fodder to sustain good quality livestock. Till a couple of decades ago, practically every tribal family had one or more buffaloes. These have now been replaced by the hardier goats and low grade cows.

Besides that, forests provided the people with a wide range of subsistence goods - firewood, timber for housing, furniture and agricultural implements, medicinal herbs and plants, edible fruits, gums, honey, roots and wild flowers. During earlier droughts, although there was undoubted hardship, the forests provided a back up life support system. There was an intimately harmonious relationship between the local people and their

natural environment. In fact, the Bhils, the oldest inhabitants of southern Rajasthan, have been referred to as 'Vanputras' or sons of the forest because of their traditional relationship with forests.

Unfortunately, this thickly forested area has today been transformed into a moonlike landscape of bare, brown hills with barely a blade of grass on them. Semi-starved low grade cattle, with a preponderance of goats and sheep, can be seen searching for food for survival. With the symbiotic relationship between the forests and the local subsistence economy destroyed, a vicious poverty trap has been created. The bared hill slopes brought under the plough loose rich top soil each year. The fields in the valleys are deprived of the rich leaf litter coming down the hills leading to reduced yields. If the rains do not come on time, there are few forests to fall back upon for survival. Water sources dry up due to limited recharging of sub-soil water. With less firewood available, precious dung has to be burnt as fuel instead of fertilizing the fields. If the crop fails due to inadequate or untimely rainfall, people either have to migrate to other areas in search of work or depend on daily wage work generated through government drought relief programmes. The remaining forests are hacked down further to collect firewood for sale to supplement declining incomes. The traditional subsistence economy is on the verge of collapse with mere survival having become a full time task.

5. The Status of Women and their Relationship to the Natural Environment

On the surface, it appears that Bhil women enjoy more freedom than the women of mainstream Hindu society. This stereotype is reinforced by the evident free mobility enjoyed by Adivasi women and the relative ease with which they can break or establish marital or extra-marital relationships.

There is also a tradition of bride price instead of dowry. This probably emanates from the important contribution of women's labour to the subsistence economy. Besides traditional women's tasks of child bearing, child care and domestic work of cooking, washing and cleaning, there is a clear division of labour between men and women in the subsistence economy. Fetching firewood and water are considered exclusively women's work. Only rarely, if ever, can one see a man fetching either of these. Similarly, taking cattle for grazing is by and large done by women although children and older men also do this. As there is hardly any tradition of stall feeding the cattle, fetching fodder is not a major activity. And then, women participate in most agricultural activities such as sowing, hoeing, weeding, harvesting and post-harvest storage and processing. The only agricultural task exclusively done by men is ploughing. When the forests were in good shape, collecting non wood forest produce other than firewood was also done by women. Today, with people's increasing dependence on wage labour, more women than men can be seen at work sites. Thus, women are also major earners for the family.

One would think that in such a situation, the status of tribal women would be far superior to that of mainstream Hindu women. In reality, as we discovered through years of working with local women, it is little different, if not worse.

Bhil society is strongly patriarchal with a strong preference for the male child. Ownership of all immovable property such as land and housing is vested in men and the only property considered to be women's is their jewellery. There is strong cultural resistance to giving even a part of the family's land to women and a family without male offspring considers it a great misfortune to have to transfer its land to the daughters. In this respect, Patels seem more willing to give a share of the family land to daughters in distress than Adivasis.

This cultural attitude principally determines women's status in society leaving them completely dependent on the whims of men, be it father, brother, husband or son. Despite the tradition of bride price, the money is controlled by men. If there is any conflict in the family, the woman has few options to moving out as she owns neither land nor house. She either must find another man to give her shelter or go back to her parents' or brothers' house. This is in a context where domestic violence, alcoholism, bigamy and desertion are common among men.

Besides that, the traditional division of labour between men and women binds her more intimately to the natural resource base. It is she who pays the price for environmental degradation by having to walk longer distances in search of firewood, fodder and water. Thus, while having an intrinsic interest in maintaining a healthy natural environment she finds herself devoid of control over decision making related to management of a basic resource like land because its ownership vests with men.

6. Evolution of Women's Involvement in PEDO's Environmental Rehabilitation Programme

PEDO's Women's Programme and its Environmental Programmes have evolved over a number of years through a fairly rich and flexible process entailing a lot of learning and questioning. Neither followed any predefined targets or project structure and women's involvement in the environmental programme got defined through problems experienced in working with only women. Thus, over time, both programmes got considerably modified, one influencing the other. Here, it is useful to briefly trace the evolution of both programmes through different phases.

6.1. The origins of PEDO's work with local women

In 1980, one of the first projects taken up by PEDO (then SWRC) was to train selected groups of women in durree making and handloom weaving.

When the improved chulha (cookstove) programme, based on training selected village women was started in 1983, some of the women who had already been associated with the handloom training came forward to be trained as chulha mistris. By 1986, the number of trained chulha mistris and supervisors had increased to 30. All of them attended monthly meetings at Mada to report on progress and problems. As they were responsible for providing chulha users regular follow up support, each one of them had established contact with 100 to 200 local women in their respective areas. It was through this extended network of contact with local women that the organisation started gaining a better understanding of their problems. Many of the women chulha mistris and supervisors were themselves affected by some of the typical problems of women in the area. Inevitably, their personal crises affected their work and the programme repeatedly lost trained women.

Simultaneously, with the commencement of the 3 years drought (1985 to 1987), the near total collapse of the natural resource based subsistence economy started becoming evident. Its impact on all local people was terrible but once again, women appeared to be the worst victims.

A major casualty was health. 3 years of crop failures reduced food availability and nutritional diversity drastically with a consequent increase in infections and disease. While women were equally, if not more, affected by this, their burden of caring for the sick members of the family also increased.

Parallel to this, anxiety and physical work loads increased. With migration of men to other areas in search of wages, women were being left behind to shoulder even men's responsibilities. Then, there was the added fear that the husband might pick up another woman while away and of physical abuse by other men due to the husband's absence.

The situation led to a serious review and reflection within PEDO which laid the foundations of its present women's and environmental programmes.

Women's problems evident through the chulha programme made PEDO decide to formulate a broader women's programme to address them effectively.

It was clear that none of these problems could be dealt with at the individual level. Organised and collective action was a pre-requisite. This meant seeking women's reflection and involvement in articulating dominant issues confronting them and defining appropriate strategies of action. For this, the chulha mistris' wide network of contacts with local women could help reach out to a still larger number of women. With this objective in mind, a large mela (gathering) of women was organised in Mada in April 1987.

The response to the mela, despite several problems, was overwhelming. During the three days (April 13 to 15, 1987), 3000 women, mostly rural, instead of the planned 1500, participated! Although the majority of them were local, women from 41 groups and organisations from different parts of the country also came. Besides endless, uninhibited singing, dancing and playing games together, the women shared their experiences, joys and sorrows. For most of them, this was the first time in their lives that they had been away from their domestic chores or travelled so far away from home.

The major problems articulated by the women during the mela fell into two main groups. The first essentially comprised economic problems. These could be linked to the virtual collapse of the agrarian economy during the prevailing drought. Topmost among the problems affecting women more acutely were the scarcity of fuel, fodder and water, forcing them to walk longer and longer distances in search of them. Due to inadequate production from the subsistence sector, there were the related problems of unemployment, increased dependence on wages from drought relief works, corruption in the execution of these works and in the management of government run ration shops, and shortage of cash for emergencies like illness leading to increased dependence on exploitative money lenders.

The second group of problems were social in nature; alcoholism among men, domestic violence, desertion, bigamy and the general insecurity in women's lives. The women also complained about the poor functioning of the government health and educational services.

The mela generated tremendous enthusiasm and represented a watershed in the organisation's rapport with women of the block. Several misconceptions about PEDO got removed and, for the first time, groups of village women started approaching PEDO to assist them in solving some of their problems.

Due to considerable discussion on the causes and impact of the prevailing drought, women of several villages who had participated in the mela, asked for fuel, fodder and fruit plants for planting on their private lands. Women of three villages asked for assistance in rehabilitating their totally degraded village common lands. Follow up meetings after the mela were held with hundreds of women who attended it. Through these, PEDO took its first step in involving women in developing both private and common wastelands.

6.2 The initial experience of women's involvement in developing private and common wastelands

After the mela the women staff were asked to prepare lists of demand for plants from their respective field areas. It was decided that PEDO would supply free saplings of the species of the women's choice on the condition that pits for the plants were dug in advance and their giving an undertaking to protect the plants after planting. A demand for 30,000 saplings was received from women of about 60 villages.

However, after the first monsoon rain of 1987 when distribution of saplings was started, the demand for plants from women shot up phenomenally. Ultimately, a total of almost 164,000 saplings were distributed to 602 women spread over 68 villages! In addition, 6000 grafted plants of mango and lemon were distributed. PEDO's staff had to overstretch themselves to meet this demand. All this resulted in inevitable confusion with plants reaching many women too late, inadequate supervision of planting, damage to plants while transporting them to far flung villages and many women not getting the species of their choice.

Inevitably, mortality among these plants was high. The almost complete failure of the monsoons in 1987 did not help matters. Many women expressed their inability to protect the plants due to having to leave home daily in search of wage work to survive. Hungry cattle roaming in searching of anything green made protection even more difficult than usual.

However, the experience made one thing clear - that the drought had made women realise the importance of re-establishing vegetative cover on their denuded lands and, if provided with some guidance and support, they would come forward in large numbers to plant trees to reduce their problems of fuel and fodder scarcity.

The three months between the women's mela and the planting season was too short a time to plan PEDO's intervention systematically. For the organisation's women staff, this work was new and there had been no time to provide them even preliminary training in plant handling and planting techniques. Their responsibilities for supervision after planting had not been defined clearly. In any case, due to the unexpected upsurge in demand at the last minute, they lost track of where many of the plants had been planted. The dispersed settlement pattern of the local Adivasis made it extremely difficult to check on plants planted all over the area.

Although PEDO had started planting on the fairly abundantly available degraded common lands in 1985, prior to 1987 its main preoccupation was to regreen the barren lands. It took the responsibility for protection itself and excepting for some dialogue with a few leaders, there was limited community involvement.

In 1987, discussions on environmental issues during the mela prompted women of Ditkon Ka Vela, Bortalav and Baletighati villages to request PEDO's help in rehabilitating their degraded common lands. PEDO agreed to support the efforts of the women's groups of the first two villages that year. By this time, the near impossibility of effective protection of plantations without the community accepting responsibility for it had made PEDO realise the importance at all stages of work.

It was in Ditkon Ka Vela and Bortalav that for the first time, the condition of right holding families accepting responsibility for protection was made a precondition for the organisation's providing assistance for developing common lands. Although initially, people of both the villages resisted this concept, the women's group of Ditkon Ka Vela came forward and

agreed to contribute a fixed sum from their wages towards building up a village common fund from which payments for protection would be made. The men agreed later.

Learning from this experience on private and common lands, planning for the 1988 monsoon was started early. To begin with, a participatory evaluation of work done during 1987 was conducted by PEDO's own staff.

In November 1987, an 8-day training programme was conducted for PEDO's women staff. An important component of this was to get the women to reflect on, and analyse the environmental changes the area has witnessed in recent years and their causes and impact on their day to day lives. This proved to be an eye-opening exercise for the women. They had never looked at the totality of the problem in this manner before. For the first time, they consciously understood the significance of trees and forests for their survival. Whether it was a decrease in soil productivity, reduced and uncertain rainfall, declining water table, drying up of perennial water sources, scarcity of fuel, fodder and nutritious foods or increased health problems, they could trace the cause to the destruction of forests.

This was followed by getting 4 groups of the women to do a planning exercise on the number of trees and shrubs a particular member of the group required for meeting her own firewood, fodder, construction material and other subsistence needs. This generated tremendous interest and excitement among the women and provided them a concrete basis for discussing action strategies with other women. For example, the women calculated that for supporting a cow or a buffalo entirely on tree leaf fodder for the whole year, 90 trees would be required for just one animal. For a goat, 50 trees would be needed. A list of 21 local species suitable for fodder was also generated. Similar calculations were made for the timber required for building a 2 roomed house.

The women were quite amazed at the numbers of trees needed for meeting just their very basic needs.

Similarly, on the basis of the past year's experience, basic principles for working with groups on common lands were evolved.

6.3 Tensions generated by the focus on women

However, at this stage it started becoming evident that the focus on working with women was beginning to generate tensions and hostility, not only among male villagers, but also among PEDO's male staff. The male staff started questioning the objectives of the women's programme. They could see few tangible outputs from it unlike the handpump installation, well deepening or contour terracing programmes with which they themselves were involved. The women's programme, with its emphasis on group building and eliciting women's total participation to them, seemed to consist of endless meetings with no tangible results. They complained that when they were asked to intimate village women about a meeting, the village men wanted to know why they were not being invited. Reports also started coming in of some of the village women being beaten by their husbands when they returned empty handed from a women's meeting. Due to the prolonged drought, everyone was desperate for getting even daily wage work. Some men had been permitting their wives to attend the women's meetings in the expectation that the organisation would provide some employment to them. When they returned empty handed, the men's frustration found release in wife beating.

We also started realising that although women were the greatest sufferers of environmental degradation and could take the lead in remedial action, the socio-cultural context made them dependent on men's support for taking any initiative. Almost all the private land is owned by men. Very few women are strong enough to assert themselves in deciding how this land should be

used. Even some of the women staff, despite their conviction and excitement about the need for better management of their lands, felt unable to see their ideas through unless their husbands agreed.

Similarly, the women staff needed the male staff's cooperation and support while working in villages. If the male staff were not convinced about the validity of what the women staff were trying to do, the women staff had to face yet another obstacle in their already difficult task.

All this led to the decision to involve men in the process of change. PEDO's objective was not to create yet another divide between men and women. Instead, the aim was to strengthen women's capabilities to deal with their problems and fight their oppression both individually and collectively. If men were made participants in the process of reflecting on how women's specific burdens had increased, they might cooperate in finding ways of reducing them. But, if instead, they felt defensive and threatened, it was likely to result in increased oppression of women in a situation where women were ill equipped to deal with it. Unless accompanied by a powerful social movement, individual women cannot suddenly challenge men's traditional supremacy in decision making related to land.

6.4 Working with joint groups of men and women on common lands

Taking these developments into account, it was decided to modify the approach and involve men in the programme. To begin with, during a 10 day training-cum-evaluation with PEDO's entire programme staff in January 1988, the impact of environmental degradation on women and the role that women could play in an environmental reconstruction programme was made an important aspect of discussion and reflection. The male staff's response to this was heartening. They themselves suggested that in all

future meetings with villagers, at least one woman staff member should be present to facilitate women's participation. The male staff also highlighted the problems of mobility faced by the women staff and supported the latter's demand for being provided bicycles and/or mopeds. To reduce village men's suspicions and hostility to separate meetings with women, it was decided that to begin with, joint meetings of men and women would be called in every village. As women's participation in such joint meetings is almost always limited, the need for having separate meetings with women would be explained.

From early 1988, the broad objectives of PEDO's environmental programme became more clearly defined as follows:

i) To reduce the people's almost complete dependence on unreliable, rainfed agriculture by increasing the diversity of crops to include economically useful trees and shrubs.

ii) To find practical alternatives to uncontrolled grazing.

iii) To find practical methods for harvesting every drop of rain water.

iv) To divide workable community managed systems of protecting and rehabilitating degraded common lands to increase their productivity and work towards women's equal participation in these.

To begin with, equal emphasis was given to promoting development of both private and common wastelands. With experience, however, priority started being given to common lands. Initially, the staff felt that it would be easier to motivate people to work on their private lands compared to developing a common resource. Within a year of trying to work with hundreds of individuals or their land holdings scattered

over a vast area and dealing with their suspicions and reluctance to replant on land they had cleared with much effort, the staff started feeling that it was both easier and more desirable to work on common lands. Questions of equity were also involved. While private wasteland development would only benefit individual owners, development of common lands would assure benefits to all members of the community.

This necessitated developing the staff's skills to work with groups and resolving conflicts within groups. Periodic follow up and review workshops with the staff have been held for this.

There are large chunks of degraded common lands in the block. These are either chernot (grazing) lands or Revenue Wastelands. Although management of the chernot lands has been vested in the Gram Panchayats, residents of particular villages or hamlets have clear, de facto grazing rights in specific pieces of the lands. Stone protection walls have been built around several chernot lands by Gram Panchayats with drought relief funds.

While defining clear principles for PEDO to work on common lands in early 1988, it was decided to build upon the existing group identity of sharing traditional rights in them. Thus, all right holding families were to be involved in the group. To make every family feel equally responsible for protection, each family was to be assured a right to an equal share of the produce. Each group had to make a prior commitment to protect the plantation before PEDO was to get involved. Day to day management decisions had to be taken by a managing committee (MC) elected by the whole group. There had to be at least an equal representation of women on the MC which was to meet regularly every month. Regular meetings of the entire group were also to be held and every effort made to encourage women's participation.

6.5 Training women for seed collection

To ensure availability of good quality seeds for its growing planting programme, especially of promising local species, PEDO organised a training programme in seed collection and storage in May 1988. Thirty women from 13 villages were taken to visit the Seed Bank of the Jawaja Project in Beawar for this. It was felt that imparting technical knowhow about seed collection to local women would not only enhance their status within the community, but would also enable them to combine their fuel gathering and cattle grazing activities with earning some income. More importantly, it could stimulate women's participation in monthly meetings at the seed collection centres and lay the foundations for developing strong women's groups.

Village meetings held after the seed collection training clearly indicated that as a sub-activity of the environmental programme, seed collection by women held tremendous potential. It could provide a basis for the formation of women's groups which could hold their own even in mixed meetings related to the plantations. Unfortunately, however, due to inadequate women staff and lack of sustained follow up of the women's seed collection groups, these have not been fully integrated into the women's programme. Women engaged in seed collection do attend plantation meetings more regularly and enjoy a better rapport with the organisation. In some villages, they have also joined the women's saving groups. However, the organisation needs to provide them more sustained and systematic support to build up their full potential.

6.6 Review of women's participation in joint groups and charting a new course of action

As already mentioned, due to the evident hostility among men to the PEDO working separately with women, it was decided to work

with joint groups of men and women on common lands. In any case, as traditional use rights to common lands are family based, it was felt that working on them with only women would generate avoidable discord. At the same time, due to women's secondary status even in Adivasi society, there was considerable concern about whether women would have any effective participation in groups in which men were also members. All that the organisation could do to facilitate women's participation was to make it a precondition for working with any community and ensure the availability of women staff during village meetings to encourage women to come out. But even this cannot be always ensured either due to inadequacy of women staff or some of them being unable to provide the continuous and regular support required due to instability and personal problems in their own lives.

Further, equal participation by women was being sought in a cultural context where there is a strong surviving tradition of men getting together twice every month on the 11th day of the lunar cycle to discuss village affairs. Women are completely excluded from this traditional village forum. As a consequence, the men are always better informed and used to taking decisions related to village affairs. Also, despite winning over the male staff to the cause of facilitating women's involvement, and providing them periodic training inputs for developing the skills for it, it is too easy for the male staff to revert to their traditional dominating or patronising role towards women. After all, they come from the same cultural background and age old traditions and attitudes cannot be changed overnight.

As members of the resource team assisting PEDO evolve its programmes, we were unsure whether the decision to work with combined groups of men and women was really a positive step or whether it was effectively going to diminish even the limited women's involvement which had become evident while working exclusively with women.

The performance of this approach was reviewed during a training programme for women staff in September 1988, together with discussing other issues of concern to the women. The consensus that emerged was that although women were the worst sufferers of environmental degradation, their lack of land ownership and traditional male domination effectively inhibited them from playing a leading role in plantation related decision making, except in a few villages. Joint meetings of men and women, while successful in reducing male hostility and securing their cooperation, tended to diminish free expression and articulation by women. The need to create a separate forum for women, in which, they could express their views and concerns uninhibited by the presence of men, was strongly felt.

At the same time, the 1988 monsoon was an exceptionally good one after 4 to 5 years of poor rains. This, in itself, had created a new situation. Large numbers of cattle had died during the drought years. However, due to the good monsoon of 1988, now there was abundant grass. Within a span of a few months, the situation of fodder scarcity had changed to one of fodder surplus. Instead of problems of fodder and water, now the women were more preoccupied with getting credit for buying grain seeds for sowing. All the stored grain had been eaten up during the years of scarcity. Also, due to a dramatic increase in illnesses during the drought years, there had been an increased need for emergency loans. The only accessible credit source was local moneylenders. During this training programme, the women talked about the extreme exploitation by local moneylenders. They responded enthusiastically to the idea of starting women's savings groups as a long term measure for getting out of the clutches of moneylenders.

The growth and development of about 30 women's savings groups since then has been a remarkable phenomenon and demand for assistance in forming new groups is continuing to come in. Surprisingly, there has been next to no male hostility to this activity being undertaken exclusively by women. The monthly meetings of these groups have also provided the much needed forum for women to get together regularly for a non-threatening, non-controversial purpose. While some of the groups have kept themselves confined to the savings activity, many have taken up several other issues of concern to the women. The existence of active women's savings groups in villages where common lands plantations have been taken up has generally facilitated more active participation by local women in their management. Three-day awareness generation 'camps' for women have been held in some of the villages having savings groups and inter-group visits and discussions have been organised to facilitate learning from each others' experiences. In the process, group members have gained confidence in articulating their problems, acting on them, and being able to talk even in gatherings where men are present.

A three-day get together of over 400 women belonging to various savings and plantation groups was held in May 1990. During this, it became evident that local women's groups have become dynamic entities and a force to reckon with. On several occasions, women group members have demonstrated greater unity and courage than the men. In many villages, women's groups now command a grudging respect from other villagers.

7. Case Studies of women's participation in development of common lands in three villages

Till 1989, PEDO had assisted 29 village groups to rehabilitate a total of 1304 hectares of their common lands. The organisation has stuck to its pre-condition of women's participation in all the groups formed since 1988. Women's

actual and active participation, however, has been highly variable. It is difficult to isolate all the factors which have influenced this. In this section, we look at the performance of 3 groups in greater detail in terms of women's role and participation at different stages. Two of them have had, and continue to have, strong participation by women while in the third one, it has been limited. All the three plantations are at least 2 years old.

7.1 Ditkon Ka Vela

The common land plantation in this village initiated in 1987 was the first to be taken up by PEDO at the request of village women. Six women from the village had participated in the women's mela in April 1987. Two of them, Galali and Ratni, took the initiative and have continued to play leadership roles. At that time, the goals of PEDO's environmental and women's programmes were being redefined and both the staff and the village women were full of enthusiasm generated by the mela. PEDO's principles for working on common lands had not yet been worked out clearly. Ditkon Ka Vela and the adjoining village of Bortalav served as experimental cases for trying out the principles of villagers accepting collective responsibility for protection and open decision making in village meetings. The response of the village women here served as an inspiration for other villagers to come forward.

7.1.1 Socio-economic structure of the village

Ditkon Ka Vela has about 60 families, all of whom are Adivasis. All families are dependent on rainfed agriculture on small landholdings. There are only seven wells which are used for irrigation. Because of this, most families can raise only one crop in a year and even that fails if rainfall is either inadequate or untimely. About 40% of the families supplement

their income by working in stone quarries nearby and members of about 30% of the families seasonally migrate to Gujarat for wage work. The nearest road is 7 kms away and virtually no government services reach the village. Due to extensive deforestation all around and the consequent fodder shortage, there are only 28 buffaloes in the village although all families own some goats or sheep. Women have to walk at least 2 to 3 kilometres to fetch firewood from the nearest forest although most families have protected small forest patches on their private land to meet some of their fuel and fodder requirements.

7.1.2 The common land plantation

Plantation has been done on 14 acres of chernot (grazing) land on which all villagers have traditional grazing rights. Due to totally unregulated exploitation, nothing except a few stunted trees were left on the land. A family from the adjoining village had started encroaching on the land which seems to have first motivated the villagers to do something to save their common resource. In 1986, the Gram Panchayat built a stone boundary wall around the land and got planting done with government drought relief funds. None of the plants survived, the boundary wall collapsed at several points, and the villagers did not receive full payment for the work they had done on the land.

It was to replant on this land that the women approached PEDO in April 1987. It should be recalled that 1987 was one of the worst drought years of this century. Poor monsoons during the previous 3 years had further impoverished the people and everyone was desperately looking for daily wage work on government drought relief programmes. These were riddled with corruption and exploitation. Village leaders were generally giving disproportionate employment to their own family members on such works. Some of them did no work at all or lorded over the others by becoming 'mates' of labour gangs. There was little

accountability for the actual work done and no discussion about the future management of afforestation projects.

7.1.3 Women's role in the process

It is in the above context that women's role in the common land plantation of this village needs to be traced. Some of the landmarks in the process have been:

- In the initial meetinGS WITH PEDO's staff, more women than men took part. Although everyone had immediate interest in getting daily wage employment through the project, women were more willing to discuss long term protection and management questions following discussions during the mela.

- When PEDO insisted on the condition that all the families give an advance undertaking to protect the plantation after planting, the men, led by the Gameti (traditional village leader) were unwilling to accept this. It is the women who agreed and gave an undertaking to contribute a small amount every month to pay for a watchperson's salary for protection.

- In the initial Managing Committee (MC) elected by the villagers in July 1987, out of 17 members, as many as 10 were women. However, till the following year, the Gameti kept objecting to women being made members of the MC. During a recent meeting, the number of members were reduced to 9 out of which 6 are women and 3 are men.

- There was always a much higher percentage of women than men doing the earthwork and planting. Women's productivity was always higher than that of men. When it was found that the cost of the physical work was too high due to payment being made on the basis of daily wages instead of output, women

willingly accepted self-monitoring of output to ensure the minimum productivity required.

- It was the women who took a stand against the family members of local leaders receiving disproportionate employment on the plantation. As a result of this, the principle of employing only one person from each family was adopted which has been used in all subsequent plantations.

- In February 1988, 7 goats belonging to 3 villagers grazed on many of the plants. On the women's insistence, all 3 were made to pay a fine of a total of Rs. 130 as per the rules formulated by the MC. This sent the signal that such violations would not be tolerated in the future. Because of this, protection has been excellent since then with a plant survival of 90 to 95 percent. Today, the originally barren land looks like a healthy young forest with trees of some species 10 to 15 feet tall and a good grass cover on the ground.

- In 1987, the first crop of naturally regenerated grass was harvested from the plantation by voluntary labour. One person from each family came to cut it on a day fixed by the group's MC. Most of those who came to harvest the grass were women. During 1988, the increased grass yield was harvested with voluntary labour and sold for Rs. 800/- which was deposited in the common fund. There was no demand for grass in the village due to heavy cattle mortality during the drought years. The 1989 grass yield was sold for Rs.500/-. Although the grass output increased between 1988 and 1989, the price fell due to surplus availability of grass.

- In November 1988, a women's savings group was started in the village. Sixteen women became members and saved a total of Rs. 1299/- within one year. Regular monthly meetings of this group have further strengthened women's participation in the management of the common land plantation. The women's group has also initiated action against malpractices of LAMPS (Large Area Multipurpose Societies set up by the government for direct marketing of minor forest produce in the tribal areas) and local moneylenders.

- The women have taken a clear decision that when fuelwood becomes available from the plantation, it will not be sold to outsiders as women have to labour hard to collect it from distant forests.

Initially, whenever an important decision had to be taken during a village meeting, the men would move aside to discuss the matter among themselves and return to the gathering to announce their decision. During our field visit for this case study, in a similar situation, the women also went aside for a similar discussion! In any case, 21 women attended the meeting compared to only 9 men. This is akin to the beginning of a new cultural tradition. When asked, the women said that till the women's mela in April 1987, women had never participated in village decisions. Only the men took these decisions during their 'agyaras' meetings. They are happy to be better informed and consider their involvement in village affairs to be a positive development.

Several women of Ditkon Ka Vela have been exposed to the activities of other women's groups through study tours, inter-village visits, melas and training programmes. The benefit they have derived from this is reflected in their increased level of confidence and articulation and in their growing group identity.

7.1.4 Unresolved problems

The village group suffers from the following, yet unresolved, problems:

- A sub-group of about 15 families has not been participating much in the village group.

- The common fund of the group has no funds left for paying a chowkidar and little monetary return can be expected from the plantation in the near future. However, during our recent meeting with the group, the women once again made a commitment to raise the money through monthly contributions.

- PEDO has inadvertently assisted a couple to build up a power base for themselves who make it appear as if they are responsible for getting the village benefits from the organisation. The villagers have not yet gathered the courage to challenge them openly to check the unfair advantages they take due to this. The fact that the villagers consider the women to be a 'dakin' (witch) wielding evil powers makes them reluctant to confront her. The couple's behaviour is becoming a threat to the unity and dynamism of the group.

7.2 Bhimsor

This village has 67 families all of whom are Adivasis. Compared to other villages, people here have smaller land holdings of only 2 to 3 bighas. The land is not very fertile either. Most families keep only goats as surrounding hills are badly denuded with nothing other than thorny bushes left on them. As a consequence, there is an acute shortage of both fuel and fodder. Due to the limited income from both agriculture and livestock, several men of the village have either migrated to

other places for work or work in nearby stone quarries. About eight to ten men have salaried jobs working as drivers or conductors.

The village is divided into two opposing factions over whether the embankment of a village pond should be raised or not. If the embankment is raised, fertile agricultural land of over half the families of the village will get submerged. These families have been opposing the project for over 10 years. Apparently, the women of this faction have been in the forefront of the struggle all this time. They have instead been suggesting that the embankment of the other village pond be raised. They claim that this will help irrigate the lands of a much larger number of families of the village. The Panchayat member from Bhimsor belongs to the faction supporting the disputed project. His primary motive seems to be to denigrate the dynamic women's group opposing the project. Apparently, on several occasions he has commented that the women in the group are getting too big for their boots and unless put in their place, men will soon have to start wearing bangles! The most recent confrontation over the pond took place in June this year. The women's group, supported by their men and children, camped near the pond for 10 days and nights, refusing to be intimidated even by threats from policemen. They successfully checked another attempt by the Panchayat to forcibly raise the embankment and forced the Sarpanch to give in writing that the work will be suspended till both factions reach a settlement.

With many men living and/or working out of the village, women have to take care of the subsistence sector of the village economy. Because of this, they tend to be more articulate and outgoing. Due to the extreme shortage of fuel and fodder, they have a strong interest in rehabilitating degraded lands. And, possibly, due to the women of the majority faction having been involved in the dispute over the pond for ten years, they have

developed a strong group identity. Today, the Bhimsor group is among the strongest women's groups PEDO is working with not only in relation to wastelands development but several other activities as well.

PEDO's contact with Bhimsor was established in 1984 when the villagers requested its assistance in starting a primary school. From 1984 to 1987, the organisation implemented well deepening, soil conservation and handpump installation programmes in the village which strengthened its contact with the villagers.

7.2.1 Women's participation in wastelands development

About ten to twelve women from Bhimsor attended the women's mela at Mada in April 1987. Following this, they expressed interest in planting trees on their private lands and received free saplings the same year.

In 1988, plantation on private wastelands in the village was done more systematically and women played a leading role in this. Their major constraint was their small wasteland holdings which they also use for raising grass during the monsoons. After the rains, the women were reluctant to do hoeing/weeding of the plants as they wanted the grass as well. As a consequence, despite good protection, plant survival was only about 40%.

In November 1988, a women's savings group was formed in the village. By October 1989, the group had saved almost Rs. 2000/- in their collective account.

In February 1989, a three-day village camp was organised in Bhimsor. This helped in building up an extremely cohesive and dynamic women's group. The group has since been in the forefront of the struggle against the exploitative practices of LAMPS officials, with support from the village men.

The group also wants to experiment with starting a village grain shop to eliminate exploitation by middlemen.

It was following discussion on the state of the environment during the village camp that the women asked PEDO for assistance in rehabilitating 60 bighas of their degraded common grazing land. They themselves obtained a map of the land from the Patwari. They also got a resolution signed by 6 members of the Gram Panchayat that only Bhimsor residents have rights in the land and, therefore to the produce from the plantation. About fourteen to fifteen village meetings were held prior to starting earthwork on the land. The villagers accepted complete responsibility for protection and agreed to deposit 1 out of every 15 days' wages into a common fund to pay for a watchperson. A managing committee of 6 members was elected unanimously. Out of these 4 are women and 2 men. Two women have been authorised to operate the group's account. The common fund has Rs. 2600/- in it at present. If this money runs out, the women say they will protect their plantation with voluntary labour. Eighty rupees has been recovered as fine from persons whose goats had got into the plantation. The group has made a rule that anyone's cattle caught inside the plantation will be tied up by the chowkidar. If the owner does not take it away within 24 hours by paying the fine, it will be auctioned and the money deposited in the common fund.

The women have also repaired damaged parts of the stone boundary wall and placed thorny bushes on top of it through voluntary labour. They also dibbled Mango and Mahuwa seeds in 1989 and in June 1990, planted branch cuttings of 2-3 types of fencing shrubs along the boundary wall to strengthen protection.

Over 95 percent of the earthwork on the land was done by women. In fact, only 2 men worked on the plantation. All the rest were women.

The planting itself was done in 1989. After just a few months of protection, some grass had come up through natural regeneration. The women harvested the grass through voluntary labour and 2 women from the village bought it for Rs. 50/-. This year, when there is likely to be more grass, the women are planning to charge Rs.3 to Rs. 5 per day per person from members of the group to harvest it. This is one of the few villages where, despite the present general grass surplus, some women have had to buy grass and even the limited grass available from the plantation has been bought within the village.

The other heartening aspect of Bhimsor's common land is that within barely one year of protection, a wide variety of local species have started regenerating naturally. A lot of rootstock was surviving under the barrenness.

This is an exceptional group which, effectively, is a women's plantation group despite being called a mixed group. Even during out recent meeting with them, there were 17 women and only 2 men present. The men do not seem to object to the women's taking part in protest activities, visiting government offices, or taking initiatives on their own. Only 2 or 3 men accompany the women during such ventures. Some of the women have developed strong leadership qualities which, they feel, have improved since the camp held in the village in February 1989. The commitment and involvement of both PEDO's staff members (a man and a woman team) working in this field centre have also contributed to the development of this group.

7.2.2 Paderi

The struggles and initiatives of the Bhimsor group have inspired the emergence of a new, equally dynamic group this year in the adjoining village of Paderi. Two women of Paderi have

their parental homes in Bhimsor. While visiting their relatives, they got acquainted with the activities of the Bhimsor group and asked PEDO for assistance for a similar plantation in Paderi. Women there also face acute scarcity of fodder and firewood as forests have been completely decimated all around the village. Many families now use dung as cooking fuel or have to buy a bundle of firewood for Rs. 10/- to Rs. 12/-. Shortage of firewood is so acute in this area that many families are now forced to bury their dead instead of cremating them.

These 2 or 3 women have identified 352 bighas of revenue wasteland near the village on which the villagers claim they have traditional grazing rights. The chernot (grazing) land of the village could not be taken up for plantation as several families have encroached on it. A few families were doing illegal stone quarrying even on the revenue land on which work has now been started.

The women who took the leadership in getting this plantation going went to the tehsil office four times on their own to complain against the illegal stone mining. With great difficulty, they managed to extract the revenue map of the land from the Patwari who was in league with those doing quarrying. They have also obtained a resolution from the Panchayat signed by 6 members that Paderi residents will have sole rights to the produce from the plantation. The women received little support from the men and had to face the hostility of the families forced to stop illegal stone quarrying. The commitment of one of the women leaders is so high that she says she is prepared to die fighting against those opposing the project. Despite such inspired struggle, only 175 bighas has become available for the plantation. The rest of the land had to be left out due to pressure of vested interests.

However, with completion of the stone boundary around the land and commencement of earthwork, support for the leading women has grown and the staff member incharge of the area has won over the displaced quarrying families by involving them in raising nurseries and providing them wage work on the land.

Paderi is a larger village with a total of about 132 families out of which about 100 are Adivasis and the rest Patels. Its problems are by no means over as the underlying conflicts within the village are bound to surface again. Consolidating the process of group formation is likely to take time. But the women who took the initiative are likely to get support from other village women as the plantation will reduce their work of collecting fuel and fodder.

7.3 Wagbole

Although a mixed plantation group has existed in Wagbole since 1988, and PEDO's condition of women's participation was equally insisted upon, women's active involvement in this group has been marginal. The process of group formation, the socio-economic structure of the village and its internal dynamics are examined here to understand why this has been so.

7.3.1 The village and its economy

Wagbole is spread over small hillocks like the other villages but here, deforestation has not been so acute. Nearby forests are in relatively better condition and all the 42 Adivasi families of the village have protected small forest patches even on their private lands. The average land holding is a bit bigger than in other villages (about 10 bighas). Due to comparatively less soil erosion, both the agricultural and common lands have better soils and higher productivity.

The main occupation of the households is rainfed agriculture from which they can get only one crop in a year. Only 5 or 6 families have wells for irrigation. Even so, agricultural production in the village is relatively better. Several village men go outside the village for daily wage work and some men have migrated to Gujarat.

The nearest road from the village is 5 kms away because of which the villagers remain relatively cut off from the outside world. Hardly any government services have reached the village and the sick have to be carried long distances for treatment.

Due to the healthier subsistence economy of the village, family labour, particularly women's labour, is required to undertake cultivation work and livestock rearing. As the village is fairly well endowed with its own fuelwood and fodder resources, the women do not have to walk long distances in search of them. Possibly, even because of this, the village women have remained almost unexposed to the outside world and men are resistant to letting them go out. The village men are relatively more conservative and fall easy prey to rumours that outsiders want to destroy their religion by converting them to Christianity.

PEDO first established contact with the village in 1984 when a primary school was started in an adjoining village. During 1986-87, well deepening and contour bunding work was done in the village.

7.3.2 The common land plantation process

In this case, it was the men from Wagbole who approached PEDO to assist them in planting on 60 bighas of their common grazing land. The Panchayat had already built a stone boundary

on it and planted there once. The wall had already collapsed in places and none of the plants survived. The villagers had asked the Forest Department to replant on the land but the Department had turned down their request saying that the area was too small.

Then, impressed with the progress of the plantation in the neighbouring village of Ditkon Ka Vela, the men approached PEDO for similar assistance. PEDO clarified the conditions on which it works on such lands. After considerable initial resistance, the men agreed to accept responsibility for protection and to put aside 1 day's wages out of every 15 days' work done on the plantation into a common protection fund. Planting was done in 1988. The primary motivation of the men at that time was to generate daily wage employment for the villagers.

Although women were called to the initial meetings, it always proved difficult to involve them in the discussions. One male village leader tends to dominate all the time and even other men are unable to say much in his presence. The women get little chance to open their mouths in such mixed meetings. A few separate meeting with the women were held initially to build up their confidence. However, these could not be sustained for long due to inadequate women staff. There has also been a high turnover of women staff at this field centre and with most of them being new while there, they have been unable to deal with the situation.

The men accepted having 3 women on the 6 member managing committee appointed for the plantation. However, it is unclear whether they were selected by the women themselves or their names simply put on the committee to satisfy the organisation's condition.

During the execution of physical works on the land, more women than men worked there on daily wages. At that time, it

used to be relatively easy to hold impromptu meetings with the women on the plantation site itself.

Since completion of the work, attendance of monthly meetings of the group has generally been poor. Only the male committee members tend to attend these and only 2 or 3 women participate.

7.3.3 Facilitation of women's participation

In terms of management of Wagbole's plantation, there is little one can complain about. The villagers have protected it extremely well. Besides good plant survival, there has been excellent natural regeneration of several local species. Grass production has also increased dramatically. Prior to the planting, the land was used for open grazing and there was little vegetation on it.

The watchman is changed by the group every month to distribute the benefit of a salary from the common fund among all village families. In 1988, every family was invited to harvest grass on the payment of Rs. 5 per head. In 1989, due to abundance of grass, there was less demand for it. But rats proliferating in the grass were damaging the plants and there was danger of the dry grass catching fire if not harvested. Every family was asked to harvest it on the reduced payment of Rs. 2.50 per head. There was also about 40 kgs output of castor seeds from the plantation. Some of these were kept as seed for the following year and the rest sold and the money deposited in the common fund.

However, as said earlier, women's participation has been limited. The organisation attempted several mechanisms for increasing it. About four to five women from the village had attended the women's mela of April 1987. They were certainly very enthused by it and at least one or two of them have

continued to be relatively more active. Then, separate meetings with women were attempted while work on the land was going on. These also made the women more aware about how the plantation was to be managed by the villagers themselves and the importance of their taking an active part in it. This was followed by training 2 village women in seed collection for PEDO's Seed Bank. Regular contact was established with them and they could earn some income from the activity.

Despite all this, the women have not felt empowered enough to start asserting their views more meaningfully. Perhaps because of the privately owned good forest patches, the women of Wagbole have never felt the negative impact of environmental degradation in the way women of other villages have and are therefore not adequately motivated to participate in plantation related meetings. In fact, in late 1989, PEDO had organised an environment camp in the village. During this, it was planned to discuss future management of the plantation and systems for harvesting, distributing and using produce like leaf fodder, firewood, poles, etc. from it in the future. Surprisingly, no one from the village came for the camp. After a lot of persuasion, a few men came but it appeared that the women were either not permitted or were unwilling to come at all. Later, it was found that a rumour had spread that the camp would be used to forcefully convert the villagers to Christianity! Similarly, in the May 1990 gathering of members of women's groups, only one woman from Wagbole participated. Apparently, rumours about women being taken away by strange men were still doing the rounds and the village men were too suspicious to let their women participate in the event. The absence of an experienced woman staff member working at this Field Centre (FC) on a sustained basis is probably also responsible for the women's continuing lack of faith in the organisation.

Only recently, on June 11, 1990, 7 women of the village have decided to start their own savings group. If the membership of this group increases and it gets consolidated, possibly its regular monthly meetings will become an effective forum for reducing the women's isolation. That might lead to the women's more active participation even in the management of the village common land.

Wagbole's experience makes it clear that women's participation cannot be ensured simply by making rules insisting that they do so! This is particularly so in a social setting where women's traditional roles are staunchly guarded by the men.

8. The Situation Today and Directions for the Future

8.1 Women's participation in other groups

There is considerable variation in women's participation in other common land plantation groups with which PEDO is working. First, it is useful to list the commonalities in all the groups:

- At least 75 percent (in some cases 90 to 100 percent) of the labour for earthwork and planting has been women's labour.
- Where grass has already been harvested, whether through voluntary labour or on the basis of payment, most of the grass cutting has been done by women.
- In the future, when firewood starts becoming available for harvesting, even this is likely to be cut primarily by women.
- Where the initiative for undertaking the plantation was taken by women (e.g. Ditkon Ka Vela, Bor Talav, Baletighati, Bhimsor), they have continued to play a leadership role in

subsequent management and protection related decisions. They have often made commitments (such as making contributions to the common fund for protection), which men were unwilling to make, and honoured them.

- Women have shown greater initiative in villages where scarcity of firewood and fodder is acute as it is they who suffer hardship in collecting these from distant places.

Beyond this, however, there has been nothing 'automatic' in the extent of women's active participation in the development of village common lands, no matter how acute their hardship of searching for fuel and fodder. Even in the villages where women took the initiative and played a leadership role, this was preceded by enabling them to interact with other women's groups through melas, visits, training programmes and awareness generation camps. Continuous interaction with PEDO's women staff has been another crucial input for facilitating women's genuine participation.

Where either the opportunities for exposure or inputs by the women staff have been weak or limited, village women's participation in decision making has also remained weak. The tradition of women being assigned a passive role in decision making in non-domestic matters and their isolation are just too powerful for women to break through on their own. In most cases, external catalysts have been needed to jolt them out of their passivity and isolation.

But, as evident from women's limited participation in villages such as Wagbole (several other groups - Oopar Gamia, Gundikuan, Wajela - are similar in this respect), periodic inputs and exposures are also not enough. What is needed is to help women create their own forum in the villages where they can meet and interact regularly to build up their confidence and develop

the capability to work collectively as a group. Initial efforts to create such groups around wastelands development brought forth men's suspicions and hostility as it was a threatening land based activity. Modifying this approach to work with combined groups of men and women proved a setback to women's participation. The majority of women (there are always a few exceptions) feel too inhibited to participate equally in groups where men are also present.

This much needed women's forum has finally emerged in the form of Women's Savings Groups. For the first time, women have been able to find a socially accepted space where they can get together regularly and have access to information on a sustained basis. Given the opportunity to participate in an uninhibited manner in exclusive women's meetings, they are increasingly gaining the confidence to articulate their views even in meetings where men are present. Indirectly, this has increased their genuine participation in the management related decisions of their common lands. In fact, the pattern which is emerging is that once women get mobilised to act on a particular problem, they leave the men trailing behind in initiative and commitment, sometimes having to drag the men along. This was evident in a few villages when the women decided to take collective action against corrupt LAMPS officials and the exploitative practices of moneylenders. The men were too scared of the repercussions of confronting their exploiters and the women often had to drag their men along as the loans are in the names of men!

Another pattern which is emerging is that women tend to be less manipulative in their actions. Due to being sidelined by the increasingly corrupted male dominated leadership structures and government services, they have not absorbed those values to the same extent. They are more prone to honouring the commitments they make.

8.2 Changed views of the male staff

This is illustrated by the changed views of PEDO's male staff about increasing women's participation in PEDO's wastelands and other programmes. Their initial doubts and hostility of 3 years ago have changed to their specially going out to involve women simply because women's response is more rewarding. Most of the male staff now feel that women's real, and not just symbolic participation is increasing and that members of women's savings groups have become more articulate and uninhibited in plantation related meetings. Many of them are now trying to get more such groups started in their field areas to enable women to gain the necessary confidence. Interestingly, one of them suggested that the tendency of some men to bring the savings money on behalf of their wives should be curbed as men's presence in the women's meetings is inhibiting for the yet weak groups. Once they have crossed a certain threshold, there is no stopping the women. The male staff gave a number of examples of such initiatives by women. In the plantation group meetings in Talaiya village, more women participate now than men. Whereas women take active interest, the men come only to get their presence recorded symbolically. And this is in a village where, to begin with, women were scared to come out and the men questioned the need to involve women. Today, the village men's resistance has diminished as they have witnessed positive changes even within their homes since the women started getting opportunities for going out.

In Behana, one man was trying to misuse the labour muster-roll The women organised a meeting, took over the muster-roll and threw the man out. Women generally do not try to manipulate the organisation for quick, personal gains.

In the Nawalshyam plantation, all the 44 labourers who worked on the land were women. Work was done according to specifications and went smoothly. As the FC Incharge said, women work with greater conscientiousness.

In Baletighati, where the women took the initiative for the plantation, they are continuing to fight against manipulative tendencies by some of the men.

Overall, there has been a great change in the attitude of the male staff. Compared to their initial doubts, today they recognise the powerful role women can and have started playing. A similar attitudinal change is becoming evident even among the men of several villages which have strong women's groups. The women's programme has once again started toying with the idea of experimenting with wastelands development by exclusive women's groups as a means of enabling the women to acquire rights to some land, albeit as a group. If this happens, it will be interesting to see if there is any difference in the way the women's groups manage their lands compared to the earlier mixed groups.

8.3 The Status of the Plantations and their Future Management

Some of the common land plantations supported by PEDO are now 4 to 5 years old. In these as well as in the more recent ones, protection by the community has been excellent. Many are beginning to resemble fresh, young patches of forest. When one sees the poor condition of similar plantations undertaken by the forest department or the Panchayats, one can recognise the superiority of the approach developed by PEDO.

However, new questions about the future management of these on a sustainable basis are now beginning to arise. The common funds of some plantation groups are either finished or nearly finished. None of the plantations are mature enough to start

yielding substantial cash incomes yet. There is also the question whether they should be used for generating cash incomes at all. Where will the money for paying the chowkidars now come from? Will the people be willing to contribute either cash or labour for this? What system will be used for harvesting and equitably distributing their produce (timber, grass, fuelwood. seeds, leaf fodder, etc.) among group members? Will the produce be distributed on payment of cash or free of cost? What will the role of the community and village committee be in taking decisions on these matters? What are the legal rights of the groups in relation to the Panchayats?

These and related issues were discussed during three day plantation camps held with 10 of the older village groups between September 1989 and March 1990. These camps helped initiate a process of reflection on some of the longer term management questions related to the common land plantations.

Each of the camps was begun with a symbolic commitment to protect the plantation by the villagers tying 'rakhis' to young plants and worshipping them. Some of the issues which were discussed were;

- Grazing versus stall feeding: Most villagers made a commitment to switch to stall feeding so that the cattle do not lose as much energy as they do while grazing and more dung becomes available as organic fertilizer.

- Protection after the group's common fund is finished: The villagers, with women in the forefront in many villages, expressed their commitment to continue protecting the plantations with voluntary labour if necessary.

- Priority to local consumption of the produce or to selling it off: In all the camps, the villagers made a commitment to give priority from their plantations. Selling anything to outsiders would be considered only where there was no need for a particular produce among the group members.

- Harvesting and distributing systems: Many groups have already evolved a variety of systems for harvesting and distributing grass from the plantation. For firewood, it was thought that in the initial years, whoever does the pruning of the plants should have the right to take away the prunings. Once more firewood becomes available, the groups will get it cut by selected members and distribute it equally among all members.

There were interesting discussions on members' rights to timber. Women of the Bhimsor group did not want to so much as discuss any tree cutting from the plantation. They want all the trees to be protected. In other groups, it was felt that some timber could be cut in the future for meeting personal requirements of disadvantaged members. In any case, no one would be allowed to sell any timber from the plantation. Whoever is permitted to cut a tree will first have to plant 5 to 10 new ones.

8.4 Legal Rights to the Land

Most of the land which the groups have developed is either village chernot (grazing) land or revenue wasteland. In each case, a distinct group of villagers, usually the residents of a phala (hamlet) claim traditional grazing rights on the land which are recognised by other villagers and the Gram Panchayat. All the groups have got a resolution from the Panchayat Sarpanch saying that the Panchayat has no objection to the group's

planting on the land and all rights to the subsequent produce will belong to the group and not to the Panchayat.

However, there has been some concern within PEDO about the groups' legal rights to the produce. At present, no one is particularly interested as there is little of value on the land. But once there is a good stock of valuable trees, what will happen? Will the forest department be able to prevent the members from harvesting the produce under some provisions of the Indian Forest Act? Will the Panchayat be able to stake a claim to the produce as the land is supposed to be under the Panchayat's jurisdiction? Most of the Gram Panchayats cover several villages and if this happens, group members who have protected the plantations with so much effort will get a miniscule share of the returns.

This issue was also discussed during the plantation shibirs. In all cases, group members were emphatic that they will not allow the Panchayat or anyone else to take away their plantations from them. But a number of complex legal issues remain unresolved and unclear.

9. Summary and Conclusions

PEDO's initial experience of involving women with wastelands development in a conservative social context brought forth hostile reactions from male members of the community. In their isolation, the women found it difficult to counter this hostility. The organisation had to compromise and start working with combined groups of men and women. However, women's participation in such combined groups remained limited due to their traditional exclusion from such forums. It was not till the women's self-confidence had been built up with the help of a vast range of other facilitative activities that their real participation started increasing. However, once women crossed a

certain threshold of breaking out of their traditional roles, their commitment and involvement is proving far greater than that of men. In some groups, women are effectively in the lead and their actions are beginning to inspire similar dynamism in women of adjoining villages.

Problems of Common Property Resource Management in India. Suggestions for Developing Effective Community Based Systems of Common Property Resource Management.

S.L.SHAH*

Management of Common Property Resources like land, forest and water for improving their productivity and their exploitation on a sustainable basis has acquired a great importance due to their very nature such as free access, unrestricted use and exploitation. In the past people were using these resources and not managing them. This did not matter as population was low and resources abundant. But due to an ever increasing population, and increasing and diversified, the management of common property resource has become problematic. One third of India's land and all its water resources are owned by the Government. These are Government property systems and not community property systems. The result is that village communities have lost all interest in their management and protection (Agarwal, et al.,1989).

The Water resources for drinking and irrigation under the Government system are mal functioning. There are lakhs of villages without drinking water facility. With the advent of the green revolution water for irrigation has become an important input. Ground-water a common property resource is being increasingly exploited by large farmers with their owned tube wells. Sustainability and equity is lacking in this sort of exploitation as the poor are looses in this sort of dispensation of a commonly owned resource. Gram Gaurav Pratisthan in Pune has developed the concept of Pani Panchayat as a village level institution to harvest rain water in percolation tanks to be shared equitably by members of the community by household and not by size of

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holding. Even the landless possess the right which they sell. The community works voluntarily to maintain the tank. Similarly the water users association in Sukhomajre village in Haryana State distributes the water equitably and even the landless get their share which they can sell to large farmers. This is more of a social engineering problem rather than a technical feat. The farmer managed irrigation systems are small and simple in their engineering design but their productivity is at par with the State Managed Irrigation systems, ~~though there~~ cost more in construction and maintenance (Lande, 1990). Since both forest and water resources besides fulfilling the basic needs of people provide imputs for the private rural productiion system such as agriculture, animal husbandry, village industries, their sustainable management is sine-qua-non for the private rural production system.

In this paper an attempt is made to discuss the main problems in the way of developing effective community based system, of common property resource management and suggestions are made to tackle the problems.

The paper is divided into three sections. The first section describes the concepts involved in the management of common property resource. Section two describes some case studies in the management of common property resource and in section three some suggestions are made to develop effective community based systems of common property Resource management.

Section-I

Conceptional Frame Work

All are familiar with the phrase 'Tragedy of Commons' which means every body's property is no body's property. The community forests are a glaring example of this tragedy. All have access to this resource. In the screen a person who strips a tree of its fuel and fodder first gets the benefit and others are left high and dry. In the absence of a common consensus the benefits from exploiting the resource accrue to the individual user while the costs are distributed over the whole community. There is thus a scramble by individual right holdes to seize the benefits before others get in there. Similarly if a farmer reduces the number of his animals or stall feeds them to decrease the pressure on community grazing lands or to allow regeneration others may not do so and he may be worse off. So he will neither restrict his own cattle from grazing on community lands nor would he stall feed them because he is not sure of his neighbours behaviour. Mutual agreement or consensus building and its enforcement depends on efficient institutions and in the absence of such institutions it is difficult to protect trees, control number of animals, indiscriminate grazing and to encourage stall feeding. As a matter of fact community forestry, a community activity that intimately involves local people, and besides fuel, fodder and timber production and use of minor forest produce, it also envisages employment generation and income generation for local development. Since it is a community owned resource there are chances of clash between the interest of individuals and that of the community. Here in comes the role of a community institution to internalise the cost that is external to the users' household by making the house hold pay a price for the use. The price may be in the form of protecting the resource or in sharing the usufruct in equity with others. The institution also helps in removing

the uncertainty about future benefits as information about every one's compliance with an agreed level, of resource use is available to all individual users. It is in this way that the collective will of maintaining the forest stock with the associated level of use emerges. The institution has then to guard against individual deviations only. The institution has to make its members agree on the principles of control, cooperation and equity. It needs cooperation because it has to fix responsibility and enforce mutual acceptance of rights and duties to maintain the productivity of the resource in perpetuity. Then the benefits should be distributed in an egalitarian way. Womens' participation and interest is vital to the success of the institution. It is found that women members do not come out openly to discuss issues in an Institution dominated by men. In that case the women may have a separate Institution to identify issues and to openly discuss them. The approach of the Institution should be enlightened self interest rather than coercion. Through education, Padyatras, meetings, camps, lectures, slide shows, T.V. films etc. an emotional relationship could be developed between people and natural resources. The emphasis should be on education and prevention rather than on punishment. A sine-qua-non for Institution building is strong willed, self less and service rendering leaders for resource management. Such men are rare but efforts should be made to identify them and to make them agree to become office bearers of the Institution.

The Institution should identify issues, priorities and learn from its mistakes in developing successful strategies in effectively implementing common property resource management programmes.

Institutions cannot function in isolation. They need to be supported by science and technology. They also need the support of a political will through good laws rules and regulations and their enforcement. If laws fetter the

sensitivity, flexibility and smooth functioning of the Institutions, goods can not be delivered. Enabling legislation is very necessary.

Section-II

Case Studies

Experiences of Van Panchayats in management of commonly owned forests in Hill districts of Uttar Pradesh.

In the hill districts of Uttar Pradesh people had unrestricted rights in the use of forest resources till 1865 except as and when some forest produce was to be exported (At Kinson, 1884). Industrialization in England, advent of railways, setting up of industries based on forest raw materials enlarged the demand and enhanced the value of forest products. The kumaon region of Uttar Pradesh, rich in forests, was one of the major suppliers of this new demand (Majumdar Bist, 1988). Commercial forestry was born and over-exploitation of forests started. To control the forest degradation, the Government enacted the Indian Forest Act in 1865 and later a more comprehensive Act in 1878. A new department, called the Forest Department was created to manage India's forest resources. When the forest bill was brought, during the course of debate on the bill, it was admitted that the people were entitled to enjoy, under very formal and clear arrangements or guarantees, rights of very extensive character (Pant, 1922). However, gradually these promises were belied. A wide range of restrictions were imposed on grazing, lopping and collection of forest produce. This brought real hardship to the people and several social movements, protests and agitations started in the Kumaon region. In 1916, the Kumaon Association was formed to deal with forest problems of these areas. In response to these agitations, Government set up a Forest Grievances Committee for Kumaon, to look into the forest problems. The Committee

recommended reclassification of forests and formation of Van Pandhayats to manage the forest in areas where local demand was heavy. Accordingly, the forests were reclassified as class I (non-commercial) and class II (commercial) forests and villagers were allowed to form Van Panchayats on class I forests. The brief review of the genesis of the Van Panchayat confirms that the people had a high stake in the forest resources and that their cooperation and participation was essential for sound forest management.

Organisational Structure of Van Panchayats

The Van Panchayat rules were framed in the year 1931. A village where two thirds of adult members pass a resolution about the formation of a Van Panchayat and indicate the land which is then surveyed by the sub-Divisional Magistrate (SDM) who gets a Khasra prepared. The approval is given by District Magistrate and sanction is made by the Commissioner.

At the village level, Van Panchayat Committee headed by Surpanch is the sole arbitrator for management of the Van Panchayat forest. The members of Van Panchayat are elected by the village people every five years. The election is mostly informal, voting is done by raising hands, not by secret ballot. It is generally ensured that all parts and all groups of the village are represented in the Van Panchayat. A village Van Panchayat Committee can have 5-9 members. The elected members are called Panchas, who then elect their leader, the Surpanch. The elections to Van Panchayat Committee is conducted under the supervision of a nominated officer of District Magistrate (DM) (usually Forest Panchayat Inspector or Patwari). Most often in village Van Panchayat committees each caste is represented in proporation to their household number in the village.

There are two advantages of the informal system of election. First, it encourages informal discussion and generally helps reach a consensus about good Panchayat candidates. Second, it avoids waste of money, time and

bitterness in electioneering, which is a common feature in village Panchayat elections. This system provides room for participation across the groups and moderate members of the opposition group are always co-opted in the Van Panchayat Committee. Several other factors help ensure that such informal elections are not manipulated by those who are socially and economically strong. These include homogeneity in caste, and less skewed distribution of land.

Dual control of Revenue and Forest Department on the Van Panchayats

At the district level, the District Magistrate is overall in-charge of all Van Panchayats for the regulatory purposes in the district. He is assisted by the Sub-Divisional Magistrate (designated Forest Panchayat Officer). Under Forest Panchayat Officer there is one or more than one Forest Panchayat Inspector. On an average for every 450 Van Panchayats there is one FPI and one subordinate staff. However, each FPI does not have equal number of Van Panchayats to supervise. FPI is responsible for conducting elections, monitoring the work of village Van Panchayats, and reporting on the functioning of village Van Panchayats to the Forest Pahchayat Officer and District Magistrate.

Linkages with the Forest Department (FD)

The FD assists the forest panchayats in two ways: a) provides technical help regarding marking and auctioning of pine trees, tapping of resin etc. and b) prepares developmental plans for the forests under Van Panchayats and executes them in initial years. For these services, the FD would receive a portion of the sale proceeds of Van Panchayat forests.

Functions and Powers: According to Van Panchayat Niyamawali 1976, the Van Panchayats have following responsibilities:

(i) To protect and develop the forests falling under the jurisdiction of the Van Panchayat.

(ii) To distribute its produce among the right holders in a equitable manner.

(iii) To demarcate its boundary by fixing boundary wall, pillars etc. and prevent encroachment in the forest land.

(iv) To enforce the regulations of the Van Panchayats.

(v) To carry out the orders of the Deputy Commissioner and Sub-Divisional Magistrate from time to time.

The Van Panchayats have the following powers:

(i) The Van Panchayat can sell fallen twigs and grass for the bonafide domestic use of the right holders in the village.

(ii) An offence involving a sum of more than Rs.50.00 (later revised to Rs.500/-) can be compounded with the agreement of the offender.

(iii) Van Panchayats can forfeit the implements used for illicit lopping.

(iv) They can impound stray cattles.

(v) Stolen timber etc. if seized can be sold only with the previous approval of the D.F.O.

(vi) Local sale of surplus forest produce from Van Panchayats to the Right holders cannot be made without the prior approval of the D.C. and D.F.O.

Modus Operandi, Issues and Problems

Forest provides grazing space, fodder, dried and fallen leaves for litter, which is used in composting, grasses, fuelwood, poles and timber for house construction. The availability of these products is not uniform and depends largely on the type and size of the forest. Depending upon the demand and supply of the forest product, each VP makes its own rules, regulations and determines method of utilisation.

reliable and simple, [illegible] method of product distribution in four Van Panchayats intensively. According to these not only the entitlement to proprietry right varies, method of utilization also varies from one VP to another VP. Even in sameVPs both entitlement and method of utilization vary.

Enforcing Regulations and Preventing Encroachment

To enforce the rules and regulations, the VPs have been empowered to compound an offence upto Rs.50 (and with prior permission from sub-divisional magistrate upto Rs.500), forfeit the instruments or weapons used for illicit lopping, catch the stray cattle and take them to the cattlepound. Three methods are used to detect and guard against the misappropriation and illicit use of the forests, namely (i) keeping a paid forest guard, (ii) since every villager has a stake in the forest, villagers report to the VP Committee if they find some offender in the forest; and (iii) the Sarpanch and Panchas visit the forest occasionally to ensure that everything is going on smoothly. But the most important method is employment of a paid guard. Depending upon the financial position and resource mobilisation from the right holders, the forest is guarded against illicit use. The VPs which do not have enough financial resources and are unable to mobilise the required resources, guard the forest themselves by each household taking turns. This method is known as Hamasawari.

The various studies suggest that the encroachment in the Van Panchayats forests land is not extensive at aggregate level (Kollabh and [illegible], 1988; Saxena, 1987). However, isolated cases of [illegible] encroachments are also reported. The Van Panchayat Committee adopts various precautionary measures, [illegible] been done it could be evicted only through legal process which is costly and time consuming, mostly informal to prevent but once encroachment has

A major [illegible] of the present structure is the generally weak support given by the Revenue and Forest Departments. Although they are responsible for providing technical, personnel and financial assistance to the VPs, these services are rarely provided. Revision of 1976 in the VPs guidelines have not led to any significant improvements in the level of government assistance.

Van Panchayat Niyamawali 1989 (Proposed)

The proposed new Van Panchayat Niyamawali 1989 has several good features such as creation of Van Panchayat Fund, under the control of Van Panchayats, provision of District Van Panchayat development Officers; provision of full time secretary of Van Panchayats; ~~abolitionof dual control~~, enhanced power of Van Panchayats to sale of forest produce; to make working plans and annual budgets and setting up of an advisory committee inclusion of village Pradhan in the Van Panchayat committee as an ex-officer member etc. However there are many shortcomings in the Niyamawali and fall sort of the expectations of the people. Some of these shortcomings are briefly narrated and suggestion for their removal are given below.

The functions and responsibilities of the District Van Panchayat Development Officer should be clearly defined. Their responsibilities should include, inter alia, educational, motivational and developmental work besides technical guidance and supervision. The should educate and convience people to form Van Panchayats where civil and soyam land are available. In the Niyamawali it is proposed that the annual budget of Van Panchayats will be submitted to the DM, who will approve it in consultation with the District Van Panchayat Development Officer (DVDO). It is suggested that the annual budget ~~forest~~ first be submitted to the District Van Panchayat Development Officer (DVDO) who will then submit it to the DM with his comments and suggestions (Shah, et al., 1[illegible]).

there should be 2-4 women bonafide right holders in the Van Panchayat depending upon total (5-9) members in the Van Panchayat. If the required number of women members are not elected, they should be nominated or coopted. The 1989 revised Niyamawali has already made provision for inclusion of one SC/ST member either elected or nominated.

An Integrated Approach to Forest Management

In previous paras, the working of the Van Panchayats, their merits, limitations and possibilities to improve their management through institutional changes has been highlighted. However, all forests whether Van Panchayat, civil and soyam or those developed by voluntary agencies, or the reserved forest are important for fulfilling basic needs of people, for ecological restoration and preservation and sustained development. Therefore, there is need for an integrated approach to forest management. In U.P. hills two distinct approaches State managed and Community managed have been identified namely Reserved Forest managed by the forest department in atypical, technocratic and hierarchical style and the Van Panchayats community owned forests managed by which are proples' institutions backed by rules framed by the Government under the Indian Forest Act 1927 and revised from time to time. Requirement for successful forest management include small and homogenous groups having high stakes in the resource; good leadership, assurance of equitable distribution of usufruct and existence of an organisation to formulate and enforce the rules, professional management etc. (Ballabh and Singh, 1988; Poffen berger ,1990). It has also been reported that the communities are able to protect those forest better which are viable having shorter gestation period and are situated near to the community (Malhotra and Poffen berger, 1989; Poffen berger, 1990). The Van Panchayats fulfil most of these characteristics but suffer from a number of constraints. These constraints have already been mentioned, and necessary modification to resolve those

constraints have been fulfilled. If the Van Panchayat rules are amended on timely basis, they have the potential to deliver the goods. Large tracts of civil and soyam forests are lying barren, degraded due to lack of systematic management.

A large part of the peoples' basic needs fuel, fodder, small wood and timber etc. are fulfilled through reserved forests. Besides the people have right of fuel-wood small wood and timbers etc. on the reserved forest. Overtime these requirements of the people for the forest produce has gone up tremendously but the rights have not been revised to cope with increased requirements. Consequently the people started illicit felling and lopping, pilferage of the reserved forest. The distribution mechanism of the rights through the Village Pradhan has further alienated people from the reserved forest. But without peoples, it is difficult to protect the reserved forest and improve and maintain their productivity on sustailable basis. The forest Department is facing increased demand with reduced availability of the forest resources and is confronting intract able problem situation. Now it is being increasingly realized by the FD that the peoples' involvement and participation is an essential component in the management though no such steps are being taken in this respect in U.I. as yet.

Community Management of Commonly Owned Resources in the Shiwaliks of Haryana State

The Shiwalik range in Haryana state is highly eroded due to overgrazing, browsing, illicit felling of trees and faulty agricultural practices. The Chandigarh lake provide of the city was getting silted due to lack of soil and water conservation measures in the watershed. The Central Soil and Water Conservation Research and Training Institute (CSWCRTI) Chandigarh identified the problem and launched a massive programme of soil and water conservation with support from the Ford Foundation. It was found that

Sukhomajri village in the watershed had a human population of 455 and an bovine population of 411 which could not be supported on 100 hectares of dry land agriculture, peoples dependence on forests for fuel, fodder and minor forest produce was increasing. The Haryana forest department realized that strong laws and force were of no avail. So a Hill Resource Management (HRMS) Society of local people was formed for protection of the watershed by the CSWCRTI. A dam was constructed for irrigation. A water users Association was formed which saw to it that every one got an equal share in the water. Even the landless got an equal share in the water which he sold to the large farmers. The agricultural productivity went up. Due to protection Bhabbar grass production increased which was equitably distributed and this rope making created additional employment opportunities.

The Sukhomajri concept of social fencing and common property resource management have attracted wide spread attention of the planners, researchers, practitioners throughout India and abroad.

The Sukhomajri concept which worked so well in Sukhomajri and Neda villages has been extended to 39 communities, now several dams for irrigation have been constructed but these communities are not functioning [illegible] due to several short comings such as lack of regular monitoring of the programme, lack of integration of the HRMS programme in the policies, procedures and routine operations of the forest department and in resolving conflicts and also for lack of a support unit of social scientists/Community organisers/Forest Department Officials for technical help and guidance (Dhar et al, 1990).

3. Forest Protection Committees an example of Joint Management of Forests in West Bengal.

An experiment was undertaken by the Government of West Bengal as far back as 1973 in the Arabari Range to realize the production potential of forests, to regulate exploitation

and to frame policies for involving people by sharing usufruct with people. The West bengal Government has shown unusual political will in this respect. They have issued Government orders and modified them from time to time to suit the needs and aspirations of the people. The success achieved has attracted the attention from administrators, foresters, planners and environmentalists at national and international levels. The Arabari methodology has been extended to several districts. Social forestry in West Bengal is fast emerging as a major land use option (Malhotra and Poffen berger, 1989 and Poffen berger 1990). The main features of this programme are that the Forest Department sanctions Forest Protection Committees (FPC) and involves the local people in protection and enrichment planting. The forests are opened for cutting and removal of grass for FPC use free of cost. The fuel wood generated from management activities including singling, prunning and removal of competing plants are given to the FPC. At the ~~pixnixxx~~ end of the rotation mainly sal, 25% of all timber generated revenues go to the FPC. Sufficient income is generated to sustain community interest. The biomass produced from the forests does not enter the market without fulfilling the local needs. Equity issues are tackled by compensating low income families who suffer the most as a result of protection. Women are included as members in the FPC as they are the primary users of fuel wood, fodder etc. Environmental awareness education is an important Component of the programm which aims at changing the value system and rational use of forest. The most effective management groups tended to comprise of 10-50 house holds, homogeneous in terms of caste and economic status similar in needs, resources and goals.

4. The Valsad District Project in Gujarat for involving people in Management of Forests.

The forest department of Gujarat realizing the increasing alienation between the villagers and forest department staff set up forest protection committees (FPC) in two forest divisions of Valsad district. The FPCs were given the usufruct of grass, fuel wood, bamboos and small timber free of cost. There is equitable distribution of usefruct to all households. Massive programmes of training the people and the forest department officials have been ~~developed~~ undertaken. They organise 'Khedut Shibirs' or training camps of farmers. Each camp consists of 250-400 farmers both males and females. The training programme consists of education in environmental protection, pad yatras, trekking in the forests, group discussions and a high level of personal interactions.

A large number of group leaders are forest trained who then train the farmers. These meetings are repeated frequently. The leaders/trainers recite their experiences in the training programmes.

The trainers are trained by the forest department. Similarly the forest department staff is also trained and motivated so that they provide the benevolent leaders needed. They are required to have constant contact with the FPC. The identification of group leaders is very important. These are identified by their effectiveness as public speakers, dramatising skills, awareness of environmental problems. The FPCs have isolated and exposed the gangs and reduced their nefarious activities through social pressure. The experience of the project is that the FPCs are successful if they have strong leadership and one homogenous community. In a multicaste village social harmoney is called for which there should be no political or social rivalry in the village (Pathan et al., 1990)

5. Community Forest Management in Rupabali Range of Orissa.

In Rupabali Reserve forest area of Dhenkanal district 264 villages are engaged in protection of an estimated 56000 hectares of land of which 12,000 ha. are Reserve forests and 44,000 ha are protected Keshra forests. These constitute 4.8 and 18.7 percent respectively of each category of forests or 11.4 percent of total forests in the State. This work is being done under the Brikshya O Jeebra Bandhu Parishad (BOVBP) (Friends of trees and living beings) formed in 1982. The movement derives considerable support through a spiritual and emotional appeal to the people. No fines are imposed on recalcitrant elements instead BOVBP members lie prostrate at offender feet or in erring village streets. The movement as such is satyagrahi in nature.

The main responsibility of FPC is protection and management of forests. The FPC rules and procedures have been framed. It maintains a meeting notice book, minutes of meetings and an account book. They have generated enough funds by way of royalty, punishment and establishment of a credit fund. The local people have perceived the ~~xxxx~~ broad based improvements both in terms of production gains and ecological gains.

Section-III

Suggestions for Developing Effective Community Based Systems of Common Property Resource Management

A few case studies have been reviewed in the foregoing pages in which the new approaches to community managed water and forest systems have been described. Each system is unique as the Van Panchayats in U.P. have a legal status though the laws need revision to make them more people oriented, the village Resource Management Societies in Sukhomajri and Nada etc. in Haryana are registered voluntary association recognized by the Haryana State Government. The

Forest Protection Committees (FPCs) in West Bengal, are unique examples of successful joint management. The Government of Haryana and Orissa have also passed enabling Government orders for Forest Protection Committees. The same is under consideration in Gujarat, whereas these Governments are showing the needed political will it is not so in case of severel other Governments.

Their methods of protection vary from paid guards, to volunteer guards to community vigilance. The village participation varies but it is found that participation by 75% or more households ensures success. The forest department in these states have shown a thoughtful and deliberate process of information sharing and dialogue with VRMS/ Voluntary agencies/FPCs and the village households. Some important suggestions emerging from these case studies for developing effective community based systems of common property resource management are described below:-

(i) The categorisation of commonly owned resources as Government managed and community managed is artificial. Both the systems are complementary and supplementary to each other. The Reserve forests, the Government Irrigation systems can not function in isolation now. The voluntary agencies/NGOs have clearly established that sustainable common property resource management need reciprocal rights, duties and privileges for which collaboration between the two is essential.

(ii) Two types of management related interactions are needed. Those among user groups for which strong local level institutions are necessary. Those between local level institution and external agencies like forest and irrigation departments, technical institutions and universities.

(iii) Several alternative approaches are available for building local level institutions but their basic criterea is the same viz., cooperation, equity and justice with a democratic set up. The success of the grass root level institutions depends upon several local level factors such as social cohesion, community unification, avoidance of faction, identification of smaller homogeneous groups of households.

(iv) Varied types of training and knowledge dissemination programmes on environmental awareness, resource appraisal, micro level planning, social engineering etc. need to be organized. Where as at the farm household level affiliation and self actualization with natural resources by appealing to their felt needs for survival as fuel wood for homes, fodder for cattle water for drinking and irrigation and for employment etc. need to be emphasized, at the Government level the training needs emphasis on social engineering aspects. The NGO's/Universities/Technical institutions can play a key role in this respect.

(v) The success of grass root level institution depends on good leaders. The leaders should be aware to environmental problems should be articulate, sincere and helpful. The leaders should be able to organise the people and put social pressure on the miscreants and mafia groups who want to make quick money from forests.

(vi) Science and technology has to play a great role in resource planning and management for community e.g. there are several multiple trees, medicinal plants where propogation methods, silvicultural/cultural practices are not well known. Similarly the knowledge base on identification and management of spring sanctuaries in meagre, Farm Irrigation systems, management integrated systems approach for forestry, water, land, animal husbandry management need more action Research (Shah, 1988, 1989 and 1990).

Conclusion

In the end it may be said that no stereotyped model for common property resource management can be suggested. They would vary from state to state and within a state. What is needed is mutual respect, trust and understanding between village households and NGOs, between NGOs and resource management departments in Government. This can come about if there is a clear cut demarcation of rules and responsibilities in the collaborative efforts of common property resource management

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* Organized by Indian Environmental Society, New Delhi Sponsored by the Ford Foundation.

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LINKING RESTORATION OF DEGRADED LANDS TO STRENGTHENING MEDICINAL PLANT RESOURCE BASE OF RURAL AND TRIBAL COMMUNITIES.

DARSHAN SHANKAR and RAJEEV KHEDKAR

1. BACKGROUND

1.1. Limitation of Rural Health Services of Government of India and State Governments.

Despite the creation of an impressive modern medicine infrastructure for health delivery services in rural areas which includes District Level Hospitals, Block Level Hospitals (for 1,00,000 pop.), Primary Health Centres (for 20,000 pop.), Primary Health Units (for 5,000 pop.) Village Health Guides (for 1,000 pop.) the percentage of the rural population actually covered by the state health services is reported to be 30% at the maximum and in certain difficult areas, as low as 3%.*

Bearing in mind the limitations of governmental machinery even with additional inputs to improve the efficiency of the system, the coverage is not expected to rise substantially. In the light of such ground realities, it has become necessary to critically review the strategy that should be adopted in India in order to achieve the goal of 'Health for all'.

Our thesis is that in a country of India's size, the state will never be able to provide basic health services to all, through its official machinery. The state should therefore revise its strategy for achieving this goal by 'enabling' communities and individuals to engage in 'self-help'for provision of 'primary' health care and should complement the community's own efforts by way of providing critical referral support. The basic instrument for promoting this 'enabling' role and self-help of rural communities should be a culturally sensitive programme of "health education". A realistic goal to aspire for by the year 2000 AD should be a provision for an enabling scheme of 'health education to all' rather than the present goal of 'health services to all'.

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* Based on studies carried out by VHAI, New Delhi and ICMR, New Delhi.

1.2.The Functioning of Traditional Health Sector: Two Streams.

In the above context it will be discovered that the traditional health culture, has a tremendous role to play, as India has perhaps one of the richest ethno-medical traditions in the world. These traditions are based on widespred local knowledge and local resources, mostly plants but also animals and minerals. The plant resources are found in all bio-geographic regions from the trans-Himalayas to the coast-line. A national campaign of 'health education to all' can only succeed in contributing to self-reliance in primary health care if it builds up on this widespread and region specific heritage of the people of india.

The traditional health systems in India, and for that matter all over South East Asia, function through two social streams.

One is the folk stream located in the villages of India. It may be called the 'Lok Swasthya Parampara'(LSP) or 'Peoples Health Culture. The LSPs are widespred. From Manipur in North East to Gujarat in the West and from Kashmir in the North to Kanyakumari in the South, all across the length and breadth of the country in all our rural communities, there exist local health traditions. The carriers of the LSPs are millions of house wives with practical knowledge of home remedies, food and nutrition, lakhs of traditional birth attendants, thousands of bone setters, practitioners skilled in acupressure (varman), netra chikitsa (eye diseases), dant vaidyas (dental care), vish vaidyas (poisons), pashu vaidyas (veterinary care) and village level herbal medicine healers, especially in tribal communities, who treat a variety of common and chronic ailments. They constitute a veritable army of self-reliant and community supported health workers delivering services at the village level.

Today the folk stream is largely ignored in the health policy due to the western ethno-centric outlook of our policy makers. No systematic attempt has been made to evalute and revitalise either its knowledge or resource base. The LSPs possess emperical knowledge of the use of local flora, passed down the ages through an oral tradition.

The second stream of the traditional health system is the scientific (or 'shastriya') level. This consists of a community of practitioners (4 lacs in size; larger than the community of Allopathic practitioners) who have studied the codified and organised indigenous medical sciences like Ayurveda, Siddha, Unani and Tibetan medicine. These indigenous systems of medicine (ISMs) have sophisticated theoretical foundations expressed in thousands of manuscripts covering treatises on all branches of medicine and surgery.

A Symbiotic Relationship

There is evidence to show that the relationship between the Lok Swasthya Paramparas and the 'shastriya' streams is a symbiotic one.

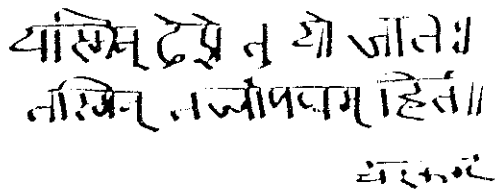
The emperical roots of the organised systems lie in the rich, diverse, experiences of numerous localised folk streams which have been organised, codified, synthesised and raised to the level of science in the organised systems.

The traditional health sector in India thus plays a substantial role in providing health care to the Indian people, and has great potential of further contributing to the self reliance of village communities, if a serious effort is made to revitalise its folk stream.

2.0.Resource base of Traditional Medicine:

Medicinal plants form the major resource base of the Indigenous systems of medicine since over 80% of the remedies are plant based.

2.1.Regional Variation



The shloka means that nature is so benevolent that it has provided every micro-region with the plant species required for its local health needs. Some examples may serve to illustrate this shloka.

The plant *Ephedra gerardiana* from which the broncho-dilator ephedrine is derived, is typically found only in high altitude regions and the local people make frequent use of the whole of the plant to make a special tea which is consumed several times daily to help them to breathe conveniently. On the other hand there are plant species like *Acorus calamus* which have wide distribution from across the tropical to the temperate regions. *Acorus calamus* has important medicinal use in nervous and respiratory disorders, which occur in a variety of bio-climates.

Regional variation of medicinal plants is inherent in the diverse expression of nature and the inability to arrive at a single, common list of plants for the whole country as is sometimes demanded by ignorant administrators, is not surprising.

Studies of LSPSS have shown that medicinal plants have tremendous potential to make village communities **self-reliant** in their **primary** health needs.*

Dwindling resources of medicinal plants make it imperative to implement suitable conservation strategies for medicinal plants.

2.2.Numbers, Location and Habitat Specificity

Of the 20,000 species of flowering plants found in India about 6,000 species are reportedly used for medicinal purposes (See Figure 1). Many of these plants are endemic and are distributed in a variety of habitats from areas of heaviest rainfall to the driest desert, from the coldest to the hottest climatic conditions, from the highest elevations down to the sea-level.**

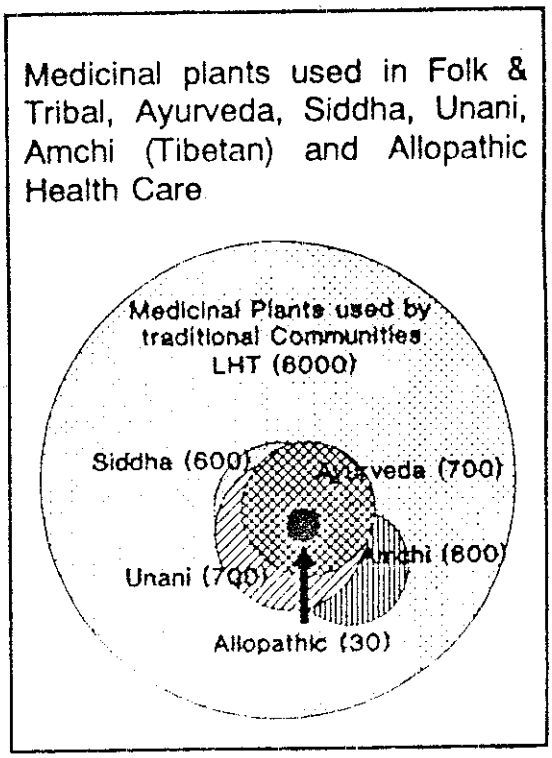


Figure 1

Some of the wild medicinal plants are highly habitat specific and they tend to behave differently under domestication outside their normal ecological range or even in their own habitat in a disturbed ecosystem. In some cases it becomes difficult for them to survive outside their natural habitat. In certain other cases they survive and grow but they may not produce the desired traits. For example, the sandalwood tree (*Santalum album*), which naturally grows in parts of the Western Ghats, when grown in Himachal Pradesh has not produced the fragrant heart-wood or essential oil which is the characteristic feature of sandalwood.

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* See LSPSS monograph entitled 'Local Health Traditions'. 1990. LSPSS, Madras unit, c/o PPST Foundation, 29, IV Main street, Gandhi Nagar, Adayar, Madras - 20.

** Ref: Koshoo,T.N., and Subramanyam,G.V. 1986. Conservation of Biological Diversity. In: Conservation for Productive Agriculture Chopra,V.L. and Khoshoo, T.N. (eds), ICAR, New Delhi pp.58-72.

Some of the desired traits in a medicinal plant are reported to be pharmacologicly active organic compounds (which are mostly secondary metabolites) like alkaloids, saponins, glycosides, coumarins, terpenes, etc.* The expression of these secondary metabolites in plants may be influenced by a variety of conditions such as edaphic factors, physical and chemical properties of the soil, presence of micro-organisms, insects and by typical plant associations. Not much is known on a species to species basis about the criticality of these factors in influencing the properties, growth and behaviour of medicinal plants in the wild and hence it is difficult to predict the medicinal qualities of these plants when placed under domestication and grown outside of their natural habitats. Whereas for ornamental plants like crotons etc. it does not matter if the domesticated plant varies from the wild state. In the case of medicinal plants any change in property would be critical to the efficacy of the plant. Hence today the only safe advice for propagation of these plants is to grow them in their natural habitats, by replanting them in the wild i.e. *in situ* propagation.

2.3 Present source of supply of medicinal plants.

Today , over 99% of the medicinal plants used by traditional pharmaceutical industries and village communities are obtained from the wild with only a handful (generally those used by the allopathic, perfumery and export industry - see Appendix II) being cultivated in farms.

The vanishing forests are taking with them a wealth of wild species. Many medicinal plant species are threatened with extinction. The extent of genetic erosion in wild plant populations has not been properly assessed and continuing exploitation of medicinal plants from the wild without any conservation measures has jeopardised the survival of numerous species (see appendix III). Over exploitation of a species from the wild may result in disappearance of discrete genepools with important traits.

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* It has often been found that the drugs prepared by isolation of the active chemical ingredients of a plant are found to have side-effects. These get balanced out perhaps due to synergy when the extract of the natural plant is used. Commercially, it is cheaper and more convenient to manufacture and sell synthetic chemical compounds as drugs, rather than depend on uncertain bulk supply of plants from nature. This may be one of the reason why

herbal medicines have not been promoted on the same scale as chemical drugs even if they were orginally derived from plants.

2.4. The loss to tribal and other village communities

The rural communities till a few decades ago had easy access to medicines in that they could collect the required medicinal plant (or plant parts such as leaves, flowers, fruits,bark, etc.) from the nearby forests, but with the increased pace of deforestation, the plants which are a source of free, reliable and locally available medicines to the village communities are becoming difficult to obtain. Today only the rich and the well-to-do can afford herbal medicines. Ironically, it is the tribal communities who collect medicinal plants from the forests and sell them to contractors for meagre sums. The same plants when processed and sold by pharmaceutical companies are beyond their reach.

Some communities had the wisdom and foresight to keep aside protected forests in the form of 'Dev-Rais' or 'Sacred Groves' from which the traditional healers could collect medicinal plants. But such Sacred Groves are small in number in the community today. A movement for re-introducing the concept of 'Sacred Groves' could result in the creation of community bio-diversity gardens in every tehsil or sub-tehsil. Some wastelands could be utilised for this project.

2.5 Strategies for conservation of medicinal plants

A broad outline of the strategy to be implemented for the conservation of medicinal plants is given below.

Set up a network of 'Nature Reserves of Medicinal Plants' in different eco-geographical regions of India for *in situ* conservation. Complementing these nature reserves should be a network of *ex situ* herbal gardens, nurseries and seed collection and distribution centres. (See Appendix I for outline of a proposed LSPSS project).

It is not only necessary to protect wild populations of medicinal plants but also to propagate them in large numbers for use. At this stage of our knowledge of medicinal plants it would not be advisable to grow medicinal plants in 'monocultures' to meet the needs of village communities since there have been little or no scientific studies on a majority of medicinal plants to ascertain whether or not, if grown in monoculture, they would have medicinal properties similar to a plant growing in the wild.

The preferred strategy in this case would be to propagate medicinal plants *ex situ* and then to 'restock' them in their natural habitats, which may be degraded forests or wastelands. Simultaneously, the village communities should be encourged to grow medicinal plants in Home Gardens, Village Level Herbal Gardens and Community Gardens for their own use. NGOs working in rural areas should take up the responsibility of promoting these concepts and should also serve as centres for multiplication and distribution of planting materials. It would also be worthwhile to identify the commom ailments of a region and select corresponding curative plants from the local flora which can be easily grown. A list of 'BASIC FAMILY MEDICINE PLANTS' should be propagated for each region.

Furthermore, it should be made mandatory for pharmaceutical companies to procure crude drugs from drug farms, plantations and other such cultivated sources only, instead of from common lands and state forests. The companies can share the costs of developing agro-technologies and conducting efficacy trials for assessing the potency of cultivated medicinal plants.

In conclusion, it can be said that favourable factors like (i) the millions of hectares of wasteland, (ii) the tropical weather conditions conducive to luxuriant plant growth, (iii) a variety of habitats covering the entire gamut from the temperate to tropical to the arid zones and (iv) above all the tremendous diversity of plant species adapted to the various habitats, open up unending possibilities for growing medicinal plants on 'Wastelands' to meet the health care needs of rural and tribal communities.

SUMMARY

The rural and tribal communities in India have a strong ethno-botanical knowledge base and they have been using medicinal plants since time immemorial to treat a varity of ailments. The utter neglet of the Indigenous Systems of Medicine in the Health Policy and the shrinking resource base of medicinal plants has weakened the 'once-strong' **Lok Swasthya Paramparas** and has made it imperative to launch effective conservation strategies for medicinal plants.

While *in situ* conservation is the preferred mode to protect and study medicinal plant populations, *ex situ* conservation is also necessary to improve availability of medicinal plants to the village communities. An effective strategy would be to set up a network of *in situ* 'Nature Reserves for Medicinal Plants' in different eco-geographical regions of the country along with a complementary network of herbal gardens, nurseries and seed collection and distribution centers.

The millions of hectares of wastelands in the country could be gainfully used to grow medicinal plants in mixed species herbal gardens for the health care needs of local village communities. The strategies for such herbal gardens should be 'region specific' in that their floristic composition should be governed by the flora of that very region.

The restoration of 'wastelands' or 'degraded lands' is thus closely linked to the strengthening of the plant resource base of rural health care.

APPENDIX I

A project along these lines is likely to be implemented in India by the 'Foundation for Revitalisation of Local Health Traditions. The project envisages:

1. A network of 100 medicinal plant conservation areas in different bio-geographical regions of India for *in situ* conservation. It is expected that a network of this kind would help conserve a significant proportion of the 6,000 odd species of plants which are used for medicinal purpose in India.

2. A complementary network of herbal gardens, nurseries and seed collection and distribution centers for *ex situ* conservation. This would improve availability of planting material of medicinal plants.

3. Cottage scale herbal medicine processing units in rural areas to create local employment.

All these activities will be co-ordinated by the Foundation and implemented by NGOs or village communities.

APPENDIX II

Plants whose Agro-Technology has been standardised

Sr.No.	Botanical Name
1.	*Abelmoschus moschatus*
2.	*Acorus calamus*
3.	*Aloe barbadensis*
4.	*Asparagus racemosus*
5.	*Atropa belladonna*
6.	*Cassia angustifolia*
7.	*Catharanthus roseus*
8.	*Commiphora mukul*
9.	*Costus speciosus*
10.	*Crocus sativus*
11.	*Curcuma amada*
12.	*Datura metel*
13.	*Dioscorea deltoidea*
14.	*Dioscorea floribunda*
15.	*Duboisea myoporoides*
16.	*Gloriosa superba*
17.	*Glycyrrhiza glabra*
18.	*Hyoscyamus niger*
19.	*Inula royleana*
20.	*Ocimum basilicum*
21.	*Ocimum gratissimum*
22.	*Ocimum kilimandscharicum*
23.	*Piper longum*
24.	*Plantago ovata*
25.	*Psoralea corylaefolia*
26.	*Rauvolfia serpentina*
27.	*Saussurea lappa*
28.	*Sesbania sesban*
29.	*Tinospora cordifolia*
30.	*Trachyspermum roxburghianum*
31.	*Vitis quadrangularis*
32.	*Withania somnifera*

NOTE: Some of these are under cultivation since long, while others are being cultivated to a limited scale or cultivation has been stopped after standardisation of agro-technology due to reasons of economic viability.

Source : Sarin, Y.K. Personal communication.

APPENDIX III

Some Threatened/Endangered Medicinal Plants

1. *Aconitum deinorrhizum*
2. *Aconitum heterophyllum*
3. *Adhatoda beddomei*
4. *Aegle marmelos*
5. *Angelica glauca*
6. *Aquilaria agallocha*
7. *Aristolochia indica*
8. *Atropa acuminata*
9. *Berberis asiatica*
10. *Clerodendrum serratum*
11. *Colchicum luteum*
12. *Commiphora mukul*
13. *Coptis teeta*
14. *Coscinium fenestratum*
15. *Dioscorea deltoidea*
16. *Dioscorea prazeri*
17. *Embelia ribes*
18. *Enicostemma littorale*
19. *Ephedra gerardiana*
20. *Gloriosa superba*
21. *Holostemma ada-kodien*
22. *Nardostachys jatamansi*
23. *Onosma bracteatum*
24. *Orchis latifolia*
25. *Picrorhiza kurroa*
26. *Podophyllum hexandrum*
27. *Premna serratifolia*
28. *Rauvolfia serpentina*
29. *Rheum emodi*
30. *Rheum nobile*
31. *Rubia cordifolia*
32. *Saraca asoca*
33. *Saussurea lappa*
34. *Scindapsus officinalis*
35. *Solanum indicum*
36. *Swertia chirata*
37. *Tecomella undulata*
38. *Valeriana wallichii*
39. *Viscum articulatum*
40. *Zanthoxylum alatum*

These plants represent only the 'tip of an iceberg'. The extent of genetic erosion in wild plant populations has not been properly assessed and continuing exploitation from the wild without any conservation measures has jeopardised the survival of numerous plants. Over exploitation of a species may result in disappearance of gene pools with important traits.

Source : (i) Sarin, Y.K. Personal Communication.
(ii) Ministry of Health and Family Welfare, Govt. of India 1986. Regional seminars on medicinal plants.

How have the changing forest policies over the 1980s affected Country's heritage of biodiversity?

By

Sri. S. Shyam Sunder IFS (Retd)

In the realm of the subject we have the National Forest Policies of 1952, and 1988, the Forest Conservation Acts of 1980 and 1988, the decisions of the (first) meeting of the National Land use andWastelands Development Council in 1986 and the Tree preservation Acts. As land is a state subject and Government forests belong to the states, the National Forest Policies are more of wishful adumbrations of what should be, than prescriptions for action. In this context, the significance of the forest conservation Act of 1980, brought about after transferring forestry to the concurrent list in 1977. The sucess of the forest conservation Act of 1980 also brings out in poor light, the amendment of 1988. Before we go into these aspects, a few issues on linkages between Wastelands, forests and biodiversity.

It has been assessed that 1/3 the area under forests, 2/3 under agriculture and the entire land area outside these two categories require soil conservation (State of India's Environment, 1982). This reflects the extent of land area that is degraded, in turn, resulting in floods and droughts (more often physiological) visiting the Country annually. The loss of soil every year is put at 600 million Tonnes.

In the midst of land with degraded or decimated tree cover, good forests cannot exist. The same factors which have caused degradation all around exert retrogressive pressures on reserve forests as well. More the extent of Wasteland, poorer the condition of forest and lesser the biodiversity. Conversely, the biodiversity in the forests can be saved only by rehabilitating the wastelands which will, in turn, meet the needs of biomass.

Contd....2....

50s to mid 70s was a period during which wholesale clearance of forests took place. "Grow More Food" was achieved not through intensive agriculture but by extention. In Karnataka there was large scale clearance of Paisary (in Coorg) Wasteland (in D.K. dt) District forests (in old Mysore) and Minor Forests (in Bombay Karnataka), areas meant to provide for the rural needs of firewood, small timber and fodder, for land grant. During tours of Ministers, the only forestry subject reviewed was the progress in clearance of tree growth. In the districts with heavy incidence of wild life more particularly elephants and tigers, strips of forest along the roads were cleared to keep the "beasts" away. Crop protection guns were granted for the asking. In case of power and irrigation projects, larger the extent of forests involved, the better the cost benifit ratio as this reduced land acquisition cost. Rehabilitation was in cleared forests in the catchment. Even this is understandable considering the mood of the day, but worse, grant of land in the rehabilitation areas was based on normal land grant rules, making it available to all and sundry, in addition to the evacuees. This practice continued till much later due to which in case of Kabini, it resulted in the abnormal Phenomenon of the entire extent of forest land cleared for rehabilitation being used up while many of the evacuees had only land grant orders and no land.

This was also the time when in areas where no revenue land was available for grant for extention of agriculture, demands placed on reserve forests were complied with, inspite of the fact that in most cases, the sites were unsuited or marginal for agriculture. In Karnataka, the Government realising the intensity of the continuing pressure, surrendered its power to release reserve forests to legislature with which release of forests for one category-extention of agriculture, came to an end. As far as the Country is concerned, this result was achieved in 1980 with the promulgation of forest Conservation Act. Release of reserve forests came down from 0.15 million hects to a few thousand hects per year.

Contd.....3/-

During 1950s to mid seventies, with the whole sale clearance of tree growth, there was surfiet of timber and firewood due to which the market value for these commodities was negligible. In case of Sharavathy project, there were no takers for some species of timber at Rs.0.25 per cft. In most of the submersion areas, the contractors chose to leave the trees of softwood species standing, as the cost of extraction was not commensurate with its value. It is in this context that investment in the forestry sector, when the 5 year plans began, was dismally low and while there has been a steady increase, this has been with referenee to earlier allocations and not based on the need. Thus even today, the investment in the forestry sector is barely 1.5% of the plan outlay, to be invested in 23% of the land area of the country.

This was the situation when the National Forest Policy in "force" had proclaimed that increase in agricultural yield should be achieved not by extention of area but by intensive practices, that for the welfare of agriculture an evenly distributed forest cover was essential and due to which reason there was need to increase the forest cover in the country to 1/3 the land area, that being in the tropics there was need to adopt scientific land use policy. It controverted the recommendations of the earlier policy(of 1894) which had opined that in the plains, if demand arose for land for agriculture, there should be no hesitation to release forests and that the people living in the viscinity of the forests had a prior claim on the forests and its produce against that of general public. It asserted that even in the case of private forests, its management must be guided by ecological considerations.

The National Forest Policy of 1952 was ahead of its time, It was conceptually brilliant but was undermined and sabotaged by every other sector. The consideration meted to the forests in revenue land and Government reserves may be gleaned for the

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earlier description. Private forests (in Kerala) in the evergreen zone in Kerala were nationalised for being cut up and distributed for agriculture.

The Forest Conservation Act of 1980 came to Indian forestry as a boon, as an umbrella of protection. Without it, with all the wild life weeks, Vanamahotsavas and seminars on ecology release of reserve forests would have continued unabated. The act had just two lines bringing in Government of India before any reserve forest could be released or used for non forestry purpose. With F C A of 1980 many profligate practices also got t o be curtailed. Earlier, clearance of forests in the submersion zone was insisted to be upto the High flood level - a level rarely reached and when reached, lasting for a few days which would permit most species to survive. In case of High tension Lines, much wider strip was being insisted on being cleared. In both these cases, with F C A, the concerned authorities have come down to the barest minimum when it was a question of project or no project. This equally applies to many Government of India projects.

Forest encroachment is another matter. Just as the country was fooled all along that the forest area in the country was constant at 23%, we are now fooling ourselves that the loss of forest is limited to a few thousand hectares per annum, released for projects or public amenities. In the hills grass lands are extending at the cost of forests, due to incendiary fires. Encroachment for cultivation is unabated. Govts. in various states had earlier ordered regularisation of encroachments, (the preamble on each occasion repeating that it was a once for all operation, never to be repeated) due to which reason, the encroachers rely on a favourable dictate at some point of time and encroachments are continuing. The only way by which such encroachment can be stopped is by destroying the crops but the moment this is resorted to the forest staff gets pulled up. They are painted, both in the legislature and by the press as brutes. FCA is equally helpless.

There are instances of failure of FCA but this is due to the over zealousness in implementing it, in failure to realise that occasionally, for a policy to be sustained a small parting is necessary for a larger gain. The result of insisting that revenue land, unfit for agriculture and transferred to forest department for afforestation. attracts the provisions of FCA is that the State Government is withdrawing the transfer order itself. In trying to save a vew thousand hectares, 800,000 hectares of land area is likely to be lost to forestry.

The amendment to the act of 1988 had provided the Govt experience of 8 years after the FCA of 1980. Damages due to floods and droughts had, instead of abating, been increasing. The gap between demand and supply of forest produce was increasing. The amdment at this stage should have aimed at reducing the degradation not only in the reserved forests but in 77% of the land area of the country, outside the reserves. It should have sought to intensify afforestation. Instead its efforts were to keep out private investment, even through joint sector. It took pains to bring in penal clauses against officials who contravened the provisions of the amended act. The 1988 act is such that if its prescriptions are to be complied with tree planting programme should come to a stand still.

The amendment states that without prior approval of Govt. of India, no forest land can be cleared of naturally grown trees, for the purpose of afforestation. A common sense understanding would imply that a natural forest should not be cleared for raising a plantation without concurrence of Govt. of India. Fine. But provisions of an act are not interpreted on the basis of commonsense. It goes by legal norms. Trees, as defined in the forest act include brushwood and stumps. It includes Eupatorium and lantana. Preplanting operation necessarily involves clearance (or damage) of such weed growth, even in the worst of degraded areas. In Karnataka, the annual programme of the forest department would involve atleast around 3000 cases and in the country 30,000 to 40,000, for which Govt. of India's clearance would be required.

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The National Forest Policy of 1988is on the same lines as the act amendment of 1988; details taking priority over essentials. It is true, it is conservation oriented, but lacks supporting measures to prop it.

The decisions taken in the (first) meeting of the National Land use and wasteland Development Council in 1986 are of considerable significance. If the amendment to the act taken up in 1988 and the new Forest Policy of 1988 had leaned on these decisions, it would have made tremendous impact on the ecology of the country. The fact that the Prime Minister is the chairman of the council and members include Central Ministers in charge of Environment and Forests, Agriculture, Water resources and Finance, all the State Chief Ministers and Deputy Chairman of the Planning Commission, would have provided the rationale for it. A few of these decisions are:

Evolving land use policy and enforcing its provisions through legislation,

Imposition of heavy penalties on those who interfere with land resources and its productivity,

Propagation and adoption of technologies relating to dry farming, land shaping and water harvesting,

Implementation of special programmes to prevent wind and water erosion,

Integrating land use planning with rural employment such that loans and subsidies are given only for those productive activities which represent efficient land use,

Charging raw material to industries at market price to induce them to go in for massive afforestation programmes,

All acts relating to planting and harvesting of trees, leasing of land, usufruct rights etc.,. be examined in the context of amendments that may be called for to motivate the rural poor and other institutions for afforestation,

Policies need be formulated and enforced so that those responsible for degradation and who contribute to the increase of wastelands are held accountable for re-foresting the degraded

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lands etc..

The forest cover in several of the developed countries is a result of implementation of decisions in these lines. Forest cannot and should not mean only reserve forests.

The extent of forest by ownership, in some of the developed countries is noted below:

Country	Percentage of land area under forest	Forest area on ownership basis State	Companies or Collectives	Private
Austria	N A	33 %	1 %	66 %
Czecoslovakia	36 %	97 %	3 %	-
Finland	66 %	24 %	9 %	63 %
France	25 %	10 %	16 %	74 %
F R G	29 %	30 %	29 %	39 %
G D R	27.5 %	68 %	27 %	05 %
Italy	22 %	06 %	33 %	61 %
Japan	68 %	31 %	11 %	58 %
Spain	51 %	04 %	30 %	66 %
Sweden	57 %	25 %	25 %	50 %
United Kingdom	10 %	45 %	-	55 %

(Source:- Forestry policy in Europe - F A O paper 86
Forestry and Forest Industries in Japan; wood products stock pile corporation, Japan)

Both the act amendment of 1988 and the New Forest Policy of 1988 could have availed of the decisions of the highest body on land use in the country, to contain misuse of land, promote tree planting in all sites under marginal cultivation, fallow land and degraded land, including those belonging to Govt. It is only through extention of tree cover and increased production of biomass to meet the needs that the natural forests can be saved.

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The policy of 1988 could also have analysed the causes of failure in implementation of 1952 policy and taken recourse to remedial measures. The Ministry of Forests in 88 was also the Ministry of Environment as well. This should have provided it the clout to bring in policy statements on land use. A few directions like no more grant of Govt land for cultivation in the mountainous regions and areas receiving less than 500 mm rainfall, bringing the nonterraced areas under cultivation in slopes of more than 25° to tree cover, ban on entry of cattle above the carrying capacity of forests, would have meant for more than hymns on advantages of ecological equilibrium

The Ministry which framed the policy in 1988 also had the advantage and support of the National Wasteland Development Board, a factor which could have helped in the orientation of the policy. Incidentally, it should be highlighted that whatever may be the failures, N W D B has succeeded to a large extent in exposing the problem of wasteland and assisting in its reclamation. Tt policies and inclusion of tree planting in the 20 point programe have produced far greater results in increasing the tree cover in India than the lofty aims ~~unbalanced~~ embalmed in our National Forest Policies.

A controversial issue is the tree preservation act, which has come into existance in many states in the 80s. While its objectives are to be appreciated its results perhaps are more negative than positive. Restrictions on felling is a disincentive to planting. It may be more advantageous for T.P.Act to concern itself on tree planting in barren areas and fallow land and not xv have any say on felling of trees. Mere nationalisation of extraction of rosewood in Karnataka has seen to the elimination of its regeneration and younger growth in-principle I mean.

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CONSERVATION OF BIODIVERSITY, WASTELAND DEVELOPMENT, AND THE LAW.

by

Chhatrapati Singh

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CONSERVATION OF BIODIVERSITY, WASTELAND DEVELOPMENT AND THE LAW

Chhatrapati Singh

NB :

The text presented here is an excerpt from the author's forthcoming book on "Forestry Development and the Law". The section is self-contained, and intelligible, even without the rest of the textual material of the book. The point of presenting this for discussion at this Conference is that, since the book is still under print, criticisms of the crucial points made here will help in strengthening the arguments in the book.

It is undeniable that India's biodiversity needs to be protected. This protection, however, is often assumed to be a matter of simply conserving forest and wild life resources. In reality however, there is an intricate relationship between land use, water use, use of forest resources, and industrial practices. All these uses and practices are governed by a complex legal framework which encourages certain possibilities and prohibit others. Unless there is an integral view which defines priorities

and delimits the possibilities, it is unlikely that any conservation of the biodiversity will occur. The remarks in this section address themselves to these issues, and suggest the legal alternatives that need to be seriously considered if we are to preserve the biodiversity.

The references in this section are limited to West Bengal, Karnataka and Maharastra. The issues, however, are national. The basic issues in other states are not radically different. A critique of this section, hence, is also a critique of the forestry and biodiversity preservation in other states.

SECTION - III.

III. MAJOR ISSUES AND PROBLEMS

1. The National Forest Policy in relation to other Resource Policies.

The National Forest Policy, 1988 is not legally enforceable. However, it is supposed to form the basis of future legislation on forestry. The Policy itself states that appropriate laws must be formulated to put this policy into action. Within the legal framework, therefore, it will be important to consider the nature and implications of this Policy.

At present the Policy is merely a guideline to what is desirable. Even this expression of what is desirable cannot be translated into action because what governs work at the ground level is the network of existing laws, they take primacy over all policies and guidelines. The main forest law --- the Indian Forest Act, has not been changed since 1927. Even the earlier National Forest Policy, of 1952, did not provide any impetus to change the forest laws. No major law reform has taken place so far on account of the 1988 Policy either. The use of the forest resources, therefore, continue to be governed by the 1927 Act and the forest policy embodied therein. Law reform, in accordance with the new Policy is, hence, a matter of top

priority. Moreover, both the policy and the laws have to be in keeping with the constitutional framework, specially the demands of articles 14, 19(1), 21 and 39 (b) & (c). So far neither the National Forest Policy nor the forest laws have paid any heed to the constitutional demands.

There are further practical requirements for the successful operation of a Policy, even if it be consistent with the Constitution. It is important to realise is that a resource use policy, such as the Forest Policy, cannot work independently of the natural resources use policy in general, namely, the land-use, water and industrial resource-use policies. If these policies are inconsistent with each other, or if they lay down totally different plans for action, the forest policy will continue to remain ineffective.

The land use and resource use policies of West Bengal do not fully match the National Forest Policy,1988. The laws concerning agricultural land, industries, and forests, were enacted with totally different policy objectives, which are not only mutually contradictory or indifferent to each other, but also different from the National Forest Policy (both of 1952 and 1988). For example, whereas the Forest Policy talks of conservation of resources and protection of tribal rights, the Industrial Policy encourages industries to use the forest resources and set up factories in

'backward' (sic) areas, i.e., near forest areas. It also encourages mining of ores as a matter of grater priority than preservation of the ecology. The Water Policy, on the other hand, encourages building of hydel and irrigation schemes which, by and large, involve destruction of dense forests (through submergence, clearance, etc.)

In such a situation there are two alternatives. First, that of making the forest, water, land and industrial policies consistent with each other and with the Constitutional requirements. The laws concerning these matters will also have to be consequently made consistent. If these policies and laws are not to be made (or cannot be made) consistent with each other for various reasons, then the second alternative is to have a sufficiently strong political will to enforce one policy against the other, such as the forest policy against agricultural or urbanisation (settlement or encroachment) policies.

2. Self-Sustained Development and the Forest Laws.

As matters presently stand, it is the industrial and urbanisation policies and not the forest policy which seem to get the upper hand. This would not be a tragedy if the industrial policy was based on a long term economic plan which looked for a sustained yield forest resource use and a self-sustaining resource base. The existing industrial

policy simply assumes the use and availability of resources, leaving the task of providing the resources (in whatever way) to someone else (namely the Forest Department). A self sustaining resource base would have to be not only resource-wise self sustained but also financially self-sustained. In the present system the industrial policy seems to assume an infinite availability of external funds to regenerate the resources. Consequently, in the last two decades, India has been continuously borrowing funds from external agencies, such as the World Bank and other international funding agencies for regeneration of the forest resources for industrial purposes. Such a industrial policy can lead to only greater and greater indebtedness. For the purposes of social forestry alone India has already borrowed more than Rs.40000 crores so far. Unless regeneration, harvesting and industrial supply are colaterally matched in a rational work plan, the financial inputs for afforestation will fail to have any bearing on the industrial supply or demand of resources. The operative methods under the present Forest Act does not necessitate drafting and execution of work-plans which have any rational connection with a financially or resource-wise self-sustained forestry system.

This major lacuna in the forestry programme in India can be corrected by at least, initially, addressing the

issues in the National Forest Policy directly, before the relevant laws are amended. There are two approaches to deal with the issue. The first relates to the state and federal revenue system under the Constitution; and the second concerns the work plans of the Forest Departments under the state laws.

In relation to the first approach, one needs to know that in the present fiscal system, the revenue generated from forest resources goes directly to the state exchequer and becomes part of the general state funds. The funds provided to the Forest Department for afforestation purposes from the state or central revenues has no connection with the generation of revenues from forest resources in the state. Such a legal arrangement was all right in a period in which there were plenty of forest resources and hence the money earned from such resources could be put into the general kitty for other development purposes. But in a situation in which the development of the forest resources is itself at stake, and in which the resources have been drastically depleted, this arrangement is unsound. Even a common sense economic calculation would suggest that to have a self-sustaining resource base the funds put into regeneration must at least ensure that as many trees have grown back as harvested, and that sufficient funds are provided for the purpose. One way to

ensure that this equilibrium is maintained is by making it an explicit National Forest Policy that a certain percentage of revenue generated out of forest resources (the percentage required to grow back as many trees as harvested) will necessarily have to be ploughed back into afforestation work by each state. The state of Karnataka has already taken a step in this direction. Under the Karnataka Forest Act, 1963, the (sections 98A, 98B) the Forest Department levies a 'Forest Development Tax' on sale of resources to industries. This tax, at the rate of 8 per cent on the sale, is credited to the Consolidated Fund of the state and transferred to the 'Forest Development Fund'. This tax covers up to 10 per cent of the total cost required for afforestation. Evidently, the development fund will have to be increased to meet the total requirements for forestry. A similar strategy could be adopted in West Bengal. Since forest is on the Concurrent List of the Constitution the states are free to arrange their own revenue and taxation laws for generating the forest development fund.

The second method to make forestry a self-sustaining system is to make it necessary within the state forest law that each forestry work plan must include the cost of reforesting, such that the total budget of any commercial project or scheme within the work plan takes in to account

not only the cost of protection and harvesting but also of compensatory afforestation. Simultaneous compensatory afforestation will have to be made mandatory for every industrial harvesting. This is not the practice within the work plans of the Forest Department at present.

The lack of a general practice of compulsory compensatory afforestation (of the same species, of an equivalent value) has not only reduced the industrial resource base, it has drastically depleted the availability of fuel, fodder, food and timber for the rural and tribal masses who have been traditionally dependent on the forest resources to satisfy these basic needs. The industries have been supplied the raw forest resources at the cost of denying these resources to the rural and tribal people and consequently impoverishing them. Such an inequitable forestry practice raises many questions concerning articles 14, 21, 19(1) and 39 (b) & (c) of the Constitution. Any forest policy and practice will necessarily have to be guided by these constitutional provisions. If forestry is to now serve the needs of the rural and tribal people as well as those of the industries it must be realised that compensatory afforestation is a matter of concern not only when major dams are to be made or other projects cleared, but one of forestry practice in general in every case. The National Forest Policy and the forest laws must, evidently,

embody the principle explicitly, and not leave it to be merely a matter of guidelines for specific environmentally sensitive projects, as is the case presently.

This outlines the major problems and issues relating to the National Forest Policy and the legal and constitutional framework within which it must operate. Let us turn now to see how the industrial policy and practice related to forestry operates concretely in West Bengal and how the issues therein relate to the forgoing discussion.

3. Industrial Policy and the Forest Laws.

Here we need to consider the industrial policy only in relation to the use of forest resources, that is, only that industrial sector which is forest based. In specific, if we look at the laws concerning industries, the following issues are relevant:

a) Issues concerning mining and industrial wastelands.

b) Use of forest lands for commercial purposes.

c) Commercial use of land, such as for tea gardens, and its relation to forestry.

Let us turn to look at each of these issues individually.

a) Mining and the Industrial Wastelands:

Industrial wastelands have been created in the state mostly through open cast mining for coal. There are about 500 hectares of abandoned coal mines on revenue and forest lands where the top soil has been so badly eroded that any afforestation or regeneration will be a strenuous task. Despite these already existing wastelands the industrial and energy policies of the governments continue to favour extensive mining.

There are no soil conservation laws, either at the state or central level which will necessitate top soil conservation measures. However, since mining constitutes a non-forestry work, it comes under the purview of the Forest Conservation Act, where forest lands are involved.

The Rules under the Forest Conservation Act lay down specific measures for compensatory afforestation where mining has be permitted by the central government. (Section 4.11 of the Rules). (Under the Forest Conservation Act the permission of the central government is required before any mining can take place in the state forest lands).

Section 7.2 of these Rules had laid down that the provisions concerning compensatory afforestation will not apply to mining leases which were given prior to 1980, that is before the coming of the Forest Conservation Act. However, the Supreme Court has changed the law on the

matter by interpreting this section differently. It has laid down that a renewal of a lease is the same as the grant of a fresh lease. (Delhi Development Authority v. Durga Chand Kaushik. A.I.R. 1973 SC 2609., and also State of Bihar v. Banshi Ram Modi.) Any continuance or renewal of mining lease on forest lands, therefore, attracts both the provisions of the Forest Conservation Act, i.e., Section 2 for prior approval by the centre, and Section 7.2 for compensatory afforestation. Section 7.4 of the Rules under the Conservation Act states that land identified for compensatory afforestation (by the Revenue Department) will be transferred to the Forest Department.

The administrative infrastructure for monitoring compensatory afforestation, however , is as yet grossly unsatisfactory. There is one single officer in the Ministry of Environment, at the central level, who is given the task of the following up the execution of compensatory afforestation. As a consequence, these provisions of the Forest Conservation Act are hardly enforced.

There are two additional problems. A great deal of the land involved in mining are not forest but revenue lands, and hence do not come under the purview of the Forest Conservation Act. Secondly, the amount of free revenue land available for compensatory afforestation is very limited. What is necessary is that soil conservation and

compensatory afforestation must be done on the very land which is destroyed due to mining. Neither the Forest Conservation Act, nor the West Bengal Forest Act, necessitates this. This is mainly because a mining technology which can carry out simultaneous (or subsequent) soil conservation is prohibitive in cost. The forest laws, therefore, sacrifice the ecological cost for the immediate industrial benefit.

The lands leased out for coal mining come under the Coal Mines Authority of India. The Authority has recently put up a proposal for the regeneration of denuded lands to the West Bengal Government. The proposal is still under consideration.

It must be noted that mining operations attract not only the Constitutional provisions, such as Articles 19(1) --- right to reside and 21 --- right to life and livelihood, but also customary and statutory rights of the people under the Forest Act and the Easement Act. By and large, in mining operations such rights of the under-privileged people have been ignored and minor compensation given to them for the loss of such rights. This is specially true in the tribal areas. The people have not been able to claim their appropriate rights and compensation simply because they do not have access to the legal system or the administrative infrastructure. If

mining operations were to take into account not only compensatory afforestation but also compensating the loss of people's rights appropriately, the actual costs would be far higher than what is presently calculated.

b) Commercial Use of Forest Lands.

The federal Forest Conservation Act, 1980, prohibits use of forest lands for non-forestry purposes without the permission of the central government, but it does not require that the state governments must take permission for contracting out or leasing out the forest resources to industries. Unlike in other states, such as Maharastra, the West Bengal government has not made long-term contracts on forest resources with the industries. The contracts are reviewed annually. Since the commercial forestry work-plan has no compensatory afforestation requirements, over the years the resources of the state have been grossly depleted. The central government, through a circular, has barred the complete felling of trees for commercial harvesting. Despite this ban, however, forest resources continue to be supplied at a subsidised rate to the industries. Currently the government is supplying timber at the rate of Rs. 350/- (Rs.225 + Rs.150 tax) per metric ton to the industries, whereas the market rate is about

Rs.600/- per metric ton.

The industrial policy and the laws need to be obviously reconsidered in light of the National Forest Policy. The province and nature of the Forest Conservation Act also needs to be seriously reconsidered --- whether it needs to be bothered about the conservation of forest lands alone or also about the resources on these lands.

A major amendment to the Forest Conservation Act is recommended so that the law regulates the use of resources too and not merely the land, otherwise the aims of the National Forest Policy cannot be achieved (coverage of 1/3 land area by forest).

If industrial growth is to be self-supporting and sustained it is necessary to abolish all subsidies and incentives. Getting raw material at lower rates from natural forests is a major loss to the over all national economy, although it may benefit the industry for a short while (till the natural resources last, which is estimated to be about 20 years at the most). From the long term economic perspective it will be better if the wastelands are commercially developed to provide a perpetual resource base for the industries. These wastelands are not likely to be developed either by the forest department (or corporation) or the industries so long as the natural forest resources can be cheaply provided from the standing

forests. As discussed earlier, the complete work plan methodology for forestry needs to be changed if a sustained resource base for the industries is to be available. Compensatory afforestation needs to be made compulsory and the cost of regeneration needs to be included in the work plans for harvesting. This can be achieved by amending the Indian Forest Act, 1927 (as adopted by West Bengal). Keeping in mind that the National Forest Policy also demands 1/3 of the land area of the state to be forested, compensatory afforestation becomes all the more necessary.

Keeping in mind the shortage of the availability of forest resources the West Bengal government has enacted the West Bengal Forest (Establishment and Regulation of Saw-Mills and other Wood based Industries) Rules, 1982, under which any one seeking a license to run a wood based industry has to first proclaim that the enterprise will not be dependent on the resources from the Forest Department, and that it will be able to sustain itself independently. Apparently, the matchwood industries have been adversely affected by the non-availability of resources at the state level, due to this law. Evidently, this law provides only a compromise measure for the conservation of resources, in view of the fact that the resources are not available, and it also gives an incentive to the industries to generate their own resources. However, the success of such a policy

depends much upon the land use policy of the state, in terms of the availability of free-hold land for private forestry as well as the regulation of the timber market. These issues need to be considered separately. Before we turn to this there is one more issue that needs to be looked at carefully, this relates to use of the free-hold or government land for purposes other than forestry, such as for tea and coffee plantation.

c) Tea Gardens.

Most of the existing tea gardens lands in West Bengal are under the regulation of private authorities, and mainly on revenue lands leased out to these authorities on a long term or perpetual basis. Such lands , therefore, do not come under the provisions of the Forest Conservation Act or the administration of the Forest Department.. Under this Act, however, any new lease of forest lands for tea gardens would constitute a non-forestry purpose use of the land, and, hence, would require permission from the central government, under Section 2 of the Act.

Some of the lands with the tea gardeners are 'resumed lands , that is lands which were transferred by the Revenue Department to the Forest Department earlier (before the coming of the Forest Conservation Act), and leased out to the tea authorities. New leases on such lands would

necessitate taking permission from the central government, under the Forest Conservation Act.

Since the gardens are, by and large, on revenue lands, the Forest Department is not obliged to regenerate these lands. They can (and have), however, assist the tea authorities to carry out afforestation on their lands.

The tea growing enterprise constitutes an 'industry' under the Industrial Regulation and Development Act. As such they are entitled to get forest resources from the Forest Department at a subsidised rate. Till about two years ago the Department had been supplying the gardens with about 75,000 M3 of timber. At present this has come down to about 25,000 M3. All this wood has been supplied at a subsidised rate of Rs.250/- per metric ton, whereas the market rate has been about Rs.600/-. Legally, the Forest Department is not obliged to supply timber to the tea gardens, and certainly not at a subsidised rate. As noted earlier, these subsidies are a dis-incentive to the tea authorities to grow their own forest resources and become self-sustaining.

The 'resumed lands' which were transferred to the Forest Department and later leased to the tea gardens were, very often private forest lands, acquired under the West Bengal Private Forest Act, or the Indian Forest Act. As such most of these lands were burdened with either customary rights

or statutory rights of the people under the forest laws. When these lands were leased to the tea gardens the rights were also transferred along with the lands. Over the years most of the forests on such lands have been either denuded or converted into tea gardens, the rights of the people, however, still legally exist. The satisfaction or realisation of these rights is a matter of private arrangements between the tea authorities and the people. The Forest Department does not come into the picture. The tea authorities are legally free to either provide timber and other usufructs to the people or simply pay them compensation. The violation of the rights, however, will at once attract Articles 21 and 39 (b) & (c) of the Constitution, and the people will have a recourse to the courts to find appropriate remedies. To meet the rights of the people there is nothing in the law which prevents the tea gardens from growing fuel wood species and supplying the resources to the people and to themselves. Alternatively, under compensatory arrangement, the tea authorities could provide coal or kerosene to meet the fuel rights of the people. The government cannot dictate this through a law or notification.

4. Private Forestry and the Land Laws.

Commercial and social forestry need not be limited to forest areas alone. It can also be supported by private forestry, which can be carried out not only by farmers but also by groups , such as societies, cooperatives and village panchayats. However, the possibility of successful private forestry depends a great deal on the general land use policy of the state and the legal framework that governs such private lands and the resources grown on them. Private forestry for industrial or other purposes will, therefore, require a consideration of land-use policy and the legal framework for private lands in general. It is to these considerations that we must turn now. It must be kept in mind that even the productive forestry by Forest Corporations is closely tied up with the availability of resources from private sources.

There are a number of laws which directly or indirectly determine the land use practice in West Bengal. The land use policy (the one in actual practice) is, therefore, the one that these laws prescribe and not what any other official land use policy may say, including the National Forest Policy. (Or government notifications which say that cooperatives, non-government organizations and other private agencies must be involved in the afforestation and use of land). Some of the important laws

which determine land use and what sort of individual or organization can actually use it, are :The West Bengal Agricultural Lands (Ceiling on Holdings) Act, 1961; The West Bengal Non-Agricultural Tenancy Act, 1949; West Bengal Land Reforms Act, 1955; The West Bengal Estates Acquisition Act, 1953; The West Bengal Urban Land (Ceiling and Regulation) Act, 1976; the West Bengal Private Forests Act; and The West Bengal Forest Produce Transit Rules. Evidently, it is neither possible nor necessary to go through the diverse provisions of these Acts. The general land use policy and practice must be analysed within the context of these laws, since at the ground level they determine the type of forestry that is possible outside the forest lands and consequently the use of such lands.

a) The Land Ceiling and Land Reforms Laws.

The West Bengal land ceiling laws limit private ownership to 12 acres of agricultural land for a family. There are relaxations for farmers cooperatives and joint farmers groups, but these are for agricultural purposes only. Richer landlords and industrial companies carry on forestry work on fertile agricultural land through the various loop holes in the law. An economically viable forestry work evidently requires much larger pieces of

consolidated land than is available under the ceiling laws.

Since forest land is controlled by the forest department, and since the department, in any case, is willing to supply the resources from such lands, the industries direct interest is in exploiting the fertile agricultural lands for generation of raw material, and not wastelands. Economic costs and productivity clearly make it more practicable for the industries to go in for the fertile agricultural land than wastelands, so long as this is possible under the laws (through the loop-holes). Given this market and legal logic, the natural consequence will be that over the years the area of wastelands (denuded forest lands) will progressively increase and more and more of the fertile agricultural land will be converted to forestry purposes. This is already being seen in many states, such as Haryana and Gujrat. Also, for absent landlords plantation of trees becomes a method of protecting their land from encroachment and the hassle of agricultural laws (such as the rights of the tiller if he tills it for more than a certain number of years). Such landlords are not really interested in good quality productive commercial forestry, even a minimum return will do, so long as their land remains protected. A great number of 'farm forests' in West Bengal (including in Haryana, Gujrat, U.P., and other states) seem to be of this type,

which is all right from the point of view of the landlords but not good from the point of view of national economic productivity.

Now a clear headed thinking and understanding of land use is required here --- as to how much of the fertile (irrigated) land does a state want to reserve for agricultural purposes and how much can it put in for forestry. This evidently depends upon the state's food and agricultural policy besides the forest policy. It is no point having land ceiling on agricultural land without putting it in this total context.

The basic question is: has the state used more of the productive (irrigated) land for food production than is required in its food policy ? If that is so the state must determine the extent to which land is required for agricultural purposes, and remove the ceiling on the rest of the agricultural land, making it possible for the industries, cooperatives and non-government agencies to commercially exploit such lands for forestry purposes. This is not to suggest any resurrection of landlordism (zamindari), the ceiling law should make it clear that it will not apply only in cases of group ownership , such as of companies, cooperatives, NGOs and panchayats, and that too only for the purposes of forestry. In some states, such as Gujarat, the government has already exempted

cooperatives from the province of ceiling laws.

If, on the contrary, it is perceived that the fertile agricultural land is barely sufficient for food production for the state, it is necessary to find legal means to eliminate forestry on agricultural lands. In such a situation it is not only necessary to enforce the existing ceiling law more stringently, but also necessary to pass another law totally banning forestry on agricultural land. Such a step is urgently required even for the development of waste lands (denuded revenue or forest lands), for , as noted, so long as it is economically cheaper and more profitable to do forestry on agricultural land why should any industry turn to the waste lands ; and also so long as the forest department is allowed to give the resources from the natural forests to the industries why should it really bother about the development of waste lands ! If the state perceives that the protection of both the natural forests and agricultural land is of paramount importance, and that the wasteland need to be developed, then this double pronged legal strategy is the only way out, namely, ban the supply of raw materials from natural forests and ban forestry work on agricultural land. This will force the development of wastelands, which would evidently be less profitable immediately, but more profitable and sustainable in the long run for industrial development. After taking

these two steps the wastelands (revenue and forest lands) can be allotted to the industries, cooperatives, panchayats, NGOs and other agencies, with strict provisions that the land can be used for forestry purposes only (the provisions of the Forest Conservation Act will not be violated). Allotment of the wastelands without taking the above two steps is unlikely to lead to the regeneration of wasteland.

One of the major reasons why the Forest Corporations have not been successful is precisely due to these two factors --- the continued supply of raw material from the natural forest resources, and the industries attempts to get the remaining resources from private lands . There is very little economic or legal necessity for the Corporations to develop the wastelands for commercial purposes --- which is the essential task given to them. Legally the Corporations are competent to enter into joint financial ventures with the industries (on a joint management and joint capital investment basis). But in the present conditions it makes little economic sense for the industries to enter into such joint ventures with the Corporations. The formation of the Corporations is in itself not a wrong or bad legal strategy, it is a method of retaining the ownership and control over forest lands, as public (government) lands, and still at the same time

allowing the industries an access to such lands. But the economic viability of such a strategy is related to the corresponding availability of the resources from forest and private lands, that is, on the demand and supply situation. So long as the demands continued to be met from these other sources the function of the Corporations will continue to be marginal.

Which of the above two legal strategies is more appropriate for the state --- whether banning forestry on agricultural land or liberalizing forestry on such lands, is a decision which can be taken only through mutual discussions between the Ministry of Forests, the Ministry of Agriculture and the Revenue Department, depending up on the amount of land required for food production, etc. Agricultural land, being a state subject, can be handled by the Department of Revenue and Department of Agriculture alone, whereas for forest lands both the state Ministry of Forests and the central Ministry of Environment are competent to take the decisions.

b) Private Forests Regulation Laws.

Through the West Bengal Private Forests Act and the Estates Acquisition Act, which are still operative, all private forests can be regulated by the government (Forest Department). The Act makes all forests grown on private

lands liable to be acquired by the state and hence provides a deterrence to the people to carry on private forestry. The reason for the enactment of this law at that time was the observation that the landlords did not really care about the forests and that the lands were getting progressively more and more denuded. But in the present context, evidently, such a law is contrary to the possible success of any private forestry, even if the ceiling law is changed. There seems to be an ubiquitous apprehension (and a genuine one) amongst private land owners that land planted with trees are liable to be going out of their possession and control. There is also a similar apprehension at the official level that revenue and private lands planted with trees will be regulated by the centre and go out of the control of the state level officials, due to the Forest Conservation Act. Both these apprehensions are antithetical to the growth of private forestry, whether by individuals or groups.

The provisions of the Private Forests Act obliviously need to be rationalized if private farm forestry is to be encouraged. Now that it has served its purpose --- of acquiring denuded and surplus ceiling lands, it should not be made to apply to all new private forestry ventures.

The scope of the Forest Conservation Act also needs to be similarly made explicit so that it does not include

village forests (panchayat forests), private forests, and forestry by NGOs and cooperatives, even if done on forest lands or revenue lands allotted by the government. Such forests need to be regulated by other state made laws, such as within the Panchayat Acts, Cooperatives Acts, Societies Act and the Companies Act.

According to the National Forest Policy the rural areas are to be made self-sufficient in their resource requirements, specially fuel and fodder needs. As such a general thrust of the forestry plan should be to re-create as many village forests as possible which will be maintained on a sustained yield basis. Where villages do not have land for such forests revenue or forests land need to be allotted for this purpose. This has been partly the thrust of the social forestry programmes. The spirit of the Private Forests Act, the West Bengal Forest Act and the Forest Conservation Act, however, seem to be oblivious of this demand of the National Forest Policy.

c) Forest Produce Transit Rules.

This act, through its schedule, restricts the kind of trees that can be felled and transported from private lands. These restrictions become dis-incentives for private enterprises, and indirectly determine the species that are planted on private lands (that is species which fall out

side the schedule, such as ecalyptus, acacia and popular , and for which official permissions will not be required). This law, therefore, although it is not its intention, decides land use for forestry in a major way, in so far as private and revenue or panchayat lands are concerned. There is a need to rationalise the law, by making it apply only in areas where natural forests exist and their protection is required. In all other areas the people must be free to select the species (and determine land use) according to their needs.

It is only after the amendment of these land and resource laws that people can freely and effectively participate in forestry work. It is a well recognised fact now that the Forest Department alone cannot provide all the growing fuel, fodder and timber needs of the people. The manpower required to generate the resources for providing such basic needs would be on the same scale as that of agriculture, and such manpower is just not available with the Forest Department. The involvement of other agencies, such as private farmers, non-government organisations, cooperatives and statutory bodies like the panchayats and municipal corporations, is inevitable. Let us turn to note the other legal factors, besides the land laws, that need to be taken into account for a successful people's involvement in forestry.

5. Joint Management and People's Participation.

The major agencies, besides the Forest Department, who can engage themselves in forestry work are: NGOs, cooperatives, panchayats, municipalities, notified groups (such as Forest Protection Committees, Mahila mandals, Yuvak Mandals, etc.), and educational and religious institutions. The institutions, evidently, can be only marginally involved since their main tasks are of a different nature.

The June, 1990 Notification of the central Ministry of Environment has directed all state Forest Departments to involve NGOs, cooperatives and other private agencies in forestry work. The Notification provides usufruct rights to such agencies and not land allotment. This is indeed a progressive step, but the problem is that the number of NGOs and cooperatives are too few to carry out the volume of task required. Moreover, most of the non-forest lands are already vested with the panchayats, municipalities and other statutory bodies. Hence the only type of land available are the wastelands with the Forest Department, which come under the purview of the Forest Conservation Act. Vide the June Notification, it can be presumed that the permission has been given by the Centre to involve the NGOs, cooperatives and other private agencies, to work on

the forest land. The Forest Department needs to encourage this where possible.

It is interesting to note that the attempt to involve people on forest lands stands in direct contrast to the earlier social forestry programme where the main thrust was on assigning usufruct rights on revenue lands and keeping people away from the forest lands. (See for example, West Bengal government Notification No: 9110(15)-G.E./423/84' Norms for distribution of vested/wastelands.). This model did not work because ,first, there was not enough revenue land to distribute or give usufruct rights on, and second, people's rights were not legally secured and hence their involvement was superficial.

In a latter model the government took over vested/ non-agricultural lands from the panchayats and handed them over to the Forest Department, on the promise that the Department will carry on community based forestry on such lands. This model, in fact does not amount to people's participation. It has the same legal thrust as that of the Private Forests Act or the Estates Acquisition Act. (This model is being tried through the West Bengal government order No: G.O. No.2749(16)-G.E. of Cal 3.4.90).

West Bengal has taken the progressive step of forming Forest Protection Committees, with which the Department is willing to share 25 per cent of usufructs for protection of

the Department's plantations. The decision to share 25 percent is on an arbitrary trial basis. The noteworthy fact about these Forest Protection Committees is that in their organisation the government has incorporated the chief members of the panchayats so that there is no conflict of interest between these Committees and the panchayats. The Forest Ranger, however, still holds more responsibilities and decision making powers than the village sarpanch (elected head of the village council) within the functioning of the Committees. (The relevant government orders are: 4461-For.D/IS-16/88; 5962-For/D/IS-16/88, dated 12.7.1989 and 27.7.1990, respectively.)

Although the formation of such Committees is administratively advantageous, it must be noted that these agencies formed by government departments through orders, are purely *ad hoc* bodies who do not have a legal standing, they have only an administrative recognition for the purposes defined and from the concerned government Department. A new government or administrative agency is not bound to necessarily follow the orders of the earlier government. Moreover, being non-statutory bodies, such agencies have no legal power to bargain with the Department for terms and conditions, nor are they eligible for credits or loans from Banks or other funding agencies. Also, when it comes to actual work such agencies will

have to work on lands which are, by and large, allotted to panchayats, municipalities and other statutory bodies, such as the Forest Department. As concerns panchayat lands although the panchayat can pass a resolution to allow such ad hoc committees to work on its land the final power to use the resources or define the rules of benefit sharing remains with the panchayat and not with the Committee. On forest lands, of course, the Department can set the benefit sharing rules.

In the final analysis it is only the elected, statutory and constitutionally warranted bodies, namely the panchayats and municipalities, which are the legally viable agencies available for forestry work. So long as these democratically elected bodies continue to exist they will continue to make demand both on land and its resources. Therefore it will be wiser for the Forest Department to work with these agencies and strengthen them, rather than set up a number of new agencies who have no statutory standing. The Forest Protection Committees can be set up as a committee under the Panchayat Act, the Act provides for this, rather than an agency legally separate from it. In terms of numbers too the panchayats and municipalities are ubiquitous. There is no question of the non-availability of such agencies. Once the agency with which the Forest Department has to work for the purposes of social forestry

has been settled, there are a number of other minor issues that need to be attended to for ensuring success.

First, the schedule of 'forest trees under the Forest Act needs to be rationalised so that people have a much greater freedom in selection of species. The rules need to be enforced only in the vicinity of genuine reserved or protected forests and not on all private lands.

Second, the transit of timber rules, under the Transit Rules, needs to be similarly rationalised. Again, they need to apply only in areas where there is a genuine possibility of theft of government timber, that is, close to government forest areas. The rule need not apply in all places.

Third, the state government must ensure that for forestry work the people get at least wages in accordance with the Minimum Wages Act. The work under this Act can be classified as 'industrial labour' so that people are attracted to undertake forestry labour.

It has been argued that the best legal strategy will be to empower and engage the panchayats in all rural areas to carry out forestry work so that the villages become self-sustaining. Since this is a central idea for social forestry it needs to be explored and explained in greater detail. The viability and legal requirements of village forests will be explored in what follows.

6. Village Forests.

To generate the forests which will serve the people's fuel, housing and other timber needs, it is necessary not only to change the tree felling and species regulations laws, as mentioned earlier, but also to amend the basic statute which regulates the elected people's organization at the grass root level, namely the Panchayat Acts. Presently, by and large, people's fuel and timber needs are being satisfied from forests with the forest departments. A major cause of denudation is the unregulatable usurpation of the resources by the people from the forest areas. The need to create village forests is, therefore, immense if the remaining natural forests are to be protected. Under various social forestry programmes attempts have been made to create community woodlots or village forests on panchayat or revenue lands. Such forests have been generated by the forest department and often simply handed over to the panchayats, without the requisite legal safeguards for the management, protection and sustenance of such plantations. In Maharashtra, for example, three year old plantations have been handed over to the panchayats, without any conditions being laid for the future. Numerous examples of social forestry, such as in Tamilnadu, has shown that such handing over does not at all guarantee the future continued existence of such forests. A permanent

solution can come about only if amendments are made to the Panchayat Act itself, and not merely through government orders or notices. The panchayat acts must necessarily incorporate the following types of changes. The Act under consideration here is the West Bengal Panchayats Act, along with the Rules made under this Act, which are applicable to the whole of West Bengal.

a) The Act must provide that the land vested in the panchayats (or allotted to it by the revenue or forest department) cannot be used for any non-forestry purposes, in the same way as the Forest Conservation Act restricts use of forestry land. The West Bengal Village Panchayat Act gives power to the state government to vest land in the Panchayats. Some of the lands earlier vested in the panchayats, which became encroached or were being cultivated for private purposes, were acquired by the state government under the West Bengal Private Forests Act. The fact that lands vested in the panchayats get encroached does not by itself become a good reason to take the land away from them. Land encroachment also occurs on revenue, forest and other public land. By this logic such lands would have to be acquired from the state too and nationalised. What one has to find is the reason due to which the panchayat lands get encroached and then try to remove these difficulties. If one looks at the functioning

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of the panchayats the difficulties are not too difficult to discover. So far the panchayats have simply not been provided enough funds even to hire a guard who can protect the panchayat lands and the resources on them. The financial and managerial infrastructure required to utilise the common lands has just not been available with the panchayats. Simply vesting land or resources in the panchayats and putting duties on them to protect these resources, as the Panchayat Acts do, will not work. Duties cannot be performed without the correlated powers and rights. Like other Panchayat Acts, the West Bengal Panchayat Act provides for 'panchayat funds' from various sources (section 57). Development funds can be provided to the panchayats (as village funds) by the state government, with clear instruction and restrictions, that such funds are meant for the purposes of village forests only, for works such as salary of forest guard, fencing, seedlings, and other protection measures. Funds can be directly allotted to the panchayats by the state government under the Panchayat Act.

b) The Panchayat Act must bar clear felling of village forests. It must allow harvesting on a rotational basis, in a scientific manner, in consultation with the forest departments.

c) The Act must necessitate that 20 per cent (or more) of the revenue earned from harvesting of the village forests must go back into the regeneration of the forest.

d) The Act must lay down clear rules for benefit sharing and use of the forest resources, as well as the duties involved in planting and protection.

e) The Act must allow the panchayats to retain the funds generated from forestry work and include it in the village development fund. At present revenue arising from common village resources go to the Zilla Parishads and then finally to the state government. No group of people can ever be interested in simply developing a resource when they know that they will have no control over the benefits arising from it.

f) The Panchayat Act empowers the panchayats to form committees. The state must instruct the panchayats to set up committees for protection of village forests and for ensuring benefit sharing. Funds must be provided to the panchayats to set up and operationalise such committees.

In brief, if village forests are to exist, the Panchayat Act must embody some of the important features of the Forest Act and the Forest Conservation Act. Necessary amendments to the panchayat acts in this respect

is a matter of urgent necessity. After these amendments are made land allotment to village panchayats (under section 51 of the Panchayat Act) needs to be done, wherever possible to maximise the number of village forests and lessen the burden of the Forest Departments. Both revenue and forest lands could be allotted to the panchayats for creating and sustaining village forests. It must be remembered that a great deal of land presently with the Forest and Revenue Departments are precisely those which were once with the villages as forest areas and were acquired by the state under the Forest Act or the Land Acquisition Act.

7. Protection of Wild - Life.

Protection and conservation of natural forests and wild life is tied up in a major way with the resource use. The major reason why the natural forests have been depleted in this century is its uninhibited exploitation for industrial purposes. Unless the wastelands, common lands and private lands are now developed to provide the industrial and domestic needs of the people there is little hope for conservation. One way in which such lands can be developed early and efficiently is by creating a legal need to do so by totally stopping the supply of resources from the natural forests. The central government's guidelines,

under the Forest Conservation Act, to stop clear felling forests, is a step in this direction. However, as noted earlier, there is a need to amend the Forest Conservation Act itself to regulate the resources and not merely the land.

The operative Wild Life (Protection) Act, 1972, protects the life of certain species of animals and birds. It does not, however, deal with the protection of flora and biodiversity in general, nor does it concern itself with the habitats of such flora and fauna, the protection of which is essential if wild life is to be protected. A comprehensive and practical Wild life Act needs to operate with a larger concept of protection which must include the flora as well as the habitat. The Act needs to be accordingly re-formulated. To enforce the Act on a rational basis all the sensitive areas of significant bio-diversity need to be identified. The survey of forest areas that is presently taking place in West Bengal, under the Five Year Plan programme, takes note of the tree species alone. There is a need to have a more comprehensive survey which must include wild life. On the basis of this survey all remaining areas of significant bio-diversity need to be declared as national parks or sanctuaries.

The fact that protection of forest areas involves protection of total habitats is not understood, and hence

not included, in the existing forest laws. The Indian Forest Act, 1927, needs to be amended to include watersheds and catchment areas and totally protect them, if water resources are to be available for the growth of forests. Mining in forest areas, similarly, needs to be strictly regulated under the Forest Act. At present it concerns itself merely with the giving of licenses. The guidelines under the Forest Conservation Act demand compensatory afforestation, but as yet it does not include provisions for proper soil conservation measures. Instead of monitoring compensatory afforestation from the Centre, it would be better to amend the Indian Forest Act so that soil conservation and afforestation can be made compulsory in all cases of mining and monitored by the state government.

8. Forest Villages.

A major issue in the protection and conservation of natural forests and wild life is that of villages or settlements inside the forests. In some states, such as Maharastra forest villages have been transferred to the Revenue Department, and hence these villages are legally classified as 'revenue villages'. This implies that the normal development work under the Tribal Sub-Plan and other programmes can take place in these villages without

confronting the provisions of the Forest Conservation Act. In West Bengal, on the contrary, there are no revenue villages inside the forests, there are 108 villages inside forest areas all of which are classified as forest villages. Of these 49 villages are encircled by reserved forests. To remove any confusions about the application of the Forest Conservation Act to the villages inside forests and developmental works therein, the central government has issued an explicit Notification which states that developmental work can be carried on in such villages provided the state makes the grant of heritable and inalienable rights of lands to the forest dwellers. (Notification No: 11-39-83-FRY (Cons), Ministry of Agriculture, dated 23.3. 1984; and No. 11-39/83-FC, Ministry of Environment and Forests, dated. 31.8.1988.). However, the states, including that of West Bengal, have not been forthcoming in making such inalienable grants to the forest dwellers. They have been more interested in rehabilitating the people in non-forest areas, due to various reasons. Consequently, the developmental programmes have not been extended to the forest villages. In West Bengal only the centrally sponsored Jwahar Rojgar Yojna (an employment scheme) has been sanctioned for such areas. The government, at the same time, is making plans to move the 49 villages out of the reserved forest areas.

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It must be noted that the dwellers in the forests have a fundamental rights guaranteed to them under the Indian Constitution --- Article 19(1), the right to reside. They can appeal both to the High Court and the Supreme Court if the government attempts to forcibly evict them.

However, on the other hand, it would be equally important to note that where such villages fall within areas which are national parks or sanctuaries, or where protection and conservation measures are essential, development works, such as road construction, are evidently counter-productive. The issues involved herein need to be considered carefully. It is often made out that in such areas there is a conflict between 'development' and conservation. A deeper scrutiny at the situation will make it clear that in fact the conflict, where it does exist, is external. It is usually the local political process which demands such development works, not the tribals or the forest dwellers. The funds provided for such work too, by and large, remain with these external agents. What the tribals and forest dwellers have been basically demanding since long is the preservation of forests, it is the forest resources that they need. In the interest of such people and in the interest of the biogenetic diversity there is an urgent need to cease all 'development' work in the sensitive protected areas and enforce the law strictly for

conservation. The areas need to be protected along with the tribals and forest dwellers. The argument that denial of 'development' work in the protected areas is violative of article 14 of the Constitution (equality before the law), holds no grounds in this case, because, first, the preservation of these areas is to be done in the interest of the forest dwellers and in national interest; and second, in the long run development of these areas consists of their preservation and not destruction. It is likely that the forest dwellers may want to lead a modern urban life-style in the coming future. This does not mean that this needs to be provided in their very habitat. Millions of people have migrated in India from rural areas to urban areas for better opportunities, and have also migrated outside India for the same reason. The forest dwellers can do the same, but, off course, the option must be theirs. If the forests are preserved they have a genuine choice, to remain within or migrate to other areas, but if the forests are to be destroyed the options are fore closed. For the sake of leaving the options open for the forest dwellers and for the future generations protection and conservation of forests is a matter of utmost significance.

INDIA'S WASTELANDS DEVELOPMENT PROGRAMME*

1. Introduction :

1.1 The total land mass of India measures 329 million hectares. About a century ago, vast areas in the country were full of tree growth and greenery. Over the years, excessive felling of forests, especially in ecologically sensitive areas, overgrazing of pastures, indiscriminate use of forested and fertile lands for industrial and other development, inappropriate agricultural practices and other factors have all contributed to the creation and spread of wastelands.

1.2 As a consequence, today almost half the land mass of India is estimated to be degraded. This degradation varies in nature and intensity from region to region but afflicts land under agriculture, forest, pasture and settlement.

1.3 In scientific terms, the creation of wastelands has been attributed to factors such as sheet erosion, waterlogging, salinity and alkalinity, wind erosion, stream erosion, shifting cultivation, sand dune movement, etc. The significance of wastelands lies in the fact that they are largely man-made and cause misery to millions of the rural poor. Degradation of land resources increases poverty, which in turn results in more degradation of land. Thus, as the environment degrades, the demands of fuelwood, fodder and timber of an ever-increasing population mount, the poor begin to exploit even more intensively, setting into motion a vicious cycle, which results in the breakdown of ecological processes and life support systems.

2. Description of Wastelands :

2.1 The Ministry of Agriculture had initially classified land into the following nine categories, according to the use to which the land is put:-

- Forests
- Non-agricultural land (i.e. towns, roads etc.)
- Barren and uncultivable land
- Permanent pastures and other grazing land
- Tree crops and groves (i.e. economic planning)
- Culturable wasteland (i.e. potentially arable)
- Fallow land other than current fallows
- Current fallows
- Net area sown

2.2 It would appear from this that barren land, potentially arable land and fallow land is waste. But categories such as forest, permanent pastures and net area sown also include degraded land. Therefore, defining wastelands on the basis of land-use statistics is unsatisfactory.

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2.3 Wasteland is better described on the basis of the quality of the land, and the kind of land degradation problem it suffers from.

2.4 Till a decade ago, no attempt had been made to collate the available information, map out such areas and categorise them. The first comprehensive review was done by the National Commission on Agriculture (Ministry of Agriculture 1976), which estimated that approximately 175 million hectares of land in the country was affected by problems of soil erosion and degradation. This included 104 million hectares of cultivable land (including 87 million hectares of eroded lands and permanent pastures), 19 million hectares of forest lands, 8 million hectares of uncultivable non-forest land, 43 million hectares of lands with special problems (saline, alkaline, deserts, ravines, etc.).

2.5 Another estimate is that of the Society for Promotion of Wastelands Development, according to which there are 93.7 million hectares of non-forest wastelands. If the figure of 35.9 million hectares of degraded forest lands (as per one estimate) is added, this would give a figure of 129.6 million hectares of wastelands for the whole country. Statewise details may be seen in Annexure I.

2.6 The estimates of wastelands arrived at by the Institute of Coastal and Off-Shore Research (INCOR), Vishakapatnam, on the basis of the maps prepared by National Remote Sensing Agency (NRSA), depicting wastelands on 1: 1 million scale for the entire country, is 55.4 million hectares. However, that these figures are very much on the lower side because wastelands which are less than 100 hectares in area have not been picked up by satellite imagery on 1:1 million scale.

2.7 In view of the conflicting estimates, as also the absence of an agreed definitive categorisation of wastelands, the National Wastelands Development Board (NWDB) requested the Planning Commission to set up a Technical Task Group consisting of experts and representatives of the Departments of Govt. of India concerned with land use to recommend an agreed definition and categorisation of wastelands. This Group prepared a preliminary report in 1986.

2.8 On the basis of this report, apart from requesting the State Governments to conduct detailed surveys and document all land suffering from physical and other deficiencies or under sub- optimal use, the NWDB worked out the description and classification of wastelands. Wastelands were described as:

"Degraded land which can be brought under vegetative cover, with reasonable effort, and which is currently under utilised and land which is deteriorating for lack of appropriate water and soil management or on account of natural causes. Wastelands can result from inherent/imposed disabilities such as by location, environment, chemical and physical properties of the soil or financial or management constraints."

2.9 Besides, the following classification of wastelands was provided :-

(a) Gullied and/or ravinous land.

(b) Upland with or without scrub.

(c) Water-logged and marshy land.

(d) Land affected by salinity/alkalinity -coastal/inland.

(e) Shifting cultivation area.

(f) Under-utilised/degraded notified forest land.

(g) Degraded pastures/grazing land

(h) Degraded land under plantation crops

(i) Sands-desertic/coastal

(j) Mining/industrial wastelands

(k) Barren rocky/stony waste/sheet rocky area

(l) Steep sloping area

(m) Snow covered land/or glacial area.

2.10 Earlier, soon after its constitution in 1985, the NWDB had commissioned the National Remote Sensing Agency to prepare a wastelands map of the country, as well as for each state. These maps depicting different categories of wastelands and their location and extent are now available on a scale of 1:1m for the States and 1:3.5m for the whole country. An overview of distribution of wastelands in the country may be seen in Annexure II.

3. Why are Wastelands created ?

3.1 Essentially, it is faulty land and water management practices which result in land becoming waste and unproductive. There are four main direct reasons:-

- deforestation,
- overgrazing,
- overcultivation,
- unskilled irrigation,

3.2 The first three strip the land of its protective vegetative cover, hastening the process of soil erosion and land degradation. Unskilled irrigation causes special problems of waterlogging and salinity. Both cultivated and uncultivated lands suffer from soil erosion and degradation.

3.3 The underlying reasons, however, can be more complex. This is most discernible in the case of deforestation. The contributory factors are wide-ranging and can be traced back to colonial times, such as :-

- Need for more land for agriculture.
- Urban and industrial demands for timber resources
- Quarrying for mineral resources.
- Land required to build railway lines and roads

3.4 The danger of soil erosion and land degradation is prevalent in many forms throughout the country. In most cases a combination of such problems exist. In absence of comprehensive and periodic surveys, estimates have been made on the basis of localized surveys, estimates and studies. Collating and extrapolating the available information, about 175 million ha., or 53%, of the total geographical area is estimated to be afflicted. Out of these about 150 million ha. is estimated to be affected due to soil erosion by water and wind. Another 25 million ha. is reported to have been degraded through ravines and gullies, shifting cultivation, water logging, alkalinity, salinity, etc.

3.5 An area of about 150 million ha is subject to water and wind erosion, of which about 69 m ha. is considered to be critically eroded. Even though severe wind erosion is restricted to desert areas of North-West, comprising states of Rajasthan, Haryana and Gujarat, wind erosion extends deep into the Indo-Gangetic Valley and prevalent almost all over Deccan India as well as along the coastline

3.6 Ravines are the most spectacular type of erosion. Ravines are found along the rivers of Chambal, Jamuna, Sabarmati, etc. and within the distance of about a kilometer or so from the water line. Gullies generally originate on land having slopes and subject to improper management. Apart from geological reasons, such as uplift pressures, management practices on sloping land and along the streams and the ingress of water into land mass are also the additional causes for such problems.

3.7 The visual impact of deforestation, and of mining in forest areas, is dramatic. Perhaps because of this,the other causes of land being rendered waste draw much less attention. Environment degradation is today all-pervasive and is taking place in every ecologically sensitive region of the country :

- In the Vindhyachal Ranges
- In the Western Ghats
- In the Deccan Plateau
- In the Himalayas
- In the Shivalik Ranges
- In the Eastern Ghats
- In the Chotanagpur Plateau
- In the Aravallis

And in almost every other hill and mountain region.

3.8 Excellent soils, lots of sunlight and water are the very attributes that make India one of the richest countries in the world in terms of its potential biological productivity. But once the land is denuded, nature turns upon itself. The high temperatures dessicate the land, and the water washes away the soil.

3.9 Also, urban settlements attract natural resources from their surrounding hinterland. This extraction often leaves a trail of environmental destruction behind. Even in the rural areas, the trigger for ecologically destructive processes usually arises out of the urban-industrial demands. Apart from deforestation and mining, this can happen through :

- construction of dams;
- extensive use of water;
- water pollution;
- air pollution;
- brick making;
- road making;
- encroachments on good agricultural land, etc.

4. Wastelands Development Programme :

4.1 Efforts to describe and tackle degraded lands or wastelands have been made from time to time. However, the first really major initiative in this direction on a countrywide basis was taken by the Government of India in 1985 when it established the National Land Use and Wastelands Development Council under the Chairmanship of the Prime Minister and State Chief Ministers and Union Ministers as members. This council is to provide national policy guidelines and ensure the necessary coordination between the concerned Ministries and Departments at the Centre and the States. Under this Council, two Boards have been established: the National Land Use and Conservation Board and the National Wastelands Development Board, the first in the Ministry of Agriculture and the second in the Ministry of Environment and Forests.

4.2 During the period from 1985-89, the National Wastelands Development Board undertook several important initiatives. Its main achievements include the following:-

- Wastelands were defined and categorised for the first time
- Wastelandsmaps were prepared for 147 districts in19 States.
- 20-Point Programme Afforestation and Tree Planting targets were achieved. Progress of afforestation through successive Plan periods as shown in Annexure III will reveal that major thrust has been made in this sector from the Sixth Five Year Plan onwards
- About 300 projects of Voluntary Agencies were sanctioned.
- A Peoples' Nurseries scheme was initiated in most States to decentralise production and distribution of seedlings.
- Funding support to Social Forestry was secured under the Rural Employment Programmes.
- Tree Growers/Farm Forestry Cooperatives were launched through the NDDB and IFFCO in 7 States.

4.3 However, a review of the work done in the first fouryears revealed that whereas the 20-Point Programme afforestation targets had been achieved and some other initiatives had also been taken, there were certain serious shortcomings which had not been overcome, as given below:-

- Planning methodology had not been worked out.
- Relevant policy issues had not been resolved
- Action programme had been rather limited in scope :
- it had been restricted to tree planting.
- Thrust in favour of fuelwood and fodder production had been lacking.
- Problems of land degradation and deforestation had not been squarely addressed.
- Management structure created was rather inappropriate.
- People's participation had been limited.
- Effective linkages with the funding and implementing agencies had not been established.

4.4 The overall result was that the Wastelands Development Programme did not progress as well as expected. The need for restructuring and strengthening the programme had been felt for some time. Recognising this, the Government decided to raise the Wastelands Development Programme to the level of a Technology Mission and on October 5, 1989, the National Mission on Wastelands Development was launched. It has since been decided that the National Wastelands Development Board shall guide and oversee the Wastelands Development Programme and adopt a mission approach for enlisting people's participation, harnessing the inputs of science and technology and achieving inter-disciplinary coordination in programme planning and implementation. The role and functions of the Board have accordingly been modified. Essentially the Board will now:

- Formulate, in collaboration with the National Land Use and Conservation Board, a perspective plan for the management development of the wastelands in the country in a sustainable manner.
- Identify wastelands, create a reliable date base and collaborate with the concerned Central and State Departments/Agencies, Local Bodies, Voluntary Agencies and other Non-government Organisations to mobilise the resources and support required for the Wastelands Development Programme including participatory and sustainable management of wastelands especially public/common lands.
- Evolve mechanisms for integrated development of wastelands through systematic planning and implementation, in a cost effective manner, specially to meet the needs of the people in the rural areas in respect of fuelwood, fodder and forest produce.
- Restore, through natural regeneration or appropriate intervention, the forest cover in the country for ecological security and to meet the fuelwood, fodder and other needs of the rural communities.
- Raise fuelwood, fodder and timber on non-forest and private wastelands in order to reduced the pressure on the forest areas and to meet the needs of industry and market.

4.5 The rationale for the mission approach may be summed up as follows:-

- To bring management focus.
- To impart a sense of urgency.
- To make qualitative changes to the ongoing programmes.
- To integrate resources - financial and institutional.
- To provide a mechanism for the resolution of relevant policy issues.
- To evolve a strategy for promoting a people's movement for wastelands development.

4.6 Goals:

4.6.1 In view of this background and considering the need for tackling the serious challenge posed by the rapid expansion of wastelands in the country, the overall goals of the Wastelands Development Programme are to:-

- Check land degradation.
- Put wastelands to sustainable use.
- Increase biomass availability, specially fuelwood and Fodder.
- Restore the ecological balance.

4.7 Strategy:

4.7.1 Wastelands development cannot possibly be a single-point programme. It requires a broader and more comprehensive approach, necessitating an inter-disciplinary and multi-pronged strategy. On this basis, the main elements of the revised strategy are:-

4.7.1.1 People's Participation at all stages, specially through the Panchayats:

No programme howsoever well conceived can succeed without the active participation of the people. This is all the more necessary for dealing with problems relating to land, which affect most people. Hence the need for developing a people's movement for wastelands development and specially for the active involvement of the Panchayats, through whom the process of empowering the people is being carried out.

4.7.1.2 Integrated Land Use Planning on Watershed Basis:

Land use planning is a pre-requisite of land resources management. This is best accomplished in an integrated manner and by taking 'watershed' as the basis. The planning capability is to be built up from below, starting from the village.

4.7.1.3 Village Level Action Plans :

The planning methodology is aimed at preparation of village level action plans, and providing for the land-based needs of the local people, specially the subsistence needs of the target groups.

4.7.1.4 Emphasison Conservation, Ecological Restoration and Natural Regeneration :

The main aim is to aid, facilitate and supplement the natural processes. Management intervention is to be resorted to only where unavoidable. Utmost priority is to be given to promoting natural regeneration and multi-tiered, diverse vegetation, preferably of endemic species. Special attention is to be given to ecologically sensitive areas. The action programme will include soil and moisture conservation measures to check land degradation and improve the hydrological regime.

4.7.1.5 Fuelwood, Fodder and Timber Production:

A concerted effort is required for meeting the ever- increasing needs of fuelwood, fodder and timber in most parts of the country. For this purpose, while on one hand, the productivity of the forest areas has to be improved in a substantial manner, on the other hand, it is essential to take up large-scale and need-based programmes for promoting Community and Farm Forestry on non-forest lands, including private wastelands.

4.7.1.6 Technology Extension:

The focus is on identifying and extending suitable low cost technologies to the field for increasing the productivity of degraded lands in sustainable ways as well as on undertaking research for developing appropriate technologies in this respect.

4.7.1.7 **Resolution of relevant Policy Issues:**

The main issues relate to land use mechanisms, grazing and livestock management and reducing the pressure on the forests in the country. Success would depend on the manner in which these relevant policy issues are addressed and resolved.

4.8 Target Areas:

4.8.1 Considering the main categories of degraded lands in the country, the target areas are:-

(a) Degraded Forest Areas.

(b) Degraded Pastures and Public Lands.

(c) Private Wastelands and Dry Farm Lands.

4.9 Approach:

To implement the revised programme, the composition, role and functions of the National Wastelands Development Board have been revised and the Board has now adopted a mission approach for enlisting people's participation, harnessing the inputs of science and technology and achieving inter-disciplinary coordination in programme planning and implementation.

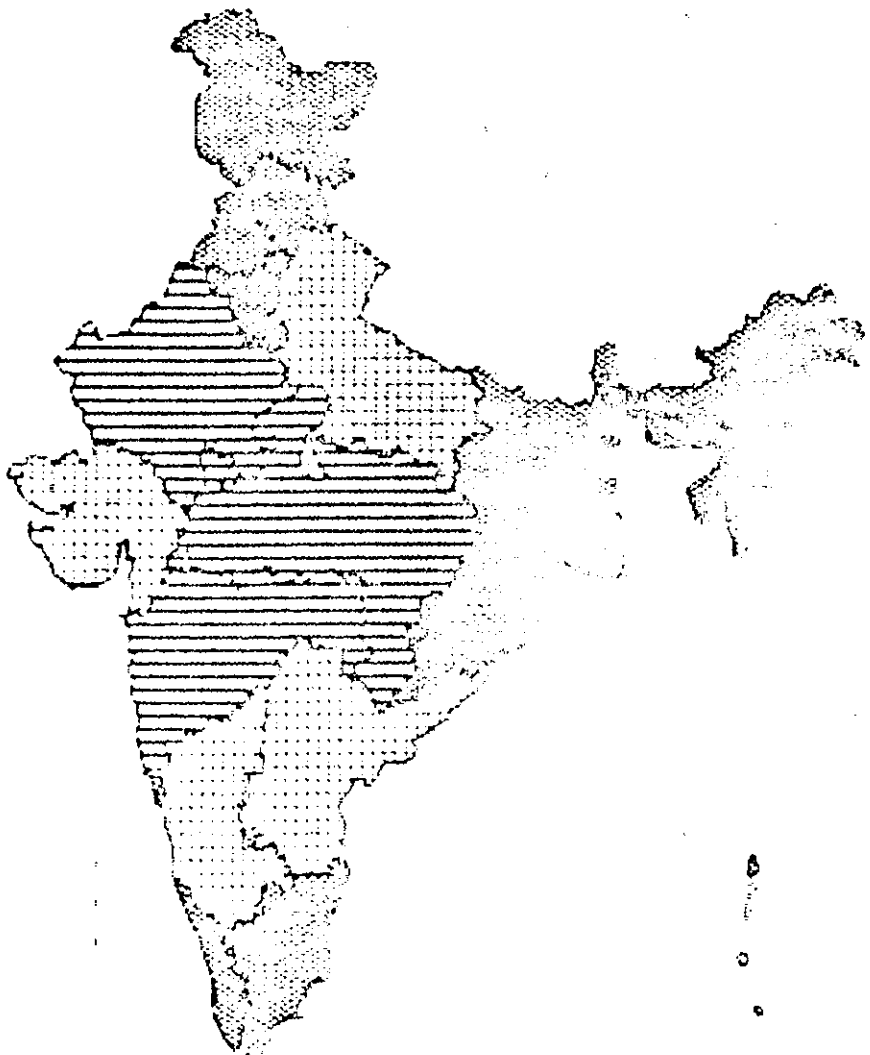
Annexure I

ESTIMATES OF WASTELANDS IN INDIA (IN LAKH HECTARES)

States/UT	Non-Forest Degraded Area	Forest Degraded Area	Total
Andhra Pradesh	76.82	37.34	114.16
Assam	9.35	7.95	17.30
Bihar	38.96	15.62	54.58
Gujarat	71.53	6.83	78.36
Haryana	24.04	0.74	24.78
Himachal Pradesh	14.24	5.34	19.58
Jammu and Kashmir	5.31	10.34	15.65
Karnataka	71.22	20.43	91.65
Kerala	10.53	2.26	12.79
Madhya Pradesh	129.47	71.95	201.42
Maharashtra	115.60	28.41	144.01
Manipur	0.14	14.24	14.38
Meghalaya	8.15	11.03	19.18
Nagaland	5.08	8.78	13.86
Orissa	31.57	32.27	63.84
Punjab	11.51	0.79	12.30
Rajasthan	180.01	19.33	199.34
Sikkim	1.31	1.50	2.81
Tamil Nadu	33.92	10.09	44.01
Tripura	1.08	8.65	9.73
Uttar Pradesh	66.35	14.26	80.61
West Bengal	21.77	3.59	25.36
UTs	8.89	27.15	36.04
Total	936.91	358.89	1295.80

N.B. The above estimate is not based on a country-wide survey of all wastelands in the country.

WASTELANDS IN INDIA



LEGEND
(ESTIMATED AREA)

A >10 m. ha.

B 5-10 m. ha.

C <10 m. ha.

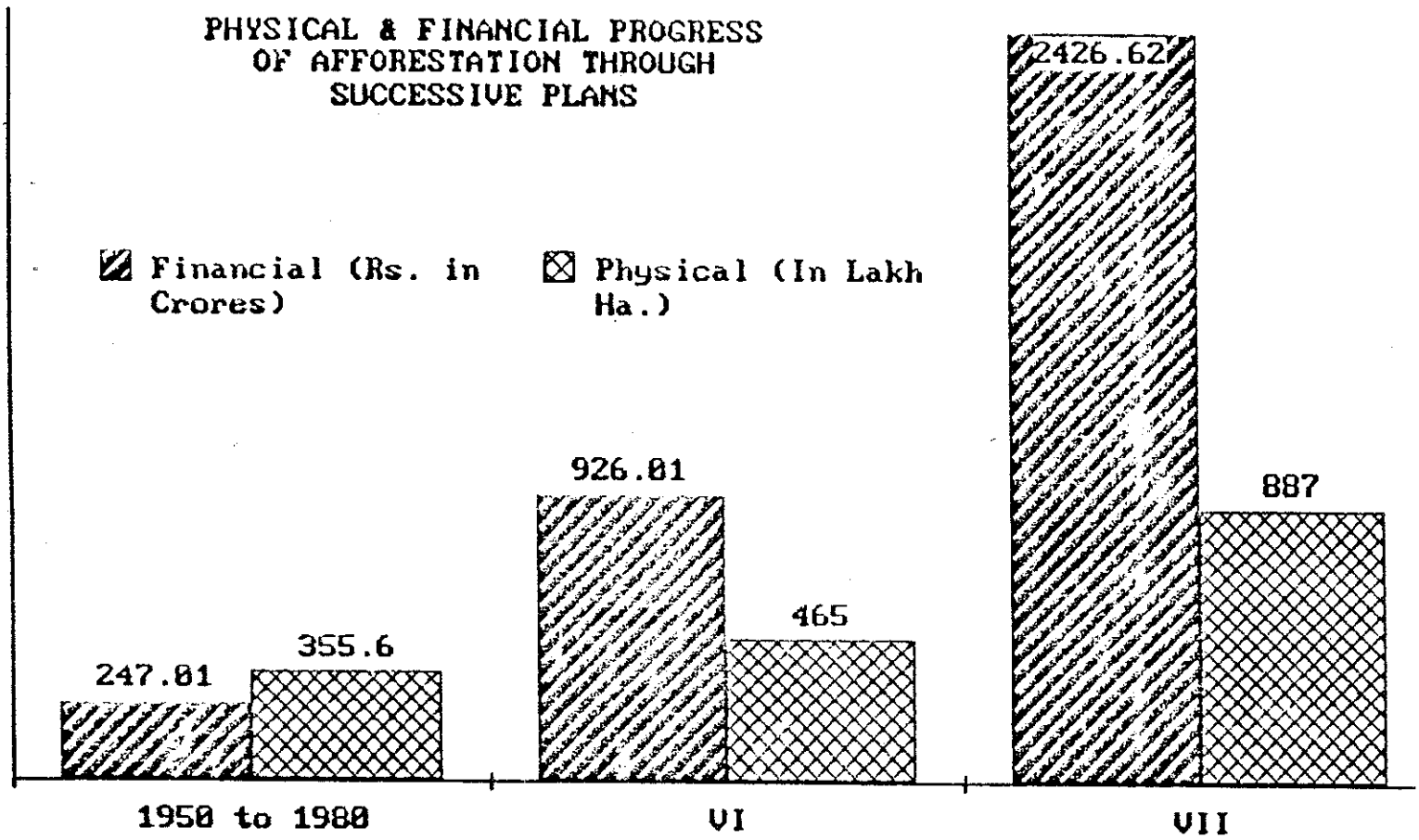
STATES

A MADHYA PRADESH
RAJASTHAN
MAHARASHTRA

B GUJARAT
KARNATAKA
ANDHRA PRADESH
UTTAR PRADESH

C OTHER STATES

Annexure III



BIODIVERSITY, BIOTECHNOLOGICAL ENHANCEMENT AND SUSTAINABLE MANAGEMENT OF DEGRADED LANDS

by
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Biodiversity, Biotechnological Enhancement and Sustainable Management of Degraded Lands

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INTRODUCTION

Advances in crop productivity in recent decades have helped to keep food grain production above population growth. At the same time, it is becoming increasingly evident that unless the technologies used to raise productivity further are of a kind that yield improvement is not accompanied by a dimunition in the biological potential of the soil, depletion and pollution of ground water resources, loss of genetic diversity and increase in biotic and abiotic stresses, we will enter a blind alley in yield enhancement. The concept of Sustainable Agriculture or agricultural practices which can help to improve production and productivity without harm to environmental capital stocks such as land, water and biological diversity, is hence gaining ground. This concept is also sometimes referred to as Ecological or Alternative agriculture. A major strategy in this area is the replacement of fossil energy based inputs with biological ones.

Biodiversity is the total variability within all living organisms and the ecological complexes in which they exist. The loss occurs at every level of biological organization. The survival of a species receives more public attention than the protection of diversity within a species, but it is diversity within species that is the key to their survival in nature in the long term. Further, genetic erosion as a whole receives less

attention since unlike soil erosion, it is not visible to the naked eye. Therefore, biodiversity conservation strategies should help to strengthen and not erode the livelihood security of the people of the concerned area. Special attention is to be given to strengthening community efforts in the conservation of biological diversity through farm women and men, community leaders, NGO's and young students and reesearch scholars. Special training programmes will have to be organized for administrators and policy makers whose action or inaction will influence the rate of genetic erosion.

It has been estimated that by the year 2020, the global population may reach a level of 8 billion. The proportion of such population living in developing countries will be about 83 percent. Globally, annual food production will have to go up to about 3000 million metric tonnes from the current 1800 million tonnes. At the same time good farm land is either getting increasingly diverted to non-farm uses or losing some of its biological potential due to various forms of damage to soil health. Even now the per capita arable land availability is only 0.1 ha in China and 0.15 ha in India. There is thus no option except to produce more from less land to meet the needs of the growing population.

FAO and UNEP estimate that a major cause of deforestation is extension of the cultivated area. In addition, soil erosion, salinazation, water logging and similar factors are reducing the biological potential of soil in many previously fertile areas. Increase in productivity per unit area thus becomes an ecological necessity. The pathway of yield improvement should however, not

result in any depreciation of environmental capital stocks like land, water, flora and fauna or influence adversely the factors that shape climate. Such a pathway is now referred to as ecological or sustainable agriculture. The vital need for accelerated economic development based on ecological ground rules was stressed by the World Commission on Environment and Development (WCED) chaired by Mrs. Gro Harlem Brundtland in its report submitted in 1987 and by the Committee of WCED on Food Security, Forestry and Environment chaired by Dr. M.S. Swaminathan. The conservation and effective use of plant genetic resources are important for reducing the need for external or market purchased inputs like mineral fertilizers and chemical pesticides.

BIODIVERSITY

About 1.5 million species have been described by taxonomists so far. Some experts estimate that over 50 million species may exist on our planet, if we have into account the prevailing genetic variability in invertebrates and microorganisms. Unfortuntately, interest in the science of biosystematics is waning among young scholars and hence we may not even know what we are losing due to deforestation and habitat destruction. Hardly 3 per cent of the terrestrial ecosystems and 1 per cent of the marine ecosystems have been designated so far globallly as "Protected areas". But according to IUCN, already 91 of such sites in 57 countries (both developing and industrialised) are threatened both due to unsustainable development and anthropogenic pressures. The number of "Protected areas" which are listed in the IUCN register as "threatened" is growing. In

developing countries, the threat to National Parks, Biosphere Reserves and Reserve Forests sometimes comes from human communities who perceive the protection as being in conflict with their economic survival. This is a sad reflection on the quality of our management of bioligical wealth. Conservation strategies should help to strengthen and not erode te livelihood security of the people of the concerned area.

The loss of genes, species and ecosystems is occuring at a time when new genetic combinations may be essential for both raising the ceiling to yield and for adaptation to potential changes in climate, sea levels and ultraviolet-B radiation, and when genetic engineering is making the transfer of genes across sexual barriers possible. The loss of every gene, species, and ecosystems will obviously limit our options for the future. Without an intelligent use of genetic variability it will be difficult to achieve sustainable advances in crop productivity. This is why the conservation and sustainable utilisation of bioligical diveristy for improving the food and livelihood security of the economically and ecologically underprivileged sections of humankind, are urgent tasks.

BIOTECHNOLOGICAL ENHANCEMENT

Biotechnology may be defined as the integrated use of molecular genetics, biochemistry, microbiology and process technology employing micro-organisms, parts of micro-organisms, or cells and goods and services. Biotechnology is comprised of a continuum of technologies ranging from long-established and widely -applied technologies to move strategic research on recombinant DNA technologies of microorganisms, plants and

animals. Biotechnology is often claimed to be an instrument to promote rural development by an improvement of agricultural produciton and the generation of jobs. It has been almost 10 years since researchers exhibited that they could use immense power of the gene through gene transfer technology on crop plants. Since then the plant genetic engineers have taken great strides. With several dozen field trials already under way, the development of high yielding plant varieties with enhanced resistance to diseases, pests and insects is becoming more feasible. The researchers are now branching out, beginning to design crop in plant agriculture with improved consumer appeal, such as tomatoes that hold up better to freezing, as well as creating plants that can serve as factories for pharmaceuticals and industrial oils. The low gradient techniques of agricultural biotechnology that find application for biotechnological enhancement in terms of production and productivity in degraded lands on a sustainable basis are described below on a selective basis.

I - PLANT TISSUE CULTURE

Plant tissue culture is a technique that has been known for 30 years. The basis of this technology rests on many plant species having the characterstic of being able to regenerate a whole plant from a single cell. A single plant cell can be derived from a leaf, root, anther, protoplast or meristem and can be grown in a test tube filled with appropriate culture medium under sterile conditions. The ultimate goal is to regenerate whole plants which can be transferred to soil. There are differnt techniques of plant tissue culture :

(i) **Meristem Culture:** The apical meristem of a plant (embryoonic cells at the tip of a plant) can be isolated and cultivated *in vitro*. This relatively simple technique can be used to micropropagate cultivars and to cultivate virus-free plants out of virus-infected plants (the meristem is usually unaffected by microbial infection). This technique is already being used for over 50 plant varieties including strawberry, cocoa, grape, lemon, and root and tuber crops like cassava, sweet potato and yam.

(ii) **In vitro multiplication:** Plant tissue culture offers the possibility for quickly mass propagating (cloning) a selected plant. Leaf or embryo tissue is used to produce callus (an undifferentiated cluster of plant cells). The callus is divided in single cells or cell clusters which can differentiate into embryo-like cells, embryoids or other plant structures, and subsequently regenerate. This technique is particularly useful when attempting to improve plants that grow slowly. Rapid *in vitro* multiplication has proven to be particularly successful with banana, plantain, potato, sweet potato, yam, and oil-palm.

(iii) **Somatic embryogenesis and organogenesis:** *In vitro* tissue masses or calli can transform into embryoids which bear a striking resemblance to embryos resulting from sexual reproduction. These embryoids can produce plantlets which are grown in greenhouses before being transplanted outside in nurseries. Undifferentiated plant cells can also differentiate in other structures than embryoids, e.g. root or leaf structures which can grow into whole plants. This process is called organogenesis.

(iv) **In vitro selection:** It is possible to select cells (and therefore plants) with desired characterstics by manipulating the media in which they grow. For instance, to select cells that exhibit improved tolerance to salts, metals, herbicides and extremes of soil acidity or alkalinity, then propagate plants exhibiting the same trait(s). This technique has been proven successful in a restricted number of cases.

(v) **Pollen and anther culture:** Pollen and anthers can also be grown in tissue culture. The resulting haploid (usually infertile) plants can, after induced chromosome duplication, regenerate into fertile, diploid, homozygous plants. This method has proven useful in shortening the time to produce homozygous plants, and providing expression of recessive genes.

(vi) **Embryo rescue:** Embryo abortion which often occurs as a result of 'wide hybridization' can be prevented by 'rescuing' the embryo and growing the embryo *in vitro*.

(vii) **Somaclonal Variation:** When cells in a callus, derived from a single natural plant, are regenerated in tissue culture, mutations in the genome may occur spontaneously. One of the most frequent causes of somaclonal variation is chromosomal rearrangement (i.e. transloction, insertions, etc.). Sometimes, deletion or amplification of gene sequences occurs. The resulting new plants are often stable and can be used to develop new varieties with desired characterstics. Somaclonal variation has been found in essentially all plant species that have been regenerated from tissue culture.

Furthermore, tissue culture is used in germplasm conservation and is an essential tool in biotechnological plant breeding. Once a plant cell's genome has been altered through genetic modification techniques, the transformed cell will have to be propagated in tissue culture.

The most notable technical drawback to tissue culture is that it has proven difficult to regenerate certain whole plants from cells. In particular, important cereal grains belonging to monocots, like wheat, oats and barley, have been regenerated in only rare instances.

A second shortcoming is that, similar to conventional plant breeding, in tissue culture the entire genome of plants is affected by induced changes. Therefore, when altering one characterstic, other unwanted changes may occur. The elimination of these traits by back-crossing often takes considerable time and effort. Moreover, the induced change may prove unstable, fading as the plant is propagated in subsequent generations.

Somaclonal variation is a technique which is used to increase genetic variation. However, somaclonal variation can also occur in situations where mutations are highly undesirable, like in the case of in vitro multiplication. The objective of in vitro multiplication is to produce a large number of genetically identical offspring. Through the occurrence of somaclonal variation the offspring is different from the parent plant. These mutated plants may have lost some of the favourable characterstics of the parent plant.

II. BIOFERTILIZERS

Many soil micro-organisms may enhance the nutrient uptake of plants. Those micro-organisms which have a direct beneficial effect on the plant may have considerable potential as biofertilizers. Three groups of plant-beneficial micro-organisms can be distinguished:nitrogen-fixing micro-organisms, mycorrhiza fungi and plant growth-promoting rhizobacteria.

1. Biological Nitrogen Fixation (BNF):

In modern agriculture the natural processes for replenishing nitrogen used up by crops are too slow to sustain the productivity needed. The shortfall is made up by chemical fertilizers, prepared industrially by taking nitrogen from the atmosphere. Some micro-organisms are also capable of fixing atmospheric nitrogen; the blue-green algae (cyanobacteria), the soil bacteria Azotobacter, Klebsiella, Bradyrhizobium, Rhizobium, and Actinomycetes. Plants cannot use nitrogen from the atmosphere. Nitrogen-fixing bacteria possess the enzyme nitrogenase, which converts atmospheric nitrogen to ammonia. To fuel the process bacteria need energy. Some, such as the soil bacteria Azotobacter and Klebsiella, use organic food. Yet another group of bacteria, notably the Rhizobia, enter into symbiotic relationships with plants; the bacteria receive some products of the plants'photosynthesis and, in return, donate ammonia to the plant, which the plant uses for synthesizing proteins.

Ecologically and agriculturally, the most important BNF systems are symbioses. An example are the soil bacteria Rhizobia

which infect the roots of the host plant (legumimous plants like peas, beans, lupins, clover and Leucaena), where they form nitrogen-fixing nodules. Each group of leguminous plants has its own species of rhizobium. Another example, is the symbiotic association of a certain cyanobacterium, Anabaena azolla, with the water-fern Azolla spp. These bacteria do not induce the host to form specialized structures, although limited anatomical modifications can occur. The fern, when introduced in paddy fields, can provide rice with nitrogen. The Azolla can also be intercropped with other plants, but most interest has been focused on rice. The nitrogen-fixing ability of blue-green algae is the principal but by no means the only reason for the increase in rice production resulting from Azolla; it can also provide green manure. Cultivation of Azolla plants is not easy. Azolla appears to be most successful in the subtropics.

Inocula of free-living blue-green algae can be directly applied on paddy field; a method which is called algalization. The effectiveness of algalization is still controversial and much additional research is required. In general, free-living blue-green algae have less potential in terms of nitrogen fixed than Rhizobium or Azolla.

Effective BNF can avoid the use of costly and eventually polluting nitrogen fertilizers. A lot can still be done to spread and improve existing technologies without any genetic engineering: various improvements in agricultural practices concerning the enhancement of nitrogen fixation by free-living and symbiotic micro-organisms, selection of more efficient and competitive microbial strains and of higher-yielding association

between plant and nitrogen-fixing micro-organisms, and the isolation of new nitrogen-fixing organisms. Competition between strains of the inoculum and inefficient indigenous strains is a major problem. The mechanisms which determine relative competitiveness are still poorly understood.

2. Mycorrhiza associations

Mycorrhiza associations can be described as the symbioses between certain fungi, particularly Vesicular-Arbuscular (VA)-mycorrhizas, and the roots of vascular plants, e.g. trees, shrubs and certain plants like wheat, sorghum, cassava, soya, tea and coffee. A VA mycorrhizal fungus is unspecific, i.e. it can infect a very wide range of host plants; it is assumed that more than 90% of all vascular plants are capable of forming mycorrhiza associations. In many circumstances, mycorrhizal infection can greatly increase the rate of uptake of nutrients, particularly phosphorus and nitrogen, from deficient soils. VA mycorrhizas are known to solubilize iron phosphate in low fertility soils. In addition, they may mobilize other scarce elements like copper, zinc, and possibly iron.

Although mycorrhizal fungi in general are widespread in soils, artificial inoculation could improve host response where the concentration of natural inoculum is suboptimal, or when the natural inoculum is inferior in the physiological effects on the host. Large-scale production of pathogen-free mycorrhiza inoculi is, however, constrained by the fact that growth of the fungus in sterile medium is not yet possible. Commercial inoculum has been produced and marketed to a limited extent in the US.

Usually the use of artificial mycorrhiza inoculants is not very effective. A major problem is the limited availability of knowledge on mycorrhiza associations. There is a lack of information about the properties and distribution of natural inoculum of VA mycorrhizal fungi. Almost nothing is known about genetic variation in VA mycorrhizal fungi or about the effects of the environment upon natural selection of genotypes. Artificial inoculation may be unnecessary if an effective population of native mycorrhizal fungi can be built up by management practices.

3. Plant growth-promoting rhizobacteria

The impact of rhizobacteria (those members of the total rhizosphere bacteria that are able to colonize roots) on plant growth may be neutral, deleterious or beneficial. The term plant growth-promoting rhizobacteria (PGPR) was given to beneficial rhizobacteria in 1978. Most PGPR are fluorescent Pseudomonas or strains of Bacillus subtilis. PGPR can be inoculated on to some crops and can subsequently improve growth. The beneficial effects of PGPR fall into two categories: growth promotion and plant disease suppression. Growth promotion is evidenced by increases in seedling emergence, vigour, seedling weight, root system development and yield. The different mechanisms of PGPR which enhance growth are not well understood, yet. Some PGPR strains are supposed to increase plant growth by positively interacting with various plant-symbiotic micro-organisms, such as Rhizobium, Bradyrhizobium, Frankia and mycorrhizal fungi. For example, several Pseudomonas and Bacillus sp. are capable of enhancing nodulation. There are also PGPR which produce plant growth hormones in culture, but there is no actual proof of such activity under normal field conditions.

Some PGPR strains do not promote growth per se, but the inoculated bacteria are controlling minor root pathogens which are not producing enough obvious symptoms to be noticed, but which hinder the complete expression of the plant's potential.

III. BIOPESTICIDES

Certain micro-organisms are natural pesticides, fungicides, bactericides and herbcides; over 100 bacteria, fungi and viruses that infect insects have been described. About 60 years ago, the basic ideas on the use of added inoculants in biological control where established, but were for long overshadowed by the enormous development of chemical pesticides, fungicides and herbicides.

Currently the most widely used bacterium in insect control (90% of all microbial insecticides) is Bacillus thuringiensis (Bt), an aerobic spore-former, which produces a proteinaceous crystal toxic against many insect species, including gypsy moths, inchworms, hornworms and cabbage looper. The toxin is very selective, safe and biodegradable. Ingestion of the toxin by a susceptible insect leads to death within a few days. Bt was first isolated in 1911 and has been commcercially produced since the 1960s. The only other signinficant bacterium for insect control is Bacillus papilliae. It is used to control the larval stages of the Japanese Beetle in ornamental turf (applied as spore dust). Insect viruses have also been applied to control for example cotton bollworm, pine caterpillars and spruce sawfly. Fungi can also be used but these control agents are not yet widely commercialized.

Besides insect control, micro-organisms are to a minor extent applied as herbicides. The oldest example of a microbial herbicide is the fungus Collectotrichum gloeosporiodes which is used in rice and soya bean.

Microbial inoculants are also applied in the control of plant diseases caused by root pathogens. A commercially produced inoculant is the fungus Trichoderma which is used against the Dutch elm disease. Another promising antagonist is the PGPR, Pseudomonas. Biological control via PGPR is usually directed towards minor root pathogens (fungi and bacteria). These PGPR are supposed to suppress plant disease by producing siderophores (chelating compounds with a special affinity for iron) which reduce the availability of iron for deleterious rhizobacteria or fungi, or by producing toxic compounds like antibiotics and HCN which are active against deleterious rhizobacteria.

The reason for using microbial inoculants in biological control is that micro-organisms have some advantages over chemicals. Biological control on a major scale is a good possibility and is being actively developed. The production of useful biological control agents is, however, a long process and needs research and development time and money. Most of the microbial inoculants which are now commercial or near-commercial have been worked on, with varying intensity, for about 20 years.

A disadvantage of microbial inoculants is their sensitivity to environmental changes in the field. Microbial inoculants are alive and growing, and hence more variable and more subject to environmental effects than chemicals. Furthermore, the sort of organisms to investigate or to search for is difficult to decide upon. The organisms should be suitable to the environment, competitive and effective. A strategy to enhance biocontrol agents is to combine them with other control methods such as the use of chemicals.

Current research on biological control agents is concentrated on minimizing the cost of production of the micro-

organisms and searching for effective means for dispersing the micro-organisms.

IV. ANIMAL EMBRYO TECHNOLOGY

Over the last 20 years, the techniques for recovery, storage and implantation of animal embryos have been perfected. Through superovulation (induced by the hormone 'Pregnant Mare Serum Gonadotropin', PMSG) about 12 egg cells can be flushed from the oviduct of the female animal. The ripe egg cells are fertilized in vitro. Subsequently, the embryos are transferred to an incubator. The ripe embryos are harvested and transferred to a carrier mother. This technique is already applied in cattle, sheep and goat breeding.

The principal benefit of Embryo Transfer (ET) is the ability to produce more offspring from a female animal than would be possible with normal reproduction. For example, each cow would normally give birth to about four calves in an average lifetime. With ET, this could be increased readily to at least 25 calves. This could, for example, enhance the rapid expansion of rare genetic stock (e.g. a new breed). ET can also reduce costs of imported cattle because importing an animal as an embryo is much cheaper. Moreover, by raising these animals in their new home country they are better able to adapt to local environmental conditions.

There are, however, additional potential advantages from ET. After in vitro fertilization, the embryo can be cloned through mechanical splitting or transplanatation of nuclei, resulting in two or more genetically identical offspring of the same sex.

It is also possible to fuse split embryos of one animal species or of different animal species. The cells of the so-

called chimera do not contain mixed genetic material, which means that the fusion of split embryos cannot be considered true genetic engineering. The resulting offspring is made up of a mosaic of cells, some of which carry genes from one parent and some from the other. An example of this method is the chimera of a goat and sheeep, a geep. Another possibility is the sexing of embryos. This could further increase selection intensities, and could permit greater specialization of the beef and milk production functions of a dual purpose population. Furthermore, ET is an essential step in the genetic transformation of animals.

Embryo transfer (ET) is still not possible to swine and buffaloes (except from occasional, non-repeated successes). Deep-freeze conservation of swine eggs has been impossible; egg mortality already occurs at temperatures below 15 °C.

V. DNA PROBES

DNA probes are single-stranded DNA fragments (tagged with a radioactive, fluorescent or enzyme label) which attach themselves to a piece of DNA or RNA which is complementary to the probe (nucleic acid hybridization). Gene probes can be used for the identification, isolation and mapping of genes.

(i) Diagnostic Reagents

With DNA probes it is possible to identify the presence of micro-organisms, hereditary markers, oncogenes, antibiotic resistance, etc. basically anything which has its origin in the DNA. Tests for infectious diseases in man, animals and plants are the easiest to produce and therefore farthest along in commercialization. The main advantage of DNA probes in diagnostics is their high specificity and speed; for example, it is possible to detect pathogens which would not be revealed immunologically.

(ii) **RFLP technology:**

DNA probes are extensively being used in a method called RFLP (Restriction Fragment Length Polymorphism). RFLP is a method to identify specific markers at many sites throughout the chromosomes using DNA probes and highly specific enzymes called restriction enzymes (bacterial enzymes which cut DNA molecules in places where there is a specific sequence of bases). Restriction enzymes cleave the DNA sequence into different fragments. The restriction fragments can be resolved according to size using gel electrophoresis. Then they are transferred out of the electrophoresis medium onto a membrane support (e.g. nylon). DNA probes are used to 'mark' certain homologous DNA sequences immobilized on the membrane. RFLP technology is applied in DNA finger printing (determination of identity, relatedness, etc.). It is also used to map chromosomal regions involved in traits of economic value (trait mapping). Furthermore, RFLP analysis is used in plant breeding to identify offspring that carry all or most of the desired genes.

For large-scale production, the DNA sequences used to be cloned in a vector. Recently it has become possible to produce DNA probes in large amounts using PCR (Polymerase Chain Reaction). This makes DNA probes more competitive with MAb tests for use in diagnostics.

A major problem with DNA probes is labelling. Until 1987, all probes had radioactive or isotopic labelling. Radio-isotopes are potentially dangerous, hard-to-handle and time-consuming. Since 1987, fluorescent substances have also been used. Fluorescent-based tests, however, have the disadvantage that they require a reader. Enzyme-based assays are generally preferred, but enzyme detection is typically less sensitive than

isotopic and fluorescent. Therefore, the use of enzyme-based probes requires amplification. Various enhancement techniques are being developed to increase the sensitivity of this system.

INTERACTIVE BOTTOM-UP APPROACH

The "Interactive Bottom-up Approach" takes into consideration the three components of information, involvement, and integration. The approach is developed on the basis of technology assessment reseach and on ethanographic studies of innovations and priority setting processes. Basic assumptions of the method are:

1. For the identification of appropriate and feasible innovations

- it is crucial to involve the end-users and the organizations which represent and work with them. This holds true both for the identification of problems and the assessment of the solutions;
- it is crucial to take into account: 1) the factors affecting the structural patterns, and 2) the actual potential for change, like governmental policies, markets, diffusion activities, and socio-economic relationships. Such an analysis gives insight into constraits for implementation of innovations as well as into opportunities to tackle the identified problems with e.g. a biotechnological innovation.

2. Ideas for appropriate and feasible innovations are often not developed because they tend to threaten vested interests since they involve competition for scarce resources and have the potential to change (power) structures.

This holds true for possible innovations in all types of organizations. For small-scale farmers who have little political power, potential innovations are particularly easily ignored.

Two activities have been suggested to deal with this general problem.

Firstly, careful attention has to be paid to the specification and justification of the project. A proposal can less easily be ignored if it can be broadly justified, i.e. can be integrated within various (governmental and other) policies, power structures, cultural patterns, etc.

Secondly, through the mobilization of those with similar interests it would be possible to create countervailing power against the vested interests.

An effective way of realizing these important conditions is the establishment of effective communication and exchange of information between different groups (farmers, scientists, policy markers and NGOs) which are committed to a shared goal (e.g. poverty alleviation) to which the innovation contributes.

3. In order to reduce the chance of unexpected negative effects of an innovation a public detate on the ideas and the proposed innovation with experts and laymen is necessary.

These assumptions have led to the establishment of the interactive bottom up approach which consists of three phases (here applied to the case of biotechnology for small-scale farmers).

Phase 1. The Inventory phase (access to global information)

This very important phase consists of exploratory activities which are aimed at providing an overview 1) of the literature, 2) of the ideas and opinions of different groups and organizations involved in rural development or research priorities for small-scale farmers, 3) of the [illegible] options can

be compared and evaluated (assessment model). On the basis of this information, priorities for biotechnological innovations can be identified. By structuring the interviews carefully, technology-push can be avoided.

Feedback on the expressed ideas and opinions should be optimized by exchange of information between the different groups. (This is a laborious process and can only be carried out if enough time is available). Ideally, a consensus is reached on the research priorities for resource-poor, small-scale farmers. If different groups set different research priorities, this may be due to a lack of consensus on the assessment model.

Through the activities in phase 1 it will become clear which organizations and people feel strongly committed to the idea of using biotechnology for the improvement of the living conditions of the rural poor. This means that an informal team can be formed to link up with relevant power structures and with local institutions through which priorities are set to improve the situation of small-scale farmers. This team can operate as an important element within the social structure by supporting and guiding the implementation of the ideas when they may reach phase 3.

Phase 2. The interaction phase (Interagency/Interdepartment dialogue involvement)

In this phase, a public debate takes place in which the results of the preceding phase are discussed in order to identify unanticipated negative side-effects and constrains to the development of the innovations. Strong criticism may lead to the rejection of (part of) the ideas (projects), to a change of priorities or to adaptation of the principles. Ideas are also

discussed on how to realize the conditions necessary for effective implementation.

Phase 3. The phase of institutionalization (Integrated System)

In this phase, specific projects are prepared, programme studies are initiated , existing institutional frameworks are adjuested, and new institutional frameworks are developed.

INDIAN GENE CENTER

The Indian region (8-38 N and 60-97 25 E) with a total area of 329 million hectares is indeed ecologically very diverse and rich in biological wealth and its diversity. It is believed that out of the 45,000 plant species recorded so far in the Indian Gene Centre, 15,000 flowering plant species and 30,000 non flowering plants (like ferns, liverworts, algae, fungi etc.) occur. About 7,000 species are believed to be endemic to India and have so far not been reported from anywhere in the world. Interestingly nearly 3,000 endemic species are found in the varied ecosystem of Himalayas, arid north west, the coastal regions and islands of Andaman and Nicobar. Interestingly about 800 plant species have been identified of ethno-botanical importance used one way or the other. The bioloigical diversity encompasses plant wealth that has considerable elements of African, European, Indo-Malayan, Sino-Japanese, Eurasian and Mediterranean in origin which clearly indicates long evolutionary past.

The plant genetic resouces through years of evolution under domestication and through processes of natural and human selections and doemestication have accumulated enormous diversity exhibiting unique adaptations and valuable gene complexes. This comprisees, primitive cultivars and land race variability as well

as wild and weedy species related to these cultigens that occur in natural and disturbed habitats. These together constitute gene pools which are rich source of many important and desirable traits. There are well over 325 wild species distributed in the diverse phytogeographic and climatic zones; North-eastern region (134), Western Ghats (16e), Deccan Plateau and Eastern Ghats (93), Western Himalayas (125), Gengetic plains (66) and North-western Plains (45).

The diversity in species and their forms can be accounted as given here; maximum species occur in fruits (109), vegetables (54), cereals and millets (51), spices and condiments (27), legumes (31), fibre plants (24), oilseeds (12), and others including sugarcane (26). However, it provides only the enlisting of species that may be closely related to crop plants. Yet, the major chunk of these have remained uninvestigated. Besides, majority of these yet await their collection and comprehensive studies. Indian cultural history overwhelmingly accounts its logical concern for the conservation of living organisms.

The rich biological diversity can be attributed to its varied physiographic and climatic situations super imposed with tribal and ethenic diversity. India's extensive mountations regions cover an area close to 100 million hectare, while arid and semi arid zone spreads over 38 million hectares. The long coastlines (over 7000 km) adds to the diversity in physical environment. The habitats vary from humid tropical Western Ghats to the huge desert in Rajasthan; from the cold desert of Ladai and the icy mountains of the Himalayas to the warm coast of peninsular India.

The conservation of biodiversity is a concept linked with strong conviction that this biological wealth will become one day very useful to man for crop improvement and sustainability of production over time and space without incurring adverse effect on soil, ecosystem and also without further deteriorating the environmental conditions, which is absolutely essential for the survival not only of the mankind but its companion species and other life forms on the earth.

In order to achieve these objectives, an holistic approach for the conservation of biodiversity has to be evolved and integrated. In the context if genetic enhancement of selected plant species, conservation of biodiversity appears quite sound. Biotechnology particularly in vitro technology assumes special significance as it provides mechanisms, techniques for both development and utilization of germplasm. Biodiversity conservation programme may necessitate considerations on the following :

(1) Ecosystem conservation

(i) In situ conservation of biodiversity.

(ii) Preparation of species diversity index, investigation on energy flow and dynamics of ecosystem.

(iii) Prioritization of key species and their complexes, communities, populations of plant species and identification of microflora associated with plant species.

(iv) Levels of threats; threatened , vulnerable or extinct (based on real data).

(2) Conservation of biodiversity

(i) Preparation of comprehensive document on such species which require immediate safe guard measures.

(ii) Identification and prioritization of species for genetic enhancement.

(iii) Employment of suitable technology (ex situ) required for achieving above goals with active involvement of well organized centres with competence and infrastructure.

(iv) Development of interactions for exchange of technology, expertise and material.

(v) Interlinking with other centres for their thorough study to assess the potential value.

(vi) To look into the commercial aspects.

(vii) To predict the impact of biodiversity conservation and genetic enhancement vis a vis environment protection.

(3) **Utilization**

(i) India must simultaneously go in for the DNA finger printing (RFLPs analysis and genome mapping) to characterise and identify potential gene (s) to be utilized today or in future through the application of new techniques of biotechnology.

(ii) High priority must be assigned to potential wild species related to our crop plants, or those which have medicinal or therapeutic value, or have aromatic value that can be of industrial potential. Microflora associated with plant species will require thrust for the conservation of soil and its productivity without having much adverse effect on environment. The group may consider some of those aspects while evolving a suitable mechanism for the conservation and utilization.

IMPLEMENTATION OF TECHNOLOGY

The use of research developed at our Indian Centres or elsewhere will require the technology to be

successfully implemented. Transfer of cellular and molecular technologies highlights particular requirements. These include :

(i) Identifying the means of both technology acquisition and support for indigenous development; (ii) Integration of the technology with conventional agricultural research; (iii) Identifying donor agency support and collaborative partners; (iv) securing indigenous commercial investment; and (v) coordinating with biosafety requirements. Biotechnology does have the potential to contribute to the solution of several important problems of farmer. The first step in such a direction is a careful analysis of how and under which conditions biotechnology can contribute to sustainable rural development, and of how choices can be made between various options.

RESOURCE USE SYSTEMS AND MAINTENANCE OF BIODIVERSITY IN PRE- AND POST-COLONIAL INDIA

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The Indian subcontinent, stretching from the hot humid tropical sea shores of the Cape Comorin in the south to the icy heights of the Himalayas in the north and from the dry deserts of Rajasthan in the west to Cherrapunjee, the rainiest place on the earth, in the east, is endowed with a bewildering array of biodiversity. The biota of the country has elements with African, Mediterranean, temperate European, Sino-Himalayan, Sino-Indian and Indo-Malayan derivation (Legris and Meher-Homji, 1968). About 20, 000 flowering plants have been already described from here (Chatterjee, 1939). Of the 80,000 animal species so far described from India are 67,000 insects, 4000 mollusks, 6500 other invertebrates, 1400 fishes, 140 amphibians, 420 reptiles, 1200 birds and 340 mammals (Zoological Survey of India, 1980). This implies that about 5 to 8 per cent of the known species of animals and flowering plants occur in India with a land surface

of only 2.3 per cent of the world. Gadgil and Meher-Homji (1986) consider if lower plants and lower animals are more carefully surveyed then India must safely harbour at least 200,000 species of living organisms. The biological communities of the country harbour wild relatives of many cultivated plants such as mango, jackfruit, banana, citrus, pepper, turmeric, legumes, jowar, millets, sugarcane and rice (Gadgil et.al., 1989).

Behind the maintenance of this rich biodiversity through millenia are the traditions of conservation deeply rooted in the Indian culture. In this paper we make an attemot to portray the extent to which traditional systems of land use, forestry, agriculture and animal husbandry in India contributed to the maintenance of biodiversity. We also examine here to what extent these systems were affected by the colonial rule and by changes following independence.

MATERIALS AND METHODS

We have gone through the pages of Indian history as well as other relevant ancient literature and documents for getting an idea of the traditional resource use systems and the maintenance of biodiversity. We have also heavily relied on the detailed ecological studies being carried out in Uttara Kannada district and other neighbouring regions of southern India by the Centre for Ecological Sciences of Indian Institute of Science as well as on the works of other scientists.

RESOURCE USE SYSTEMS AND BIODIVERSITY

In this paper we have dealt with the maintenance of biodiversity under four different modes of resource use, namely, gathering (including shifting cultivation), nomadic pastoralism, settled cultivation and industry. Indeed the industrial development in India began with the advent of British colonialism from the dawn of 19th century although the Portuguese dominance along the West Coast dates back to the early 16th century.

Dependence on biodiversity

We may characterize the economy of gatherers as a natural economy in so far as it draws all its resources directly from nature (Dasmann, 1988; Worster, 1988). A study by Gadgil et.al. (1990) in coastal Uttara Kannada show that the Kumri Marathis, inhabiting the remote villages in the midst of the evergreen forests, (and who were known to be expert hunters and gatherers including shifting cultivation), in spite of the stringent regulations on their traditional mode of life imposed by the state, cent percent of the families depend on the biodiversity of the tropical forests to a substantial extent. The authors have observed that the Mukris of coastal Uttara kannada, who are today mainly agricultural labourers, but exhibit strong traditions of hunting gathering way of life, still rely on the gathering and sale of forest produce to some extent. Forest tribals often have amazing knowledge on the use of the biodiversity of the forests. Sudarshan (1990) states that the Soligas of Biligirirangan Hills of Mysore use 213 herbal medicines.

Unlike the gatherers the nomadic pastorals presumably will have lesser dependence on the biodiversity except as grazing resources. The traditional agriculturists often continue to depend on the biodiversity. A survey by D.M. Bhat (personal communication), in Sirsimakki, an orchard village of Uttara Kannada, reveal that the people there collect the produce of at least 85 species of wild plants which altogether have 175 uses.

The industry on the other hand begins with exploitation of limited number of species with high market value after the depletion of which it resorts to the monoculturing of the same at the cost of the other species as well as gradually increase the number of species exploited. This has been well brought out in a recent study carried out by the authors in the evergreen forests of Uttara Kannada (Gadgil and Subash Chandran, 1989).

The following discourse makes it clear that the traditional Indian society had a real stake in the conservation of the biodiversity and evolved a variety of mechanisms for conserving the same. The prescriptions of this society, based on traditional ecological knowledge and simple rules of thumb, may be considered "prescientific". Indeed, considering the track records, one could argue that the scientific prescriptions of industrial society show little evidence of progress over the simple rule of thumb prescriptions. Similarly one could argue that government enforcement of these scientific prescriptions represent little progress as compared to the earlier enforcement of procedures based on religion or social convention (Gadgil and Berkes, in press).

India is a unique country for the study of traditional versus modern resource management systems and the maintenance of biodiversity. Paralleling its tremendous diversity of plants and animals is an equally remarkable diversity of cultures. For even today, India is a juxtaposition of stone age hunter-gatherers like the cholanaikas of Kerala, slash and burn agriculturists like the Maria Gonds of Central India and the Khasis of North Eastern India, nomadic pastorals like the Bhotias of the Himalayas and the Gavlis of the Western Ghats, subsistence agriculturists of the dry Deccan, commercial agriculturists of the Sutlej and Godavari deltas along with advanced industrial urban centres like Bombay and Calcutta. It is an agglomeration of tens of thousands of caste groups still retaining strong barriers of endogamy (Karve, 1961).

Gathering

Gadgil and Guha (1990), discussing on the ecological niche relationships of these hunter-gatherer populations, who inhabited productive, stable tropical environments, speculate that bands of these people who organized into tribes may have occupied a distinctive, spatially disjunt niche. Such human communities would be expected to develop traditions of sustainable utilization of their resource base, although instances of overhunting cannot be ruled out. A beautiful instance of such a tradition is provided by Malhotra et.al. (1983) from a study on the hunting practices of an ecological guild of three non-pastoral nomadic castes of the semi-arid region of Western Maharashtra.

The Tirumal Nandiwallas mostly hunt animals like hyena, leopard cat, wild pig, hare and porcupine with the help of dogs. Each family has an average of five dogs. The Vaidus hunt smaller carnivores like mongoose, toddy cat and domestic cat by using baited traps and an average of 1.5 dogs per family. The Phasepardhis never used dogs to hunt, but used a trained cow in misguiding blackbuck or deer into snares. They also snared certain birds. These various hunting techniques, but none more sophisticated beyond those of other groups and differing in the type of prey, is a classical case of cultural adjustment to reduce competition between these hunter-gatherer castes and at the same time conserving the prey species from over-exploitation.

In coastal Uttara Kannada, which had its forests teeming with wildlife at least till the close of the 19th century (Campbell, 1883), though hunting is no more a major source of animal food, two of the castes, the Halakki Vokkals and Mukris carry it out at least as a ritual. Our studies reveal that both these castes had some dependence on shifting cultivation as well. Today the Halakkis are growers of rice and vegetables and perform agricultural labour as well as indulge in some fishing for their own domestic consumption. The Halakkis are specialists in beating the forests and driving the game towards a huge net. The Mukris who are agricultural labourers and gatherers of forest produce have a strong tradition of hunting. In the well wooded interior villages with more wildlife both Mukris and Halakkis hunt land mammals using the same techniques. But the Halakkis who are mainly rice cultivators never indulge in gahtering like Namadharis, Haviks, Kumbhars, Madivals etc. also consider

gathering of forest produce for sale as the domain of the Mukris. It has been even found that the other agricultural castes, including the Havik Brahmins, who are strict vegetarians, finance the Halakkis and Mukris for periodically carrying out the hunt presumably for the safety of the crops. In the suburban coastal villages of Kumta town, with very little forests, though the Halakkis ritually hunt once in a year, to appease the 'Betedevaru' or the hunter's god the Mukris at the most trap marsh birds during the winter season.

Some of the traditions of the Indian society related to prudent resource use with probable origin during the gathering mode of life, which would have helped to maintain biodiversity of animal populations are the following :

(i) Protected life history stages : The harvest of certain life history stages may be prohibited. For instance in the village of Kokre-Bellur near Bangalore birds breeding at a heronary may be left unmolested, though they may be hunted elsewhere and at other seasons (Gadgil, 1985). Phasepardhis, the nomadic hunter-gatherers already referred to earlier, traditionally set free any fawn or pregnant doe of antelopes or deers caught in their snares (Malhotra, Khomne and Gadgil, 1983).

(ii) Closed seasons : During the hindu month of Aravana, which coincides with the peak of the rainy season of India, several Hindu castes abstain from eating fish and meat (Gadgil, 1985). The authors have found that even Halakki Vokkals and Mukris of Uttara Kannada in spite of their traditions of hunting, abstain

from eating animal food at least for two days in a week. Most of Ambiga fishing caste of Kumta taluk have been found to abstain from fishing or collection of bivalves on Mondays.

(iii) Sacred plants, sacred groves and sacred animals : In India a variety of plant and animal species have been considered sacred by one or more communities and therefore never destroyed (Pressler, 1971). It is likely that the tradition of attributing sacred qualities to many plants and animals may be going to the hunting-gathering and shifting cultivation days. The peepal tree, Ficus religiosa, has a conspicuous position in the cultural landscape of North India and human collective memory for more than 5,000 years. It was depicted even on Mohenjo-daro seals. Buddha himself found enlightenment under the peepal tree (Mansberger, 1988). Our studies show that all species of Ficus are normally not cut down by the largely tradition bound society of Uttara Kannda. Ficus species are recognized as keystone resources by ecologist, of particular significance in the overall maintenance of tropical biological diversity (Gilbert, 1980). Recent research has revealed that even in the tropical rain forest environment, where the climate may appear monotonously constant, animals can experience alternating periods of feast and famine. In such environments Ficus species play a pre-eminent role in the ecosystem as a dry season staple for birds and mammals (Terborgh, 1986). In Uttara Kannada the village deities, which belong to the pre-Britain period, are mostly found under trees like Ficus infectoria, F. benghalensis, F. tsiahela, F. mysorensis, F. callosa etc. as well as several others like

'bakul' (Mimusops elengi), 'surugi' (Ochrocarpus longifolius), Sysygium cumini, Caryota urens, mango etc. Majority of such trees are fruit trees.

Major problems facing agriculture in the humid tropics are the low nutrient status of many tropical soils and pest pressures. Shifting cultivation which evolved as a form of land use to circumvent these problems requires extensive tracts of land (McGrath, 1987). When population was low and fallow period long, much of the land under this system should therefore remain under various successional stages of natural vegetation which may be even richer than the natural vegetation in game animals such as ungulates. Hunting therefore would continue to play a significant role in the economy of the shifting cultivators. A band of hunting gathering would then become transformed into a hamlet of shifting cultivators. The natural living resources of this territory continue to be of value to the human occupants in many ways. The tribe therefore may be expected to retain the cultural practices of ecological prudence, including maintenance of sacred groves and be a part of the culture of the northeastern and central Indian tribal belt (Pressler, 1971).

Brandis (1897), the first Inspector General of Forests, found that sacred groves were very numerous and that they existed in nearly all the provinces of British India. Bor (1963) reported that "the largest deodar (Himalayan cedar) are those which are planted near temples and which are venerated and protected from injury".

Sacred groves and biodiversity

Sacred groves are more or less pockets of climax vegetation preserved on religious grounds. Several such groves are reported from the Western Ghats of Maharashtra and Goa (Gadgil and Vartak, 1974a ; 1974b; 1981). The authors have located hundreds of such sacred groves. Most of these are known as 'Kan' or 'Bana' locally. Yennemadi (1989) observed that the 'Kans" of Supa in Uttara Kannada, which were evergreen forest patches in the vicinity of villages, were equivalent to 'Rai' in Marathi. "They are believed by the people to be sacred to the village God or Goddess, and have been preserved from time immemorial. The 'Kan' is comparable to the 'Kavu' of Kerala and Tamilnadu. Kerala is known for its numerous snake groves ('Sarpakavus') which are indeed bits of dark evergreen forests. The 'Sasta' or 'Ayappa' temples of Kerala and the 'Aiyanar' temples along the east coast of Tamil Nadu and the erstwhile Malabar province or Kerala are situated in forests or groves called 'Kavus' (Pillai, 1939; Alexander, 1949). Ayappa is also a common village deity of Coorg in the Western Ghats Sri Satyan, 1965). Many of the finest forests in Coorg were dedicated to sylvan deities (Wilks, 1810). Sacred forests of Coorg known as 'Devarkadus' have even today a place of pride in the annals of conservation. Riseley (1808) observed that "All over Chota Nagpur there are many jungle-clad hills ... the favourite haunts of bears, which beaters of the Animistic races steadfastly refuse to approach until the mysterious power which pervades tham has been conciliated by the sacrifice of a fowl. Everywhere we find sacred groves, the abode of equally indeterminate beings, who are represented by no

symbols .."

Sacred groves of India are considered as one of the most valuable legacies from the primitive practices of nature conservation. The nature of religious cults associated with such groves suggests that the practices are very ancient, deriving from the hunting-gathering stages of the society. The composition of the vegetation corresponding to the climax formation for that region, corroborates the supposition that the sacred groves have been immune from human interference for a very long time (Gadgil and Vartak, 1974a). Such protected habitats today harbour the only known populations of a number of species which have elsewhere disappeared. For instance the tree Kunstleria keralensis is found in a sacred grove in Kerala (Gadgil and Vartak, 1976). Gadgil and Subash Chandran (1989) have observed that Dipterocarpus indicus found more towards the southern parts of the Western Ghats, has its northern limit in Uttara Kannada, where some of the sacred 'Kans' have provided excellent refugia for it. Moreover, Myristica swamp, reported by Krishnamurthy (1960), as rare and threatened habitat from the forests of Travancore in southern Kerala has again its northern limit in a sacred 'Kan' of Uttara Kannada. Myristica magnifica and Pinanga dicksonii are mainly confined to this swamp habitat. These sacred groves are found to be islands of conservation in the middle of villages or inside secondary or degraded forests and are found to play a crucial role in the vegetational restoration of the latter. Our observations reveal that the sacred groves often play a role in the protection of ecology of a region as well as even

serve as a source of dry fuelwood, dry leaves and a number of non-wood produce for many village communities.

Way back in 1801 the British traveller Dr. Francis Buchanan while passing through Uttara Kannada district stated "The forests are the property of the Gods of the villages in which they are situated and the trees ought not to be cut without having obtained leave from the 'Gauda' or head man of the village, whose office is hereditary and who here also is priest ('pujari') to the temple of the village God". Buchanan however considered this as "merely a contrivance to prevent the government from claiming the property (Buchanan, 1870).

Sacred animals cow, bull, monkeys, elephant, blackbuck, female antelope, peafowl etc. are some of the many sacred animals of many sections of Hindus. The worship of even dreaded animals like tiger and cobra are prevalent in the country. Many of these traditions, significant for conservaiton of biodiversity, presumably dates back to the hunting-gathering days. Totems of any castes or clans have certain totemic plants or animals which they do not destroy or let others destroy if they can help it. Thus the Mores and Ghorpades of Maharashtra derive their clan names from their totemic animals - peafowl and monitor lizard respectively, although other clans of the Maratha caste will hunt and eat them (Gadgil, 1985). There are eight such groups among the Halakki Vokkals of Uttara Kannada, each having one or more totems like tortoise, sambar, monkey, hog deer, two types of fish, Acacia speciosa and several other trees (Campbell, 1883; Risley, 1908). The Halepaiks (Nawlhariis) of Uttara Kannada have two endogamous groups, 'Tengina Deevars' and 'Baini Deevars'.

Traditionally a caste of toddy tappers, the former draw toddy from coconut palm and the latter from the 'Baini' or Caryota urens. Territorially the coconut tappers are mainly to be found along the coast and the Caryota tappers in the interior forest areas. According to Risley (1908) each group has again exogamous sub-groups called 'balis' with totemic plant or animal which include wolf, pig, porcupine, snake, sambar etc. The totems of the Indian castes and clans include wide ranging species of plants and animals like mushrooms, pumpkin, fig tree, rice, turmeric, Indian corn, mangoes, cucumbers etc. as well as sal fish, frogs, eel, snakes, tortoise, iguanas, peacocks, parrots, heron, rat, nilgai, pig, bull, buffalo, tiger, lion, bear, jackal, cow etc. (ibid). Such practices, widely prevalent in the country even today, would have inadvertently helped the maintenance of biodiversity.

Pastoralism and settled agriculture

Many scientists believe that pastoralism followed the earliest agriculture (Jacobs and Stern, 1952). Pastoralism is practised by nomadic people in which food getting is based largely upon the maintenance of large herds of animals. Pastoralism is usually associated with terrain such as steppes, rolling hills and grasslands. These are areas of low rainfall where cultivation is difficult but grasses are plentiful (Ember and Ember, 1977). Domestication of animals and cultivation of plants began to gather momentum some 10,000 years ago (Hutchinson et.al., 1977). Plants such as wheat, barley and lentils and animals such as cattle, sheep and goat were first domesticated

here and provided the stimulus for the beginnings of agriculture and animal husbandry on the Indian subcontinent itself (Jarrige and Meadow, 1980). The habitats most favourable for cultivation was along the smaller water courses in the relatively drier tracts of northwestern India, the Indus plains and the Deccan peninsula, since without metal tools the agricultural-pastoral people could not penetrate the moister forests such as those of the Gangetic plains or the west coast. Agricultural settlements developed in these drier regions over the period 6000 to 1000 B.P. (Possehl, 1982; Dhavalikar, 1988; Allchin and Allchin, 1968). There was also animal husbandry, including nomadic cattle grazing. It has been suggested that there was gradual deforestation in parts of the Deccan over this period, with timber fences slowly giving way to stone walls around the camps of the pastorals (Allchin, 1963). At the same time hunting-gathering and some shifting cultivation might have continued to dominate the moister tracts (Misra, 1973).

Iron was introduced to India by about 1000 B.C. Iron, along with fire made it possible to bring the middle Gangetic plains under intensive agriculture-pastoral colonization with wet paddy cultivation as a key element (Kosambi, 1970). This spread would have led to clashes with food gatherers for whom the forest with its wild animal populations served as a resource base. The invading agricultural and pastoral tribes, who worshipped the elemental forces of nature like the fire (Agni) to clear the forests and water (Varuna - the water God) to nourish the crops, were quite a contrast to the hunter-gatherers, who had a great

stake in conservation and worshipped the spirits of trees, groves or ponds as well as animals. Fire worship, carried out by the Brahmin priest, was a major ritual of the invaders (Gadgil and Guha, 1990).The burning of the Khandava forest as depicted in Mahabharatha by Krishna and Arjuna though couched in terms of a great ritual sacrifice, was evidently to provide land for Arjuna's agricultural/pastoral clan. Brahmins, who presided over such fire rituals, often served as pioneers, in such forays into the quantities of wood and animal fat. Any attempt to disrupt such holocausts by the native food gatherers, termed as demons or Rakshasas would be used as a convenient reason by the Kshatriya warriors. Dushyanta's visit to the abode of Kanva, the Brahmin sage and killing of wild animals with total abandon appears to be for the destruction of the resource base of the hunting and gathering forest tribals (Karve, 1974; Gadgil and Guha, 1990).

Rise of Jainism and Buddhism

By the time of Buddha, some 2500 years B.P. settled griculture and pastoralism had covered wide tracts of the country. Food gatherers continued in the hilly and mountainous tracts. Settled agriculture and pastoralism would have resulted in higher populations and clearance of more forests (Lal, 1984). An ethic of exhaustive use of resources, with the Yajna (fire sacrifice) as its cornerstone, was challenged by new belief system of Buddhisn and Jainism which stressed upon more careful and sustainable patterns of resource use. These religions professed compassion and kindness. Such a belief system is likely to have appealed to the agricultural - pastoral population

(Thapar, 1984). Jainism spread to the South India as early as the fourth century B.C. Buddhism gained footing in the south even before the Satavahanas came to power in second century B.C. Buddhist monks and nuns began to receive the pious attention of the poorer laymen and women, cultivators and many others (Yazdani, 1960). By advocating that resoruces should not be used wastefully, these belief systems had an important element of conservation (Gadgil and Guha, 1990).

Resurgence of conservation ethics

Jainism perhaps had its sway in the north India during the period preceding Buddha. Buddha himself is reported to have been born in a sacred grove, Lumbinivana (Gadgil, 1985). The early Buddhist literature reflects the agrarian landscape in the pre-Buddhist period. Around the 'gama' (village) or suburban area lay the 'khetta' or pasture and its woodland ot iis uncleared forest primeval forest like Andhavana of Kosala, Sitavana of Magadha etc. which were retreats haunted by wild beasts and woodland spirits (Rapson, 1935). During the time of Chandragupta Maurya (4th century B.C.), the first emperor of Indian history, forests were carefully conserved and classified. Certain forests were treated as sanctuaries for the protection of wildlife. Deers, rhinos, bisons and buffaloes, peacocks and fishes were protected this way. The milch cow, the calf and the stud-bull were not to be killed. The state controlled the sale of meat and confined it to licenced slaughter houses (Sastry, 1956).

The Mauryan emperor Asoka (3-4 century B.C.), grief stricken after the destructive Kalinga war, became a dedicated votary of

Buddha. He made sterling contribution towards conservation of biodiversity and campaigned as well as enacted laws for prudent use of natural resources. He planted avenue trees which gave shade and bore fruits; enacted game laws for preservation of wildlife, prohibited slaughter of animals for sacrifice, banned holiday feasts; started centres for medical treatment of cattle, arranged to plant even exotic medicinal plants and trees. Vide Pillar Edict V slaughter of 22 animals were prohibited, no unnecessary forest shall be set on fire, no killing of animals or selling of fish on certain specified days or on days of feast. Even branding of horses and elephants was prohibited (Srikantaya, 1956).

The ethic of non-violence had a pervasive influence on the Indian society. It led to a total ban on the slaughter of cattle at ritual sacrifices and on consumption of beef by all the upper and most of the upper castes. This ethic must have been important in the continuation of old, and development of new traditions of protection of wild animals and plants as well. Such traditions have played a significant role in influencing the pattern of utilization of biological resources in India over the last several centuries, especially till the arrival of European colonial powers (Gadgil and Guha, 1990).

Caste system and ecological steady state

Gadgil (1982) states that the emergence of a new Hindu caste system, towards close of the age of the empires, by the second half of the first millenium A.D. tend to minimise competition for the resources of the land approximate ecological steady state in

which each group maintained a balance with its resources. Under the caption 'Gathering' we have already given certain instances of adjustments between different caste groups tend to minimize competition and lead towards an ecological steady state.

One more instance by the authors may be cited here to illustrate the point. Havik Brahmins and Halakki Vokkals are two important agricultural communities of Uttara Kannada, inhabiting almost the same villages especially in the coastal taluks. The former are experts in raising multistoreyed orchards of Areca, pepper, banana, cardomom etc. Holding the plough is a taboo for them. The Halakkis are mainly used to wet paddy cultivation and growing of vegetables. The Haviks being strict vegetarians their main protein supply comes from milk. The Halakkis derive their proteins mainly from fish, bivalves, fowls and meat including those of wild animals. The Haviks domesticate large number of cattle, 7.6 per family (from survey of 91 families). The proportion of bulls and bullocks versus cow is 1 to 2.2 and the average milk yield is 4 litres per family and almost every family makes curds, butter etc. The Halakkis domesticate only 4.7 cattle per family, the main purpose being ploughing as well as for manure (total families surveyed was 53). The proportion of bulls and bullocks versus cow is 2.1 to 1, the opposite of Haviks. The average milk availability per family is only 0.8 litres. Only 20 percent prepare curds and 11 percent make butter and ghee. It is evident that the Halakkis, who were also shifting cultivators in the past, started giving importance to cattle rearing only after the stoppage of shifting cultivation by the close of the 19th century. Coastal Uttara Kannada being a heavy rainfall region

promoting evergreen forests the cattle have to depend on savannized lands of very limited extent. If all communities kept unrestricted number of cattle the region's forests would have been destroyed and the state of ecological equilibrium would not have been achieved.

The legacy of agricultural communities

These communities essentially carried forward the traditions of ecological prudence and maintenance of biodiversity of the gathering mode of life which include protected life history stages, closed seasons (for instance collection of leaf manure from the village forest limited to particular season only as in Halkar village of Uttara Kannada), protection of sacred plants and sacred groves etc.

COLONTAL PERIOD

Portuguese colonialism

The fall of Goa to the Portuguese, in the early 16th century, jolted the traditional guilds of ariculturists or 'gaunkars' of coastal lowlands. Literally a war was waged on Hinduism by the Jesuits in addition to extortion of taxes from the village communities. Since oppressed people under native rulers fled from Goa to the adjoining territories the state treasury was depleted making the Viceroy Count S. Vincente write to the King of Portugal in 1667 : "....The gentios (Hindus) do not have properties and Canarins (neo-converts) get from their lands only as much as they need for their maintenance. No one can

extract honey or oil out of stones. These miracles only God can work .....I know but to weep at the miseries I see". The [illegible] continued and even those who got converted into Christianity, hoping for a peaceful life, started fleeing from Goa. "Slavery has been a common factor in Goa much before it became profitable trade for the Portuguese in the Americas (De Souza, 1981).

Collapse of the 'gaunkars' led to wide breaches in the bunds causing inundation of fertile lands by salt water. "What took the gaunkars centuries to build was undone in no time" (Pereira, 1980).

The terror in Goa had a tumultuous impact on the ecology of the West Coast and Western Ghat regions of south India. The outpour of Konkani speaking Goan refugees, who settled all along these regions, would have resulted in overlapping of the niches of the traditional societies and perhaps led to more competition for the use of natural resources. Dutch chronicles of 17th century state that the Konkini Brahmins were established traders, already even in southern Kerala. They also pursued agriculture assisted by Kudumis (Kunbis, Poonem, 1948). In Uttara Kannada the impact would have been more severe. Being a hilly district with very limited scope for settled agriculture, the Kunbis in thousands had no other option but to fell the species rich evergreen forests for shifting cultivation. This mode of subsistence, already being pursued by certain local castes like Karivokkaligas, Halakkivokkals etc became a more rampant affair and considerable tracts of forests would have lost their primeval

nature during this time. In Uttara Kannada today for almost every professional group of Kannadigas there are Konkini counterparts like Kannada and Konkini rice cultivators, palm tappers, washermen, carpenters etc. During the British period many Konkini Brahmins became big landlords and forest contractors, the latter was a new niche created in the district, a legacy of the British.

British colonialism

Unlike the Portuguese, who destroyed traditional Goan farming systems, economy and culture through religious persecution, taxation and slavery, the British, already an industrial power in Europe of 17th century, had a more lofty motive of building and consolidating a trans-oceanic empire the pursuit of which had considerable impact on the ecology of the sub-continent. Some of the means, pertinent here, to achieve this objective are briefly discussed here :

1. Abolition of community control : In pre-colonial India extensive tracts of land and water were controlled by local interests and used in a sustainable fashion. The colonial interests lay in taking over control of as much of the country's resources as possible. A British report of 1801 talks of the 'pretence' of the landlords of Uttara Kannada cultivating pepper on hills that the timber trees are their property, and of sacred groves as a 'contrivance' designed to prevent the government from claiming its rightful property (Buchanan, 1870). The British Government claimed rights over all lands not under cultivation, as well as all waters. Unlike the indigenous population the British were interested in a narrower diversity of resources. In

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1805, the Government, for the first time laid claim to the indigenous forests of the western coast. In the words of Cleghorn (1861)

"....from this period upto 1822 a partial and somewhat ill advised attempt at conservancy was made but it thoroughly failed in its objectives; and all the restrictions which had been imposed during its existence were removed. This relaxation, or rather abandonment of law, however in course of time led to results of a still more disastrous nature, which threatened the speedy and complete destruction of the forests themselves".

2. The veils of single objective forestry : The early 19th century British forestry mainly centred around the extraction of natural teak and some other ship building woods. In 1797 Captain Hiram Cox, British Resident at Rangoon, testified to the exceptional durability of Burma teak ships (Hall, 1945). Malabar coast also produced good quality teak for British navy, in addition to few other species like poon, rosewood and Hebbalsu (Artocapous hirsuta). The exhaustion of these species was already evident by mid 19th century (Cleghorn, 1961). Depletion of natural teak was immediately followed by a vigorous programme of its monoculture by clearing of species rich natural forests. Way back in 1804 itself small plantations of teak were raised in coastal Uttara Kannada which were utter failures (Cleghorn, 1861). Beginning with the mid 19th century itself a vigorous programme of teak monoculturing was launched creating fragmentation of forest habitats. Converting the evergreen forest blocks into teak made these systems fire-prone. One after the

other forest working plans were prepared which aimed at clearfelling and conversion of substantial areas of natural forests into teak monoculture. Even though teak is no more an industrial wood this tradition, unmindful of the dependence of the local population on forest biodiversity, had been ruthlessly carried out into the 1980's, though teak is no more a shipbuilding wood.

3. Rampant profiteering : Munro stated in 1838 : "The system of throwing open teak forests to all who wish to cut or giving them to contractors is in the highest degree ruinous. They cut indiscriminately all that comes in their way; any range of forests, however extensive would be destroyed if left to their tender mercies .... The teak forests in Malabar are, I am told are in this predicament" (cited in Stebbing, 1922). From Himalayas to Kerala the British administration tried to wrest the control over the forests from the village communities and local rulers. As early as 1801 the East India Company instructed its Resident in Kathmandu "to endeavour to obtain the privileges of cutting and transporting timber on a contractual basis if he found the Government of Nepal disinclined to come to terms over the cession of forest lands". Trees which were cut to any extent in Nepal, on payment of a pittance of four annas each, in 1858, were sold at Rs. 30 or more (Sen, 1932).

4. The Railways and depletion of forests : Guha (1988) considers the building of the railway network, soon after the Indian Mutiny, as the crucial watershed in the history of Indian

forestry. The main objectives were transport of natural resources out of the Indian countryside and easy movement of British troops. The railways, in the words of Cleghorn (1861) was to cause "an immense demand for timber, (which) entirely changes the features of the district through which (the railway lines) pass... I may specify the Palghat, the Shevrai Hills, and the North Arcot hills; in these the old woods have everywhere fallen to meet the urgent demand for timber". The jungles close to the railway lines were depleted of bamboo in the Madras Presidency. In Salem 'I fear that a good deal of the oldest and best (satinwood) was destroyed by the railway contractors".

5. Suppression of evergreen forests : With the depletion of forests in the easily accessible areas the British, by the close of the 19th century, prepared forest working plans for systematic exploitation of the Western Ghat forests. The early plans primarily aimed at exploitation of large sized hardwoods from the evergreen forests. The British foresters saw with consternation the vigorous return of the evergreen forests to the suppression of the deciduous hardwoods especially in the old shifting cultivation sites of Western Ghats. These forests, though richer in biodiversity as well as more desirable from the ecological angle, contained mostly "inferior or "worthless" tree species from the forester's point of view. Clear felling of such forests for planting with teak, clearing both underwood and overwood of evergreen species to promote the deciduous hard woods were the common practices adopted by the foresters.

6. Battle against the bamboos : Bamboo, often known as poor man's timber, has manifold uses for the mankind. Various forest working plans show that India had a rich reservoir of bamboos. During the general famine of 1865-55 thousands of people from scarcity - stricken Bombay - Karnatak region came to Uttara Kannada and survived the critical period by subsisting on bamboo seeds (Campbell, 1883). The British exploited the bamboo stocks ruthlessly and transported the same to urban centres (Cleghorn, 1861). The foresters considered bamboo as a weed to be eliminated (Gadgil and Subash Chandran, 1989).

7. Hunting as a sport : The British developed hunting as a sport. The Gazetteers of the 19th century provides elaborate techniques of tracking down and shooting of the forest game. Campbell (1883) states scores of wild animals were killed in the Uttara Kannada district during 1840-1882.

8. Fall in the tree standards : The forest exploitation strategy consisted of selection of large size class trees, often beginning with teak, in Malabar and Canara regions. The depletion of teak led to monoculturing of the same, lowering of girth limits as well as logging of second and third choice timbers. For instance in Uttara Kannada district the exploitable girth of teak plummeted from 6.5' to 7' in 1901 to 4' during 1945, in spite of nearly one century of monocultural history of teak in the region. The girth of Heddi (Adina cordifolia) was lowered from 7 to 8' in 1918 to 5' in 1940-45 and thereafter (Gadgil and Subash Chandran, 1989).

9. Introduction of contract system : The British introduced the contract system where community management prevailed once. On the integrity of the contractors Cleghorn (1861) stated : "Instead of finding a class pf persons possessing knowledge of timber trade, there is only a multitude of rogues ever ready to tender for contracts, to receive advance and to appropriate them". The forest contractor had no interest in the sustainability of the resource under his care. He aimed at maximum profit in as short a period. For instance Wingate (1888) observed the ruin the contract system created in the 'Kans' or evergreen sacred groves of Uttara Kannada ; "The contractor sends forth his sub contractors and coolies, who hack about the Kans just as they please, the pepper vines are cut from the root, dragged from the trees and the fruit then gathered, while the cinnamon trees... are all but destroyed".

AFTER INDEPENDENCE

Independent India saw a rather frenzied drive by the state for industrialization in the Western model without any consideration for ecological and socio-economic conditions of the coutnry. The state continued to function in the imperial style as far as the forests were concerned. It even strengthened its hold through more legislation. The Forest Conservation Act of 1980 actually discourages the participation of individuals and communities in forest plantation and protection. At least in some instances, apparently the community control over the forests came as a hindrance to the extracftion of raw materials by the forest

based industries. The dissolution of the traditional Forest Panchayats of Uttara Kannada may be cited here. Coincidently the order to surrender the rights of the Panchayat over the forests under their control, to the Forest Department, came when the Muroor-kallabbe Forest Panchayat raised protest when their forest was logged by a packing case industry. Of the 11 such bodies in the district, nine surrendered their forests to the Government in 1970's. Two of the Panchayats, with traditionally strong set up, are fighting for survival in the High Court of Karnataka. What followed this action could be termed as "tragedy of the commons", the people themselves liquidating the tree growth in the surrendered forests (Gadgil et al. 1990).

In the "national interest", which has virtually been equated with the industrial sector, the National Forest Policy of 1952 legitimised exclusion of the local communities from the benefits of forest management. The ideology of scientific forest management paid scanty attention to the ecological wisdom of the rural communities, gained through centuries, and replaced the same with an external value system (Gadgil and Guha, 1990). In contrast to the small scale forestry as practised by peasants and other rural communities, of which maintenance of biodiversity was the hallmark, the so called scientific forestry postulated and practised single or few objectives forestry which had its origin in the colonial era. Opportunistic logging of leading commercial species, the depletion of which was ensued by rampant monoculturing, and disclaiming the rest as "inferior species" and thereby to be palmed off to the forest based industries at

abysmally low prices became the tenets of forest working in India. Thus bamboo became a weed and was sold the Birlas run rayon factory at Rs. 1/- per tonne in Kerala and for Rs. 3.12 for tonne of paper manufactured in Karnataka (Gadgil and Subash Chandran, 1989; Gadgil and Guha, 1990). In the list of other inferior species appeared such trees of inestimable value to the ecosystem and the human community like mango, wild nutmeg, Sysygium, Mimusops, gulmav (Persea macrantha), Strychnos nux-vomica poon (Calophyllum tomentosum), Artocarpus hirsuta etc. (Gadgil and Subash Chandran 1989). The main features of the post-colonial forestry are summarised here :

1. Sequential exploitation of forest resources : Forest based industries were heavily subsidised by the state and permitted to extract from the war ravaged forests. As per an agreement between the Indian Plywood Manufacturing Co. Ltd and the Government of Bombay, executed in 1946, during the dying moments of the British Raj, the company was granted concession areas in the main timber belt of Uttara Kannada, 61.5 acres of land was leased to the company at Dandeli, for a rent of 25 paise for acre, in addition to free bamboo and climbers for operational purpose, vehicles to run toll free on forest roads, rights to use and construct any roads or slides, free water from Kalinadi, free quarrying of stones and earth for construction of factory etc. The company was permitted to log 28 species of trees for Rs. 1/- a tonne, Rs. 20/- a tonne for another four species and four other species at prevailing market prices. Such a glaring undervaluation of the resource was to the bewilderment of the local communities,

heavily dependent on the forests. Eight more species were added in 1948, and still more from time to time, presumably due to the exhaustion of the earlier allotted ones in the concession areas. The Company was allowed to start subsidiary units. The concession areas of the company and its units almost covered the entire forest areas of Uttara Kannada by 1967 (Gadgil and Subash Chandran). Nevertheless the depletion of industrial timbers was evident by the end of 1970's and thereafter the policy of forest exploitation in other regions continued and today timber is liberally being imported from the rain forests of Malasia etc. as the Uttara Kannada forests are depleted of big trees.

2. Concept of protection forestry non-existent : An FAO study (1984) form Kerala states that areas which are inaccessible were earlier classified under protection working circle. But improved accessibility resulted in transfering of more areas to selection and even conversion working circles. A forest working plan for Uttara Kannada (Shanmukhappa, 1977) blandly stated its main objective as "exploitation of mature and over-mature crop" by opening up hitherto unworked areas and using the opportunity to bring to the market as many new species as possible.

3. Under-reporting of the quantity logged : Against the prescriptions on the paper there are no reliable statistics on the exact number of trees cut in the forests, the extent of incidental damage and the disposal of the latter. A study by the authors in the climax evergreen forests of the Sharavati Valley of Uttara Kannada has brought to the light that against the prescription of eight trees per hectare, 16 were cut in one

sample and 17 in another. Most of them being buttressed giants of the primeval forest, their fall crushed several more smaller trees (62 in the first and 81 in the second) which is in addition to canopy opening to the extent about one third of the area, soil compaction, destruction of ground vegetation, roads, slidings and loading sites, disturbance to the wild-life which include the endangered lion-tailed macaque, the great Indian hornbill and the trogon (Gadgil and Subash Chandran).

4. Disruption of genetic diversity : Plants in their very variety supply the people with not only food, but also with a cornucopia of useful and vital products to cover virtually every need. The tropical forest is a rich source of plant and animal genetic material for the future of the mankind. In spite of all that the logging for especially industries transcended all such considerations. For instance in Uttara Kannada rare habitats like Myristica swamps and even sacred 'Kans' were not spared. Paradoxically enough even the preservation plots of the Forest Department, which owe their origin to the British period were not salvaged (Gupta, 1981). As if not enough the policy of raising teak and later of Eucalyptus was pursued more vigorously to the detriment of species rich natural forests.

Combined with further degradation of the habitats through the construction of hydel projects, their townships, mining for iron and manganese and land releases for various other purposes have adverse effects on both plant and animal diversity.

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TRIBAL -FOREST INTERACTION AND CONSERVATION OF BIODIVERSITY

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The tribals, very aptly called "adivasis", are the original inhabitants of our country. They constitute 6.94% of the country's population. Though the tribals live in large numbers in some states and to a smaller extent in many others, still their ways of life, intimacies with Nature and no less important, their problems appear to be more or less similar.

In Karnataka, the tribals have made their home mainly in four districts viz Mysore, Coorg, Chikkamagalur and Dakshina Kannada and they constitute about 1% of the total population.

The changing times have adversely affected the tribal population which has reduced them from a relatively free life at forest to the one of abject poverty and dependency which has its roots in ignorance, lack of education and organisation on the part of tribals on one hand and the apathy, commercial attitude and an inability to appreciate the tribal life and culture on the part of the majority population.

The questions that may arise in the minds of all concerned are about the present forest cover and the biomass requirement of people at large, the tribal population and their interaction with the forest and a healthy way out to accept their living in the forest of which they are in inseparable part. The enquiry further leads us to the questions viz, what is the quality of tribal life at present and how it could be really improved, at the same time conserving the biodiversity, as

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tribals' life in particular and the life of people of the larger section in general are dependent on the forests of our country. In the following discussion our experience in Karnataka has been mainly considered.

Forest Policy - Trends

The earliest forest policy dates back to as far as 1865 when the British rulers brought fourth restrictions on rights of local people by declaring forests as " Reserved Forests". Indian Forest Act of 1878 was more comprehensive but continued and further extended the control over the forests. In 1894 the British renewed its policy and emphasised the commercial needs and revenue collection. The Indian Forest Act of 1927 brought together all the major provisions of the earlier ones including the duty on timber. In 1952 " National Forest Policy" was issued which was only an extension of the colonial policy. The interests and priorities of local people was made subservient to larger national interests. In 1956 National Commission on Agriculture emphasised the Industry oriented forestry and ignored the conservation-oriented forestry. The forest bill of 1980 was mainly based on the recommendation of National Commission on Agriculture which was totally against the interest of the local forest dwellers.

The forest policy has been amended time and again but the fact remains that the forest dwellers have been restricted in some way or the other with respect to their access to forest for food, fodder, daily needs etc in the name of national needs. But the national interests, unfortunately in implementation are confined augmenting revenue earnings from the forest. While in the earlier days if it helped the

ship-building, railway sleepers or the city needs, in the later days, the city needs and the industrial demands are being met with, by the forests. So, forests " for the people" does not sound correct because only a section of the population reap the chunk of the benefits.

I. THE PRESENT STATUS OF TRIBAL - FOREST INTERACTION

The Dwindling forest

Time and again we are reminded of the report of the National Remote Sensing Agency (NRSA) which enumerates the deforestation to the extent of 1.3 million hectares of forest every year in our country. This results in serious ecological imbalance and also tells upon the economic growth of the country resulting in bankruptcy. Destruction of bamboo forests in Karnataka is an example. But the worst hit, who might not have drawn the eyes of the larger section of people, are the tribals as they directly depend on the forest for their daily life.

This leads us to the conclusion that the entire population of our country, while appreciating and participating in the conservation of the forest, would have directly helped itself and indirectly the tribal people. Though the allegations levelled on the tribals for the dwindling of the forests are far-fetched, a new appreciation of the conservation of the forest on the part of the tribal is a must. This may be reviving of the old tribal traditions and sentiments on the scaredness of forest or the thoughts of scientific outlook which might have been shared by the enlightened people with the tribal. But the best way

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would be that the tribal himself should become enlightened and competent enough to fight for the environmental cause and demand for the preservation of forest.

The missing link

Our experience has shown that tribal people are able to comprehend many of the ecological factors quite quickly because it is a matter of their daily life and ages of forest living has made them intutive. Their saluting trees, prayers while entering from one forest into another-all these are sublime thoughts. The soil erosion, rainfall, watershedding and tree cover, are well understood by the tribal. The missing link appears to be the noncomprehension of the effect of the use and abuse of environment at the macro level. Sharing of these thoughts may provide this missing link which may much help the subjective participation of the tribal people.

The daily life of a tribal

It is not surprising that the life of a tribal is interwoven with the forest. For food or medicine fruit or honey and for his meagre firewood and housing needs he goes to the forest. Earlier he did hunt small game but, now it is prohibited. a required measure for wildlife preservation of which later.

From the earliest days, tribals in many parts of the country have lived on shifting cultivation or podu cultivation. Be it any of these forms, it is not harmful if a cycle of 18-20 years is maintained. We can see at BR Hills, good natural regeneration of forests with varieties of trees in the areas where shifting cultivation was practised earlier.

The avaricious contractors and also officers who have done clear felling with eagerness have found it convenient to accuse the tribals of destroying the forest through shifting cultivation. Had this clear felling been properly checked, much of the destruction could have been avoided. As times have changed there has been new problems the main one being an increase in population. Also the earlier habits of tribals are changing due to external influences and they too are now getting involved in various other programmes. This has made some of the seminomadic tribes to stick on to a place. There were days when these people were moved like chess pawns in the interest of Government plantations by the Forest Department, but, of late, there has been a new outlook.

The effect of weaning away the tribal from shifting cultivation might not have given much relief to the forest in the face of the onslaught of industrialisation, but without providing alternates, this has resulted in colonisation, alienation and marginalisation of the tribal.

Minor Forest Produce

In the earliest days tribals had free access to the major forest produce. This was supplementing their food and also helped them in their meagre income. But later, private contractors were permitted to collect minor forest produce. The avaricious contractors and their henchmen were exploiting forest with the result, in addition to collecting the minor forest produce, they not only were carrying away valuable forest wealth but also incidentally caused destruction. Now the LAMP societies (tribal co-operatives) have come into being. Though this is certainly a great

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improvement, tribals who collect the produce at great risk do not reap the full benefits as the goods are auctioned and bought by outside merchants. True, collection of minor forest produce results in a few tribals getting better wages during the season, but the community as a whole does not prosper.

Another factor is the involvement of non-tribal secretaries posted by the Government. They function like an imposed authority and care very little for the tribal development. Cases of corruption are also not wanting. Instead of making due profit and giving it to the community many societies are far beyond any achievement.

Health Status

The forests were the important resource bases for food and nutrition and also the medicinal needs of the tribal people. The shifting cultivation with mixed crops of cereals, pulses and oil seeds was enabling them to get enough nutritious diet. The protien food from small games and birds was an essential part of their food. The edible mushrooms, fruits, nuts, tubers and greens available in the forest further supplimented the nutrition of the tribal people.

The tribal culture has a good traditional knowledge of herbal medicines. Some of the tribes use as many as 400 to 500 herbal remedies for their day to day health needs.

The nutritional and health needs of the people was met without in any way affecting the forests and wildlife. The tribal people who are staying within the forests and who have access to the plant resources continue to have a

good nutritional and health status compared to the people who are living outside the forests and those living near the degraded forests. The malnutrition and Vitamin deficiency diseases are very common amongst these people.

The traditional decentralised health care system is being eroded due to deforestration and they are unable to get the herbal medicines easily. The modern health care system is yet to reach the remote tribal areas and it is beyond the reach of the poor. Some of the health indicators like infant mortality rate are as high as 180 to 200 per thousand amongst these alienated people.

Traditional cultural links

The songs of the tribals are particularly linked to the forest in a beautiful blend and so also are their social and religious practices. The worship of trees, reverence to elephants, salutations to forest are all noble sentiments. Deforestation brings alienation. Especially to come away from the gods they worship is particularly painful for them. One tribal old lady said to be a hundred years old, once told us, " I have lived here all these years near my god. I have to die here only"; so strong are their bonds. Also sharing of food or any other commodities loses its significance when the tribal has got nothing to share!

Tribal Movements

There have been tribal movements in the earlier days when their interests were flouted by the Government. Santhals' movement is an example. The Jarkhand movement is still an unsettled issue. Innumerable smaller social actions have taken place throughout India. In Mysore district

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the satyagraha/dharanas by the Yelandur, Chamarajanagar and Kollegal tribals and the more recent one at "Doddahosur Lingapura" at Periyapatna are examples.

It is needless to mention that unless Government brings about meaningful development programmes for the tribal people of Karnataka, they too may sooner or later take recourse to the violent movements as in Andhrapradesh.

The causes for the present status of deforestation and impoverishment of tribals

A study of the causes of deforestation in Karnataka reveals that the deforestation is caused by other factors rather than by tribals themselves. Sometimes this appears to be a convenient way of the affluent people to side-track the main issues. This is mainly due to the ecologically unsould development programmes and vested interests. The following are the major causes of deforest ation.

1. Industrial exploitation:

The industrial exploitation is as old as last century when the forests were freely used for ship building, Railway sleepers and many other needs by the colonisers. But the demands of later days has been alarming. For example this has resulted in cutting of bamboo forests for paper and pulp wood.

2. Tea/Coffee plantations

This also is a "gift " of the earlier colonial regime which has been continued due to its profitable divedends. The coffee plantations of Birlas(really 1500 acres) at Chamarajanagar forests in BR Hills range within the reserved forest is an example. The tribals in the

forest still are struggling hard. The tea plantations at Galibeedu in Coorg in Western ghats is another example.

3. Clear felling and monoculture

This is an off-shoot of industralisation and the voracious needs of cities. The monoculture does not support wild life nor help common man. Eucalyptus forests for the sake of poly fibre/ rayon industry is an example. This is detrimental to ecological balance as well.

4. Smugglers and Poachers

Sandal wood, ivory and costly timber are the "prize" items normally hit upon by the smugglers and poachers. The killing of tuskers (for eg Biligiri and Male Mahadeswar Hills) results in the progeny of elephants dwindling. No tribal would ever hurt an elephant. So the nontribal poachers who set a very dangerous example deserve punishments like death penalty or life sentence. As regards sandal wood, it is the nontribal who takes to smuggling. But the tribal suffers, either by involving as a labourer, but many a time just for the fault of living in the forest; This is injustice. In every case the real culprits should be nabbed and severe punishments awarded. By recognising tribal management of forests this problem can be tackled.

5. Displacement of tribals by big dams

In the Kabini project, hundreds of families were displaced with a promise of new land. A vast area of virgin forest was submerged. Till date they are homeless and still fighting for the cause. In addition hundreds of

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hectares of forest are drowned. The utility of growing crops and the benefits reaches definitely people who are economically better. Whether this could be achieved by smaller dams, tanks and by traditional water shedding system without destroying huge areas of forest is a matter of serious concern.

6. Quarrying

Another reason for the destruction of forests is quarrying. The quaries not only loosen the soil in the hills, resulting in erosion but also distrub the wild animals and pollutes the environment. The locals and tribals get lured for the slight higher wages the 'quarry kings' offer and eventually dig their own grave. The only way out appears to be the nationalisation of granite; is it not as precious as forest wealth? Or could we lease out forest also to contractors to their mercy? The technical aspects only should reign supreme and political and such considerations should be pushed aside.

7. Encroachment of forests by non tribals and increased demand on bio mass needs

The encroachment of forests at the fringes is a very common feature by the nontribals. Many a time this is done with the knowledge of lower officials. In addition they exploit the biomass to such an extent that there is a constant depletion of the forests. Accommodation of refuges by destroying virgin forests has further added to the deforestation process.

8. Forest fires:

Forest fires is yet another cause for deforestation which calls for proper management for protection from fire hazards and creaking greater awareness amongst the public and the tribals.

II. ORGANISATION OF TRIBAL FOREST INTERACTIONS SO AS TO ENHANCE THE QUALITY OF LIFE OF TRIBALS AS WELL AS CONSERVE BIODIVERSITY

In order to organise tribal-forest interaction with the twin-objectives of enhancing tribal life and conserving biodiversity, the following suggestions are offered. The mis-conception that presence of tribals in a forest is detrimental to the biodiversity is totally baseless. An appreciation of tribal life and acceptance of the great need of bioconservation by all concerned will achieve this objective.

Joint Management of forests by Tribals and Forest Department

Forest is the home of tribals, they have become strangers in their own home! There has been a trend in some parts of the country to involve tribals in the forest management. This calls for an understanding that tribals are a part of the forest and a change in the attitude towards them is needed. This will also mean taking forestry to grass-roots. We have heard of one such experiment at West Bengal. The tackling of forest problems with the help of the Sangha in some of our parts is a good step towards this end. This would also avoid middlemen who cause havoc because of self-interest.

Hitherto when the forest land was even forbidden for the tribal in the sense he was restricted; there was no feeling on his part to become responsible for it. The following experiences reveal the gains the subjective participation of the tribal by earmarking some place for him in the treepatta scheme.

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The tamarind branches which were used to be cut for fodder are no longer cut, because there is tree ownership.

The rampant destruction of forest on the fringe s by non-tribals by way of cattle grazing, cutting firewood etc has been tackled by the local tribals because they have become responsible for some land on the fringes.

In another instance, sandal wood has been seized by the tribals and the smugglers chased away. We may mention here that when tribals become responsible for certain portion of the forest by way of the patta or otherwise, they take every step to stop intrusion by outsiders.

Management of forest by the tribals can be worked out in the following way:

1. Allotting regions at forest with clear lines of demarkation around a single or cluster of villages.
2. Making a responsible body with the help of able and educated tribal people, who will be involved in the planning. implementation and evaluation of the project.
3. Only a forest official who is aware of the tribal culture and who has communication skills to interact with tribal communities in a democratic way should be made a member of this joint management committees.
4. The village(s) should be entitled for certain benefits suiting the life-style and essential needs.
5. Outsiders. rich people and vested interests should be kept out of this body.

Forest fires and the tribal

The stories of accidental forest fires. say, by the rubbing of bamboo etc do not appear to be convincing. Most often it is due to human error. There are also certain b

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in the tribal that after a fire there is good yield etc. Therefore a lot of awareness has to be created in the tribal about the gravity of destruction in a forest fire. The following measures may be worthwhile.

1. Educating the tribal in respect of forest fires and consequent destruction of saplings also
2. Bringing the magnitude of losses in the forest fires to the minds of the people.
3. Management of forest fires by the people and community responsiblity. This involves special training also.
4. Clearance of dead wood in the forest from time to time. This will also help in saving green plants getting cut for firewood.
5. Curtailing the movement of strangers by recognising the authority of the community.

Tribal needs and forest

The tribal needs, as compared to the outside world is so insignificant that there is not much reason to be alarmed about the use of forest by the tribals. But in view of the growing population, certain measures to keep the population-area ratio low is welcome. A case in point is at some of the interior podus in BR Hills, though the tribals are living for quite a long time, the forest has not been affected at all.

Fodder is a need of the tribal and common fodder farms should be taken up around the tribal villages adjacent to them for grazing of cattle, sheep, or stall feeding of goats. Five hectares for each village may be required.

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As regards afforestation planting of trees, monoculture should be strictly avoided. Trees which are useful by way of fruits etc to tribal people as well as monkeys, birds etc should be planted. The industrial forest should not take away the place of natural forests.

Though the tribals count upon their agriculture, not all the members of the family can get involved in it. And during the lean period even these people go without employment. Employment gurantee scheme by enlisting all the unemployed tribal youth and systematic planning at each range has to be done. If the employment is on daily wages, minimum wages have to be paid. If it is on contract basis, the PWD schedules of rates for the hilly area should be strictly adhered to. Wherever there are tribal co-operatives/ Sanghas the work should be entrusted to them and should not be entrusted to forest officers directly.

Of late tribals are taking to Cottage industries which are well in tune with preservation of ecology because there would be no pollution. Wherever tribal people have taken up self-employment in bamboo, bamboo plantation should be taken adjacent to tribal villages to the tune of about 10 hectares, so that tribal people have direct access to the bamboo for their need. Similarly cane growth may be taken in suitable places.

Wherever tribal people are involved in mat-weaving, Kora grass plantation in suitable climatic regions may be taken up.

There should be a regular supply of jungle wood for tribal people who are involved in carpentry (for low cost housing and agricultural implements).

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Wherever agarbathi (incense sticks) is taken up there is need for bamboo sticks and jigatu (a gum- the bark of the Kudamavu). Hence growing these and involving tribals in extraction of Kudamavu bark on scientific lines is necessary.

The herbal medicines are much used by tribals. Each tribal area should have 10-20 hectares of herbal garden where all the trees and plants of medicinal value could be preserved and multiplied, the herbal garden may be managed by the tribals in association with forest department.

Housing is a need which was earlier confined to some bamboo sticks and forest grass. Now the new, low cost tile roofed houses have come into being. In some places cement rafters etc are used, thus minimising the use of wood. These needs are to be met so that the tribal may peacefully live in his dwelling.

Forest, wildlife and tribals

It is appreciated that wild life should be well protected. The tribal sentiments and traditional ways can help in this regard, as for example the reverence to elephant. As regards hunting, it should be strictly prohibited no doubt, but the wildboar population with a disproportionate increase may be a point for consideration, in some places.

The tribals having been living in harmony with wild life for ages and there is no need to evict them from 'project Tigers' or wild life sancharies. They could be meaningfully involved in the management of wild life without displacing them.

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The researchers are eager to bind tigers with radio-active collars and spot their movement and appear to have landed in contr versies whether it is ethical at all and also the possibilities of deatns due to overdoping the hapless animals. I is not possible to make use of the traditional knowledge of the tribal people and learn about these wild animals in a more natural way?

Trenches/Electrical Fencing

In order that the tribal may get rid of wild animals destroying his meagre crop, at the same time a situation of scaring away animals does not arise, elephant trenches as well as electrical fencing where feasible can be made use of. Some of the interior tribal hamlets are inaccessible and hence construction of proper game roads should be taken up.

Tribal people should be imparted with knowledge of environmental needs like forest fire protection, ecologically sound farming methods etc. Adequate training and equipment should be provided to the fire watcher squad.

All the programmes can be implemented only through people's participation. Hence people should be involved in planning implementation and evaluation.

Minor Forest produce

As regards minor forest produce the following improvements are urgently need to be carried out:

1. Encouraging tribals themselves to make the end product. At present these minor forest produce is being purchased by contractors who rea greater benefits.
2. Avoiding non-tribal held on the LAMP societies and avoiding the imposing of non-tribal secretaries

3. Training inputs to tribal people both technical and administrative.
4. Safer and improved methods of collecting minor forest produce.
5. Lessening the overhead expeditures of the LAMP societies
6. Guarding against corruption.

Alternate sources of energy, energy saving devices forest and tribals

The alternate sources of energy may not be as much relevant to the tribal as for other because of his simple and meagre requirements. But energy saving by way of astra-chulas, non-burnt bricks for low cost housing appear to be of great importance. It is heartening to see many tribal homes with this type of ovens, this causing saving in fuel .

Awareness as to not to burn the firewood unnecessarily has to be built into the tribal mind. This would also make him more sensitive to forest fires.

The other possibilities which help the tribal people are Gober gas. solar water heaters, and solar lighting wherever feasible.

Fruit Tree Patta scheme and social security plantation

By far, the fruit tree patta scheme and social security plnatation happen to be really very innovative measures, helping the tribal as well as enriching the forest. For planting fruit trees, wastelands like the presend C & D lands and degraded forest may be used. Good selection of fruit-tree species is also important.

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Forestall "development processes" which cause deforestation

a. Plantations

The tea, coffee and such plantations by the rich owners cause enough of disruption in the tribal-forest existence. These people encroach forest land, get nice employment from the tribals, and reap thousands by paying a rupee more as bait to the tribal and make him work like a bonded labourer. For the tribals who liked a free life this is definitely a set back in their cultural pattern too.

b. Quarrying/Mining

This is also similar to plantation employment, but the worst part of it is that the soil is eroded and results in destruction of forests. The dynamites etc used here distrubs wild life also.

c. Big Dams

Mention has been made regarding the big dams and displacement of tribals. Mitigating the suffering of people who are affected at present and stopping future big dams by technically resorting to other watershedding systems would help tribals. The orthodox watershedding practices like tanks, small dams etc should be revived.

Environmental Education

A matter of great impact, though over a longer period, is tribal education with an overtone on environmental preservation. Along with this scientific education, revival of the old sentiments which preserve forests will help the cause.

Preservation of ecologically sound traditions and Myths

Tribals ha e been living in harmony with Nature and they have developed over years, traditions, customs and myths for the preservation of the environment. These have to be studied in depth and efforts should be made to preserve all these valuable traditions.

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35.

CONSERVATION OF GENETIC- AND BIO-DIVERSITY IN SUSTAINABLE AGRICULTURAL PROGRAMMES

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1. GENETIC AND BIO-DIVERSITY

Genetic diversity among crop plants has been the most important raw material for natural and artificial selection. Crop plants have evolved through millenia following complex interactions of the processes such as natural and artificial selection over and, recombination of the available genetic diversity (Frankel and Bennett, 1970; Frankel, 1975). The recent plant breeding techniques also employ recombination and selection to improve the genetic potentiality of crop plants and hence their success relies completely on the availability of genetic diversity (Harlan, 1974). The importance of such genetic diversity in world agriculture is evident from the fact that 50 per cent of the increase in yields in the past five decades is attributed to the development of improved genotypes (Duvick, 1986). All other cultural practices and improved technologies such as fertilizers, pesticides and mechanisation have contributed to the remaining 50 per cent. Genetic diversity is also important in buffering crop plants against pest and disease epidemics. For instance, during the early 1980's, the entire corn belt of America faced a severe threat from the corn virus disease (Duvick, 1986). Corn hybrids sold elsewhere in the country developed by introgression with germplasm from Argentina were found to be resistant to this virus; in just over a year, the whole of the western corn belt was replaced by this new corn variety.

Similarly during early 1960s, the widespread infestation of sorghum by green bugs resulted in an estimated loss of $ 100

million. It's recurrence was prevented by identifying the resistance genes from sorghum germplasm (Duvick, 1986). Soybean crops develop susceptibility to cyst nematode every 5 to 6 years. As a result, breeders are forced to frequently resort to the soybean germplasm collections for identifying the source of resistance to this nematode (Duvick, 1984).

Thus, for achieving stability in agricultural production it is imperative that genetic diversity of crop plants be maintained. Unfortunately, with the advent of agriculture and with the recent trends in cropping systems, genetic diversity of crop plants is acutely threatened (Harlan, 1975; Miller, 1973; Wade, 1974) : related wild species are increasingly endangered by the loss of their habitats, land races are becoming extinct and farm lands are being covered by cultivars with narrow gentic base. Especially during the last decade, the process of urbanization and the increased commercilization of agriculture have hastened the disappearance of the precious genetic resources of crop plants, the products of millions of years of evolution on the agriculture habitats (NRC,1989). Thus, there is a great need for conserving the genetic resources particularly the land races, and diverse genotypes being cultivated (Frankel, 1974).

Further, genetic diversity of crop plants also encompasses genes in the related wild species that could be utilised through interspecific hybridization. For instance, in cultivated wheat, Triticum aestivum, resistance to rust was borrowed from the putative parent Aegilops squarrosa (Kerber and

Dyck, 1979). In cotton, the most successful varieties are developed by hybridizing distantly related species. Thus conservation of plant diversity is equally important as that of the genetic diversity of crop plants. In this paper, we hence treat the genetic diversity often analogous to the biodiversity.

Intensive agriculture has also lead to a considerable loss of diversity of animals in the agricultural habitats (Gliessman, 1989). The components of intensive agriculture that have caused the loss of plant and animal diversity are often common. Hence we refer to the diversity of plants and animals interchangeably in order to identify the components of intensive agriculture that have lead to their destruction.

2. SUSTAINABLE AGRICULTURE

Sustainable agriculture is -

> "a philosophy and system of farming. It has its roots in a set of values that reflect a state of empowerment, of awareness of ecological and social realities, and of one's ability to take effective action. It invovles design and management procedures that work with natural processes to conserve all resources, promote agroecosystem resilence and self regulation, and minimize waste and environmental impact, while maintaining or improving farm profitability" (MacRae et al. 1990).

This concept originated in Europe and USA during 1960's (Paoletti et al., 1989). Nevertheless, the syndromes of this system can be shown to be prevalent among the primitive agriculture system of several tribes and of few developing countries such as India. Sustainable agriculture evolved as a practical concept following the realization that the conventional agricultural systems are highly energy intensive and are destroying our living environment due to the widespread use of ecologically damaging chemicals such as pesticides and weedicides (Pimentel et al., 1989a). For instance, the US Agriculture spends about 49 m.tonnes of chemical fertilizers and 350,000 tonnes of pesticides every year (Pimentel et al., 1989a). An estimated 17 per cent of the annual fossil energy is used to produce and supply food and fibre in USA. Pimentel et al.,(1989b) showed that the cost in terms of fossil energy in producing an hectare of corn has increassed 15 folds during the period from 1700 to the present while the corn yields increased only 4 to 5 folds.

Sustainable agriculture has been differently viewed depending upon the intensity to which the natural ecological processes are incorporated it (Table 1; MacRae et al., 1990). The main emphasis of sustainable agriculture is a) to minimize the risk; b) to diversify the product output range so that farming is self sustainable and c) to decrease the input vector in order to make agriculture environmentally safe (Titi and Ipach, 1989). Thus it's concept distinctly emphasises on increased reliance on environmentally safe methods such as use of

integrated pest management, organic farming and use of wide range of crop species that ensure stability in the yield levels. It differs from the conventional agriculture in several major issues as given in Table 2 (MacRae et al., 1990).

3.AIM OF THE PAPER

The purpose of this paper is to suggest strategies of conserving genetic and biodiversity in programmes of sustainable agriculture. For this, we first trace the patterns of changes in the genetic- and bio-diversity of crop plants as agriculture shifted from primitive to intensive system. In the process, we identify the components of conventional agriculture that have led to the destruction of genetic and biodiversity. Based on these components we formulate and suggest few models to conserve genetic- and bio-diversity in sustainable agriculture programmes.

4. PROCESS OF AGRICULTURE AND LOSS GENETIC- AND BIO-DIVERSITY

While domesticating the crop plants, man has continously exercised selection for his desired types. In the process a major portion of the genetic diversity of crop plants has been culled out. Thus, domestication per se has considerably narrowed down the crop genetic diversity. Accordingly, the degree of primitiveness of agricultural system would directly reflect on the extent of genetic diversity of crop habitats (Francis, 1989). For instance, Smith and Francis (1986) showed that genetic diversity of croppig system decreases from shifting cultivation in the humid tropics (primitive) to absolute monoculture system of cultivation (intensive agriculture; Fig. 1).

5. COMPONENTS OF INTENSIVE AGRICULTURE THAT HAVE LED TO THE LOSS OF GENETIC- AND BIO-DIVERSITY

5.1 Monoculture and monocropping

As agriculture began to be practised as an industry like enterprise, it started to acquire several syndromes of the latter. Monoculture cropping system is one such feature that evolved as a result of specialisation in agriculture. Even in regions remotely touched by modern agriculture, increasing area is brought under monocroppig system. In north-eastern hill regions, a survey shows that nearly 76 percent of cultivated area is under monoculture (Dhiman et al, 1988).

In intensive agriculture increasing percentage of area under any crop was planted with few genotypes representing a very narrow genetic base. For instance, from 1965 onwards, there has been a steady increase in the percentage of rice area under high yielding varieties that have replaced the highly diverse land races (Anonymous, 1986). Though these high yielding varieties seem to represent a broad genetic base, tracing their genealogy, reveals an appaling truth that their entire gene pool is made up of a few land races (Li and Yuan, 1986;Fig. 2).

Thus, much of modern day agriculture dangerously depends on a very narrow genetic base of crop plants. In US, 68 per cent of the land under cotton is covered by merely 6 cultivars and 71 per cent under maize by hybrids developed from 6 inbreds only (Duvick, 1984).

Isozyme pattern analysis of few crop species have similarly indicated that the genetic diversity of the cultivated varieties is far less than that of the total existing in the population (including the wild relatives; see Table 3; Brown, 1978).

In some parts of interior Africa, Morishima and Oka (1979) found that farmers plant mixtures of Oryza glaberrima and O.sativa much against the suggestion by the agricultural officers to grow only the latter. Their study indicated that such mixed planting not only buffers yield against unfavourable conditions but also maintains a high degree of genetic diversity within the rice populations. They noticed that there is an optimum combination of O. glaberrima and O.sativa that provides the highest gentic diversity in the rice fields. Further, their study also indicated that the diversity within rice population was positively correlated with the species diversity of the habitat indicating an active introgression between the wild / weedy and the cultivated rice types. The contribution of such wild/weedy species to maintain genetic diversity in cultivated crop plants is well established (De Wit and Harlan, 1975) in several other systems such as Eleusine coracana - africana complex (Dattananda, 1983; Mehra, 1962) and in Maize- Teosinte complex (Wilkes, 1988; Benz,1989).

The loss of genetic diversity due to monoculture is not restricted to crop plants alone. Nearly 65 per cent of the 6 to 7 million dairy cows bred each year in US are derived from the use of 500 performance tested bulls that in turn are sons of only

10 best bulls of the previous generation (NRC, 1989). Clearly, the present day dairy cattle in America represent a very narrow genetic base.

5.2 Topographic features

Another syndrome of converting agriculture to industry like enterprise is maintaining a 'sterile' environment on the farm lands (Mader, 1990). Consequently, alterations in several topographical features such as removal of water holes, clearing of bunds and fragmenation of land became prominent features of intensive agriculture. These have led to considerable change in the genetic and biodiversity of the farm lands.

5.2.1 Bunds and Hedgerows

Since the beginning of agriculture, bunds and hedgerows have served as repositories of genetic and biodiversity of the crop and animal species. But the general tendency of modern agriculture is to have large fields without elaborate bunds and hedges to facilitate mechanical and agronomic operations. Even when farms are heavily bunded, they are usually cleared off vegetation with the belief that they act as source of inoculum for the weeds, pests and disease infestation of farm lands (Nazzi et al., 1989). As a result, modern farmlands have lost their most important and potential repertoirs of genetic and biodiversity.

Several studies have indicated that hedgerows and bunds indeed help maintaining both plant and animal diversity on farm

lands. Nazzi et al. (1989) found that farms with hedgerows had an abundance and variety of Carabidae and Formicidae compared to those without hedgerows. They argued that hedgerows simulated the extinct biotopes of farmlands and hence maintain the genetic and biodiversity reminiscent of the original habitat that is now replaced by the farming habitat.

The bunds and or borders may also serve as 'hot spots' for local evolutionary interaction of the flora and fauna (Mehra, 1962; De Wit and Harlan, 1975; Duttananda, 1983). For example, Maelfait and De Keer (1990) showed that spider species inhabiting an intensely grazed field have quite different life cycle strategy than those inhabiting the surrounding border zone. The two zones also differed in the composition of species; the margins of the pasture lands had relatively uniform frequency of more species than the grazed pasture.

In recent years, increasing emphasis has been laid on the importance of features such as bunds, borders, small fallows on the farm lands to conserve biodiversity (Maelfait and De Keer, 1990). These areas serve as refuges/reservoirs for many organisms whose otherwise natural habitats are destroyed. Further, boundaries of farms may also serve as uninterrupted corridors for the dispersal of organisms (Samways, 1989b).

5.2.2 Water holes and ponds in farms

Farm dams or ponds constitute an integral part of most agricultural systems. They are shown to support a number of aquatic flora and fauna. Samways (1989a) found that small

earthen farm dams, characteristic of the agricultural landscape of southern Africa, serve as excellent nature reserves. Several species of Odonata (dragon flies) normally found in the mountain regions were present along the farm dams. Thus though farming per se adversely affects the flora/fauna by altering the natural landscape (Pyle et al., 1981; New, 1984), the associated construction of small ponds may help conserve the biodiversity. However, with the recent emphasis on weed free and sterile environment, modern agricultural system has cleared much of these small weedy water holes thus destroying the floral and faunal diversity associated with them.

5.2.3 Fragmentation

Population ecologists have argued that the intra-population gene pool exchange is an essential process for species to persist in their respective habitats (Nicholson, 1958). Consequently, the size of the interacting population is an important parameter that influences the survival of the species. But, in developing countries, such as India, the size of the farm holding has been decreasing both due to increase in population and intensification of agriculture. The fragmentation of lands is generally associated with the formation of intervening roads, farmhouses etc.,. These might have serious consequences on the genetic-and bio-diversity of farm lands (Forman and Godran, 1986) as they disrupt the corridors connecting the genetically interacting populations.

Saunders (1990) showed that in South West Africa, break down of corridors due to farming substantially affects the avifauna diversity. He demonstrated that the local disappearance of the Carnaby Cuckatoo is purely because of the disruption in the continuity of the natural vegetation that linked the habitats of the species.

Similarly, Reh and Seitz (1990) showed that fragmentation of lands through roadways reduced the average heterozygosity and genetic polymorphism of the common frog, Rana temporaria in Germany.

Nevertheless, studies by Webb and Vermatt (1989) of the remnant heathlands in UK showed that fragmentation might also have positive effects on diversity. They showed that biodiversity of heathlands was negatively associated with the size of the area. The original large heathlands had low diversity while the recently formed, highly fragmented heathlands adjacent to farm lands exhibited a high level of species diversity.

5.2.4 Other features of modern agriculture affecting genetic and biodiversity

Besides the major features discussed above, few other components of modern agricultural ecosystem have also impaired the genetic and biodiversity.

Following the introduction of gene pools from distant regions for cultivation, several alien weed species have invaded

and colonized the farm lands replacing the local crop genetic diversity. Braithwaite et al. (1989) showed that in coastal areas of northern Australia, the introduced shrub, Mimosa pigra, has been spreading rapidly. Comparison of the faunal diversity between areas infested with the weed for 3 and 5 years showed that the latter harboured relatively less faunal diversity. It is suggested that the spread of the competitively growing M. pigra may lead to destruction of plant and animal apecies if it is not checked. Closer home, Kaul (1967) reported a similar invasion of Croton from S. America into India. Its spread and dominance in almost all habitats is a clear indication of the erosion of the locally diverse weeds. Of recently, this species is giving way for another noxious and more competitively dominating weed, Parthenium hysterophorus.

Another fall out of modern agriculture is the intense grazing activity by the cattle on the adjoining fields and farms. Noy-Meir (1990) showed sites with less grazing supported significantly more of wild cereal grasses than those with intense grazing activity. A study in Arizona desert (Brown and Heske, 1990) showed that artificial exclusion of the keystone rodent guild from grasslands has resulted in significant increase in the composition and growth of tall grass species. The study indicatd that through seed predation and soil disturbances, the keystone species has major effects on the biological diversity and biogeochemical processes. In other words, the practices associated with conventional agriculture system such as intense

grazing, digging etc., might have serious consequence to the biodiversity in the long run.

From the foregoing, it is clear that the loss of genetic- or bio-diversity in intensive agricultural systems is because of the different philosophy and strategy followed compared to that proposed for sustainable agriculture. Intensive agriculture borrowed the economic principles that governed the growth of industrial enterprise. Hence it developed as a profit oriented, energy intensive and highly specialised enterprise; it aims at maximising short term gains and disregards the long term sustenance of the environment and economy. Because of its emphasis on specialisation in the cultivation of crops, it has led to a massive erosion of genetic- and bio-diversity.

However, few mosaics characterised by primitive agricultural systems still maintain the genetic- and bio-diversity. The practice of cultivation of mixtures of Oryza species in interior parts of Africa (Morishima and Oka, 1979), maintenance of untended bunds in parts of Africa and Italy (Morishima and Oka, 1979; Nazzi et al, 1989a), weedy water holes in parts of South Africa (Samways, 1989) are but only few instances of such primitive agriculture conserving the biological diversity. Similarly, Benz (1988) reported that Sierra de Manantlan of Mexico where farmers have been resisisting the modern agricultural practices, maintain still today probably the richest diversity of Zea species. Some of the features of these mosaic habitats which are in obvious contrast with those of intensive

agricultural systems are indeed proposed by the philosophy of sustainable agriculture.

Hence we suggest that there may be important lessons to be drawn from the highly endangered system of primitive agriculture that barely survives today in several parts of the world (eg., in some tribal areas and developing countries). Fortunately, the agricultural systems of few developing countries have not yet reached the irrevocable stage. There is still potentiality to revert and modify these agricultural systems to conform to sustainable agriculture and to save the residual genetic- and bio-diversity existing on farm lands.

6. MODELS OF CONSERVATION

In this section, to develop suitable models of conserving genetic diversity of crop plants in sustainable agriculture, we first present the existing methods of conserving the genetic- and bio-diversity; we simultaneously identify the problems associated with these methods. Finally, based on our earlier discussion on detrimental effects of the components of intensive agriculture, we propose several methods to conserve genetic diversity.

6.1. EXISTING METHODS:

6.1.1. GERM PLASM COLLECTION:

Following Vavilov's (1940) seminal work on the centres of diversity of crop plants, agricultural workers realised that crop diversity has wide geographic distribution. Hence they started exploration, collection and introduction of genetic material to

improve local gene pool of the crops (Sprague, 1980). After Harlan's warning about the danger of the erosion of crop genetic diversity (Harlan and Martin, 1936), breeders began to build up their own germplasm collections. On a larger scale, germplasm banks were established for several crops at international crop research centres. To facilitate exchange of the material, these centres were linked with breeders all over the world. International Beureau of Plant Genetic Resources (IBPGR) is one such organisation linking national level Bureaus of Genetic Resources (eg NBPGR in India). This approach has indeed paid good dividends to the world community of plant breeders in their efforts to genetically improve the local crops.

However, this method has its associated problems:
First, exploration of genetic resources of crop plants is never complete. Desired genes might also exist in the related wild species of the crop plants. This means exploration can not be restricted merely to the cultivated crops and to their centres of diversity. But the entire vegetation cannot be explored, collected and stored in cold rooms. For instance, Teosente, the closest relative of maize, a major contributor of several genes to maize diversity through introgression is found widespread in Mexican Valley (Benz, 1988; Wilkes, 1988). The germplasm collectors of maize have found it difficult to explore and collect the entire representation of Teosente diversity (Benze, 1988). Similarly, in Sierra de Monantlan of Mexico where other Zea species occur in wild, have not yet been completely explored because of the continuous generation of diversity in the

populations of these speices. This has prompted the estabishment of a Biosphere at this place for in situ conservation of the diversity.

Second, introduced material has to be tested for its acclamitization to the new areas before it is accepted for cultivation. This warrants evaluating a large proportion of germplasm which obviously is highly expensive. Futher, Introduction has also often led to the invasion by alien weeds.

Finally, long term maintenance of genetic diversity is expensive and often not possible because of the seed viability problems (Agarwal, 1990).

6.1.2. NATURE RESERVES

This approach is based on the principle of setting apart areas for nature conservation while keeping the degree of land use in other places at existing or increased level (Mader, 1990). The nature reserves are generally proposed to be established at the centres of crop diversity. Unfortunately, centres of diversity are highly diffused and spread out. Further, genetic diversity also constitues rare and endemic species. Hence, the biological and physical boundaries of such nature reserves is practically difficult to define. Besides, several workers (eg., Mader,1990) have argued that conserving genetic diversity in nature reserves is not an appropriate strategy because of the following :

a. Nature reserves per se can not compensate for the loss of genetic diversity occuring at an alarming rate outside the reserves.

b. Not all species can be conserved in nature reserves. For instance, Plachter (1985) showed that only 10 % of the endangered species live within the nature protection areas in West Germany.

c. The quality of nature reserves can not be permanently maintained because of the continuous human imapct, especially if the reserves are small and their natural ecotones lost.

6.2. CONSERVATION OF GENETIC- AND BIO-DIVERSITY IN SUSTAINABLE AGRICULTURE

Though in the above section, we have highlighted the drawbacks associated with the existing methods of conserving genetic- and bio-diversity of crop plants, we do not mean to advocate against practicing such methods. Rather, we propose that these methods are often less effective and at times inadequate for a realistic conservation of genetic diversity. This might be probably because these methods have evolved for the conservation of genetic diversity in the milieu of the problems associated with intensive agriculture. Hence in the context of sustainable agriculture, they obviously need to be augmented with other practices that encourage in situ conservation of genetic diversity.

6.2.1. In Situ conservation (in the agricultural habitats)

Strategies of conservation of genetic diversity in sustainable agriculture should aim at a) reducing the human impact on the agricultural landscape and b) development of integrated habitat linking systems. This approach encourages build up and maintenance of genetic- and bio-diversity in the agricultural habitats such that the diversity relevant to the local needs can be encouraged. This would also help in the renewal of genetic diversity and facilitates a continuous crop-weed evolution through introgression.

Based on the components of intensive agriculture that have lead to loss of genetic- and bio-diversity, we propose the following strategies to be incorporated in to sustainable agriculture. We hope that these would help in restoring the location specific genetic- and bio-diversity and would help in the ecological management of the weeds and pests on the farmlands.

1. Mixed cropping and using varities with broad genetic base

a. Suitable mixtures of crop plants. A suitable mixture of crop species per se to meet the local needs should be encouraged. This not only buffers the economic risk due to loss of any single crop but also promotes the genetic diversity in the vicinity of the farm lands. This infact is evident from the studies of Oka and Morishima (1971) and Morishima and Oka (1980).

b. Mixture of varities: Instead of the present practice of maintaining the uniformity in crop varities, the area under each crop should be planted with mixture of genotypes. An analogous concept (multiline varities) was infact first recommended for preventing the desease epidemics and build up of specific pathogenic and pest races (Vanderplank, 1963). There are several instances when persistent cultivation of a single genotype has lead to the devastating consequences. The breakdown of resistance built using several genes in IR 36 in Indonesia during 1986 is one such example (Singh, 1989). Such epidemics could be avoided by cultivation of mixed genotpes such as land races. Further, such mixture of varities also helps maintain the genetic diversity within the farmlands.

c. Focus on Breeding Methodology: Conventional plant breeding programmes aim at releasing genetically stabilised and uniform genotypes as cultivars. Further their primary aim is to improve specific quality of the genotype or variety and they do not particularly consider using a very broad genetic base. These have lead to a considerable narrowing down of the genetic diversity of varieties relased to the farmers. However, the history of plant breeding shows that culitvars developed by composit and synthetic breeding methods based on the principle of panmictic mating among a wide range of genotypes have provided stable and genetically polymorphic varieties whose yield performance is often on par with hybrids. Indeed one of the most successful method of breeding in sunflower has been the population improvement. This method that insists on use of an

array of diverse genotypes as a base material is being consistently followed by Russian breeders (Pustovit, 1964; Sindagi and Virupaksha, 1986).

Thus, we suggest that breeding methods to develop varieties for sustainable agriculture should orient to incorporate wide range of gene pool such that the genetic diversity of crop plants is maintained on the farm land per se. Indeed recognising the narrow genetic base of the hybrids of the entire corn belt of America (Smith, 1988), Goodman (1988) suggested the development of synthetics.

2. Topographic features

As argued earlier, several topographic features such as bunds, weedy waterholes and hedgerows contribute substantially to the genetic- and bio-diversity of farm lands. It is therefore appropriate that farmlands should be designed with an optimum proportion of these structures. Further, the present practice of keeping the bunds and water holes highly 'sterile' should be discontinued to facilitate the build up of the weedy forms and wild relatives. The ensuing introgression between these weeds and the crop varieties would lead to a dynamic process of generating new diversity.

Fragmenting farm lands with bunds might also increase the rate of gene exchange as shown by Webb and Vermaat (1990). Bunds might also serve as interconnecting corridors of isolated vegetative patches. Such corridors would help in the active exchange of gene pools through diffusion and dispersal.

3. Wet lands as microreserves

It is shown that species richness is more in infertile than fertile wet lands; they also had more rare species (Moorie et al, 1989). A proprtion of these infertile wet lands should be left aside as microhabitats to serve as local repositories of genetic- and bio-diversity. Since these wetlands may not represent the prestine environments (Benz, 1988) this view of conservation may appear naive especialy considering that man as the most prevalant force in nature might still contribute to the disturbance of these microhabitats. However, this does not mean that setting aside wetlands as microhabitats should not be an important aspect of conservation, but that they may require an active and judicious management.

Finally, programmes aiming to conserve the land races, wild and weedy relatives of the cultivated crop plants have to consider the right of farmers to earn their livelyhood. In this context, the models suggested above may not be readily practiced by the farmers unless they are ensured of the cost of adopting them. Though sustainable agriculture incorporating these models might still be profitable in the long run (Winkelman, 1977; Benz, 1988; Stanhill, 1990), at the initial stages, involvement of government and international agencies might be necessary to encourage their adoption by the farmers. In this context, formation of Sierra de Monantlan Reserve in Mexico for conserving the wild species and land races of Zea by UNESCO-MAB (Benz, 1988)

and subsidization to farmers adopting traditional farming for in situ conservation of traditional varities as in Yugoslovia would be best models to emulate.

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Table 1. Spectrum of Schools of Thought in Agriculture from Low to Hi
Sustainability

School of thought	Characterized by
LOW	
Conventional (monoculture)	External solutions to internal proble detachment, Compensatory control, unawareness
(minimum tillage chemical banding)	Efficiency
Low-input sustainable agriculture (LISA)	Substitution of benign inputs
Lemaire-Boucher	
Ecoagriculture	
Organic	Benign design and management
Biological Regenerative	
Bodynamic	
Premaculture	Internal solutions to internal prob
Bioregionalism	Integration, balance, awareness, re
Natural	to feedback; Complex indirect, long bioecological, local approaches to problems.
HIGH	

Table 6. Comparative genetic diversity of gene pools

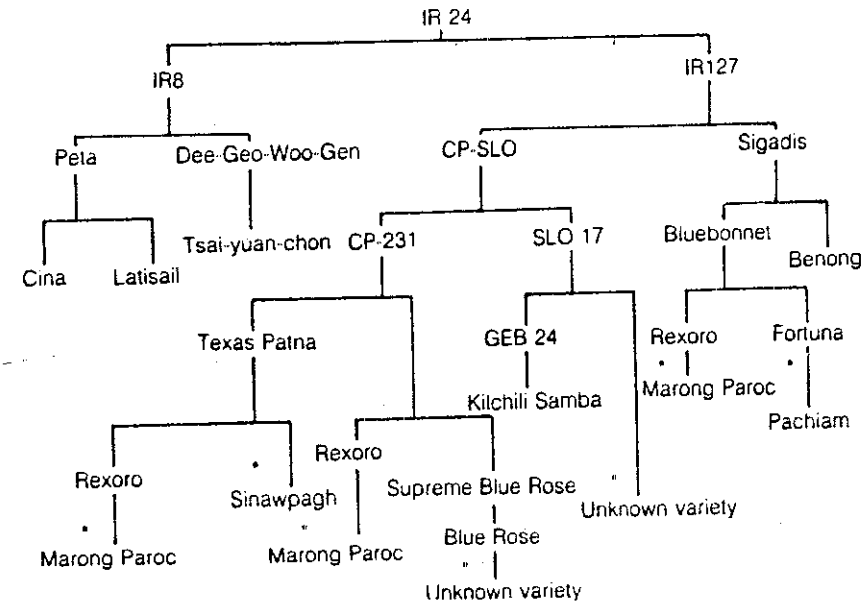
Population			Sample	100 X He (Diversity index)
Pholx cultivars	-within cvs	17 loci	56	4.1
	-total		16	13.3
P. drummondii	-within popns	28	28	6.3
	-total	10	10	8.9
Phaseolus coccineus	-8 indigenous cvs	4 loci	22	3.9
	-5 wild popns		22	10.0

FIGURE LEGENDS:

Fig. 1. Reduction in genetic diversity as Agriculture shifted from shifting cultivation to monocropping system. (from, Smith and Francis, 1986).

Fig. 2. Genealogy of some paddy genotypes.

Maximum
Genetic Diversity
Minimum
Genetic Diversity
Cropping Systems
Shifting cultivation
in humid forests
12-crop mixtures
in Africa
Maize-cassava-bean
Maize-bean
Bean cultivar mixture
Multiline cereals
Wheat varieties
Double-cross maize hybrids
Single-cross maize hybrids


IR 24
IR8
IR127
Peta
Dee-Geo-Woo-Gen
CP-SLO
Sigadis
Cina
Latisail
Tsai-yuan-chon
CP-231
SLO 17
Bluebonnet
Benong
Texas Patna
GEB 24
Rexoro
Fortuna
Marong Paroc
Kilchili Samba
Pachiam
Rexoro
Rexoro
Sinawpagh
Supreme Blue Rose
Unknown variety
Marong Paroc
Marong Paroc
Blue Rose
Unknown variety

36

COMMENTS [illegible]

REVIEW OF BACKGROUND PAPERS FOR WORKSHOP ON LINKAGES BETWEEN WASTELANDS AND BIODIVERSITY

TO BE HELD IN BANGALORE SEPTEMBER 15-21, 1991

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Bisaliah. 'Development of Social Forestry: Some Second Generation Concerns."

A useful overview of contemporary issues in social forestry. The conclusion is too verbose and can be reworked. What is the connection between social forestry involving at most a few plantation species and the theme for the workshop-biodiversity? Perhaps this aspect can be explained into further.

Fernandes. "Forests and the State of the Tribals Today."

A fine analysis of the alienation of control over natural resources on the tribal populations of the country and the genesis of tribal impoverishment. With such a solid analysis, the author can consider using this forum as an opportunity to also suggest broad principles for development activities in tribal areas, the development of cooperatives in tribal societies to interface with the commercial formal, economy, the possible involvement of tribals in wasteland development, and so on, to firm up his conclusions in line with the theme for the conference.

Kumar. "Biotechnology and Biodiversity."

An overview of the state of the art in biodiversity from the aspect of biotechnology. Section 3 may be condensed or eliminated as it is technical information which is not new or especially relevant. This is a new area of work in India, still not developed. Specific suggestions on how India could gain from the conservation of its genetic biodiversity could be helpful. The whole area does not appear to have much connection with wasteland reclamation.

Ramaswamy. "Role of Non-Governmental Organizations in Wastelands Development and Nature Conservation."

This paper says nothing new and does not have any concrete suggestions to offer. Perhaps the author would do well to examine NGO involvement in social forestry which is stressed in the paper.

Sudarshan and Somasundaram. 'Tribal Forest Interaction and Conservation of Biodiversity.'

This paper repeats old adages about the exploitation of tribal populations. Section II offers some concrete suggestions for the involvement of tribals in forest management. The opening section can be abridged, the references are tardy.

Shah. "Problems of Common Property Resource Management in India."

This is a study on development of community based systems of common property resource management. The conceptual framework can be condensed. The section of Van Panchayats in the hill areas of U.P. may be condensed a bit, as there are well addresses in other publications. The other case studies mention by the author in West Bengal, Gujarat, and Orissa may be stressed. The author's suggestions are not operational and as a result are not likely to be useful.

Shyam Sunder. "How have the changing forest policies over the 1980s affected the country's heritage of biodiversity?"

A broad recap of changing forest policies in India. The author might further focus on Karnataka since he has much experience in working there. Would the author like to suggest privatization of forest and wastelands? If so, please elaborate, as this might be a useful suggestion for certain Indian industries. Further suggestions on how the FCA of 1980 can be strengthened. Perhaps a case study of the Kabini scheme would also add to this paper in highlighting the failure of forest management policies and the abysmal non-implementation of resettlement schemes and how the forests of India have to pay for the failures of various departments.

Hegde and Bhat. "Credit and Marketing facilities Needed to Promote Wasteland Development Exports by Farmers."

Far too many generalizations on the role of forests and the harmful role of contractors The authors may wish to focus on the basket weaving cooperative in Uttara Kanara to makes their points on credit and marketing facilities. The various zones suggested should be worked into existing classification schemes. There is very little in this paper on credit and marketing per se and this should be emphasized. Perhaps the authors may wish to focus on marketing cooperatives and how they could function be started. Generalized statements will not be very useful.

Gadgil. "Conserving India's Biodiversity. The Societal Context."

A fine paper looking at India's problems with the conservation of biodiversity from the human ecology approach.

Adkoli. "What role to Industrial Plantations Have in Wasteland Development?"

Makes a clear case for the development of industrial plantations in wasteland areas. More information on the costs associated with wood raised in wasteland as well as ownership issues would be desirable. Finally, we have someone who says that biodiversity associated with wastelands is a myth and explains why monocultures are desirable. This should be highly useful for the workshop.

Uma Shanker and Ganeshaiah. "Conservation of Genetic and Biodiversity in Sustainable Agricultural Programmes."

The authors make a clear case for conservation of biodiversity from an agricultural viewpoint as well as provide some fine ideas on sustainable agriculture. However, the economic and ecological incentives for wasteland development for the conservation of biodiversity viewpoint are ignored (perhaps because this is a new avenue of thought). Highly referenced and thought-provoking study from an agricultural viewpoint.

Dogra and Behl. "Conservation of Genetic Diversity of Forest Trees and its Linkage to Restoration of Degraded Agricultural Land-Soil Sites."

The authors actually go into the specifics of tree selection for wasteland reclamation. This is a technical paper and quite relevant to the theme of the workshop.

Sarin and Khanna. "Wasteland Development by Women's Groups."

While this paper in in the form of a paper submitted to the ILO, it could be made more relevant to the workshop with some amendments. The initial sections on the other work of SARTHI can be condensed into a short background to the work of the organization, before the authors get into wasteland development.

Rodgers. "The Management of Protected Area Buffer Zones for the Maintenance of Biodiversity."

A fine paper on the necessity of retaining and developing buffer zones of protected areas for the maintenance of biodiversity. The author starts with definitions to clarify the discussion, which will be useful for the workshop. The reference section is missing from the copy which was circulated.

Engineer. "Role of the Mass Media in Promoting Ecologically Sustainable Development Policies."

This paper has nothing to do with the theme of the workshop. May be the author would like to comment on the role of the mass media in ensuring the implementation of resettlement schemes associated with development projects.

Ramakrishnan. "Conservation Linked with Sustainable Development."

The author describes how the ecological and social linkages aspects of an agro-ecosystem can be useful for the conservation of biodiversity. The jhumming system of agriculture is described in detail.

Prasad. "How can we involve people at large in planning, monitoring, and field action related to development of degraded lands and conservation of biodiversity?"

The Sukhomajri and Chipko examples need to be de-emphasized in preference to the other areas which have received little publicity.

Pandeya. "The role of Forest Department in maintenance of biodiversity on lands falling outside the nature reserve system."

Has identified the connection between social forestry and biodiversity which is critical to the theme of the conference. The author may be asked to go into this aspect further in terms of actual figures on how much land may be afforested, what the fuelwood and timber demands of the country are, and how consequently, the reclamation of wastelands (appropriate mechanisms for which should also be described from the Forest Department's angle) can ease the pressure from natural forests.

Saldhana. Restoration of Wastelands-Role of Academic and Research Institutions.'

More detail on the role of academic and research institutions, less on the extent of wasteland, would be desirable. Which are the academic and research institutions which can play a leading role? What is the current situation?

Gandhi, Rastogi, Mathew. Information Gaps for Linking Degradation of Wasteland to Conservation of Biodiversity'

Lack of research information, inadequate management systems are highlighted in this summary. We don't know how interviewing 'elders' can elaborate on 'biodiversity' of wastelands.

Sarin and Sharma. "Women's Involvement in Rehabilitation of Common Lands in Bicchiwara Block of Dungarpur District, Rajasthan."

While this paper is in the form of a paper submitted to the ILO, it could be made more relevant to the workshop with some amendments. The initial description of the area, women's issues, and PEDO, can be condensed into a short background to the work of the organization, before the authors get into reforestation programs carried out by PEDO.

Nuthan and Vasundhara. "Role of Indigenous species in Restoring Degraded Lands and Sustaining Biodiversity in Revegetation Programmes."

The paper is most relevant to the theme of the workshop as it discusses the case for indigenous species in restoring wastelands.

Melkania. "Integrating Biodiversity Movement in Mountains."

Highly generalized paper. Can benefit from further focus on mountain ecosystems and specific causes for the creation of wastelands. The topic needs to the changed.

Chandran and Gadgil. "Resource Use Systems and Maintenance of Biodiversity in Pre and Post-Colonial India."

A good piece of research. Four systems of resource usage are studies for their impact on the country's biodiversity through the ages. A well-documented historical account.

151/NES-CS/91

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19th Aug. 1991

COMMENTS ON THE BACKGROUND PAPERS OF THE WORKSHOP ON LINKAGES BETWEEN WASTELANDS AND BIODIVERSITY: CES, IIS, BANGALORE, SEPT. 16-21,91

I have not received all the papers. All those that we have received show common concern for maintaining biodiversity through people's participation. However, the analysis of the causes as well as of participation differs depending on the person's background.

Some papers like those of Shyam Sunder see a bigger role of the people than of industry in the destruction of forests. He mentions for example, that 90 per cent of the wood is used for fuelwood, most of it for cooking. This assumption is disputed today based both on the data available and on qualitative studies. The data of forest departments like those of MP till 1984 (when many fuelwood related activities were banned in this major 'catchment area' of fuelwood), show a proportion of 45%-55% between industrial timber and fuelwood. Much of the latter is also used for industry. Other studies like those of Gupta, Desai and Ganfuly (1981) put the total need of fuelwood at 100 million mt. But studies like those of Anil Agarwal show that the total cutting of fuelwood from forests is only around 30 million tons. It was assumed till now that the rest of the fuelwood was smuggled out of forests. But the data produced by these and other studies show that the dificit is ma-de up by crop and other agricultural waste and not by cutting illegally from forests.

However, that today headloading has become a major problem is obvious. The history of forests as presented by Chandran and Gadgil, and by Sudarshan and Somasundaram give an indication of the causes. It is important to understand these causes of degradation if biodiversity has to be restored.

The second aspect to be borne in mind in the analysis of causes is the diversity of social groups. Gadgil has brought out the difference between the "ecosystem people" and the "omnivores communities." This "class" division is crucial. But it is essential also to remember that there are cumulative inequalities in the country based on more than one source of inequality. This comes through in the paper of Madhu Sarin and Chandrika Sharma. Even among the "ecosystem people" male-female inequality remains and as can be seen from the paper of Fernandes, it is getting strengthened as a result of Sanskrtisation in the post-ecosystem degradation years. If focus is only on the "ecosystem and omnivores" people, then the cause of past degradation may be found well, but the factors of future solutions may not be analysed equally well. Similarly class formation in these formerly egalitarian societies has to be understood. That too is the result of environmental degradation and of the shortages that follow.

Thirdly, the very understanding of participation has to be conditioned by these nuances. Participation as a strategy has been mentioned by all the authors. Most have remained at the principle. But somehave thought of it only as benefit-oriented. While working out a strategy, one would

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have to situate it within the diversity of ecosystems mentioned by Melkania, the type of technology and the consequent choice of species discussed by Nutha_n and Vasundhara, the sustainable development and the type of awareness building alluded ~~by~~ to by P. S. Ramakrishnan, and by Sudarshan and Somasundaram, ~~and~~ the constraints emerging out of male-female and class difference in the ecosystem societies themselves and the incentives required, as mentioned by Shah and by Sarin and Sharma.

Finally, the role of support institutions needs more analysis than is found in most of the papers. The role of the forest department as well as of research institutions would have to be situated within this participatory context without in any any way downgrading the role that the updating of technologies have to play.

Walter Fernandes

PAPER 1, N.S. ADKOLI
What Role Do Industrial Plantations Have in Wastelands Development?

Sections 1.1.1 and 1.1.2 can be deleted. Section 1.2 is sketchy and should be revised to include more details. Sections 1.1 and and 1.2 can be synthesized into a single section, provisionally titled, "Industrial Demand for Forest Products". Sections 4.2 and 4.3 can also be subsumed under this heading.

The logical next section then would be "Supply of Forest Products for Industrial Use." The materials from section 1.3 and the statistics from sections 3.2 and 4.1 could be used for this purpose. Information on the geographic distribution of demand and supply would strengthen the text.

The third section should discuss the current and projected shortfall in the industrial supply of forest produce.

The fourth section should focus on competing, non-industrial uses, particularly fuelwood and fodder demand. Data should be segregated into marketed, urban-destined firewood and non-marketed fuelwood retained for rural use to better reflect urban versus rural demand.

A comment on the table on page 12. The percentages add up only to 89.48% - what about the remaining 10.52%? In addition, while it is true that fuelwood as a single item appears to exert the largest pressure on forests, overall industrial demand (sum of the remaining items in the table) exceeds fuelwood pressure. Fuelwood accounts for 41.99% of consumption, and industrial demand for 47.49%. The discussion following the table obfuscates this fact.
The third column of the table, with figures in millions of tonnes, doesn't correspond to the column on percentages.

The first table on page 7, based on 1974-75 data, is useless for a historical comparison because the categories in the 1981 FAO table do not correspond with the categories in the first table.

Are there any updated statistics of the timber inventory on Forest Department lands, and on the level of annual increment? If not, why?

On page 6 the author pins forest degradation on mismanagement by tribals and villagers. There is no effort to be objective. Surely responsibility for the degradation of forests in India is shared equally by villagers, the Forest Department and industry?

Sections 2.2 and 7 can be synthesized. "Wastelands" should be

carefully defined. Are biologically productive but economically unproductive lands "wastelands"? The first sentence of section 7 implies precisely this.

The allegations against monoculture are poorly refuted in section 3.3.2. If they are to be rejected, it must be done more substantively using empirical results.

The first table on page 13 should be rearranged into three columns: projected demand, projected supply and projected shortfall and used in the third section of the paper (see above).

The figure of degraded lands cited on page 17 must be 29.2 million ha rather than 292 million ha.

Overall, Shri Adkoli's paper could be restructured as follows:

1. Industrial Aspect
    - 1.1. Demand
    - 1.2. Supply
    - 1.3. Shortfall

2. Non-Industrial Aspect
    - 2.1. Demand
    - 2.2. Supply
    - 2.3. Shortfall

3. Role of Wastelands
    - 3.1. Definition
    - 3.2. Technical Considerations
    - 3.3. Economic Considerations
    - 3.4. Institutional Considerations

4. The 1988 National Forest Policy

5. Wastelands, Biodiversity and Economic Welfare

PAPER 2, S. BISALIAH
"Development of Social Forestry: Second Generation Concerns"

The emerging second generation concerns stated on page 2 should be enumerated succintly to ease reader retention. They can be expanded upon in the text later. Dr. Bisaliah lists ten concerns, but surely these can be grouped into categories? One possible agglomeration is: distributional concerns, institutional concerns, financial concerns, and ecological concerns. Once organized into categories, these concerns will be easier to address in logical fashion in the text.

The philosophies of participatory development, institutional innovation and equity (over economic efficiency) are the key aspects of social forestry that the author evokes, although it isn't always clear in his discussion whether he is referring to farm forestry or community forestry (that distinction is drawn explicitly only later in the text). Each of these three philosophies demand more substantive discussion. In addition, it would be interesting to compare how the three vary under different institutional arrangements (for example, farm forestry, community forestry, multi-agency forestry and production forestry).

In emphasizing the need to balance feasibility and desirability the author offers sound advice, but no illustrative support. Are there case studies of social forestry projects where such a balance has been achieved?

Early in the text, the author equates social forestry and wastelands development. One is clearly the means to the other, but the link needs to be more clearly made.

Overall, Dr. Bisaliah's would be enhanced by:

(a) reorganization of the text; and,
(b) purging needless rhetoric like "people's movement".

One additional minor remark: the analysis of panchayats on page 13 is rather uncritical. Panchayats clearly are sometimes effective vehicles for social forestry and sometimes not. It is important to analyze when they are effective and when they are not.

PAPER 3, P.D. DOGRA and H.M. BEHL
"Conservation of Genetic Diversity of Forest Trees"

A fine paper that invites only minor comments. On page 1, the authors cite 93.6 million ha as available for growing trees. What is the source of this figure and what is the nature of the available land in physical and tenurial terms?

On page 2, a map of India indicating alkalinized areas would supplement the text.

On page 4, the authors declare that "the net adaptive value of a provenance or population of a species is determined by many components" but thereafter fail to state these components. Clarification is required here.

On page 6, the authors write about "destructive sampling". What is this?

The sections on "Exotics" and "Indigenous Species" are highly relevant but inadequately discussed. These sections should be expanded. The two categories should be compared and contrasted in terms of their capacity to:

(a) restore degraded lands; and,
(b) enhance biodiversity.

How valid are the criticisms labelled against exotics such as Eucalyptus and Leucaena? Is there a direct link between improving biodiversity and restoring degraded tracts?

The paper lacks a conclusion. A strong summary of the main points is required at the end.

Pages in the text should be numbered. Fine and overly technical details should be placed in endnotes. A glossary of technical terms should be provided in the appendix for lay readers.

PAPER 4, RUSI ENGINEER
"Role of Mass Media in Promoting Ecologically Sustainable Development Policies"

An offbeat paper but clearly dealing with an important topic. There are no major objections to the paper apart from the fact that it would read better if organized into sections.

At points the paper runs the risk of drifting into generalities, rather than remaining a focussed analysis of the role of written media. If ecologically sustainable development is to happen, it is first imperative that there be a dialogue between concerned actors (state, NGOs, academics, media, and communities) on normative considerations: after all, what is ecologically sustainable development? There may be multiple perspectives on it, which then complicates ex post evaluation of policies. "Success" becomes contingent on evaluative criteria.

This means that the role of media is to reflect as neutrally as possible the efforts of each concerned actor, including its own efforts, to the public at large, taking into account conflicting institutional perspectives. Journalists must critically evaluate the actions of institutions without succumbing to institution-bashing. The idea is neither to press an ideological agenda nor to disguise institutional conflict. The idea is to provide a forum for dialogue and negotiation.

This thrust is absent in Mr. Engineer's paper. He appears to side exclusively with NGOs, and never with the state. Is an anti-state stance always appropriate?

Towards the end of the paper Mr. Engineer enjoins the "environmental movement" to produce a joint manifesto that will enable mass media to respond "sympathetically" to its concerns. There is no overt reason for mass media to respond this way to the environmental movement, just as there is no overt reason for Indian environmentalists to speak with one voice. The plurality of voices may be disconcerting, but is not necessarily reprehensible. The role of mass media is search for common concerns in the cacophony of voices, to articulate these concerns, to provide citizens a forum to express their concerns, and to give the state a chance to respond to the concerns. Isn't mass media the vehicle for making development a dialogue, rather than an imposition from above?

An aside: reflections on the "wastelands-biodiversity" issue would add relevance to the paper in the context of the proposed workshop. It shouldn't be forced in, however, unless the author feels knowledgeable enough to write on the subject.

PAPER 5, WALTER FERNANDES
"Forests and the State of Tribals Today"

Dr. Fernandes' paper is comprehensive, but tends towards an ideological stance. To pit state against tribals, or capitalism against subsistence may have utility as an analytical device, but often occludes the true nature of societies. Tribal societies may indeed have been more "conservation-oriented" than modern societies, but whether this translates into an "ecological ethic" dictating "harmonious" coexistence with the environment is debatable. In addition, pre-capitalist societies are not necessarily pre-market societies. It is the relations of production that define capitalism, not the absence or presence of markets. This concept does not clearly emerge in Dr. Fernandes' paper. On pages 4-5, for instance, he writes: "Land...is today understood primarily or even exclusively as an object of agriculture and construction. This is a capitalist view of property..." Hardly. Agriculture has been the centerpiece of peasant economies for centuries, dating to pre-capitalist times. And individual ownership with absolute rights does not correspond to capitalism (in fact, one would be hard-pressed to find capitalist societies where land owners ever had absolute rights).

These are conceptual criticisms of Dr. Fernandes' paper, but they by no means invalidate his contribution to an important topic: the modification of tribal societies by the forces of modernization.

Some additional minor remarks:

On page 5, section 1, the author asserts that tribal societies practised conservation by "building a whole set of religious customs, traditions, myths and social control mechanisms to ensure that a balance was kept between human and environmental needs." First, this statement is highly functionalist. To posit the evolution of religious customs as a function of conservation seems simplistic. It also suggests a synoptic rationality on the part of tribal societies. Second, what empirical support is there to bear out the statement that society and environment were in a balance in tribal cultures?

On page 9, section 3, there is a reference to "tribal egalitarian ideology." Ideology is an inappropriate word, at least from the strict sociological standpoint. "Ideology" in sociology means a distorted view of reality that has an instrumental purpose.

On page 5, line 8, the author writes that "common lands, wastelands, forests, ponds, gardens, etc. were a common property resource." Could the author clarify whether there was an equivalent of "waste land" in tribal vocabularies? How was land distinguished in the indigenous classification system?

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On page 4, lines 5-7, the author generalizes about a code of honour among tribals. Can "tribals" be treated as monolithic entity? Given the multitude of tribal groups in India, surely there must have been a vast variation in customs?

In the conclusion, the author writes that "at this stage space does not allow us to make all the suggestions..." It is precisely these suggestions that the workshop requires. To fault the *status quo* is far easier than posing viable alternatives to it. Using his wealth of knowledge, Dr. Fernandes should move us in this direction.

In sum, Dr. Fernandes has written a fine paper, although the link to wastelands and biodiversity is often tenuous.

PAPER 6, MADHAV GADGIL
"Conserving India's Biodiversity: The Societal Context"

Dr. Gadgil's paper, with slight modifications, could be the position paper for the workshop. As with several other papers, it is concerned more with biodiversity and less with wastelands. The idea is to articulate the links between the two.

The major hypothesis of the paper is that "ecosystem people" have the institutional capacities to practise prudent rather than profligate resource management. However, the hypothesis is not empirically verified. Case studies for evidential support would strengthen Dr. Gadgil's position.

The image of a hostile and monolithic state is also problematic. The Indian state, for all its shortcomings, has made some genuine efforts to promote rural development. Whether these efforts have been misguided or otherwise flawed is another issue.

On the whole, a thoughtful paper.

PAPER 7, TARA GANDHI ET. AL.
"Information Gaps for Linking Degradation of Wastelands to Conservation of Biodiversity"

The brief appraisal of this paper: dealing with an important subject, but poorly organized and sketchy. Several important issues are neglected, and others are dealt with very generally.

What is required is a systematic effort to classify the information gaps, to speculate on why these gaps exist, and then provide viable strategies for bridging the various gaps.

To give just one example: while the the establishment of the NRSA has greatly expanded our knowledge of the resource base in India, there are some fundamental limitations to remote sensing. How can these limitations distort information and how can these distortions be corrected?

With major re-thinking, this paper can be an important contribution to the workshop.

PAPER 8, K.M. HEGDE and GANESH BHAT
"Linkage Between Waste Lands and Biodiversity: Credit and Marketing Facilities Needed..."

The authors propose a model of waste lands development that is vaguely similar to the concept of "extractive reserves" being floated in Latin America. The idea is to marry economic viability, ecological sustainability and equity through aggressive marketing of minor forest products by local cooperatives.

Some conceptual remarks on the paper:

In the introduction, it is not clear from the authors' discussion whether they consider biologically degraded lands or economically unproductive lands as "waste lands". Clarification is needed on this point.

Under the heading "Holding Pattern and Types of Land" it would help if the authors provided rough estimates of lands under each listed category.

On page 3, the authors state: "it is agreed by the experts that growing of tree crops is the only solution [for improving waste lands]." Who are these experts? To say that tree crops are the only way out seems extreme. Shrubs and grasses have a major role in restoration ecology. Nitrogen-fixing non-tree crops also have a role. Would the authors disagree?

The second section of the paper, "Classification of Forest Produce" (page 3) is best included under the next section, "Dependence of Agriculture on Forest," to emphasize how heavily peasant economies rely on adjoining forests.

The final two paragraphs on page 7 degenerate into a diatribes and should be eliminated. There are compelling reasons to preserve biodiversity and to refurbish waste lands: not because "natural forest is the mother of mankind," not even because "diversity is the law of nature," but because peasants all over the world have diverse household needs which, till today, are satisfied through non-market transactions: from surrounding forests and jungles.

On page 12, it is asserted: "Technically speaking most our waste lands except few rocky hells, desert areas and saline and alkaline lands are merely wasted lands." What is meant by "merely wasted lands?" In the same paragraph, the figure of 33 percent is cited as the "recommended forest cover." It may have been recommended by the Planning Commission at one time, but what is the basis for the figure and why should we continue to subscribe by it?

In the last paragraph on page 12, the authors say that demand for fuelwood at the turn of the century will be 200m^3. Surely they mean 200 *million* cubic metres?

On page 13, the authors write that 175 M ha is available for afforestation in India. How was this figure derived? What is the tenurial breakdown of these 175 M ha, and how can they all be available?

The last ten pages of the paper deals with marketing and credit strategies necessary to promote waste lands development. The basic issues here are to:

(a) create material incentives for farmers to participate (this includes shortening the gestation period of tree plantations); and,

(b) reduce transactions costs of market-based exchange by improving the institutional infrastructure.

A more careful discussion of the costs associated with imperfect credit markets, imperfect information, and inadequate access to resources (including marketing facilities) will greatly augment the paper.

Overall, a commendable effort that requires heavy editorial work.

PAPER 9, PATNAM V.S. KUMAR
"Biotechnology and Biodiversity"

One of the best papers in the set. Can be published as is with minor editorial changes.

The link to "waste lands" requires more clear statement.

PAPER 10, D. NUTHAN and M. VASUNDHARA
"Role of Indigenous Species in Restoring Degraded Lands"

The authors alight on an important subject, but fail to do it justice. For one, their paper deviates too much from its title. The focus on the causes of degradation (pages 2-4) and on planning (pages 14-15) are peripheral to the core: which should be an in-depth analysis of the role of indigenous species in restoring degraded lands.

What are the advantages of native species over exotics in biophysical terms? In terms of their adoption by farmers and place within indigenous knowledge systems? These are the key questions that the paper should strive to answer, substantively and comprehensively.

After the recommended revisions likely to be a valuable contribution to the workshop.

PAPER 11, C.D. PANDEYA
"The Role of Forest Department in Maintenance of Biodiversity"

It is interesting to contrast Shri Pandeya's paper with Shri Adkoli's and Shri Shyamsundar's papers. Although they are each from the IFS, one lauds the 1988 National Forestry Policy whereas the others criticize it. Could it be that Shri Pandeya's views are not popularly shared by his IFS colleagues?

The paper as it stands is acceptable. It would, however, be far more interesting if the IG could compare and contrast the 1952 and the 1988 National Forest Policies, focussing on:

(a) the shift in objectives over the course of three decades; and,

(b) changing demands on the Forest Department.

A secondary issue: how does the Forest Department explain the expansion of degraded forestlands, and how does it propose to treat them?

PAPER 12, M.K. PRASAD
"How Can We Involve People at Large in Planning, Monitoring, Field Action Related to Development of Degraded Lands?"

The major hypothesis in Dr. Prasad's paper is this: wherever benefits are unambiguous people will take the initiative to restore waste lands into their own hands. The hypothesis is certainly plausible but, unfortunately, Dr. Prasad does not make the effort at empirically verifying or rejecting it. He instead leaves it as an assertion.

(A related question: what does it mean to have "unambiguous benefits?" That terms needs to be unravelled).

The case studies Dr. Prasad includes are useful, but do not really verify his hypothesis. DGSM, Sukhomajri, Bankura and Arabari are the few success stories in an sea of failure - and it is unclear that they were self-driven initiatives. There are other problems with the examples too. DGSM, for instance, had its origins as an organization to press for more local *contracting* in Forest Department activities, and *not* as an organization devoted to ecological restoration.

(The Chansar story on page 8 is incomplete - text has been truncated at the end).

The most interesting segment of the paper is the section on "When Will People Come Forward to Participate?" (pages 13-17) It, however, requires better organization, and the strategy on pages 16-17 needs to spelled out in finer detail.

Overall, a laudable effort by Dr. Prasad to tackle a difficult issue.

PAPER 13, P.S. RAMAKRISHNAN
"Conservation Linked with Sustainable Development"

Part of the problem with this paper is that it is a chapter from a book. The reader is therefore often caught off-guard when references to previous chapters are made in the text. The paper needs to be revised so that it can stand on its own.

In terms of substantive comments, they are as follows:

On page 1, the author declares: "...there are many social challenges that impinge upon peoples' perception of environment and development." It is unclear what he means here. What are these "social challenges"? Are we more concerned with how these social challenges operate upon peoples' perception (so that we may emerge with multiple perceptions of environmental and developmental issues), or are we more concerned with measurable environmental changes employing some explicit evaluative criteria?

On page 2, citing Gleissman (1989b), Dr. Ramakrishnan talks about the agroecosystem in traditional society being "well harmonized within its ecological, socio-economic and cultural components." Harmony is a problematic concept, because it evokes images of a static rather than a dynamic society. The tendency to view traditional societies as harmonious and modern society as disharmonious (*a la* Ferdinand Tonnies or Emile Durkheim) seems to structure the answers we then offer in how to deal with these societies. How is "harmony" defined and evaluated?

On page 4, the author refers to "r-strategists" and "k-strategists": what are the origins of this distinction and could the author clarify the two in detail in an endnote?

On page 9, in para 2, the author suggests redesigning "agroforestry systems incorporating insights of tree architecture (cf. Chapter 9)." It would be useful for the workshop if the author could draw the material from Chapter 9 into this paper. The same comment applies to para 1 and para 3 on page 12.

There may be a need to establish the link between biodiversity and wastelands more explicitly, but overall an excellent paper, highlighting relevant issues.

PAPER 14, S.R. RAMASWAMY
"Role of Non-Governmental Organizations in Wastelands Development and Nature Conservation"

Mr. Ramaswamy tackles a topic of great relevance, but fails to give a balanced assessment of the effectiveness of NGOs versus state agencies. Clearly, the emergence of NGOs indicates that state agencies have faltered somewhere along the way, that there are perceived lacuna that they have been unable to fill. However, this does not generate the inevitable conclusion that state agencies are always anti-people and ineffective, whereas NGOs are always pro-people and effective (as suggested, for instance, on page 12, para 6). This simplified dichotomy neglects that NGOs, like their state counterparts, have agendas which have *nothing* to do with the felt needs of the people they purport to represent.

Pressing an anti-state agenda only detracts from the many valuable insights that Mr. Ramaswamy has to offer.

Recommended: a less polemical paper, focussing on the critical role of NGOs as a bridge between states and communities.

PAPER 15, W.A. RODGERS
"The Management of Protected Area Buffer Zones for the Maintenance of Biodiversity"

A topical paper that requires minor editorial work, better organization, and less jargon (like "ecodevelopment"). Given the population density in India, is it practical to think of "protected area buffer zones"? What about ethical issues like the exclusion of villagers from their resource hinterlands, or the establishment of wildlife preserve adjacent to villages, thereby exacerbating the dangers of wildlife-inflicted depredations? Can a "poor" country like India afford to entertain concepts like "deep ecology"? Who benefits from the establishment of biodiversity and/or wildlife preserves, and who bears the costs?

These are questions that should be tackled upfront, but are not in Dr. Rodgers paper. Despite this, the paper is a valuable one.

PAPER 16, CECIL SALDANHA
"Restoration of Wastelands - Role of Academic and Research Institutions"

Mr. Saldanha's paper is useful in pulling statistics together, but avoids a potentially more interesting avenue of research: institutional differences in statistics and the policy implications of such conflict. This may, in fact, be a key area for academic/research intervention.

In line 3, page 1, of the text, the figure of 175 million ha is cited, but the source of the figure is not cited. Is it from the Ministry of Agriculture, and what were the criteria that generated that vast figure? (This reviewer has seen figures ranging from 58 million ha to 175 million ha - a plain indication of how nebulous the concept of "waste lands" is).

In para 4, page 1, the author declares: "This vegetation would have supported a reasonable fauna, ensured sustained land capability and water availability and contributed to the well-being of our people." This appears to be more a wishful statement than an empirical one. What is "reasonable fauna"? What is "sustained land capability" (using what technological assumptions and what definition of sustainability)? What is "well-being"? The embedded assumptions in the statement are untenable.

In para 1, page 3, Mr. Saldanha makes the tantalizing remark that "there is a general pattern in the processes that lead to the formation of wastelands..." What is this "general pattern"? The author leaves this unclarified.

The role of academic/research institutions is not discussed until page 4, and seems almost like an afterthought. There is a need to more fully explore the role of such institutions and integrate this into the main text (pages 1-3). As it stands, the title of the paper is misleading.

With suggested revisions, can be a useful contribution to the workshop.

PAPERS 17 and 18, MADHU SARIN ET. AL.
"Women's Involvement...Bicchiwara Block...Rajasthan"
and
"Wastelands Development by Women's Groups...Panchmahal District"

These are among the strongest papers in the set, and the comments consequently are minor.

First, the two papers address very similar issues. Ideally, therefore, the major insights from each should be sythesized into a single paper that would begin by presenting the salient aspects of the wastelands-gender interface; follow it up with a conceptual framework describing the links; and use case studies to substantiate the propositions contained in the framework. The wealth of case material suggests that this will be no problem.

A legal matter: are these papers copyrighted by ILO, since they were presented at an ILO-sponsored workshop?

PAPER 19, S.L. SHAH
"Problems of Common Property Resource Management in India"

The key assertion of the paper is the role of institutions in internalizing the externalities caused by uncoordinated, individual actions. The model Dr. Shah presents is the classical Olsonian one, where institutional success (in terms of collective action) is linked to small user-group size and the presence of selective inducements/sanctions. The case studies included are interesting but not coherently linked.

The following suggestions may help Dr. Shah's analysis:

(a) Can institutions like the van panchayat succeed despite the presence of a "free-rider" problem?

(b) How is "institutional success" defined?

(c) Is it possible to model the interaction between the Forest Department and the van panchayats as a bargaining game (along the lines of the sharecropping models developed in agricultural economics?) Can this approach provide new insights into the interaction?

(d) How do institutions reduce "transactions costs"? (see the work of Oliver Williamson, 1975).

Overall, the paper would be improved if definitions were more clearly stated (for instance, of "common property resources"); if a typology of van panchayats were built, based on their degree of effectiveness (by systematically delineating the factors that influence effectiveness); and if state-community interaction were more fully developed conceptually.

Despite this array of comments, a fine paper.

PAPER 20, S. SHYAM SUNDER
"How Have the Changing Forest Policies Over the 1980s Affected the Country's Heritage of Biodiversity?"

A polemical paper that is, however, valuable simply because it offers such a contrast to the remaining papers. Coming from a retired IFS officer it also offers key insights into the workings and mindset of the Forest Department. Presumably, it is more reflective of the popular view within that institution than the perspective offered by Mr. Pandeya.

Any comments challenging the polemics of the paper would ruin the spontaneity and intent of Shri. Shyam Sunder's article. Leave as is and contrast in an introductory chapter with the views of Mr. C.G. Pandeya and Mr. S.R. Ramaswamy.

Editorial revisions required prior to publication.

PAPER 21, DR. H. SUDARSHAN and H.N. SOMASUNDARAN
"Tribal-Forest Interaction and Conservation of Biodiversity"

The paper has a tendency to idealize tribal cultures, without case studies to support assertions. A systematic appraisal of tribal-forest interaction is required to redeem the paper. The section on the "Daily Life of a Tribal," for instance, had the potential for being very interesting, but simply fails to deliver. Too much of the paper, instead, gets mired in generalities.

What is the view of tribals on the ongoing changes in their society? Do they feel disoriented, do they welcome certain aspects of modernization, do they feel threatened? An ethnographic study would be extremely revealing.

If the authors could tell the story from the standpoint of besieged tribal communities they would perform a valuable service.

PAPER 22, R. UMA SHANKAR and K.N. GANESHAIAH
"Conservation of Genetic- and Bio-Diversity in Sustainable Agricultural Programmes"

The key argument of the paper is that genetic diversity of crop plants is imperative for achieving stability in agricultural production (page 3). Precisely how genetic diversity contributes to stability in production needs to be stated upfront.

A glossary of technical terms in an appendix would make the paper more accessible to lay readers.

The final section, "Models of Conservation," should be spelled out in greater detail since that is clearly the main contribution of the authors to the workshop. The central arguments in earlier sections (for example, genetic diversity is necessary for agricultural stability) should be explicitly linked to the recommendations in the final section.

In retrospect, a fine paper that requires minor editing and restructuring.

39.

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23rd Aug 91

Dr Madhav Gadgil,
Centre for Ecological Sciences,
Indian Institute of Science,
Bangalore-12.

Dear

Sub: Workshop on linkages between Biodiversity and Wastelands, 16-19 Sept 1991

...

I am noting below my comments on some of the papers.

Information gaps for linking degradation of Wastelands to Conservation of Biodiversity

While several good suggestions have been made, I would like to mention that under Ecological aspects subjects at 4, 5 & 6 are already well documented. Some of the publications on the subjects are : Functional aspects of succession in deciduous forests (Whittaker 1975), A revised survey of Forst types of India (Champion & Seth 1968), studies on the endemic flora of India & Burma (Chatterjee 1939), The Study of Tropical Vegetation in Madhya Pradesh and Gangetic Valley (Misra 1958), A Priliminary survey of Forest types of India and Burma (Champion H.G, 1936), Studies on the endemic flora of India and Burma (Chatterjee D, 1939), plant succession, an analysis of the development of Vegetation (Clements 1916), Community and Ecosystems (Whittaker, 1970), Evolution of ecosystems (Cloud-Presten, 1974), Bioecology (Clements & Sheltord, 1939) Succession (Durry and Wisbet 1973), etc.

On item 5, I would like to point out that seedlings are regularly, raised by the forest dept in Karnataka of more than 125 species.

..2

Role of Non-governmental Organisation in Wastelands Development and Nature conservation

It is likely that the comments are based on authors experience in other states. Yet, on some of the issues, I would like to clarify the position in Karnataka.

Antipoor bias - In two cases, degraded forest land has been offered on lease basis to (1) Mysore Paper Mills, a government undertaking and (2) KPL, a joint sector undertaking. Both are under government orders and not at the discretion of the bureaucrats. The plantation programme of MPM has gone through successfully and with harvesting of the first crop, capacity production of paper is now achieved.

It is mentioned that raising of community wood did not take off. Against a target of 33,500 hects under community woodlots, the achievement has been 37,000 hects.

Situational flexibility needed :

The departmental nurseries now account for less than 20% of the total production. Rest are raised in Kissan nurseries. The seedlings that are raised, for distribution, are those for which indents are placed through the motivators.

Inhibiting factors :

About 280 million seedlings are now raised in Kissan nurseries.

Regarding contradictions between National Wastelands Development Board and Land use council, as far as I know, there is only one council, the National Land use and Wastelands Development Council. The council has not pleaded for more stringint laws on tree felling.

Some priorities

On the item of taking over of land by forest dept, it may be of interest to be authour that 8 lakh hectares of C & D land (land classified as unfit for agriculture) transferred to the forest dept mainly for afforestation in 1978, is now ordered to be transferred back (except for areas planted up etc) to revenue dept for regularisation of encroachments and for grant for cultivation.

Let alone monopoly of Forest Corporation on Private wood, the Corporation does not buy it. There are requests that it should.

Govt does not impose its choice of species on people. It would be knaive to expect that Governments choice (if it has one) will be adopted by the people in their land.

..3

Conserving Indias Biodiversity : The Societal Context

Under Current focus, mention is made of establishment of few large nature reserves that serve as centres of outdoor recreation for the omnivores. Atleast in Karnataka around 60% of the sanctuaries have nither roads nor resthouses. These are areas selected purely from the point of view of Wild life conservation.

It is not known to which category of land the senior Forester had referred to while suggesting releasing the locked up capital of overmature timber in the sacred. If it refers to Devarakadus, in the true sense it is not a sacred grove. It is a category of revenue land set aside for meeting the timber needs of the designated temple.

Mention is made of Dandeli, the largest wildlife sanctuary on the Western ghats, remaining so only on paper. I will try to explain the compulsions which had prompted the constitution of a very large extent of area as Dandeli sanctuary:

The area of Dandeli sanctuary, as set up in 1956 was 20%. Sq.kms.

With the coming in of the Paper mill, Commencement of Hydro Electric Projects, & heavy influx of human population, the forest dept felt that one way of make it difficult for release of forests would be to enlarge the limits of the sanctuary. During 70s, there was also no certainity that the suspension of game licenses would not be revoked, as it was being continued on year to year basis. Additionally it was felt that if a larger extent of area was constituted as sanctuary it would afford scope for wild life to migrate from disturbed areas to forests away from these centres. Hence in 1975, the enlarged sanctuary covering 5729 Sq km was created. In 1987 by when the major project works were over, the situation was reviewed and the area of the sanctuary was reduced to 834 sq kms. The motive was to benifit wild life and not to creation of the largest santioning in W.ghats on paper.

Finally, it would have been useful to indicate the ratio of use of forest resources by the omnivors and the ecosystem people while putting forth the theory of distinction of the resources by the farmer whereas the blame is normally apportioned to be latter. I would vote for this concept.

Regards,

Yours sincerely,

(S. Shyam Sunder)

110

COMMENTS ON THE BIODIVERSITY CONVENTION OF UNCED

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(Note: These comments are based on the 'Biodiversity Strategy and Action Plan' --- referred to as BSAP below --- prepared by World Resources Institute, IUCN, and UNEP, as also documents of the Preparatory Committee for the UNCED. The BSAP may not be the basis of the actual convention --- see p. 91, para 9.8 --- thus there is a real fear that the convention may be far less progressive than the BSAP. Indeed, many of the good points and the thrusts of the BSAP are missing from the Preparatory Committee documents. Especially important are the 10 basic guiding principles of the BSAP [p. iii, para 10], and the Key Components of the Convention as suggested in the BSAP [p. 91, para 9.8]. Any convention on biodiversity must incorporate these points).

1. International relations (Action 3, paras 3.29 to 3.44)

1.1 The BSAP discusses the changes necessary in the international aid process. It is quite good there. However, it does not explicitly talk about changing the existing international trade relations situation, wherein the 'developed' countries continue to be exploitative vis-a-vis the 'developing' countries. Trends in GATT are in fact increasingly towards getting the latter to open up their economies, while continuing protectionism policies in the former. The environmental impacts, and therefore impacts on biodiversity, of this inequality is not addressed head-on in the BSAP, nor in other documents. India must put this forward as an essential component of the convention.

1.2 There is also no safeguard against the misuse of a convention like this to increase international trade inequalities, or interference in the internal policies of 'developing' nations. The convention, especially if it is legally binding (see below, para 7) but even if it is not, could become another tool for blackmailing by the 'developed' countries (e.g. the Mexican tuna fish case), in the name of environmental preservation.

1.3 Apart from "ridding the development assistance process of its biodiversity destroying tendencies" [BSAP, p.iv], there is a need to stop all transfer of technologies, industries/industrial processes, and materials which are similarly destructive. This does not come out clearly in the BSAP or other documents.

2. Intellectual Property Rights [BSAP, Action 5, paras 4.17 to 4.32]

2.1 'Developed' countries, under the influence of MNCs, are pushing hard in meetings of the GATT and TRIPS (Trade Related Aspects of Intellectual Property Rights) and other international fora, to introduce an international IPR system for biological materials. Apart from the ethical objections to any system of patenting plants and animals, there are serious economic and political implications for the 'developing' world, especially with the rapid growth of biotechnology in agriculture and animal husbandry. The BSAP does build in some safeguards against the misuse of IPRs in biological materials, but India should press for the abolition of all IPRs in such materials altogether (if not of the system as a whole).

2.2 The BSAP suggests that the private sector be encouraged in the fields of plant breeding etc. by IPRs suited to each individual country's needs, and by setting up appropriate seed-production and certification infrastructure [BSAP, p. 36, paras 4.25 to 4.27]. It does not, however, imply that this be done at the cost of the public sector. Nevertheless, this is a controversial recommendation and needs to be discussed.

3. Integrating Local Human Needs with Biodiversity Conservation

3.1 The sections on 'Conserving Biodiversity in the Wild' [BSAP, Actions 12 and 13, paras 5.34 to 5.85] and 'Increasing Local Benefits from Biodiversity' [BSAP, Actions 7 & 8, paras 4.38 to 4.56] are given separately, with no discussion on the interface between the two. In any case, the latter deals mainly with farmers involvement in genetic resource conservation. There is no focus on benefitting/involving/integrating local human populations in and around areas sought to conserved for their biodiversity value, such as national parks and sanctuaries. India is a prime example of how misplaced wildlife management and protection efforts have engendered or increased existing conflicts between people and wildlife. The convention must tackle this issue, assuring local people continuation of their rights/activities, or other benefits where these rights/activities are to be curtailed. Even in a situation where local people or some of their activities must be excluded from an area, this must be done after adequate consultation and discussion with these people, after having satisfied them of the need for such an action, and after having ensured the provision of suitable rehabilitation measures. Just as the convention must not become a tool to increase international disparities, it must not also be used to pressurise countries to introduce policies/programmes which further exclude the poor from their resources. The convention must include all these clauses.

4. Ex-citu Conservation [BSAP, p. vi-vii, Actions 14 to 17]

4.1 There must be an explicit clause that ex-situ conservation of biodiversity, especially of animals, must be done only when in-situ conservation is not adequately possible. It should not become an excuse for destroying natural ecosystems, even if full germplasm collection and storage from these ecosystems has been done.

4.2 The 'Progress Report of the Secretary-General of the Conference', on 'Conservation of Biological Diversity' [Preparatory Committee for UNCED, 2nd Session, 18 March-5 April, Geneva] mentions in passing the "ex-citu conservation...should be undertaken in the countries of origin of biological diversity" (para 13). The BSAP completely omits this point. There is an urgent need to ensure that biological materials, like germplasm, do not become the monopoly of 'developed' countries, or of MNCs and international institutions (like the IRRI). Such a clause is a must in the convention.

4.3 There is a suggestion that FAO "should coordinate the development of a global system of ex-situ conservation" [BSAP, p. vii, Action 14d]. Given the past record of agencies like the FAO, for instance in promoting the Green Revolution despite its negative impact on agricultural biodiversity, this is a highly controversial recommendation. It should be dropped altogether. If at all there is a need to coordinate a 'global system of ex-citu conservation', some other method must be found, in which an organisation under the UN merely acts as a clearing-house and information-disseminator. On no account must there be international control over this.

4.4 A global fund to assist conversion of existing ex-situ sites into as close a simulation of natural conditions as possible should be set up. This is especially so for zoological parks.

4.5 As in the case of India, all countries should be encouraged to stop any further take of animals from the wild, except in the extreme case of species which have become unviable in the wild, or are in imminent threat of becoming so.

5. Global Monitoring and Awareness

5.1 There is a suggestion to set up a NGO, linked with WCMC, FAO, and UNEP, "to issue world-wide alerts on impending threats to biodiversity" [BSAP, p. viii, Action 20a]. The idea of a global warning system network is good, but this must be delinked from bodies like FAO, otherwise what happens if FAO's own policies become threats to biodiversity, as they have in the past?

6. Biodiversity Convention and other Conventions

6.1 There is a need to ensure that the concerns and thrusts expressed in the biodiversity convention are reflected in other UNCED conventions. That this may not be so is a real danger, for instance if the forestry convention is to be based on the Tropical Forestry Action Plan. The BSAP also recommends this [BSAP, p. 91, para 9.9].

7. Legal Status of the Convention

7.1 While the BSAP does not suggest a legally binding convention, the Progress Report of the Secretary-General (cited above) states that the first three meetings of the ad hoc Working Group of Experts on Biological Diversity agreed on "the urgent need for a new international legal instrument" (para 8). This is, like in the case of the Forestry Convention, very controversial. A legally binding convention could become a powerful tool for the sort of misuses discussed in para 1.2 above. This needs to be discussed.

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DR. S. BISALIAH, I.I.D. (Minnesota)
Coordinator

D.O No : Regnl/52/91-

Date : May ,1991

Dear Dr.Ravindranath,

Sub:- Workshop on linkages between wastelands and Biodiversity.

-:-

Please refer to your letter dated March 19, 1991. I have gone through the following workshop papers which you had sent along with this letter and my brief comments are stated as below:

1. Walter Fernandes: Forests and the State of the Tribals, Today.

   One major conclusion of the paper (pp.40-41) that requires careful deliberation at the work is: sustainable development requires meeting the basic needs of all and extending to all the opportunities to satisfy their aspirations for a better living standards....." How do you go about in operationising this good intension in the case of tribals?

2. Ratnam V.S.Kumar: Biotechnology and Biodiversity

   Dont have a comment

3. S.R.Ramaswamy: Role of Non-Governmental Organisations in Wasteland Development and Nature Conservation.

   The paper does not throw much of a light either on logical foundation for the Role of NGOs or on lessons learnt from some experiments.

4. H.Sudarshan and H.N.Somasundaram: Tribal - Forest Interactions and Conservation of Bio-diversity.

   Dont have any comment.

p.t.o

5. Shah, S.L: Problems of Common Property Resource Management In India - Suggestions For Developing Effective Community Based Systems of Common Property Resource Management.

Dont have any comment.

6. S.Shyam Sundar: How have The Changing Forest Policies Over the 1980s Affected Country's Heritage of Biodiversity.

Dont have any comment.

7. K.M.Hegde and Ganesh S.Bhat: Credit and Marketing Facilities Needed to Promote Wasteland Development Efforts by Farmers.

The paper is too general, and the issues are not well focussed.

8. Madhav Gadgil: Conserving India's Biodiversity - The Societal Context.

Dont have any comment.

10. Adkoli, N.S: What Role Do Industrial Plantations have in Wasteland Development?.....
.....

Dont have any comment.

11. R.Umashankar and K.N.Ganeshaiah: Conservation of Genetic And Biodiversity In Sustainable Agricultural Programmes.

The paper is quite concrete in contents, and issues are properly outlined for deliberations.

12. P.D.Dogra and H.M.Behl: Conservation of Genetic Diversity of Forest Trees.....

Dont have any comments.

13. Madhu Sarin and Renu Khanna: Waste Land Development by Women's Groups.....

Dont have any comments.

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Coordinator

D O No.

Date :

14. W.A.Rodders: The Management of.....
.....

Dont have any comments.

15. Rusi Engineer: Role of the Mass Media.....
.....

Limited in focus, but well focussed.

16. P.S.Ramakrishna: Conservation Linked with Sustainable Development.

Dont have any comments.

17. M.K.Prasad: How Can we Involve people.....
.....

Dont have any comments

18. C.D.Pandey: The Role of Forest Department in Maintenance of Biodiversity on Lands Falling Outside The Nature Reserve System.

The theme is good, and concrete suggestions could emerge at the time of deliberations.

19. Cecil J.Saldanha: Restoration of Wastelands.....
.....

Dont have any comments.

20. Tara Gandhi, Ajay Rastogi and Tomas Mathew: Information Gaps.....
.....

Dont have any comment.

21. Madhu Sarin and Chandrika Sharma: Women Involvement in Rehabilitation.....
.....

Dont have any comments.

..4

22. D.Nuthan and M.Vasundhara: Role of Indigeneous Species.....
.....

Dont have any comment.

23. N.P.Melkania: Integrating Biodiversity.....
.....

Steps outlined in page 12 need more discussions from the operational view point.

24. M.D.Subash Chandran and Madhav Gadgil: Resource Use systems.....
.....

Dont have any comments.

Since I will be away from the country with effect from May 27, 1991 to work in a World Bank Project in Nigeria for about two years or so, I will not be able to attend the workshop. I thank you and Prof.Madhav Gadgil for the opportunity given to me to work with you on this important theme.

Further, the Regional Centre will continue to have collaboration with your centre and with MYRADA, in organising the Training programme on Micro-Planning.

With warm regards,

Sincerely yours,

S Bisaliah
(S.BISALIAH)

To,

Dr.N.H.Ravindranath,
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42.

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January 15, 1991.

Dear Ravi,

Policy and Institutional Framework for Maintaining/

Enhancing Biodiversity on Degraded Lands

I am sorry for the delay in getting back to you. In this note I have tried to get a handle on this topic by taking a historical view, as also try to understand the forces that account for the present trends and possibilities for improving the condition of degraded lands.

Colonial policy to generate surpluses for the metropolitan economy supported by the instruments of the industrial revolution, as embodied in the early introduction of the railways in the sub-continent, set in motion the process of treating natural resources, including forests as commodities for sale. This resulted in large scale destruction of forests. A more damaging trend was that rights and control over forest lands were alienated from local communities and social formations with a stake in maintaining these forests. An important condition for the success of this policy of exploitation was to demolish the authority of local institutions to manage and safeguard these resources. A consequence of this was for the values of conservation and community discipline endemic to communities and social formations dependant on safeguarding natural resources, specially forests to get undermined.

In the post independence period, ironically these trends were further intensified. The perspective towards forests and natural resources continued to be that of it being means for capital accumulation and a state resource. The process of alienating the control and rights of local communities continued unabated. In fact the democratic pressures unwittingly assisted these trends as the modern state sought to replace traditional and feudal authority over these resources. The difference no doubt in the post independence period was that earlier the purpose underlying extraction and alienation was to further colonial interests, in the latter phase, the purpose was to improving the national economy conceived however in terms of GNP, rates of growth, enhancing agricultural and industrial production. The importance of biodiversity; of forests as the foundation for the cultural, political and economic well-being of the rural communities and society in general was not appreciated and found no place in government policies or institutional building efforts.

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Interestingly enough the faith in a nature conquering approach to development enjoyed so much legitimacy in the decades of independence that the Gandhian vision which had intuitively understood the limits of such an approach was totally eclipsed in the debates regarding development planning and policy.

By alienating people's rights and by damaging the productive capacity of their local resource base people were without reason to manage their natural resources. Local institutions and values that had historically represented the collective stake of the community in maintaining bio-diversity were marginalised. The new institutions that emerged were instruments for 'development' no doubt, but also for destruction of natural resources crucial for ensuring a sustainable source of livelihood for rural people. The current state of common property resources in the rural areas is testimony of this phenomenon. These days, by and large, Panchayats are more inclined to protect encroachments than they are inclined to safeguard common property resources. These grassroot authority structures, for structural reasons, are not meaningfully accountable to the local poor notwithstanding the fact of elections.

One of the consequences of this kind of development where the state assumed overwhelming powers, responsibility and ownership of resources was the growth of the bureaucracy dealing with these resources and development. Since the interests of the state and that of the people were divergent, specially in view of the policy of the state to see forests as a commodity, the conflict of interests became manifested in a plethora of rules and controls to prevent people from accessing what were becoming a scarse resources. The state being more sensitive to the interests of the industrial class, the need to further differentiate between local needs and industrial needs extentuated the conflict of interest between the State Forest Departments and the people. The implications were for the people to totally abdicate any responsible role in managing forests, if anything they felt legitimate in wanting to exploit these resources before others did.

The implications of the forgoing for a policy and institutional framework for maintaining and enhancing the biodiversity on degraded lands are that we search for ways to enable people to re-establish a sustainable and mutually supportive relationship with their natural resource base and their livelihoods. Merely giving back people the lands and rights they once possessed is not likely to achieve the desired goal. If the forests existed today and the needs, culture and values of the past had not been undermined this might have been a meaningful option, but as things stand the situation has drastically altered. Infact it is not inconceivable that more rights in themselves would accelerate degradation rather than reduce degradation.

BIODIVERSITY STRATEGY AND ACTION PLAN

A Call for Urgent National, Local and International Action to Save, Study, and Use Sustainably and Equitably the World's Biotic Wealth

First Draft -- Do Not Quote
May 23, 1991

World Resources Institute (WRI)
International Union for Conservation of Nature (IUCN)
United Nations Environment Programme (UNEP)

In consultation with

Food and Agriculture Organization (FAO)
United Nations Education, Scientific and Cultural Organization (UNESCO)
1991

The statements and recommendations in this document are for the open review of all participants in the Biodiversity Strategy Programme. They do not necessarily represent the policies or opinions of WRI, IUCN, UNEP, or other collaborating organizations.

BSAP5.23

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The thrust of a new policy should lie on building on the following possibilities.

What we have among the bulk of the rural people, is a growing disenchantment with the promise of plenty associated with modern day development ideology. For the mass of people education and development have not delivered what it promised it would. The rural people are still poor, insecure and denied self-respect. There is the realisation on the part of the people that they should not abdicate the responsiblity for development to the state and its functionaries. While the sense of disquiet in regard to present trends is strong, what is not so evident whether is the alternatives that spontaneously evolve will focus people's quest for betterment in a self-fullfilling way. For people to have confidence in the potential for sustainable and equitable model of development based on safeguarding natural resources and bio-diversity, it is important for people to experience developing ~~local~~ here resources through community action as meaningful. For this to happen more than the rights being restored to people, it is essential that institutions are created that will provide the resources and management framework within which people begin feel that the process of restoring as degraded lands as a means and ends is viable and desirable. For people to experience a sense of viability in this model of development, we need to be able to provide people at the grassroot support that draws on modern developments, relevant to the goal of sustainable development.

At present there is a paucity of institution who can mediate the interest of the people in this fashion. Whereas there are many institutions critiqueing the present system, there are few that are able to make people experience ~~in~~ the viability of the eco-vision.

The capacity to help and deal with NGOs and local communities from this perspective needs to be developed within the Forest Department as also among intermediate organisations such as educational institutions, research organisations and the business community. A mix of decentralisation and centralisation is needed, it would not do for every village to have its own water harvesting structure, if the catchment is not large enough to justify so much storage capacity. Those built on the downstream would get rendered infructuous if too many water-storing structures were built upstream. The role of science and technology would require suitable adaptation to mediate between decentralisation, the need for equity adequacy of production and sustainability

Decentralisation of initiative and management would have to go hand in hand with people developing a shared wider sense of their collective interest in properly managing their natural resource base. The latter would require people who can assess options at a meso or macro level so as to provide local groups with relevant information on which to plan their strategies for regenerating degraded lands and optimising compatability of human needs with that of the natural resource base. The approach to regenerating

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wastelands or local resources cannot succeed and be sustained for long if it is not built on a foundation that takes a comprehensive view of developing an alternative model of development. An approach that is a people-centred and local resource base-centred, must permeate all development interventions. Changes in one variable, that is decentralisation and greater rights vis-a-vis one set of resources are not likely to be able to resist the cooptive and countervailing pressures from the mainstream forces of development. It is important that institutions emerge that can promote comprehensive development, which would include focusing on degraded lands as a resource that is compatible with the idea of people-centered development, and one that promotes autonomy and self-reliance. For degraded lands to be regenerated, there is no substitute for people's involvement and institutions, and for the latter there is no substitute for a meaningful alternative approach to development as a whole. Unless preparations are made to make people feel whole and confident in managing the totality of the lives, through a eco-vision of society, it is unrealistic to expect to them to sustain split attitude to development where one part of them is environmentally conscious minded and another is oriented to dependency on the state and its bureaucratic and technocratic approach to development.

The need and scope for voluntary organisation is immense. Having said this it does not follow that a policy that results in the indiscriminate proliferation of NGOs will be beneficial to the cause. Here care would have to be taken to ensure that a culture of equality, trust but accountability is built into the relationship between people, NGOs and the state organisations.

Yours sincerely,

Mehta

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P.S. I am sorry if this is not of much use to you I have not had time to do justice because of family commitments. My brother's marriage necessitated my absence. Please excuse me. I hope to Madhav for not having the typos on landless [illegible] I am sure you can make more out of it. Best wishes for Diwali I am sure,

NOTE TO THE READER

This is the first draft of the Biodiversity Conservation Strategy and Action Plan (BSAP). The BSAP is being developed through the input of a large number of governmental and non-governmental organizations around the world. This first draft is based on background studies by collaborating institutions and input received through meetings and consultations on biodiversity during the past two years, including workshops on the Biodiversity Strategy held in Bogota, Colombia in 1989, and at the IUCN General Assembly in December 1990.

This draft will be discussed at the following regional consultations:

Nairobi, Kenya. June 10-14.
San José, Costa Rica. June 23-26.
Brasilia, Brazil. July 7-10.
Keystone, Colorado. July 14-17.
Jakarta, Indonesia. July 15-17.
London, England. July 22-24.

In addition, four experts workshops will contribute to the recommendations in the BSAP:

Information for Decision-Making: How Tropical Countries can Mobilize their Biotic Wealth. June 19-22. Costa Rica
Conservation Technologies: Integrated Approaches to Biodiversity Protection. July 3-6. Brazil
Property Rights, Biotechnology, and Genetic Resources. June 10-12. Kenya.
Linkages between Biological Diversity and the Restoration of Degraded Lands. September 15-22. India.

Based on these consultations and workshops, as well as written comments received from more than 200 other individuals who will receive the draft for review, the document will be extensively revised and reviewed by an advisory committee on September 6-7 1991, in Gland, Switzerland.

We encourage your comments and suggestions on this draft. Please offer both general suggestions, as well as specific changes, and, where possible, re-written paragraphs or entire action recommendations (including citations.) Please also distribute copies to others who may be able to contribute.

Comments should be sent to:

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PARTNER ORGANIZATIONS

A number of organizations have been involved in the work leading up to the production of this draft and will be actively involved in the process of further analysis and revision. The following organizations have formally asked to be listed as partner organizations in the Biodiversity Strategy Programme:

African Centre for Technology Studies (ACTS)
Asian Development Bank
Association of Systematics Collection (ASC)
Australian Department of the Arts, Sport, Environment, Tourism, and Territories
Australia National Parks and Wildlife Center
BIOMA, Venezuela
Botanic Gardens Conservation Secretariat
Center for Marine Conservation
Commonwealth Science Council (CSC)
Conservation International
Caribbean Natural Resources Institute (CANARI)
Endangered Species Scientific Commission, China
Fundación Natura, Ecuador
Fundación Neotrópica, Costa Rica
Fundación Pro-Sierra Nevada de Santa Marta, Colombia
Fundaçao Pró-natureza (FUNATURA), Brazil
Fundación de Parques Nacionales, Costa Rica
The George Wright Society
Indigenous Food Plants Programme, Kenya
Indonesian Environmental Forum (WALHI)

International Board for Plant Genetic Resources (IBPGR)
International Council for Bird Preservation
International Council for Research in Agroforestry
Kenya Institute for Organic Farms
The Keystone Center
Linnean Society of London
Missouri Botanical Garden
National Institute of Biodiversity (INBIO), Costa Rica
National Museums of Kenya
The Natural History Museum, U.K.
Plant Conservation Office (IUCN), U.K.
Plant Genetic Resources Centre (PGRC/E), Ethiopia
Ramsar Conservation Secretariat
Rare Breeds International, Italy
Smithsonian Institution
Society for Conservation Biology
The Nature Conservancy
Western Hemisphere Shorebird Reserve Network
World Bank
World Conservation Monitoring Centre
World Wide Fund for Nature (WWF)
World Wildlife Fund (US)

In addition, the Biodiversity Strategy Programme is guided by an **International Coordinating Group**, made up of representatives of:

African Centre for Technology Studies (ACTS)
Australian Department of the Arts, Sport, Environment, Tourism, and Territories
Fundaçao Pró-natureza (FUNATURA), Brazil
Indonesian Environmental Forum (WALHI)
The Keystone Center
Ministry of Forests and Environment, India
National Institute of Biodiversity (INBIO), Costa Rica
Plant Conservation Office (IUCN), U.K.
World Conservation Monitoring Centre, U.K.
World Conservation Union (IUCN)
World Resources Institute (WRI)
United Nations Environment Programme (UNEP)

EXECUTIVE SUMMARY

1. Humanity is destroying one of the world's most invaluable and irreplaceable assets: biodiversity. This vast global collection of genes, species, habitats, and ecosystems -- and the cultural diversity that is its human expression -- is a rich natural endowment that can meet human needs today and in the future as it has in the past. But instead of guarding that endowment, humanity is over-exploiting and wasting it in the name of economic development.

2. The loss of biodiversity can impoverish human life and alter the course of human development. Humanity gets all of its food and many medicines and industrial products from other species. For generations, farmers have relied on the genetic diversity of crops and livestock for stable food supplies in the face of a constant evolutionary battle with the pests that prey on crops. And the world's diverse habitats and ecosystems provide "ecological services" too, purifying water, keeping soils fertile, regulating micro-climates, cycling nutrients, and absorbing and breaking down pollutants. Not least, people everywhere turn to nature for recreation and spiritual renewal.

3. The first to feel losses of biodiversity are people who depend directly on biological resources for a living. Farmers who have developed diverse cropping systems attuned to local ecological, social, and cultural realities become more vulnerable as modern agricultural systems take hold and the responsibility for food security shifts to a state agricultural system that is in many cases ill-suited to the job. Forest dwellers and fishing communities lose their livelihoods when species are overharvested or habitats destroyed. Of course, no one is immune to the long-term impacts of biodiversity loss. If climate change materializes in coming decades, as expected, we will all more than ever need the full complement of biodiversity to help us adapt.

4. Already biodiversity losses have reached crisis proportions. In tropical forests alone, habitat loss over the next half-century could doom 35 percent of the species in these ecosystems to extinction. One species of plant, bird, or mammal and some 50 other tropical forest species are now being sentenced to extinction each day. But the problem doesn't stop there. Many freshwater ecosystems, mediterranean zones, and islands possess even higher percentages of endangered species than tropical forests do, even though the total number at risk is smaller.

5. Habitat loss is often a prime cause of extinction, but it also represents a loss of biodiversity in its own right. Some habitats, such as the tall grass prairies of the United States and the forests that ringed the Mediterranean, are now essentially gone. In many countries, well over half of the land is now converted from its natural state. The genetic diversity of agricultural crops and livestock is also imperilled. Local, national, and international efforts to maintain this diversity by saving traditional varieties in gene banks have not stemmed losses in farmers' fields, and gene banks themselves are not fail-safe.

6. If human populations and economic activities grow as projected, diversity loss could make it hard or impossible to use natural systems sustainably at even today's production levels. Already, nearly 40 percent of the planet's net primary productivity -- the accumulation of plant biomass -- is directly consumed, diverted, or wasted in human activities. As people consume ever more, the resources available to the other 30 million species on earth shrink, in effect tightening the noose on the world's biodiversity. At some point, no amount of clever land management can prevent a catastrophic loss of biodiversity.

7. As biodiversity's links to human and planetary well-being become clearer, some preliminary steps to stem further losses have been taken. Governments are beginning to pass protective legislation, establish more protected areas, and invest more in managing natural resources. Scientists are finding new ways to use biodiversity for human benefit. Non-governmental organizations are raising public awareness and showing how conservation relates to a broad range of public concerns. Community groups are conserving traditional seed varieties, planting more indigenous trees instead of taking chances with "introduced" varieties, defending their rights to manage traditional common-property resources, and voicing their concerns to governments. But if public support, scientific evidence, and government programmes make the prospect of real change seem possible, they are manifestly insufficient to stop the erosion of

biodiversity.

8. Most of the actions taken over the past several decades address the symptoms of biodiversity's loss, not the basic causes. At the root of biodiversity loss are burgeoning human numbers and appetites, an over-emphasis on short-term vs. long-term economic development, misguided policies, inequity, ignorance, and institutional narrow-mindedness and short-sightedness. Many of the fundamental changes needed to address these root causes will probably not be made for the sake of biodiversity alone. But many -- especially stabilized and ultimately reduced levels of population and consumption -- are also needed to improve world health, nutrition, and sanitation, and to nurture security and peace. Conversely, putting biological resource management on a sustainable footing will improve the livelihoods of millions of people.

9. Heroics alone won't stem biodiversity losses. Instead, what's needed is a wide range of local, national, and international activities aimed at saving, studying, and husbanding the world's biodiversity. Saving biodiversity means taking steps to protect existing genes and species. Studying biodiversity means documenting its composition and distribution; reaching a deeper understanding of the role and function of genes, species, and ecosystems; and bringing the ethical, cultural, and material values related to biodiversity to the fore. Using biodiversity wisely means using it equitably and sustainably for the benefit of all people now living and future generations as well.

10. The admittedly huge and complex task of saving biodiversity must be guided by basic principles about biodiversity's intrinsic worth and its role in the biosphere and in human society. The ten spelled out here have guided the individuals and institutions involved in the Biodiversity Strategy Programme:

1. *Every form of life is unique, warranting respect regardless of its worth to humanity.*

2. *Biodiversity conservation is an investment that can yield local and national benefits; it is not an unrecoverable cost or an unbearable burden*

3. *Fundamental changes in development patterns are needed in all countries and regions to conserve biodiversity.*

4. *All countries and communities - not just a few species-rich regions - have a vested interest in saving, studying, and wisely using their biodiversity.*

5. *Whether on land or sea, action to conserve biodiversity must be planned and implemented at a scale determined by ecological criteria. Piecemeal actions won't work.*

6. *Cultural diversity is inseparable from biodiversity.*

7. *The costs and benefits of biodiversity conservation should be shared more equally by the world's peoples.*

8. *Increased public participation, respect for basic human rights, and greater institutional accountability are fundamental prerequisites for biodiversity conservation.*

9. *Without significant policy and institutional changes, increased funding for biodiversity conservation will not slow biodiversity loss and could even accelerate it.*

10. *Local and global priorities for biodiversity conservation are as legitimate as national priorities.*

11. Built on these principles, the Biodiversity Strategy and Action Plan (BSAP) calls for a Decade of Action by governments, non-governmental organizations, the private sector, local communities, and international institutions to save, study, and wisely use the world's biotic wealth.

12. Conserving biodiversity must, ultimately, of course, take place at the local and national level. But since global actions can either pave or obstruct the way, coordinated responses are needed at four levels:

1. At the local level, community organization, local government, Non-governmental Organization (NGO) networks, and active local participation in all levels of decision-making.

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2 At the national level, the creation of national biodiversity action plans and through policy reform, strengthened management and scientific institutions, investment in conservation, increased local involvement in land use planning and natural resource policymaking, and changes in tenure and management responsibility.

3. At the intergovernmental level, a biodiversity convention, changes in intergovernmental agreements, and revamped international development assistance.

4. At the global level, new funding mechanisms under joint control of governmental and non-governmental organizations, strengthened professional and management networks, new data and monitoring networks, and a new global board to monitor implementation of the BSAP.

13. Since diverse approaches are needed to come to grips with the crisis, and since overcentralization of management and authority is one of the root causes of biodiversity loss, the BSAP does not call for a single implementation mechanism, secretariat, or implementing agency. Needed instead is decentralized but coordinated action that escapes the pitfalls of centralized planning and implementation, including the illusion that more action is under way than actually is. BSAP's strength lies in the broad constituency that helped develop it, that is supporting its release, that will monitor its implementation, and that is taking the actions called for in the plan.

14. All of the actions called for in the BSAP must be implemented immediately. Actions that directly address the root causes of the loss of biodiversity may not yield results for years. Others may make an immediate difference that will quickly fade unless ed by long-term actions. Those most likely to mediate results are those aimed at well-defined and carefully pinpointed problems -- key forests in jeopardy, species at risk of extinction, and so forth. If these emergency actions are carried out within the next 10 years, the predicted species extinction crisis can be postponed and cut down to size, and key genetic resources can be stabilized. As for the long-term actions needed to make sure these gains are permanent, they consist mainly of policy and institutional changes.

A CALL FOR A DECADE OF GLOBAL ACTION

REVAMP POLICIES THAT INVITE THE MISUSE OF BIOLOGICAL RESOURCES

Action 1. Modify national income accounts so that natural assets generally and the loss of biodiversity specifically are depreciated. (p. 26)

1a. *Governments negotiating the Biodiversity Convention should establish a global task force to refine methodologies for quantifying biodiversity's contribution to national economies.*

1b. *National governments should by this decade's end revise their systems for calculating national income accounts to incorporate the values of biodiversity.*

1c. *The United Nations should revise its System of National Accounts (SNA) to incorporate known biodiversity values and put more resources into improving the methods used to set such values.*

Action 2. Reform natural resource policies that invite biodiversity loss in forestry, fisheries, and agriculture. (p. 28)

2a. *National governments should reform forestry sector policies that provide incentives for degradation and conversion of critical forest ecosystems, and encourage monocultural reforestation.*

2b. *National governments should reform agricultural policies that promote uniformity of crops and crop varieties and that encourage the overuse of chemical fertilizers and pesticides.*

2c. *National governments in developing countries should rethink and revamp policies mandating "public" ownership and control over forests and coastal resources.*

Action 3. Rid the development assistance process of its biodiversity destroying tendencies. (p. 30)

3a. *Development aid agencies and multilateral development banks should incorporate biodiversity values into their criteria for designing and evaluating loans and projects and for assessing developing countries' economic performance.*

3b. *Development assistance agencies and multilateral development banks should trim their portfolios of ongoing and planned projects that have significant negative effects on biodiversity.*

3c. *Multilateral banks and bilateral development assistance agencies should open the development assistance process -- the design, implementation, and evaluation of projects and the policies that guide them -- to public scrutiny, participation, and accountability.*

INCREASE LOCAL BENEFITS FROM BIODIVERSITY

Action 4. Strengthen and decentralize agroecological and crop breeding research. (p. 33)

4a. *The funders and administrators of national agricultural research programmes should strengthen and decentralize national plant breeding work and increase farmer-based research.*

4b. *International agricultural research programmes should provide national research institutions with the tools needed to solve local problems, instead of attempting to develop solutions potentially applicable to all regions.*

Action 5: Nations should tailor intellectual property rights regimes governing genetic resources to their development needs. (p. 36)

5a. *International Fora, such as the GATT and WIPO, should not standardize IPR protection as applied to biological materials.*

5b. *Countries should build the seed-production and certification infrastructure needed to support private-sector breeding programmes and to make IPR systems successful.*

5c. *Countries should establish national review boards and an ombudsman office to monitor the impacts of IPR regimes.*

Action 6: Increase public access to information and public participation in genetic resource management. (p. 37)

6a. *Countries should enact codes of conduct for genetic resource collection.*

6b. *Countries should enact codes of conduct for genetic resource introduction.*

Action 7: Strengthen informal or "grassroots" networks for conserving genetic resources. (p. 38)

7a. *Global and international institutions should significantly increase funding for community-based genetic resource conservation efforts in developing and developed countries.*

7b. *National governments should encourage the establishment of local seedbanks and local genetic resource conservation programmes and remove legal barriers to the conservation of genetic resources.*

7c. *National agricultural research and germplasm conservation institutions should increase collaboration with informal genetic resource conservation networks.*

Action 8. Increase the use of native tree species in agroforestry, forest production, and the restoration of degraded lands. (p. 40)

8a. *Forestry development programmes, including bilateral or multi-lateral assistance and TFAP exercises, should allocate funds to applied research on native species.*

8b. *National forestry research institutions and Non-governmental Organizations should collaborate to develop guidelines and training programmes to support local initiatives in indigenous tree conservation and use.*

Action 9. Legitimize and improve traditional medicinal practices. (p. 41)

9a *Regional and national programmes should be established to increase applied research on the effectiveness of traditional medicines.*

9b *National governments should broaden codes of conduct for the collection of plant genetic resources to include medicinal plants.*

Action 10. National governments should, where appropriate, encourage and facilitate establishment of community-based natural resource management regimes in areas currently within the public domain. (p. 42)

10a *Governments should accord full legal recognition to the ancestral domains of tribal and other long-term occupants of specific territories, and assist them in adapting traditional practices to modern pressures and conditions.*

10b *In areas within the public domain where communities depend on land and biotic resources in their immediate area for their livelihood, governments should develop joint management regimes which provide sustainable benefits to both the state and the community.*

CONSERVE BIODIVERSITY IN THE WILD

Action 11. Establish ecosystem-wide management programmes for twenty priority Biodiversity Conservation Regions annually for the next decade. (p. 48)

11a *U.N. Agencies and non-governmental organizations should establish an ad hoc international task force to select areas of international importance for the conservation of biodiversity.*

11b *Governments should establish joint public/private authorities to manage critical biodiversity conservation regions of international importance.*

Action 12. Double the area of the global network of protected areas. (p. 54)

12a *U.N. Agencies and non-governmental organizations should establish an ad hoc international task force to conduct by 1993 regional reviews of protected areas, identify gaps in the system, and set priorities for international support.*

12b *The ad hoc international task force should identify existing or proposed protected areas that are important for their biodiversity components but face serious threats and warrant immediate action.*

12c *The ad hoc international task force should give high priority to the need to strengthen networks of non-contiguous conservation areas providing essential habitat for species at different life stages or different seasons.*

12d *Governments and non-governmental organizations should launch a major programme to establish special coastal and marine protected sites.*

12e *All nations should conduct national protected area system reviews by 1996.*

12f *Public and private protected area managers should use ecological restoration techniques to rehabilitate or expand existing protected areas to meet requirements for conserving biodiversity.*

Action 13. Strengthen protected area management. (p. 59)

13a *Governments and non-governmental organizations should establish an international facility to support protected areas.*

13c *[Who should?] Develop the capacity to manage protected areas.*

13d *The Commission on National Parks and Protected Areas (IUCN) should establish regional associations of protected area managers.*

CONSERVE BIODIVERSITY IN OFF-SITE FACILITIES

Action 14. Strengthen and expand the international

and national germplasm conservation network. (p. 63)

14a. *Donors should increase their support for national crop genetic resource-conservation networks.*

14b. *Genebank managers should increase collaboration with managers of botanic gardens, zoos, protected areas, and the informal genetic resource conservation network.*

14c. *National and international genebanks should expand their conservation of tree species.*

14d. *FAO should accelerate research on reproductive biology of domesticated animal genepools and cryopreservation of gametes and embryos and should coordinate the development of a global system of ex situ conservation.*

14e. *Nations should establish or strengthen national policies on ex situ conservation needs for domesticated organisms through national planning processes.*

14f. *Universities and International Agricultural Research Centres should train more scientists in developing countries on ex situ conservation and its integration with in situ interests.*

14g. FAO should *establish regional centres, associated with germplasm banks, to screen diversity.*

Action 15. Develop the world's botanic gardens as a major *ex situ* network for conserving local wild plant resources. (p. 68)

15a. *National governments should develop a network of new botanic gardens with minimum facilities in the tropics to complement conservation in protected areas.*

15b. *The Botanic Gardens Conservation Secretariat should establish a global database for the ex situ holdings of wild species, including both plants and seed, in botanic gardens, arboreta, and other centres such as crop genebanks.*

15c. *Botanic gardens and arboreta should adopt strict procedures for sampling, documenting, and maintaining germplasm collections.*

15d. *National governments and non-governmental organizations should increase their use of botanic gardens as tools to help in reintroducing species to the wild and in habitat restoration and rehabilitation.*

15e. *The Botanic Gardens Conservation Secretariat should encourage the development of national and regional botanic garden networks.*

15f. *All botanic gardens engaged in conservation activities should subscribe to the principles laid down in The Botanic Gardens Conservation Strategy.*

Action 16. Using the Global Botanic Garden Network as a model, build a germplasm conservation system to conserve medicinal plant species, especially those suffering genetic erosion or threatened with extinction. (71)

Action 17. Strengthen the role of aquaria in the conservation of biodiversity. (p. 72)

17a. *Aquaria should take on greater educational responsibility.*

17b. *Aquaria should allocate more funds to scientific research.*

17c. *Commercial aquaria should provide financial support for conservation through a new fund for sustaining aquatic species and habitat diversity.*

17d. *Aquaria need to stop promoting or encouraging the capture of living marine organisms for display.*

EXPAND UNDERSTANDING OF BIODIVERSITY

Action 18. Launch a ten-year campaign to build public awareness and support for biodiversity conservation. (p. 74)

Action 19. Strengthen and expand networks of national, regional, and international Biodiversity Conservation Centres gathering and providing biodiversity information tailored to local and national needs. (p. 75)

19a. *Nations should establish of national or regional biodiversity "centres" designed to promote, through research and contractual relationships, a national programme to save, study and use biodiversity.*

19b. *Nations should undertake national biodiversity inventories as part of an integrated data network*

19c. *Governments should strengthen international biodiversity information centres to foster information exchange and to help set international priorities.*

19d. *All national and international Biodiversity Information Centres should use the same set of basic indicators of the status and trends in biodiversity.*

Action 20. Establish an Early-warning System for Monitoring Potential Threats to Biodiversity. (p. 79)

20a. *A non-governmental organization linked to WCMC, FAO, and UNEP should be established to issue world-wide alerts on impending threats to biodiversity.*

20b. *National Agricultural Programmes should institute "Genetic Diversity Checks" for major crop varieties.*

Action 21. Promote basic biological research related to the conservation of biodiversity (p. 81)

21a. *Governments should triple their funding of ecological research during the decade.*

21b. *Governments and the scientific community should strengthen International Scientific Organizations so that they can play a more central role in global conservation efforts.*

Action 22. Promote basic social research related to the conservation of biodiversity. (p. 82)

Action 23: Launch a decade of research and action on the role of ethics, culture, and religion in conserving biodiversity. (p. 83)

23a *Establish a biodiversity ethics task force to serve as an international focal point for a decade of research and action on biodiversity ethics*

23b. *Major organizations committed to biodiversity conservation should, in collaboration with the Biodiversity Ethics Task Force, work to build the capacities of national and international organizations to promote biodiversity ethics*

23c. *Conservation organizations, academic researchers, and governments should work together to build the capacity of individuals and groups to take leadership in developing effective biodiversity ethics in local bioregions.*

INTEGRATE BIODIVERSITY CONSERVATION INTO NATIONAL PLANNING

Action 24. Develop national biodiversity conservation plans. (p. 86)

BUILD NEW MECHANISMS FOR GLOBAL COOPERATION

Action 25: Strengthen the implementation of current inter-governmental conventions and agreements. (p 90)

25a. *The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971)*

25b. *The Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)*

25c. *The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Washington, 1973)*

25d. *The Convention on Conservation of Migratory Species of Wild Animals (Bonn, 1979)*

25e. *The Convention on the Conservation of Antarctic Marine Living Resources (1980)*

25f. *The FAO International Undertaking on Plant Genetic Resources (Rome, 1983)*

25g *The International Tropical Timber Agreement (Geneva, 1983)*

Action 26: Negotiate and implement a Convention on Biological Diversity. (p. 91)

Action 27: Mobilize $1 billion per year in additional international investment in biodiversity conservation, utilizing new and innovative mechanisms to both raise and spend it. (p. 91)

27a. *Governments, multilateral development agencies, and NGOs should work together to establish a variety of new funding sources and mechanisms, totalling $1 billion per year, to meet developing country needs related to the conservation and use of biodiversity.*

27b. *Learning from recent experiences, banks, governments, and conservation NGOs should promote the continued use of debt-for-nature swaps as a means of protecting biodiversity.*

27c. *Funders, governments, and non-governmental organizations should promote the use of trust funds or endowments to ensure the continuity of biodiversity conservation funding and to boost developing countries' capacity to use such funding effectively.*

Action 28: Strengthen the influence of non-governmental organizations in intergovernmental institutions concerned with biodiversity conservation. (p. 95)

28a. *Governments and intergovernmental institutions should accord non-governmental organizations greater access and respect in intergovernmental forums that deal with biodiversity issues*

28b. *Donor organizations should invest in building non-governmental organizations' capacities for information management, data analysis, policy research, advocacy, media liaison and public outreach.*

28c. *NGOs should examine and strengthen their accountability to their constituencies.*

Action 29: Non-governmental organizations should strengthen and increase their independent biodiversity activities and campaigns at the global level. (p. 96)

Action 30: The United Nations General Assembly should declare an International Biodiversity Decade to put the actions called for in this Action Plan into practice. (p. 96)

PREFACE

1. The Biodiversity Strategy and Action Plan (BSAP) is a response to the need to complement and reinforce wide-ranging efforts now underway to conserve biodiversity. The BSAP is the first milestone in a process launched by governments and non-governmental organizations (NGOs) in 1988 to support and catalyze local, national, and global action to conserve biodiversity.

2. The Biodiversity Strategy and Action Plan has three objectives. First is to provide advice and information to decision-makers on priority policies and programmes for conserving biodiversity. Second is to promote a global partnership of local, national and international groups to implement efforts to save, study, and wisely use biodiversity. Third is to focus action and investment upon priority activities through a call for a ten-year plan of action.

3. The BSAP aims to build on and strengthen current biodiversity initiatives at all levels. Internationally more than 80 governments are currently negotiating a convention on the conservation of biodiversity under the auspices of the United Nations Environment Programme; membership in the FAO Commission on Plant Genetic Resources is expanding to include a broad cross-section of northern and southern nations; the Man and the Biosphere programme of UNESCO is launching a new effort to establish long-term research programmes at important biosphere reserves in all parts of the world; a multilateral fund managed by UNDP, UNEP, and the World Bank -- the Global Environment Facility -- has been established to provide significant new financial support for biodiversity conservation; and dozens of international NGOS representing many perspectives are focussing new public attention on major issues of biodiversity.

4. Nationally, biodiversity conservation action plans have been developed by such countries as Madagascar and Suriname and are being developed in other countries. Biodiversity has figured importantly in some National Conservation Strategies and development plans, major investments in protected area systems have been made in many parts of the world, and biodiversity data centres and research programmes are now established in many countries.

5. At the local level, grassroots organizations are establishing community seedbanks, developing new uses of biodiversity, reintroducing traditional crops, and literally fighting for the preservation of ecosystems on which local communities depend.

6. The thousands of activities being undertaken by communities, governments, NGOs, and international organizations often take place in relative isolation, reflecting the need for local approaches to local problems. Still, this diversity of approaches is unified by a common cause -- meeting today's needs while passing on to future generations an environment rich in genes, species, habitats, ecosystems, and the knowledge enabling their wise use.

7. Local, national, and international actions are also linked by economic and ecological realities. Local problems may ultimately stem from international debt or trade policies, or may result from misguided national policies. For this reason, local actions may not achieve their potential unless they take place in a supportive national and international framework.

8. The BSAP accords particular attention to international biodiversity conservation priorities and to the global cooperation needed to carry them out. But international efforts will succeed only if they support legitimate national and local needs and priorities. The BSAP identifies needed actions, but it also calls for negotiations to develop mutually acceptable solutions that address the needs and priorities of local, national, and global interests simultaneously.

9. The BSAP is one of a family of international initiatives designed to translate the concept of sustainable development into reality. In particular, the calls for action in the BSAP reinforce and elaborate the actions called for in *Caring for the Earth: A Strategy for Sustainability* (1991), the successor to the *World Conservation Strategy* (1980). *Caring for the Earth*, identifies the conservation of biodiversity as one of the principal goals of development in the coming decades, and it places biodiversity conservation in the broader context of actions required to promote human welfare and environmental conservation more generally.

10. Governments are currently negotiating a global biodiversity convention. The intent is to promote common goals and come up with a programme for international cooperation on priority activities of global interest. The Biodiversity Convention will be a critical addition to the global conservation movement. Yet, no single international convention can address all biodiversity conservation needs; and, even if adopted quickly, it will require many years to become effective. Many crucial conservation actions can be undertaken much more rapidly under local and national initiatives, including new programmes, new investments, and policy reforms. But, a considerable amount of national capacity-building is required if countries are to collaborate effectively with an international agreement on biodiversity. In any case, conservation cannot wait for the convention. Nor need it: many of the activities that would be supported by such a convention can begin immediately.

11. The partners that collaborated on the BSAP are themselves implementing broad, far-reaching, and diverse activities to conserve biodiversity. Their efforts so far indicate the potential of an even broader global partnership and the importance of taking a variety of approaches to common goals.

12. [Appreciation to those individuals and institutions that supported the development of the Biodiversity Action Programme.]

I. INTRODUCTION

1.1 The human race entered the industrial age with a population of one billion, sharing the earth with a diversity of life forms perhaps as great as the planet has ever possessed. Then, as now, biological diversity -- the variety of the planet's genes, species, and ecosystems -- constituted the basis for human survival and prosperity. Biotic resources -- the portion of biodiversity that people do or could use -- were freely available to support human livelihoods and aspirations. Today, with population more than five times as large and resource consumption far greater still, both the limits of biological resources and excessive human use are becoming clearer.

1.2 As the relationship between the human race and the natural environment changes, maintaining biodiversity assumes far greater urgency. Because humanity draws the raw materials needed to adapt to change from the variety of life on Earth, the loss of each additional species or genetic variation reduces the options for responding to changing conditions.

1.3 But instead of conserving the rich resources of forests, wetlands, and seas, humanity is rendering them non-renewable by depleting and destroying so many so fast. In this human rush to survive and develop, the biological imperatives of nature have been obscured.

Biodiversity: What Is It and Why Is It Important?

1.4 Biodiversity is the variety and variability of life. (See Box 1.1.) This diversity stems from hundreds of millions of years of evolutionary history, over which time established species have changed or died out and new species have come on the scene. Over the past 150,000 years, human cultures have emerged and adapted to the local environment, discovering and managing the biotic resources of local ecosystems to better meet their needs. People have even influenced the creation of genetic diversity. Many habitats that now seem "natural" bear the marks of millennia of human modifications -- fires, shifting cultivation, selective planting, and the removal of species. The domestication and breeding of countless varieties of crops and livestock tailored to local conditions has further shaped biodiversity. Today, humanity benefits from the biological and cultural legacy of past generations.

1.5 In the past, values that maintained and enhanced biodiversity were often woven into the cultural wisdom and inherited practices of the people. Today, there is no society that manifests an ethic of biodiversity adequate to the social and technological conditions of modern life. In fact, the dominant norms of so-called "modern" and "developed" cultures are primary factors responsible for the destruction of biodiversity. What biodiversity *means*, and whether and how it is maintained, enhanced, or depleted, is primarily a matter of human activities and perceptions and hence moral, cultural, and religious values. It is misleading to juxtapose economic and other "utilitarian" approaches to biodiversity with those that stress so-called "intangible" moral and spiritual values. All human relationships to the environment are value-laden and tangible. The real contrast is between different *kinds* of values, and the crucial question is how to create an ethical framework that makes economic interests, ecological values, and social justice as mutually supportive as possible.

1.6 But there is hope for change. Many religious and cultural traditions are now making substantial contributions to the search for a more just and sustainable way of life, including defensible ethics of biodiversity. And even at the inter-governmental level, the United Nations Charter for Nature -- assented to by most governments -- states that:

> *Every form of life is unique, warranting respect regardless of its worth to man, and to accord other organisms such recognition man must be guided by a moral code of action*

1.7 It is unlikely, however, that one universal code of action is appropriate. Biodiversity means different things to different people in different cultures. These cultural differences enrich our appreciation for the meaning of biodiversity; conversely, biodiversity is a primary source of the world's rich and precious cultural diversity.

1.8 Biodiversity is also the primary source for fulfillment of humanity's material needs, and its capacity to adapt to changing environmental conditions. An environment rich in biodiversity provides the widest array of options for both nurturing human welfare and

BOX 1.1
The Diversity of Life

Biological diversity is an umbrella term for the degree of nature's variety. It is useful to divide biodiversity into the hierarchical categories of genetic, species, and ecosystem diversity. These three levels of biodiversity describe quite different aspects of living systems and are measured in different ways: they are not alternatives or substitutes.

Genetic diversity refers to the variation of genes within species. This diversity may be in the form of distinct populations of the same species, such as the thousands of traditional rice varieties in India, each named and readily distinguished by farmers. The number of such varieties is one measure of the genetic diversity within a domesticated species. Genetic diversity can also refer to genetic variation within a population. Cheetahs, for example, exhibit remarkably little variation in their genetic makeup, while Indian rhinos show very high genetic diversity. The genetic diversity within a population or species can be accurately measured, but limitations of data generally restrict such measurements to domesticated species and populations held in zoos or botanic gardens.

Species diversity refers to the variety of species within a region. A region with many species has a high species diversity. In practice, when measuring species diversity, scientists also take into account how closely related species are to each other. For example, an island with two species of birds and one species of lizard is considered to have greater diversity than an island with three species of birds but no lizards. Thus, even though there may be more species of beetles on earth than all other species combined, they do not account for the majority of species diversity because they are so closely related. Similarly, the land has many more species than the sea, but the species on land are more closely related to each other than the species in the ocean. Thus, the diversity of marine ecosystems is higher than a strict count of species would suggest. This more precise measurement of species diversity, which takes into account the relatedness of species, is referred to as "taxonomic diversity."

Ecosystem (or habitat) diversity is more difficult to measure than species or genetic diversity because the "boundaries" of habitats and ecosystems cannot be precisely defined. Nevertheless, so long as habitats and ecosystems are defined using a consistent set of criteria, their number and distribution can be measured. Until now, such consistent schemes have been applied in reasonable detail only at national and sub-national levels, though some global classifications have been made at very coarse resolution.

Human cultural diversity could also be considered part of biodiversity. Like genetic or species diversity, human cultures have developed in part to solve the problems of existence in particular environments. And like other aspects of biodiversity, cultural diversity is a foundation of human existence today and a resource for adapting to changing conditions. Cultural diversity is manifested by diversity in language, religion, land management practices, art, music, social structure, crop selection, diet, and any number of other attributes of human society.

weathering local and global change. Many past civilizations that could not deal with change, including those of their own making, collapsed -- an important lesson with so many profound economic, political, and environmental changes now afoot. Anticipated climate change will both create and exacerbate social and economic stresses, and there is no substitute for biodiversity in helping people adapt to these changes.

1.9 The world's species provide humanity with all of our food and many medicines and industrial products. For generations, farmers have drawn on the genetic diversity of crops and livestock to keep food supplies stable in the face of the constant evolutionary battle with the pests that prey on crops. And all people depend on clean water, fertile soils, predictable micro-climates, the nutrient cycle, and nature's pollution-absorption capacity. Many also set great spiritual and recreational store by nature and its creatures.

1.10 In both traditional and industrial agriculture,

biodiversity is a critical resource. In age-old systems, several varieties of many crops are planted together to minimize the likelihood of crop failure. The Massa of northern Cameroon cultivate five varieties of pearl millet, the Ifugao of the island of Luzon in the Philippines can name more than 200 varieties of sweet potato, and Andean farmers cultivate thousands of clones of potatoes, more than 1,000 of which have names. Far from curious throw-backs, these systems will continue to form the backbone of sustainable agriculture in many non-industrialized countries.

1.11 In industrialized agriculture, the value of biodiversity is readily quantified. For example, plant breeders can take credit for at least one-half of the doubling in yields of rice, barley, soybeans, wheat, cotton, and sugarcane that took place in the United States from 1930 to [illegible] a threefold increase in tomato yields; and qu[illegible]upled yields of corn, sorghum, and potato. All told, genetic diversity contributes an estimated $1 billion annually to the value of production of U.S. agriculture (OTA 1987).

1.12 Biodiversity's role in human health is equally important. About 80 percent of all people in developing countries rely on traditional medicine for their primary health care -- and the medicines they use are culled from a tremendous number of plant and animal species. In China, 19 percent of all plant species have been used in medicines, while indigenous groups in North America made use of some 13 percent. Respect for traditional medicines is on the rise throughout the world, and even in modern "pill cultures" the medicinal value of biological diversity is readily apparent. Approximately one-fourth of all prescriptions dispensed in the United States contain active ingredients extracted from plants. Only a decade ago, interest in natural products was decreasing in pharmaceutical companies, but with the advent of modern screening techniques and the realization that expectations for "rational drug design" were wildly optimistic, interest in natural product research has surged.

1.13 Biodiversity's other uses and values reach deep into almost every aspect of human life. Throughout much of the world, wild species form a major part of the diet. In Sarawak, Malaysia, for example, wild pigs harvested by hunters had a market value of $100 million per year [when?]. About 75 percent of all Ghanaians depend largely on traditional sources of protein, mainly wildlife (including fish, insects, caterpillars, maggots, and snails). Other direct uses include recreation and tourism. In Canada, 84 percent of the population participates in such wildlife-related recreational activities as fishing and wildlife photography, providing benefits declared to be worth $800 million annually. In the United States, wild species make up an estimated 4.5 percent of the Gross Domestic Product, worth $87 billion per year in the late 1970s (Prescott-Allen and Prescott-Allen 1986).

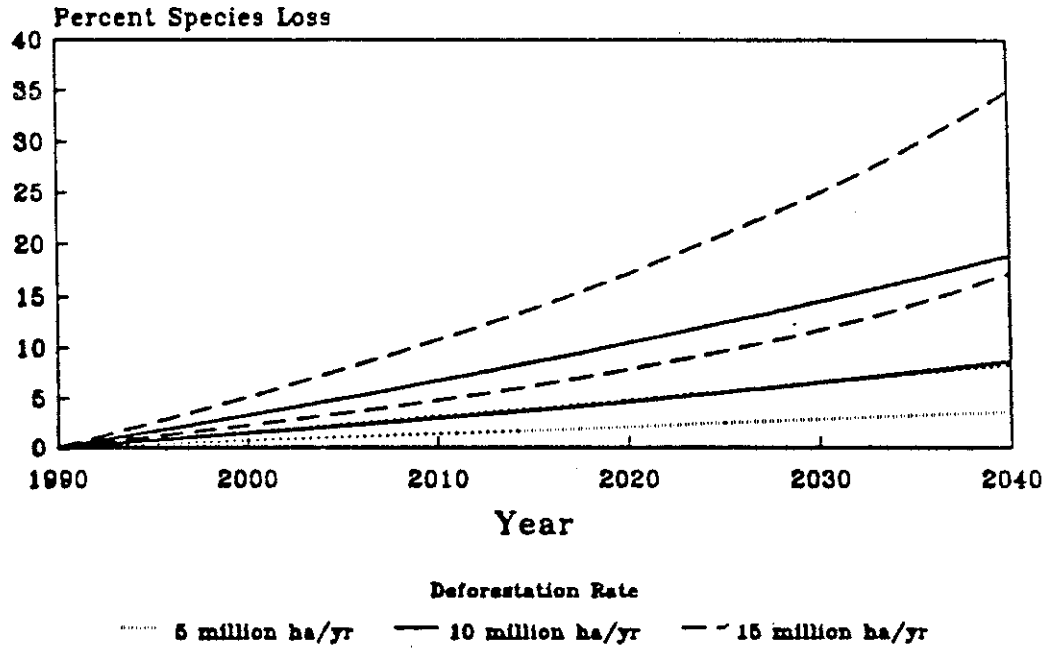
1.14 Harder to quantify but at least as important are the indirect values of biodiversity -- including so-called ecosystem functions or services. The destruction of U.S. coastal estuaries between 1954 and 1978 cost the nation over $200 million annually in revenues lost from commercial and sport fisheries. Even more important is biodiversity's unquantifiable "option value" -- the potential future benefits that humanity may obtain from species.

A Vanishing Heritage

1.15 Not since the Cretaceous Era ended some 65 million years ago has biodiversity loss been so rapid and so great as it is today. The crucible of extinction today is in tropical forests where the greatest number of species are threatened. If current rates of forest loss hold, approximately 5 percent of tropical forest species may be sentenced to extinction over the next 25 years. (These species may not expire on the spot, but once their populations and habitat are sufficiently reduced their eventual loss will take only a few decades.) Today, annual losses of these forests exceed 15 million hectares. If tropical forest loss continues to accelerate, the toll could reach 35 percent in the next half-century. (See Figure 1.1) Between 50 and 90 percent of the world's 30 million species live in tropical forests, and over the next 25 years tropical deforestation may commit roughly 20,000 species to extinction each year -- nearly 50 species per day. If losses so great seem to defy common sense and experience, remember that such large, visible species as birds, mammals, and plants make up less than 5 percent of the world's species and that in these groups alone one species a day will be sentenced to extinction.

1.16 Outside of species-rich tropical forests are many other ecosystems whose inhabitants are at especially high risk of extinction. In such

Figure 1 1
Tropical Forest Species Extinction Scenarios



Lines bracket the percent of species likely to be sentenced to extinction over various time periods given rates of tropical deforestation either lower than (5 million ha/yr), roughly equal to (10 million ha/yr), and greater than (15 million ha/yr) today's rate

Source: Reid 1991

Mediterranean regions as California, South Africa, Chile, and Southwest Australia, nearly 10 percent of all species are imperilled. Oceanic islands, home of most extinctions in past centuries, also remain among the most threatened ecosystems on earth. Some 60 percent of plant species endemic to the Galapagos islands are endangered, as are 40 percent of Hawaii's endemic species and 75 percent of the endemic plant species of the Canary islands. And species in freshwater habitats, where pollution has been dumped and exotic species introduced with near abandon, are perhaps most threatened of all. Some 40 to 50 percent of freshwater snails in the southeastern United States have been driven to or near extinction. In the northwestern United States, 159 stocks of anadromous, or ocean-migrating, fish are at high or moderate risk of extinction, if they are not already extinct.

1.17 Habitat loss is often the principal cause of species extinctions. But the habitat loss represents a loss of biodiversity in its own right. In many countries, relatively little habitat remains that has not been transformed by human activities. In 49 out of 61 countries of tropical Asia and Africa, more than half of the habitat has been substantially modified by humanity. In Bangladesh, 94 percent has! And history shows that some such losses are permanent (by the human calendar anyway): forests around the Mediterranean Sea are thought to have covered 10 times their current area before they were cleared, and the prairie ecosystems of central North America have been virtually eliminated in the past several centuries

1.18 Dramatic losses of species and habitats have somewhat obscured equally large and important threats to genetic diversity. In agriculture during the past century, a tremendous diversity of locally adapted varieties of crops and livestock has been replaced by many fewer varieties. How much the genetic base has eroded is hard to say, but in the United States 97 percent of the varieties of some 75 vegetables grown in the early 1900s are now extinct (Fowler and Mooney 1990). Of more than 7,000 apple varieties grown between 1804 and 1904 in the United States, 86

percent are gone Genetic erosion has been particularly great since the 1950s and 1960s, when modern varieties of many crops were introduced These Green Revolution varieties rapidly squeezed out the traditional varieties from which they were bred Modern varieties were adopted on 40 percent of Asia's rice farms within 15 years of their release, and in some countries (among them, the Philippines and Indonesia) more than 80 percent of farmers began planting the new varieties.

1.19 Local communities, nations, and international agencies have responded to the loss of genetic diversity, but not swiftly or broadly enough. National and international gene banks have helped to slow the loss of genetic diversity, but the high costs of regenerating the seeds periodically and the risk of mechanical failures make seedbanks less than fail-safe. In 1980, experts estimated that even in developed countries between one-half and two-thirds of seeds collected in past decades had been lost (Fowler and Mooney 1990).

1.20 Many such losses register swiftly. In 1970, the U.S. corn farmers sacrificed $1 billion to a disease that swept through the genetically uniform varieties. Genetic uniformity also took a toll in the Soviet Union in 1972, and in citrus in Florida in 1984. Potential for such outbreaks also exists in Bangladesh, where some 62 percent of rice varieties come from a single maternal plant, and in Indonesia (74 percent) and Sri Lanka (75 percent).

1.21 The loss of genetic, species, and ecosystem diversity both stems from and invites the loss of cultural diversity. Diverse cultures have bred and sustained any number of varieties of crops, livestock, and habitats. Conversely, the loss of certain crops, the replacement of traditional crops with export crops, the extinction of species enshrined in mythology and folklore, or the degradation or conversion of homelands is a cultural as well as a biological loss.

1.22 In general, the status of cultural diversity and the trends influencing it are at least as disturbing as those describing genetic, species, and ecosystem diversity. For example, since 1900 one Indian tribe has disappeared from Brazil each year (Clay 1991). Similarly, almost one half of the world's 6000 languages will die out in the next 100 years. Of the 3000 languages expected to survive the century, nearly half of those are likely to be lost soon thereafter.

1.23 Although habitat modification and fragmentation pose the single greatest threat to terrestrial species and genetic diversity, four other threats are also profound:

1 Over-exploitation of species of plants and animals. Numerous forest, fisheries, and wildlife resources have been substantially reduced through overexploitation, sometimes to the point of extinction. Historically, both the Great Auk and the Passenger Pigeon succumbed to such pressure and the Lebanon cedar -- once blanketing 500,000 hectares -- was reduced through over-harvesting to a few scattered remnants of forest. Today, the Black Rhino has been hunted to the verge of extinction, and numerous other endangered, vulnerable, and rare vertebrates are threatened by overexploitation. Most of the damage stems from the human harvest of food, but the search for pets, curiosities, and material for "scientific" collections has also reduced some populations and wiped out others.

2. Pollution of soil, water and atmosphere Pollutants strain ecosystems and, often, reduce or eliminate populations of sensitive species Barn owl populations in the United Kingdom have fallen by 10 percent since new rodenticides were introduced. Illegal pesticides used to control crayfish along the boundaries of Spain's Cota Donana National Park in 1985 killed 30,000 birds (MacKenzie 1986). Acid rain has caused declines in forest species and harms fresh-water organisms sensitive to changes in the acidity of water Marine pollution, particularly that from non-point sources, has defiled the Mediterranean. In coming decades, a "side-effect" of air pollution -- global warming -- could play havoc with the world's living organisms and may already be bleaching and killing corals (Williams and Williams 1990, Goreau 1990). Other such examples abound.

3. Introduced species. Introduced species are responsible for many of the recorded extinctions of species, especially on islands, where a new predator or competitor can rapidly endanger species that did not co-evolve with the newcomer. Of course, species

introductions are not invariably negative. Most countries grow crops brought in from other regions of the world. In Australia, the Mediterranean, northern Europe, northern Asia, and the United States and Canada, more than 90 percent of agricultural production is derived from introduced species (Kloppenburg and Kleinman 1987). But introductions of wild species have sometimes had devastating results. In Hawaii, some 86 introduced plant species are considered serious threats to native ecosystems. The clear message is that species introductions can be a boon or bane to human welfare and that careful management and strict regulations are what determines the difference.

4. Industrial agriculture and forestry. Until this century, farmers and other agricultural peoples created and maintained a tremendous diversity of crop and livestock varieties around the world. But, thanks to modern plant breeding programmes and the resulting productivity gains achieved by planting comparatively fewer varieties of crops comparatively more responsive to water, fertilizers, and pesticides, that diversity is shrinking fast. Similar trends are transforming diverse forest ecosystems into monocultural tree plantations -- in some cases with as little ecological similarity to a natural forest as a field of maize.

1.24 These forces of biological impoverishment stem from the diverse and complex strategies humanity has devised to survive, prosper, cooperate, dominate, and compete. Until recently, the effects of this development process on nature were largely ignored. As people awaken to the damage it is inflicting on the web of life and to the ways human activities can circumscribe the human prospect, the search for solutions must turn inward. The roots of the biodiversity crisis are not "out there" in the forest or on the veldt but, rather, embedded in the way we live. They lie in our own burgeoning numbers and appetites, our unsustainable economic activities, our ignorance, and the now-outmoded institutions that do our bidding and order our relationship to nature. These are the "root causes" of biodiversity loss, and of all of the human suffering which that loss entails. It is these root causes that must be addressed if humanity is to pass on the planet's life support systems to future generations in good working order and to earn our privileged place in nature.

Root Causes for Biodiversity Impoverishment

1.25 Biodiversity loss cannot be effectively slowed unless its root causes are addressed directly. The problem is that the root causes of biodiversity loss are as complex as the human condition itself. A workable approach must comprehend the full range of causal factors, but focus on those where there is real leverage for action. For simplicity's sake, "root causes" can be divided into two categories, contextual and operational.

1.26 "Contextual" root causes are those issues that form the context within which action to slow biodiversity loss must be oriented. Chief among these factors are two: levels of population growth and resource consumption on the one hand, and the increasingly interconnected nature of the world trading and economic system on the other. While concrete action can be taken to influence these forces, none are amenable to fundamental change in the near future -- a painful fact that must be accepted.

1.27 "Operational" root causes are those that can be changed relatively soon. These include market failures and government policies that provide incentives for biodiversity depletion, ignorance about the role and importance of biodiversity in human life, inequity in the control and benefits from biotic resources, weak or inappropriate institutions and laws, and underinvestment in biodiversity conservation. Addressing these operational root causes is often difficult, but the difficulties lie in failures of vision, commitment, and political will, not in the nature of the causes themselves.

Population, Consumption, and Biodiversity

1.28 The tremendous rate of population growth and resource consumption that has characterized the last century and that continues today at historically high rates is a fundamental cause of biodiversity loss. Demographic momentum generated by growth over the last four decades assures that growth to some degree will be with us for at least the next half century, but the rates and magnitude of this growth and the eventual size at which the global population stabilizes -- critical considerations for biodiversity -- will be determined by actions taken now.

Box 1.2
Population and Biodiversity in Two Worlds

The current predicaments of the Chesapeake Bay on the eastern seaboard of the United States and the Ecuadorian Amazon illustrate how the interplay of changing populations and their patterns and methods of consumption can have serious implications for regional ecosystems and the organisms which inhabit them.

Home to 2,700 species of plants and animals, the Chesapeake Bay is the largest estuary in North America. A population increase of 87% between 1940 and 1986 generated a corresponding expansion in development. Much land that previously lay fallow, in pasture, or wooded was consumed by the growing sprawl. In the wake of land lost to residential, industrial, and retail development, local farmers heavily intensified their use of inputs. Irrigation increased fourfold from 1954 to 1987; the amount of fertilizer jumped from 210 to 250 pounds per acre, while its nitrogen content more than doubled.

Consequently, nutrient levels in the Chesapeake have increased over 200 times, leading to eutrophication and dinoflagellate blooms. The number of areas afflicted with oxygen depletion has risen fifteen fold. Concentrations of toxic compounds and metals have climbed sharply. And despite plentiful rainfall, flows of fresh groundwater have been reduced by 11%. As a result of these changes, the area of submerged aquatic vegetation -- critical to the ecosystem -- is severely diminished. Annual oyster harvests have declined from 100 million pounds in the late 1800's to about 20 million in recent times. And populations of species such as shad, alewife, and blue crab have plunged.

Unfortunately for the bay, these trends are not likely to abate anytime soon. In its report issued in 1989, the Year 2020 Panel, a joint commission appointed by the region's chief executives, concluded that the projected population increase of 2.6 million by the year 2020 would overwhelm the very costly environmental protection measures already established to help improve sewage treatment and reduce industrial pollution. Newer projections paint a more sobering picture still, indicating that the region's population will experience this growth in two decades instead of three.

The Ecuadorean Amazon, one of the world's most richly diverse ecosystems, faces perhaps an even more troubling future. Mostly poor, Ecuadoreans do not use as many resources as people in the Chesapeake Bay watershed. But their numbers are growing much more rapidly. If the current growth rate of 2.7 percent is not lowered, the country's population will double from 10 to 20 million by the year 2015. Thanks to droughts, current population pressures, and deteriorating environmental conditions, the higher quality agricultural regions along the Pacific Coast and in the Andes valleys are already being abandoned. The only real areas left to absorb the additional ten million people are the cities and the Amazon. By applying the current population density of Ecuador as a whole to the Amazon region, World Bank economist Herman Daly calculates that at the extreme upper limit the rainforest might support four million people -- less than half of the projected population increase.

1.29 Since human beings must consume natural resources to survive, the inherent limits of the natural resource base force a corresponding limit on the number of people who can draw their livelihoods from it. Beyond these limits, humans begin to deplete nonrenewable resources or to convert renewable resources into essentially nonrenewable ones, thus transgressing their ecological carrying capacity. Within these ultimate limits, however, carrying capacity is a dynamic concept, determined not only by population size, but also by such variables as consumption levels and technological innovation.

1.30 Humanity's depletion of natural resources is the product of the per capita consumption level of a population and the technology employed to satisfy that consumption, multiplied by the number of individuals. Carrying capacity may be "expanded" by altering consumption patterns or by improving the technologies and policies that support them -- efficiency measures that allow scarce resources to reach more people without increasing stress on the natural environment.

In short, even at minimum levels of consumption, societies can exceed carrying capacity through sheer population numbers; on the other hand, relatively small populations can exceed a region's carrying capacity if their per capita consumption is high and their technologies are inefficient and destructive.

1.31 As a natural resource, biodiversity is subject to the human demands expressed in the basic resource consumption equation discussed above. Historically, the relationship between the growth of human civilizations and habitat loss has been inversely proportional. As human numbers have expanded over the centuries, habitat has disappeared. This rule of thumb, while oversimplified here, holds true in every region of the world that is more than sparsely populated.

1.32 Not only does humanity directly displace biodiversity. It also competes with other species for natural resources. An estimated 40 percent of the net primary production of terrestrial green plants -- the food source for all animals -- is appropriated for human use (Vitousek, et al., 1986). As a result, ecosystems have been simplified and the diversity and numbers of species greatly reduced. The world's biotic systems simply won't enable us to continue to expand our appropriation of primary productivity to meet further growth in human population.

1.33 Population growth and its effects on biodiversity must be viewed from two perspectives. In the industrialized world, where populations have reached replacement or sub-replacement levels, consumption and technology are the primary sources of impact on ecosystems, though regional transmigration and immigration can greatly exacerbate the already precarious imbalance between humanity and nature. In the developing world, where population growth rates are still high, sheer growth in numbers and poverty (i.e. unacceptably low levels of consumption) are the problem.

1.34 Overall wildlife populations in the Everglades of southern Florida, for example, have plummeted during the last century while the human population has increased more than thirtyfold. The main culprit in this decline is the diversion of essential freshwater flows from the wetlands for agricultural, municipal, industrial, and residential usages. Due largely to transmigration, Florida's annual population growth rate is 2.7 percent, with 80 percent of that growth along the coasts. At this rate, the state's population will double in a generation, further amplifying human demands for the freshwater resources that most of the region's biodiversity resources depend on for survival.

1.35 Ninety-five percent of the unprecedented population growth projected over the next decade and into the twenty-first century will occur in the developing world. There, people rely more directly on natural resources, and costly environmental protection measures seem largely unaffordable, but that is where many of the world's most threatened ecosystems lie. There, too, human population growth interacts with grossly inequitable land tenure, massive international debt, and economic and political factors to hasten the liquidation of habitat.

1.36 As populations and per capita consumption increase, so does the need for increases in production of food and other goods and services. Despite the yield improvements of the "Green Revolution," total world cropland area increased by 332 million hectares between 1950 and 1980, much of it at the expense of forests, wetlands, and natural grasslands. Since most countries have reached their arable land frontier already, more biologically productive but agriculturally marginal habitat will continue to be converted. Larger and more affluent populations also require more energy, and in the developing world this need translates largely into fuelwood demand. Population and consumption growth also contribute to the over harvesting of fisheries stocks. At the same time, coastal and marine biodiversity is threatened by the expanding volumes of human waste that overwhelm the inadequate sewage systems of fast-growing coastal cities in developing countries.

1.37 Population growth cannot be stopped overnight, but it can be slowed and eventually stabilized, as the experience of many nations attests. The struggle for equality, opportunity, and dignity for women -- and adequate education and health care for their children -- has been repeatedly shown to be perhaps the most crucial factor in stabilizing population growth. Bringing down high and wasteful consumption rates in developed countries -- and among elites in developing ones -- however, is just as important as reducing aggregate growth in numbers. Indeed, consumption and growth in numbers are merely interchangeable variables. Developing

countries cannot be expected to take global concern about growth in human numbers really seriously if the industrialized countries do not get equally serious about reducing their resource consumption

The Global Trading System and Biodiversity

1.38 The penetration of interlinked local, national, and global market forces into the farthest corners of the globe is a fact of life in the 1990s. Since 1950, measurable global economic activity has nearly quadrupled to create a $13 trillion world economy. These large increases in economic activity and exchange have combined with the expansion of roads, communications networks, and other infrastructure to bring the influence of market forces into the once-remote areas that contain the greatest remaining concentrations of biodiversity.

1.39 Along with the benefits it provides to at least some nations and people, the nature and spread of the global exchange economy signal hard times for biodiversity. In the past, the world was a "patchwork quilt" of relatively autonomous regions. Knowledge, subsistence strategies, and social structures evolved in each region more or less independently, and people applied diverse selective pressure on their own patch. No one group could have great impact on biodiversity overall, and some even enhanced it. But the global exchange economy that has evolved over the past century is organized around common principles of comparative advantage, specialization, and exchange, all of which promote cultural and biological homogeneity and, therefore, erode biodiversity

1.40 In agriculture, global exchange demands that producers in a particular region now specialize in the relatively narrow range of crops that give them a comparative advantage in the world economy. As the number of crop species grown declines, such supporting species as local nitrogen-fixing bacteria, mycorrhizae, predators, pollinators, seed dispersers, and other species that co-evolved over centuries with traditional agricultural systems die out. Use of fertilizers, pesticides, and high-yielding varieties -- necessary in the global exchange economy for maximizing production and net monetary return over the short-term -- exacerbate this loss

1.41 In addition, global exchange requires producers to adapt to rapidly changing market signals, shifting land, capital, and labor from one crop to another in the space of a few years. Ecological services, however, cannot shift so rapidly: "The problem, simply put, is that environmental services cannot freely shift from the support of rice, to the support of cotton, to suburban lawns, to concrete, to alfalfa, to marsh habitat for waterfowl, and back to rice the same as a reasonably adaptive person might shift from being a farmer, to an urban gardener, to a game warden, and back to being a farmer." (Noorgard, 1987)

1.42 Some supporting species may be able to adapt rapidly, but many cannot. For this reason, some loss in diversity is attributable to the increase in the pace of environmental change as time-honored traditional agricultural practices give way to the rapidly changing practices that allow farmers to mass produce for the global demand.

1.43 The dynamics of global market exchange have corollary effects on wildlands, particularly tropical forests. Traditional pressures from agriculture did not appreciably erode the forest's diversity since population densities remained low, market pressure slack, and the backbone of most traditional subsistence strategies was a "portfolio" of shifting cultivation, hunting, and gathering of forest products. In the global exchange economy, in contrast, rapid, large-scale, and total conversion of forests (often to monocultural cash [illegible]. When the price of coffee or palm oil drops, the plantation cannot quickly revert to the biologically diverse forest that preceded it, even in the if human pressures subside

1.44 In short, the existence and extension of the global exchange economy is a fundamental root cause for biodiversity loss. Although humanity is unlikely to revert to a traditional patchwork of semi-autonomous communities and societies, taking the biodiversity challenge by the horns means acknowledging the very real costs humanity is paying for doing its business in the global supermarket. Once those costs are fully understood, it will be easier to control some of the global exchange economy' most devastating impacts on biodiversity.

Operational Root Causes

1.45 Beyond the two key contextual factors discussed above are a number of important

"operational" root causes for biodiversity loss that can be addressed quite decisively by individuals, communities, and institutions. Most important among them are the following:

1.46 **Ignorance** about biodiversity, about what ecological role it plays, how much it is worth, and how it is lost;

a. Humanity lacks sufficient understanding of both the global ecosystem and its innumerable parts, and of our own economic, social, and ethical dependence on biodiversity. This ignorance is compounded by the destruction of cultural diversity and traditional knowledge of nature.

b. The knowledge that we do have is not adequately reflected in policies and institutions, nor in the general public's understanding.

c. Those who depend most directly on biotic resources -- rural communities -- have almost no access to information about development projects and other actions that fundamentally and irreversibly alter the ecosystems that their lives depend on.

1.47 **Inequity** in the ownership, management, and flow of benefits from both the exploitation and the conservation of biotic resources:

a. In most countries, ownership and control of land and biotic resources, and all the benefits they confer, are distributed in ways that work against biodiversity conservation. In many countries, power over resources is concentrated in the hands of a small but powerful minority with little accountability to the population at large. Rapid depletion of species and habitat destruction become the norm, and local communities are given no incentives to exercise stewardship over land or other resources in their areas. In other places, however, local communities may exercise too much control, appropriating and depleting biotic resources without due regard for the needs and claims of society at large.

b. Similarly skewed patterns of property rights and institutional control of the management, use, and benefits of agricultural genetic resources have exacerbated the erosion of genetic diversity in agriculture.

c. International trade, debt, and technology transfer policies and practices foster inequities that resemble -- and often reinforce -- those found within national systems.

1.48 **Market failures** that cause biodiversity to be undervalued, and thereby promote their rapid depletion.

Normally, markets are considered efficient resource allocators. With regard to biodiversity, however, pervasive market failures occur because of the nature of the resources in question.

a. Many biotic resources are consumed directly and never enter markets. Many forest products other than timber, for example, are utilized directly by local communities, so their value does not register in markets. The comparative value of timber cutting and other exhaustive uses are therefore overvalued, creating incentives for forest destruction

b. In addition, much of biodiversity's benefit is in the form of "public goods," the value of which cannot be captured by any one owner, and is thus excluded from the market's calculations. Watershed protection, for example, benefits the public at large in tangible, quantifiable ways, but the benefits are too diffuse to appreciably influence market incentives to either conserve or degrade the watershed ecosystem.

c. Wherever property rights in biotic resources are indeterminate, the market undervalues the resources. This is true of rights in local genetic resources as well as rights in forests, wetlands, and coral reef systems.

d. Some values of biodiversity -- aesthetic and spiritual ones in particular -- are intangible. No market values these

1.49 **Economic policy distortions** that reinforce market failures or create new "policy failures."

Where markets undervalue biodiversity, governments should intervene with policies to correct the failures Unfortunately, the wrong policy interventions in the market only reinforce market failures.

a. Policies in forestry, fisheries, or agriculture sectors that provide incentives for rapid exploitation of biotic resources without concern for conservation or long-term sustainability are major culprits in the loss of forests, wetlands, and fisheries resources.

b. Macroeconomic policies affecting the relative terms of trade and level of investment between different sectors of the economy frequently catalyze the depletion of specific resources or the destruction of particular habitats.

c. Policies and mechanisms for calculating gross national income (i.e. "GNP") do not consider biotic resources as capital, but instead equate their depletion with net income. The undervaluation of biodiversity is thus institutionalized in the very calculus upon which countries devise economic policies. This error is then replicated in the design of sector-specific activities and projects, since project alternatives are evaluated with the same faulty economic yardstick. [Insert graphic to illustrate GNP and the problem with treating depletion as net income]

1.50 **Weak and inappropriate institutional and legal arrangements** that hinder effective action and, all too often, contribute to the problem.

a. While ecological and economic realities call for a cross-sectoral approach to biodiversity conservation and management, existing government agencies operate within strict sectoral mandates that often compete and overlap or, alternatively, leave important gaps unfilled.

b. Although effective resource management requires an integration of policy and action from the central government to the community level, existing institutions tend to overcentralize planning, short-shrift implementation at the local level, and fail to invite local participation and respect local cultural variation.

c. The centralized institutions of government and private enterprise whose policies determine biodiversity's fate are largely closed to broad participation. Affected communities, knowledgeable scientists, non-governmental organizations, and others with a stake in biodiversity are denied the chance to both make their claims and to contribute their wisdom and recommendations. In addition, these centralized institutions preempt -- by their very existence -- possibilities for development of creative, more broad-based alternatives.

d. Agencies and organizations charged with nature conservation suffer from the same institutional weaknesses and malaise that cripple forestry, agriculture, and other sectoral agencies. Efforts are fragmented and overlapping, conservation planning is neither comprehensive nor strategic, and the wide range of available in situ and ex situ conservation tools and technologies are not integrated.

e. International inter-governmental organizations, including the United Nations agencies and development assistance bodies, reflect similar tendencies to compete and overlap, to plan and implement their activities in centralized and even secretive ways, and to limit the participation of the communities most affected by their actions. And at the international level, accountability is removed yet one step further from those communities.

1.51 **Resource management programmes** that are too small and fragmented to conserve biodiversity effectively.

Largely due to the strictures of existing laws and the mandates and "cultures" of institutions, biodiversity conservation has typically been limited to specific management regimes -- protected areas, the management of individual endangered or threatened species, etc. But a particular protected area or even a group of them, often fails to meet plants and animals' habitat requirements, particularly those of migratory species. Moreover, land-use practices outside

protected areas can alter water supplies, introduce pollutants, and change microclimates.

a. Larger region-wide solutions are called for to address the habitat needs of entire communities of plants and animals. But, in most situations, managing entire landscapes as national parks or forest reserves is not practical. Yet the sectoral agencies responsible for biodiversity conservation seldom have the expertise or authority to manage a diverse landscape of developed and undeveloped land.

b. Often, a wide variety of public and private agencies are responsible for different actions on the same landscape. Small wonder that many implement overlapping or contradictory programmes. Coordination among institutions won't occur without new incentives for cooperation.

c. Regions of sufficient size to be effective geographical units for biodiversity conservation typically come under various local, state or provincial government jurisdictions. Some involve two or more nations. As a result, resource management policies and programmes are not integrated within biologically defined regions. Ecosystems are fragmented according to legal and sectoral mandates, disciplinary specialties, and political jurisdictions.

1.52 **Grossly inadequate financial resources** available for biodiversity conservation and at best rudimentary **financial mechanisms** for generating and dispensing conservation investments.

a. Collective investments in biodiversity come nowhere near the actual value of the resource in question. The problem is mainly that biodiversity conservation is seen as a cost rather than an investment. Then too, those who do invest have little guarantee of reaping the benefits of what is in large part a "public good".

b. Mechanisms for utilizing available funds are simplistic and inefficient. In many cases, increased conservation funding merely strengthens outmoded, inequitable, and inefficient ways of doing business.

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II. GOALS AND PRINCIPLES FOR BIODIVERSITY CONSERVATION

2.1 The goal of biodiversity conservation is to use biological resources today in ways that do not diminish the world's variety of genes and species, destroy important habitats, or reduce the knowledge base that enables their wise use.

2.2 The three basic requirements for conserving biodiversity are to save it, to study it, and to use it sustainably and equitably.

2.3 **Saving biodiversity** means taking steps to protect existing genes and species. The best way to maintain species is to maintain their habitats, so saving biodiversity often involves actions to manage or protect key habitats. But maintaining diversity in highly modified habitats may also be required, along with efforts to restore lost species to their former ecosystems to preserve species in such off site (*ex situ*) facilities as genebanks, zoos, and botanic gardens.

2.4 **Studying biodiversity** means documenting its composition and distribution; understanding the role and function of genes, species, and ecosystems; and increasing awareness of biodiversity's ethical, cultural, and material values. Because of the close association between biodiversity and cultural diversity, studying cultural diversity and cultural practices is often as important as studying the species and varieties that they use.

2.5 **Using biodiversity sustainably and equitably** means mobilizing benefits of the variety of genes, species, and habitats for current and future human welfare. From biodiversity, ethical, aesthetic, cultural, material benefits can be drawn, as well as environmental services, and these must be used equitably and sustainably. Augmented use of biodiversity may increase the incentives for conservation, but all too often its use has created or exacerbated social inequities, and ultimately imperiling further use. Often the best use of biodiversity is no utilization at all. Society can decide not to use certain organisms -- such as whales -- or to postpone use. [Note support of IUCN General Assembly Resolution 18 24]

Action for Both Immediate and Long-Term Results

2.6 Many of the actions required to address the root causes of biodiversity loss and to promote the maintenance, study, and wise use of biodiversity require sustained commitment. Hopes for overnight results are misplaced. Indeed, long-term commitments are needed to change policies, institutions, laws, and attitudes; develop human capacity; inventory biodiversity; strengthen protected areas and *ex situ* conservation networks; and to carry out the research needed to understand and wisely use biodiversity.

2.7 The time required for these tasks rules out the possibility that isolated "quick fixes" or "emergency actions" will conquer current problems. Changes in basic policies, attitudes, and understanding are needed to develop a conservation ethic that will endure, not traditional short-term project work or quixotic conservation fads. Biodiversity will be safeguarded and serve humankind only to the extent that it gets woven into the fabric of culture and economy.

2.8 But biological diversity is now disappearing at a rate unprecedented in human history. Without urgent action today to stem this loss, long-term changes can have only limited success. At worst, the biodiversity lost in the coming decades will so constrain options for responding to the crisis that even the most heroic efforts will not surmount cascading extinction. Thus, together with work on the long-term agenda, immediate action is needed to strengthen conservation networks; conduct applied biological and social research; establish monitoring mechanisms, rapid inventory and survey programmes, and data centres; and support grassroots conservation.

2.9 Even more important, rapid reform is needed in the government policies that promote -- either by design or by default -- the depletion of biological diversity.

2.10 Urgent and long-term actions to respond to the biodiversity crisis are presented in the following chapters. The divisions between many of the actions called for are artificial. For example, strengthening protected area networks is impossible without simultaneously reforming policies and ensuring that the costs and benefits of these policies are equitably distributed. Of particular concern is approaching the

need to strengthen institutional and human capacity together with the need for increased financial resources -- two sides of the same coin.

2.11 The actions described below have been designed to respond collectively to the root causes of biodiversity loss. All must be implemented: undertaking one-half of the action plan will not save one-half of the world's threatened biodiversity. Similarly, all the principles that have influenced this plan should also guide local, national, and international planners and decision-makers as they implement the actions called for. Harking to only some will not work

Ten Strategic Principles

Principle #1: Every form of life is unique, warranting respect regardless of its worth to humanity.

2.12 Biodiversity is both a fact and a value -- its meaning varies with individuals and cultures. There is no "biodiversity ethic" common to the modern world, though one must be nurtured if biodiversity conservation efforts are to succeed.

2.13 Ethical work on biodiversity must reflect a constant interchange between theory and practice. In particular, culturally diverse ethical views -- including those of the world's remaining indigenous peoples and humanity's dominant religions -- must be appreciated and incorporated into biodiversity conservation.

2.14 More generally, culturally diverse ethical approaches deserve to be treated with the same seriousness as other elements of biodiversity conservation. Doing so, however, implies a greatly increased commitment of funds for work on understanding and disseminating biodiversity ethics -- a notable departure from "business as usual." Work on the ethical dimensions of biodiversity conservation must therefore be accorded higher priority, and its objective must be to develop moral codes of action and put them into practice.

Principle #2: Conserving biodiversity is an investment that can yield local and national benefits; it is not an unrecoverable cost or an unbearable burden.

2.15 The world's genes, species, and habitats are a rich natural endowment capable of meeting human needs today and in the future. But instead of guarding the endowment to ensure a continuing source of benefits, humanity is over-exploiting and wasting it in the name of "development." Development paths must shift to embrace biodiversity as an asset worthy of conservation. Conserving biodiversity, like providing education or health care, should be seen as an *investment* that can yield significant returns to human welfare. Some such investments may not be profitable for the private sector, but their societal value is unquestioned.

2.16 Returns on investments in biodiversity conservation are aesthetic, scientific, cultural, and material. Local varieties of potatoes are invaluable resources to farmers in the Andes, diverse species in tropical forests are sources of food, medicine, and construction materials to forest-dwelling peoples, natural habitats protect village watersheds, protected areas provide tourism revenue, and healthy ecosystems are the foundation of the productivity of agriculture, forestry, and fisheries. Wise policies to save, study, and use biodiversity create a flow of benefits to humanity that in turn reinforces the need for its conservation.

Principle #3: Fundamental changes in development patterns are needed in all countries and regions to conserve biodiversity.

2.17 The root causes of biodiversity loss lie in the current patterns of economic development and natural resource use, and in the institutional arrangements through which that development is shaped and carried out. Biodiversity conservation must therefore be based on changes in those patterns and practices, across the whole range of human activities that influence biodiversity. There is no "biodiversity sector"; rather, the loss or conservation of biodiversity stems from decisions and actions taken in "mainstream" economic activities, and it is in them that change matters most.

2.18 While biodiversity requires every country to reform its theory and practice of development within the context of its own history and goals, regional and global linkages are extremely important in an increasingly interdependent world. In particular, the high rates of resource consumption and resource waste in the industrialized North are a root cause for current high rates of biodiversity loss in many biodiversity-rich developing countries of the South. In coming to grips

with this issue, attention must be paid to inequitable North-South trade relations, Third World debt, and obstacles to the transfer of technologies from North to South.

Principle #4: All countries and communities -- not just a few species-rich regions -- have a vested interest in saving, studying, and wisely using their biodiversity.

2.19 Every country possesses a diversity of natural life that is fundamental to the well-being of its present and future citizens. Even countries that have comparatively few species within their boundaries still depend upon their plants, animals, habitats, watersheds, and shorelines for environmental services, cultural identity, and an array of material goods. Conserving biodiversity is thus not an issue just for countries with large numbers of species. Even though California has far fewer species than a similar-sized area of tropical forest, some 12 percent of its plant species are threatened with extinction. Even though humanity at large may feel the loss of species in tropical forests more, California may take losses closer to home much harder. In any case, biodiversity conservation must begin in *everyone's* backyard.

Principle #5: Whether on land or sea, action to conserve biodiversity must be planned and implemented at a scale determined by ecological criteria. Piecemeal actions won't work.

2.20 Plants and animals, their community structures and ecological processes, exist in particular places that offer food, shelter, and other habitat requirements. As waterworks, pesticide use, regional deforestation, the drainage and filling of wetlands, and large-scale monoculture agriculture increase, past approaches to conservation that rely primarily on protected areas may be insufficient. If stream flow is be reduced or polluted, winds carry toxic chemicals into protected areas, or local climate changes, and the availability of additional habitat for migration and other requirements are all but eliminated, nature reserves remain islands in an altered landscape.

2.21 A common response to these assaults has been to harden the edge of protected areas by fortifying protection measures and to isolate them from the surrounding economy and human culture. But this approach leads to alienation of local communities, the loss of benefits to neighbors and the national economy as a whole, loss of concern for nature, and the destruction of the cultural basis of stewardship.

2.22 As experience has proved amply, the conservation of biodiversity can work only when the entire landscape is covered. The overall hydrology, nutrient flows, and other geochemical cycles of the larger region profoundly influence any given patch. In the sea, this includes currents, upwellings, and other larger scale features of the marine environment also come into play locally.

2.23 The artificiality of many boundaries used by humanity for convenience's sake is especially plain in those cases where species migrate across landscapes or the sea in search of food supplies, breeding or birthing grounds, such as with whales, migratory birds, fish and turtles. Conserving these species and their ecosystems often means managing spaces separated by considerable distances.

Principle #6: Cultural diversity is inseparable from biodiversity.

2.24 Both biodiversity and the diversity of cultural practices exist because there is no single "best" solution to life. The world's species and cultures represent a vast array of solutions to the problems posed by survival in various geographic regions. Human cultures are local adaptations to the environment, analogous to the local adaptation represented by a species or a traditional variety of crop.

2.25 Like biodiversity, the diversity of cultures and patterns of resource management provide invaluable options for future generations. And both are seriously threatened with severe erosion in coming decades.

2.26 Many of the actions aimed at conserving biodiversity would also help preserve cultural diversity. The biodiversity conservation agenda thus often reinforces efforts to secure rights for minority groups attempting to maintain their cultural practices in the face of pressure to join the global economy, be they tribal peoples in Brazil or farmers in Yorkshire. Perhaps most significant, conserving biodiversity often *requires* conserving cultural diversity and visa versa. The loss of ceremonial varieties of rice in the Philippines and the loss of ceremonial blue corn from the Hopi lands in the United States are physical manifestations of the erosion of these cultures. To

maintain the rice, its cultural use must be maintained To maintain the culture, the traditional rice must be maintained.

Principle #7: The costs and benefits of biodiversity conservation should be shared more equally by the world's peoples.

2.27 One of the greatest obstacles to conserving biodiversity is the beneficiaries of the use, or misuse, of biological resources too seldom pay the full costs. Instead, the environmental costs associated with the misuse of biological resources are passed on to society at large, while a small number of people receive the benefits of over-exploitation. When a species expires or watersheds are destroyed to satisfy an external demand for timber or some crop, too often farmers and forest dwellers suffer instead of those who profit from the commodity.

2.28 Ironically, society at large not only bears these costs, it also often subsidizes over-exploitation. Between 1979 and 1982, Indonesia's government sacrificed over $2 billion of potential forest revenues to logging concessionaires and allied interests (Repetto 1988). While some of this money found its way to particular government officials, none of it even entered the national treasury. Similarly, up until 1990, the U.S. government provided $50 million annually to subsidize the over-exploitation of the Tongass National Forest.

2.29 Comparable inequities also plague actions to save biodiversity. For example, protected areas benefit society at large, but the land-use changes required to establish a protected area represent a significant cost to people who formerly used the land, many of whom are never equitably compensated. Moreover, some segments of society may benefit more from the conservation of biodiversity than others. Although protecting areas helps ensure that potentially valuable medical compounds are not lost, the chief beneficiaries of new medicines are consumers who can afford western-style pharmaceuticals, not the rural poor who may give up hunting, farming, or fishing so that the protected areas can be established.

Principle #8: Increased public participation, respect for basic human rights, and greater institutional accountability are fundamental prerequisites for biodiversity conservation.

2.30 The basis of any realistic strategy for conserving biodiversity must, as noted, be changes in basic patterns and processes of development and the distribution of costs and benefits. These issues can be addressed effectively, however, only to the extent that affected people are guaranteed the right and afforded the resources and opportunities to participate in and influence policy-making and implementation. The corollary of this principle is that large institutions that make the decisions affecting all of our lives -- government agencies, multinational corporations, development agencies, and others -- must be held more accountable for how their decisions and actions affect biodiversity and the communities that depend on particular ecosystems and biotic resources

2.31 A key element in increasing public participation and institutional accountability is full and timely public access to information relevant to policy decisions. The public must have the state's legal guarantee of access. At the same time, large institutions must facilitate such access by, for instance, providing timely notice of projects or planning processes and documents (translated into the languages of affected communities and publics, if needed). In some cases, particularly in developing countries, participation may also need financial help to meet the expenses of participating

2.32 Respect for basic human rights is an essential prerequisite for meaningful participation and accountability in the large institutions whose decisions affect biodiversity. Participation -- even where formally provided for -- is an empty phrase in an atmosphere of intimidation, repression, and violence, especially where the ecosystems and biotic resource base of ethnic minorities, tribal peoples, women, and other disenfranchised groups are at issue.

Principle #9: Without significant policy and institutional changes, increased funding for biodiversity conservation will not slow biodiversity loss and could accelerate it.

2.33 Few dispute that biodiversity conservation is underfunded worldwide -- particularly in developing countries where biodiversity loss is most critical Nevertheless, merely pouring additional funding into an inappropriate or even hostile policy and institutional environment is likely to be ineffective at best. At worst, it could strengthen the constellation of

factors that jeopardize biodiversity loss.

2.34 What's the point, for example, of increasing funding for forest protection in a country where powerful policy incentives are pushing migrant farmers, loggers, and miners ever deeper into those forests? If the funds are channeled through a centralized forestry bureaucracy that is inefficient or corrupt, the infusion could exacerbate corruption, prop up "old guard" bureaucrats, and reinforce the institutional status quo for managing forests. Yet, these same funds could catalyze or encourage policy and institutional change in the hands of socially committed and politically skillful resource managers and decisionmakers.

2.35 Even where funding is clearly needed, and the policy and institutional environment is relatively supportive, the rigidity and unwieldiness of funding mechanisms slows or imperils progress. For this reason, innovation in financing is a top priority for biodiversity conservation. Endowments, trusts, debt swaps, concessional grants facilities, small grant programmes, and ways yet untried are needed to enable countries and localities with limited funds to safeguard sites of outstanding national or global value, develop innovative ways to sustainably use biotic resources, and strengthen their own capacities in biodiversity conservation.

Principle #10: Local and global priorities for biodiversity conservation are as legitimate as national priorities.

2.36 The people who today are most directly concerned with conserving biodiversity are the forest dwellers, farmers, trappers, fishermen, and others relying directly on biological resources for their livelihoods. Each day, they manage the diversity of life to meet their perceived needs without unnecessarily diminishing the environment's capacity to meet their needs on the next day. Reflecting their own livelihoods, their priorities may sometimes differ from those of others concerned with biodiversity conservation. They may also attempt to eliminate what to them are threatening aspects of biodiversity -- such as lions, wolves, or other predators, just as society at large makes to eliminate smallpox or AIDS. Even from an ethical standpoint, each individual in the global human community is right to try to meet his or her own daily needs

2.37 One way to sort out differing perspectives and priorities for conserving biodiversity is to view them through local, national, and global "lenses". (See Box 2.1) Globally, the first priority would be to maintain the greatest global diversity of species. Attention would focus on species-rich countries or regions where extinction threats are high. Attempts to identify "hotspots," "megadiversity countries," and Vavilov centres of diversity show how the world looks when viewed through this lens (McNeely et al. 1990) [Add figure of global priority schemes]

2.38 Nationally, choice and priorities in conserving biodiversity reflect each country's development needs. A nation in northern Europe may rank low on a list of international biodiversity conservation priorities because it has relatively few species, but from its own perspective conserving them should be a top priority. By the same token, conserving wheat varieties may be the global concern for genetic resource conservation in Ethiopia, but conserving sorghum is likely to be a higher *national* priority.

2.39 Locally, conservation priorities shift to species and habitats that directly meet material, cultural, and aesthetic needs. From a local standpoint, it may be entirely rational to remove certain species or modify habitats that directly threaten human welfare. Crops of little national significance may be vital to local community or serve important cultural roles.

2.40 Efforts to influence national and local action based on globally perceived conservation needs are destined to fail if they run counter to local needs. Cooperation among countries is needed to lead and orient biodiversity conservation and to set international priorities for action. But these priorities should not be put forward as requirements for national and local action, but, rather, as one component of a global partnership. For priorities that are higher priority internationally than nationally or locally, then international institutions should provide acceptable incentives through funding or technical assistance, or should help broker debt relief and technology transfer.

2.41 International initiatives often fail because national and local perceptions are treated as obstacles instead of legitimate points of view. Actions may be bought, but not solutions. Enduring solutions demand that a partnership be reached among all concerned

BOX 2.1

Three Views of Biodiversity Conservation

	GLOBAL	NATIONAL	LOCAL
PRIORITY	Save all species and genes	Save species and genes useful nationally	Meet resource needs
GUIDING CONCERN	Intergenerational equity Ethics	Sustainable development Ethics/utilitarian	Direct benefits Utilitarian/cultural
OWNERSHIP	Common heritage	Sovereign resources	Local resources
PRIORITY SITES	Megadiversity countries Hotspots	National hotspots and regions serving multiple needs	Sources of Cultural/ material benefits
STRATEGIES FOR ACTION	Debt leverage Development assistance Conditionality	Debt forgiveness Technology transfer Biotechnology National planning	Regaining resource control Participation in planning

parties.

The Need for International Cooperation

2.42 The conservation of biodiversity is a common concern of all humanity, but this shared concern does not translate into shared priorities or opportunities. Within nations, local needs for food, fuel, and shelter may conflict with the national government's plans to use biodiversity to fuel natural development priorities. Among nations, the threats to biodiversity differ, as does the technological or economic capacity needed to respond to them. The nature lover in the United States or Europe generally holds a very different view of the elephant than does the African farmer or the Sumatran palm oil entrepreneur. [Add "Manatee Perspectives" graphic -- "meat" vs. "harbor weed-chewing machine" vs. "obstacle to development" vs. "charismatic megavertebrate"]

2.43 National governments hold the power to shape the internal policy framework within which biodiversity conservation will ultimately succeed or fail. For this reason, national biodiversity planning (discussed in Chapter VIII) is a key mechanism for defining opportunities and clarifying choices. Yet, the international framework of policies, laws, and flows of resources, technology, and capital defines and limits the options available to individual countries, so international mechanisms are also a vital element of the broad partnership needed to conserve biodiversity.

2.44 More specifically, effective international mechanisms are needed to face four global challenges impinging on biodiversity conservation:

a. Addressing Global Concerns. Like the ocean, the atmosphere, and space, the world's biodiversity is of common concern to all mankind. It is in all nations' interest that biodiversity is maintained not only in their own country but in other countries as well. To fulfill this global responsibility, international mechanisms are needed to identify global priorities and to negotiate and facilitate the exchange of resources, knowledge, and technology among countries.

Moreover, biodiversity forms part of a much larger agenda of concerns currently being addressed by the world community. Climate change and global warming -- attended by

changes agricultural productivity, rising sea levels, shifting storm patterns, and oscillating supplies of fresh water -- appear to threaten the well-being of people everywhere Deforestation, soil erosion, and industrial pollution are also increasingly recognized as global threats Added to this, patterns of population growth and resource consumption signal greater levels of stress upon the planet's productive capacity Biodiversity concerns are intimately linked to all of these threats.

b Responding to Global Economic Interdependence. Biodiversity issues and actions cannot be divorced from their economic context In today's world, that context is one of increasing global economic interdependence For instance, oil from Saudi Arabia fuels the machines and provides the feedstock for the fertilizers and pesticides that allow marginal land in West Africa to grow, on trees originating from South America, a crop of cocoa for Switzerland to make into chocolate that is flown on American-made airplanes to Singapore for distribution in Southeast Asia; the profit made by the West African farmer allows her to purchase a Japanese motorcycle, Ethiopian coffee, and Thai rice No longer vulnerable only to local ecological and economic factors, this farmer's livelihood is now dependent on international commodity agreements, market forces, and many other factors that make the world function as a single system In such a world, effective biodiversity conservation requires actions in such areas as trade policy, and debt that can take into account and transform the complex global linkages between economics and biodiversity.

c Addressing Uniquely International Issues. Biological or political factors make certain issues inherently international These include the fate of such ecosystems as the oceans and Antarctica and major threatened habitats that span more than one country, whether contiguous, or not In addition, a long list of international policies, agreements, and legislation affect biodiversity -- such as intellectual property rights agreements, regulation of biotechnology, trade agreements, and debt forgiveness -- and international mechanisms such as conventions and agreements are needed to address their biodiversity dimensions.

d Catalyzing National Planning and Action. Finally, international actions can catalyze national actions It is naive to think that a "national biodiversity planning exercise" will easily come to grips with the hard choices and policy reforms that biodiversity conservation requires: the inertia of governments and powerful interest groups will both obstruct change Yet, the combination of international pressure and international assistance can provide the financial or technical support needed to bring change about and make it last For example, the international condemnation of the subsidized destruction of the Tongass National Forest in the United States helped to transform what had been a unthinkable policy change into an urgent political priority.

Elements of a North-South Partnership

2.45 Since World War II, the concept of "development" has split the world into "North" and "South," a division reinforced by the end of the cold war While the North/South distinction masks a great deal of diversity and complexity, it is nevertheless a reality Fully 80 percent of the world's economic wealth is controlled by the small fraction of the world's population living in the North, while some of the most endangered ecosystems are situated in the poor countries of the South This is the context within which biodiversity conservation efforts must develop and to which they must respond.

2.46 If a partnership between North and South to conserve biodiversity is to be built, each side's concerns must be treated as legitimate by the other For this reason, the biodiversity agenda must include along with such specific concerns as conventions on species trade and migratory birds more general North-South issues such as trade, debt, technology transfer, investment, and concerns over national sovereignty, democracy, and human rights Although resolution of these larger contextual issues will not be determined primarily by their biodiversity dimensions, cooperation on biodiversity is unlikely to materialize without attention to these broader issues, especially to the following six:

2.47 Third World debt: By 1989, the Third World's debt stood at $1.2 trillion, 44 percent of its collective GNP. Nations of the South in that year paid $77 billion in interest and repaid $85 billion worth of principal. Since 1983, the traditional flow of capital from North to South has been reversed, and net flows from South to North now amount to over $50 billion annually. The influence of this financial hemorrhage on the South's ability to increase investments in biodiversity conservation is enormous. At the same time, debt relief *per se* is no guarantee of more effective conservation unless specific links between the two are set in place. "Debt for nature swaps" are one method of linking debt relief with biodiversity conservation, but these have been too small to more than dent either the debt crisis or the biodiversity challenge.

2.48 International Trade: Currently, the relative terms of international trade work against the countries of the South, and many markets in the North are closed to the goods they produce. "Trade liberalization," in the absence of appropriate national policy frameworks, often reinforces the trade disadvantages of developing countries, further diminishing resources potentially available for biodiversity conservation. At the same time, trade patterns and prices for specific commodities -- such as tropical timber, prawns, and a variety of cash crops -- intensify pressures for forest degradation and wildlands conversion. As the world becomes increasingly linked through trade, these issues must be on the table whenever the international dimensions of biodiversity conservation are discussed.

2.49 Access to technology and genetic resources: The principle of free access to genetic resources reaches back millennia to the informal exchange of seeds among farmers and accounts largely for the world agricultural patterns today. Less than half the crops sold in Africa or the Americas originated in these regions and in Australia, the Mediterranean, northern Europe, northern Asia, the United States, and Canada, more than 90 percent of production is derived from introduced species (Wood 1988). But governments have adopted policies reducing access to genetic resources so as to meet national development needs. In the developed world, many countries have established laws granting a limited monopoly to individuals or corporations that develop new varieties or introduce novel genes into plants. Some countries have also restricted access to the genetic resources of non-food crops, such as coffee germplasm in Ethiopia, or have used access to genetic resources as political bargaining chips. The United States, for example, has on several occasions extended trade embargoes to cover international germplasm stocks stored in national seedbanks.

2.50 But while genetic resources have tended to move relatively freely, the technologies for exploiting the potential wealth of genetic resources are largely in private hands and access is proprietary. Because the value of genetic resources often derives from a combination of the resource itself and the technology needed to use it, steps taken to protect biodiversity are not likely to benefit all nations unless they are coupled with efforts to ensure that both the resources and the means of developing them are widely available.

2.51 Transfer of Financial and Technical Resources: Since much of the most threatened biodiversity is located in the South, while most financial and technological resources are in the North, a substantial transfer of those resources from North to South must be an integral part of any North/South partnership to conserve biodiversity. Even in situations where the long-term national economic benefits of actions to conserve biodiversity are clear, such as watershed protection or tourism, most developing country governments are hard-pressed to meet the short-term costs of conservation. In other cases, Southern governments may consider the opportunity cost of protecting a particular location or species too high, even though that action may be of international importance. Finally, some governments fear that aid for conservation will simply be re-allocated out of current aid budgets, at the expense of agriculture, industrial development, military procurement, and other priorities. Countries of the South thus require additional concessional aid for biodiversity conservation.

2.52 Northern countries also possess an enviable knowledge base that developing countries can draw on to design conservation actions and projects. Particularly in the emerging field of conservation biology, and in the fields of systematics, protected areas management, genebank management, and ecology, access to existing knowledge can greatly facilitate conservation action in developing countries. From the South's point of view, transfer of this

knowledge base -- as opposed to the continued import of expatriate "technical experts" -- is an important component of biodiversity conservation assistance

2.53 For their part, the countries of the North require increased accountability for financial and technical assistance. Many tropical countries, for example, levy substantial "reforestation fees" on foreign timber companies, but do not use the funds collected to protect and regenerate the natural forest. Increased transfers from North to South, whether via taxation of exported commodities or direct foreign assistance, will require a substantially higher standard of transparency and accountability on the part of recipient countries.

2.54 Reducing resource consumption and waste: Industrial countries' heavy consumption of natural resources is a threat, not only to global sustainable consumption, but also to the natural heritage of the Third World, which is the prime supplier of those commodities. Countries of the North must be prepared to make significant lifestyle changes that may involve short-term sacrifices in conventional economic growth in exchange for biodiversity conservation actions in the South. Concurrently, countries of the North must act to conserve their own biodiversity, and not just point the finger at the South. Government officials and non-governmental organizations alike in the South bridle at the furor in the North over destruction of tropical rainforests while countries such as Canada and the United States continue to decimate the last of their old growth forests. Many tropical countries, in fact, have greater percentages of their land area in protected areas than do many countries in the North. With far greater financial resources and far less socio-economic pressure on habitats and ecosystems, the North must put its own biotic house in order as a matter of good faith and global responsibility.

2.55 At the same time, countries of the South must recognize that their own urban elite have become profligate resource consumers and that their current visions and plans for economic development need to be revised accordingly.

2.56 Participation, accountability, and social justice: Because biodiversity forms the basis for people's livelihoods, decisions concerning the control of biotic resources and access to their benefits are political. Fundamental questions of distributive justice cannot be divorced from the development and implementation of biodiversity policies, if those policies are going to be durable and effective. Issues of participation in policy-making, access to information, due process of law, and accountability of government and private industry to affected communities must be an integral part of discussions on biodiversity conservation. The artificial division between "technical" and "political" issues must be eliminated because the two are inextricably intertwined. While the accountability of national governments to their people is at the heart of this set of issues, the accountability of international agencies and multinational corporations to the communities their decisions affect is also crucial.

2.57 The six difficult and sensitive contextual issues discussed here are not likely to be resolved in any campaign to conserve biodiversity. Nevertheless, alongside the ten basic principles discussed previously, these five issues must be discussed openly if a meaningful North-South partnership to slow biodiversity loss is to be forged

A CALL FOR A DECADE OF GLOBAL BIODIVERSITY ACTION

1 The partners and contributors to the BSAP, from all regions of the world, call for **a decade of action** to save, study, and revamp the use of the Earth's biotic wealth. The world's genes, species, and ecosystems constitute both the sovereign resources of the nations where they are found and the common concern of all present and future generations

2 This all-important venture is vested in local, national, and intergovernmental cooperation. Recent efforts to conserve biodiversity have been thwarted by fragmentation of goals and means and a lack of coordination. Ways must now be found to make the commitment and the action of local communities, corporations, non-governmental groups, scientific networks, governmental bureaus, international organizations, and financial bodies support each other. Without cooperation across every level, headway against the root causes of biotic impoverishment will be impossible.

3 Biodiversity is the source of foods, medicines, materials, chemicals, beauty, inspiration, and cultural beliefs that can be counted on to yield new products, services, and ideas in the future. It is also the reservoir that humanity will draw upon to adapt agriculture, forestry, and fisheries to climate change's uncertain effects. In this sense, the incentive for involvement and cooperation in a global programme is individual, community, and national self-interest. Yet this fundamental need to conserve biodiversity to improve human welfare brings with it many obligations -- for sharing financing, knowledge, skills, and information and for more equitably distributing biodiversity's costs and benefits among nations and classes.

4 Progress can be expected only if reform and investment are sustained in a decade of focused action. During this period, key biodiversity areas can be rescued from danger and genes in jeopardy can be collected. Just as important, the slower, deeper changes needed to get at the root causes -- changes involving cooperation among institutions, community management, tenure and property rights, research, training and education, and technology transformation to reduce waste -- can be set in motion.

5 Recent experience with attempted reform of resource management has shown that highly centralized programmes can leave out or alienate the people who live in and depend upon forests, farms, wetlands, and other key components of biodiversity. Grand and over-centralized plans issued from on high can't accommodate multiple interests, much less make sure that the costs and benefits are equitably distributed. To avoid these dead-ends, this global programme calls for decentralized action using a wide array of tools and approaches.

6 A number of mechanisms already exist or are being established to implement action to conserve biodiversity:

7 Local Level -- The local level is the heart of the programme. It is here where people live and work, where biotic resources are employed and abused, and where stewardship must be strengthened or re-established. Local community organizations and governments can work separately or join forces to protect diversity in the field. They can participate in inventory and research programmes, demonstrate traditional resource use practices, and implement measures to curb waste. Experience already demonstrates how communities can rescue threatened plants and animals and how species and varieties of direct value to local people can be multiplied and employed in gardens, farms, and orchards.

8 Local communities cannot, however, be expected to sacrifice local opportunities for the sake of the global community unless they receive commensurate benefits to offset their losses. They also cannot be expected to act wisely without adequate information on biodiversity's role and value. Indeed, governmental action is needed to create policy incentives for local stewardship and promote equity

9 National Level -- Governments can exhibit leadership by preparing national biodiversity plans as a means of setting goals and priorities for saving, studying, and using biodiversity equitably and sustainably. An open process will provide the opportunity to balance local, national, and other competing interests. It can also prompt governments to commit to the protection, discovery, and

mobilization of the nation's biotic potential, fortify or revamp policy incentives and regulations, and orient investments and international cooperation.

10 Midway between national planning and local community action lie efforts to manage large ecosystems -- watersheds, coastal zones, mountain ranges, and other regions of particular biodiversity value. These regions are big enough to embrace protected areas, complete ecosystems, farms, forests and villages, as well as the interactions between people and their environment -- a challenge every bit as great as designing international agreements or creating new funding mechanisms for biodiversity conservation.

11 Intergovernmental -- A wide variety of current and planned multilateral policies, technical programmes, and financing institutions address the protection, study, and use of biodiversity and biotic resources:

a *Policy*: The United Nations provides the existing policy framework for the relations among and responsibilities of nations. The World Charter for Nature is one important element of this framework, and several conventions are already in force governing many aspects of biodiversity conservation. [Include text of World Charter in Annex]

GATT and UNCTAD govern international commerce and terms of trade in commodities, thus affecting forest, agriculture, fishery, and other biological resources. Governments are also negotiating two conventions and considering an international agreement, all of which bear directly upon biodiversity and biotic resources. The global biodiversity convention promises to establish the long-term intergovernmental basis for the determination of international priorities for cooperative action to protect key biodiversity sites and promote the equitable sharing of costs and benefits. The convention is also expected to include a special fund for these purposes. The climate convention and a possible international forestry agreement are expected to link steps to slow deforestation and expand re-vegetation plans to the need to maintain and enhance diversity.

b *Technical Programmes*: The United Nations specialized agencies -- including FAO, Unesco UNEP, UNIDO, WHO, and WIPO -- provide technical guidance and assistance to member governments in on economic development, legislation, research, training, education and conservation. Bilateral institutions also provide technical support to developing nations in these fields, and non-governmental organizations from North and South sponsor a growing number of programmes in resource planning and management and in policy development.

c *Finance*: Support for biodiversity can come from various financial institutions. Among these are the FAO International Fund for Plant Genetic Resources, the World Bank and the regional development banks, and the World Heritage Fund. The proposed biodiversity convention is expected to include a fund that could support actions called for in the BSAP. Bilateral development agencies provide financial support for biodiversity-related activities. The new Global Environment Facility (GEF) pilot project administered by the World Bank, UNDP, and UNEP, has considerable potential for creating endowments for managing of key biodiversity regions and sites, financing inventory and research, and promoting sustainable resource uses.

12 But not even action by communities, governments and intergovernmental organizations add up to an adequate response to the biodiversity crisis. The fourth level of action -- Global -- must involve scientific institutions, professional associations, information networks, and all citizens concerned about the future of the world's biotic wealth. Ordinary people, as well as their leaders, must be aware of what is at stake and the choices now pending, and they must have a say in key decisions that affect their present and future welfare.

13 The following programme of action contains proposals for addressing the root causes of biotic impoverishment and sets the stage for significant progress in the forthcoming decade and beyond. Each action meets a specific objective. Each is "assigned" to one or more agencies. For each, specific mechanisms

are identified, costs and benefits are estimated, and a schedule is set. This programme is comprehensive and the whole is much greater than the sum of its parts. If the programme is not pushed forward in its entirety, the root causes of biodiversity loss will remain entrenched. The biggest danger is that agencies will pick the "easy" activities and those upon which money can be spent quickly, leaving the reform agenda untouched, and in the end dealing with the challenge as "business as usual."

14 Much of the conservation work needed can be carried out within each country with the human and institutional capacity and resources already on hand. But to protect key sites, to develop the national capacity to manage, inventory, and develop biotic resources innovatively, to transfer technology, and to compensate local communities for opportunity losses, international funds larger than those already considered in the development of the GEF are needed. Along with information needed for wise decisionmaking, these funds must be able to flow swiftly to the governmental agencies, non-governmental organizations, community groups, scientific institutions, and professional organizations that need them.

15 [Finally, a schedule for the overall programme is provided to suggest how various activities should be implemented over the Decade of Biodiversity Action -- to be added in final draft].

III. REVAMP POLICIES THAT INVITE THE MISUSE OF BIOLOGICAL RESOURCES

3.1 The conservation and sustainable management of biodiversity can take place only in a supportive policy environment. But most current government policies were not designed with biodiversity conservation in mind. Indeed, many national policies throughout the world explicitly invite individuals and corporations to exploit particular species, convert natural habitats to agricultural and industrial uses, and raise fewer crop and livestock species and varieties. Other policies, such as those governing land tenure, take a significant indirect and unplanned toll.

3.2 The paradox of biodiversity conservation is that broad shifts in policy are needed to make it work but that it will perforce be a secondary or even peripheral concern when many influential policies are made. Now while momentum is gathering, it is particularly crucial that policy choices be made in the full knowledge of what is sacrificed when biodiversity is lost, and what its full economic value is. When policy-makers know the full costs and benefits of different policy options they are more likely to make biodiversity a core objective and value. When the wider public knows the consequences for biodiversity of alternative policy choices, it can play a more active and informed role in influencing those choices.

Action 1. Modify national income accounts so that natural assets generally and the loss of biodiversity specifically are depreciated.

3.3 Objective: To revise the calculation of national income accounts to reflect the full economic values of biodiversity, and the true costs of its loss, so that biodiversity conservation can become an integral criterion for economic decision-making.

3.4 Justification: Currently, ecosystems such as forests and wetlands are treated as essentially "free goods," and their degradation is not counted as a depreciation of a nation's basic capital stock. A distorted picture of a nation's economic health results, and with this picture in mind nations make more wrong-headed policies, back inappropriate development projects and send the wrong market signals to the private sector, thus accelerating biodiversity loss.

3.5 Changing this spiral of self-delusion will require national governments to alter the methods by which they calculate their economic performance -- to literally take biodiversity into account. This means developing more credible methods for assessing biodiversity's economic worth and building of national capacity to carry out such analyses. Donor agencies can play an important role in supporting these changes in developing countries, as can universities and non-governmental organizations everywhere. For its part, the United Nations can catalyze change by revising its standardized national income accounts model, a process that is already under way but only at a glacial pace.

1a. *Governments negotiating the Biodiversity Convention should establish a task force to refine methodologies for quantifying biodiversity's contribution to national economies.*

3.6 Justification: Biodiversity's value is poorly reflected in national decision-making largely because calculating the economic benefits of biodiversity conservation in terms that economic planners and policy-makers find credible is so difficult. Ideally, conservation decisions should never be made strictly on the basis of cost-benefit analyses because many values of biodiversity cannot be measured with the limited yardsticks of conventional economics. But these measuring devices remain the tools of the trade, so every effort must be made to make them more accurate and flexible.

3.7 A number of attempts have been made to measure the economic benefits of biodiversity. By one estimate, for example, 4.5 percent of the U.S. Gross Domestic Product is attributable to wild species. Another recent study measured the economic costs and benefits of several protected areas, including calculations of tourism, watershed, and genetic resource values. Other contributions to biodiversity accounting include estimates of ecotourism values, so-called existence values and option values of certain species or habitats, the value of fisheries or forest productivity, the value of non-timber forest products, the contribution of genetic diversity to increased crop

productivity, and the contribution of natural products to the pharmaceutical industry.

3.8 But despite the considerable research reflected in these studies, no general framework or methodology for incorporating biodiversity values into public decision-making has yet emerged. With such a framework, economists could compare the value of conserving biodiversity with the opportunity costs of deferring or foregoing commodity production investment or the conversion of natural habitats to other land uses. Planners could incorporate costs related to lost genetic resources, degraded watersheds, or species extinctions in calculations of the social welfare of various development options. And policy advisors could better analyze market and policy failures that distort the relative merits and drawbacks of conservation and development options.

3.9 Mechanisms for Implementation: An international task force should be established to develop a framework that national governments, academics, research institutions, and development assistance agencies could use to determine the economic benefits of biodiversity conservation. Such a framework should include the benefits derived directly from biological resources and from the "environmental services" of intact ecosystems (such as watersheds and mangroves), but should also highlight benefits related to maintaining the diversity of genes and species per se and the values of genetic resources. Finally, such a framework should stress the subsistence values of biotic resources for communities directly dependent on natural habitats and ecosystems. Too regularly, such values are overlooked since subsistence goods and services do not pass readily through the money economy. The World Commission on Environment and Development provides one model for how such a task force might come into being, look, and work.

3.10 While such an international effort could be an important catalyst and could provide some credible answers relatively soon, national action is needed if policies are actually to be affected. Consequently, developing national capacity in "biodiversity economics" be developed in government agencies dealing with economic planning, in universities, and in non-governmental organizations is a high priority in biodiversity conservation.

1b. ***National governments should by this decade's end revise their systems for calculating national income accounts to incorporate the values of biodiversity.***

3.11 Justification: Developing credible methodologies for "biodiversity accounting" is only a first step. National governments must also revise their official calculus of cost and benefit, a move that requires legal change and political will, as well as sound methodologies. A good deal of work has been done on how the values of forests and soils -- and the costs of their depreciation -- can be integrated into national income accounts. Yet, governments must not wait until a complete methodology has been elaborated to act. Enough is known now to allow government economists to begin to incorporate some biodiversity values into national accounts, even as research on methodology continues.

3.12 Mechanisms for Implementation: Some 20 countries are already working to develop national balance sheets for the more easily "monetizable" natural resources, such as soil and timber. Getting decision-makers to use them is, however, a political challenge. If, for example, a revised calculation of the alternative costs and benefits of logging versus preserving a forest area shows that the nation's net benefits are much greater if the area is preserved, then logging interests will lose out, even though the country as a whole will benefit. To the extent that logging interests -- powerful forces in the United States, Canada, Indonesia, and most countries where logging is a major industry -- hold sway over policy-makers, it will take considerable political will to overcome resistance to "biodiversity accounting" and the policy changes that it indicates. Where political leaders and economic planners possess real commitment, their resolve can be bolstered by an informed and aroused public and, in developing countries, by supportive development assistance agencies.

1c. ***The United Nations should revise its System of National Accounts (SNA) to incorporate known biodiversity values, and it should put more resources into improving the methods used to set such values.***

3.13 Justification: As countries devise their criteria and methodologies for developing natural resources accounting balance sheets, they look to the United Nations Statistics Office's System of National Accounts

(SNA) for models and guidance. If biodiversity is to be given appropriate value in systems of national accounts, the revised SNA must lead the way.

3.14 Mechanisms for Implementation: Changes in the SNA proposed in 1991 already include a natural resources "stock account" balance sheet for assets that, like land, sub-soil minerals, and timber, can be tangibly quantified as productive assets at any given time. While this is an important change, the SNA does not yet include the same "stock" information in its "flow" accounts (the accumulated net flows reflected by the change in the natural capital stock between two dates). For example, if a country's forested area increases in a given period, it should be counted as capital accumulation; if its forests decrease, the loss should be counted as capital consumption and be duly reflected in GNP figures. The failure to date to fully incorporate the insights of recent research on natural resource accounting into the SNA stands as a glaring inconsistency that decreases the accuracy and value of the system.

3.15 So far, the SNA does not directly incorporate biodiversity values per se and significant conceptual and empirical problems surrounding the environmental accounting values of non-market biodiversity goods and services remain. But, as progress in quantifying these more diffuse biodiversity values credibly, these too should be incorporated into the SNA.

Action 2. Reform natural resource policies that invite biodiversity loss in forests, fisheries, and agriculture.

3.16 Objective: To reform or eliminate government policies that increase biodiversity loss by creating or reinforcing market failures that cause biotic resources to be overexploited and degraded.

3.17 Justification: Governments regularly intervene in markets with policies intended to increase agricultural production, spur industrial growth, provide a "safety net" for the poor, and protect the environment. Because markets aren't good arbiters of such public goods such as a healthy environment and such social goals, a strong educational system, policy interventions to, say, clean up pollution or improve public schools, are widely considered to be a legitimate and even obligatory governmental function.

3.18 In natural resources sectors, however, many government policies exacerbate rather than correct market failures, thereby hastening biodiversity loss. Notable here are sectoral policies that provide incentives for wasteful and unsustainable logging and conversion of natural forests, over-exploitation of fish and other marine resources, and overuse of monocultures and chemical inputs in agriculture. Cutting across these areas are tenurial policies that leave the ownership of land and natural resources in a limbo of "open access" and in some cases make resource degradation -- particularly forest destruction -- the precondition for establishing a legal claim. Reforming this whole range of policy distortions is one of the most important steps that can be taken to slow biodiversity loss.

2a. *National governments should reform forestry sector policies that provide incentives for degradation and conversion of critical forest ecosystems, and encourage monocultural reforestation.*

3.19 Justification: Government policies regulating logging, the development of timber processing industries, and reforestation catalyze deforestation in many countries. Timber revenue systems capture only a small portion of the available "economic rent" from forest production. In other words, governments are selling their timber at far below market rates. Widespread in the tropics, this practice is also norm in the United States, where private contractors rush to obtain timber concessions that they frequently "high grade" in order to extract the best specimens of the highest value species, disturbing extensive forest areas in the process. Along with other incentives for reckless exploitation, the short duration of most concessions (typically shorter than a single harvest rotation) reinforces a "cut and run" mentality. At the same time, few incentives for forest regeneration are on the books.

3.20 In the past decade, many tropical timber-producing countries have also instituted policies to promote the growth of wood-processing industries. While "value-added" domestic processing is in theory an efficient way to reduce pressure on standing forests (by generating additional value from the same amount of timber), in practice such policies often increase deforestation. Domestic processing takes place primarily in inefficient mills, so too many logs must be harvested to meet any level of demand. Even worse,

such policies have rapidly created a powerful and often politically influential forest products industry that demands steady or increasing supplies of raw materials

3.21 Some governments have also developed reforestation policies -- subsidies, tax breaks, and the like. But such reforestation has been carried out almost exclusively through monocultural plantations designed to meet industry's needs. While often justified as a way of taking pressure off of natural forests, such plantations generally feature only fast-growing exotic species that are no substitute for the high-value woods found in natural forests. In addition, monocultures -- composed of a single species and, in some cases, a single genetic seed stock -- are by definition the antithesis of biodiversity. A final drawback of the industrial plantation model in developing countries is that it frequently involves the privatization of *de facto* the common lands of the rural poor, driving them in many cases into natural forest areas. No one disputes the need for reforestation, but in many countries current policies to foster plantation development invite *deforestation*.

3.22 Mechanisms for Implementation: While ultimately governments must act to reverse the perverse policy incentives that undermine biodiversity, others can encourage governments to act. Academicians and policy research institutions can provide hard data exposing the folly of such policies vis-a-vis both the national treasury and biodiversity. And activists, journalists, and politicians can put the case to the public and to responsible officials. In such countries as the United States and Indonesia, such political momentum is already gathering, but a great deal more needs to be done.

2b. ***National governments should reform agricultural policies that promote uniformity of crops and crop varieties and that encourage the overuse of chemical fertilizers and pesticides.***

3.23 Objective: To promote greater diversity in agriculture and agricultural practices; to better meet national objectives related to agricultural production and food security; and to improve farmer's livelihoods and farmer's control over farming decisions.

3.24 Justification: Many national agricultural policies are costly worldwide and have severe negative impacts on parts of the farming community -- particularly marginal farmers. In developed countries, these policies have enriched primarily farmers with large land holdings and contributed to environmental degradation. In developing countries, combinations of food price controls and subsidized agricultural inputs have met short-term consumer demands but have removed incentives for agricultural production and undermined food security. These policies have also decreased the diversity of species used by farmers and increased crop uniformity.

3.25 Uniformity in agricultural practices is not inherently bad. Indeed, farmers have long sought to increase the uniformity of specific varieties -- up to a point -- to improve their agronomic characteristics. But many current policies increase uniformity far beyond desirable levels. In particular, the following types of policies undermine diversity in agricultural systems and should be reformed:

a. *Input subsidies*. By reducing the cost of such inputs as water, pesticides, and chemical fertilizers, subsidies serve to promote "industrial" agriculture geared to a small number of highly-uniform crops at the expense of farming systems based on a wider range of varieties.

b. *Food price subsidies*. Government actions to reduce food prices for urban consumers cut into farm profits. Alone, such food price controls would not necessarily affect agricultural diversity, but in combination with input subsidies they can be very damaging. For farmers using modern crop varieties requiring large amounts of inputs, input subsidies help neutralize the impact of food price controls. But farmers using low-input systems and traditional varieties receive no such offsetting benefit. Apart from this serious inequity in the distribution of costs and benefits among farmers, this policy combination also discourages agricultural innovation among low-input farmers who might otherwise participate in breeding programmes or experiment with new varieties or crops

c. *Overvalued exchange rates*. Many governments in developing countries have overvalued their exchange rates in order to subsidize imported capital goods for industry and to cheapen both imported and exportable food. These policies basically "tax" all agriculture, but taxing farmers who use manufactured inputs less than those who don't has the same impact as the combination of input subsidies and food price controls

discussed above.

d. *Research policies biased toward high-input agriculture.* Since its inception, the driving force in national agricultural research has been to increase production of a few major crops through technology change. This research model has been exported from the industrialized to the developing world through the international agricultural research system. Although this research approach may have provided much-needed "breathing room" in the race between production and population, a fundamental reshaping of agricultural research policies is needed over the coming decades to meet future production needs. (See Action #4: *Strengthen and decentralize agroecological and crop breeding research.*

e. *Credit policies that discriminate against "minor" crops and traditional varieties.* All too often, governments don't give agricultural credit to farmers using traditional crop varieties or growing crops of only local importance. Particularly in developing countries, where the benefits of "improved" varieties may disappear in marginal agriculture, these policies are counterproductive. They both reduce productivity and also accelerate the erosion of crop diversity.

2c. ***National governments in developing countries should rethink and revamp policies mandating "public" ownership and control of forests and coastal resources.***

3.26 Justification: Most developing countries assert state ownership and control over the great bulk of their forests and their coastal resources (near-shore fisheries, coral reefs, mangroves). Such a policy creates "open access," which for several reasons leads to overexploitation. First, weak and overly centralized state agencies can't enforce the public mandate, and most governments haven't managed such areas effectively. Second, asserting public ownership where the state can't manage the resource basically makes it fair game for landless people and other rural poor seeking a livelihood. Finally, communities that have occupied such areas for generations under traditional resource management and customary arrangements are effectively turned into outlaws in the eyes of the state.

3.27 Under "open access" regimes, spoils go to the quickest and the strongest, and incentives for maintaining ecosystem productivity and diversity are nearly absent. Local limits set by customary law on who may take how much of what resource are legally voided, state enforcement of any controls are ineffective, and a wide range of outsiders -- migrants, timber concessionaires, commercial trawlers, and others -- grab resources in a "first come, first serve" free-for-all. Traditional communities frequently join in the frenzy when so many competitors arrive on the scene. The degradation of tropical forests, depletion of fisheries, destruction of coral reefs, and conversion of mangroves to unsustainable fast-buck aquaculture are all legacies of open access.

3.28 Mechanisms for Implementation: While the effects of public ownership are remarkably similar throughout the developing world, constructive alternatives must be tailored to the local situation. In some cases, privatization and secure individual property rights may be the most effective policies. In others, particularly those involving indigenous inhabitants of ancestral domains, governments should legally turn the land back to the community, delineating a perimeter and allowing the community to revamp its own systems of property and resource management to accommodate with modern pressures and conditions. In yet other cases, governments should work with local communities to establish resource management partnerships in which each side holds rights and responsibilities and reaps benefits. (See Chapter IV, Action 10.) In all cases, however, there will be a core of land and sea resource areas that governments rightfully should own (e.g. national parks), or predominantly control (e.g., timber concessions and critical watersheds). In these "public" areas, more effective state management and enforcement systems are necessary, along with increased financial resources to support them.

Action 3. Rid the development assistance process of its biodiversity-destroying tendencies.

3.29 Justification: Development assistance -- through grants and loans for either projects or "structural adjustment" -- is frequently a powerful catalyst for the destruction of habitats and ecosystems, the over-exploitation of certain species, and the oversimplification of agricultural landscapes and farming systems. Indeed, the policy calculations of the aid agencies are ruled by the same impoverished economic framework that distorts national policies toward biotic resources.

3.30 Because aid agencies and development banks play such an important role in the development policies of many tropical countries that possess disproportionately high levels of biodiversity, their negative effect on biodiversity has been considerable. For the same reasons, however, development agencies and banks could catalyze the transition in developing countries in the transition from biodiversity destruction to biodiversity conservation for sustainable development. While the rhetoric of biodiversity conservation has grown stronger in the aid agencies in recent years, the transition has yet to be made.

3a. *Development aid agencies and multilateral development banks should incorporate biodiversity values into their criteria for designing and evaluating loans and projects and for assessing developing countries' economic performance.*

3.31 Justification: Apart from directly supporting the incorporation of biodiversity values into national income accounting in developing countries, development agencies should internalize calculation of these values into their own operations.

3.32 Mechanisms for Implementation: First, donors should explicitly incorporate monetary values for biodiversity into their evaluation of proposed projects and should develop official, binding guidelines to direct their staffs to do so. These values should be considered separately and in addition to those biodiversity values that cannot easily be put into monetary terms, such as the preservation of species endangered by a project, the incursion of a proposed project into natural areas of sacred or spiritual value to local communities, or the loss of a country's last major area of a particular ecosystem type.

3.33 Second, donors making large sectoral and "structural adjustment" loans should assess the impacts of their lending on biodiversity values, using the same criteria used for projects. This is particularly important where adjustment and sector lending promote the privatization and commoditization of natural resources, thereby accelerating their utilization and degradation.

3.34 Finally, the multilateral development banks should explicitly incorporate a "natural resources accounting" methodology into their often influential country economic reports on particular borrowing countries. When, for example, a country is either complimented or chastised in a World Bank country economic report for its policies' effects on biodiversity, a significant step will have been taken toward mobilizing the political will for change within that country.

3b. *Development assistance agencies and multilateral development banks should trim their portfolios of ongoing and planned projects that have significant negative effects on biodiversity.*

3.35 Justification: While development of internal biodiversity conservation policies and criteria is important, these are only means to the end of curbing development projects that destroy biodiversity. Often, large projects involving roadbuilding, energy development, extraction of minerals and petroleum, industrial agriculture, and resettlement replicate faulty policy assumptions about the relative costs and benefits of biodiversity loss and conservation.

3.36 Implementing Mechanisms: Specific development projects -- whether ongoing, in the pipeline, or planned -- should be evaluated using the new biodiversity conservation policies and criteria laid out in Box 3.1. If specific projects fail these tests, then they should be modified or canceled. Public participation and access to information are key elements in making such a system work.

3.37 Development assistance projects designed specifically to conserve biodiversity -- to, for instance, expand and strengthen protected areas networks -- are a potentially useful adjunct to reforms of "mainstream" development projects. But adding "green" projects is no substitute for deleting "brown" ones. The important new World Bank-UNDP-UNEP Global Environmental Facility (GEF), for example, should not be seen as a way to offset problems caused by the World Bank's mainstream lending objectives and criteria.

3.38 In addition, agencies that loan funds rather than grant them must recognize that while investing in biodiversity has potentially large returns, those returns do not necessarily flow into the national treasury. Real economic benefits may flow to a diffuse group of rural dwellers, for example, but not show up as government revenue. Accordingly, governments may

Box 3 1
Biodiversity Policies and Criteria for Development Assistance

[Criteria to be drafted based on input from region consultations and workshops]

be reluctant to borrow for some biodiversity projects at usual rates and terms, which makes the need for additional and concessional biodiversity funding -- as envisioned in the GEF -- clear.

3c. *Multilateral banks and bilateral development assistance agencies should open the development assistance process -- the design, implementation, and evaluation of projects and the policies that guide them -- to public scrutiny, participation, and accountability.*

3.39 Justification: Development assistance funding -- whether loans or grants -- has important effects on biodiversity, and all too frequently they have been negative. Not only has development assistance often directly contributed to the world's loss of biodiversity; it has in many cases also alienated rural communities from the biotic resource base on which they depend. Aid agencies and development banks must be accountable not only to the governments they assist or lend to, but also to the communities whose lives are affected by their projects and programmes. In addition, development agencies' funds are public funds, provided ultimately by the citizens of the countries that capitalize and support those agencies.

3.40 In many cases, however, development agencies -- particularly such multilateral financial institutions as the World Bank and the IMF -- operate without an appreciable degree of public scrutiny, participation, or accountability, particularly in developing countries. Increased "openness" in the decisions and operations of these agencies would increase local communities' ability to reject projects that degrade their biotic resource base or alienate them from it and increase the leverage of citizens the world over who don't want biodiversity destroyed in the name of development.

3.41 Mechanisms for Implementation: The first step in opening up planning and decision-making is increasing public access to information on proposed projects and on the development of policies and operational guidelines well before decisions are made. Development agencies can make some information more accessible directly; in other cases, they must use their leverage with governments that are reluctant to grant access to the public. But access to information involves more than just a change in confidentiality rules. If local communities and their advocates are to truly participate in development assistance decisions affecting them, the agencies must make sure that information reaches both in a form they can use. At the agencies expense, draft terms of reference, appraisal reports, and feasibility studies may have to be translated into local languages and distributed in planned project areas. Also at its expense, meetings may be needed to explain and defend what is planned.

3.42 Besides providing timely access to information, development agencies should institutionalize consultations that give non-governmental organizations and other public representatives the opportunity to discuss proposed policy changes with the agencies. When specific projects are at issue, the Environmental Impact Assessment process should allow for public comment as well. In all consultations, the agencies must respond to comments and concerns, not just listen to them.

3.43 Finally, development agencies need to come up with more participatory procedures for evaluating completed projects. Typically, agency staff or hired consultants carry out such evaluations. Rarely do they systematically involve the communities from the project areas, their advocates, or independent experts and critics. If projects funded by development agencies are to support biodiversity conservation rather than invite biodiversity loss, projects must be assessed by affected communities as well as technical experts.

3.44 Increasing participation in project and policy design, management, and evaluation will increase up-front project costs significantly. But measured in terms of the savings -- bad projects avoided, lives not needlessly disrupted, and biodiversity not wastefully lost -- they are a wise investment.

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IV. INCREASE LOCAL BENEFITS FROM BIODIVERSITY

4.1 Why should villagers respect a protected area boundary if its establishment has removed resources without compensation? What incentive exists for sustainable forest management when the costs of unsustainable management are borne by future generations and by communities downstream suffering agricultural losses from increased sedimentation?

4.2 Many BSAP recommendations address these and other inequities in the distribution of the costs and benefits of biodiversity conservation. The emphasis here is on increasing local benefits from biodiversity. But the policy reforms, public funding increases, and boost in national capacity to utilize biodiversity called for elsewhere all play important roles in increasing equity in the distribution of the costs and benefits of conservation and use.

4.3 Examples of the need for policy reform in support of biodiversity conservation abound. For instance, to foster the growth of local agricultural technologies and the local adaptation of crops and varieties, reform is needed in the way agricultural inputs are subsidized and food prices set. Currently, agricultural growth is predicated on costly imports rather than on the readily available resources of genetic diversity and local knowledge. Similarly, reforms are needed in land tenure policies to give people a greater stake in sustainable production from biological resources.

4.4 Public funding of conservation is a second key element of the broad strategy for addressing inequities in how biodiversity is used and paid for. (See Chapter IX: *Build New Mechanisms of Global Cooperation*) Since large segments of society benefit from biodiversity, but no mechanism ensures that this diffuse set of beneficiaries pays the costs of conservation, support for conservation through the public sector is clearly essential. Currently, most experts consider public funding for biodiversity conservation to be one or two orders of magnitude below the level needed to maximize the social welfare from biodiversity.

4.5 A third mechanism for increasing equity in the conservation and use of biodiversity is to build the national capacity needed to benefit fully from biodiversity. Funds spent on biodiversity conservation should be considered investments, not burdens. Yet, they will be sound investments only if countries are able to reap the benefits. Where biodiversity conservation has substantial local benefits, this criteria is readily met. But, the biggest inducement to invest in conservation may be governments' recognition of the potential of biodiversity conservation to buttress national development. (See Chapter VII: *Expand Understanding of Biodiversity*)

4.6 These three approaches to equity reinforce all-important efforts to increase local benefits from biodiversity. But the driving forces are the mechanisms that promote local innovation and sustainable resource use, thus insuring that the custodians of the resource benefit directly from its use and that the benefits meet local needs. Such mechanisms are likely to empower local communities and have large multiplier effects in national economies, in contrast to strictly financial approaches that may foster dependency.

Action 4. Strengthen and decentralize agroecological and crop breeding research.

4.7 Objective: To increase farmer security and agricultural production by shifting research emphasis to the utilization of local genetic resources and indigenous knowledge.

4.8 Justification: Today's national and international systems of agricultural research are geared to produce relatively uniform technologies in environments that can be modified to suit the technology. In a nutshell, science is used to solve farmers' problems faced, not to strengthen farmers' ability to solve them. This system delivered dramatic increases in agricultural productivity. Capitalizing on three inputs -- genetic resources, scientific expertise, and purchased agricultural chemicals -- it has alleviated hunger in some areas. But even in developed countries, industrialized agriculture is not environmentally sustainable (Faeth et al 1991).

4.9 In developing countries, it is even more apparent that this model of agricultural research cannot serve people's needs over the long term. In

many regions, farmers face loss of livelihood as their diverse cropping systems -- often well adapted to the ecological, social, and cultural realities of their circumstances -- are replaced by modern agricultural systems that shift the responsibility for food security to the state, which is often not prepared to accept it. In most current agricultural research programmes, farmers' traditional knowledge -- of enormous value under circumstances where the environment cannot be modified through fertilizers, irrigation, and pesticides -- is ignored or lost, along with crop varieties and food plants that are far more suited to the local conditions and dietary preferences than most modern varieties.

4.10 Constraints on the use and further development of these physical and intellectual resources must be removed to help communities to benefit from their own resources. For starters, agricultural researchers should place less emphasis on a resource in scarce supply -- agricultural inputs -- and more on those in great abundance -- local knowledge and local genetic resources. Research programmes should be broadened to address locally important crops or the needs of farmers on marginal lands. But, more than that, researchers must collaborate closely with farmers and work within a policy framework that rewards local innovation and research. (See Action 5.)

4.11 In national agricultural research programmes, such changes in effectiveness and power must occur alongside those in emphasis. These programmes are weak, as well as misdirected. Severe funding constraints and the lack of technical expertise, coupled in many countries with the mandate to meet the immediate food needs of large non-agricultural sectors, have forced national agricultural research programmes to focus narrowly on short-term high-input solutions to agricultural problems. At base, national agricultural research programmes in developing countries need bigger budgets, more technical staff, and collaboration with strengthened national universities (de Janvry and Dethier, 1985). Thus fortified, they would be better able to attune their research strategies to longer-term needs.

4a. ***The funders and administrators of national agricultural research programmes should strengthen and decentralize national plant breeding work and increase farmer-based research.***

4.12 For most countries, the primary need in agricultural breeding programmes is to optimize use of traditional breeding technologies. Modern biotechnological techniques can solve specific problems, but even so, a strong public programme in crop breeding is needed to realize the benefits of biotechnology. And merely establishing new field testing sites is not enough. To better meet the needs of marginal farmers, plant breeders must adopt farmer-based seed improvement activities along the lines of the model of Ethiopia's "Seeds for Survival Programme" in Ethiopia (See Box 4.1.)

4b. ***International agricultural research programmes should provide national research institutions with the tools needed to solve local problems, instead of attempting to develop solutions potentially applicable to all regions.***

4.13 International Agricultural Research Centres (IARCs) must increasingly provide tools that enable local solutions to agricultural problems. In crop breeding, new emphasis should be placed on the release of genetically diverse, "unfinished" germplasm that can be tailored to local conditions by national breeding programmes or by the private sector. In addition, the IARCs should strengthen technical assistance and training programmes aimed at national agricultural research stations and should carry out more collaborative research with the national stations.

4.14 Donors should also consider establishing an independent non-profit organization to develop and disseminate novel approaches, information, and enabling technologies for applying molecular biology to world agriculture. Current developments at the cutting-edge of biotechnology may provide few benefits to agriculture in developing countries. Not only are the problems facing industrial agriculture and developing country agriculture dramatically different, but the process of reaching solutions differs as well. For one thing, developing countries need help modifying imported technologies -- a process that could be fostered by an organization that, instead of focussing on specific agricultural problems, identifies the scientific, technical, and logistical bottlenecks that inhibit the development of local solutions to agricultural problems and designs and helps implement innovative new strategies for overcoming these limitations. One recent proposal gaining increasing currency among both NGOs, donors, and international

Box 4 1
On-Farm Landrace Conservation and Enhancement in Ethiopia

Since 1988, the national Plant Genetic Resources Center/Ethiopia (PGRC/E) has been implementing a revolutionary new type of plant genetic resource conservation and use. It is revolutionary not because its activities are new -- farmer seed conservation and breeding has been the norm for millennia -- but because it reverses the standard interaction between national breeding programs and farmers. On a network of 21 farms in drought-prone areas of two provinces, PGRC/E is involved in on-farm landrace conservation and breeding programs of sorghum, chickpeas, teff, field peas, and corn.

Seeds previously collected from the region were given to the farming families in the program, and, along with the varieties that the farmers were already growing, farmers associations have selected the best varieties. Together with PGRC/E scientists, they have also undertaken simple forms of mass selection to improve each season's crop production. Representative samples of the original seed stock are planted alongside the selected material to help farmers critically evaluate their selection, as well as to maintain this original stock in its natural environment. The on-farm work also helps scientists understand the farming systems used with each of the varieties that are being collected. Certain types of cultivars that were adapted by the farmer but later abandoned to reduce risks of crop failure or avoid marketing problems are also saved in PGRC/E genebank.

Farmers have also become involved in the maintenance and selection of elite indigenous material being developed by national agricultural researchers. Breeders have been developing a number of lines of indigenous wheat varieties for specific conditions. These varieties are given to farmers who then select those that best meet their own needs. Farmers multiply and use the seed stock best suited to their own conditions while PGRC/E provides guidance on conservation, selection, use, and distribution.

PGRC/E plans to expand and strengthen the involvement of farmers in the conservation and use of Ethiopia's germplasm resources by increasing the number of farmers involved and by expanding the program to cover a broad range of agro-ecological conditions in the country. It hopes to extend the program in the long-run to cover other aspects of genetic resource conservation, including *in situ* conservation of forage species and wild relatives of cultivated plants. A substantial amount of the *in situ* conservation work pays for itself, since the farmers prefer the landraces to the input-intensive modern varieties. But for the program to be maximally effective, conservation efforts will require financial or other inputs to help farmers assuming the custodian role for genetic diversity.

Source: Worede (in press)

agencies calls for the creation of a Center for the Application of Molecular Biology to International Agriculture (CAMBIA) that would meet this end.

4.15 Expected Result: The upshot of these wide-ranging activities should be a transformation in the approach of agricultural research in developing countries, from one modelled along the lines of research in industrialized countries, to one making the optimal use of the genetic and human resources available in developing countries to solve locally important agricultural problems. Under this new dispensation, the perceived value of local genetic resources would increase as a result. Even more important, a diverse cropping system would take hold, and diversity in landraces would be maintained.

4.16 Costs and Benefits: Funding in [ ] for the International Agricultural Research Centres amounted to [ ]. In 1980, funding for international agricultural research amounted to 18.5 percent of outside funding of all agricultural research in the developing world. Strengthening national agricultural research programme would cost [$]. Strengthening the above described activities of the IARCs would cost [$]. Establishment of a centre for the application of molecular biology to international agricultural research would require an annual budget of $11 million per year for the decade.

Action 5: Nations should tailor intellectual property rights regimes governing genetic resources to their development needs.

4.17 Objective. To provide incentives for private-sector genetic resource innovation and conservation.

4.18 Justification. Agricultural advances are the product of both public and private-sector innovation. In industrialized countries, considerable emphasis has been placed on strengthening incentives for private-sector innovation through the creation of intellectual property rights regimes, including plant patents for asexually reproducing plant varieties, plant breeders' rights, and utility patents. This suite of intellectual property rights, under review by individual countries and by international bodies, has had mixed success. Plant breeders' rights in particular appear to have fallen short of their goals in developed countries; as a result, efforts are now under way to tighten the control of breeders over lines that they have released.

4.19 Few developing countries have intellectual property rights regimes related to crop genetic resources. Most private-sector breeding activities in developing countries involve only hybrid material that farmers must buy from breeders each season. The establishment of Plant Breeders Rights in several developing countries (among them, Argentina and Chile) has not worked in the absence of adequate seed-certification programmes and adequate means of enforcing the legislation.

4.20 Although considerable debate surrounds various aspects of IPR protection, most parties agree that:

a. Increased IPR protection will not necessarily encourage innovation in agriculture -- numerous preconditions must be met before IPR protection can hope to achieve its desired effect.

b. The impact of IPR protection on genetic diversity is unclear -- some aspects seem to reduce diversity while others may increase it.

c. IPRs address only a narrow part of the broad set of social goals that genetic resource conservation and use serve. In particular, though they promote innovation, IPRs indirectly undermine conservation by encouraging the spread of improved varieties.

4.21 A number of steps should be taken to ensure that IPR regimes serve the joint goals of conservation and innovation. But the bottomline is that nations should tailor IPR regimes to their current needs. They should adopt IPR only after farmers, breeders, and the government carefully consider the programme's costs and benefits and only when such programmes encourage local and informal innovation and the conservation and maintenance of genetic diversity.

5a. International Fora, such as the GATT and WIPO, should not call for the standardization of IPR protection as applied to biological materials.

4.22 Objective: To ensure that IPR policies meet national development needs.

4.23 Justification: IPRs are development tools. As such, the must be tailored to and change with each country's unique needs. Whereas patent protection may promote cutting-edge innovation in a developed country, IPRs may provide little in-country incentive for innovation in countries that lack basic technological infrastructure. The few developing countries that have recently joined the ranks of industrialized countries did so by building technological capacity through adaptive innovation (labeled "piracy" by industrialized countries), not by strongly protecting patents.

4.24 Action Needed: GATT negotiators should exclude biological materials from agreements under the TRIPS (Trade Related Aspects of Intellectual Property Rights) negotiation. Countries that choose not to establish patent protection for biological materials should not be required to establish *sui generis* systems of protection (such as plant breeders' rights). On the other hand, all countries should explore the potential value of establishing some form of intellectual property protection to encourage local private-sector innovation in genetic resource development.

5b. Countries should build the seed-production and certification infrastructure needed to support private-sector breeding programmes and to make IPR systems successful.

4.25 Objective: To stimulate the development of private-sector breeding industries that will help provide improved seed to farmers.

4.26 Justification: Without support from public institutions, private-sector breeding programmes will not succeed whether or not IPR regimes are established.

4.27 Action Required: Two basic preconditions for the establishment of successful private sector breeding programmes are the establishment of a strong public sector breeding programme to provide unfinished germplasm for the private sector, as well as training for breeders, and the establishment of effective public seed-certification programmes.

5c. Countries should establish national review boards and an ombudsman office to monitor the impact of IPR regimes.

4.28 Objective: To help ensure that quick actions are taken to address the negative impacts of IPR protection on either biological diversity or social welfare.

4.29 Justification: Given the many unknown impacts of IPR protection on biological diversity, and the potential for a few business and affluent, market-oriented farmers to reap an unfair share of the benefits or for small business to lose patent disputes just because they can't afford much legal assistance, a mechanism is needed to help monitor IPR impacts and to provide a forum for airing disputes involving breeders, NGOs, local communities, and the public sector.

4.30 Action required: Countries should establish National Germplasm Property Right Monitoring Boards comprised of technical experts and representatives of farmers groups, non-governmental organizations, national research institutions, and the private sector.

Action 6: Increase public access to information and participation in genetic resource management.

4.31 Objective: So that decisions on genetic resource management are based on the basis of the best available information and potentially affected individuals, organizations, or nations are advised of activities related to genetic resource collection and use.

4.32 Justification: Until recently, global aspects of plant genetic resource management have been in the hands of a small number of concerned scientists and national and international institutions. Without broad participation in decision-making, many groups such small farmers, and conservation NGOs believe current management practices don't meet their needs. Genetic resource management won't become the common responsibility of farmers, communities, nations, and the global community until communication lines are opened between resource managers and the public and access to decision-making is given to all concerned parties.

6a. Countries should enact codes of conduct for genetic resource collection.

4.33 Objective: 1) To promote the collection, conservation, and use of genetic resources in ways that respect the environment; 2) To promote a better balance of economic benefits between the users and donors of germplasm and the caretakers of wild genetic resources; 3) To ensure the safe exchange of plant genetic resources and associated technologies and scientific information; 4) To help reduce ecological degradation and the loss of genetic diversity; 5) To foster the direct participation of farming communities, as well as of scientists and organizations in countries where germplasm is collected, in plans and actions for conserving and using genetic resources (FAO 1991a)

4.34 Action Required: A draft "International Code of Conduct for Plant Germplasm Collecting and Transfer" is currently under review by the FAO Commission on Plant Genetic Resources. Chances are that this Code of Conduct will be accepted by the Commission at its next meeting in April 1993. Governments should adopt national codes of conduct modeled along the lines of the FAO code immediately, and expand them to explicitly include animals and other living organisms. In addition, national codes of conduct should be broadened to include guidelines for the collection of medicinal plants and animals for chemical extraction.

6b. Countries should enact codes of conduct for genetic resource introduction.

4.35 Objective: To ensure the safe exchange of genetic resources, to help reduce the loss of genetic diversity, and to increase direct public participation in plans and actions related to the use of genetic resources.

4.36 Justification: All countries are well aware of the risks associated with introducing exotic pests and diseases, and most have well-established quarantine mechanisms to minimize these risks. But these mechanisms don't adequately safeguard the genetic resource base against all of the risks associated with introductions. In particular, genetic engineering has recently changed the nature of the risks associated with plant and animal introduction, since engineered organisms have no history in natural environments that can guide evaluation. Accordingly, strict codes of conduct related to the release of genetically engineered organisms are urgently needed in all countries. In addition, one of the biggest threats to local genetic diversity is simply the introduction of new plant varieties. Whether these varieties are transferred internationally, or developed and used nationally, steps to minimize their potential impacts on genetic diversity can't be taken unless the local communities and institutions responsible for conserving biodiversity are alerted to upcoming releases.

4.37 Actions Needed: All countries should adopt strict biosafety guidelines, containing the basic elements laid out in Box 4.2. (For the record, the FAO Commission on Plant Genetic Resources is currently considering adoption of a code of conduct containing many of these provisions (FAO 1991b).) In addition, FAO should draft an "International Code of Conduct for the Introduction of Genetic Material."

Action 7: Strengthen informal or "grassroots" networks for conserving genetic resources.

4.38 Objective: To strengthen a key element of the global genetic resource conservation network and to return greater control of genetic resources to farmers.

4.39 Justification: Actions initiated by governments, research institutions, universities, and scientists are vital to genetic resource conservation. However, the formal conservation network must collaborate with the informal one consisting of farmers and NGOs. These grassroots conservation networks fill important gaps in the formal system by focusing on regionally important crops, marginal areas, and the maintenance of traditional agricultural practices. They also provide additional crop options and varieties to local farmers (Salazar 1991). By nature decentralized, the institutional structure of non-governmental organizations often better meets the needs of genetic resource conservation and use in many regions than does the structure of national institutions.

4.40 Informal genetic resource conservation networks already play a significant role in germplasm conservation. For example, of the 1799 heirloom and standard varieties of beans held by the Seed Savers Exchange (a non-profit network of farmers and gardeners based in the U.S.), only 147 are found in the U.S. government-supported collections. In a 1991 survey of twelve grassroots seed conservation groups in the southwestern United States, roughly one half of the groups maintained over 1,000 accessions of seeds (Dahl and Nabhan 1991). U.S. organizations range from single individuals to groups with memberships of over 2800 people. The median annual budget of the organizations is roughly $50,000.

4.41 Although detailed figures for community-based conservation efforts in developing countries are more difficult to obtain, the importance of community-based activities is almost certainly much greater than in developed countries, where the formal system is much more developed. Brazilian non-governmental organizations, for example, are leading efforts to link conservation and breeding of maize by farmers, and non-governmental organizations and farmers' organizations in Peru and Bolivia are playing key roles in potato conservation (Montecinos and Altieri 1991). Yet, the potential of informal conservation networks in developing countries is severely constrained by funding. For example, one farmers' organization in the Philippines surveyed and collected traditional varieties being grown on the island of Mindanao, but could raise a meager $15,000 for the programme. Indeed, the single biggest obstacle to the development of community-based plant genetic resource systems in both developing and developed countries is funding (Nabhan 1991, Salazar 1991).

4.42 In developed countries, the next most important obstacles are the availability of facilities (freezers, office space, grow-out plots, etc.) and trained personnel. In developing countries, the other key

Box 4 2

Guidelines for a Code of Conduct for Releases of Genetically Engineered Organisms

1 Scope: There is not one "correct" definition of scope -- different countries and agencies within countries may use different definitions The term genetic engineering is typically used to refer to the most modern techniques, such as recombinant DNA, but it does not have a clear definition The most appropriate definition is to encompass primarily organisms that could not occur in nature, such as the definition adopted by the European Community Council of Ministers

2 Responsibility for Oversight National governments should establish appropriate policies, laws, and regulations for oversight of proposed introductions Not all countries, however, have sufficient scientific expertise to evaluate the ecological risks of proposed introductions To support national oversight, one or more qualified international organizations should establish a technical assistance program

3 Prior Informed Consent. No company, institution, government body, or person should export a genetically engineered organism intended for introduction into the environment for experimental, commercial, or other purposes without the informed consent of the government in each country in which a release may occur

4 Basis for government decisions. In making decisions about proposed introductions, national governments should protect natural ecosystems and biodiversity, as well as the health and well being of the citizens When introductions involve genetically engineered animals, decision-makers should also consider the humaneness of the engineering and the treatment of the animals In general, decisions about introductions should be made case-by-case Predictions of ecological effects must take account not only of the organism's phenotype, but also of the environment into which it is introduced

5 Step by step development. Genetically engineered organisms should be developed in a stepwise manner They should first be evaluated in the laboratory, then in a contained facility such as a greenhouse, then in small-scale field experiments, and finally in large-scale experiments Only after they pass each of these tests should they be made widely available

6 Containment measures. Releases should be conducted in ways that minimize unnecessary dispersal of genetically engineered organisms

7 Monitoring procedures. Releases of genetically engineered organisms should be monitored to confirm predictions about the organism's effects, dispersal or escape, gene transfer, and survival and reproduction

8 Ecological information in proposals for environmental release. Agencies, businesses, or others proposing releases should provide to governments of countries in which the release will occur all the available information needed to evaluate the potential ecological impacts of the proposed release

9 Public availability of information. Any person or organization proposing to introduce a genetically engineered organism should make publicly available all the information needed to evaluate its potential ecological effects

10 International record-keeping. Because people have had little experience with environmental releases of genetically engineered organisms, readily accessible records of releases should be kept All entities conducting releases should notify a designated international organization of every release

Source: Goldburg (1991)

obstacles include the financial constraints facing farmers who might be involved in the work, adverse

policy conditions, the speed with which new varieties and access to inputs are changing agricultural practices, and lack of support systems. In addition, in both developed and developing countries, very little interaction or collaboration takes place between the formal and informal system. (Again, the Seeds for Survival programme described in Box 4.1, provides an excellent model for strengthening collaboration between the formal and informal system.) To help strengthen the network, the following actions are needed:

7a. *Global and International institutions should significantly increase funding for community-based genetic resource conservation efforts in developing and developed countries.*

4.43 These funds could be provided through the Global Environment Facility (World Bank/UNDP/UNEP), the Fund for Plant Genetic Resources (FAO), or a fund established under the Biodiversity Convention. Since it is essential that funds find their way to small-scale community-level projects, non-governmental organizations may be the best conduits for funding. The International Fund for Agricultural Development (IFAD), which regularly supports small-scale agricultural development projects, is one model. Regional needs for funding amount to: [$].

7b. *National governments should encourage the establishment of local seedbanks and local genetic resource conservation programmes and remove legal barriers to the conservation of genetic resources.*

4.44 Many countries not only fail to support local genetic resource conservation; they discourage it. For example, most national policies in Southeast Asia are not favorable to community plant genetic resource conservation. Non-governmental organizations in Indonesia have reported that the government has burned traditional rice cultivars planted by farmers as recently as 1984. In many countries, farmers planting traditional varieties can't obtain agricultural credit.

7c. *National agricultural research and germplasm conservation institutions should increase collaboration with informal genetic resource conservation networks.*

4.45 Such collaboration may begin with the establishment of national plant germplasm system advisory boards for certain types of genetic resources (for example, an heirloom crop advisory board for North America) or with the inclusion of grassroots representatives on other advisory boards. Ideally, the collaboration would resemble that in Ethiopia's Seeds of Survival programme. National agricultural research institutions should provide training, guarantees of access to genetic resources, and research tailored to the needs of small-scale farmers. One place to start to increase collaboration will be through the involvement of groups involved in grassroots conservation in national agricultural planning processes.

4.46 The payoffs from such collaboration can be significant. In Thailand, one non-governmental organization, TREE, launched a rescue operation to save plant genetic resources from being lost as the Thai government aggressively introduced new seeds coupled with agricultural loans and extension services. In two years, TREE collected more than 4,000 accessions of rice and almost 3,000 accessions of other food crops. Duplicates of these collections were given to the national gene bank. However, with the one notable exception of Ethiopia, the current trend is one-sided: non-governmental organizations are attempting to work with national systems that don't reciprocate.

Action 8. Increase the use of native tree species in agroforestry, forest production, and the restoration of degraded lands.

4.47 Objective: To increase the value of indigenous tree species, to reduce the global uniformity developing in forestry patterns, and to better meet local needs for food and forest products

4.48 Justification: If native species are used in reforestation and agroforestry, the incentive to conserve of native species is increased. Moreover, in many regions, native species provide many more benefits than exotics. The primary obstacle to the use of native species is the lack of silvicultural information

4.49 Reforestation worldwide is increasing rapidly. Exotic species have played a major role in reforestation projects, especially in the production of fiber and uniform sawtimber. However, the need for tropical hardwood production for both domestic needs and specialty exports has been largely overlooked

Even though both domestic and international markets are expanding to accept larger numbers of species, fewer and fewer are being used in reforestation. Indigenous species are often overlooked in commercial programmes aimed at wood production on grounds that exotics grow faster. But many native species grow rapidly and show good form, making them excellent choices for plantations (Butterfield 1991).

4.50 Tree planting is also being promoted worldwide in an effort to improve the lives of small farmers, to halt desertification and to provide fuelwood, fodder, and other benefits to rural people. Tropical forestry development programmes currently depend on a few fast-growing exotic species. Programmes aimed at subsistence and small farmers need to consider species that yield a variety of benefits, only one of which is fast growth. Once selection criteria are broadened, it becomes obvious that native species have much to offer. Just for starters, local people are familiar with their various uses, and they are well adapted to local conditions. Rural development programmes could be more effective in promoting tree planting if they offered native species to local people, who know and value them.

4.51 Since the myths surrounding native species are perpetuated until information to the contrary is available, the greatest obstacle to the increased use of indigenous trees in forestry programme is lack of information. Recent work with native species punctures many such myths and shows that indigenous trees can be highly productive, often more productive than the exotics that replaced them.

8a. *Forestry development programmes, including bilateral or multi-lateral assistance and TFAP exercises, should allocate funds to applied research on native species.*

4.52 Every forestry programme can, at minimal cost, develop techniques for working with desirable native trees rather than depending on exotics that may be easy to handle but otherwise inappropriate. Project by project, international donors should earmark a small proportion of their development funds to applied research on native species, thus allowing each project to establish its own research priorities for choosing suitable species.

4.53 As part of any development planning process, ministries, research organizations, or non-governmental organizations should establish programmes to test the potential and adaptability of native species against the use of proposed exotics. Special funds or subsidies could be made available to farmers and community groups that include native species in reforestation programmes. Skimping on such investments in applied research is a mistake since yields and economic returns are at stake. Even research in "species provenance trials" -- where the growth of different varieties is compared under similar conditions -- can greatly increase yields, more than offsetting research expenses.

4.54 Many forestry programmes are now funded for five to seven years. Trial plantings established during the first few years can give preliminary feedback on the performance of currently used species versus other promising species within three years. If large differences or responses are noted, programme targets can be readjusted. Final results will come at the end of the project (5 to 8 years for fast-growing species) and still provide valuable information for future tree planting. One project in Costa Rica, working in one geographic area with a large number of species, required approximately $100,000 annually.

8b. *National forestry research institutions and non-governmental organizations should collaborate to develop guidelines and training programmes to support local initiatives in indigenous tree conservation and use.*

4.55 Channeling millions of dollars to large regional organizations that then develop a handful of species only reinforces dependence on exotic species. Funds can be more efficiently used if local projects are encouraged to develop information on the species they wish to use. Technical assistance may be needed to train project personnel on research methods or techniques, but the expense pales beside potential dividends.

Action 9. Legitimize and improve traditional medicinal practices.

4.56 Objective. To increase the value of local genetic resources by increasing the health care benefits obtained from those resources.

4.57 Justification. According to the World Health

Organization, roughly 80 percent of the world's population relies on traditional medicine for primary health care. Although modern pharmaceuticals can often significantly improve health care, the wholesale disruption of traditional health care systems and their replacement with more costly modern systems can have disastrous effects. For this reason, Western science should be used to help improve traditional health care systems, not replace them. In this effort, local biodiversity can help people take greater control over their own health. High priority actions to meet these needs are increased applied research on traditional medicines, and formalized information exchange on traditional medicinal practices

9a. *Regional and national programmes should be established to increase applied research on the effectiveness of traditional medicines.*

4.58 Like many modern medicines, some traditional medicinal treatments have harmful effects. But while most countries have adopted elaborate procedures to screen the effectiveness of modern medicines, few bother to apply them to traditional medicines. More often, traditional systems are ignored or frowned upon. Instead, applied research programmes should be aimed at decreasing the cost of medicinal therapy by drawing on local practical knowledge of the treatment of common ailments and putting local remedies within reach of all people and medical personnel.

4.59 An example of such a programme is the TRAMIL programme in the Caribbean, which examines the effectiveness of traditional remedies through ethnopharmacological surveys and classifies traditional herbal remedies as toxic, indeterminant, or beneficial/innocuous (Weniger and Robineau 1988) Health care workers use the manual produced by the programme, "Elements for a Caribbean Pharmacopeia," as a guide to useful traditional medicinal treatments in the region.

9b. *National governments should broaden codes of conduct for the collection of plant genetic resources to include medicinal plants.*

4.60 The information exchange between traditional healers and botanic gardens, pharmaceutical companies, or intermediaries must be formalized. Significant advances have been made in pharmaceutical development by relying on the knowledge of traditional healers. But in many cases, these advances have been predicated on the stolen trade secrets of medicinal healers

4.61 To empower the people and communities using these health resources and to provide effective incentives for the conservation of local genetic resources, indigenous knowledge must be treated as a resource that can t be obtained, much less used, without a contract or agreement. As a first step toward this recognition, nations should adopt the FAO International Code of Conduct for Collectors of Genetic Material that governments are now developing. The FAO draft, however, does not specifically include medicinal plants and animals, so national governments should consider broadening the code. Any national codes of conduct devised should recognize people's rights to their knowledge and ensure that licensing agreements are reached with individuals and groups before materials are removed.

4.62 Model contracts for the collection of medicinal plants should also be developed and circulated widely through non-governmental organization networks and indigenous peoples organizations. Nations should allow ethno-pharmacological exploration only if scientists observe national codes of conduct for genetic resource exploration.

Action 10. National governments should, where appropriate, encourage and facilitate establishment of community-based natural resource management regimes in areas currently within the public domain.

4.63 Objective: To support the establishment of effective regimes for conservation of forests, fisheries, and other biotic resources by local communities, in areas where such regimes offer the best chance of saving and sustainably utilizing those resources

4.64 Justification: In many areas where local populations are directly dependent upon the land, sea, and their resources, state ownership and centralized government management of those resources has proven to be an inadequate model for effective conservation of biodiversity. A range of local community management options -- in one or another kind of partnership with state resource management agencies -- provides promising alternatives in many places. The success of these alternatives, however, depends on concrete and secure incentives for the communities to manage

biodiversity sustainably. Provision to communities of some level of rights in land or its resources are the first necessary element of such a system. (See Chapter III, Action 2c.) Second, there must be both a real and perceived increase in the material benefits flowing to the community. The third key element is an increase in the community's control over the direction of its own development.

4.65 Calls for greater community involvement in biotic resource management are often misinterpreted by governments as demands that they turn over resources management to local people *in toto*. To the contrary, governments should not just "walk away", even in those cases -- such as indigenous communities' ancestral domains -- where full community ownership of resources is justified. Government agencies have a legitimate and important role to play in safeguarding national interests, and in enforcing certain minimum standards of resource stewardship, even on wholly private lands. In addition, local communities generally require a range of government services to be effective resource managers, including access to technologies and technical knowledge, credit, and help in building sustainable linkages between local and external economies. What is needed is a flexible range of partnerships between state and community, tailored to local situations through a process of dialogue, participatory investigation of options, and implementation of practical solutions. The building of trust between communities and government agencies is a crucial element, for mistrust has frequently been the norm.

10a. ***Governments should accord full legal recognition to the ancestral domains of tribal and other long-term occupants of specific territories, and assist them in adapting traditional practices to modern pressures and conditions.***

4.66 Justification: Certain peoples -- usually called "tribal", "native", "indigenous", or "indian" -- have a special claim of right on particular territories of the world, areas that in many cases overlap with concentrations of biodiversity. Their claim rests on their long occupation of a particular place, their cultural, spiritual and economic ties to it, and their ability in most cases to manage it without greatly impoverishing its biodiversity. Equally important, the cultural diversity inherent in the world's indigenous groups is under great threat from the incursion of dominant societies and economies. Protection of indigenous territorial rights is a prerequisite for meeting that threat. In addition, indigenous knowledge and resource management systems are a valuable source of information for society at large about how to develop sustainable biodiversity strategies at a larger scale. Finally, the ethical and spiritual relationships between many indigenous societies and their environment provide inspiration and guideposts for the development of biodiversity ethics worldwide.

4.67 Indigenous peoples do not, however, have all the answers, nor do they desire to be left alone in some kind of "human zoo". Many traditional strategies are inadequate to deal with the pressures of modern economy and society; as they adapt, governments must provide the kinds of support and services that will allow both indigenous peoples and their territories to develop sustainably.

4.68 Mechanisms for change: Governments should take immediate steps to legally recognize tribal and indigenous territories under national law, and should support indigenous communities in defending those territories against incursion by outsiders. In addition, both governments and development agencies should enter into a sustained dialogue with indigenous groups concerning the kind of development they desire. Governments and other outsiders should provide information on options, financial support, and services, but the power of decision should rest ultimately and unambiguously with indigenous peoples themselves. Finally, indigenous peoples should be permitted to develop their own organizations to represent their interests in national and international fora, and governments, corporations, and development agencies should deal directly with them.

10b. ***In areas within the public domain where communities depend on land and biotic resources in their immediate area for their livelihood, governments should develop joint management regimes which provide sustainable benefits to both the state and the community.***

4.69 Justification: Many millions of people live in or on the fringes of lands designated as public domain, or draw their livelihoods from "public" coastal waters, but are not indigenous inhabitants of ancestral territories. They may or may not be particularly good

stewards of biodiversity, or possess particularly rich traditional knowledge about it. Nevertheless, they depend on these lands and resources for their livelihoods, are generally very poor, and have nowhere else to go. Biodiversity conservation cannot succeed under such conditions unless these communities are made partners in the effort. Governments must make a sustained and creative effort to establish such partnerships.

4.70 Mechanisms for Implementation: Because local conditions vary, there is no one "blueprint" for joint government-community management of biotic resources. Governments and local communities can develop systems in which local people hold leasehold rights on government land, and both the lessees and government agents work together on the land. Such arrangements have been pioneered in a number of community forestry initiatives in South and Southeast Asia. In other cases, local rights may be granted in particular uses of an area's resources, but not in the land itself. The "extractive reserves" established in the Brazilian Amazon are an example of this approach. In other cases, such as commercial forestry ventures on public lands, guarantees of wage employment for the community -- or even straight profit sharing -- may be a viable option. Finally, in cases where lands and resources are acquired for public purposes -- such as the building of dams or development of timber plantations -- just compensation should be paid to those who are disadvantaged, whether they hold formal legal title to land or not.

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V. CONSERVE BIODIVERSITY IN THE WILD

5.1 A variety of management tools have been used by people to save, study, and use wild plants and animals. Hunting territories and closed seasons helped primitive peoples avoid over-exploiting the resources upon which their lives depended. Ancient cultures established reserved zones to protect sacred sites and species, royal hunting areas, and such resources as shipbuilding materials. More recently, as humans have appropriated more area to support economic development needs, governments in all parts of the world have taken steps to conserve biodiversity in the wild.

5.2 The management tool used most frequently to conserve wild biodiversity has been the legally defined protected area. Such sites maintain those essential ecological processes that depend on natural ecosystems; preserve the diversity of species and the genetic variation within them; maintain the productive capacities of ecosystems; safeguard habitats critical for the sustainable use of species; protect beautiful landscapes and wildlife; provide opportunities for scientific research, education, training, recreation, and tourism; and serve as sources of national pride and human inspiration.

5.3 The term "protected area" refers to several management approaches designed to achieve conservation objectives. (See Box 5.1.) In some protected areas, people are excluded and protection is strict. In others, cultivation is permitted to varying degrees. So far, more than 130 nations have together established some 6,500 major protected areas, covering nearly 5 percent of the planet's land surface (or, roughly, two Indias). (See Box 5.2.) Through this global network of protected areas, biodiversity can be safeguarded and studied, and sustainable use can be supported. Although protected areas are but one part of a complete biodiversity strategy, they are the foundation upon which other conservation and development activities build.

5.4 While protected areas focus on the "wild" parts of biodiversity, much diversity is also contained within long-settled areas. Indeed, the pattern of diversity seen today reflects tens of thousands of years of human activity. Conserving biodiversity thus demands interaction with people in human settlements, on farms and forests, or engaged in coastal and marine-based activity. Such interaction enables the linkages between plant and animal resources and human values to be established and the various uses of the resource (be they hunting and gathering, ethnic ties with species or sites, recreation and tourism, extraction and harvesting, or scientific research and monitoring) managed.

5.5 Local communities often possess detailed knowledge of the ecosystems and species with which they are in contact and know how to use them sustainably. More generally, cultural diversity -- the great variety of behavior, beliefs, and knowledge that make up the world's myriad cultures -- provides the basic raw material for adapting to the environment. Drawing on this wealth could ease the needed shift to sustainable societies.

5.6 The value of protected areas can only grow. They are the storehouses of the genetic raw materials needed for plant breeding, pharmaceutical exploration, and biotechnology and they will help society adapt to predicted changes in climate. They also serve as cornerstones of sustainable forestry management, providing non-timber forest products and serving as reservoirs of genetic diversity for harvested timber species.

5.7 But a new approach is needed to link the full spectrum of land uses, from strict protection to intensive production. In particular, places of high biodiversity value -- including forested areas, wetlands, and coastal sites -- should be protected and managed within the larger framework of land and water uses. Institutional arrangements should be established that involve all affected people in planning and implementation, foster agency coordination, and monitor selected indicators of biodiversity conservation.

5.8 Precedents for this integrated approach are found in many ancient cultures. In parts of Central America, Ecuador, and Peru, for example, local people have for generations combined migratory agriculture with arboriculture and wildlife management. These mixed agricultural and forestry systems are highly productive, ecologically sound, and labor intensive -- a combination that makes for more equitable income

Box 5.1
Categories and Management Objectives of Protected Areas

Wildlands are managed to provide a variety of goods and services to people and to maintain and enhance nature. By systematically sorting out the objectives of management a set of standardized categories can be listed that classify the types of outputs from each type of area, the forms of human occupancy or use to be permitted, and the role of these areas in overall local, regional and national development and conservation.

I. Scientific reserve/strict nature reserve. To protect nature and maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, environmental monitoring and education, and for the maintenance of genetic resources in a dynamic and evolutionary state.

II. National park. To protect outstanding natural and scenic areas of national or international significance for scientific, educational, and recreational use. These are relatively large natural areas not materially altered by human activity, and where commercial extractive uses are not permitted.

III. Natural monument/natural landmark. To protect and preserve nationally significant natural features because of their special interest or unique characteristics. These are relatively small areas focussed on protection of specific features.

IV. Managed nature reserve/wildlife sanctuary. To ensure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment when these require specific human manipulation for their perpetuation. Controlled harvesting of some resources may be permitted.

V. Protected landscapes. To maintain nationally significant natural landscapes characteristic of the harmonious interaction of man and land while providing opportunities for public enjoyment through recreation and tourism within the normal life-style and economic activity of these areas.

VI. Resource reserve. To protect the natural resources of the area for future use and prevent or contain development activities that could affect the resource pending the establishment of objectives based on appropriate knowledge and planning.

VII. Natural biotic area/anthropological reserve. To allow the way of life of societies living in harmony with the environment to continue undisturbed by modern technology; resource extraction by indigenous people is conducted in a traditional manner.

VIII. Multiple-use management area/managed resource area. To provide for the sustained production of water, timber, wildlife, pasture, and outdoor recreation, with the conservation of nature primarily oriented to the support of the economic activities (although specific zones can also be designed within these areas to achieve specific conservation objectives).

distribution than the alternatives currently being imposed upon their lands through government policies and agricultural extension.

59 Even though protected areas will probably never cover more than about 10 percent of the global land mass, they can contribute greatly to biodiversity conservation and sustainable development if managed properly. Fortunately, permanent agriculture in most nations covers no more than about a quarter of the land area, so ample room remains for well-managed forestry, shifting cultivation, grazing, and the like. In lands surrounding the more strictly protected areas, these uses along with other categories of management

Box 5.2
Protected Areas in IUCN Categories I-V as of mid-1990

The sites include all those protected areas over 1000 hectares in size, classified in IUCN categories I to V and managed by the highest competent authority in the country. Data are constantly changing, with new areas being established, information being refined, and some areas being de-gazetted; this table presents the best available information as of mid-1990

REALM	Number	Total area (sq km)
Afrotropical	536	1,018,845
Indomalayan	778	332,420
Palaearctic	2386	1,231,164
Oceanian	81	73,613
Nearctic	1253	2,226,813
Neotropical	736	1,076,151
Australian	590	404,124
Antarctic	165	31,436
Totals	6525	6,394,566*

* Equals 4.9 percent of land area

Source: 1990 UN List of National Parks and Protected Areas

(Box 5.8), could help buffer negative human influences. In any case, finding the right balance is vital since large landscapes managed to maintain biodiversity while supporting sustainable development activities are, along with the protected areas themselves, an essential element in global efforts to conserve biodiversity.

Conserving Biodiversity at the Ecosystem Level

5.10 Strictly protected areas cannot meet all of society's needs for genetic resource management, watershed protection, recreation, education, and the many other goods and services that biodiversity can provide. Further, recent advances in conservation biology have shown that by themselves the strictly protected categories will not be able to conserve all, or even most, species, genetic resources, and ecological processes. (For instance, few protected areas are large enough to accommodate species that seasonally move up and down mountain slopes, from wet to dry habitats, or to and from breeding grounds.) Far greater expanses are required for conserving biodiversity than modern societies are willing to retire from agriculture, forestry, and other forms of direct production.

5.11 The co-existence of biological diversity and economic activity requires a regional approach to conservation and use. Through "Biodiversity Conservation Regions" (BCRs) that cut across territorial and sectoral jurisdictions, concepts of sustainability could be translated into practical objectives, taking both socioeconomic and environmental factors in account. A BCR is a region with high value for biodiversity conservation in which a management regime is established among governmental, community, corporate, and other private interests, to coordinate land-use planning of both public and private land-owners and to define development options that will ensure that human needs are met without diminishing biodiversity.

5.12 Many Biodiversity Conservation Regions will cover hundreds of thousands of hectares. Determining exactly the "right scale" for biodiversity management is a matter of meeting four criteria. The territory (land or water) must:

1. meet the habitat requirements for viable populations of keystone and indicator species;

2. maintain the integrity of the region's biological communities, habitats, and ecosystems;

3 be of sufficient size to enable nutrient and waste cycling, migration, reproduction, and stream flow;

4. include those residents and communities that both contribute to the management and understanding of the region's resources and need to cooperate with the management regime to ensure equitable and sustainable use.

5.13 The success of ecosystem management depends upon the recognition of common interests among local groups, local government, and the

organizations responsible for resource conservation. In turn, this requires an institutional structure for formulating and implementing the programme of work and investment needed to meet each Biodiversity Conservation Region's objectives. This approach may take many different forms depending on the patterns of land ownership involved. Inter-ministerial or interagency task forces may guide management of areas comprised entirely of federal lands, whereas regional authorities composed of state, local, federal, and private representatives may be more suited in other regions. Finally, non-governmental organizations may take on central tasks including identification of land-use options, organizing of community-based management programs, and the direct administration of particular sites

Action 11. Establish ecosystem-wide management programmes for twenty priority Biodiversity Conservation Regions annually for the next Decade.

5.14 Objective: Through collaboration among governments, local groups, and international organizations, to select, finance, plan, and implement ecosystem management regimes in regions of high biodiversity value, including forest areas, wetlands, and coastal zone sites.

5.15 Justification: Based on the limited data available, scientists have identified a number of regions of the world that harbor high diversity of species, genes, and ecosystems. These have been called "hotspots" of endemism, "megadiversity regions," and "centres of plant diversity." In the Amazon Basin, most of the regions of high diversity that scientists have identified are already settled or in use. Few options remain for establishing strict protected areas large enough to guarantee regional diversity. Here and elsewhere, the only alternative is regional mixed-use management.

11a. ***An ad hoc international task force should be established by U.N. Agencies and non-governmental organizations to select 200 regions of international importance for the conservation of biodiversity.***

5.16 Objective: Under the auspices of a consortium including representatives of IUCN, FAO, UNESCO, UNEP, the Ramsar Convention, donor institutions, and relevant non-governmental organizations, a special Ad Hoc task force should be established to identify and select 200 regions that are of high priority biodiversity value and that lend themselves to regional management approaches. The World Conservation Monitoring Centre (WCMC) can facilitate the task force's work by providing data and information-processing support.

5.17 Justification: Forests, wetlands, and coastal and marine systems are key ecosystems for which priority sites must be established at the international level. Specific issues relevant to the determination of priorities in these ecosystems are presented in Boxes 5.3 to 5.5. Of course, attention given to these ecosystems must not be at the expense of that to other ecosystems that may be of even greater local importance. [Box of specific guidelines and criteria for the choice of BCRs, to be developed]

5.18 Given the pressures upon these environments the identification of key regions must be done in a manner that provides technical, scientific and political credibility to the process. Governments, local communities and development assistance must see the recommendations as non-partisan and in the best interest of the global community. These international priorities must then be reviewed by national and local groups to determine whether, how, and at what cost such regional management approaches could be established.

5.19 A first approximation of regions of outstanding biodiversity value based upon scientific analysis is provided in Annex I. Obviously, further work is needed to incorporate the prerogatives of host countries, non-governmental organizations, and communities, and to take the full range of biological, economic, social, and political factors into account

5.20 Action Required: The task force will review existing studies and efforts to identify outstanding biodiversity regions, and the experience of on-going regional management efforts. The task force will commission projects to examine candidate regions in the field, hold discussions with national and local institutions, and provide recommendations. A report will be published annually, under the auspices of the task force, proposing regions warranting international technical and financial cooperation.

Box 5.3
Maintaining Biodiversity in Forest Areas

[A two page boxed folio is being developed, in collaboration with IUCN and WCMC, to illustrate problems and options for maintaining biodiversity in forest areas at all latitudes. Includes a world map highlighting key forest areas that should be managed at the regional scale. Will illustrate the specific case of tropical forests in West Africa.]

5.21 Institutional Support: At least parts of many Biodiversity Conservation Regions will be protected under such international agreements as the World Heritage and Ramsar conventions and the Man and Biosphere Programme. These should be assessed for their role in conserving biodiversity by the respective management authorities, with the support of the secretariats of those agreements. Each of the 200 Biodiversity Conservation Regions should qualify as a Biosphere Reserve and should be nominated to UNESCO for inclusion in the World Network of Biosphere Reserves. National governments will need to develop the regional approaches tailored to each Biodiversity Conservation Region's unique needs, constraints, and opportunities.

5.22 Expected Results: Annual reports by the task force to national governmental institutions, NGOs and development assistance agencies, providing information about 10 Biodiversity Conservation Regions that warrant technical and financial support.

5.23 Costs and Benefits: [to be determined]

11b. *Governments should establish joint public/private management regimes to manage critical biodiversity conservation regions of international importance.*

5.24 Objectives: Governments should call together representatives of local community organizations, industry, professional groups and government offices, non-governmental organizations, and international groups to negotiate institutional procedures for management of BCRs of international importance identified by the task force in Action 11a. At the same time, these groups should identify other regions of high importance for biodiversity conservation also in need of regional management that may be important nationally but not identified as international priorities.

5.25 Justification: Governmental, non-governmental and private groups have unique and major roles to play in establishing BCRs on the ground. Only they, working in concert, can define the specific area to be encompassed by BCRs, the role of each interest, and how to share the costs and benefits equitably. They can establish goals, plan activities, secure commitments (including that to policy reform), and set schedules. At the same time, a government-sponsored clearinghouse should be set up to help coordinate international cooperation and assistance with related efforts taking place under the auspices of various environmental, tropical forest, wetland, and biodiversity conservation plans.

5.26 Action Required: Numerous examples of regional management could be used to establish management guidelines for national BCRs. These include Yellowstone (USA); La Amistad Biosphere Reserve, Costa Rica and Panama; Guanacaste, Costa Rica; Serengeti/Ngorongoro/Mara, Tanzania and Kenya; the Great Barrier Reef, Australia; the Mediterranean Regional Sea; and Antarctica. (See Boxes 5.6 and 5.7.)

5.27 Institutional Support: The UN specialized agencies, OAS, IUCN, and some non-governmental organizations are especially prepared to provide technical cooperation on this subject.

5.28 Expected results: The following targets are proposed:

a. Identify, finance, and implement 200 Biodiversity Conservation Regions during the decade. These will include priority forest areas, wetlands, and coastal and marine sites

b. Develop for each Biodiversity Conservation Region a written management plan that sets forth an assessment of the region's biodiversity value and the programme for inventory, data, and information management; protected area management; needs for off-site facilities; policy reform; regulation and legislation;

Box 5.4
Maintaining Biodiversity in Wetlands

[A two page boxed folio is being developed with IUCN and the Ramsar Convention Secretariat to illustrate problems and options for maintaining biodiversity in wetlands at all latitudes. It includes a world map highlighting key wetland areas that should be managed at the regional scale]

Wetlands in all parts of the world are essential for conserving biodiversity, even though they may contain relatively few species. Upstream catchments that provide water and stream flow to riverine environments, lakes, and other wetland areas are typically left out of conservation management programmes, and the integrity of the watershed is often compromised as a result. Virtually all wetland habitats are important for conserving the biodiversity of fisheries, but of particular relevance are inland floodplains which are often affected by development projects

Wetlands are also valuable to human society for the functions they perform (such as flood control and storm protection) and the products they yield (such as wildlife, fisheries and forest resources) While the economic evaluation of wetlands is in its infancy, available figures underline the importance of wetlands to local people and to the national economy. In Mali, the inner delta of the river Niger supports 550,000 people (7.8% of the country's population), 1985 livestock exports from the delta (cattle, sheep, and goats) were valued at US$8 million Estimates of sustainable mangrove exploitation for Indonesia in 1978 indicated a potential of US$18 million worth of exports and an equal amount for domestic consumption of charcoal, tan bark, and other mangrove products. In Nicaragua, the annual production of shrimp dependent upon 20,000 hectares of mangroves in Estero Real in the Gulf of Fonseca is estimated to exceed 5 million kg worth US$34 million. Development of effective conservation action at these internationally important sites is but one component of the comprehensive approach required to conserve the world's wetland resources

Indeed, high profile action at sites of international importance should be viewed as being first and foremost the mechanism through which to raise awareness of the importance of wetlands, and of the urgent need for institutional changes that will allow a more decentralized and integrated approach to managing these resources

The most comprehensive approach to effectively managing wetland Biodiversity Conservation Regions will be through the development of a national wetlands policy. Conceived and carried out by concerned line ministries, as well as the local authorities responsible for taking decisions on wetland use, it can institutionalize practices that favor wetland conservation Steps in this direction have been taken by Uganda and are being considered by other developing nations, in particular among Contracting Parties to the Ramsar Convention. Within the framework provided by such a strategy, specific action on high-priority habitats or sites can help develop and promote innovative approaches to management and institutional cooperation Special attention needs to be paid in such strategies to incentives for wetland conversion provided by national agricultural policies In North America, wetland conversion has been encouraged by tax subsidies and crop-price supports, while in Nigeria subsidies for wheat cultivation have invited conversion of floodplain wetlands In Ecuador, subsidies for diesel fuel have provided a major incentive for the expansion of commercial aquaculture.

Targets: Add at least 30 additional key wetlands to the Ramsar Convention programme during the Decade Five new contracting parties to the Convention will be added each year

research and monitoring; role and participation of local communities; management of forestry, agriculture and fisheries; international cooperation; institution building; and budget.

c. Cover an aggregate of 5 percent of the world's boreal, temperate, and tropical forests in Biodiversity Conservation Regions, including in this total forest lands dedicated to strict protection and sustainably managed extraction

Box 5.4 (Cont)
Priority Wetlands for Regional Management Programs

Africa
Banc d'Arguin (Mauritania)
Bijagos Archipelago (Guinea-Bissau)
Outer Niger delta (Nigeria)
Rufigi delta (Tanzania)
Inner Niger delta (Mali)
Lake Chad and surrounding floodplains (Chad, Cameroon, Nigeria, Niger)
Sudd (Sudan)
Lake Bangwaulu and floodplain (Zambia)
Kafue flats (Zambia)
Okavango delta (Botswana)

Latin America
Pantanal (Brazil)
Chaco (Paraguay)
Esteros de Rebeira (Argentina)
Llanos (Venezuela)
Orinoco delta (Venezuela)
Floodplains of middle and lower Amazon (Brazil)
Laguna de Terminos and Usumacinta-Grijalva delta (Mexico)
Caribbean coastal lowlands of Honduras, Nicaragua, and Costa Rica
Lagoa dos Patos lagoon complex (Brazil)
Maranhao coast (Brazil)

Asia
Indus delta (Pakistan)
Sundarbans (India & Bangladesh)
Irrawaddy delta (Burma)
Mekong delta (Vietnam)
Poyang lake (China)
Coastal lowlands of Kalimantan (Indonesia)
Coastal lowlands of east Sumatra (Indonesia)
Coastal lowlands of Irian Jaya (Indonesia)
Great lake (Cambodia)
Bharatpur (India)

North America
Everglades (United States)
[Others to be added]

Europe
[To be added]

zones (national forests, community forests, or extractive reserves).

d. Add 30 additional key wetlands to the Ramsar Convention programme during the Decade. Mobilize five new contracting parties to the Convention, per year during the period.

e. Give added impetus to UNEP's Regional Seas programme, to the conservation of small islands and marine areas. [more specific targets here?]

5.29 Costs and Benefits: Funding for 200 Biodiversity Conservation Regions, (including the task force to select regions) will cost an estimated $1 billion annually for the decade. Mechanisms for funding regional management in the Biodiversity Conservation Regions identified by this task force are presented in Chapter IX: *Build New Mechanisms for Global Cooperation*. Funding from industrialized countries will be required to support planning, inventory, data and information management, institution building, and the management of key sites.

Conserving Biodiversity at the Site Level

5.30 While nearly 5 percent of the planet's land has been established as protected areas, far more is needed to offset intensifying human demands on natural resources. All protected areas support local, regional and national development with such environmental services as water, nutrient cycling, climate amelioration, cleansing of air, and amenity values. Individual protected area sites form key components of both the regional land management regimes described above and of national protected area systems. Strengthening conservation at the level of specific protected areas thus complements the establishment of regional management regimes, and plays an even more central role in ecosystems where no regional authority has been established.

5.31 Despite the leading role played by protected areas in programmes to conserve biodiversity, these areas suffer from a number of problems:

a. *Conflicts with local people.* In a protected area, local people's use of resources is restricted to what is in the interests of the nation. Because the balance between conservation for long-term national

Box 5 5
Maintaining Biodiversity in Coastal and Marine Areas

[A two page boxed folio is being prepared with CMC to illustrate problems and opportunities for the maintenance of coastal and marine areas at all latitudes. A map will illustrate key regions, and give particular reference to the UNEP Regional Seas programme.]

public benefit and exploitation for immediate local or private gain is elusive and constantly shifting too often local people end up paying the opportunity costs of conservation; in extreme cases, hostility mounts and life is lost in pitched battles between subsistence "poachers" and protected area staff.

b. *Conflicts with other government agencies.* The agencies responsible for protected areas tend to be relatively weak and thus vulnerable to policy conflicts and budget cuts. Agricultural, forestry, and fisheries incentives may promote encroachment on protected areas; highway departments may find the "free" lands contained in protected areas prime sites for new roads; tourism departments may try to attract more tourists than a protected area can support without damaging the resource; energy departments may wish to build dams in protected areas; and industrial development policies may stimulate pollution and climate change, which harm protected areas.

c. *Insufficient management.* When protected areas are surrounded by agricultural lands and reduced to fragments of once-extensive habitat, even small populations may not be viable in the long term unless remaining habitats and the species they support are carefully managed -- a tall order where impending changes in climate and land use in adjacent areas complicate the task, shortages of trained personnel are exacerbated by a narrow conception of management that excludes social, economic, and political considerations and by the poor state of even the ecological underpinning for management.

d. *Insecure funding.* Most protected areas are funded from the national budget. Since such budgets are declining in real terms in most parts of the world, protected areas feel the brunt even where protected areas are highly profitable -- as in Kenya, where tourism to national parks is the nation's second leading earner of foreign exchange -- only a small portion of the economic benefit they earn is reinvested in protected area management.

e. *Weak national constituency.* The numerous benefits of protected areas have been viewed too narrowly. Typically, the general public sees these areas as exotic vacation spots or remote wildernesses rather than as essential contributors to national welfare. Most sectors that earn real benefits from protected areas -- tourism, irrigation, fisheries, public health, zoos and aquaria, science, disaster prevention, and others -- do not recognize these benefits.

5.32 Despite these problems, many governments hope to expand their protected area systems to help put development on a sustainable footing. Their challenge is to find ways to add new protected areas, better manage existing ones, and build more positive relationships with the people who live in and around the protected areas even as budgets shrink and demands on resources grow.

5.33 To help nations meet this challenge in the coming decade, and to optimize the world's protected areas' contribution to conserving biodiversity, action predicated on the following general objectives are required:

a. To identify the protected areas that are so important to global welfare that they justify an international investment in management;

b. To help governments in all parts of the world establish or expand systems of protected areas in ways appropriate to each country;

c. To build the capacity of institutions to manage protected areas and adapt to changing conditions;

d. To determine the status and trends of the biodiversity contained in the world's protected areas;

e. To build support for protected areas among local communities; and,

f. To specify the highest priority scientific

Box 5.6
ECOSYSTEM MANAGEMENT AT YELLOWSTONE

The birthplace of the idea of national parks, Yellowstone, may be re-created in a new image, as part of the Greater Yellowstone Ecosystem (GYE). This hybrid of a developed and protected area embraces a new framework for conservation, called ecosystem management, based on a growing awareness of the ecological connections that bind protected areas and surrounding lands. Twenty-eight different political units co-exist within the borders of three states, Idaho, Wyoming, and Montana. The U S Forest Service controls the single largest land area, followed by the Park Service and the Fish and Wildlife Service. State and private lands are also scattered through the region.

The past few decades have shown that this pattern of land management cannot adequately conserve wildlife or natural resources. This awareness has been fostered by a series of crises threatening the ecological integrity of the GYE, as well as a new wave of development and exploitation that threatens to irreparably harm the area. Below-cost logging in the National Forests has taken a toll on habitat and opened up potential wilderness areas to human use without adequate assessment. About half of the national forest lands are currently under oil and gas lease or lease application. There has also been concern over the building of infrastructure and increasing levels of tourism.

Most state and federal agencies in the GYE understand the rationale for a sustainable, ecosystem-centered management philosophy and have tried to respond to a growing public desire to preserve natural processes on public lands. However, many critics dispute that existing inter-agency coordination can harmonize land management across the divided landscape that makes up the ecosystem. Not only are fundamental administrative changes opposed by private interests and public agencies, but the changes may also require a revised legal foundation and new information and management techniques.

An essential goal of ecosystem management is to maintain linkages and relationships within the ecosystem, rather than protecting individual species or natural features. Human occupation and commodities production fits into an ecosystem management plan, so long as they do not degrade the ecosystem. Of course, ecosystem management should also attempt to preserve features of value to people, including a sense of naturalness or natural integrity. Some commentators state that the first step toward implementing these goals is to build consensus by educating people on their meaning and implications, and by creating a dialogue between the many parties involved on the formulation of specific policy recommendations.

Some advocates of ecosystem management want to institute reforms at an even more fundamental level. Making the Park Service an independent agency would distance it from the intense politics of the Interior Department and reduce pressure and interference from elected officials. Another possibility is "greenlining" the GYE, establishing an authority with control over the entire region along the lines of the Adirondack Parks Agency, or the California Coastal Commission.

Instituting change in this fractured political landscape has been difficult. The Park Service and the Forest Service have met extraordinary resistance from local people in response to their "Vision For the Future," a planning document that stops well short of advocating a transition to ecosystem management.

The two largest environmental advocacy groups in the GYE are planning for ecosystem management. The Wilderness Society is developing a transition strategy for a sustainable local economy. The Greater Yellowstone Coalition's "Greater Yellowstone Tomorrow" programme has drafted an environmental profile of the area and plans to develop a "blueprint for action" to bring ecosystem management to the GYE.

research required to support protected area management.

Actions 12 and 13 will address the first three objectives, while the latter three are treated in sections on information and research.

Box 5.7

[Additional example(s) of on-going regional management in key biodiversity areas could be included. Boxes are being prepared for La Amistad Biosphere Reserve, Costa Rica and Panama; Guanacaste, Costa Rica; Serengeti/Ngorongoro/Mara, Tanzania and Kenya; Great Barrier Reef, Australia; Mediterranean Regional Sea; and Antarctica.]

Action 12. Double the area of the global network of protected areas.

5.34 Objective: Governments are called upon to ensure that areas of outstanding importance for conserving biodiversity are managed for that purpose and given legal protection so they can do so; to protect sufficient land or marine territory to reduce the extinction rate of plants and vertebrates to no more than the background rate.

5.35 Justification: As human demands on natural resources increase, options for new protected areas are rapidly disappearing, so locations where new protected areas are required and possible need to be identified soon.

12a. U.N. Agencies and non-governmental organizations should establish an ad hoc international task force to conduct by 1993 regional reviews of protected areas, identify gaps in the system, and set priorities for international support.

5.36 Objectives: The task force and the supporting regional reviews should attempt to expand the global protected area system to cover (in all categories, both public and private, and representing all major ecosystems) at least 10 percent of the Earth's land area.

5.37 Justification: The task force discussed in Action 11a can also serve this role. The selection of individual sites requires not only technical methodology, but scientific credibility and political acceptance. A combination of UN specialized agencies (UNEP, FAO and UNESCO) IUCN, WCMC and other important field-oriented NGOs) can establish the necessary procedures and credibility to gather and analyze data and information, and propose priorities for action that will be acceptable to governments and development assistance institutions. The leadership of this task force could also serve to promote coalitions for action among governmental and NGO groups at the national and local levels.

5.38 Actions Required: Building upon the work already under way by the Commission on National Parks and Protected Areas, the World Heritage Convention and several NGOs, and the information available from the World Conservation Monitoring Centre, the task force will expand the regional review process of IUCN. In addition to consultations with government bureaus and communities, the programme of work will include field work to examine sites and Geographic Information Systems (GIS) analysis.

5.39 Institutional Support: The essential technical support will come from IUCN, FAO, UNEP and UNESCO. Data and information will be supplied by WCMC and national agencies and NGO sources. The field missions and discussions at the national level should benefit from the political support of the task force. Recommendations for policy development and reform and for investments should be offered under the aegis of the task force to relevant governments, institutions and development assistance agencies.

5.40 Expected Results: Regional reviews published from each of 14 regions, under the aegis of the task force, providing credible and acceptable information on priorities for action and investment in protected areas. Taken together, these reports will provide the basis for doubling the coverage of the global protected area system over the Decade.

5.41 Costs and Benefits: Regional reviews, which would help to orient the preparation of national reviews, would draw on existing information rather than generate new data, would each cost about $150,000. Some 14 such reviews would be required, corresponding to the 14 regions identified by IUCN's Commission on National Parks and Protected Areas.

12b. The ad hoc international task force should identify existing or proposed protected areas that are important for their biodiversity components but face serious threats and warrant immediate

action.

5.42 Objective: Identify threatened sites, provide information to governments, NGOs, communities and potential supporters, and mobilize funding and political support.

5.43 Justification: Key sites for their value to biodiversity are threatened by inadequate policies, insufficient management personnel often lacking training opportunities and equipment, and a variety of regional conflicts often due to the lack of development options for neighboring communities. (See Box 5.9.)

5.44 A preliminary list of 100 threatened sites of high biodiversity value that require such support over a two-year period is presented in Box 5.10. Unless national governments, private groups and international organizations come up with major financial and technical support to help strengthen and implement protected areas, efforts to identify key sites will remain of little use. While measures are put in place to address the fundamental issues behind biodiversity losses, many biologically important areas are in danger of collapse or degradation. These threatened sites -- many located within Biodiversity Conservation Regions -- need immediate help.

5.45 Supporting institutions: National governments and non-governmental organizations are called upon to take action on a site by site basis, supported by international funding. The new international facility proposed in Action 13a (p.59) would assume responsibility for this new programme. Developing country governments should confirm their commitment to the perpetual maintenance of these high priority sites and provide the legal, administrative, and operational structures needed to receive and rapidly invest funds for emergency conservation activities. Establishing endowment funds through national banks may be particularly appropriate. (The Parks in Peril programme of the Nature Conservancy and its partners in Central and South America and the Caribbean, and the work of Brazilian institutions on Amazonian conservation, in cooperation with Conservation International and the Smithsonian Institution illustrate how a broad array of governmental and non-governmental specialists can together set conservation priorities.) At the international level, such conservation organizations as IUCN should provide technical advice on the preparation of systems reviews; UNDP, UNEP, the World Bank and other development assistance agencies should provide financial and technical support to the effort; and international agreements should be developed to support the effective management of these areas.

5.46 Expected Results: One hundred threatened sites would receive managerial and financial support by 1994 from international sources to bolster staff numbers and capacity, provide short-term training and equipment, improve community relations, and other activities with immediate response.

5.47 Costs and Benefits: Total direct investment on the 100 high priority sites, during the first two years of the Ten-Year Action Plan, is estimated to reach $500 million.

12c. ***The ad hoc international task force should give high priority to the need to strengthen networks of non-contiguous conservation areas providing essential habitat for species at different life stages or different seasons.***

5.48 Objectives: To strengthen existing networks and establish new arrangements to protect species that migrate or require access to a number of sites to survive.

5.49 Justification: Various species -- among them, migratory birds, whales, certain fish and marine turtles -- won't survive unless habitat protection covers their entire migratory routes and all their seasonal activities. Typically, their food, shelter, and breeding or spawning grounds are scattered across considerable distances, sometimes falling within the land and sea territory of several nations and on the open seas. Some such clusters of sites can be managed as protected areas, but others may require seasonal arrangements with farmers, fishermen, and other resource user communities to alter or in some cases forgo harvesting practices and other resource uses or activities. [Possible examples of whales, walrus in Beringea, marine turtles, migratory bird flyway.]

5.50 Action Required: [to be completed]

5.51 Institutional Support: [to be completed]

5.52 Expected Results: [to be completed]

BOX 5 9
What is a Threatened Protected Area?

The concept of threatened sites forms part of the World Heritage Convention ("World Heritage In Danger"), the IUCN Commission on National Parks and Protected Areas' "Threatened Protected Areas List", the Green Book for "Endangered Landscapes," and Canada's "Endangered Spaces" program

A protected area is considered to be "threatened" when:

Management is insufficient The budget is insufficient to support sufficient trained personnel to implement the necessary management measures (such as preparing management plans, marking boundaries, and administering basic protection and public outreach programs), thereby placing the future of the site in doubt; and,

Its boundaries and regulations are disregarded Human settlements, farms, hunting, or harvesting of forest products are taking place within the legally established area, and the lack of collaboration with other public agencies and private interests in the surrounding region is leading to the destruction of the area's resources;

5.53 Costs and Benefits: [to be completed]

12d. Governments and non-governmental organizations should launch a major programme to establish special coastal and marine protected sites

5.54 Objective: To ensure that specific coastal and marine protected areas are established and managed to maintain their diversity and to contribute their benefits to society sustainably.

5.55 Justification: Protection of the marine environment lags far behind that of the terrestrial habitats. Institutional mechanisms for conserving coastal and marine areas are insufficient or inappropriate, jurisdictions are often fragmented, management objectives may be difficult to agree upon, and questions of ownership and use rights are often even more difficult than those on land. Even though coastal and marine areas cannot be protected by limited site-specific methods, like terrestrial national parks, human use in these areas can be regulated and overall management objectives achieved if such sites are envisioned within such larger-scale management regimes as those suggested in Action 11.

5.56 Action required: Identification of which coastal and marine sites need special protection; development of management structures appropriate for the coastal and marine zone; and improved regional cooperation for marine conservation.

5.57 Supporting institutions: Each central government needs to decide how it wishes to protect biodiversity in the coastal and marine zone and to assign management responsibility. National policies for conserving biodiversity in the coastal zone need to be developed, guiding preparation of the coastal zone management plans which incorporate various categories of protected areas. International organizations, such as UNEP, IOC, and IUCN, should specify the options available. (In particular, the UNEP Regional Seas programme should pay far more attention to protected areas in the coastal zone.) Universities and marine research institutions should advise governments on coastal-zone management

5.58 Expected result: Protected areas, including estuaries, mangroves, sea grass beds and coral reefs, established along key sections of the coastal zone of each coastal nation and over important sea sites, and managed under regimes tailored to circumstances. By the year 2000, all such protected areas should operating under management plans.

5.59 Costs and benefits: [to be detailed]

12e. All nations should conduct national protected area system reviews by 1996.

BOX 5 10
200 Protected Areas Needing Immediate International Support

[This box will include 200 sites identified through IUCN's regional reviews involving extensive field work and analysis by protected area professionals, public agency and private organization officials, and scientists. In most cases, the nomination of these sites has been published. Following a review of these existing studies (CNPPA Regional Strategies, other), 200 sites were selected through further dialogue by knowledgeable individuals.]

5.60 Objective: To identify priorities actions needed to establish or strengthen national systems of protected areas.

5.61 Justification: Only national institutions can determine the commitments and investments to be made in protected areas that are in the national interest. Experience demonstrates that long term goals can be achieved only if protected areas are planned as elements of whole networks of sites within the larger economic, cultural and political context.

5.62 Action Required: Each national protected area authority should review the protected area system to: assesses options for additional protected areas, with a national objective of at least 10 percent of the land area receiving special protection for conserving biodiversity; determine how private lands can contribute to biodiversity conservation; and identify mechanisms for collaborating with other government agencies to bring the necessary land under conservation management. (See Box 5.8.)

5.63 Institutional Support: At the international level, such conservation organizations as IUCN should provide technical advice on the preparation of systems reviews; UNDP, UNEP, the World Bank and other development assistance agencies should provide financial and technical support to the effort; and international agreements should be developed to support the effective management of these protected areas.

5.64 For national governments, these reviews would afford the means for developing ways to deliver the benefits of protected areas to society; identifying which potential protected areas most need urgent attention; and objectively assessing which management categories are most appropriate for each protected area. As for the international agencies, the reviews would help them identify investment priorities for establishing new protected areas and collect the data needed to guide action in the proposed Biodiversity Convention.

5.65 Expected result: A series of national protected area system plans; identification of possible areas to be added to the global network of protected areas; priorities for action to establish such areas; and identification of the protected areas most in need of management attention. By the end of the decade, the global network of protected areas would cover 12 million square kilometers of securely managed wildland.

5.66 Costs and benefits: The cost of conducting a national protected area system review will vary with the size and complexity of a country, but will average around $500,000. [to be completed]

12f. ***Public and private protected area managers should use ecological restoration techniques to rehabilitate or expand existing protected areas to meet requirements for conserving biodiversity.***

5.67 Objective: To restore lands adjacent to existing protected areas, to develop corridors between sites, and to reclaim abandoned lands that can contribute to social needs and biodiversity, and do so with native local flora and fauna, following ecological principles.

5.68 Justification: Many existing protected areas are small in size or do not include all the habitats necessary to meet the requirements of their flora and fauna. Typically, these areas are no longer surrounded by wildlands, but rather by farms, pastures, and degraded forests. Elsewhere, sites of high potential value as new protected areas are altered and degraded, thereby reducing their potential for biodiversity

Box 5.8
Sample Table of Contents of a Protected Area System Plan

1. Introduction

Brief overview of the national legal and policy setting; purpose of the system plan; method of study; inventory of habitats and key species.

2. National Policy for Protected Areas

Review of national development plans and how protected areas contribute; national objectives for protected areas; standards and criteria for different categories of protected areas; relations with other sectors; relations with surrounding lands; beneficiaries of the nation's protected areas.

3. Evaluation of Existing Protected Areas

Adequacy of existing protected areas to achieve national conservation objectives; classification of each area by management category; objectives for each area; description of costs and benefits in broad terms.

4. Proposed Additions to the Protected Area System

Description of gaps in the system; specification of new areas; proposals for possible deletions; draft objectives for each area; description of possible conflicts in allocating the area for conservation objectives; and list of costs and benefits of managing each site as a protected area.

5. Additional Mechanisms for Achieving National Conservation Objectives

Assessment of the contribution to private lands to national conservation objectives; role of private protected areas; role of provincial protected areas; contribution of other government lands to conservation objectives (e.g., military reservations, forests, fishing reserves, etc.); recommended policies for enabling these lands to contribute to conservation objectives.

6. The Proposed System of Protected Areas

Proposed protected area system; management responsibilities for each site and category; priority rankings; relation to national development plans.

7. Implementing the Plan

Financial implications; personnel requirements; who does what; training requirements; research priorities; costs and benefits.

conservation. [A box on Guanacaste National Park could illustrate its catalytic role in restoring adjacent lands to restore the park, building corridors to nearby wildlands, and contributing to local economies.]

5.69 Institutional Support: [to be determined]

5.70 Action required: The mosaic of forest patches, farms, woodlots, stream and lake shores, and

hedgerows that make up the rural landscape can also be the successful basis of biodiversity conservation and watershed management. Skillful restoration using native vegetation and animal life can meet local cultural and economic needs for timber, fuel wood, game meat, fish, medicinals and other materials while fostering a biotically diverse environment.

5.71 Cost and Benefits: [To be completed.]

Action 13. Strengthen protected area management.

5.72 Objective: To provide technical and financial support to agencies responsible for protected area management so they can fullfill their responsibilities for the full range of management functions including protection, inventory, research, monitoring, education and awareness, and restoration.

5.73 Justification: While the global network of protected areas has expanded significantly even in light of growing human numbers and escalating competition for the use of marine, coastal and land areas, few areas are truly secure. The combination of weak policies, lack of political and financial support, absence of training opportunities, conflicts among governmental ministries, and the invasion of areas by colonists makes it likely that the expanding numbers of protected areas are being offset by habitat degradation, poaching, the influence of agrochemicals and introduced species, and encroachment on areas that remain listed and gazetted. Far stronger support is required, often from international sources.

13a. ***Governments and NGOs should establish a new international facility to support protected areas.***

5.74 Objectives: This facility should support and coordinate policy development, technical assistance, training, information exchange, advice on funding mechanisms, and the maintenance of a registry of key sites. The facility should also support non-governmental organizations and private land owners who manage key sites for biodiversity. One of the primary objectives of the facility should be to provide information and mobilize funding and political support for investments in protected areas. This would include both strengthening existing sites and the development of new areas. Private sites should also be included in the registry.

5.75 Along with providing technical and financial support for protected areas, three other key objectives of the protected area facility should be to:

1. develop for practical application the quantitative tools needed to identify and select sites of outstanding value for germplasm, species diversity, habitat diversity, and ecosystem processes;

2. design mechanisms for ensuring the long-term financial viability of protected area systems, including self-financing programmes, where feasible, or endowment funds set up for specific areas; and

3. develop mechanisms to quantify the benefits -- both tangible and intangible -- of protected areas.

5.76 Justification: This facility should take over the functions of the ad hoc task force (Actions 11 and 12) and provide long-term continuity to the effort. Governments negotiating the Global Biodiversity Convention should consider providing for this need in the provisions of the Convention, its Secretariat and programme.

5.77 Institutional Support: Already IUCN's Commission on National Parks and Protected Areas consists of a global network of some 400 of the world's leaders in the protected area field, but this is a voluntary network serviced by a two-person Secretariat. UNESCO's Biosphere Reserves Programme supports a network of some 300 biosphere reserves, but the budget is small and many kinds of protected areas are not covered. Most nations have protected area agencies, and many have at least limited international programmes. But a new international facility on protected areas needs to be established to harness growing concern about the management of protected areas.

5.78 Expected Result: An international facility responsible for providing technical support to protected area agencies to meet their management commitments. More specifically, additional personnel will be hired to carry out key tasks; professional and field personnel

trained for specific duties; additional land (such as inholdings) purchased; management facilities constructed or remodeled; specified projects implemented with neighboring communities, including those aimed at boosting employment and addressing other issues of welfare and equity; new partnerships established between support institutions and national and local organizations. Countries and cooperating international organizations alike will benefit if investment options for management programmes that support national, local, and international priorities are clearly oriented.

5.79 Costs and Benefits: The annual budget of the protected areas facility, with a professional staff of 15 and an active programme as outlined above, would be about $50 million. In most cases, revenues from protected area management are not expected to cover the operational and capital costs of the work required.

13b. *[Who should?] develop the capacity to manage protected areas.*

5.80 Objective: To greatly expand efforts to develop modern protected area managers in all countries by improving curricula and securing funding for the key training centres, promoting improvements in the career structures of management institutions, and providing performance incentives.

5.81 Justification: Management is above all about people, and the individuals managing protected areas are ultimately responsible for conserving the planet's most valuable areas for biodiversity. However, too often these individuals are neglected, poorly trained, poorly equipped, and poorly paid. If protected areas are to make their necessary contribution to society, the individuals responsible for managing them must be given the tools and incentives necessary to perform.

5.82 Action required: Greatly increased efforts to develop modern protected area managers in all countries (involving curriculum development, improved career structures, training programmes, performance incentives, and the purchase of equipment) and new approaches to enable the private sector -- non-governmental organizations, universities, industry, and others -- to contribute to conserving biodiversity.

5.83 Institutional Support: First and foremost, governments must provide a career structure that will attract highly qualified individuals into resource management. They will also need to provide the incentives -- training, equipment, health care, education allowances, salaries, performance bonuses -- that will bring out the best in the staff. In some cases, these may be better provided by the private sector, in which case governments should consider making their protected areas parastatal. At the same time, the regional training schools, universities, national ranger training programmes for lower-level staff, and other training mechanisms need to be up-dated and improved with technical and financial support from international organizations.

5.84 Expected result: Trained personnel at all levels, dealing successfully with local people, scientists, resource management problems, and the many other issues required to manage a modern protected area; a career structure in all protected area agencies; incentive structures that encourage good performance; and well-equipped field staff in all countries.

5.85 Costs and Benefits: When balanced against the increased benefits to the nation of a well-managed protected area system, the costs of training are minimal; a general guideline is that training should comprise about 5 percent of a protected area facility's annual operating budget. International support to regional training centres will cost [$]. Performance incentives can often be provided in kind or through the budgets of other government agencies (those concerned with education or health, for instance.

13d. *The Commission on National Parks and Protected Areas (IUCN) should establish regional associations of protected area managers.*

5.86 Objective: To foster professional development, standards of practice, and collegial interaction among protected area managers; to establish in each world region an association of individuals who are professionally involved in protected areas, especially those that form part of BCRs or are otherwise part of international networks.

5.87 Justification: International cooperation in protected area management is relatively weak, even though many of the problems encountered in such areas are common to most countries. Further, even

when protected areas lie along both sides of an international boundary (as at least 70 protected areas do), cooperation between the respective management agencies is weak at best. As a result, efforts are duplicated unnecessarily, and opportunities to improve professionalism in management are missed.

5.88 Action required: Design and support mechanisms for supporting protected area management at a regional level. Establish in each region of the world a network of individuals who are professionally involved in protected areas; and enable network members to work collaboratively to address the highest-priority problems in their region, thereby increasing the effectiveness of protected areas. Through information exchanges, dialogue, professional training, guidelines, and manuals, and staff exchange, and study travel, standards of professionalism that fit each country's needs will be developed.

5.89 Supporting institutions: The networks should involve government protected area management agencies, universities, and the private sector. Regional agreements may be required, but even informal networks can function well if they are in all participants' interests. Participating institutions should send their staff to these meetings and otherwise contribute to the network. International organizations -- FAO, UNESCO, UNEP, IUCN, WWF, and others -- should support such networks through technical and financial contributions and through participation and active involvement. This action can be facilitated through the IUCN Commission on National Parks and Protected Areas, in collaboration with the FAO regional programmes

5.90 Expected results: Active networks of protected area managers in all 14 CNPPA regions, working together to address issues such as training, World Heritage nominations, identification of priorities for international support, sharing of results of scientific research, development of new management approaches, etc.

5.91 Costs and Benefits: Each network could be run on a budget of about US$ 500,000 per year, to cover communications, travel, publications, and other costs. These funds, contributed by the GEF in support of the long-term appropriate management of the global network of biodiversity sites, could be administered through regional programmes (IUCN, FAO)

Action to Conserve Genes and Species in their Natural Habitats

5.92 [To be drafted by the Species Survival Commission of IUCN in collaboration with other knowledgeable individuals]

VI. CONSERVE BIODIVERSITY IN OFF-SITE FACILITIES

6.1 By almost any reckoning, the most effective and efficient mechanism for conserving biodiversity is habitat protection. But off-site (*ex situ*) facilities -- botanic gardens, zoos, genebanks, and aquaria -- are also very important components of a comprehensive conservation programme. They supplement *in situ* conservation by providing for the long-term storage, analysis, testing, and propagation of threatened and rare species of plants and animals and their propagules. For wild species whose populations have dwindled, these facilities back up *in situ* conservation, provide material for reintroductions, and safeguard the genetic material needed to breed domesticated species in the future. Some *ex situ* facilities -- notably zoos, botanic gardens, and aquaria -- also give the public a window on the wider, wilder world and expand opportunities for basic and applied research. In short, on-site and off-site conservation actions must be established and coordinated as parts of unified programmes.

6.2 None of the off-site conservation tools were first established with conservation in mind. Instead, botanic gardens and genebanks were initially created as collections of economically important plants being introduced to new regions or as working collections for plant breeders. Zoos and aquaria were established either to display "curiosities" or as commercial ventures. But the goals of *ex situ* facilities are changing fast. No longer marginal to conservation or even detrimental as some once were, *ex situ* facilities have emerged as a major component of biodiversity conservation networks. The leading zoos and botanic gardens are now being transformed into "biological parks." And the barriers between off-site and on-site conservation are also disappearing. Golden-lion tamarin monkeys are being reared in captivity and re-introduced to help the natural population in the Atlantic forest of Brazil increase more rapidly. Captive rearing in a zoo thus becomes part of the conservation of the species in the wild.

6.3 Despite these changes, off-site conservation facilities are currently unable to fulfill their role in biodiversity conservation. The historical orientation of zoos, botanic gardens, and genebanks, combined with funding constraints and obligations to meet commitments to education and other objectives, means that many species are "slipping through the cracks." The research needed to improve the success of off-site conservation has also been a low priority of both the institutions themselves and of funding agencies. In addition, the promotion of off-site conservation without due consideration to the equitable use of the germplasm stored in the facilities ultimately undermines well-meaning conservation efforts. (See Chapter IV for actions related to equitable use of biodiversity.) And, finally, few governments and policy-makers understand or respect the key role that *ex situ* conservation could play in integrated biodiversity conservation. For these reasons, much needs to be done to strengthen the role of off-site facilities in the conservation network.

Germplasm banks

6.4 For millennia, farmers have selected and bred crop varieties, maintaining varieties close at hand for their own use. But with the emergence of formal plant breeding in public research institutions and the private sector during the past century came the establishment of off-site collections in which a wide array of germplasm is maintained for access by a wide array of breeders. In the past three decades, national and international germplasm conservation centres as part of an international network have been strengthened with the overall aim of conserving representative segments of diversity. However, action overall has been limited, and little has been done to strengthen informal genetic resource conservation networks.

6.5 International and national action has concentrated on major crops and forages, trees of value in plantation forestry and agroforestry, and animals of major breeds. This focus now must be broadened to include the wider genepool of local and global value. New biological technologies now give breeders access to virtually the entire biota for crop or livestock improvement. Additionally, research based on domesticated genepools is directly applicable to action to save heretofore neglected threatened species and groups of organisms -- among them, medicinal plants, species important for ecosystem rehabilitation, minor animal breeds, and many crop species of traditional importance in local agro-ecosystems (especially tropical and subtropical tree crops).

6.6 The following sections cover actions needed to strengthen national and international conservation efforts related to:

a. *Crop genepools*: Staple food crops and forages (mostly herbaceous), including a limited number of high-priority tree fruits and some plantation crops. Formal systems of crop genetic resource conservation include some wild species that are closely related to cultigens and that are part of the wider genepool used by breeders, but the overlap with efforts to conserve threatened wild species is small.

b. *Forest genepools*: Primarily genes of use in developing wood products and agroforestry, though increasingly including non-wood products. This category partially overlaps with fruit trees and plantation crops, though the overlap with threatened wild species is much greater

c. *Domesticated animal genepools*: Primarily genes of use in breeding. Some wild progenitors of major domestic species still differ so much from domesticates that they provide a "reservoir" of diversity even though they are unlikely to contribute greatly to current breeding. Work with wild species must be done in collaboration with zoos.

6.7 For all of these groups, *ex situ* conservation strategies are based on collections preserved for the long-term supplemented by those designed for short- or medium-term storage. The long-term collections provide a secure repository of diversity for the future and samples for restocking short-term collections. Short-term collections are the collections breeders use. (For crops, the two types of collections are now known as base collections (long term) and active collections (medium term).) The institutions holding these collections should be considered "genetic resources centres" rather than genebanks because their activities range broadly from the multiplication of samples, exchange of genetic material, to the characterization, evaluation, and documentation of germplasm.

6.8 Over the past 25 years, major advances have been made in the conservation of genepools of globally important crops but forest trees, domesticated animals, medicinal plants, or so-called "minor" crops of local or regional importance have been comparatively neglected. The aim of the actions proposed below is to strengthen and extend the global networks of germplasm banks so as to:

a. Safeguard representative samples of economic organisms by inventorying what is conserved ex situ and supplementing those collections;

b. Better document and describe conserved samples;

c. Facilitate research on the biodiversity of genepools;

d. Manage collections according to the best scientific standards; and

e. Provide access to materials to users.

6.9 Strengthening the formal system of genetic resource conservation requires a threefold increase in current *ex situ* activities. (See Box 6.1.) Not only must funding triple over the next decade; so must efforts to apply innovative scientific methods. At the same time, national and international conservation action must be complemented by actions to strengthen the informal network of farmers, forest dwellers, and NGOs involved in germplasm conservation. (See page 38, Action 7.)

Action 14. Strengthen and expand the international and national germplasm conservation network.

6.10 Objective. To help ensure global, national, and local food security.

6.11 Justification: Worldwide, more than 40 base seed collections, over 20 field genebanks, and several hundred other germplasm collections have been established, (mostly within national programmes). Now the pressing need is to forge cooperative linkages between dispersed collections of any specific crop or forage; to limit duplication to that needed to ensure safety; to upgrade standards for storage, description, documentation; and to increase governments' funding commitments to national facilities and manpower.

14a. *Donors should increase their support for*

Box 6.1
Targets for Genebank Coverage

	Current number	Target number in 5 years[1]
Crop genepools	2 million	3.0 million
Forest species	few thousands	1.5 million
Domesticated animals	few thousands	0.5 million?
Medicinal plants	± 0	0.5 million
Ecosystem rehabilitation	± 0	0.5 million
Locally important plants	few hundred	1.0 million

1 Assuming rationalization of excessive duplication in existing collections

national crop genetic resource-conservation networks.

6.12 Bilateral and multi-lateral donors should increase their support for national and regional germplasm conservation networks, including genebanks. (See Box 6.2). These genebanks should serve national agricultural research needs and conserve high-priority regional crop genepools. Genebanks cannot, however, stand alone. Before governments decides to expand genebank facilities, the ground work must be laid in national agricultural programmes. Without strong national breeding programmes, trained personnel, continued government support of the facility, and links to university programmes and to the informal germplasm conservation network, genebanks will at best be storage facilities for use by other countries.

6.13 One way to support genebanks is to set up endowment funds for significant germplasm collections of international importance, particularly those held in developing countries. Donors should also allocate funds from development assistance projects to national programmes to collect and conserve plant germplasm, that would otherwise be destroyed by the development project.

14b. ***Genebank managers should increase collaboration with managers of botanic gardens, zoos, protected areas, and the informal genetic resource conservation network.***

6.14 The International Board of Plant Genetic Resources (IBPGR), the genebanks of international agricultural research centres, and FAO's Commission on Plant Genetic Resources should expand their roles in coordinating the genetic resource conservation network. At the same time, genebanks should build meaningful partnerships between government-funded programmes and those of non-governmental organizations and universities, especially in developing countries.

6.15 Cost. In total, less than $70 million per year is available from all sources for national and international systems of germplasm conservation. In contrast, $150 million annually is needed during the first few years of the decade to keep national programmes and other institutions running smoothly.

6.16 Monitoring and Evaluation. The FAO Commission on Plant Genetic Resources plans to issue regularly a status report on plant genetic resources. This report should monitor efficiency, provide measures of long term commitments by governments, and avoid oversimplistic measures based on numbers of samples or national boundaries. The work of the Consultative Group on International Agricultural Research (CGIAR) is monitored through the external review of its centres including the IBPGR. Future reviews of IBPGR should assess the Board's strategy in association with those of other organizations.

14c. ***National and international genebanks should***

Box 6 2

Priorities for Regional Action

The success of regional germplasm centers depends political considerations and the cultural bonds in the region In some cases, truly regional germplasm banks are feasible, in others not Depending on such considerations the following attention to genebanks or cooperative activities are priorities

Targets for Years 1 - 5

- Support for the SADDC genebank for Southern Africa
- Strengthen ongoing regional networks for Europe
- Strengthen regional collaboration in N Africa, the Sahel, and SW Asia in collaboration with African Ministers of the Environment and ACSAD
- Expand regional activities in C America/ Caribbean
- Strengthen regional activities in the Andes
- Strengthen networking for N America (Canada, USA, Mexico)
- Enhance regional cooperation in E Africa

Future Targets for Years 6 - 10

- Strengthen regional activities in East Asia
- Develop regional activities in C Asia
- Develop stronger networking in S Asia and SE Asia
- Develop stronger networking in W and C Africa and lowland S America

expand their conservation of tree species

6.17 Objective To conserve genetic diversity of tree species and to make that diversity more readily available for use.

6.18 Justification. Although it's much more important to conserve the diversity of tree species *in situ* than crop genepools, seed genebanks and specially designed living collections can complement *in situ* conservation. Currently, only a limited number of tree genepools are targeted for *ex situ* conservation -- among them, economically important temperate species, tropical pines, *Eucalyptus*, and nitrogen-fixing trees of interest for fuelwood, reforestation and agroforestry. The collection, conservation, and documentation of the genetic resources of forest tree genepools have been guided over the past 25 years by FAO. However, compared to that for the work on crops, funding has been relatively low, even though the needs are glaring and the priorities clear.

6.19 Similarly, the breeding of many forest species is rudimentary compared to that of many major crops, and research on genetic resources is not user driven. Much of the genetic improvement of forest species depends on collecting specific provenances, growing these out in provenance trials and re-selecting. However, the biotechnological revolution has opened up new possibilities for screening and for accelerating targeted collecting, and putting diversity to use more rapidly For instance, rapid screening for storage characteristics makes it possible to conserve threatened tree genepools that might otherwise be overlooked on the false assumption that their seeds are too "recalcitrant" to withstand storage. More generally,

mass propagation of a wide range of genotypes is required and conservation research and development for those species with recalcitrant seeds using tissue cultures can go hand in hand.

6.20 *Ex situ* conservation of tree germplasm can supplement and reinforce efforts to conserve species in protected areas. Additionally, *ex situ* materials can be used in ecosystem rehabilitation projects to avoid over-reliance on exotic materials, to facilitate plantation and social forestry establishment, and to strengthen agroforestry programmes.

6.21 Actions Needed:

a. Continued funding of international coordination through FAO;

b. New national and regional tree germplasm banks, in most cases joined with crop genebanks, especially at the national level;

c. Accelerated provenance trials and the development of scientific guidelines to enable governments to create or fortify networks of tree species conservation genebanks.

d. Screening programmes to identify easily stored species;

e Revision of *ex situ* collecting and conservation priorities to include ecosystem rehabilitation and minor forest products;

f. Enhanced knowledge of diversity of tree species genepools using biochemical and molecular techniques.

6.22 The Consultative Group on International Agricultural Research (CGIAR) is now expanding its activities to embrace forest species. As a co-sponsor of CGIAR, FAO will be able to make sure that CGIAR's new research complements its own and that a global system of *ex situ* forest genetic resource centers is developed within the decade.

6.23 Costs. Given the major role trees play in the environment, a sustained global annual total of $100 million for *ex situ* conservation of forest tree germplasm is needed, backed by significant increases in funding for enhanced tree breeding and seed production.

6.24 Monitoring and Evaluation. *Ex situ* work on tree species must be monitored in relation to conservation of those same genepools *in situ, and* global coordinating mechanisms must be developed along with comprehensive databases. The FAO Commission on Plant Genetic Resources should take the lead in monitoring, and evaluation methods should be drawn up jointly by all interested parties including, for instance, IUCN, ITTO, UNEP, and UNESCO.

14d. *FAO should accelerate research on the reproductive biology of domesticated animal genepools and cryopreservation of gametes and embryos and should coordinate the development of a global system of ex situ conservation.*

6.25 Objective. To ensure the conservation of indigenous breeds of domestic animals for use in breeding and as part of cultural heritage.

6.26 Justification. As agricultural patterns have changed over the past century, meat and milk have come to play larger dietary roles in much of the world. The introduction of new livestock breeds to meet burgeoning demands has lead to the rapid loss of indigenous breeds of domestic animals. Exotic breeds are rarely used in current breeding, but new breeding methods are nevertheless opening the way to wider use of the genepools. For this reason, indigenous breeds -- those developed over a long periods through local breeding or selection -- must be conserved for future breeding. These breeds are also part of a shared cultural heritage and may appeal to ecotourists.

6.27 As with plants, three types of genetic materials can be recognized in domesticated animals: ancestral wild species, unimproved indigenous breeds, and improved breeds. (In general, the evolutionary distance between wild and domesticated animals is less than in plants.) Depending on the species, differing emphasis needs to be placed on three types of genetic materials. *Ex situ* conservation works only with those species whose semen and ova, or embryos, can be preserved, so living collections are also needed. The costs of both genebanks and living collections for domesticated animals are much higher than those for conserving plants. Another obstacle is that strategic research is still needed on genebank storage techniques. So far priorities and proposals have been

developed, but no truly global system. Time is of the essence, particularly given the many years needed to produce mature animals from cryopreserved genetic materials.

6.28 Actions Needed: Cooperation is needed to establish regionally based programmes for conserving domesticates through captive breeding, the storage of ova, semen and embryos, and collaboration with institutes that captively breed wild relatives and with regional breeding programmes based on species of special interest. Emphasis should be on breeds that are endangered, obsolete, or that embody unique adaptations to specific ecological conditions and uses.

6.29 More attention must also be paid to lesser-known species that have sustained local meat production or legal trade in skins, furs, and other products. Conserving such species insures the continued productivity of these local resources and may also strengthen CITES (Convention on Trade in Endangered Species) if endangered species are targeted for domestication and breeding programmes.

6.30 Costs. Eight regional centres should be established to conserve a total of ten domesticated species, with approximately 1,000 breeds per species (allowing for safety duplication). Each centre, if fully equipped, will require around $200,000 annually for operating costs, salary, and maintenance. A conservative total of $2 million is needed annually, not counting start-up costs or the costs of global coordination, currently through FAO, that could bring the annual total to roughly $10 million. Additionally, a further $2 million is required annually for six years to finance strategic research on germplasm storage since more work is needed on using the frozen gametes and embryos of some threatened breeds.

6.31 Monitoring and Evaluation. A global mechanism for monitoring the *ex situ* conservation of domesticated animal varieties has not yet been developed. Mechanisms for external, scientific review should be negotiated when the regional centres are established, and FAO should maintain and enhance its coordinating role. New mechanisms for monitoring could be developed after some of the regional programmes have logged operating experience, but care must be taken to ensure that this monitoring is integrated with conservation efforts in zoos and protected areas.

14c. *Nations should establish or strengthen national policies on ex situ conservation needs for domesticated organisms through national planning processes.*

6.32 Objective: To ensure a supportive policy environment for *ex situ* conservation.

6.33 Justification. In most countries, only weak links exist between managers of genebanks, policy-makers, and the broader conservation community. Because most funding for germplasm collection comes from international sources and is channelled through specific national ministries, many programmes are developed at the request of international organizations and these rarely become integrated at the national level. In some poor countries, several inadequate seed genebanks have been established instead of one well-functioning one. In others, National Conservation Strategies have ignored *ex situ* conservation. And in almost no countries have national genetic resource systems taken necessary steps to strengthen the informal conservation networks of farmers and NGOs or to establish collaborative programs. (See Action 7, Chapter II.) All too rarely is germplasm conservation part of national biodiversity planning processes. (See Chapter VIII: Integrate Biodiversity Conservation into National Planning).

14f. *Universities and International Agricultural Research Centres should train more scientists in developing countries on ex situ conservation and its local integration with in situ interests.*

6.34 Germplasm conservation won't be effective or efficient until far more individuals are trained in *ex situ* conservation and its integration with wider genepool conservation. Although the growth in the number of trained scientists has been impressive, it has been compartmentalized. Additionally, research funding has not kept pace with growth in the field, so specialists too often lack the operating funds needed to perform effectively.

6.35 More and better training centres are needed. Existing centres should be assessed, and their reach expanded. Universities in both developed and developing countries, along with the International Agricultural Research Centres, could also help build personnel capacity for biodiversity conservation.

6.36 Costs and Monitoring During the decade, at least 30 fellowships per year should be available for developing country scientists. These funds should come from international donors and administered through FAO, the IBPGR, or through a board comprised of both governmental and non-governmental representatives. New "twinning" consortia of universities in industrialized and developing countries are needed, and their recurrent costs should be provided through international funds. An annual cost of $1.5 million is required in total.

14g. ***FAO should establish regional centres, associated with germplasm banks, to screen diversity.***

6.37 Objective: To improve the ability of scientists to monitor patterns of genetic diversity in order to strengthen conservation efforts.

6.38 Justification. New developments in biochemistry and molecular biology permit scientists to rapidly assess patterns of genetic diversity -- one of the key attributes of value in germplasm collections. Rapid screening makes it easier to target sampling, to establish the limits of variation in the collections, and to monitor patterns of genetic diversity in the field. With these new techniques, costly and often hit-and-miss fieldwork can be kept to a minimum and the extensive duplication of limited ranges of diversity in germplasm banks can be avoided.

6.39 Most regions already have institutions that could screen diversity using the newest techniques. But these institutions need help setting priorities and developing sharply focused workplans -- help that international expert task forces convened by prestigious academies and similar organizations could provide.

6.40 Costs: Approximately $0.75 million annually would be required to establish an effective screening programme.

Botanic gardens and arboreta

6.41 The world's 1500 botanic gardens and arboreta not only constitute by far the most important *ex situ* conservation facilities for wild species; they also represent the most significant institutional resources for plant conservation. Together, they maintain the largest array of plant diversity outside nature, and they have major, if often overlooked, potential as resource centres for conservation, education, and development. If the infrastructure and technical facilities of most of these institutions can be strengthened, they could conserve *ex situ* stocks of most of the world's endangered plant species. An estimated 300 to 400 botanic gardens could together house major conservation collections on a long-term basis; of these, 250 or so gardens have the capacity to establish and maintain seedbanks at an accepted scientific and technical level. If so, up to 20,000 rare or endangered plant species could be conserved in the botanic garden system, either as seed in long-term storage or as growing plants or tissue cultures (WWF/IUCN/BGCS 1989).

Action 15. Develop the world's botanic gardens as a major *ex situ* network for conserving local wild plant resources.

6.42 Objective. To provide an internationally accepted mechanism for collecting and conserving of germplasm of wild species of economic importance that are not covered by the FAO and CGIAR plant genetic resource systems.

6.43 Justification. Historically, tropical botanic gardens have played a crucial part in the introduction of crops to new regions and have helped establish the current pattern of agriculture in many parts of the world. Their role as centres for introducing or acclimatizing plants was largely taken over by state or private agricultural institutions during the past century. Today, botanic gardens do have a continuing role to play in introducing and assessing germplasm and in the tropics they are increasingly being used to meet local needs largely neglected by the international agricultural and forestry genetic resource agencies. Local communities use tens of thousands of local indigenous crops (the so-called minor crops) and other wild-collected species, and the botanic gardens network can be mobilized to help select and conserve these species' germplasm. (See Box 6.3.)

6.44 Botanic gardens should increasingly cooperate with forestry agencies in the selection of indigenous species for reforestation, fuel wood plantations and other uses. (Often foresters rely on exotic germplasm just because its easier to get than the seeds of indigenous species.) Botanic gardens can cultivate

Box 6.3
Groups of Economic Plants of Priority for Botanic Gardens

Medicinal plants	Beverages
Fruits	Intoxicants
Fibres	Timber
Oils, waxes, tannins	Fuelwood
Vegetables	Forage and Pasture
Rootcrops	Wild Relatives of Crops
Ornamentals	Spices

indigenous forest species, study their seed-germination and storage requirements, assess their cultural characteristics, and make the results available for trials by foresters. If the indigenous species then pass muster, the gardens can work with foresters to establish seed nurseries (See Chapter IV.) In Sri Lanka, the Royal Botanic Garden--Peradeniya and communal nurseries are already undertaking joint projects under this model, and in Honduras the Lancetilla Botanic Garden and Experimental Station are working with neighboring local communities to produce fruit-tree germplasm.

6.45 Costs. The cost of maintaining an adequate germplasm collection of a species depends on whether the species is a tree, shrub, or herb, whether it is maintained as a seed sample under conditions of desiccation and refrigeration in a seed bank, in a field genebank, or as a clonal collection, or in tissue or cell culture. Also capital, maintenance, and labor costs differ from country to country. As a basis for calculations, a figure of $1,000 to $2,000 for an adequate sample of species per annum can be used. (This is several orders of magnitude less than for maintaining breeding samples of such animal groups as birds and vertebrates.) To maintain conservation collections of 20,000 plant species would thus cost $20 to 40 million per year -- in global terms, a very reasonable cost for ensuring the off-site survival of samples of a considerable percentage of the world's endangered species. To this, however, must be added the costs of strengthening the world's botanic garden network over the next decade: [$]

15a. *National governments should develop a network of new botanic gardens with minimum facilities in the tropics to complement conservation in protected areas.*

6.46 Objective. To establish botanic gardens in those areas of the world where most plant species are at risk and where most conservation action is needed.

6.47 Justification. The uneven distribution of botanic gardens in the world reflects history and politics, not the distribution of plant diversity. Most botanic gardens are in north temperate regions -- Europe has 540 and North America has 290 -- and together these contain fewer than 40,000 species. In sharp contrast, Latin America boasts just under 100 gardens, but these contain some 90,000 plant species. Moreover, many tropical botanic gardens have fallen into decline because they are no longer needed to introduce plants.

6.48 An encouraging development in the last decade is the creation of new botanic gardens in tropical countries (such as [ ] and [ ]). These are precisely the gardens that are needed to undertake local conservation and development in areas of high diversity. But their survival without substantial external support is doubtful. Relief could come in part from botanic gardens in temperate countries. These northern counterparts could "twin" themselves by providing funding or technical assistance, supporting staff exchanges, or lending support in some other way.

6.49 Costs. Creating a conservation-oriented botanic garden is costly, but if the land can be provided free by the state, local authorities, or private donors, and if the costs are shared among several public sectors, it should be possible to create the minimal facilities needed. Elaborate buildings and structures are not needed.

15b. *The Botanic Gardens Conservation Secretariat should establish a global database for the ex situ holdings of wild species, including both plants and seed, in botanic gardens, arboreta, and other centres such as crop genebanks.*

6.50 Objective. To collect and monitor data on *ex situ* collections of plants so as to strengthen conservation programs.

Justification. Most surveys of germplasm exclude the holdings of botanic gardens. So do today's agricultural genetic resource databases, though these at least contain data on some wild species. To fill this gap, a comprehensive database is needed that covers

holdings of all wild species (especially those of economic importance) in seed banks, botanic gardens, or other institutions.

6.51 Botanic gardens emphasize the conservation of rare and endangered species. Details of 60,000 accessions of threatened plants, representing 8,000 species in over 300 botanic gardens, are already held in the databases of the Botanic Gardens Conservation Secretariat (BGCS), and an estimated 12,000 to 15,000 threatened species are being cultivated. Seed accessions of thousands of wild species are in the seed banks and germplasm systems of several countries, but only for a small number of crops has there been any attempt to collect and organize this far-flung information.

6.52 The next few years will see heightened interest by the scientific community on traditional crops, species gathered from the wild, tropical tree crops under development, and many other categories only cursorily covered by international programmes. It is not possible to modify all the special purpose databases; nor would this serve the interests of countries. New databases incorporating data on a range of well-defined descriptors would serve the conservation community much better and would also foster interdisciplinary thinking among taxonomists, genetic conservationists, planners, developers and funders. The global database should be based on the Botanic Gardens Conservation Secretariat's existing cultivation database.

6.53 The world's botanic gardens hold an extraordinarily diverse array of specialist collections covering many plant groups -- bromeliads, cacti and succulents, orchids, palms, bamboos, alpines, rhododendrons, and primulas, to name but a few. Many other gardens have built up substantial collections from various regions, including many rare or endangered species. These collections need to be analyzed in detail and their value for conservation assessed. Catalogues and checklists of such species should be made available both electronically and in hard copy. In the BGCS' annual analysis of the conservation collections held by each member garden, the holdings of each should be compared with all others, including arboreta and other *ex situ* collections.

6.54 Many botanic gardens hold accessions of one or two individuals of rare or endangered species, and these should be propagated and duplicates made available for other gardens (especially those in the country of origin) and for their eventual return to the wild. Likewise, botanic garden holdings of plants that are no longer found in the wild should be propagated and duplicates provided as an insurance policy.

15c. ***Botanic gardens and arboreta should adopt strict procedures for sampling, documenting, and maintaining germplasm collections.***

6.55 Objective. To enable botanic gardens to fulfill their role as holders of *ex situ* conservation collections and form part of the world's germplasm system by adopting stringent standards developed by IBPGR and others for conserving crop germplasm.

6.56 Justification. The investment in plant accessions by botanic gardens is so enormous that it's merely prudent to try to ensure that the wild origin material that they hold is sampled and maintained in such a way as to make it suitable as germplasm for conservation, as well as for education and amenity value.

15d. ***National governments and non-governmental organizations should increase their use of botanic gardens as tools to help in reintroducing species to the wild and in habitat restoration and rehabilitation.***

6.57 Objective. To reintroduce threatened species to their natural, ecologically similar, or degraded habitats.

6.58 Justification. The main source of material for plant reintroductions (apart from the field itself) is botanic gardens. They have the facilities for raising seed and propagating material so as to build up the large stocks of plants needed for successful reintroductions or for habitat restoration or the regreening of degraded landscapes. Also, they are the most appropriate centres for studying the reproductive biology and cultural requirements of the plants to be reintroduced. In those many cases where botanic gardens are located near the locality where the reintroduction is to take place, the gardens can also monitor experiments over the long-term. (A number of botanic gardens have already gained some experience of reintroductions.)

15e. *The Botanic Gardens Conservation Secretariat should encourage the development of national and regional botanic garden networks.*

6.59 Objective. To maximize the strengths and impacts of every botanic garden by coordinating their conservation activities and stimulating new efforts through national or regional networks.

6.60 Justification. National botanic garden networks have already been created in Australia, China, Mexico, and other countries. These networks arrange regular meetings to coordinate policy, encourage the exchange of material and expertise, help reduce excessive overlap in functions and collections, share expensive facilities, and forge links with still other conservation organizations and networks. For instance, in *ex situ* conservation, a national network can arrange for certain gardens to grow certain species and designate one or more gardens to house seed banks and associated facilities or other expensive facilities (such as those needed for *in vitro* storage of germplasm). Regional networks or associations may be appropriate for clusters of countries with only a few botanic gardens each, though political constraints might alter some operations. Models include such regional networks as the Latin American-Caribbean and the Ibero-Macaronesian Associations of botanic gardens.

15f. *All botanic gardens engaged in conservation activities should subscribe to the principles laid down in The Botanic Gardens Conservation Strategy.*

6.61 Objective. To make botanic gardens a more powerful world force for conservation and give them the leading role in *ex situ* conservation of plant species

6.62 Justification. Although many botanic gardens hold collections of conservation value, only in the last decade or so have they played an active role in practical conservation. Indeed, in planning their joint Plant Conservation Programme, IUCN and WWF recognized botanic gardens as an important but neglected constituency for conservation. In 1987, IUCN established the Botanic Gardens Conservation Secretariat (BGCS) as an international network of botanic gardens committed to conservation. Now independent and more than 300 members strong, BGCS works for the adoption of the Botanic Gardens Conservation Strategy (WWF, IUCN, BGCS, 1989), which provides a rationale for involving botanic gardens in conservation and outlines their role in implementing the *World Conservation Strategy*. If all gardens concerned with practical conservation follow the policies set out in the Strategy, they will collectively make a huge contribution to global biodiversity conservation.

Action 16. Using the Global Botanic Garden Network as a model, build a germplasm conservation system to conserve medicinal plant species, especially those that are suffering genetic erosion or threatened with extinction.

6.63 Objective. To make sure that medicinal plant species are conserved to meet the needs of people using traditional medicines and to provide a resource for exploration for new pain-killing and life-saving drugs.

6.64 Justification. For the conservation and development of medicinal plants, botanic gardens are a natural institutional base. As population growth and habitat losses continue, many of the medicinal plants used in both traditional and modern medicines are becoming rare and losing much of their genetic variation.

6.65 Without the cooperation of botanic gardens, the future of many medicinal plants cannot be assured. For the increasing number threatened with local extinction, cultivation is the only way to ensure their availability. To help in this effort, several botanic gardens especially in China, India, Sri Lanka, and Indonesia, are studying cultivation requirements and providing seed sources. The cultivation of medicinal plants not only ensures continuity of supply but can provide a source of income.

6.66 Guidelines for the WHO, IUCN and WWF and a call for action is given in the Chiang Mai Declaration following a Consultation held by these organizations in 1988. (See Box 6.2.) [Add more description]

Aquaria

6.67 Aquaria share no common conservation concern or mission; nor do they fit into a single definition. Most were built as tourist attractions to stimulate the local economy. Some of these aquaria

Box 6.2
Chiang Mai Declaration on Medicinal Plant Conservation

[To be supplied]

violate conservation goals by harvesting the sea to continually replace display organisms to keep seashells, corals, dead animals, and other salable souvenirs in stock. Some also erect buildings in nearshore waters for underwater viewing, thus displacing the natural communities living there.

6.68 Yet, other aquaria are scientific institutions or interpretive centres involved in the conservation of important coastal ecosystems. Scientists studying sea otters at the Monterey Bay Aquarium and at Sea World/Hubbs Research Institute were active participants in trying to save sea otters and other marine mammals following the EXXON-Valdez oil spill in Alaska. Similarly, the Boston Aquarium's Edgerton Laboratory, actively involved in conservation biology, has directed a breeding programme network to maintain the diversity of African chichlid fish in Lake Victoria. Almost all aquaria educate the public about endangered species and marine conservation. Clearly, the potentially important role of aquaria in the conservation of biodiversity needs to be developed. Aquaria are proliferating, and their public influence is growing commensurately.

Action 17. Strengthen the role of aquaria in the biodiversity conservation.

6.69 Objective: To reduce the negative impacts of aquaria on biodiversity and enable these facilities and institutions to become tools for the conservation of biodiversity.

6.70 Justification: *Ex situ* conservation in aquaria is nascent. The main pioneer has been the Great Barrier Reef Aquarium, established in 1990 as part of Queensland's effort to protect the Great Barrier Reef system. If aquaria are to play the key role in conservation that they could, several challenges must be overcome. First, the aquaria must collect fewer organisms in the field to restock their displays, relying instead on carefully designed breeding programmes that work the opposite way -- re-introducing healthy species into the wild. Aquaria must also give increasing attention to organisms of key importance in the marine ecosystem, rather than focusing exclusively on charismatic or unique species. Finally, aquaria must also increasingly share information on captive rearing and maintenance techniques, rather than guarding this information as trade secrets.

17a. ***Aquaria should take on greater educational responsibility.***

6.71 Objective: To increase people's understanding about the nature of marine and freshwater biodiversity and about the risks that it faces.

6.72 Justification: Aquaria can show the public that marine organisms are not isolated individuals in tanks, but part of naturally occurring populations and communities and that these creatures survive only in a healthy and naturally productive environment. Aquaria can also serve conservation goals by stressing new information on marine species and ecosystems and by demonstrating the functional role that each display organism plays in the dynamic balance of life. Specifically, their educational programs should draw attention to threatened coastal and aquatic habitats and ecosystems and emphasize the detrimental effects of human activities on valued species and other human benefits.

17b. ***Aquaria should allocate more funds to scientific research.***

6.73 Objective: To build the knowledge base that aquaria needed to fulfill their roles as conservators.

6.74 Justification: Science is not a high priority in aquarium operations. Yet, successful maintenance and breeding programmes depend on good basic and applied research, so dual programme plans with both conservation and science goals are needed. The aim of such plans should be providing more satisfying environments for captive animals and for understanding adaptations important to biodiversity. In particular, understanding which organisms flourish in

an artificial environment and which suffer, and why, could shed light on how to adaptat wild-caught organisms to *ex situ* environments.

17c. *Commercial aquaria should provide financial support for conservation through a new fund for sustaining aquatic species and habitat diversity.*

6.75 Objective: To increase the linkage between aquaria and biodiversity conservation efforts in natural systems and to increase the financial support for *in situ* conservation.

6.76 Justification: Because commercial aquaria benefit from the diversity of marine and freshwater species, a share of their profits should be used to ensure that these resources are maintained in the wild.

17d. *Aquaria need to stop promoting or encouraging the capture of living marine organisms for display.*

6.77 Objectives: To minimize the collection of aquatic organisms for displays in aquaria.

6.78 Justification: The depletion of natural populations of species for display in aquaria, or for sale in curio shops associated with aquaria, can sometimes represent a threat to biodiversity. As aquaria become more integral components of biodiversity conservation networks, they must gradually give up the collection of wild species and turn to captive breeding instead.

Zoos

[Draft being prepared by Dr. George Rabb, Director Brookfield Zoo and Chicago Zoological Society; Chairman of IUCN Species Survival Commission; American Association of Zoological Parks and Aquaria.]

[Space permitting -- map of a selected region locating zoos, gardens, aquaria and other facilities, highlighting gaps and sites needing particular investments]

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VII. EXPAND UNDERSTANDING OF BIODIVERSITY

7.1 A major obstacle to the wise management of biological resources and the conservation of biodiversity is a lack of information, and what information there is too seldom gets to the people making or influencing decisions on resource management, either because its withheld by national governments and international development assistance agencies or because people are unaware of its availability. Even more striking is the level of scientific ignorance. Less than 15 percent of the world's species have even been identified and described by scientists, and even less is known about how species interact and how ecosystems function. When biotic resources are managed in such utter ignorance, of course actions are often misdirected.

7.2 Taxonomists, ecologists, resource managers, and resource economists have decried the lack of support for the research needed to reduce ignorance of biodiversity at the same time that decision-makers have criticized the scientific community for not providing the information needed for setting priorities and designing conservation plans. A pathological situation now exists -- research capacity is too small in most countries to meet the planners' needs or to help mobilize the benefits of biodiversity to meet local and national needs. Yet, without more complete understanding of biodiversity the public discounts its importance and nations allow valuable assets to be wasted.

7.3 To break free of this situation of chronic underinvestment in research, changes in both public awareness and in the nature of research will be needed. The three requirements of biodiversity conservation -- saving, studying, and using sustainably and equitably -- have been treated separately by researchers and policy-makers. As a result, funds needed for building the knowledge base needed in each area have not been forthcoming and information generated for one purpose does not necessarily meet other needs. But if biodiversity conservation were presented as a package of research and information oriented at mobilizing biodiversity to meet national needs, the incentive for investment in each area would be increased.

Action 18. Launch a ten-year campaign to build public awareness and support for biodiversity conservation.

7.4 Objective: To promote individuals' awareness about biodiversity and that of decision-makers in communities, governments, and international organizations so as to build commitment for the necessary investments and reforms required to meet the goal of biodiversity conservation.

7.5 Justification: The role that biodiversity plays in meeting human needs is poorly appreciated. Human dependence on the diversity of plants and animals for foods, ecosystem services, industrial commodities, building materials, water, waste recycling, nutrients, and other elements of the human ecosystem eludes or baffles most people. At best, it is half understood and completely taken for granted. Indeed, one chief reason that governments and communities don't protect key habitats and manage renewable resources sustainably is that they don't fully understand the potential human impacts of biological impoverishment and degradation. [Box on evaluation of awareness levels, e.g., the UNEP Harris Poll on Environment. Others?]

7.6 Thanks largely to the efforts of non-governmental organizations worldwide, more and more people are finally becoming aware of the loss of species and habitats -- especially such well known, odd, or particularly attractive species as the panda or elephant and such habitats under siege as wetlands, tropical forests, and old-growth temperate forests. But awareness won't expand fast or widely enough without the help of the media, religious and educational institutions, and conservation organizations.

7.7 Institutions Involved: Efforts organized by non-governmental organizations through campaigns and decentralized networks spread information and build awareness in culturally relevant manners efficiently and cheaply, and these groups have already built community bases. Thousands of conservation and development non-governmental organizations around the world already work on the protection, understanding, or use of biodiversity. Some promote national parks, others support research activities, and still others help develop community seed banks or improve forestry and agricultural practices. Their independence from political structures gives their messages added weight. Unfortunately, non-

governmental organizations are typically under-staffed, under-trained, and under-funded. But supporting those that disseminate information about biodiversity will have a big pay-off. [Boxes on IUCN's network, ELC, and other potential lead organizations?]

7.8 The World Conservation Union (IUCN), in partnership with the World Wide Fund for Nature (WWF) and the Environment Liaison Centre--International (ELCI), [and who else?] should establish a coordinated programme to help non-governmental organizations promote awareness about the value and status of biodiversity. This effort must be worldwide and must raise awareness of global issues (including deforestation and climate change) along with local ones. If community leaders collaborate with non-governmental organizations, local perspectives will help shape campaigns while local leaders will gain a better grasp of national considerations and perspectives.

7.9 Support for non-governmental organizations can help promote open hearings, town meetings, or national campaigns. All should be encouraged. In particular, national governments should endorse open hearings on biodiversity by consortia of the nation's non-governmental organizations, perhaps as part of the national planning process described in Chapter VIII.

7.10 Cost. Annual cost for the programme is $4.5 million, or $45 million for the decade. (This programme would be in addition to ongoing efforts that probably already amount to this level of investment.) Each of the lead organizations will require $500,000 to prepare materials, communications, and networking; and $10,000/year will be allocated to each of 400 non-governmental organizations. Many non-governmental organizations in developing countries rely to some extent on external funding for their activities. Over the 10-year period, bilateral and multilateral organizations should contribute $30 million to this programme through normal development assistance mechanisms: UNEP and UNESCO should each provide $5 million, and international NGOs and foundations should provide $5 million. A steering committee composed of representatives of the lead organizations and major funders, with an equal number of NGO representatives, will guide the network's activities.

7.11 Indicators of Success. Attitudes and decisions can change rapidly. In some cases, inappropriate investments can be dropped or reframed quickly. Some measures of success may include the initiation of a national biodiversity plan, the holding of national dialogues on biodiversity, the drafting and enactment of biodiversity legislation, the reversal and reform of inappropriate policies and perverse incentives, and new cooperative agreements among governments, NGOs or local communities to jointly plan and manage key sites, research, inventory, or sustainable development projects.

Action 19. Strengthen and expand networks of national, regional, and international Biodiversity Conservation Centres gathering and providing biodiversity information tailored to local and national needs.

7.12 Objective. To provide decision-makers with what they need to know to effectively manage biological resources, and to give local communities and nations greater access to biodiversity's potential benefits.

7.13 Justification. Useful information is urgently needed if wise decisions are to be made on biodiversity's protection or use. At a time when the world is swamped with data from remote sensing and satellite platforms, the basic data that a land manager or finance minister needs to make decisions concerning biodiversity if often missing. National and international information networks are needed to:

a. Monitor changes in biodiversity status and trends at genetic, species, and ecosystem levels, and trends in conservation action.
b. Provide information on biodiversity to national planners.
c. Provide the data needed to implement the proposed Biodiversity Convention and to monitor the implementation of the BSAP.
d. Provide base-line data for gauging future changes.

7.14 Such user-driven information networks must build on existing institutions. In particular, at the international level FAO, UNEP, and the World Conservation Monitoring Centre (IUCN/WWF/UNEP) already aggregate information at the global level. (As two examples, the FAO Commission on Plant Genetic Resources is developing a Status Report on Plant Genetic Resources, and the World Conservation

Monitoring Centre is publishing a Biodiversity Status Report as a component of the BSAP.) The primary need today is to establish national Biodiversity Information Centres that provide information locally and nationally and to strengthen international organizations' capacity to provide global summaries of those data.

7.15 National Biodiversity Information Centres must be more than "data storage facilities." National centres must be actively involved in efforts to save, study, and wisely use biodiversity, and must be closely linked to the entire range of user communities -- not just environment ministries or conservation organizations. A good example of the "cutting edge" of National Biodiversity Information Centres is The Instituto de Biodiversidad in Costa Rica (INBio), which works with protected areas, off-site facilities, governmental ministries, museums, universities, data bases, research institutions, and international networks. As shown in Box 7.1, INBio provides a bridge between the unexplored potential of diversity in the wild and the needs of a broad set of communities.

7.16 Where taxonomic inventory and systematics (the study of the kinds of organisms and the relationships among them) are rarely considered valuable for national planning, INBio makes this information useful to land managers and potential national users of biodiversity by actively tailoring the information to the needs of the users. INBio also provides an institutional structure that enables Costa Rica to enforce its sovereignty over its genetic resources. Whether housed in one institution -- as with INBio -- or many, this concept of finetuning information acquisition to meet user needs is vital. Instead of being dismissed as "just" basic science, inventory will be recognized as a prerequisite for a strong national effort to benefit from and preserve the natural wealth of a country.

19a. ***Nations should establish national or regional biodiversity "centres" to promote, through research and contractual relationships, a national programme to save, study, and use biodiversity.***

7.17 National and regional biodiversity information centres must be established or strengthened to undertake inventories, maintain collections and data bases, and build linkages to communities, governments, non-governmental organizations, industry, and other user constituencies. Such centres may be single institutions in certain provinces, regions, or countries, but, more often the centre's parts will be housed in various institutions.

7.18 As part of the establishment of such centres, support will be needed for national efforts to inventory biodiversity, to identify the information needs of governmental, non-governmental organization, community, and private-sector constituencies, and to provide this information efficiently to these groups. Also needed are technical assistance on the design and installation of centres, the training of personnel, the formulation of universal methods and procedures for managing data, and the establishment of contract procedures or licensing agreements for users in the private sector.

7.19 Cost: [Estimates of cost and benefits from INBio workshop, and elsewhere]

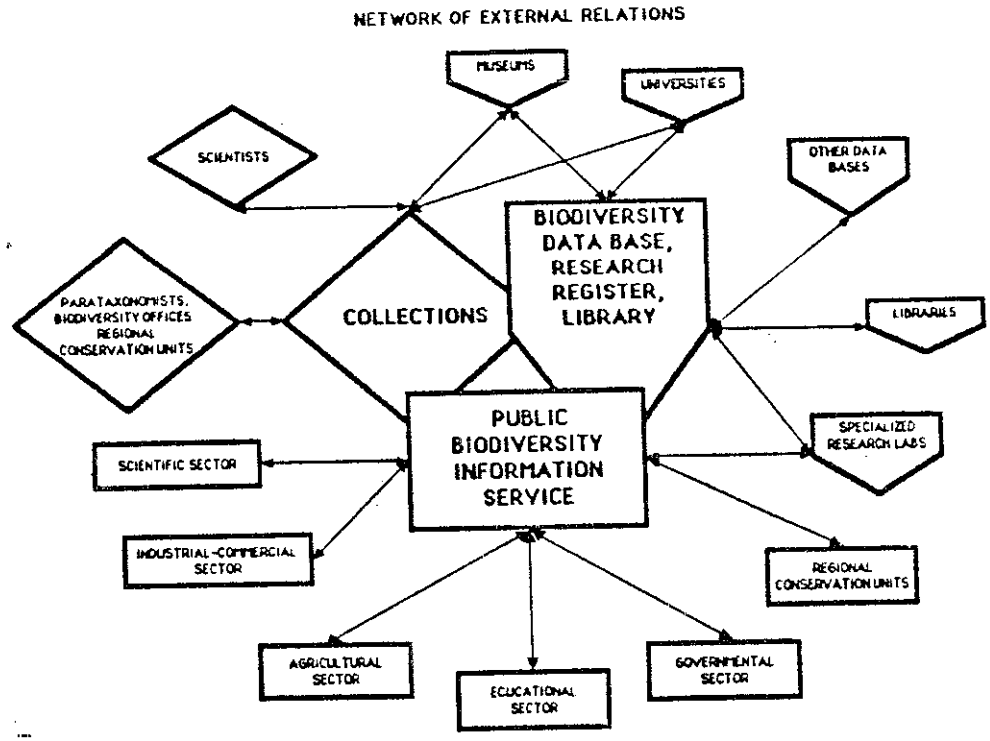
19b. ***Nations should undertake national biodiversity inventories as part of an integrated data network.***

7.20 Scientists need ten years of hard work to refine their understanding of the distribution and status of species and habitats. Support for their work must come in parallel with the establishment of the national or regional institutional structures for storing and retrieving the information easily. Efficient inventory techniques must be developed, staff trained to carry them out, and information maintained in convenient forms. As part of this effort, the number of experts in the taxonomy and distribution of the world's biodiversity must be increased substantially.

7.21 An excellent model for a user-driven detailed inventory project is the Flora of North America Project. The project will produce both published volumes and a computerized database and is expected to take about 12 years to complete. One of the first steps of the project was a workshop of professionals from a wide range of existing or potential user groups designed to determine how floristic information is being used and what could be done to make the information more useful and to encourage its use (Morin et al. 1989).

7.22 However, as a complement to the detailed

Box 7.1
National Biodiversity Institute of Costa Rica (INBio)



inventory work that must be undertaken, short-cuts and streamlined assessment techniques must be utilizied where time and money are severely limited. More rapid means of predicting regions of high diversity or endemism are needed since basic conservation priorities must often be set in the absence of detailed inventories. Here governments should consider utilizing rapid assessment techniques for biological surveys modeled after the techniques used in Bolivia by Conservation International. (See Box 7.2.) In addition, soil, climate, and topographical information alone can be used to roughly delimit regions of probable value for biodiversity conservation. This first-cut analysis can then be supplemented by information on plant or vertebrate diversity.

7.23 Of course, such tricks of the trade have drawbacks and limits. Particularly in the tropics, scientists do not yet know how well this streamlined approach will conserve other groups of organisms, such as insects. Comprehensive studies of all taxa at several research sites are needed to begin to answer this important question.

7.24 Until species are at least named and described, whatever properties and traits of potential use to humanity they might possess can't be assessed. Thus, needs for increased taxonomic research go hand in hand with needs for increased screening of species for their potential value as medicines, foods, or industrial products. Given the small number of taxonomists available, the relatively high cost of this type of research if undertaken by international organizations, and the size of the challenge, high priority should be given to enhancing the research and screening capacity of local institutions in developing countries. Since species inventory and local initial screening are labor-intensive and inexpensive, training individuals in developing countries to do this work will help build strong in-country capacity for studying and conserving biological diversity and create sorely needed jobs.

Box 7 2

Rapid Biodiversity Assessment

Conservation scientists and planners agree that more information is needed about rain forests and other high-biodiversity ecosystems to minimize the loss of species as deforestation in the tropics continues to accelerate

Within the 2 billion acres or so of tropical rain forests that remain today, biologists agree some areas are uniquely endowed with plant and animal diversity But few of the zones of known and suspected high biodiversity have been thoroughly studied And conservationists have not set out in a systematic way to devise conservation strategies for these areas

By the late 1980s, many prominent conservationists had begun to advocate a rapid approach to studying poorly known tropical forest areas, an approach that would combine disciplines and capitalize on experienced field biologists' ability to judge unfamiliar locations Scientists involved in this effort would work closely with local colleagues in the field and would present findings informally to in-country conservation groups and governments for immediate application to conservation and land use planning

Conservation International (CI) launched the first formal Rapid Assessment Program (RAP) in 1989 The CI team of four included an ornithologist, mammalogist and two botanists all widely respected authorities on neotropical biodiversity On each trip, local expert counterparts joined this core group, often from complementary disciplines Because RAP focused on areas where little scientific exploration or conservation action has been undertaken, this participation was critical Further research or protection in areas subsequent to a RAP trip invariably depends on local experts

The field methods used by the team include surveys of avian, mammalian, and botanical diversity using standard techniques such as tape recording, mist nets, botanical transects, and live capture of mammals in Sherman box traps At Alto Madidi in northern Bolivia, the RAP team used these methods over 12 days to document 403 bird species, 45 mammal species, and an abundance of woody species 34 percent greater than the average species diversity in tropical moist forests

Following Conservation International's first RAP expedition to Bolivia in mid-1990, the team met with Bolivian non-governmental organizations to discuss preliminary findings In presentations to the Bolivian Conservation Data Center and the University of San Andres, team members discussed priority areas for further study by Bolivian biologists and possible applications of the findings in land-use planning

Pending formal publication of the scientific findings from Bolivia in mid-1991, the RAP team has continued to work with the country's CDC, the University, and the National Herbarium, and both national and international conservation groups have begun to focus activities on the area identified in the first expedition A second expedition, to the Cordillera de la Costa in Western Ecuador, was completed in early 1991, and follow-up work is being carried out with the Escuela Politecnica Nacional and Ecociencia, an Ecuadorian NGO

The rapid assessment approach brings the experience and skills of the best field scientists to bear on areas of urgent conservation priority Its strengths lie in the caliber of the team members and the synergy of a multidisciplinary approach Its principal weakness are that there is no readily transferable methodology and no subsequent cross-checking to verify findings

7.25 Costs and benefits: This inventorying work could easily cost $500 million per year, with this amount set primarily by the current shortage of trained personnel rather than by the actual needs for inventory. But it will yield basic information about national biodiversity; strengthen the capacity to determine optimal expenditures to achieve national biodiversity conservation objectives; provide information of use in agricultural and pharmaceutical development; and build up the number of trained field biologists in each

country and the capacity to assess biodiversity trends in time to avoid costly corrective measures.

19c. *Governments should strengthen international biodiversity information centres to foster information exchange and to help set international priorities.*

7.26 If linked in a network, national biodiversity centres can be made more effective through the exchange of data and data management techniques. A fundamental step needed to establish such an international network of data centers is the establishment of one or more International Biodiversity Information Centers. Such centers could synthesize national information to better meet international decision-makers' needs, and could provide technical assistance and training for development of national and local networks.

7.27 Two key institutions that currently aggregate data on biodiversity for use by the international community are the World Conservation Monitoring Centre (WCMC) and FAO. The FAO Commission on Plant Genetic Resources plans to publish a periodic status report on crop genetic diversity. Because of the limited funding thus far available in the Fund for Plant Genetic Resources, however progress on this report has been slow, so national governments should provide the funds that the Commission needs to assemble and publish this report.

7.28 As part of the BSAP, the World Conservation Monitoring Centre plans to publish a biennial Global Biodiversity Status Report based on information held within the global network of data centres and presented in standardized tables by country. The data will describe not only the status and distribution of genetic, species, and ecosystem diversity, but also their management and utilization, together with the legal, financial, and institutional basis for conservation. These data represent the minimum core database needed to monitor and audit biodiversity through the networked national centres.

19d. *All national and international Biodiversity Information Centres should use the same set of basic indicators of the status and trends in biodiversity.*

7.29 Although conserving biodiversity is increasingly being accepted by policy-makers as an important component of sustainable development, attempts to implement conservation suffer from the lack of an analytical framework for establishing objectives, for monitoring status and trends, and for establishing priorities and targets. Without such a framework, biodiversity conservation may flounder. Unfortunately, most schemes for measuring components of biodiversity are mere "shopping lists" of scant use to policy-makers. The various indicators that have been proposed often accurately describe ecologically important aspects of biodiversity, but their development has been driven by what information is readily available, not by the needs of policy-makers or the clearly defined objectives of biodiversity conservation. A minimum set of indicators such as those proposed in Table 7.3 would provide a common framework for national and international decision-making.

Action 20. Establish an Early-warning System for Monitoring Potential Threats to Biodiversity.

7.30 Objective: To provide the public, governments, and non-governmental organizations with immediate information on hazards to biodiversity.

7.31 Justification: Much can be done to avert the wholesale loss of biodiversity in specific regions if adequate information on potential threats is available. If a development project is planned for a remote valley, non-governmental organizations or government institutions can arrange to collect traditional varieties of crops or wild relatives that might be lost. Agricultural research stations can collaborate with local farmers to strengthen community genetic resource conservation efforts. The environment ministry and national or international non-governmental organizations can speed up biodiversity assessments to ascertain if certain areas deserve to become protected areas.

7.32 The success of efforts to prevent biodiversity and cultural diversity loss hinge on advance notice. In some cases, advance notice of project plans allows NGOs or other institutions to generate basic data on needs and constraints that may cause planners to redesign or abandon inappropriate projects. Advance notice will also decrease the risk of crop failure in the event that genetic uniformity is increasing to dangerous levels. Among the threats that an "Early-Warning

Box 7.3
BIODIVERSITY STATUS INDICATORS

Species

1. Species Richness
2. Percent (number) of species threatened with extinction
3. Percent (number) of species threatened with extirpation
4. Percent of species with stable or increasing populations
5. Percent of species with significantly declining populations
6. Number of endemic species
7. Percent of endemic species threatened with extinction
8. Percent of endemic species in protected areas
9. Percent of threatened species in *ex situ* facilities
10. Percent of threatened species with viable *ex situ* populations

Habitat and Communities

11. Percent of (habitat)(ecosystem)(vegetation type) dominated by non-domesticated species
12. Rate of change from non-domesticated to domesticated
13. Percent of (habitat)(ecosystem)(vegetation type) in fragments greater than 10,000 hectares
14. Protected area coverage

Domesticated Species

15. Crop diversity index (Number of crops grown in a region as percent of number grown 10 or 50 years previously)
16. Crop varietal index (Number of varieties of each crop in a region as a percentage of the number grown 10 or 50 years previously)
17. Crop vulnerability index (Relatedness of varieties of a crop as based on pedigree information)
18. Percent traditional varieties in *ex situ* collections
19. Genebank status index (Percent of collection regenerated within past 15 years)

System" should monitor are:

a. National or international development projects, including dam construction and agricultural development projects.
b. Road construction.
c. Introduction of new crop varieties.
d. Increased genetic uniformity of crops.
d. Political, economic, or technical hazards to operation of gene banks.
e. Encroachment on protected areas.
f. Natural or human-caused climatic threats to biodiversity, including desertification, floods, drought, and global warming.
g. Plant or animal invasions.

20a. ***A non-governmental organization linked to WCMC, FAO, and UNEP should be established to issue worldwide alerts on impending threats to biodiversity.***

7.33 The network of national and international Biodiversity Information Centres described above should play a central role in monitoring these threats. However, a mechanism is needed for rapidly alerting individuals and institutions worldwide of impending danger.

7.34 This organization, with international funding, should act as a clearinghouse for information generated by national and global programmes on biodiversity threats. It should also prioritize those threats to draw attention to actions that may cause major losses of wild species, severely disrupt ecosystems, or otherwise threaten human livelihoods significantly.

20b. ***National Agricultural Programmes should institute "Genetic Diversity Checks" for major crop varieties.***

7.35 Objective: To minimize the risk of crop failure due to increased genetic uniformity.

7.36 Justification: The threat of genetic vulnerability helped stimulate the establishment of national and international crop genetic resource conservation networks in the past two decades. The $1 billion loss to the U.S. corn crop in 1970, followed by the weather-induced loss of much of the Soviet wheat crop in 1972 and the citrus cancer outbreak in Florida in 1984 were graphic -- and expensive -- reminders of

potential costs associated with genetic uniformity in agriculture.

7.37 With rigorous data in short supply, it is hard to judge the current threat posed by genetic uniformity, but it seems significant. For example, some 62 percent of rice varieties in Bangladesh, 74 percent in Indonesia, and 75 percent in Sri Lanka are derived from one maternal parent. In the United States, a survey by Don Duvick in 1981 revealed that genetic vulnerability was of "some concern" for 44 percent of breeders and was a "serious" concern of 10 percent. Duvick noted that in the ten years since the corn blight, there had been a notable increase in cultivar diversity in cotton and soybean but none in wheat.

7.38 What is most surprising about the current picture of genetic vulnerability, however, is that it is so unclear. Billions of dollars have been spent to respond to the threat of genetic uniformity, and yet no attempt has been made to monitor genetic diversity in agriculture, even though such measurements would seem to be the single best indicators of the status of crop genetic resource management and would certainly be the most relevant indicator of vulnerability to crop failures

7.39 To fill this gap, national agricultural research programmes should adopt a set of indicators of the status of crop genetic diversity in farmers' fields. (See also Box 7.3) These indicators will enable researchers to alert policy-makers to potentially serious declines in diversity that may undermine productivity or other components of farmers' security. A minimum set of indicators would be:

a) Number of species grown in defined regions.
b) Number of varieties grown in defined regions.
c) Genetic diversity of varieties grown in defined regions.

7.40 Actions Needed:

1. National agricultural research institutions should obtain and publish data on the area planted to specific varieties of crops in each province or state.

2. National agricultural boards or Plant Variety Protection Offices should require that breeders make available (at least confidentially) the entire pedigree of new varieties

3. National boards or the PVP office should publish yearly measurements of the genetic diversity of crops.

4. Review boards should establish guidelines to follow if such indicators reveal dangerous trends.

Action 21. Promote basic biological research related to the conservation of biodiversity.

7.41 Objective: To strengthen the scientific undergirding for wise policy and management decisions.

7.42 Justification: Scientists now know enough about the distribution of biological diversity, the threats that it faces, and the conservation tools available to maintain it so that current conservation efforts could be expanded considerably without fear of wasting effort or money. But important remaining gaps in knowledge will continue to hinder conservation and limit the benefits that biological resources can provide to humanity unless research programmes are greatly strengthened. Indeed, as understanding of biodiversity grows, so does recognition of the pressing needs for further research.

7.43 The current financial commitment to biodiversity research is extremely low. Only $24 million was spent by U.S.-based organizations (governmental and non-governmental, including universities and museums) on biological diversity research activities in developing countries in 1989 (Abramovitz 1991). This amounts to less then one-half of one percent of all foreign assistance provided by U.S. AID in that year. To make matters worse, only a small number of scientists are qualified to take on such research projects: no more than 1,500 or so professional systematists worldwide have been trained to carry out research on the taxonomy of tropical species (NRC 1980).

7.44 One of the highest priority needs for basic research has already been discussed: The need to accelerate inventory and systematics research. (See Action 19b.) But other needs include:

21a. *Governments should triple their funding of ecological research during the decade.*

7.45 Key research topics that should be supported with this increased funding are detailed in Box 7.4. Accelerated research is particularly essential in four areas of community and ecosystem ecology.

a. The relationship between biodiversity and ecological processes is poorly understood. Further research on water and nutrient cycling, energy flow in ecosystems, ecosystem stability, soil formation, and other processes will help scientists to more accurately predict how extinctions or land-use changes influence various ecological processes. Research on communities and ecosystems will help scientists find out which species are functionally redundant and which are keystone species whose loss is likely to reverberate throughout an ecosystem. Management strategies for biological resources could also benefit greatly from such work.

b. Research on the effects of fragmentation on biological diversity and ecological processes must be accelerated. Greater understanding of how fragmentation affects natural and semi-natural ecosystems will help planners improve the design of protected areas, help scientists develop management plans for individual species, and help them more accurately predict fragmentation's impacts on various ecological processes. Such research can also help conservationists identify species at risk of extinction due to fragmentation and manage habitat fragments in a "supersaturated" state -- with, that is, greater species richness than the area of the habitat would naturally allow. Further studies of the ecology of ecotones, edge effects, the effects of fragmentation on dispersal, and the utility of conservation corridors are also needed to aid in the design and management of protected areas.

c. Community restoration and rehabilitation of degraded lands are quickly becoming two of the most important tools for conserving biodiversity and for meeting people's needs for productive biological resources. Both techniques require greater knowledge than scientists now have of the ecology of the community being restored, and rehabilitation requires further knowledge of exotic species suitable for introduction. The potential impacts of climate change on ecological systems make the need for this research even more urgent. More particularly, the ability to predict the composition of communities following climate change must be enhanced so that restoration techniques can be used in anticipation of new climatic conditions, and new techniques are needed to help establish slow-maturing species now under climatic conditions that will probably prevail decades from now.

d. The monitoring of biodiversity and ecological processes, essential for decision-making, needs far greater research emphasis. Monitoring schemes, as well as sampling procedures for ecosystem and population data, must be redesigned to yield the maximum information useful to decision-makers at a minimum cost. Studies must be directed at easily monitored bellwether species that can reveal changes in the entire community or ecosystem. Toward these ends, greater use of remote-sensing techniques for monitoring should be encouraged in all countries.

7.46 Increased support is also needed to boost research in population ecology. The maintenance of biodiversity requires an understanding of the factors influencing the persistence of populations of individual species. The approach known as "population viability analysis," which attempts to determine the minimum viable population of species, is proving extremely valuable in assessing land-management options, management plans for single species, protected area designs, and ex situ breeding programmes. Further research into the demographic and genetic factors influencing small populations and support for the development of better models for population viability analysis are vital.

21b. *Governments and the Scientific Community should strengthen International Scientific Organizations so that they can play a more central role in global conservation efforts.*

7.47 Purpose: To increase international scientific collaboration and input into global and national conservation efforts.

[This section to be drafted through input from the International Union for Biological Sciences (IUBS), The International Council of Scientific Unions (ICSU), the Scientific Committee on Problems of the Environment (SCOPE), and other organizations, experts, and interested individuals]

Action 22. Promote basic social research related to

Box 7 4
Key Biodiversity Research Topics

1. Determine the ecological consequences of land- and water-use change through a functional understanding of how land conversion and water diversion affect ecological processes

2. Determine the evolutionary consequences of anthropogenic and other environmental changes

3 Inventory the patterns of genetic, species, habitat, and ecosystem diversity Determine the rates of change of biological diversity and the subsequent effects on community structure and ecosystem processes Accelerate research on factors determining diversity at all levels

4. Accelerate research on the biology of rare and declining species and develop the scientific information needed to sustain populations of potentially valuable rare and declining species

5. Determine patterns and indicators of ecological responses to stress so that the technologies needed to assess the status of ecological systems, to forecast and assess stress, and to monitor the recovery of damaged ecological systems can be developed

6. Accelerate the basic science of restoring damaged and degraded ecological systems by developing, testing, and applying principles of restoration ecology.

7. Advance, test, and apply ecological principles for the design and use of sustainable, managed ecological systems at appropriately large scales

(Source: Lubchenco et al 1991)

the conservation of biodiversity.

[To be written]

Action 23: Launch a decade of research and action on the role of ethics, culture, and religion in conserving biodiversity.

7.48 Knowledge about how ethics, culture and religion affect human behavior is an essential component in mapping any effective strategy for conserving biodiversity. To that end, action-oriented research and dialogue on ethical, cultural, and spiritual dimensions of biodiversity must be pursued seriously and systematically over the coming decade, with funding adequate for a serious effort.

7.49 This research and dialogue should follow three tracks. One should be aimed at strengthening the internal capacity of organizations directly promoting implementation of the Biodiversity Strategy and Action Plan to deal effectively with ethical issues and aspects. The second should be strengthening the capacity of national and international institutions to promote ethics of biodiversity. The third should be to strengthen the capacity of individuals and groups to take the lead in developing effective ethics of biodiversity in local regions. On all tracks, ethics research should be integrated with research in the natural and social sciences and with action for social change.

7.50 The IUCN Ethics, Culture, and Conservation Working Group, an international volunteer network, has developed a detailed proposal for "A decade of research and action on the role of ethics, culture, and religion in conserving biodiversity" in the framework of the Biodiversity Conservation Strategy Programme The proposal is the synthesis of input from 70 persons in more than 20 countries. What follows is a summary of the actions this group has called for.

23a. *Establish a biodiversity ethics task force to serve as an international focal point for a decade of research and action on biodiversity ethics.*

7.51 The informal task force organized under the Biodiversity Conservation Strategy Programme should be developed into an internationally representative and organizationally effective working group with expert capacities in environmental and development ethics, religion, the social sciences and humanities, the arts, and communications. Such a task force will require full-time staff and the substantial foundation resources to carry out serious investigation and dialogue.

7.52 The task force should begin working immediately with those organizations committed to implementing the Biodiversity Strategy over the next decade so that the best thinking on biodiversity ethics from around the world is fully integrated into the effort. Task force members should regularly take part in important biodiversity policy forums and symposia on basic ethical and cultural issues pertinent to biodiversity conservation. They should also systematically reach out to policy-makers and the public through publications and other media. After several years of work along these lines, a major international meeting should be held to consolidate findings and possibly propose a major Biodiversity Ethics Project under the auspices of the task force or an appropriate NGO or intergovernmental organization.

23b. *Major organizations committed to biodiversity conservation should, in collaboration with the Biodiversity Ethics Task Force, work to build the capacities of national and international organizations to promote biodiversity ethics.*

7.53 While the Task Force can play an important educational and catalytic role, major national and international institutions must themselves promote biodiversity ethics too. Partners in the Strategy Programme and the Task Force should collaborate with other major institutional initiatives to promote biodiversity ethics.

7.54 Major areas for such collaboration include: "Biodiversity and the World Ethic of Sustainability" (focussing on the international agencies and national government representatives most important to the debate on the meaning of sustainable development); "Biodiversity ethics and non-governmental organizations" (focussing on the emerging role of voluntary associations as primary vehicles for ecological responsibility); "Biodiversity Ethics and Law" (focussing on providing ethics perspectives in national and international attempts to draft environmental laws, conventions, and treaties); "Biodiversity Ethics, Business and the Professions" (focussing on development of professional and commercial codes for using biodiversity and on the nature and evolution of the modern corporation and its relationship to biodiversity); and "Biodiversity Ethics and the Academy" (focussing on the development of biodiversity ethics curriculum in schools and universities).

23c. *Conservation organizations, academic researchers, and governments should work together to build the capacity of individuals and groups to take the lead in developing effective biodiversity ethics in local bioregions.*

7.55 A bioregional approach to elaborating biodiversity ethics is crucial if ethics is to make a practical difference in conserving biodiversity. Often, the ethics most conducive to biodiversity conservation is grounded in the unique ecological and cultural history and resources of the local region and its special "sense of place." Moreover, the most effective citizen action on behalf of biodiversity comes from the people who are the most intimately acquainted with a region, who identify with it, wrest their livelihood from it, take pride in it, and are ultimately responsible for it. For this reason, action on biodiversity ethics should ultimately focus primarily at the bioregional level.

7.56 Work at the bioregional level should be led by inter-disciplinary teams from that region and be closely linked with individuals and communities closest to the issue at hand. Particular initiatives should be determined by people in the region itself, but they might include the following: comparative case studies on non-governmental organization, church, and other sponsored projects in which efforts to protect biodiversity deliberately reflect locally defined ethics and values; work with integrated conservation and development pilot projects to understand their ethical dimensions and inject ethical considerations into their design and implementation; inclusion of environmental ethicists as members of conservation and development project teams, much in the way that hospitals employ medical ethicists; community arts -- dance, music, public murals, community theatre, and the like -- that elaborate and promoting biodiversity ethics; research on the role of sacred spaces in

conserving biodiversity and on how to strengthen that role today; and assistance to grassroots groups trying to define their own ethics of biodiversity and to share their visions with other groups throughout the world.

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VIII. INTEGRATE BIODIVERSITY CONSERVATION INTO NATIONAL PLANNING

Action 24. Develop National Biodiversity Conservation Plans.

8.1 Objective: To ensure that every country integrates biodiversity conservation objectives into its planning mechanisms and documents by the end of the decade, thus laying the groundwork for developing its own capacity to save, study, and use biodiversity sustainably.

8.2 Justification: Virtually every country has some type of planning mechanism for setting policy priorities, allocating resources, and dividing authority and responsibility among government agencies, between national and local government, and between government and the private sectors. If well done, planning exercises can provide the basis for broader local and expert input, integration of sectoral efforts, and both increased and more effective international assistance. To date, however, very few national planning mechanisms or documents adequately incorporate biodiversity conservation, and until biodiversity conservation is firmly ensconced as an objective in planning, it will remain a low national priority.

8.3 Of course, such planning exercises must be viewed as tools that countries can use to develop their own priorities and capacities for saving, studying, and sustainably utilizing biodiversity. If national biodiversity conservation planning is perceived solely as an obligation imposed by the international community, little progress will be made.

8.4 At the same time, national biodiversity planning can provide countries with the capacity to define and articulate their own interests in the international arena. Development of a "foreign policy on biodiversity" is increasingly important in the context of proposed conventions or agreements on biodiversity, forests, and climate change, renegotiation of the General Agreement on Tariffs and Trade (GATT) and the International Tropical Timber Agreement (ITTA), and the increasingly important role of biodiversity conservation as a criteria for development assistance. Countries that have not set their own biodiversity priorities, assessed their own biotic resources, and determined both what they have to offer and what they want in return, are at a distinct disadvantage at the international bargaining table.

8.5 Mechanisms: A wide variety of planning mechanisms can be used to promote and integrate biodiversity conservation in development, and no one model is right for every country. In many countries, intermediate planning steps -- such as national conservation strategies, tropical forest action plans, or environmental action plans -- may be useful. All countries, however, should develop an explicit Biodiversity Action Plan to integrate scattered initiatives, ensure that the full range of biodiversity conservation issues are addressed, set priorities, and catalyze action.

8.6 While each country's Biodiversity Action Plan will reflect its own goals, history, opportunities, and constraints, there are certain principles and prerequisites for effective biodiversity planning that every country should consider. The following points echo the strategic principles and actions called for in previous chapters. The focus here, however, is on systematically integrating those principles and actions into formal planning mechanisms, processes, and documents.

Recommended Criteria for Developing National Biodiversity Plans

a. *Planning for biodiversity conservation must involve all sectors that influence biodiversity, not just the traditional "conservation" elements*

8.7 If biodiversity conservation is to go beyond the traditional agenda of protected areas, programmes to protect individual species, and ex situ conservation, then this broader mandate must be reflected in the institutional design of the national biodiversity planning process. Ministries or departments of agriculture and public works should negotiate together, along with park managers. In the forestry sector, agencies concerned with production as well as conservation must be represented. In short, the whole range of sectoral agencies whose activities affect or benefit from biodiversity should be given a chance to

present their views and priorities and be held accountable for how their planned activities and investments affect the country's biodiversity.

b. *Biodiversity planning must be a bottom-up and participatory process that reflects the insights and priorities of local government, natural and social scientists, and non-governmental organizations.*

8.8 While coordination between government agencies at the national level is essential to effective biodiversity planning, alone it is not enough. Many other actors and interests depend on biodiversity, influence it, and possess valuable knowledge and perspectives not available to -- and perhaps resisted by -- central government agencies. The insights of the scientific and academic community are valuable resources, and their participation should be eagerly sought and facilitated. Non-governmental organizations are often-forceful advocates for local people and for biodiversity conservation, and they should have a say in how biodiversity conservation plans are made. So should representatives of the private business sector.

8.9 Finally, the interests and perspectives of both local communities and local governments need to be directly represented in all national planning for biodiversity conservation. As a practical matter, this is often best accomplished through decentralized planning -- holding a series of state or provincial planning meetings that can form the basis for a national plan. This kind of "bottom-up planning" is often endorsed in the abstract, but it is truly effective only where the legal and administrative structure for planning formally requires it and financial resources are made available to facilitate it.

c. *Planning for biodiversity conservation requires political will -- which implies that ultimate planning authority be placed in the hands of agencies with real power.*

8.10 Where the locus of biodiversity planning is a relatively weak agency, the resulting plan is almost invariably ineffective. Effective planning requires leadership by one or more agencies with real power to allocate resources and set national priorities. In almost all cases, this means that agencies charged with management of protected areas should not be the political centre of a biodiversity planning process, even though they will certainly be important participants. Rather, ministries or departments of planning or finance -- or those with equivalent power -- should serve as political catalysts for biodiversity planning. Such agencies are also frequently more effective in eliciting cross-sectoral cooperation than such sectoral agencies as forestry or wildlife.

d. *Biodiversity planners must establish clear objectives and set clear priorities, not merely develop a "wish list".*

8.11 Effective biodiversity planning is as much a matter of deciding what **not to do** as it is of deciding what to do. Financial, human, and institutional resources for biodiversity conservation are limited. A lengthy list of everything that might be done with unlimited resources is no plan at all.

8.12 Effective biodiversity planning begins with the elaboration of national objectives, derived from a broad-based participation and consultation. Once a consensus forms on objectives, substantive priorities can be set, and corollary priorities for policy reform, legal change, institutional strengthening, human resources development and investments in the field can be developed.

8.13 Because hard choices must be made in biodiversity planning, lengthy negotiation and compromise are essential. If any party walks away from the table with everything asked for, either the party has been fooled, or someone else is being short-changed. An effective negotiation and compromise among all stakeholders takes time and costs money, and it is likely to be initially contentious. But there is no other way to develop a plan that is truly "national" and that has a prayer of being implemented.

e. *Policy reform and institutional change must be central elements of biodiversity planning, not just raising and spending money.*

8.14 Most national environmental planning exercises have focussed excessively on developing projects for investment and getting them into the national plan, particularly as more funding becomes available for biodiversity conservation. In most cases, however, increased funding without attention to policy reform and institutional change is a waste of money.

Boxes on National Biodiversity Planning

This chapter will include two boxes providing examples of efforts to integrate biodiversity into planning: Tentatively these will cover Indonesia's National Biodiversity Action Plan and California's Biodiversity Conservation Strategy Each box author will be asked to address the following issues:

a. Brief introduction on the biological, economic values of the country's biodiversity, and the rates of loss

b. Catalysts for development of the plan (e g public pressure, development assistance agency interest, legislative mandate, increased awareness by policymakers, etc)

c Historical, institutional, and strategic reasons for choice of the mechanism chosen (e g Environmental Action Plan in Rwanda, TFAP in Ecuador, Biodiversity Action Plan in Indonesia, Biodiversity Strategy in California)

d. Process by which the plan was developed (how broad was participation, and how was that participation manifested in the process), with a specific focus on how biodiversity was conceptualized and considered in the process

e What the plan contains (focusing on biodiversity components, where the plan in question is broader in scope than just biodiversity, as in the case of Ecuador and Rwanda/Madagascar)

f. Implementation and impact of the plan; strengths and weaknesses

At worst, it may actually reinforce the effects of perverse policies and inappropriate institutional arrangements

8.15 Before any biodiversity conservation investment or project is decided upon, the policies and institutions that influence it should be scrutinized. Where weaknesses and problems are identified, concrete plans for eliminating or reducing them should be incorporated into the plan Since planning is too often equated with haggling over how to spend money, a focus on policy and institutional reform must be explicitly written into the legal terms of reference for biodiversity planning and championed by the agencies and individuals taking the lead in planning.

f *The full range of conservation tools and technologies must be considered in developing biodiversity conservation plans.*

8.16 No single tool, like national parks, zoos, agroforestry or seed banks, can meet all the objectives of biodiversity conservation The full range of available tools must therefore be systematically considered in developing national biodiversity action plans Traditionally, however, the range of in-situ and ex-situ conservation tools discussed in Chapters V and VI have been developed piece-meal, each managed in relative isolation, by separate agencies and private institutions. As a result, there is little shared understanding of the advantages and limitations of each approach, and different tools are not developed in ways that would support each others objectives.

8.17 To remedy this problem, a national biodiversity planning process should first work with those institutions associated with each conservation tool to articulate the role of each approach, its relative strengths and weaknesses, and the policies and actions needed to strengthen its contributions to biodiversity objectives. Second, the full range of these tools should then be incorporated into the plans for each traditional sector. Land use plans, for example, should employ appropriate ex-situ options to those habitats that require special forms of protection and use Forestry, agriculture and fisheries plans should determine which species and genetic resources require protection within mixed-use systems, or propagation, captive breeding or removal to off-site facilities, such as zoos, botanic gardens, seed banks or experiment stations.

8.18 Some species can best be protected through

small scale reserves and extractive systems within community farming and forestry schemes, orchards or gardens. Thus, in addition to the larger public resource management agencies, some conservation tools can best be applied directly by local groups, further strengthening the rationale for their involvement in the planning process.

8.19 Finally, planners and policy makers need to incorporate research, inventory and information management activities into programmes and budgets when considering each conservation tool. Anotherwards, not only should the full range of conservation tools be utilized; explicit plans for strengthening the capacity of each conservation tool also need to be a part of the process.

g. *Biodiversity conservation planning exercises must include systematic attention to implementation.*

8.20 Environmental planning and "national plans" of any sort have earned a bad name among those eager for effective action. All too frequently, elaborate plans are developed only to languish forgotten on the shelf. Lack of political sponsorship and broad participation may be to blame, or lack of attention to capacities for plan implementation, or both. Clearly, the capacity of institutions to absorb new funding and take on new activities, the need to provide long-term financial support for initiatives beyond the life of a specific project, and the need for mechanisms for monitoring plan implementation have been neglected.

8.21 One reason that implementation issues get overlooked is that institutions' formal mandates are often confused with their capacities to operate in the field. Ministries of forestry in many countries, for example, are legally responsibly for managing vast portions of the country's public forest estate, but do not actually plant or harvest trees in much of this estate. In fact "management" is the aggregate result of activities by local communities, commercial interests, and others, with only sporadic interventions by forestry officials. Similarly, non-governmental organizations are also frequently plagued by the divergence between the formal mandates they set for themselves and their actual capacities to foster community empowerment or conserve specific habitats on the ground.

8.22 If biodiversity planning is to be effective, the institutions involved must resist rote reiteration of their formal mandates and instead honestly evaluate their strengths and weaknesses. Based on this evaluation, they should then accept re-allocation of authority and responsibility where indicated and decide what needs to be done to strengthen their role in implementing the biodiversity conservation plan.

h. *Biodiversity conservation planning should take international and foreign policy dimensions into account.*

8.23 Many international forces impinge on the options a particular country has in planning its future and the role of biodiversity in that future. Among these are trade relations and agreements, debt burdens, development assistance policies, pesticide marketing and agricultural commodity markets. While a national plan will not be able to control these forces, it can attempt to shape their effects.

8.24 In addition, countries are increasingly called upon to participate and take a stand in international forums relevant to biodiversity. Countries with a comprehensive and effective national biodiversity plan automatically have a stronger hand at the international environmental bargaining table. To the extent that national planning processes explicitly take international demands and dimensions into account, that hand is better still.

IX. BUILD NEW MECHANISMS FOR GLOBAL COOPERATION

9.1 While citizens and governments everywhere must set the priorities and take the lead in slowing biodiversity loss, no government or people can do it alone. Global cooperation is essential in the coming decade. A wide range of avenues for cooperation already exist, ranging from governmental treaties to non-governmental organization and scientific networks. To capitalize on their strengths, these mechanisms should be fortified. But new complementary mechanisms are also needed. In particular, a global agreement or convention on biodiversity should be negotiated and implemented in the coming decade, and new mechanisms for mobilizing and spending new biodiversity conservation funding wisely need to be developed.

9.2 In both strengthening and developing new instruments and institutions, narrow definitions and structures of "international cooperation" must be expanded. All too frequently, "global cooperation" is taken as a synonym for agreements between governments and the institutional arrangements such agreements necessitate. But, however important, intergovernmental agreements and institutions are not the only -- or in all cases the most effective -- vehicles for global cooperation and action.

9.3 International conventions, for example, in themselves achieve very little. They are simply statements of common purpose and commitment by governments. No government is likely to enter into or comply with commitments involving sacrifice or expense unless it has adequate funds and technical support. Increasingly often, this requires taking environmentally sound development paths and operating within the constraints of the biosphere. Ironically, those development pathways make the international conventions themselves less necessary. For this reason, the discussion of international conventions must be based upon and backed by much more practical action.

9.4 Since biodiversity loss is a global and a local threat as well as a national one, citizens and local communities have a legitimate right to directly express their views and press their claims in the international arena, through a variety of means. Indeed, non-governmental organizations, scientific, and religious networks, the international media, and a variety of other vehicles and forums for global debate and cooperation number among the others already playing important roles.

9.5 Governments must come to respect these new vehicles for cooperation as allies, rather than considering them competitors. The global biodiversity dialogue must be seen as a multifaceted process, serving diverse interests in diverse ways.

Action 25: Strengthen the implementation of current inter-governmental conventions and agreements.

9.6 Though not the sole mechanisms of global cooperation, intergovernmental agreements and institutions nevertheless provide extremely important opportunities for global progress on biodiversity conservation. Many conventions and agreements on biodiversity have already been negotiated, and they could help slow biodiversity loss if implemented effectively. Most, however, are not attaining their objectives because participants lack of political will and funds, or, less often, because the instruments themselves are unenforceable.

[The following sections on specific treaties and conventions will be filled in over the coming months, in consultation with their governing secretariats and independent experts, particularly those of the IUCN Law Centre. It is also expected that the deliberations of the "Global Consultation on the Development and Enforcement of International Environmental Law with a Special Focus on Biological Diversity", to be held in The Hague in August, 1991, will contribute substantially to this section.]

25a. *The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971)*

25b. *The Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris, 1972)*

25c. *The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Washington, 1973)*

25d. *The Convention on Conservation of Migratory Species of Wild Animals (Bonn, 1979)*

25e. *The Convention on the Conservation of Antarctic Marine Living Resources (1980)*

25f. *The FAO International Undertaking on Plant Genetic Resources (Rome, 1983)*

25g. *The International Tropical Timber Agreement (Geneva, 1983)*

Action 26: Negotiate and implement a Convention on Biological Diversity.

9.7 While the agreements discussed above could contribute significantly to biodiversity conservation, even if they were all strictly observed and enforced they could not collectively either cover either the world's threatened biodiversity or all the issues of use and ownership. As understanding of biodiversity's broad scope and importance grows, so does the impetus for a comprehensive biodiversity convention.

9.8 The key components of the Biodiversity Convention should be:

a. A commitment by governments to survey their natural living resources -- both domesticated and wild -- and conserve sites of particular importance for their biological diversity, as well as species and domesticated varieties threatened with loss;

b. The establishment of a tripartite system of rights and obligations that holds that: i) conserving biodiversity is humanity's and all nations' common responsibility; ii) states have sovereignty over the biodiversity contained within their borders; and iii) farmers and local communities whose labor has helped shape the genetic resources available today have rights over local genetic resources and rights to compensation for their work in molding those resources.

c. The establishment of a funding mechanism and the provision of both technical and financial assistance to countries in need of support for their work surveying, characterizing, and conserving biodiversity.

d. The regulation of access by would-be users of biological diversity; it's use should be controlled and appropriate charges levied to ensure that the countries and communities that are the custodians of the earth's biological richness benefit from its utilization;

e. Arrangements by which the commercial exploiters of biological diversity help pay for the conservation of that diversity in the countries that give it refuge.

f. The establishment of a monitoring and early-warning system to alert governments and non-governmental organizations of potential threats to biodiversity.

[Governments are currently negotiating a Convention on Biological Diversity, under the auspices of UNEP; it is hoped that the near-term outcome of that process will be clearer by September 1991 and can be incorporated into this document. UNEP, the IUCN Law Centre, and the Hague Consultation noted above, will be major sources of input.]

9.9 Finally, close links must be established between the biodiversity convention and the proposed climate convention and forest agreements. (See Box 9.1.) At a minimum, governments must ensure that the climate convention and forestry agreements are compatible with the actions called for in the biodiversity convention and the BSAP. Governments should also consider formally linking the forestry agreement to the biodiversity convention as one of a number of protocols.

Action 27: Mobilize $1 billion per year in additional international investment in biodiversity conservation, utilizing new and innovative mechanisms to both raise and spend it.

9.10 Just as society invests in education and health, it should also invest in the conservation of biodiversity. Even obliterating the root causes of biodiversity would not obviate the need for zoos, botanical gardens, and seedbanks. Similarly, the needs for funds and training for managing wildlands are perennial, just like those for education.

Box 9 1
Conventions on Biodiversity, Forests, and Climate Change
Ensuring Linkage and Consistency

Governments are currently involved in negotiation of conventions or agreements on not only biodiversity, but on forests and on climate change These processes must be mutually supportive, for the issues at hand are indeed inextricably intertwined Tropical forests constitute the greatest part of the earth's biodiversity, and deforestation is one of the main causes of species loss at the present time Forests also constitute living "sinks" for atmospheric carbon, as well as sources of atmospheric carbon when standing forests are burned Accordingly, an agreement on forests must include criteria related to biodiversity and must mesh with the development of a biodiversity convention An agreement on forests must, in turn, be linked to the climate change convention, and the treatment of forests in the climate context must take biodiversity factors into account

There are certain cross-cutting strands evident in all three of these proposed international instruments One is science All are about protecting complex environmental systems from human impacts, and managing human activities to that end To do this efficiently we need to understand these systems and their response to human impacts, and we need to develop the technological capacity to either abate the causes of those impacts and develop new and non-disruptive patterns of industrial and other development

Another cross-cutting thread is the need for survey and monitoring We are still ignorant about the precise locations of the areas which are most suitable for conversion to agriculture and industrial uses, those areas that should be preserved as key repositories of biodiversity, and those areas which can support sustainable production under their present vegetation cover, as some forests are capable of Additionally, all of the proposed conventions will require criteria and mechanisms for monitoring parties' performance

A third common strand is the need for economic assistance to the developing countries in order to take steps which they may be willing to take except for the lack of essential resources This is particularly relevant in the biodiversity context, since those countries with the greatest biodiversity are relatively poor in financial and technical resources

A fourth strand is the burden of responsibility on the more industrialized countries to reduce their impact on the biosphere through cutting back on their emissions of potentially damaging substances A major step forward has come through the wide acceptance of the Montreal Protocol, and hence the promise to eliminate CFCs Less progress is being made in the acceptance of the need to stabilize emissions of other greenhouse gases This lack of progress not only directly impacts on the biosphere, but also presents a political obstacle when developing countries -- with considerably less resources -- are asked to alter their own development paths with relation to greenhouse emissions, forests, and biodiversity conservation

A fifth common strand lies in the linkages of issues raised in all three convention contexts to the world economic and trading system It may well be that none of these interlinked international Conventions can implemented -- or even negotiated -- without attention to these factors

9.11 Even though biodiversity is a common concern of all humanity, the primary source of funds for biodiversity conservation has always been national governments. Since funding for biodiversity conservation is one or two orders of magnitude below the level needed to maximize the social welfare from biodiversity, and since developing countries face serious financial constraints, significant additional financial resources must be mobilized.

9.12 Some initial attempts have been made to increase international funding for biodiversity conservation. Several of the conventions discussed above include funding mechanisms (in all cases less than $2 million per year), and various international planning mechanisms have helped stimulate increased financial commitment to conservation. Bilateral and multi-lateral development agencies have also increased their financial support for biodiversity conservation

conservation activities, including both government agencies and non-governmental organizations, have historically been financially strapped so a sudden infusion of large sums over short periods of time could overwhelm them. Moreover, many long-underfunded organizations need long-term operations and maintenance funds even more than they need project funds.

9.25 One of the most promising avenues for addressing both boosting absorptive capacity and satisfying the need for long-term financial support for biodiversity conservation activities is the establishment of trust funds or endowments for biodiversity conservation. Such funds could i) stimulate organizations to expand their technical capacity because they are assured of a long-term funding base, ii) help finance the recurrent costs of protecting areas or *ex situ* management, and iii) represent diverse interests involved in biodiversity conservation (through a board of trustees).

Action 28: Strengthen the influence of international non-governmental organizations networks in intergovernmental institutions concerned with biodiversity conservation.

9.26 Non-governmental organizations are already exerting important and positive influence on inter-governmental negotiations and institutions related to biodiversity. They have a much more substantial role in preparations for the 1992 UNCED conference than in any previous UN conference. Numerous non-governmental organizations are registered observers at the biannual meetings of the ITTO, and some sit on their government's official delegations. IUCN's Law Centre made important contributions to the initial stages of the Biodiversity Convention drafting process Many non-governmental organizations have been non-voting participants or observers in meetings where the conventions have been negotiated, and some have helped monitor their implementation. The World Bank has increasingly recognized the legitimacy of non-governmental organizations, and has set up a number of mechanisms for consulting with them on policies and projects. Overall, this increased interaction has improved the quality of intergovernmental efforts, increased accountability, and built public support for treaties such as CITES.

9.27 But non-governmental organizations' roles in inter-governmental institutions are constrained by a number of factors Chief among these are official suspicion, denial of access to information, and lack of the financial resources needed to attend international meetings. In addition, many non-governmental organizations, especially those in developing countries, lack the capacity for data analysis, policy research, media liaison, and other public outreach. Finally, questions of non-governmental organizations' accountability to their constituencies arise, especially where the social and physical distance between the international NGO's representative and the communities affected by the issues under discussion are great. This is particularly true when non-governmental organizations in the North try to represent their NGO colleagues in developing countries, colleagues who in turn try to represent rural communities and others at some distance from themselves.

28a. *Governments and intergovernmental institutions should accord non-governmental organizations greater access and respect in intergovernmental forums that deal with biodiversity issues.*

9.28 National governments, and their representatives in intergovernmental institutions, can do much to strengthen the role of non-governmental organizations in intergovernmental biodiversity affairs They should support formal observer or participant status for non-governmental organizations in negotiations and regular meetings, and welcome them collegially. Governments should also revise the many rules that restrict NGOs' timely access to information required for informed participation. Loosening governmental secrecy rules is one key; another is translating relevant documents into the language of affected nations and communities. Governments should also increase funding support for NGO participation in key negotiations and meetings; a seat at the table without a plane ticket to get to the table is not enough.

28b. *Donor organizations should invest in building non-governmental organizations' capacities for information management, data analysis, policy research, advocacy, media liaison and public outreach.*

9.29 If non-governmental organizations are to exert more influence on government deliberations on the

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world's biodiversity, their capacities need to be built up considerably. Donor organizations, whether governmental or private, can contribute greatly to building these capacities through well-considered projects and programmes in data management and analysis, policy research and writing, language skills training, accounting, publications development, media outreach, and public awareness.

28c. *NGOs should examine and strengthen their accountability to their constituencies.*

9.30 Many international non-governmental organizations involved in biodiversity conservation are urban-based organizations working on behalf of rural peoples and communities, often located on different continents. In the context of inter-governmental institutions and conventions, "the rural poor" can become an abstraction, rather than flesh and blood people with strongly held convictions and positions on the issues at hand. Compromise may be the lifeblood of negotiation, but nobody elected environmentalists in Washington, Nairobi, or Jakarta to compromise on behalf of rural communities without consulting with them first. The misunderstandings stemming from such relationships have increasingly colored non-governmental organizations' participation in inter-governmental affairs and can threaten the legitimacy of NGO efforts in the eyes of both governments and local communities. As non-governmental organizations become ever more involved in intergovernmental biodiversity affairs, they must redouble their efforts to remain accountable to those whose interests they speak for.

Action 29: Non-governmental organizations should strengthen and increase their independent biodiversity activities and campaigns at the global level.

9.31 While participation in intergovernmental biodiversity affairs and institutions represents a key NGO role for the 1990s, it is by no means the only one. Working strictly in this arena will stifle creativity, boldness, and innovation. Indeed, non-governmental organizations should continue to take an independent stance, campaign for fundamental changes, and put forward ideas and solutions that governments are not yet ready for. While some groups should be at the bargaining table, others should serve as watchdogs, calling the bluff of empty rhetoric and holding intergovernmental institutions accountable for their actions and their promises.

9.32 Such independent NGO activities need not all be confrontational, however. For example, the Keystone International Dialogue Series on Plant Genetic Resources conducted under wholly independent NGO auspices, are an exercise in consensus-building between all concerned parties.

Action 30: The United Nations General Assembly should declare an International Biodiversity Decade to put the actions called for in this Action Plan into practice.

[A draft resolution will be developed over the coming months. Input of all interested readers is requested.]

Chapter Citations

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ANNEX I: Priority regions for biodiversity conservation

The following regions have been identified by various studies and reviews as being of particular importance for biodiversity conservation because of one or more of the following factors: i) high species richness, ii) high species endemism, or iii) high level of threat to species. This list should be used as a first-cut in identifying the 200 Biodiversity Conservation Regions (BCRs) discussed in Action 11. Obviously, many of the regions are far too large to be managed as one entity, thus some may ultimately include several BCRs within them. In addition, other regions not on this list will be added through further research and consultation.

Nearctic Realm

California Floristic Province [6,2]
Southern Appalachian Uplands - Great Smoky Mountains of USA [2]
- *Great Smoky Mountains National Park*
- *Coweeta Experimental Forest*
- *Cherokee National Forest*

Note: The Hawaiian Islands are part of the Oceanian Realm; the Everglades are Neotropical.

Palaearctic Realm

Baetic Mountains and sub-Baetic Mountains of Spain [2]
Canary Islands [2]
European Alps of Austria, Italy, and Switzerland [2]
High Atlas Mountains of Morocco [2]
Jabal al Akhdar of Libya [2]
Liang Shan Mountains of China [2]
Mountains of the Balkan Peninsula [2]
Mt. Omei of China [2]
Subtropical Forests of Yanbaru, Okinawa [2]
Taurus Mountains of Turkey [2]
Troodos Mountains of Cyprus [2]
Tropical Rain Forests of Hainan, China [2]

Note: See Eastern Himalayas under the Indomalayan Realm)

Afrotropical Realm

Air and Tenere of Nigeria [4,2]
Cape Floristic Province of South Africa [8,4]
Coastal Forests of Kenya and Tanzania [4,2]
Cote d'Ivoire [8,4]
Eastern Forests of Zaire [2]
Forests of southwest Ethiopia [2]
Fouta Djallon of Guinea [3,2]
Gebel Elba of Egypt and Sudan [2]
Gola Forest [4,2]
Great Dyke of Zimbabwe [2]
- *Serpentine flora*

Haute Katanga of Zaire [2]
Huilla Plateau of Angola [2]
Imatong Mountains of Sudan [4,2]
Kalahari Sands of Zambia, Zimbabwe, Botswana, and South Africa [2]
Loma Mountain [4,2]
Lowland Rain Forest of Cameroon [2]
Lowland Forests of Zaire, possibly Ituri Forest [2]
Madagascar [2]
- *Eastern Madagascar* [7,4]
- *Western moist forests* [2]
- *Southern Spiny Thicket vegetation* [2]

Mbala District of Zambia [2]
Mt. Cameroon [4,2]
Mt. Mulanje of Malawi [4,2]
Mt. Nimba [4,9,2]
Mt. Kenya [4,2]
Northern Somalia [2]
Simien Mountains [2]
Socotra Island [2]
Tai Forest of Cote d'Ivoire [4,2]

Indomalayan Realm

Northwestern Borneo [7]
Borneo [2]
- *Bako National Park, Gunung Mulu National Park, and Lambir Hills (Sarawak)*
- *Bukit Raya, Kutai (Kalimantan)*
- *Kinabalu Park (Sabah)*
- *Ultramaphic flora of northeast Borneo (Sabah)*

Bolovens Plateau of Laos [2]
Binh Tri Thien of Vietnam [2]
Christmas Island of Australia [2]
Cuc Phuong of Vietnam [5,2]
Eastern Ghats [2]
- *Nallamalai, Andrah Pradesh of India* [2]

Western Ghats (IM Review 1986) [5,2]

Agastyamalai Hills [2]
Great Nicobar Island [5,2]
Eastern Himalayas [7,5]
Fan Si Pan area of Vietnam [2]
Namdapha, Arunachal Pradesh, India [2]
Western Himalayas
Nanda Devi, Uttar Pradesh of India [2]
Java [2]
Gede-Pangrango National Park
Kenting National Park of Taiwan [2]
Langbian Plateau of Vietnam [2]
Mascarene Islands [2]
Nilgiri Biosphere Reserve [2]
New Amarambalam Reserve [2]
Silent Valley [2,5]
Peninsular Malaysia [7,5,2]
Endau-Rompin
Limestone flora
Montane flora: Cameron Highlands, Genting Highlands, Fraser's Hill, Kedah Peak
Northwest Peak region: Gunung Perak, Pangkor Island, Kedah, Segari Melintang Forest Reserve, Penang, Dindings area
Philippines [7,5,2]
Limestone flora of Luzon
Lowland rain forest of Samar
Lowland rain forest of Sibuyan Island
Mt Apo (de-gazetted as a National Park)
Mt Giting-giting (Sibuyan)
Mt Pulog
Palawan
Sierra Madre Mountains of northern Luzon
Seychelles [2]
Sri Lanka [6,5]
Horton Plains [2]
Knuckles [2]
Peak Wilderness [2]
Sinharaja Forest [2]
Sulawesi [2]
Limestone flora
Lore Lindu National Park
Mt Rantemario
Ultramaphic flora, possibly Morowali National Park
Sumatra [2]
Gunung Leuser National Park
Limestone flora
Mount Kerinci
Siberut

Oceanian Realm

Hawaiian Islands [2]
Juan Fernandez Islands of Chile [2]
Lord Howe Island of Australia [2]
Marquesas Islands [2]
New Caledonia [7,2]
Rain Forest of Fiji [2]
Rapa [2]
Rapa-Nui National Park
Western Caroline Islands [2]

Australian Realm

Kakadu National Park [2]
Kosciusko National Park of Australia [2]
Southwestern Australia [6,2]
Temperate Rain Forests of southwest Tasmania [2]
Tropical and Sub-tropical Rain Forests of northeastern Australia [2]
A portion of the central dry region of Australia [2]

Antarctic Realm

North Auckland region of New Zealand [2]
Chatham Island of New Zealand [2]
Insulantarctica

Neotropical Realm

Aconquija Area, Argentina [2]
Atlantic Coast of Brazil [7,2]
Northern Andes (Eastern) in Colombia [2]
Western Amazonian Uplands [7,2]
Caatinga of northeastern Brazil [2]
Cerrado of central Brazil [2]
Chaco of Bolivia, Paraguay, and Argentina [2]
Central Chile [6,2]
Colombian Chocó [7,2]
Awa Reserve (Ecuador)
Darien National Park (Panama)
Los Katios National Park (Colombia)
Utria National Park (Colombia)
Coastal Cordillera of Venezuela [2]
Cordillera Volcanica Central of Costa Rica [2]
Braulio Carrillo National Park
Volcan Irazu National Park
Volcan Poas National Park
La Selva Protection Area
Cordillera Volcanica Central Forest Reserve
Cuba [2]
Deserts of Chile-Peru [2]
Atacama Desert
Dry Forest of Costa Rica [2]

Guanacaste National Park
Dry Forest of Peru [2]
Cerro de Amotape National Park
Western Ecuador [7]
Galapagos Islands of Ecuador [2]
Guyana Lowland Forest [2]
Hispaniola [2]
Jamaica [2]
Lacandon Tropical Rain Forest of Mexico [2]
Montes Azules Biosphere Reserve
Lesser Antilles [2]
Monte, Argentina [2]
Osa Peninsula of Costa Rica [2]
Pantepui Region of Venezuela [2]
Pantanal of Brazil [2]
Alto Parana in Paraguay [2]
Peten of Guatemala [2]
Platano River Watershed of Honduras [2]
Rio Platano Biosphere Reserve
Puna of Peru, Bolivia, and northern Argentina [2]
Sierra de Manantlan of Mexico [2]
Sierra de Manantlan Biosphere Reserve
Sierra Nevada de Santa Marta of Colombia [2]
Talamanca Range of Costa Rica and Panama [2]
Cordillera de Talamanca National Park
La Amistad National Park
Tehuacan Valley of Mexico [2]
Temperate Rain Forest of Chile [2]
Uxpanapa-Chimalapa region of Mexico [2]

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ANNEX II: List of Resource Institutions

a. An annotated list of institutions that can provide information to local, national and international groups, including:

IUCN
WCMC
ICBP
UNEP
FAO
UNESCO
WWF
BGCS
AAZPA
IBPGR
etc

ANNEX III. Biodiversity Action: Financial Needs Worksheet

Actions	Annual International Funding Needs	Annual National Funding Needs
Action 1. Modify national income accounts 1a. Global task force 1b. National action 1c. Revision of U.N. System of National Accounts		
Action 2. Reform natural resource policies 2a. Forestry sector policies 2b. Agricultural policies 2c. "Public" ownership policies		
Action 3. Reform development assistance 3a. Incorporate biodiversity values into loan criteria 3b. Trim portfolios of projects with negative effects on biodiversity. 3c. Open process to public scrutiny, participation, and accountability.		
Action 4. Agroecological and crop breeding research. 4a. National national plant breeding. 4b. International agricultural research programmes		
Action 5: Intellectual property rights 5a International Fora 5b Seed-production and certification infrastructure 5c National review boards and an ombudsman office		
Action 6: Public access to information and participation 6a Codes of conduct for genetic resource collection. 6b. Codes of conduct for genetic resource introduction		
Action 7: Informal networks for conserving genetic resources. 7a Funding for community-based genetic resource conservation 7b. Remove legal barriers. 7c. Increase collaboration		
Action 8. Use native tree species 8a Forestry development programmes 8b. Forestry research institutions		
Action 9. Improve traditional medicinal practices. 9a. Applied research. 9b Codes of conduct for the collection of plant genetic resources.		

Action 10. Encourage community-based natural resource management 10a. Legal recognition for ancestral domains of indigenous people. 10b. Joint management regimes		
Action 11. Ecosystem-wide management for twenty Biodiversity Conservation Regions annually 11a. International task force 11b. Public/private authorities for managing BCRs		
Action 12. Double the area of protected areas. 12a. International task force 12b. Identify threatened protected areas 12c. Networks of non-contiguous conservation areas 12d. Special coastal and marine protected sites. 12e. National protected area system reviews 12f. Use ecological restoration		
Action 13. Strengthen protected area management. 13a. Iternational facility to support protected areas. 13b. Develop the capacity to manage protected areas. 13c. Establish regional associations of protected area managers		
Action 14. Strengthen germplasm conservation network. 14a. Support for national crop genetic resource conservation networks. 14b. Collaboration. 14c. Expand conservation of tree species. 14d. Accelerate research on domesticated animals 14e. National policies. 14f. Increase training. 14g. Regional centres to screen diversity.		
Action 15. Develop the world's botanic gardens. 15a. Network of botanic gardens in the tropics. 15b. Global database. 15c. Strict procedures for sampling, etc. 15d. Increase use for helping in reintroducing species 15e. Develop national and regional botanic garden networks. 15f. Subscribe to the principles laid down in BGCS.		
Action 16. Build system to conserve medicinal plant species		
Action 17. Strengthen the role of aquaria 17a. Greater educational responsibility. 17b. Allocate more funds to scientific research. 17c. Provide financial support for conservation		

17d. Stop promotion of activities detrimental to aquatic diversity.		
Action 18. Ten-year campaign to build public awareness		
Action 19. Strengthen networks of Biodiversity Conservation Centres 19a Establish national or regional biodiversity "centres". 19b. Undertake national biodiversity inventories 19c. Strengthen international biodiversity information centres. 19d. Adopt a set of basic indicators of biodiversity.		
Action 20. Establish an Early-warning System 20a. Establish NGO to issue world-wide alerts 20b. Institute "Genetic Diversity Checks"		
Action 21. Promote basic biological research 21a. Increase funding of ecological research. 21b. Strengthen International Scientific Organizations.		
Action 22. Promote basic social research		
Action 23: Promote research and action on the role of ethics 23a. Establish task force. 23b. Build capacities of organizations to promote biodiversity ethics 23c. Build capacity of individuals and groups to take leadership.		
Action 24. Develop national biodiversity conservation plans.		
Action 25: Strengthen current inter-governmental conventions and agreements. 25a. Ramsar 25b. World Heritage 25c. CITES 25d. Convention on Migratory Species (Bonn) 25e. Convention on the Conservation of Antarctic Marine Living Resources (1980) 25f. International Undertaking on Plant Genetic Resources 25g. ITTO		
Action 26: Negotiate a Convention on Biological Diversity.		
Action 27: Mobilize $1 billion per year 27a. Etablish new funding sources totalling $1 billion per year 27b Promote continued use of debt-for-nature swaps 27c. Promote the use of trust funds or endowments		
Action 28: Strengthen influence of NGOs 28a. Accord NGOs greater access and respect		

28b. Build NGOs capacities. 28c. Strengthen NGOs accountability		
Action 29: Strengthen NGOs independent biodiversity activities		
Action 30: Declare an International Biodiversity Decade		

TOTAL:

BIODIVERSITY STRATEGY AND ACTION PLAN

COMMENTS ON THE FIRST DRAFT

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1013

EXECUTIVE SUMMARY

1. Humanity is over-exploiting and wasting bio-diversity in the name of economic growth, as well as development.

2. The loss of biodiversity can impoverish human life and alter the course of human history, rather than development.

3. Herders also feel the loss biodiversity as they too depend directly on biological resources for their living.

4. The empirical basis of the statement that one species of plant, bird or mammal and some 50 other tropical forest species are going extinct every day is weak.

8. In addition to reduction and stability in population and resource consumption, equity is also important.

9. The meaning of "Heroics alone won't stem biodiversity losses" is unclear.

10.1 Every form of life, as well as ecosystems and landscapes, is unique and warrants respect irrespective of its worth to humanity.

10.3 Development patterns importantly depend on man-man dealings within and between nation states.

10.4 All countries and communities have a vested interest not only in their own, but in the global heritage.

10.5 Conservation of biodiversity must be planned and implemented considering that the world has become a single resource catchment and keeping in mind global fluxes of resources.

10.7 The costs and benefits of biodiversity conservation should ultimately be shared fully equally by the world's peoples.

10.10 Nation states are an arbitrary scale.

12.2 At national level, internal policies, for example, subsidies to agriculture affect biodiversity in other parts of the world as well.

12.3 At the intergovernmental level, changes in intergovernmental agreements should focus especially on terms of trade.

Action 3 :

3a,b,c The development aid agencies and multilateral development banks should take into account the overall global patterns of resource fluxes, relations amongst nation states and terms of trade in order to incorporate biodiversity values while designing and evaluating loans and projects.

Action 10 :

10a, b Governments should make sure that money and benefits reach all the way down to community based organizations.

Action 12 :

12e National protected area system reviews should be conducted bottom-up rather than from top alone.

Action 13 :

13d The commission on National parks and Protected Areas (IUCN), in addition to establishing contacts with regional protected area managers, should ensure that funds benefit local people.

Action 18 : Ten year campaign to build public awareness and support for biodiversity conservation - shouldn't it be a bottom-up process ?

Action 21 :

Decentralization would be a more effective conservation strategy. Barefoot scientists should be given support to enable them to play a role in global conservation efforts.

Action 23 :

23a Biodiversity ethics task force should stree that respect for nature and respect for people have to go hand in hand.

Action 27

27b A global tax on overconsumption of resources should be levied.

PREFACE

8. International conservation efforts will bear fruit (in place of succeed) only if they support legitimate national and local needs and priorities.

INTRODUCTION

1.1 The extent to which world's resource consumption has gone up should be stated explicitly.

1.3 Human rush to increase consumption of resources (not just survive and develop) has obscured biological imperatives of nature.

1.7 Biodiversity is a significant (not necessarily primary) source of the world's rich and precious cultural diversity.

1.17 Is there any habitat anywhere that has remained untransformed by human activities ?

1.21 Note that many cultivated plants are not crops in the ususal sense ?

1.22 Why should the language diversity be preserved ?

1.23 Plant species are over-exploited for timber, fuelwood and fodder uses as well.

1.24 Forces of biological impverishment relate significantly to strategies of some groups to displace or eliminate others.

1.28 In addition to demographic momentum and global population stability, economic momentum and steady state economies are also critical considerations for biodiversity.

Box 1.2 In addition to increase in population, irrigation and use of fertilizers, there has been an across board increase in per capita resource consumption.

Specify the resource use of Ecuadorians vis-a-vis people in Chesapeake Bay area - 10%, 50% or 80% ?

1.29 Humans have always contributed to depletion of nonrenewable resources.

1.30 A region's carrying capacity may be exceeded either due to overpopulation or overconsumption of resources by organizing resource fluxes from outside. For example, flow of resources into Japan.

1.31 Expansion of human number over the centuries has transformed the habitats.

1.33 In the industrialized world, high and growing levels of consumptions and technology are the primary sources of impact on ecosystems.

1.36 Fish export is another factor that contributes to the overharvesting of fisheries stock.

1.40 Subsidies for agriculture in industrial countries and the consequent global underpricing of bioresources also force specialization into a relatively narrow range of crops.

1.44 The problems arise not merely because there is global trade, but because the unequal terms of trade lead to imbalances in fluxes of materials.

1.46 c. Rural communities should participate in decision making in addition to having access to information.

1.47 a. Specific examples should to be given.

1.48 b. Agricultural subsidies distort the perception of benefits from biodiversity.

II. GOALS AND PRINCIPLES FOR BIODIVERSITY CONSERVATION

2.4 Studying biodiversity should include traditional knowledge of cultural practices.

2.7 Key changes needed are those in relations of power amongst different segments of human societies.

2.9 Rapid reform is needed in the TNC's policies that promote depletion of biological diversity within as well as outside the country; not just policies of Governments.

2.14 Ethical approach to biodiversity conservation should include respect for people along with respect for nature.

2.15 The world's genes, species and habitats are being overexploited and wasted in the name of growth as well as development.

2.16 Since local people often are the real beneficiaries of biodiversity conservation, empowering them is of great significance.

2.17 The root causes of biodiversity loss lie in the current patterns of economic growth.

2.18 Biodiversity conservation requires every country to reform its theory and practice of development and growth.

While coming to grips with the issue of high rates of resource consumption in the North being root cause for current high rates of biodiversity loss, imbalanced resource fluxes between north and south, and the need for and technology transfer to correct these imbalances has to be considered..

2.19 Conserving biodiversity is today not an urgent issue for many countries because of their ability to draw resources from distant places.

2.26 Knowledge, resource use practices, religious beliefs, ethnic markers and chance all go to generate cultural diversity. Only some of these components are central to biodiversity conservation.

2.54 Heavy consumption and waste of natural resources by the industrial countries could be checked and reduction in resource consumption could be brought about by correcting the resource flux imbalances, for instance, through paying much better prices for biological commodities being exported from countries of the south.

A CALL FOR A DECADE OF GLOBAL BIODIVERSITY ACTION

3. The incentive for involvement and cooperation in a global programme is individual, community and national - corporate self interest.

4. Will the collection of genes in jeopardy end up in monopoly over them by TNC's ?

5. Highly centralized programmes do not take advantage of local knowledge. They cater to vested interests of those who do not care for conservation.

7. The local level is where people live and work. It is here that the biotic resources are used well (instead of employed)or abused.

8. Local communities cannot be expected to sacrifice local opportunities for the sake of the global communities unless they are guaranteed long term assured benefits.

9. At national level, not just open but bottom-up process will provide the opportunity to balance local, national and other competing interests.

III. REVAMP POLICIES THAT INVITE THE MISUSE OF BIOLOGICAL RESOURCES

3.1 TNC policies may be even more important than Government policies.

3.2 Economic strategy employed by those in power may be to conserve, capture and ultimately liquidate biodiversity.

3.3 Depreciation of natural assets and loss of biodiversity _ Costs and benefits accruing to whom should be carefully analyzed. This acvtivity also needs to be strengthened.

3.9 Establishment of International task force to develop a framework for determining economic benefits of biodiversity conservation and also their distribution.

3.10 National capacity in "biodiversity economics" - and in analyzing the political economy of biodiversity be developed in government agencies dealing with economic planning.

3.10 1b National governments should revise their systems of calculating national income accounts to incorporate the values of biodiversity and the distribution of benefits.

3.12 Countries while developing national balance sheets, should elucidate distribution issues. They must analyze what is "national interest" and how it is defined.

Action 2 :

3.16 Reform or eliminate government policies - equally importantly WB, TNC policies.

3.21 There must also be analysis of national governmental policies affecting other countries.

3.25 c. Impact of agricultural subsidies on global price levels of agricultural commodities must also be looked into.

3.26 Most developing countries assert state ownership and control over the great bulk of their forest and coastal resources - as a part of their colonial heritage.

Asserting public ownership where the state cannot manage the resource makes it not only fair game for landless people and rural poor, but also for big landowners.

3.28 Who benefits from the resources in public areas ?

Action 3 : One way of ridding the development assistance process of its biodiversity-destroying tendencies is to eliminate excessive and imbalanced resource fluxes.

The policy calculations of the aid agencies are ruled by the same impoverished economic framework and strong vested interests amongst donors.

Ultimately development assistance should be phased out; resource transfer should be through better terms of trade.

3.38 Payment to local inhabitants should ideally be made directly.

3c Details of development assistance process should be made available to public scrutiny, participation in both donor and especially recipient countries down to grassroots would be most worthwhile.

3.44 Increasing participation in project and policy design, management and evaluation will also contribute to the basic value of respecting other people, conferring dignity on them.

IV. INCREASE LOCAL BENEFITS FROM BIODIVERSITY

4.11 In national agricultural research programmes, changes in objectives, approach should also be brought about.

4.49 A shift of emphasis to non-wood-forest produce would help create interest in a large number of species.

4.53 US farmers are being paid to keep land fallow, why cannot farmers worldwide be paid to maintain biodiversity on their farms, around their villages ? Such funding should be conditional on and proportional to the conservation value of biodiversity being maintained.

4.54 8b. Schools and colleges should also collaborate in developing guidelines and training programmes to support local initiatives in indigenous tree conservation and use.

4.55 There should be an emphasis on promoting non-bureaucratic science.

4.68 It is not always clear as to who is "indigenous" and who is not.

V. CONSERVE BIODIVERSITY IN THE WILD

5.4 Conserrving biodiversity demands interaction with people in human settlements, on farms and forests, or engaged in coastal and marine-based activity and also nomadic herders. Indeed there is much, probably ill place antipathy against herders; and this needs much careful thought.

5.8 Conservation would have to be considered on a whole range of spatial scales from individual Ficus religiosa trees through village sacred groves/woodlots to large national parks / biosphere reserves.

In this section much more needs to be said of a bottoms-up approach, local nodal agencies.

5.31 a. In a protected area, local people's use of resources is not always restricted to what is in the interests of the nation.

5.33 What is limiting ? Identification ? Formal protection ? Overall social support ? Local support ? Conservation oriented management? Where should the money go ? Policing has proved largely ineffective. Why not pay local people in proportion to biodiversity value of their locality ?

5.56 Identification of coastal and marine sites for special protection. How about offshore waters and lakes ?

5.66 Costs and benefits : We need a new approach of conducting a national protected area system review. In India at least it could be done very well and in a cost-effective fashion by involving undergraduate colleges scattered throughout the country.

5.70 Instead of identifying key areas, why not develop methodology for putting a biodiversity value on any area; of identifying a guardian community; of identifying ways of continually appropriately rewarding that guardian community ?

5.79 I would question the whole techno-bureaucratic approach. Let us do away with it and pay the local people in proportion to the value of biodiversity they help maintain in their own locality.

5.83 Institutional support - Training should be through local schools and colleges to all people.

VI. CONSERVE BIODIVERSITY IN OFF-SITE FACILITIES

6.2 Zoos are huge money guzzlers competing with habitat conservation. Reintroduction and captive rearing is still a dicey proposition.

VII. EXPAND UNDERSTANDING OF BIODIVERSITY

7.1 Much of the knowledge on species and their interaction with ecosystems is location specific.

7.2 There is a gulf between (decision makers + scientists) and local people who have knowledge and motivation.

7.5 Human dependence on the diversity of plants and animals for foods, industrial commodities and various other materials and resoruces eludes and baffles most people in the affluent urban-industrial sectors (including commercial agriculture sector) in north as well as south.

One of the reasons that governments and communities do not protect key habitats and manage renewable resources is that they do not care because their destruction does not affect them.

7.9 A bottom-up process of planning for biodiversity conservation is needed. Popular science movements that are taking root in many parts of India could greatly help in such a process, as would involvement of rural colleges.

7.14 District level environment data centres could be established with local colleges over most of India.

7.15 Establishment of district level centres would be more useful.

7.18 It would be worthwhile providing support for establishment of a network of district level centres for inventorying biodiversity, to identify the information needs of governmental, NGOs and community etc.

7.23 Decentralized information systems can be more effectively related to cultural diversity also.

7.24 Species inventory and local initial screening can be done at colleges. No new infrastructure would be necessary.

Box 7.2 Within the 2 billion "acres" -- use "hectares".

7.5 Inventorying should also aim at a rapid assessment of biodiversity / conservation value to help plan how best to use money.

Box 7.3 Habitat and communities : Habitat richness, endemism and threat should be added.

Domesticated species : Crop varietal richness to be added.

7.44 Why nothing about traditional knowledge ?

7.45 d. The research emphasis on monitoring biodiversity and ecological processes should include the landscape ecology approach as well.

Action 22. Please see enclosed paper entitled "Conserving India's biodiversity : the societal context".

7.49 Research should also focus on values - how they are shaped and how they change.

7.54 Emphasis should be on considering how to maintain grassroots respect for nature that is on decline.

VIII. INTEGRATE BIODIVERSITY CONSERVATION INTO NATIONAL PLANNING

8.10 Link money to maintenance of biodiversity value. Planning should not be putting together sectors but putting spatial elements together. Rewards should be fixed to spatial elements in relation to biodiversity value.

Why is there no chapter addressed to TNC's, World Bank ?

9.8 One of the components of the Biodiversity Convention should be long term commitment to tackle root causes.

9.11 Do not pay national governments. Instead at international level, improve the terms of trade in favour of countries of the south; and then organize direct flow of funds to local communities.

9.23 Local communities should be involved as already suggested.

9.30 Adopt decentralized process of developing conservation strategies.

REPORT OF THE WORKING GROUP I

ON

TECHNOLOGY AND R&D FOR PROMOTING BIODIVERSITY AND RESTORATION OF THE DEGRADED LAND

These issues are discussed and presehted along the following headings :

1. Matrix of problems according to land categories
2. guidelines for R&D
3. Technology options available and problems associated.
4. Thrust areas of Research.
5. Action plan for operationalising the recommendations
6. Barriers to such an effort.

GUIDELINES FOR R&D

1.0 Solution should be sustainable (includes: social,economic and ecological sustainablity)

2.0 Location specific solutions required in terms of
Agroclimatic zones
Socio economic conditions of people
Micro-habitats

3.0 Build on local knowledge & resources

4.0 Creating local employment or services (Low cost alternatives.)

5.0 It should be a collaborative effort involving local groups/ scientific institutions /business or industry

TECHNOLOGY OPTIONS AND ASSOCIATED SHORT COMINGS

problem	option	comments
1. Soil and water conservation	(Mechanical measures)	
	contour bunds	Contribute to natural regeneratoin as well B.T,C.D,N.B F.P are costly and need technical inputs
	small section bunds	
	Bench terraces	
	Diversion channels	
	Gully plugging	
	Silt traps	
	Check dams nullah	
	bunding, farm lands	
	Trench and mound	
	saucer pans	
	(Vegetative measures)	
	Contour strip cropping	
	Brush wood dam (agave,vitex)	Relatively cheaper, permanent, simpler, provides seed material
	Khus grass on bunds	
	wind brakes	

Problems and shortcomings :

(Mechanical)

1. Not self help technology
2. Needs group action
3. Lack of coordination between Govt. depts.
4. Relatively large outlays(high costs)
5. Prone to damage and need regular maintenance.
6. Bench terraces not suitable for growing trees and other modifications like'Gradonis ' can be tried.

(Vegetative)

1. The planted material is prone to grazing.
2. Inadequate supply of planting material.

2.0 Revegetation strategies.

Options available :

1. Monoculture and block planting
2. Miscellaneous sps mix planting
3. Strip planting
4. Agroforestry model (trees on bund,alley cropping)
5. Fodder banks
6. Pavitra vans and oushadi udyans
7. Dryland horticulture

Comments :

1. Tree fodder could be for supplementary use in summer
2. Decentralised nursery,seed bank for propagation of local species
3. Preparing specialized packages based on demands and needs of local situation. eg: Sps packages for fencing, fodder, green manure, medicinal plants,
4. Acute knowledge gap about the various indigenous sps and combination of sps on performance indicators for different habitats.

2.1 Problem of Exotic weeds :

Many exotic weed sps like Parthenium, Lantana, Eupatorium, Mikania, Borreria, Gallinsloga, Xanthium, Eichornia, Salivinia, Croton, Datura have aggressively occupied degraded lands suppressing growth of palatable sps.

Options :

1. Biological control using natural enemies
2. Mechanical removal.

3.0 Produce utilisation

3.1 Biomass used as fuel for cooking and heating etc.

Options

1. Efficient cooking stoves,Brick kiln,bath water heating stoves
2. Efficient kiln for Tobacco curing,jaggery making,lime kilns
3. Biogas plants and wood gasifiers

Solar water heating.

Comments :

1. Adequate number of models (location specific) are not available.
2. Cost is high.
3. Dissemination mechanisms like: quality control, backup services not adequate and education not given to users.

3.2 Overgrazing

Options :

1. Rotational/controlled grazing
2. Stall feeding
3. Reduction in population of unproductive animals
4. Regeneration of desired sps of grasses and legumes.
5. Community fodder banks
6. Introduction of crossbred cows
7. Ripping of compacted soils

Problems :

1. Stall feeding is labour and capital intensive and needs good infrastructural facilities for cross bred cattle to be maintained.
2. Low productivity of native animals
3. Controlled grazing, community fodder bank and regeneration of fodder sps need collective action and cooperation community

which is difficult to come about.

3.3 Medicinal plants

options :

1. Sophisticated pharmaceutical techniques available.

Problems

1. Collection procedures are some times destructive.
2. No regeneration being done.
3. Problem of identifying plants due to complex nomenclature
4. No infrastructre of nursery and seed banks.

3.4 Overharvest of timber and green manure

Sustainable intensity of harvest to be followed, but such prescriptions are hardly worked out.

3.5 Change in cropping pattern

Study and evaluate the different dimensions of traditional cropping pattern of the locality before making changes.

THRUST AREA OF RESEARCH

* S & W Conservation

  Study, inventory creating a data base of traditional soil and water harvesting techniques (region wise)

  Identifying sps. for soil conservation (region wise)

  Low cost methods for reducing seepage loss.

Vegetation

Study of contemporary relevance of "traditional / native " plant sciences

Reasons for non adoptions of the recommended soil and

moisture conservation

Phenology, seed biology and propagation techniques of local biodiversity in every biomes (426 in India)

Dictionary of vernacular names (with coverage of names used by all ethnic community) regorously correlated with botanical names.

In-situ studies on ecology of important sps of trees, grasses and shurbs etc. which would inturn help ex-situ conservation

Conservation Biology in protection areas

Techno-economic and biological studies of various polyculture models.

Research areas for medicinal plants, fodder, fuel, structural needs or other NTFP
(degraded land and degraded cropland)

Studies on nutrient cycling by trees (nutrient pump theory), microbial/micorhizal association for nutrient extraction

Studies on natural regeneration

Silvicultural practices in promoting BD (density, type str., harvesting cycle, thinning, economic analysis

Nutrient composition, palatability of indigenous sps.

Documentation and evaluation for veterinary care

Identification of keystone, indicator sps. for ecological status, water and minerals etc.

cost-benefit analysis for different vegetation strategies.

Studies of linkages between cultural and biological diversity
R & D on alternative use of exotic weeds biomass and industrial application

Biomass conservation

1. Developing alternate cook stove and bath stove
2. Developing appropriate dissemination strategy; quality control, user services, specification
3. Use of alternative feed stock for biogas plants

ACTION PLAN

1. Setting up regional B.D. research committee which would identify local institution to carry out studies. (major participants being the forest dept., academic institutions, agricultural universities)

2. Involvement of schools/college teachers and students in monitoring BD status.

3. Funding for ethnobotanical studies include a component for rewarding and acknowledging the local community

4. Any B.D. studies undertaken should be with participation with the local community.

5. Provision of feedback should be given to the community as outcome of the study.

Adequate funding for ecosystem research for long term / short term studies

BARRIER

Attitude : Academicians not keen on field orient studies particularly on participatory research

Indifference towards the study of traditional knowledge both oral traditions and texts

Inadequate organized funding on biodiversity studies in human ecosystem.

Institutional capabilities to undertake B.D. studies to be strengthened.

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CENTRE FOR
ECOLOGICAL SCIENCES

46.

REPORT OF THE WORKING GROUP II

ON

EROSION OF BIODIVERSITY, DEGRADED LAND,

CURRENT APPROACH, PROGRAMME

INTERNATIONAL AND POLICY

Our task was to identify institutional forms desirable at the village level in order to increase biodiversity and improve natural resource management.

I. In order to achieve this, the group felt that organization of the people of each village is essential. Its task could be :

a) To convert the present open access system to one regulated by the village community, when necessary in cooperation with the revenue, forest or development administration.

b) To regulate and where necessary change the production system in such a way that all the families in the community have access to the biomass they need and have adequate income for a living.

c) The village people's organization would normally include the panchayat members too. But they would be accountable to the gram sabha that would include men and women of all the castes / communities.

d) This would require an administrative structure that is more responsive to the people and has greater coordination between departments than is the case today. A nodal department in each set of villages is one out of many possibilities.

e) Such an approach involves acquisition of new skills as well as altitudinal changes in the people's community as well as among administrators. Some support structures would thus be needed, that would equip the community to create and manage the resource either by itself or jointly with the administration. It may be an NGO or some other resource group.

Briefly, biodiversity and biomass regeneration would require a new natural resource management system in which (a) various departments whose inputs are required are involved as one unit (b) decision making and financial and other management systems are decentralized, (c) the gram sabha and the administration are partners and (d) external support is received in the form of resource inputs and checks and balance such as regular assessment by an independent agency.

II. Various tasks of joint management

1. The community and administration would first identify the biomass needs of the community and the areas from which they are met. Various levels of dependence should also be identified :

a) Those with primary dependence on biomass. Their very survival depends on it, e.g. basket makers and artisans, of those whose food comes from NWFP.

b) Those to whom it is supplementary, e.g. NWFP collectors or fodder users.

c) Those whose dependence is marginal, e.g. only for fuel.

d) Seasonal residents such as cowherds who come to the area for a

couple of months in a year. They cannot create the resource but have to use it.

2. The community and the administration together also identify various types of biomass lands in the area :

a) Areas with good tree cover with abundant supply of biomass. These would have to be protected by working out criteria for people's access to NWFP.

b) Totally or partially degraded forest lands and people without income. Their regeneration has to be linked to the people earning an income. People's involvement is essential for their regeneration. They have to begin a stake in it which is rarely done. The mental frame of the administration has to be changed to become responsive to the people's needs and to the creation of a stake in the regeneration oft these lands.

c) Irrigated lands where the people do not depend on the degraded forest land or hills around - the administration would have to develop it by itself.

d) Non-forest degraded land that would require an approach similar to 2b.

III. Possible Constraints :

1. People's participation : People's organization without the creation of alternate local systems. They have to demand better delivery systems from a massive administrative structure. If this structure does not respond adequately, demonstration

among the people may be the consequence, unless their demand for a better delivery system goes hand in hand with building up local skills such as training of barefoot agricultural, medical and other workers they need.

2. On the part of the administration :

a) State monopoly and the system of selling NWFP instead of people's cooperatives or processing by them. This encourages middlemen and contractors who exploit the people.

b) Lack of funds : More the barren area, more the funds needed to

- create resource
- preserve the resource
- ensure an income for the people in order to prevent the destruction of the resource.

But funds are extremely limited. When foreign funds are made available, they are not incremental but replace local funds.

3. Imposition of decisions : Decisions on the species to be planted, management systems etc. are imposed from above. The local level official has very little discretionary power. The situation gets worse when foreign funds are involved. The type of species, the type of returns etc. are imposed on the forest department by the funding agency.

4. Legal status : Often the legal status of the land involved is not known. there have been many cases where the people have created a resource but the revenue or forest department had appropriated it later by claiming that the land or common resources are their property.

5. Lack of disincentives : In many cases the resource created is auctioned by the panchayat leader and the income used to build other infrastructure such as schools and dispensaries that are essential and nothing is used to replace the resource. Legal provisions as well s disincentives such as remo .l of all the subsidies should be provided to ensure reinvestme : .. a part of the income in the creation of the resource. At th same time, it is important to question the wisdom of offering the incentive of income from auctioning the timber. NWFP should be considered the major, if not the only, benefit.

IV. Possible Solutions

1. Where wasteland development has been successful, it has not been merely because various types of trees were planted. People have ensured biodiversity if the resource thus created can meet their needs, not for the sake of biodiversity in itself. Hence focus should be on meeting people's needs.

2. Experience in the field shows that there has been greater creation of the resource through protection of existing tree cover and regeneration of degraded and semi-de ed land than through plantation. But most official schemes f us only on

plantations. This is true about wasteland development, training and other schemes. Also programmes such as forest protection and regeneration should be subsidized, instead of limiting funds only for plantation.

3. Local populations have a great amount of knowledge about the type of species that grow or can grow in the area, soil, water and forest management and protection etc. It is important to revalarise this knowledge and build on it. This would be an essential element of people's participation which is not to be merely in schemes worked out by others bu' mainly in planning and managing the scheme, based on their k[illegible] and needs, and getting its benefit.

4. When possible the local population should be encouraged to make a contribution to the scheme, i[illegible] the form of fertilizers, labour etc. However, this requirement should be flexible. Otherwise landless labourers who survive only on daily wages and cannot contribute free labour may be excluded from the scheme.

5. An altitudinal change on the part of the administration is essential if it is to become more responsive to a joint management approach essential for resource creation with biodiversity. The presence of an NGO or some other resource group that can interact with the people and with the administration can go a long way in achieving this. Such groups should therefore be identified and encouraged.

6. More decentralization and greater coordination too are needed. Decentralization would be in the form of decisions concerning the type of schemes, management of resource, choice of species etc. Decentralization is required also in decisions concerning the detailed use of funds, criteria for benefit sharing etc.

7. The central authority will not disappear because of this. Broad guidelines will be laid down by the central / state government / board etc. Detailed criteria can be worked out at the local level.

8. Decentralization would also require checks and balances to ensure that benefits reach all the families, that funds are properly used and that biodiversity is maintained. This is best done by appointing an independent external (i.e., non-governmental and from the local community) agency for regular social, financial and environmental audit of the schemes.

9. Benefit sharing should, as far as possible limited to NWFP. In most cases a share in the income from timber is promised to the local community. This works as an incentive for local leaders to auction timber without reinvesting a part to recreating the resource. In other cases, benefits are promised much earlier than is viable. For example, in some West Bengal schemes, the people are promised monetary income from sal poles ten years after the saplings are planted. People therefore sell these poles in order to get monetary income and cut poles from other plants for their own use. We suggest that the incentive of

these poles in order to get monetary income and cut poles from other plants for their own use. We suggest that the incentive of income from timber should not be offered any more. Where it is available, reinvestment of a part of the income for resource creation. Disincentives too can be introduced for example, removal of all subsidies (including on fertilizers etc.) if this condition is not met.

10. Finally, however, wastelands development and biodiversity cannot be achieved without proper land use classification and a land use policy. It could perhaps be a part of a broader policy that deals with natural resources - land, water, forests etc.

Members of the Group :

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REPORT OF THE WORKING GROUP II

ON

EROSION OF BIODIVERSITY, DEGRADED LAND, CURRENT APPROACH, PROGRAMME INTERNATIONAL AND POLICY

By Ajay Mehta

Points emerging from group discussions :
Theme : Current approaches and institutions and policies.

The discussions were free-wheeling and not built around the themes in a focussed way.

The government lacks a proper and systematic perspective on what the appropriate land use should be for the country. it also lacks a strategy on how to approximate what is desirable in terms of a package of incentives and disincentives for those in control of natural resources and biodiversity.

For any perspective on land use to be operationally successful, it is essential that the perspectives reflect the needs of the people at grass-roots. Unless their problems and needs are not catered to, they are not likely to share the view of planners and respond to their signals.

People at the grass-roots, in particular the poor, are structurally prevented in many cases from being able to contribute to managing natural resources in a sustainable way.

The prices available to primary producers ar low, access to benefits are unequal and the ability of the poor to reflect their self interest within the existing institutional arrangements is highly circumscribed.

The current approaches to enhancing biodiversity and improving degraded lands often overlook the impediments that the poor face. The top down approach both within the structures of government and with respect to the local communities reduces the possibilities of inventions being made that are responsive to local needs. Well intentioned administrators are constrained by the system and the people by administrators, their lack of authority and autonomy to do something in their context.

There is need for broad based decentralization and democratization of power within the administrative structure at one level and at another level an even greater need to empower people at the grass-root level. One principle of empowerment could be that those with maximum stake should also have adequate authority to manage resources. Field officers should be empowered to deal with social issues of local communities so as to be able to establish a harmonious relationship. Likewise the community of poor should be empowered to manage common property resources since they have the greatest stake in doing so.

The processes of empowerment are complex and need sustained effort.

Special efforts need to be made to address impediments to empowerment. Unless the poor experience the positive and

sustained backing of institutions desirous of promoting biodiversity and improving the quality of degraded lands, they will not transfer their energies into the programmes we are talking about. The backing must aim at being comprehensive in providing an alternative to the forces that are responsible for the destruction of biodiversity and degraded lands (at least at the local level). Piece meal and erratic support for efforts by the people or other implementing agencies will slow down the kind of participation of people that is necessary for improvements to occur.

Empowerment needs to be thought of at many interconnected levels. People's entitlement to the benefits of biodiversity should be enlarged. There can be little disagreement about that and safeguards to ensure its realization should be carefully worked out. For instance prohibit sale of NTWP so that people can enjoy these for both consumption and income generating purposes.

More important, at this stage where the availability of biomass is so low as to find means by which the production of biomass can be enhanced and the process of doing so involves the people and provides built in mechanism for their benefiting from the growth of biomass.

In semi-arid areas, where the scope for commercial forestry is minimal, any increase in biomass generation (keeping in mind local needs) on any kind of public lands are likely to benefit the local people. This fact should orient the policy makers to target investments in these areas because these are also areas of

high policy or legitimacy to joint forest management offers immense scope for an increase in biomass production and availability provided the government and those who mediate the interests of the poor do not get bogged down in complicated negotiations about rights and leases and defining each other's responsibilities. If there is more biomass it will reach the local communities since there are few commercial possibilities for the biomass that can be grown in these areas.

In brief government, NGOs should simplify the rules pertaining to participation of people. Real rights at present leave little to do with paper rights, and yet more time goes in creating paper rights.

Investing in local institutions to manage natural resources are a must. The existing grass-institutions can be dysfunctional, either because they are dominated by the elite or these institutions are dependent on forces that are not representative of the interests of the poor. The idea of gram sabha and VNRMC can become a reality if these are helped to identify and realize substantive benefits fort he community in terms of providing eco-services. Creating space for substantive gains, within the existing constraints is not easy, and therefore strong back up support should be an integral part of the process of setting up peoples organization to promote better management of natural resources and diversity.

Since the way social processes work, there is an on-going tendency for progress generating its own contradictions. Those

leaders or institutions that are able to promote the interests of the poor are also likely to come under pressure by forces inimical to these tendencies, to either accommodate (coopted) to the dominant tendencies or to be thwarted. To ensure that there is no permanent set back one must see that institutions and processes being set up are capable of providing in built correctives to the tendencies of cooperation or resistance. Democratizing knowledge and knowledge generation by people is one such corrective (idea of bare foot ecosystem motivators) but a whole matrix of institutions need to conceptualized to reckon with this phenomenon. The people's organization must have vertical linkages to other institutions who can mediate interests in the higher power centres. There is need to develop categories of accountability as also mechanism of institutional renewal that will help the combined effort at regenerating biodiversity to keep on course.

At the level of the government or the ministry of Environment, there should be space and multiplicity of efforts. Both top down and bottom up processes have shown encouraging results. Neither should get precedence though structurally the case fro empowering people at the grass-roots should inform both approaches. The tendency for government to standardize support packages should be eschewed, the diversity of problems and capabilities to address these problems requires flexible support.

Innovative efforts should be documented to isolate key principles. Mechanism should be created to restore the status of

common property resources. A compensation fund, either managed by the community or by the state should be created to secure the sanctity of CPRs and biodiversity significant patches, in keeping with the vision of dispersed bio-density as an integral part of policy.

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REPORT OF THE WORKING GROUP III

ON

LEGAL AND POLICY ISSUES CONCERNING BSAP

AND

THE NATIONAL BIODIVERSITY CONSERVATION ACTION PLAN

I. The Biodiversity Strategy Action Plan (BSAP) recommends formulation of biodiversity conservation action plans at the national level. The recommendations made here are aimed at providing the background to such an action plan (Ref. Action 24. pp.86.BASP).

The Group endorses the overall aims of the BASP, with certain specific suggestions about the orientation and emphasis that need to be made to suit the needs of the Third World. The Group's recommendations are in two parts, the first that directly concerns the national level plan, and the second that relates specifically to BSAP. The first part of the Report is a collective output from the Group. The second part is a collection of papers from individual members of the Group.

The Report is based on a common acceptance, by the Group, of two basic principles: that in all activities relating to natural resources use, preservation and regeneration of biodiversity must be given the highest priority; and that no conservation is ever possible if the consumption and utilization of the resources are not in harmony with the desire to conserve. In the light of

these two basic principles, the Group notes with concern that India's consumption and utilization policies and practices are not in the least in keeping with conservation practices. In specific, the disharmony is noted between the forest policy and other policies, such as the industrial policy, the water policy and the energy policy. The industrial policy and laws promote unlimited use of natural resources, giving various incentives and subsidies for the utilization of these resources. The water policy and laws, on the other hand, show no concern for biodiversity preservation. They allow unchecked execution of projects in very sensitive areas of biogenetic reserves. Similarly, the energy policies do not take note of the fact that due to the poor availability of energy resources in the rural and tribal areas, that is, to the vast majority of Indians, severe depletion of forest resources is continuously taking place.

In the light of these realizations the Group recommends an immediate formulation of a comprehensive National Natural Resources Policy, which would form the basis of all subsidiary policies dealing with individual natural resources in the future, such as the forest policy, the water policy and the energy policy. All subsidiary or sectoral policies need to be consistent with the Natural Resources policy in intent and practice.

In the light of this the Group suggests the setting up

of a task force by the Ministry of Environment which will do a comprehensive survey of the existing sectoral policies and laws concerning all natural resources use, to locate the points of contradictions, identify areas of conflicts and methods by which these contradictions and conflicts can be resolved. Mechanisms to come up with a consistent National Natural Resources Policy needs to be immediately evolved. The composition of this task force must include representatives of all relevant ministries and government agencies, as also non-governmental bodies. Preferably, it should be chaired by an eminent person outside of the governmental system.

The Group noted the fact that since different projects and plans affecting natural resources use are executed under different policies and laws, which are not consistent with each other, the present method of environment impact analysis and project clearance are grossly inadequate for the conservation of biodiversity. The Group recommends a more comprehensive strategy, and strengthening of the existing infrastructure, for joint conceptualization, clearance, execution and monitoring of projects from an integrated perspective of natural resource use. Specifically, the system of environmental impact assessment and clearance, at present having only a status of a guideline, must be made statutorily binding. This could be done under the EPA.

Recommendations

1. A systematic attempt needs to be made to identify forest lands of rich, unique, critical, and/or fragile biological value. Simultaneously, a study of the social pressures on these areas is required. Based on the information derived, protected area status needs to be given to these areas.

2. Since existing protected area categorization is somewhat limited (four categories in the Wild Life Act), and does not address the needs of a diverse range of biological and social situations, the relevant Act needs to be modified to expand and make more sophisticated the system of categorization. Protection under this system would vary from complete non-interference into biological processes, to maintenance of traditional human uses, to enhanced human use consonant with biodiversity conservation.

3. Specifically, the conceptualization and operationalisation of a network of Biosphere Reserves needs immediately to be given legal status with appropriate amendments to the Wild Life Act.

4. Degraded forest lands which the Forest Department has been unable to conserve or regenerate, should be converted to Panchayat land, or to Joint Ownership and Management Land, with the specific mandate of regenerating both the biodiversity potential as well as the social use functions of these areas. The legal status of these lands must be appropriately changed.

5. The Forest Conservation Act of 1980 should be amended to exclude from its purview the legitimate, small-scale needs of local communities such as schools, hospitals, pipelines, etc. In no individual case should such conversion be greater than one acre. No other diversion of forest lands should be allowed now.

6. The practice of periodically regularizing encroachments on forest lands needs to be stopped, and legally prohibited. Exemptions can be made in the case of the legitimate needs of those without any other source of livelihood.

7. The Forest Conservation Act and the Indian Forest Act protect merely the forest land, not the resoruces on them. The Acts must be appropriately amended for protection of biodiversity.

8. In many parts of India, demarcation, classification and settlement of rights, in forest areas are still incomplete. There is an urgent need to complete this task at the earliest.

9. The recognition of customary rights, such as nistar, dapayati, etc. and the concessions given in the forest land areas, is arbitrary. Such rights are sometimes given where there are no standing trees, and often the concessions given in areas where there are trees do not have any relation to the people's economic needs. There is an urgent need to rationalize these customary and legal

rights, from the point of view of the local people's actual economic and basic needs, and the ecological condition of the area.

(ii) Tribal Lands

Issue

Lands held and controlled by tribals, either those under tribal councils or those declared as Scheduled under the Constitution, have not been immune to the forces of biodiversity destruction. An anomaly in this is that while the actual land in these areas is inalienable, the resources on the land, e.g. the forests, are not. A strange situation has therefore come up where state governments harvest natural resources from these areas, thereby affecting both biodiversity as well as the livelihood of tribals. Simultaneously, tribal councils have often succumbed to the temptations of commercializing their forests, and are selling these off at an alarming rate in some parts of the country.

Recommendations :

1. Rights over all resources in areas classified as tribal areas, must be vested in the tribals. An appropriate amendment in the Constitution, as also in the relevant Acts, concerning non-alienability of tribal lands, need to be made.

2. This right should be restricted to the bona fide use of these resources, and should not be extended to their commercial exploitation for sale outside the tribal areas.

3. Since commercialisation of forests is being done in many cases by tribal councils in the absence of alternative livelihood means, the legitimate developmental needs of tribal areas must be given priority in state plans. Incentives must be extended to help in the conservation of biodiversity, to offset the 'sacrifice' or 'loss' in revenue that tribal communities may feel.

4. Existing traditional practices, such as shifting cultivation, which may now be causing irreversible damage to biodiversity, need to be reoriented. The necessary financial, technological, and infrastructural support for this needs to be extended by governmental and non-governmental bodies.

(iii) Revenue Land

Issue :

A sizeable amount and variety of biologically rich land is in the hands of the Revenue Departments of each state. Simultaneously, a considerable amount of land belonging to the Revenue Departments is currently degraded, or being allowed to degrade, with the attendant loss of biodiversity.

Recommendations :

1. As in the case of forest lands, a systematic attempt needs to be made to identify revenue lands of rich, unique, critical, and/or fragile biological value. Simultaneously, a study of the social pressures on these areas is required. Based on the information derived, protected area status needs to be given to these areas, using the kind of categorization developed for forest lands in (a) (i) above.

2. Wherever the Revenue Department does not have adequate mechanisms for effecting biodiversity conservation measures, arrangements enabling joint management of Agriculture, Horticulture and Forest Departments and Panchayat bodies may be explored.

(iv) Panchayat Land

Issue :

The system of local governance, which to some extent contributed towards the protection of biodiversity by protecting common lands and other such measures, has been considerably weakened by decades of political interference from above. Panchayat bodies have been replaced by a centralized system of governing which is unresponsive to local needs, and completely insensitive to local environmental conditions. Wherever Panchayat bodies are still active, they are dominated by the same sorts of hierarchies and concerns that are seen in the national and state governing bodies. With little stake in the

maintenance of local biodiversity, many Panchayat bodies are today equally insensitive to environmental concerns.

Recommendations :

1. Changes need to be brought about in the Panchayat Acts to introduce concerns of biodiversity conservation and make it the responsibility of Panchayat bodies to maintain biodiversity while developing the local resources for the community's needs.

2. Specifically, amendments in the Acts need to provide for the preservation of areas with considerable biodiversity value, and for the development, management, rotational harvesting, sharing, selling, and regeneration of other forests on Panchayat lands.

(v) Land Under Other Government Agencies

Issue :

A considerable amount of land belongs to or is controlled by government agencies like the armed forces, PWD, Irrigation Departments, etc. Some of this land has rich biodiversity, such as border lands controlled by the armed forces. Some of this land is degraded, and needs regeneration; yet other land has considerable potential for enhancing biodiversity, such as roadside strips.

Recommendations :

1. As in the case of forest and revenue lands, areas under other government agencies which are of considerable biodiversity value need to be given protected area status under the system of categorization being proposed above.

2. Specific changes in the relevant Acts such as the MUnicipal Corporation and Cantonment Acts need to be made to make these agencies responsible for biodiversity protection and regeneration, as also to empower them to take action in this respect.

(b) PRIVATE LANDS

(i) Individual

Issue :

Private agricultural lands and other kinds of lands are the repositories of a considerable amount of biodiversity in India, including thousands of varieties of crops, livestock, and trees. Due to environmental degradation, fragmentation, and wrong policies and programmes regarding agricultural development, there has been considerable loss of this biodiversity. Since over half of India's land comes under the category of private lands, the scope of biodiversity conservation and regeneration is immense.

Recommendations :

1. Farm forestry for industrial purposes must be banned on fertile agricultural lands, i.e. those classified under 1 to 4 categories (of the ICAR classification). Such plantations must be promoted only on Class 5,6,7 and 8 agricultural lands.

2. Existing agricultural policies are harmful to biodiversity because they promote a very small number of high yielding varieties, monoculture and use of synthetic chemicals. These need to be discouraged.

3. Traditional farming systems and several modern sustainable farming practices which promote diverse and integrated farm systems, which include multiple cropping, livestock and tree culture need to be encouraged.

4. Subsidies or incentives for agriculture which encourage biodiversity destroying technologies need to be redirected towards technologies mentioned above.

5. Policies need to encourage regeneration, preservation and transfer of indigenous seed varieties and experimentation by the local farmers.

6. All lands under private ownership should be put to optimal use and the statutes of a state should ensure that such lands should not remain unused beyond the period required for regaining soil fertility. allowing these lands to degrade due to neglect has adverse effects on

biodiversity of lands and water elsewhere.

(ii) Corporate Lands

Issue :

Lands belonging to NGOs, cooperatives, and industries, are also repositories of biodiversity. The scope for preservation of this biodiversity on cooperative and industrial lands is however very limited, given the specific objectives with which such land is managed.

Recommendation :

1. Emphasis needs to be placed on biodiversity conservation and regeneration on lands belonging to NGOs, including schools and universities, voluntary groups, hospitals, etc.

B. WATER LAWS AND POLICIES

1. National Water Policy should be more comprehensive to include marine areas and groundwater. It should be considered in view of the fact that it has shown no appreciable concern towards the presentation of biodiversity including maritime zones. It is necessary to identify the critical areas of biodiversity preservation in rivers, lakes, estuaries, streams, canals and reservoirs and to give them protected area status.

2. Water policy is not in keeping with the aims of the forest policy. Like the industrial policy, water policy is to be reconsidered in the context of natural resoruces

policy.

3. Appropriate laws are needed to check groundwater depletion and pollution and control its use.

4. Wherever possible revert back tanks, rivers etc. to joint management with Panchayats a nd NGO's and village communities.

5. Contracting system on water based resources should be banned and joint management systems should be considered.

6. With realization of the fact that large scale use of water resources such as big dams has led to decrease in biodiversity it is important to initiate decentralized, smaller scale use of water resource which are conducive to the preservation of biodiversity.

7. When people other than those with customary rights are given licenses for fishing in coastal areas or rural areas such licenses should not notate the rights of the original users.

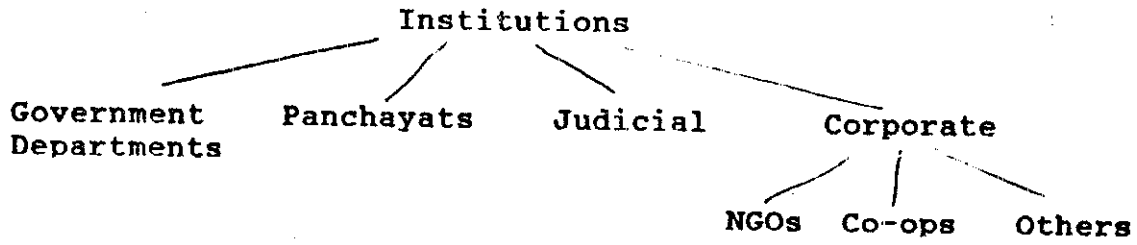
8. Large scale harvesting of water based resources should not be given preference over the existing customary rights of the local people. Water laws need to be amended to recognize the traditional rights of the people which have already been recognized over a century by the courts.

9. Legal policies and legal framework need to be framed for

India's maritime zones, especially in the use of technologies that harm biodiversity, should be discouraged, for eg. trawlers.

C. INSTITUTIONS

The following institutions are considered here :



1. As regards government departments, we find two major factors which get in the way of biodiversity preservation :

   1) Lack of coordination

   2) Lack of information

a) Government

1. Natural resource use coordination body under Ministry of Environment and Forests involving representatives of all relevant Ministries to be formulated.

2. Means to ensure greater interdepartmental / ministry information and coordination.

3. Ministry of Environment and Forestry's infrastructure to handle environmental clearances to be strengthened.

(b) Panchayats

As in the case of forest resources, the traditional village communities have been deprived of their task of management and preservation of water resources. The Group recommends that :

1. Where possible, water tanks and rivers (within limited areas of riparian jurisdiction) must be vested in the local communities, not only for maintenance but for total benefit sharing, in a joint management programme and for regeneration of biodiversity.

2. The panchayat Acts must be appropriately amended to allow the development funds, benefits and regeneration to be made feasible within the Act.

(c) Judicial

Courts are ill-equipped to handle environmental legislation.

1. A body of expertise needs to be built up to support courts in environmental legislation.

2. The use of Lok Adalats for environmental legislation should be considered.

(d) Corporate

(i) Industries

1. Large-scale and medium scale industry and public corporations should necessarily employ environmental manager whose responsibility is to ensure the preservation of biodiversity in all projects undertaken by the industries. In this respect the relevant provisions should be made in the laws governing the functioning of the industries such as the Factories Act and the Industrial Development and Regulation Act.

2. Directorate of small scale industries should ensure the preservation of biodiversity. The directorate should employ environmental manager to carry out similar tasks.

3. Guidelines laid down in the environment and Forest Protection Act to this effect must be immediately enforced.

(ii) Municipal corporation

1. Necessary financial resources should be provided to the municipality to carry out the various responsibilities under the municipal laws, for the protection and conservation of environment.

2. Where finances are available to municipalities, it must be ensured that priority is given to the work that is necessary for the preservation and conservation of the biodiversity.

(iii) NGOs

Amongst the corporate agencies, one of the most vital role that can be played for the preservation of biodiversity is that by the NGOs. The group however, finds that the NGOs are severely limited in their action due to lack of information.

Recommendations :

The group hence recommends that :

1. Insofar as the information is concerned, where the utilization of the natural resources is concerned, the operation of the Official Secrets Act must not apply, except when there is a genuine matter of national security, integrity and contempt of the Constitution.

2. There must be a constitutional as well as a legal recognition of the right to information of all citizens.

3. Where publications of government reports, notifications, gazettes, studies of commissions and other studies are concerned, the onus to publish, price and disseminate such information within a stipulated time, must lie on the concerned public official. In case of undue delay the official must be held liable. It must also be the duty of the concerned officials to supply the relevant documents, gazettes, notifications etc. to the publication divisions, public outlets, libraries etc. within the stipulated time, notwithstanding which he/she must be held liable.

4. The powers of government officials to 'classify' any document as 'secret' or 'classified' must be delimited within the reasonable bounds of law. No document must be so classified if it is in public interest and does not concern the national security, integrity or contempt of the constitution. All such documents must be necessarily made public within the stipulated time period.

5. Suppression of the facts undertaken by the industries is not conducive to the preservation of biodiversity. It must be made mandatory for the industries that all information, which does not violate the copyright or the patent laws, must be made available to accredited NGOs (or those having social, official or public recognition) on their request.

It is believed that the NGOs can play their appropriate role in biodiversity preservation only if they have access to information. The above recommendations would make this possible.

Members of the Group :

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REPORT OF WORKING GROUP IV

ON

COMMUNITY INVOLVEMENT, CREATION OF AWARENESS

AND

HUMAN RESOURCE DEVELOPMENT

Approach paper by Prof. Madhav Gadgil

Action suggested for awareness programmes for various target groups :

1. State apparatus

The different sections of state apparatus should be made aware of the kind of activities currently going on to achieve the task of biodiversity conservation.

The target groups under the state apparatus can be legislators (politicians), administrators, officials of the departments of forest, irrigation, agriculture, industry and power. In the awareness programmes, documentation and success stories like that of West Bengal and Haryana on joint management or participatory management of natural resources can be used. The data available at the ENVIS centre on biodiversity can also be utilized.

Decentralized data bank to project the consequences of major developmental project may be set up.

Documentation should be followed by microlevel planning for the integrated development at the district level.

This awareness programme for the legislators can be linked up with their orientation programme on legislative /

parliamentary affairs. The parliamentary environmental forum may be revived.

The programme for the departmental officials can be included in their routine carrier programme.

Emphasis should be given to field work in all the above training programmes.

Teachers of colleges and universities can be utilized in implementing some of the above.

Group 2 : Industry :

Bring awareness amongst the owners of the industry about scarcity of raw materials and reasons for the depletion of BD.

Impress upon the industry the need to look for alternate source of raw materials when subsidized supplies are stopped in a phased manner.

Group 3 : Scientific community :

Scientific community should be made aware of their relevance in the society and of the fact that they should involve themselves in programmes like making inventories of natural resources, microlevel planning and help NGOs and Government agencies as and when required. They should be encouraged to publish the results of their experiments also in popular journals so that they could reach the needy persons. The institutions or the funding agencies for scientific studies to be made aware that they should support more on research work in alternate source of energy.

Scientists must be exposed to traditional knowledge bases.

The group felt that the grouping of community into rural elite and rural poor is improper and therefore this target group is reclassified as urban community and rural community.

Group 5 : Urban Community

The awareness programme should highlight correlation between consumers goods and their resource bases so that people will change their lifestyle with a view to conserve BD.

The programme should touch upon the following :

1. Fuelwood conservation - use of high efficiency chulas, solar energy, biogas.
2. Availability of water - proper use, step down use. Two qualities of water supply to be made. Resort to recycling used water.
3. Handling of domestic garbage.
4. Recycling of used papers
5. Discourage the usage of packets made of non degradable packing materials.
6. Discourage the use of papers in pre-primary education.

Group 6 : Rural Community

Awareness programme should touch upon the following :

1. Alternate energy sources and use of high efficiency chulas.
2. More rational landuse pattern (for elites)
3. Use of integrated pest management including traditional method of pest control.
4. Effect of over emphasis on high yielding strains in crop husbandry and animal husbandry to loss of BD.
5. Diversity of inland aquatic organisms especially fishery to be encouraged.

6. Danger of exotic species.

7. Disposal of garbage.

8. Encourage stall feeding wherever pasture lands are scarce.

These awareness programmes can be linked to literacy mission. The programme should utilize audio-visual programme on case studies, traditional and folklore art media can be utilized.

Demonstration programme wherever possible should be included. Special emphasis to be given to programme exclusively for women.

Group 7 : Voluntary Agencies

1. Training to pick up expertise in the different aspects of BD conservation.

2. They must be given opportunities to know developments like BDCS, WCS etc. and flow of informations on such matters should be ensured.

3. They must have orientation training in human behavioural sciences which offer a wide scope in bringing their attitudinal adjustments in line with the local community.

4. Research oriented word also be taken up by NGOs besides acting as purely awareness creators and facilitators.

5. A loose network of NGOs may be attempted.

Group 8 : International Agencies

1. The programme should also include attempts to project the Indian position with regard to BD convention including IPRs.

2. Efforts should be made to convince the international agency that they can influence the funding agencies the desirability of assisting only environment friendly development projects.

CENTRE FOR
ECOLOGICAL SCIENCES

DEGRADED LANDS:

Approach paper by Dr. N.H. Ravindranath

The group found that the suggested programme for HRD has an exhaustive coverage and hence restricted the recommendations to the following additions :

1. Under the heading farmers on page 38, one more item to be added as serial no. 4 namely "farmers should be trained in raising saplings in nurseries and they just be provided with necessary materials.

2. On page no. 39 (under the head community) two more items to be added, namely serial no. 8, women should be given orientation in management of community resources since women play key roles in exploiting resources.

   Serial no. 9, aware of population control so as to reduce pressure on resources.

3. The subject matter included in the list provided for the awareness programme of forest departmental personnel should go into course content of their formal training programme.

4. Awareness programmes should be prescribed for other departments like agriculture, animal husbandry and irrigation.

5. There should be awareness programme for non-school going children and students of urban schools.

6. Urban communities and rural communities must have separate programmes and the urban communities should be brought into the programmes suggested for them in approach paper no. 1

7. The community education programme could be organized in 3 phases not in 2 phases as suggested in the approach paper.

   Phase I will consist of the training of the instructors drawn from school teachers, NGOs and concerned individuals in community awareness programme.

Members of the Group :

M.K. Prasad

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PROF. MADHAV GADGIL

October 30, 1991

Dear

Sub : Working Groups reports of the Workshop on Linkages between Biodiversity and Degraded Lands.

I am happy to inform you that we have received the following comments on the reports of the working groups that were circulated earlier.

Comments on report of the Working Group - I :

The format of the report should be made a little more uniform and narrative on the lines of other reports.

Pg. 2 : Problems and shortcomings : Point No. 2

Local leadership and initiative are lacking though certain simple technologies may be available.

Pg. 4 : No.3.2 Options : Introduction of cross-bred cows :

Since cross-breeding with European cattle involves considerable problems of labour, expenditure and maintenance, crossing with hardy, high milk yielding indigenous varieties should be promoted. The NBAGR at Karnal could give information on such local breeds.

Pg. 7 : No. 3 : Rewarding local communities :

Acknowledgment and reward should be substantial enough to make it worthwhile for communities to pass on their knowledge and expertise to successive generations. If not in cash, the 'reward' could be in the form of land or housing or some other traditional lifestyle.

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Comments on report of the Working Group - II :

Since the recommendations of Working Group II relate to some of the key issues, it seems particularly important that these recommendations should specifically focus on what actions we think the MOEF should take. (A couple of suggestions in this regard are made below) :

In the recommendations of Working Groups II and III regarding the institutional set up for local natural resource management, there is an inconsistency which needs to be noted. Working Group II recommends the creation of "village people's organizations which would normally include the panchayat members, and which would be accountable to the gram sabha" (para I c). On the other hand, the report of Working Group III recommends (pg. 11) that "changes need to be brought about in the Panchayat Acts maintain biodiversity while developing the local resources for the community's needs", and is silent on the changes, if any, that need to be brought about in the Panchayat Acts in regard to the powers and functions of gram sabhas.

It is not suggested that such differences can or should be eliminated. On the contrary, the workshop's recommendations should explicitly recognize the existence of such differences and suggest means whereby we could move towards greater clarity on this critical issue. Since there is increasing agreement that the whole question of village level institutions for the management of local natural resources is of absolutely crucial importance, the workshop may wish to recommend that the MOEF should :

(a) Officially recognize, through an appropriate policy declaration, the importance and the necessity of setting up and empowering such village level institutions, explicitly acknowledging that the "people's participation" that has so far been talked about will have to take the form of democratically managed and adequately empowered community institutions at the village level, and

(b) Set up a broad-based consultative mechanism (perhaps through a Working Group or Consultative Committee in which both governmental and non-governmental organizations are adequately represented) whose task would be to systematically examine the emerging issues and provide such inputs to government as are essential for evolving effective policies in this all-important area.

The other critical issue touched upon in the report of Working Group II is the necessity for "an administrative structure that is more responsive to the people and has greater coordination between departments than is the case today" (I d). In this context, once again, the Workshop may wish to recommend that :

(a) the MOEF should explicitly recognize that in the absence of this kind of administrative reform it cannot adequately discharge its own mandate, and therefore it is both necessary and appropriate that the MOEF should initiate and take the lead in working towards such reform. (Towards this end, it may often be unnecessary to look further than the recommendations contained in several excellent reports of various high level committees and Administrative Reform Commissions appointed by the GOI itself over the years).

(b) The Working Group proposed in 2(b) above may have a suitably constituted sub-group which could be asked to look at the question of administrative reforms.

Comments on report of the Working Group - III :

Pg. 6 : Recommendations :

As mentioned in points 1 and 2, it is of great importance to establish a more sophisticated system of categorization of protected areas, since several endangered species or rich fragile ecosystems occur in non-forest areas. For this purpose a database on floral and faunal species, as well as on ecosystems must be prepared to identify areas of their natural occurrence, so as to initiate protection measures, irrespective of whether the land is under forest department, revenue department, or any other land classification. A similar procedure should be followed for aquatic and marine species and habitats.

Pg. 14-16 : Water : Laws and policies :

As mentioned in point no. 1, laws and policies relating to protection of maritime zones need to be developed. Coral reefs need special mention, since apart from destructive activities like coral mining, dredging etc., marine pollutants from the land as well as from ships in the open sea cause considerable biodiversity loss. Pollution control regulations should be imposed on tankers, passenger / cargo ships as well as on smaller motorized boats and launches.

Policies requiring international cooperation may need to be adopted for conservation of oceanic fauna such as Cetaceans, sea birds etc.

Pg. 15, No.8 :

Certain traditional practices e.g. harvesting of conch shells, marine turtle eggs, sea bird eggs etc. were once sustainable, but now need to be curtailed since most of these species have become endangered. Alternatives must be found.

Pg. 6, No. 4 :

It is stated that the degraded forest lands which the Forest Department has been unable to conserve or regenerate, should be converted to Panchayat land. It is also stated in the end that the legal status of the land must be appropriately changed. These recommendations need to consider the important fact that the degraded forest lands are increasing day by day due to biotic pressures particularly due to increased population and resultant human activities. The limiting factor with the Forest Department is the paucity of funds. Combined with this there is no political support to the activity of the Department. This makes the task of conservation very difficult. Very few forest lands are now capable of regenerating naturally. This is due to excessive grazing in forest lands particularly in the forest lands near habitations. Instead of joint ownership and management, the recommendations should be for joint management and commitment to offer the produce to the people. Ownership of the land need not be changed into Panchayat Lands.

No. 7 :

It is stated that the Forest Conservation Act and the Indian Forest Act protect merely the Forest land and not the resources on them. Indian Forest Act 1927 (and its adaptations in the States) is the fundamental Act and it does protect all the resources. One has to read Section 2 along with Section 26 of the Act which would make it amply clear that the Indian Forest Act is a comprehensive Act for protection of Forests, i.e., forest land as well as forest resources. Even the Act protects the over surface as well as underground resources in forest land. The purpose of the Forest (Conservation) Act, 1980 is specific. It is to curtail alienation of forest land for any other non-forestry purposes.

Comments on report of the Working Group - IV :

pg. 3 :

The first para does not fully express the point discussed by the group, with regard to communities. It could be recorded as "The group felt that categorization of communities into rural elite and rural poor is not sufficient since the urban community also needs to be included as a target group. Therefore communities should be reclassified as (1) urban community and (2) rural community in which there are recommendations intended for the rural elite as well as for the rural poor".

pg. 3 Group 5 : Urban Community :

Awareness programmes for the urban community must draw connections between consumption practices and their effect upon the natural environment as for instance deforestation caused on mountain sides for the sake of making crates of apples. Consumer

movements should be started to discourage excessive use of packaging materials, disposable containers and other consumer disposables.

A serious effort must be made to discourage firewood use in urban areas.

The recommendations of Working Group IV are ad hoc, haphazard and arbitrary, lack any sort of cohesive framework and are not addressed to anyone in particular. If a set of recommendations on awareness / HRD are considered essential, none may object if Madhav and/or Ravi were to completely rewrite these as they think fit and a draft is sent to all members of Working Group IV and to the convenors of the other Working Groups for their approval.

Additions to report of the Working Group IV :

Group 5 : Urban community:

7. Awareness programmes to be organized for media men and tourists.

Group 8 : International Agencies :

3. The social and antisocial forces responsible for loss of biodiversity to be pointed out.

4. What are the inputs required have to be in commensuration with demands and the amounts to be quantified.

5. International agencies should compensate by financial grants for sacrifices leading to biodiversity conservation.

DEGRADED LANDS :

8. There should be national campaign for documenting biodiversity resources.

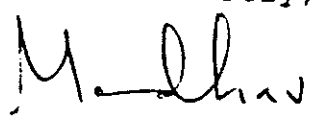
9. The provisions for Awards existing in Land and Agricultural Departments must be tapped for giving incentives for biodiversity conservation efforts.

10. Some kind of a bulletin to be started.

Kindly let me have your reactions to these comments by 15 November 1991, so that we can finalize the reports.

With warm regards,

yours sincerely,



MADHAV GADGIL