# TRAINING PROGRAMME FOR IAS OFFICERS

# ON

# MANAGEMENT OF ENVIRONMENT

## PROGRAMME SCHEDULE



DATES : 12 - 17 FEBRUARY 1990

VENUE :

RUSTOM CHOKSI
INDIAN INSTITUTE OF SCIENCE
BANGALORE 560 012

ORGANISED BY
CENTRE FOR ECOLOGICAL SCIENCES
INDIAN INSTITUTE OF SCIENCE
BANGALORE 560012

CONTENTS

# 1

## Monday, 12 - 2 - 1990

**Theme : Issues in Environment and Development**

| Time | Topic | Faculty |
|---|---|---|
| 9:00 - 9:30 AM | Registration | |
| 9:30 - 10:00 AM | Environment and Development : an overview | Prof. D K Subramanian<br>Computer Science and Automation, Indian Institute of Science<br>Bangalore 560012 |
| 10:00 - 10:15 AM | ..... Tea ..... | |
| 10:15 - 11:45 AM | Managing the environment of Andaman, Nicobar and Lakshadweep islands | Father C.J. Saldanha<br>Centre for Taxonomic Studies, St. Joseph's College, Bangalore 560001 |
| 11:45 - 12:45 PM | Energy and environment | Shri T R Sathishchandran<br>Director, Institute for Social and Economic Change<br>Nagarbhavi,Bangalore 72 |
| 12:45 - 1:30 PM | ..... Lunch ..... | |
| 1:30 - 2:30 PM | An approach to landuse management | Shri Zafar Saifullah<br>Devt. Commissioner<br>Vidhana Soudha,Bangalore |
| 2:30 - 3:30 PM | People's participation in managing the environment: Presentations by panelists | Prof. K S Jagadish<br>Dept. of Civil Engineering<br>Indian Institute of Science<br>Bangalore 560012<br><br>Shri S R Ramaswamy<br>Editor, "Uttana"<br>Bangalore 560019<br><br>Smt. Almitra Patel<br>50, Kothnur,Bagalur Road<br>Bangalore 560077<br><br>Shri Jayakumar Anagol<br>Formerly Member,KPSC<br>Bangalore<br><br>Dr. Anand Kabbur<br>India Development Service<br>Dharwad 580008 |
| 3:30 - 3:45 PM | ..... Tea ..... | |
| 3:45 - 5:00 PM | Discussion | |

# 2

Tuesday, 13 - 2 - 1990

Theme : Agriculture, Animal Husbandry and Environment

| Time | Topic | Faculty |
|---|---|---|
| 9:30 - 10:30 AM | Agricultural Development and Environment | Dr. G.V.K. Rao<br>Institute for Social and Economic Change<br>Nagarbhavi, Bangalore |
| 10:30 - 10:45 AM | ..... Tea ..... | |
| 10:45 - 11:45 AM | Can we sustain agricultural growth? | Prof. R K Hegde<br>Vice Chancellor<br>University of Agricultural Sciences, Dharwad |
| 11.45 - 12.45 PM | Problems & Prospects of environmental solutions in the rural scene | Prof. L S Prahlada Rao<br>Formerly Addl. Secy.<br>Dept.of Science & Technology, Ecology & Environment<br>Govt. of Karnataka<br>Bangalore |
| 12:45 - 2:00 PM | ..... Lunch ..... | |
| 2:00 - 3:15 PM | Watershed development: Presentations by panelists | Shri Zafar Futehally<br>Moitaka, Kodaikanal<br><br>Shri Ramachandra Chetty<br>Chief Conservator of Forests[D], Bangalore<br><br>Prof. B R Hegde<br>Professor of Agronomy<br>University of Agricultural Sciences, Hebbal<br><br>Shri D Satyamurti<br>Director, Watershed Devt. Board, Bangalore<br><br>Prof. Ram Prasad<br>Dept. of Civil Engineering, Indian Insitute of Science<br>Bangalore 560012 |
| 3:15 - 3:30 PM | ..... Tea ..... | |
| 3:30 - 5:00 PM | Discussion | |

Wednesday, 14 - 2 - 1990

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Field visit:

To Kabbalanala Watershed Project
Kanakapura Taluk, Bangalore District.

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|---|---|
| 9:00 a.m. | Departure from Bangalore |
| 10:30 a.m. | Arrival at Kanakapura |
| 10:30 to 11:00 a.m. | Tea |
| 11:00 a.m. to 1:30 p.m. | Visit to Achalu microwatershed |
| 2:30 p.m. to 3:30 p.m. | Visit to Naripura Microwatershed Field |
| 3:30 p.m. to 5:00 pm. | Visit to Duntur Microwatershed Field including Operational Research Block |
| 5:00 p.m. | Departure from Duntur |
| 6:30 p.m. | Arrival at Bangalore |

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Accompanying : Shri V. Narasimhaiah
Joint Director
Agriculture State Watershed Development Cell
Bangalore.

Phone : Office: 266874
262019

Residence : Yelahanka 203

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# 4

Thursday, 15 - 2 - 1990

**Theme : Energy and Environment**

| Time | Topic | Faculty |
|---|---|---|
| 9:30 - 10:30 AM | Population pressure on India's resource base | Dr. C Chandrashekhar<br>Applied Population Research Trust,"Ananda"<br>Bangalore 560046 |
| 10:30 - 10:45 AM | ..... Tea ..... | |
| 10:45 - 11:45 AM | Energy planning for Karnataka | Prof. A K N Reddy<br>Chairman, Department of Management Studies<br>Indian Institute of Science, Bangalore 12 |
| 11:45 - 12:45 PM | Managing biomass as an energy source: case study of Astraole, community biogas and wood gasifier | Dr. N H Ravindranath<br>Centre for Ecological Sciences, Indian Institute of Science<br>Bangalore 560012 |
| 12:45 - 2:00 PM | ..... Lunch ..... | |
| 2:00 - 3:15 PM | Pollution:<br>Presentations by the Panelists | Shri S R Hiremath<br>Samaja Parivarthana Samudaya, Dharwad<br><br>Dr.A S Lakshman<br>Chairman & M D<br>Senapathy Whitelay Ltd.<br>Bangalore 560042<br><br>Captain Raja Rao<br>Director,Dept.of Ecology & Environment,Bangalore<br><br>Dr. R Doreswamy<br>Chairman, Institute of Engineers, Bangalore<br><br>Dr. Vinod Vyasalu<br>Institute for Social and Economic Change<br>Nagarabhavi, Bangalore |
| 3:15 - 3:30 PM | ..... Tea ..... | |
| 3:30 - 5:00 PM | Discussion | |

# 5

**Friday, 16 - 2 - 1990**

**Theme : Forestry and Environment**

| Time | Topic | Faculty |
|---|---|---|
| 9:30 - 10:30 AM | Wildlife conservation | Shri Bhoja Shetty<br>Forestry Consultant<br>Bangalore 560078 |
| 10:30 - 10:45 AM | ..... Tea ..... | |
| 10:45 - 11:45 AM | Tribals, forests and wildlife | Dr. H Sudarshan<br>Vivekananda Girijana<br>Kalyana Kendra<br>BR Hills, Via<br>Chamarajanagar<br>Mysore District 571317 |
| 11:45 - 12:45 PM | Forestry and environment: perspectives of a Forester | Shri Yellappa Reddy<br>Chief Conservator of<br>Forests, Dept. of Forests<br>Aranya Bhawan,Bangalore 3 |
| 12:45 - 2:00 PM | ..... Lunch ..... | |
| 2:00 - 3:15 PM | Forest management:<br>Presentations by panelists | Shri Ranjan Rao Yerdoor<br>Nagarika Seva Samithi<br>Belthangadi Tq. DK Dist.<br><br>Prof. M V Nadakarni<br>Institute for Social<br>and Economic Change<br>Nagarabhavi, Bangalore<br><br>Shri K M Hegde<br>Sahyadri Parisara Vardhini<br>Sirsi, North Kanara<br><br>Shri D M Chandrashekhar<br>Retd. Chief Justice of<br>High Court of Karnataka<br>Bangalore 560 001<br><br>Shri S Shyamsunder<br>Retd. Principal Chief<br>Conservator of Forests<br>Aranya Bhavan,Bangalore |
| 3:15 - 3:30 PM | ..... Tea ..... | |
| 3:30 - 5:00 PM | Discussion | |

Saturday, 17 - 2 - 1990

Theme : Integrating environmental considerations with development, planning and implementation

| Time | Topic | Faculty |
|---|---|---|
| | Presentation of group reports by the participants | |
| 9.30 a.m. - 10.10 a.m. | Forestry | - Sethi, N S<br>- Rathore, A S<br>- Sawian, H A D<br>- Mishra, J S<br>- Prabhakaran, S<br>- Ashok Koshy<br>- Harnam Singh |
| 10.10 a.m. - 10.30 a.m. | Energy & Industry | - Prasad Rau, M V S<br>- Beck Julius<br>- Sengupta, N K |
| 10.30 a.m. - 10.45 a.m. | TEA | |
| 10.45 a.m. - 11.15 a.m. | Tribal Development | - Rao, I S<br>- De, B L<br>- Daithankar, S G<br>- Kol, A C<br>- Mukherjee, S K<br>- Dam, S<br>- Man Mohan Singh<br>- Indrajit Pal<br>- Chakravarty, K K |
| 11.15 a.m. - 11.30 a.m. | Urban Development | - Abhay Prakash<br>- Chandrachoodan, K<br>- Mayilvahanan, M |
| 11.30 a.m. - 11.45 a.m. | Water Resources | - Stuti K Kacker<br>- Harnam Singh<br>- Kasipandian, S |

| | |
|---|---|
| 11.45 a.m. - 12.00 p.m. | **Rural Housing**<br>- Ram Sajiwan |
| 12.00 p.m. - 12.15 p.m. | **Agriculture, Land Use**<br>- Sharada Prasad |
| 12.15 p.m. - 12.30 p.m. | **Big Dams : Blessing or Damnation**<br>- Man Mohan Singh |
| 12.30 p.m. - 12.45 p.m. | **Strategies for Eco-benign Development**<br>- Dhoundiyal, B N |
| 12.45 p.m. - 1.00 p.m. | **Civic Duties & Conservation of Environment**<br>- Pius Pandarwani |
| 1.00 p.m. - 1.15 p.m. | **Urban Forestry**<br>- Harnam Singh |

INTRODUCTION



COURSE TITLE : MANAGEMENT OF ENVIRONMENT (S-12)

Residential or not : Non-residential

Objectives : To examine the whole range issues of environment and development, ranging from the broad framework of development policies down to specific problems of management of resource base for industries, of industrial effluents leading to pollution and conservation of biological diversity in nature reserves.

Course : Human ecological situation in India; content Patterns of natural resource use on the Indian sub-continent; Depletion of capital stock of renewable resources; pollution of soil, water and air; declination of biological diversity; Impact of environmental degradation on different classes of the society; urban middle and upper classes, slum dwellers, affluent farmers, marginal farmers, landless agricultural labourers, rural artisans, pastorals, nomads.

Land use policies: a case study of Karnataka Experiences of the watershed development programme. Proposed Comprehensive Land Use Management Programme.

Management of village common lands to meet rural biomass requirements: a case study of Karnataka.

Management of the pollution of Tungabhadra river by Harihar Polyfibres: a case study.

Nilgiri biosphere reserve an attempt to marry conservation of biological diversity with ecodevelopment: a case study.

Open discussion on issues of management of environment of India.

Methodology : Background material on all the topics under discussion is compiled for this course. The course would bring together technical experts, administrators and representatives of industry as well as workers from voluntary agencies who would make short presentations to stimulate wide ranging discussions on the issues involved.

At the end of the course the participants will have gained following : The partcipants would have been stimulated to think of the manifold issues pertaining to management of India's environment and relate these to their own responsibilities.

# 9

## POPULATION PRESSURE ON INDIA'S RESOURCE BASE

C. CHANDRASEKARAN

The presentation will attempt to give an overview of the dynamics of India's population, the inadequacies of the data base on India's population for adequate planning and draw attention to some of the ways in which population exerts pressure on India's resource base.

### (A) POPULATION DYNAMICS

(1) The population of India which in 1901 was 238 million had increased to 685 million according to the 1981 population census and is now estimated as about 820 million. The census commissioner of 1951 population census termed 1921 as the 'year of great divide' as prior to it, population was increasing at a slow rate (0.53 per cent per year between 1901 and 1921, and 1.22 per cent per year between 1921 and 1951). The year 1951 also proved to be another 'year of great divide' as population increased at the rate of two per cent per year between 1951 and the decades that followed.

(2) By 1921 the era of famines and epidemics which had kept population growth low ended. Public health activities had started and urbanisation and modernisation had made a beginning. Death rates had begun to decline. After 1951, droughts and famines had lost their former tenor, sporadic droughts in 1966 and 1967 in Bihar, Eastern Uttar Pradesh and Eastern Madhya Pradesh were severe but the logistics of food movement were worked out so well that a catastrophe such that which occurred in 1943 in Bengal was averted. More important, disease control was accelerated by the application of modern public health technology for the control of malaria and

by the use of newly discovered antibiotics.

(3) The First Five Year Plan included family planning as one of the areas of activity necessary for social and economic development. Progress, in the initial stages, was slow but the programme got accelerated after 1965 when the 'clinic' approach was substituted by the 'community approach'. Some of the landmarks of the family planning programmes are given below:

(a) The operative concern of the First Plan(1951-56) was restricted to provision of advice in Government hospitals and rural medical centres, and field experiments on different methods of collecting information on the medical, technical and motivational aspects of family planning

(b) In the Second Plan a more rigorous action-cum-research programme was undertaken; as a part of this programme facilities for sterilization were provided and the number of family planning clinics was raised from 147 to 4165

(c) In the Third Plan(1961-66) emphasis changed from 'clinic' to 'Community Approach'. Besides sterilization and conventional contraceptives, IUD(Lippe's Loop) was introduced on a large-scale in 1965

(d) In the Inter-Plan period(1966-69) commercial distribution of Condom under the name 'Nirodh' was launched. The practice of fixing annual family planning targets was initiated during this period.

(e) The Fourth Plan(1969-74) set the objective of reducing the birth rate to 25 per 1000 population by 1979. Integration of family planning with MCH was

emphasized. The Medical Termination of Pregnancy Act of 1971 came into force in 1972 'Mass Vasectomy Camps' were held

(f) In the Fifth Plan(1974-79), the target date for reaching a birth rate of 25 was shifted from 1979 to 1984. The target for 1979 was 30. The Plan was supplemented in 1978 by the Draft 1978-83 Plan of the Janata Government. A new Rural Health Scheme was introduced under which community Health Workers (now renamed as Health Guides) selected by the village communities from among their own people were appointed

(g) The Sixth Plan(1980-85) reflected the recommendation of the Working Group on Population Policy set up by the Planning Commission. The Working Group recommended that the long-term goal of the country should be to reach the net reproduction rate(NRR) of one by setting the following targets for the different states.

i) by 1991-92 the good performing states of Andhra Pradesh, Himachal Pradesh, Gujarat, Haryana, Kerala, Maharashtra, Punjab and Tamil Nadu should reach the NRR of one;

ii) by 1996-97 the moderately performing states of Assam, Karnataka, Madhya Pradesh, Orissa and West Bengal should reach the NRR of one; and

iii) by 2001-2002 the low performing states of Bihar, Jammu and Kashmir, Rajasthan and Uttar Pradesh should reach the NRR of one

The national birth rate of 21 as the target was to be reached by 1996. The death rate was to be 9 and the infant mortality rate 60 per 1000 births by that time.

To reach the birth rate target, 60 per cent of the couples in the reproductive age group was to be protected.

(4) The target to be reached for population growth has since been revised. The revised target in the Seventh Plan envisages an NRR of one for the whole country by the year 2001. While this revision is an indication that the tempo of the family planning programme has not come up to expectations, the achievements of the family planning programme should not be underrated. It is estimated that the programme averted 85 million birth by March 1987. Of these the bulk had been averted by sterilization of the male or the female.

(5) The Registrar-General of India has projected India's population till 2001 on a set of three assumptions with regard to the increase in the percentage of couples protected by that year. The High, Medium and Low assumptions assume that 28, 50 and 62 per cent of couples would be protected. Under these assumptions (and making some allowance for increase in the age at marriage it is estimated that the population in 2001 would be 1052, 991 and 959 million respectively

(6) An important point to notice is the age distribution of the population in 2001 under the three assumption given below:

(in million)

| Age group | High | Medium | Low |
|---|---|---|---|
| 0-14 | 377 | 316 | 284 |
| 15-64 | 627 | 627 | 627 |
| 65 & above | 48 | 48 | 48 |
| All ages | 1052 | 981 | 959 |

(B) INADEQUACIES OF DATA BASE

The above presentation might give the impression that the demographic data available in India is rich and accurate enough to describe with precision the characteristics of the population and study its dynamics. Although constant efforts are being made to improve the quality of demographic data available, demographers have to rely largely on estimates obtained by using indirect methods of estimation rather than rely directly on the information provided in several government publications. Some of the important lacunae are pointed out below so that to the extent possible administators who share the responsibility for production of demographic data might use their energies to improve the present situation.

1)Decennial Population Census: The ten-yearly population census - the next one being scheduled for 1991 - is the main source of population data available on a national basis. It is a huge undertaking requiring considerable administrative skill, once the methodology of census-taking is well established after a series of discussions of many parties concerned. No census claims to enumerate persons with 100 per cent accuracy and the errors by omission or erroneous addition are estimated by undertaking a post-enumeration survey. Investing energy at this juncture will pay dividends. More light can be thrown on the differential accuracy in the enumeration of males and females especially as successive censuses have shown a continuing decline in females as compared with males. Censuses do not often provide data on births and deaths and attempts to secure such data from censuses have largely been unsuccessful. Indian Census of 1981 obtained data on the number of children born and children surviving on a 20% sample of

ever-married women and in the 1991 census it is proposed to obtain such data for all ever-married women.

Age distribution, if accurately available can be a mirror of several happenings in the past. The number of children enumerated in the 0-4 age group is particularly important, although very often it is deficient either because of omission to record children or due to errors in recording ages.

The District Census Hand Book, published after the census, should be an invaluable reference book for administrators. So are the Village Registers.

2) Data on Birth and Death rates: The registration of births and deaths as a national obligation has existed in India for more than a century in some form or the other and the Registration of Birth and Death Registration Act of 1969 is now uniformly applicable over the whole country. Yet, the data on birth and death rates available from this source even at the present time is far from satisfactory. In 1984, for instance, while in Punjab 85 per cent of births and 91 per cent of deaths were registered, in Uttar Pradesh and West Bengal the percentage of registration was below 15 per cent.

At present, we rely on the Sample Registration System or indirect methods of estimation to gain knowledge of birth and death rates. A Model Registration system introduced in a limited number of primary health centres provides some data on causes of death.

3) Contraceptive Prevalance and Birth Rate: At present, it is difficult to reconcile the estimate of contraceptive prevalence, obtained albeit through devious

3) Contraceptive Prevalance and Birth Rate: At present, it is difficult to reconcile the estimate of contraceptive prevalence, obtained, albeit through devious calculations, with the level of birth rate obtained through the Sample Registration System. One reason for this discrepancy is assumed to be the boosting of the data on acceptors especially because of the financial incentives provided by the government, which serves as the starting point for working out Contraceptive Prevalence.

(C) POPULATION PRESSURE ON RESOURCE BASE

It is too common to blame population for the inability to increase the living standards of the people. In this process, often, it is not made clear whether one is talking about population size or the rate at which population is increasing. Some comments on population trends and resource needs are made below.

(1) Population and Food: Historically, there is constant reference in demography to the relationship between population and food. One of the reasons is the stress that Malthus put on these two factors and the theory which he developed on the assumed relationship. Our Five Year Plans(except perhaps the second) have laid great stress on food, which is naturally one of the basic requirements of man.

We have done fairly well on the food scene. From 108 million tonnes in 1970-71, the food grain production has touched 175 million tonne-mark. Rate of increase of food production has exceeded rate of population increase. Is this a satisfactory state?

Some comments made are:

(a) New technology has been high-cost technology not benefitting the poor consumers in terms of low prices.

(b) the production impact has been more on the superior

cereals like wheat and rice and confined to relatively affluent farming areas in Punjab, Haryana, Western U.P. and some pockets in the south

(c) emphasis has shifted from expansion of cultivated areas which has reached its potential to increase in productivity

(d) the growth lessons learnt in the green revolution areas could be irrelevant and harmful in the areas where water is scarce

(e) demand would be influenced by changes in the spatial and rural-urban distribution of the population and also its age-sex structure, and by inter-regional and inter-sectoral differences in tastes and preferences

(f) In 1986, an estimated 45 per cent of India's population suffered from some level of malnutrition. Largely this was due to the inability of large numbers of poor families to buy food at market prices and the maldistribution of food within families

(g) there are severe constraints on future food production. At least a quarter of India's irrigated land is in danger of being rendered unusable by waterlogging, alkalinity, and increasing salinity caused by inadequate drainage of irrigation water. In Gujarat's coastal districts ground water resources have been over-exploited for irrigation, and almost half the hand pumps now yield saline water because of the ingress of sea water

(h) As the Economist noted recently "India's green revolution is going brown around the edges". An estimated 12 billion tons of top soil are washed away every year. Hungry live stock eat the ground bare; when

the violent monsoon storms come, flash floods carry away the top soil. Poor soil in turn retains less water

(i) India's food production is still dependent on the monsoon.

(2) Population and Development: Industrial development is often considered as the key to raising to living standards and industrialisation has universally been accompanied by urbanisation. India's industrialisation is also largely confined to metropoliton and other cities and towns. Urbanisation in India is still at a low level as only about 25 per cent of the population live in urban areas as compared with about 75 per cent or over in many of the Western Countries. The pressure that urbanisation and industrialisation in India exert on resources, and the environmental damage they cause are well brought out in the paper entitled Population, Resources and Environment: The Indian Dilemma by Madhav Gadgil in Population Issues published by the Applied Population Research Trust. He draws attention to the fact that resources are diverted for the benefit of elite engaged in the organized sector of modern industry - especially the white and blue collar workers, the bureaucracy, the military and the substantial land holders in tracts of green revolution agriculture at the cost of masses who consist of agricultural labourers, small and marginal farmers and in some cases of urban slum dwellers. Such diversion depletes considerably the resource base of the rural poor. Dumping of wastes from urban areas and several factories into rivers affect the activities and livelihood of the rural population - especially the rural indigent. Several examples are cited in the paper referred to. There is need for careful planning of the process of industrial development if population is not to deplete the resource base, let alone its betterment. C.

Gopalan the well known nutrition expert, draws attention to the maldistribution of food by quoting figures which point out that the ranks of the 'hungry' are swelling inspite of increased food production. The war against hunger is essentially a war against poverty according to him. According to some studies 'the nutritional status of urban-slum dwellers in India is no better than that of poor rural labour'. The urban-slum dwellers are straining the amenities of the cities but are eking out a bare subsistence.

(3) The general social and economic background of the population is fairly well-understood. The percentage of literates is low and efforts are being made to improve the situation. Success in family planning programme will help particularly in making the younger generation more literate and also lessen the task for doing so. Housing, water-supply and provision of power are some of the needs which greatly strain the available resources.

(D) POINTS OF INTEREST

(1) The population growth of India is marked by two 'divides'. These were the years 1921 and 1951. While 1921 steadied population growth to 1.22 per cent per year, 1951 marked the growing of the population at the rate of 2 per cent per annum.

(2) Such an increase is not a unique phenomenon as most countries have gone through similar experience. The explanation lies in built-in cultural factors which were directed to maintain high fertility and which are slow to change. After a time, a generation in some cases, the birth rate comes down. The whole process is termed 'demographic transition'.

(3) Deliberate attempts to reduce fertility by the use of family planning methods meet with strong opposition.

(4) India's family planning programme was the first national programme to be evolved in any part of the world. The programme has used various devices but the extent of success has not been phenomenal.

(5) Population projections show that the effect of greater success in fertility control will not affect the size of the population as much as its age-distribution. Economic development cannot overlook this fact.

(6) Success in family planning will ultimately lead to the stabilising of the population size. In the process the age distribution of the population will change. The population will have less proportion of persons in younger age groups and the percentage of old people will increase. While the former is advantageous, the latter will pose many problems.

(7) The success of economic and social programmes depends both on the administrators and the response of the public. Family planning strategy requires careful consideration by the administrators.

(8) Demographic data base is very poor. Demographers have to work mostly with estimates. Administrators should make every effert to improve the data base in several directions.

(9) Food production in the country has more than kept up with the population. But the food situation is strongly criticised. The damage done to natural resources in an effort to improve food production has also come under severe criticism.

(10) Industrialisation and urbanisation have done considerable damage to natural resources. Although the increase in urban population is proceeding at a relatively slow rate, cities have been unable to absorb the immigrant population.

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# MANAGING THE ENVIRONMENT OF ANDAMAN, NICOBAR AND LAKSHADWEEP ISLANDS

- C. J. SALDANHA

## INTRODUCTION

Recent decades have witnessed an increase in developmental activities in the Union Territory of the Andaman and Nicobar Islands. These activities have simultaneously given rise to a growing concern over their adverse environmental impact. As each sector presses for acceptance of its developmental proposals, the total effect on interdependent ecosystems and on the resource base itself may be lost sight of. The Planning Commission in its *Report on integrated, environmentally sound developmental strategy for Andaman and Nicobar Islands'* of 1986 not only reflects this concern but also shows the way to an integrated rather than compartmentalised approach to planning.

To further this "integrated and environmentally sound developmental strategy" the Ministry for Environment, Forests and Wildlife, G.O.I., set up a "Core Group" in February 1987. The immediate task before the Core Group was to prepare a brief "state-of-art" statement on the environmental situation in the Islands supported by a strong data base.

Visits to the Islands, discussions with several helpful local officials and scientists as well as interaction among members of the Core Group have resulted in a better understanding of the natural and man-made ecosystems, their linkages and the implications of one or other option in the developmental process.

The Andaman and Nicobar Islands have been studied for over a century by scientists specialising in a wide range of disciplines. Collating the information has been a priority undertaking.

The environmental conditions and the consequences of development in the Andaman Group of Islands are sufficiently distinct from those in the Nicobar Group. In the former, accelerated immigration from the mainland and the setting up of a number of forest-based industries have led to extensive settlements and the conversion of forest areas into revenue and agricultural lands. The Negrito tribals are confined to specified islands or to tribal reserves. On the other hand the relatively larger population of the Nicobarese with a distinctive life-style and vigorous agro-horticultural practices has withstood the onslaught from the mainland. Nevertheless, large-scale commercial plantations, plans for a free port and the development of defence facilities are beginning to alter both nature and the natives. An EIA would help in evolving a proper perspective for long-term development.

## THE NATURAL ECOSYSTEMS OF THE ANDAMAN AND NICOBAR ISLANDS

There are three important natural ecosystems in the Andamans—the Forest Ecosystem, the Marine Ecosystem and the interphase between the two, the Mangrove Ecosystem. The topographical features, the climatic regime and the soil characteristics are the foundations on which these interconnected systems are built up.

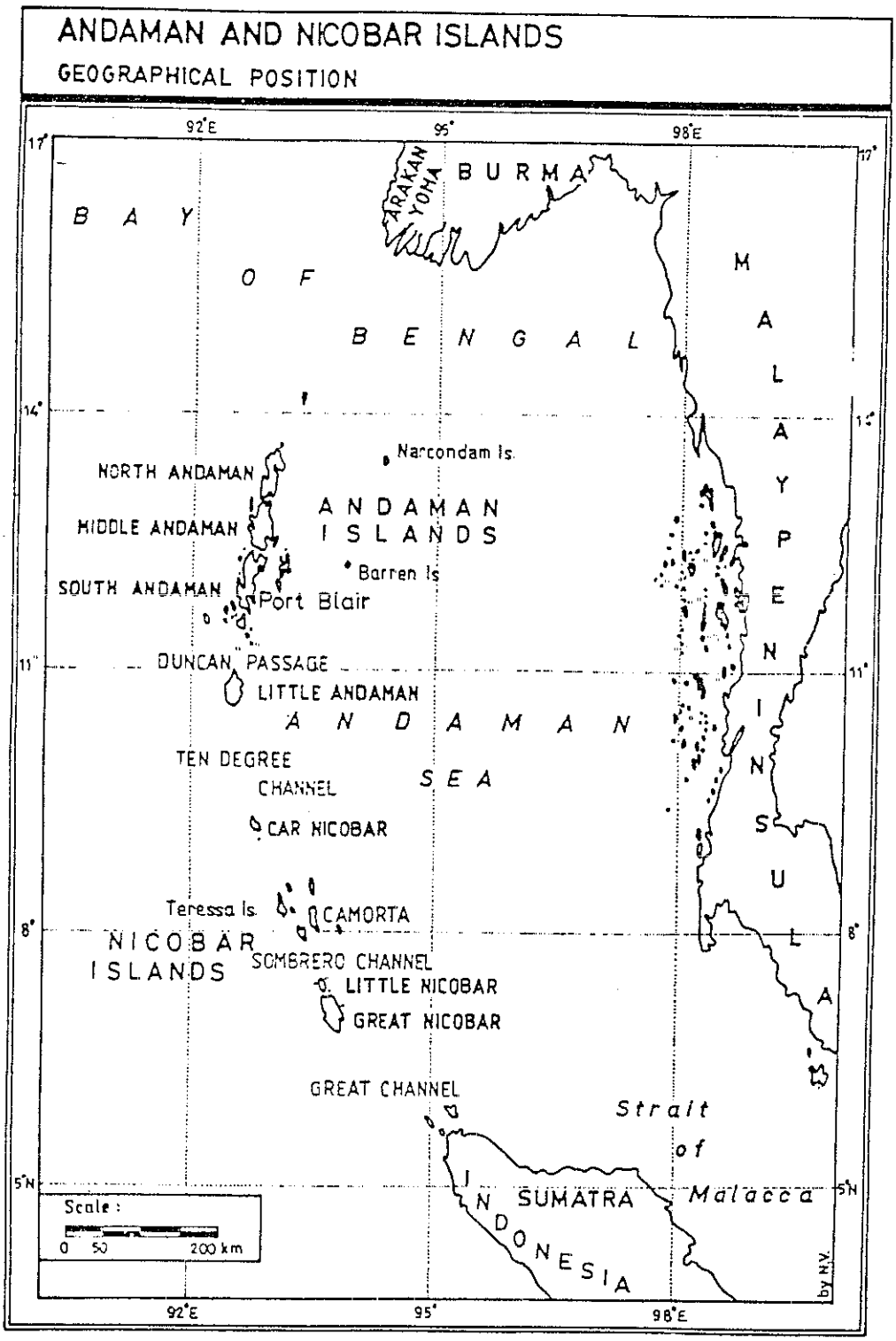

ANDAMAN AND NICOBAR ISLANDS
GEOGRAPHICAL POSITION
92°E
95°
98°E
17°
14°
11°
8°
5°N
BAY OF BENGAL
BURMA
ARAKAN YOMA
MALAY PENINSULA
Narcondam Is.
NORTH ANDAMAN
MIDDLE ANDAMAN
SOUTH ANDAMAN
ANDAMAN ISLANDS
Barren Is.
Port Blair
DUNCAN PASSAGE
LITTLE ANDAMAN
ANDAMAN SEA
TEN DEGREE CHANNEL
CAR NICOBAR
Teressa Is.
CAMORTA
NICOBAR ISLANDS
SOMBRERO CHANNEL
LITTLE NICOBAR
GREAT NICOBAR
GREAT CHANNEL
Strait of Malacca
SUMATRA
INDONESIA
Scale :
0 50 200 km
by N.V.

Fig. 1

**Topography and climate**

There are more than 325 islands in the Andaman Group. Their rugged features impress even the casual visitor. While steep hills abound, flat terrain is extremely limited. The larger islands are deeply indented by long, meandering, saline creeks. The soil is generally poor and porous with very little water-holding capacity. Patches of clay occur in the low lands restricting permeability. The hypothesis that the Islands are emergent peaks of a submerged mountain related to the Arakan Yoma Range of mainland Burma might explain these features.

Proximity to the Equator and to the sea ensures a hot, humid uniform climate with day temperatures around 30 degrees Centigrade. Since the Islands are under the influence of both

| | | *Andaman and Nicobar Islands* | |
|---|---|---|---|
| Location | : | 6° 45′ N-13° 41′ N lat. | |
| | | 92° 12′ E-93° 57′ E long. | |
| Distance | : | Port Blair—Madras | 1,133 km |
| | | Port Blair—Calcutta | 1,255 km |
| Area | : | 8,249 sq km | |
| | | Andaman Group | 6,408 sq km |
| | | Nicobar Group | 1,841 sq km |
| Coastline | : | 1,962 km (1/4 of Indian coastline) | |
| No. of Islands | : | More than 325 (21 inhabited) in Andaman Group | |
| | : | More than 24 (13 inhabited) in Nicobar Group | |
| Excl. Eco. Zone | : | 6 lakh sq km (30% of E.E.Z. of India) (approximate) | |

| | | *Little Andaman* | |
|---|---|---|---|
| Location | : | 10° 27′ N-10° 53′ N | |
| | | 92° 2′ E-92° 35′ E | |
| Area | : | 731.416 sq km | |
| Mean Annual Rainfall | : | 3 000 mm | |
| Temperature | : | 25° C - 30° C | |
| Population (1981) | : | 7,991 Onge | 98 |
| | | Nicobarese | 679 |
| | | Others | 7,214 |
| Land Use | : | *Revenue* | 3,435.96 ha |
| | | *Forest Plantation* | |
| | | N.R.A. | 154.7 ha |
| | | Oil Palm | 1,593.0 ha |
| | | Spices | 21.0 ha |
| | | *Reserve Forest* (including Tribal Reserve of 52.296 ha) | 67,091.0 ha |

*Source:* Forest and Plantation Development Corporation.

southwest and northeast monsoons. it rains through from May to February but for a short break in October. The mean annual rainfall is 3800 mm: the maximum recorded annual precipitation of 4,361 mm was in 1961 while the minimum of 1,539 was in 1979. The flat terrain is waterlogged for several months during the monsoon. On the other hand there is scarcely any ground water. Except in Great Nicobar there are no rivers worthy of the name. Fresh water streams remain perennial only if the catchment is under forest cover.

The Little Andaman Island is cut off the Andaman Islands by the Duncan Passage and from Car Nicobar by the Ten Degree Channel. It has an identity of its own (Plate 2).

The Little Andaman is for the most part flat. Ten per cent of the area is of tidal flats, swamps and beaches. Another 63 per cent forms the coastal plain. The central and southern portions are undulating to hilly with the highest point rising to 156 m. The island was till recently covered by thick forest sufficiently distinct from the forests of the rest of the Andaman Islands. Padauk so typical of the other Islands is not native here.

The Nicobar Group consists of more than 24 islands of which 13 are inhabited. These islands are in three groups: the northern, middle and southern.

The northern group has two islands, a small island named Bathimalay and Car Nicobar. The latter is flat with a highly modified plant cover. Headquarters of the Nicobar District, it has an Air Force Station with an airstrip. Although it does not have a proper jetty, it is connected by sea to the mainland and other islands by ship, plane and helicopter services.

The middle group is made up of more than eight islands. Chowra, Teressa, Bompoka and Katchal form a series on the west. Nancowry, Camorta and Trinkat make an eastern cluster. Tillanchong and Isle of Man are slightly to the northeast. A striking feature of the plant cover here is the presence of large patches of grassland surrounded by good forest growth (Plate 3). We are told that these grasslands were created over a century ago by clearing the forest as part of a Danish effort to develop dairy farming in the region.

| | | | *Great Nicobar* | |
|---|---|---|---|---|
| Location | | : | 6°45′ N-7°15′ N<br>93°38′ E-93°55′ E | |
| Area | | : | 1045 sq km | |
| Perennial Rivers | | : | 5 | |
| Hill Ranges | | : | 5 | |
| Highest Point | | : | Mt. Thullier (670 m) | |
| Population: | Tribal | : | Schompen | 212 |
| | | | Nicobarese | 164 |
| | Non Tribal | : | Settlers | 4,180 |
| | | | Floating Pop. | 1,539 |
| | | | | 6095 |
| Land Use: | Protected Forests | | 96855 ha | |
| | Revenue Area | | 6260 ha | |
| | Defence Area | | 1510 ha | |

The southernmost group consists of two large islands the Little and Great Nicobar as well as eight smaller islands. A good study on the climate, geology, vegetation and tribes of the Great Nicobar has been made by N.P. Balakrishnan as far back as 1982. The vegetation of the Great Nicobar is rich, with many endemics. A rare feature in the Territory is the presence of several fresh-water rivers (Plate 4) especially the Galathea, Alexandra, Dagmar, Amrit Kaur and Jubilee Rivers. Indira Gandhi Point (Pygmalion Point) is the southernmost point of the Indian Union and about 150 km from the Indonesian Island of Sumatra (Plate 5).

**The forest ecosystem**

The tropical climate the long rainy season and an average relative humidity of 79 per cent have nurtured a good forest cover over practically all the Islands. These forests are important for *what they are*, for *what they do* and for *what they give*.

Although the botanical exploration of these forests is incomplete a recent checklist of the Angiosperms in the Islands names 1,370 native species placed in 668 genera and belonging to 111 dicot and 24 monocot families. Many of these plants do not occur anywhere else in the Indian Union as their affinities are with the Malaysian flora. Of these species, 206 are endemic and occur nowhere else in the world.

Champion and Seth have classified the Andaman and Nicobar Forests into six types. Bamboo and cane brakes form local variations. Seral associations appear as semievergreens.

*Forest Types in the Andamans*

| | |
|---|---|
| 1. Giant Andaman Evergreens | Climax formation in lowlands. Almost extinct due to large-scale clearance of flat terrain for agriculture. |
| 2. Andaman Tropical Evergreens | Multi-storied, closed canopy forests. Grow in hilly terrain. |
| 3. Andaman Moist Deciduous Forests | Open canopy forests with seasonal leaf fall. Occur on lower slopes on 45 per cent of total area. Yield timber of more economic value. |
| 4. Andaman Hill-top Evergreens | Stunted, wind-resistant forests. |
| 5. Littoral Forests | Open formations of tall, sturdy trees with limited undergrowth. On sandy beaches above high water level. |
| 6. Mangrove Forests | Dense formations well adapted to salinity, tidal fluctuations and marshy soil. Interphase between land and marine ecosystems. |

The Giant Andaman Evergreens, regarded as the climax formation in the Islands, once grew on the alluvial soil along streams and in the lower valleys. Magnificent buttressed trees festooned with climbers and epiphytes and interspersed with canes and bamboos rose to 30 m and more (Plate 6). *Dipterocarpus alatus*, the tall Gurjan, was common in these forests.

The Andaman Tropical Evergreen Forests and the Andaman Moist Deciduous Forests form a mosaic on the lower hills of the Islands. In the Great Nicobar the virgin Evergreen Forest occupies most of the central hills. The decidous trees often occupy the area between the tidal zone

and the evergreen patches (Plate 7). The White Chuglum (*Terminalia alata*) and Padauk (*Pterocarpus dalbergioides*) are important constituents of the Moist Deciduous Forest.

The Hill-top Evergreens occur on the hill tops and their physiognomy is greatly influenced by strong winds. Saddle Peak (737 m) in the North Andaman and Mt. Ford (435 m) in Rutland present good examples of such vegetation. *Dipterocarpus costatus* the local Gurjan rises to scarcely 10 m.

Littoral forests form a narrow belt on sandy or shingle beaches. Growing just beyond the high tide mark, the trees are sturdy and withstand the fury of monsoons and cyclones (Plates 10 and 11). *Manilkara littoralis* (Bullet Wood) and *Heritiera littoralis* (Sundri) are common. They act as wind breaks protecting the island shores. Bleached tree trunks uprooted on secluded beaches are mute evidences of tempestuous situations.

Tropical forests generally support a variety of animals. The absence of mammalian carnivores is therefore surprising. The largest native land mammal is the Andaman pig (*Sus scrofa andamanica*). Among the 2,100 terrestrial animal species reported from the Andaman and Nicobar Islands, 1,500 are insects. Of the 238 native bird taxa 95 are resident and endemic, 43 resident and 100 migrant.

The Negrito tribals are part of the forest ecosystem. They have not only made the forest their home but they cannot survive without it. Today they constitute four groups – the Andamanese, the Onge, the Sentinelese and the Jarawa.

The Andamanese forming about 10 tribal communities held sway over the greater part of the Archipelago. The Jarawa also lived on the larger islands. Both groups being hunter-gatherers, they lived by gathering honey, fruits and roots, by hunting the native pig or by harpooning fish. Proficient in the use of the bow and arrow, they prepared their arrowheads from bits of metal stripped from ocean wrecks. The Sentinelese are the least known of the tribes living in zealously guarded isolation on North Sentinel Island. The Onge were the sole inhabitants of Little Andaman.

*Tribal Population in the Andamans*

| Tribe | Year | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1901 | 1911 | 1921 | 1931 | 1951 | 1961 | 1978 | 1980 | 1985 |
| Great Andamanese | 625 | 455 | 209 | 90 | 23 | 19 | 24 | 25 | 28 |
| Onge | *672* | *631* | *346* | *250* | *150* | 129 | 106 | 97 | 98 |
| Jarawa | | *114* | *114* | *70* | *50* | *500* | *250* | *250* | *200* |
| Sentinelese | | *117* | *117* | *50* | *50* | *500* | *100* | *500* | *50* |

All italicised figures are estimates. Total tribal population in 1858 was 5,000 i.e. about 3500 Great Andamanese and 1,500 Onge;Jarawa Sentinelese. (After Pandit)

Besides being a rich repository for plant and animal species—hundreds of them endemics, the forest ecosystem is part of the worldwide tropical vegetation so crucial to the survival of living systems. The forest is probably the most efficient bioconverter of solar energy. Relative to its limited area the biomass production of the Andaman forests is substantial.

By the metabolic processes of the forest the atmospheric balance is maintained, run-off controlled, surface water is conserved and percolation sustained. The poor island soils are enriched and their erosion prevented. Control of siltation protects the coral beds. It also maintains the soil conditions necessary for the survival of the mangroves. The organic nutrients leached into the surrounding sea sustain both mangrove and marine ecosystems.

## The marine ecosystem

Although the land area of the Andaman and Nicobar Islands is only 8,249 sq km, the Exclusive Economic Zone of the Islands extending to 200 nautical miles from the shoreline, is 75 times larger, approximately 6 lakh sq km. This is an enormous real estate comprising 30 per cent of the E.E.Z. of India.

The waters around the islands have been studied during cruises by several vessels. One of the earliest studies was on the benthos by R.V. Valdivia in 1849. These were followed by expeditions

*Marine Biological Diversity*
(Some Findings)

| Group | Species | Authority |
|---|---|---|
| Phytoplankton | | |
| Diatomaceae | 22 | Nair & Gopinathan |
| Dinophyceae | 33 | (1983) |
| Myxophyceae | 1 | |
| Marine Algae | | |
| Chlorophyceae | 16 | Gopinath & |
| Phaeophyceae | 17 | Panigrahy (1983) |
| Rhodophyceae | 22 | |
| Marine Invertebrates | | |
| Coelenterata (Including 179 Scleractinian Corals) | 326 | Subba Rao (1987) |
| Polychaetes | 161 | Tikader, Das & Subba Rao (1986) |
| Crustacea | 407 | " |
| Pycnogonids | 8 | " |
| Molluscs | 790 | " |
| Echinodermata | 331 | " |
| Marine Vertebrates | | |
| Pisces (Including some fresh water fishes) | 750 | " |
| Reptilia (Including 4 Turtles) | 11 | Subba Rao (1987) |
| Mamalia (Whale, Dolphin & Dugong) | 3 | Tikader, Das & Subba Rao (1986) |
| Meiofauna | 324 | G.C. Rao (1977) |

on R.V. Dana, R.V. Galathea and R.V. Vityaz. Ships of the Indian Navy and from the National Institute of Oceanography have added to our knowledge of these seas and at the same time exposed the large gaps that still exist in our knowledge.

The geology of the ocean bed and the composition of the sediments have been partially investigated. The ocean currents and the temperature variations at different depths have been noted. The differences between the water of the Bay of Bengal and that of the Andaman Sea have been recorded. The euphotic zone limited by the silt load in the Gangetic and Irrawady deltas increases in the region of the islands. This has a direct bearing on the productivity of waters around the Andaman and Nicobar Islands.

The continental shelf is narrow and slopes rapidly to great depths. The Central Basin in the Andaman Sea plunges to over 3,000 m. The narrowness of the shelf is compensated for by the numerous bays, lagoons, creeks and reefs replete with a wide variety of plant and animal life.

Scientific papers and popular illustrated books serve as introductions to a wonderworld of graceful corals, star-fishes and sea cucumbers.

The western side of the Andaman Islands has a coral reef running intermittently for about 350 km. The islands of Ritchie's Archipelago, the Labyrinth Islands and the inshore waters of Cinque Islands have beds where multicoloured fish flit about among marvels of coral architecture.

There is an abundance of fish in the shallow waters as well as in the deep sea. A conservative estimate puts the possible annual catch at 50,000 tonnes. (A reported estimate by N.I.O. places the probable annual catch at 4,74,000 tonnes/annum). Shrimps, lobsters, crabs and molluscs add to the variety and abundance. Of the marine mammals the Dugong moves about in shallow water while the Dolphin gambols around shoals of shimmering fish in the open seas. Four species of sea turtles come to the sandy beaches to lay their clutch of eggs in shallow pits just above the high tide mark.

### The mangrove ecosystem

The mangroves form an easily discernible transitional system between the forests on land and the life in the open sea. Mangroves in the Andaman and Nicobar Islands are estimated to occupy 1,15,000 ha of which 50,000 are in the Andaman group. These mangroves are considered to be one of the most important surviving formations in the world (Plate 13).

The push and pull of the tide, the limitations of waterlogged slush and the salinity gradients of the creeks require special metabolic and morphological adaptations. Stilt roots anchor the plants

| | *Mangroves in the Andaman and Nicobar Islands* |
|---|---|
| Area | 1,15,000 ha (50,000 in Andamans) |
| Zone | Outer, middle, inner |
| Plants | Algae — micro and macro<br>Angiosperms — sea grass, epiphytes, trees and shrubs (38 spp.)<br>Communities — six types |
| Animals | Prawns, crabs, mullets, mussels, oysters, fish, crocodile |
| Role | Buffer against erosion<br>Shelter and breeding ground for aquatic life<br>High productivity of organic detritus |
| Resource | High calorie fuel wood; tannin |

(Plate 14). Breathing roots turn upwards as if gasping for air. Seedlings are nurtured on parent trees until they are capable of a secure, independent existence.

Soil and salinity vary from the outermost to the middle and innermost zones of the mangroves. *Rhizophora mucronata* and *R. apiculata* occur in the outer zone. *Bruguiera gymnorrhiza* and *Ceriops tagal* as well. *Avicennia* and *Lumnitzera* form a middle zone. The shrub *Acanthus ilicifolius*, the fern *Acrostichum aureum* as well as the palms *Nypa fruticans* and *Phoenix palustris* occur in the innermost zone where the tide and salinity are mild (Plates 15-18).

The organic detritus is plentiful and nourishes a wide variety of marine fauna. Crabs, mullets, mussels and oysters thrive here. Fishfry and prawn seed are plentiful. The marsh crocodile placidly awaits its unwary prey.

## THE MAN-MADE ECOSYSTEMS OF THE ANDAMANS AND NICOBARS

The natural ecosystems of the islands—forest, marine and mangrove are not only linked to each other, they also form the resource base for the man-made ecosystems—forestry and industry, agriculture and fisheries. The people, whether as householders or as service agencies, control and at the same time depend on these four man-made systems.

### People

The survival, amelioration or degradation of ecosystems depend largely on man. Within the confines of an island ecosystem, the arrival of humans, especially in large numbers can bring about great changes. The Andamans show the impact of such an intervention.

Till the end of the 18th century the islands were inhabited only by native tribals estimated at a little over 5,000. The Andaman tribes were Negrito hunter-gatherers. Those in the Nicobars were horticulturists and herders belonging to the Mongoloid race.

It was in the late 18th century that the seafaring nations of the West made their contact with the islands mostly to replenish their supply of the drinking water. The British who might have appreciated the strategic location of the islands made a first attempt at establishing a settlement at Port Cornwallis in 1788. This was abortive. A second attempt was made in 1858 at Port Blair. Land was cleared for a prison and a penal colony set up. Chatham became the headquarters of the forest department and Ross Island was reserved for the British residents.

A number of convicts were permitted to settle in small villages so that they could become self-supporting by agriculture and cattle rearing, both in a primitive way. The Bhantu, Mopla and other settlements came up but did not harm the natural ecosystem. The annual rate of population growth till 1941 was 0.5 per cent. With the occupation of the islands in 1942 by the Japanese, there was a decadel decrease of 8.3 per cent in the population.

The post-1950 period witnessed a large-scale increase in the population. It jumped from 30,971 to 1,88,741 between 1951 and 1981. The Andaman Group of islands showed an increase from 18,962 to 1,58,287, 88 per cent of the increase in the whole territory.

#### Tribals

There is a sharp contrast in the population statistics of the Negrito tribals and the mainland settlers in the Andaman group of islands. The Andamanese and Onge populations have dwindled to such low figures that their long-term survival is doubtful. Is it their contact with the outsider that has caused their quasi extinction? The Sentinelese are putting up a last ditch stand in their

*Population Growth in Andaman and Nicobar Islands*

| Year | Population | Decennial Increase |
|---|---|---|
| 1911 | 26,459 | |
| 1921 | 27,086 | + 627 |
| 1931 | 29,476 | + 2,390 |
| 1941 | 33,768 | + 4,292 |
| 1951 | 30971 | —2,797 |
| 1961 | 63548 | + 32,577 (105% incr.) |
| 1971 | 1,15133 | + 51,585 |
| 1981 | 1 88711 | + 73,608 |
| 1985 (est) | 2,50,000 | + 61,259 |
| 2000 | 4,05000 | + 1,55,000 |

island hideout. The rationale of the overtures being made by the Andaman and Nicobar Administration is likely to be suspect in their eyes. The Jarawas, segregated in their reserves in South and Middle Andamans are equally apprehensive. It was painful for us to hear that their homeland 'was infested by hostile tribals'. Since the Jarawa Reserves are well stocked with timber and easily accessible envious and greedy eyes are being cast on them. The Andaman Trunk Road, constructed after long arguments has increased the confrontation between the tribal and settler. The role of the gun toting bush police is ambiguous and needs to be well defined and faithfully carried out.

There are proposals to set up a 'contact hut' for the Jarawas of Middle Andaman in the Kadamtala area. Two more sheds one for stores and another to house the bush police are contemplated as part of this complex. Rice, utensils and some other gifts are to be given to the Jarawas of Middle Andamans. There is a further plan to contact the Jarawas of South Andaman by transferring gift-bearing Jarawas from Middle to South Andamans.

Extreme caution is needed in these efforts at contact. The fanfare accompanying these efforts and the money spent by the contact teams make one apprehensive. A greater interaction with the ASI and the Andaman and Nicobar Administration is absolutely essential before some of these plans are implemented.

The misery of the once great Andamanese in their pseudocivilised tin-huts on Straight Island has been commented upon by Dr. S. C. Nair in an earlier study. A high level investigation is imperative before we interfere with the remaining courageous and virile Negrito tribal groups.

*Onges*

Till 1967 the Little Andaman was inhabited by the Onges only. From a strength of about 700 a century ago, cut down by warfare and succumbing to disease, they had dwindled to 129 by 1967. They now number only 98.

During the last twenty years these exclusive inhabitants of the island have had to face an influx of over 7,000 mainland settlers as well as another 700 Nicobarese descended from the 60 families transferred from Car Nicobar to Harmandar Bay in 1973.

Shifted from Hut Bay their original hunting and collecting ground, the Onge have now been herded to the tribal settlements at Dugong Creek and South Bay. They are under the tutelage of social workers trying to teach them the three R's as well as better methods of horticulture and fishing (Plate 19).

According to reputed anthropologists the Onge are becoming more and more dependant and docile instead of continuing as members of a self-reliant and independant society. The psychological impact of being hopelessly outnumbered in their own island is becoming destructive.

During discussions with various officials we began to wonder whether there was a design and ulterior motive in the apparently benevolent regrouping of the Onge. The Director of Tribal Welfare was clear in his statement that 668 sq km in the Little Andaman constituted a Tribal Reserve. However, the Forest and Plantation Development Corporation records list this area as Reserve Forest while at the same time restricting the Tribal Reserve to only 52 296 ha. It would seem that by shifting the Onge to Dugong Creek and South Bay, the rest of the Island has been opened up for commercial exploitation (Plates 20 and 21).

*The Schompens*

The Forests of the Great Nicobar are the home of a semi-nomadic, monogamous aboriginal tribe with mongoloid features. They now number 214. Living in groups they move from place to place in the forests of the central uplands. It is probable that they were pushed into inaccessible areas by the Nicobarese who have several settlements along the coast.

The Schompens depend very much on the forest. Their home, their food, their medicine are all from within the forest. They have also been known to fish. Anthropological and ethnobotanical studies on the Shompens are available. These throw considerable light on the life style, needs and the hazards facing the tribe.

The greatest hazard is without doubt modern man. There are plans to group these forest nomads in tribal settlements. Going by what has happened to the other primitive tribes, this plan can sound the death knell of one more group.

Discrete contacts and some essential health care might help the Schompens. However, destruction of their forest homeland, construction of a highway through their territory, extraction of timber are so many nails in the coffin of these people. This is exactly what the authorities are up to. The GREF is constructing a tared road from Campbell Bay on the east coast to Kopenheat on the west coast. A Forest Working Plan is being prepared for the extraction of timber. The Schompen Hut on the East-West Road is a caricature in tin and stone of the traditional thatched forest dwelling of these tribals (Plate 22). No wonder it is occupied by the staff of government organisations and not by any Schompen.

*The Nicobarese*

The Nicobarese constitute the largest tribal group in the islands. Belonging to the Mongoloid race and probably to the Indomalayans, the horticulturist herders now number around 22,000. They live in 156 villages in all the inhabited islands of Nicobar District, their greatest concentration being in Car Nicobar where they number 13,514 (1981 census) (Plates 23 and 24). Being horticulturists they have good coconut plantations, and also grow tuber and fruit crops. They rear pigs, fowl and some cattle. Physically sturdy, they augment their land resources by fishing in the sea with harpoons or nets cast from their traditional boats.

They have under the leadership of a Nicobari leader the late Bishop Richardson, been influenced by Christianity and are able to cope with some of the development of an external civilisation while retaining a good part of their tribal social structure.

Encouraged by the Church and the civil administration, education has spread to several villages. Eighteen per cent are literate and the school-going population is around 12 per cent.

There have been several studies on the life, customs, habits, house construction and boat-making

techniques of the Nicobarese. A few observations could however be helpful here.

1) Efforts are being made by the Department of Tribal Welfare to help the Nicobarese. The whole Nicobar District is covered by the Integrated Tribal Development Programme. There is also a Tribal Sub-Plan as part of the Seventh Five Year Plan. Funding for the sub-plan in 1987-88 is as follows:

a) Flow of funds from Union Territory Plan—Rs 795 732 lakhs

b) Special central assistance—Rs. 20 lakhs and

c) Centrally sponsored schemes—Rs. 45 lakhs. Thus there is an annual outlay of Rs. 860 732 lakhs for 1987-88.

2) The Andaman and Nicobar (Protection of Aboriginal Tribes) Regulation of 1956 restricts the entry of non-tribals into the tribal areas. Sale of land in the tribal territory to non-tribals is forbidden. However, as seems to be the case in Little Andaman, a subtle shift in nomenclature can alter the status of the tribal lands

3) The Nicobarese population is increasing. Pressure for more land is building up. The Nicobarese shifted to Harmander Bay from Car Nicobar in 1973 have grown from 60 households to 165 households so that the original land allotment of 200 ha has become inadequate. Similar situations are arising in the other islands.

4) The barter trade of earlier years seems to be continuing although in the form of cooperative societies. There seems to be a monopolistic hold on trade, inter-island cargo shipping, agencies for vehicles, etc. There is need for an objective look on price of horticultural and farm produce to see whether they reflect market values. So also the supply of consumer goods like clothing, food, petrol and diesel should be stepped up in a free marketing system.

5) At present the Nicobarese are contented with their lot. Although the most advanced of the local tribes, they might not be able to cope with an invasion of people and the cultural shock which a large free port could create. This consideration has to be kept in mind in future plans for development of the islands.

6) Given the skill of Nicobarese in traditional fishing, a number of the younger men could be trained to exploit the marine wealth either by deep sea fishing or by mariculture (Plates 25 and 26).

SETTLERS

The settlers in the northern islands form several groups. The reprived convicts have their hamlets around Port Blair. The Karens have their distinctive colony at Webi near Mayabunder in Middle Andaman.

The labour force for forest operations, APWD undertakings and Andaman Harbour Works is largely from Chotanagpur. A good part of these Ranchi tribals used to return to the mainland after the annual tasks were completed (Plate 27). Many however, have made their home in the islands. In spite of their contribution to the economy of the islands very little has been done for their welfare. An easy reply to our queries was 'they are tribals and quite happy in the forest'. Some of these landless Ranchi tribals have become serfs of the landed settlers. Others live in slums as at 'School Lines' at Port Blair.

The privileged settlers are the refugees from Bangladesh who were resettled here in 1950-60. Each household was given five acres of flat land for paddy, five acres of hilly land for tree crops and one acre of land to build a homestead. Twelve tons of free royalty timber was given for house construction, five tons of timber for house repairs once every five years, a ton of timber for tools and/or a dinghi. Licence to extract liberal quantities of firewood, bamboo, ballies, posts, thatching leaves and cane was also given. These privileges still continue in slightly reduced quantities.

There are other groups that have settled in the Andamans. They are mainly from Tamilnadu, Andhra and Kerala. They are mostly in service organisations, carry on commerce or perform specialised jobs. A large number have connections with their native place and repatriate part of their earnings. (The reports of the Census of India, Sec. 24, Pts. I-VI contain a wealth of data on the people in the Islands)

The administrative services contain a large floating population. Most live in Port Blair. Other centres like Mayabunder, Diglipur, Rangat and Long Island have representatives of the administration.

There are three types of settlers in the southern islands.

The first is made up of ex-servicemen (Plate 28). From 1969 onwards, 337 families were settled on the eastern coast of Great Nicobar. A forest area of 1,499.65 ha was cleared. Each family was given 11 acres of land (4.45 ha). Schools and primary health centres were established for their benefit. An Agricultural Demonstration Farm was set up. A 35 km North-South Road was constructed from Campbell Bay to Shastrinagar and an East-West Road of 8 km.

The second type of settlers in the Little Andaman and Katchall Islands is of Sri Lankan repatriates or Bangladeshi refugees. The former, estimated to be about 268 (1981 census) have primarily been settled in Katchall and work in the F.P.D.C. rubber plantation. The Bangladeshi refugees have been settled in Little Andaman at Netaji Nagar, Ramakrishnapur, Vivekanandapur and Rabindranagar. These have smaller agricultural plots and cultivate vegetables.

A third class of people is made up of labourers with their families working for the A.P.W.D., Andaman Harbour Works, Forest Dept., F.P.D.C., G.R.E.F. and the local contractors. These form the largest group. Some are salaried with proper pay scales. A good number are on daily wages. Not a few of these have spent long periods in the islands but continue to be landless labourers. It would be right that they should be given priority in the allotment of house sites in revenue areas.

There is a group of surreptitious entrants into the islands about whom not much is officially known. According to rumour, they come from different parts, even from Bangladesh or Sri Lanka. Their number is a guess. The area estimated to be under encroachment is over 3,200 hectares (Bhatee, 1986). What is even worse, the encroachments are honey-combing forest areas in North, Middle and South Andamans. Encroachments up to December 31, 1978 are going to be regularised. Once regularisation of earlier encroachments is done, in all probability fresh encroachments will be made. Socio-economic and political pressures will inhibit eviction. Demands will be made to advance the cut-off date. There have been new encroachments in Rutland, Cuthbert Bay and North Andamans. Vested parties even encourage and protect the encroachers. Roads have been sanctioned to scattered encroachments, water and electricity have been made available. A high official of the administration remarked that over 50 per cent of his department's work was to habilitate illegal encroachments. Regrouping of hamlets from inside the forest to revenue lands outside the forest must be a top priority in environmental protection. Unless the regrouping is done effectively it will only result in further forest land being cleared while the hamlets within the forest persist.

There is pressure to convert more forest land into revenue land. The Home Ministry has issued a note identifying eight needs for the conversion of land for non-forest use: (1) defence, (2) health, (3) education, (4) government offices, (5) residential quarters, (6) public undertakings, (7) P.W.D., and (8) social services. Utmost restraint needs to be exercised in asking for this conversion. Priorities should be carefully identified.

The islands are unable to support the present population with local resources. Food, building materials, petroleum products, clothing and even paper have to come from the mainland and made available at subsidised rates.

Transportation from the mainland to the islands and from island to island is inadequate and antiquated. The annual plans for the islands have tried to make provision for more vessels. There has been a time lag between the placing of an order and the supply of the vessel. Road transport is being improved by the construction of motorable roads and increase in the number and frequency of buses. Air travel is by daily flights from the mainland—either from Madras or Calcutta on alternate days. Car Nicobar is now part of the Indian Airlines network. A helicopter service operates between islands when there are no technical snags.

The Government subsidises travel. On every passenger who arrives or leaves by ship the State incurs an expenditure of around Rs 1,000 (See Plates 31-33). Most officials and their families are permitted to travel by air to and from the islands at State expense. Helicopter travel, though limited, is highly subsidised.

Thus an entire system is being built up in the islands which is not economically viable. Systems that have to be kept going by costly and artificial means are liable to collapse at any time. Our study presents us with a picture of a large bureaucracy, a section of the people sapped of initiative and enterprise by subsidies, of social injustice to underprivileged but hardworking groups.

**Forestry and forest-based industries**

About 86 per cent of the geographical area of the Andaman and Nicobar Islands is supposed to be under forest cover. This is around 7,144 sq km out of a total land area of 8,249 sq km. According to the Forest Department 41 per cent of this area constitutes tribal reserves. Further, out of the balance of 4,115 sq km, small wooded islands occupy a considerable area. The timber here is commercially unexploitable. As a consequence, the actual exploitable forest area is likely to be around 30 per cent. Hence the supposition that forests occupy 86 per cent of the islands needs to be carefully and realistically analysed.

The numerous islands and the rugged topography have made forest operations difficult and expensive. Only good logs are moved to the roadside leaving about 36 per cent of the biomass as lops and tops in the forest (Plates 34-35). The logs are loaded on to trucks, transported to a water point where 'floaters' and 'sinkers' are lashed together into rafts. These rafts are towed to a harbour and shipped either to the mainland or to a local saw mill, match wood unit or veneering and plywood factory. The forest work is carried on with help from either settlers or mainland workers among whom a large proportion belong to tribals from the Ranchi area. Elephants are used for dragging, loading and unloading the timber (Plates 36-39).

The demand for wood and wood products during the pre-1950 period was low. The Government Saw Mill at Chatham, established in 1853, supplied sawn timber to the settlements around Port Blair. Industrial demand increased with the establishment of a match splint unit by WIMCO at Port Blair in 1926. Good quality logs of Padauk *(Pterocarpus dalbergioides)*, Gurjan *(Dipterocarpus alatus)* and White Chuglam *(Terminalia bialata)* found a ready market in the mainland.

The post-1950 period was characterised by an increasing demand for timber within the islands. The influx of batches of mainland settlers into the islands meant not only conversion of forest land but also supply of a large quantity of timber, often free, as building material for their houses. Wood-based industries also increased rapidly. Thus the extractions which were around 49,000 cu m/annum in 1950 have touched 1,45,000 cu m/annum in 1986. Due to the advances in wood technology, the intensity of extraction has also been stepped up. The number of commercially exploited species has shot up from four in 1952 to 40 today.

35



*Forest Area in Major Islands of Andaman Group*
(Area corrected to sq km)

| Island | Geographical Area | Forest Area* | Percentage of Forest Area |
|---|---|---|---|
| N. Andaman | 1376 | 1248 | 90.7 |
| M. Andaman | 1536 | 1349 | 87.8 |
| Baratang | 298 | 283 | 95.0 |
| Havelock | 114 | 96 | 84.2 |
| Neil | 19 | 7 | 36.8 |
| S. Andaman | 1319 | 945 | 70.0 |

*Forest area is the area under the jurisdiction of the Forest Department. It does not necessarily indicate an exploitable tree cover.

Is such a phenomenal increase in the rate and intensity of extraction within a limited island system sustainable? If replenishment of the stock were adequate there might have been some hope. The facts do not give room for optimism.

Forest plantations of exotic timber species have been failures. Mahogany, teak, eucalyptus and tropical pines were introduced at various times. Despite initial promise none has been found to be a commercially viable replacement for the local species. The soil and groundwater conditions in the Islands are different from those in mainland India, Burma and Malaya. These might have contributed to the lack of success.

Natural regeneration of local species and the Andaman Canopy Lifting System have been regarded as the best way of restocking the island forests. Seeds from 'mother trees' left behind during extraction germinate well, often within a week, to begin a new rotation.

The Working Plan prepared by Mr. Chengappa in 1952 gave detailed prescriptions particularly regarding the post-harvest regeneration operations. The plan had two main objectives. Firstly to convert the irregular natural forests into uniform forests of native timber species. The second objective was the realisation of maximum yield of timber. This entailed a series of clearing, girdling and canopy lifting operations spread over several years (Plate 40). The rotation period prescribed by Chengappa was 150 years. This was subsequently reduced to 100 years and then to 75 years in later working plans, the exploitable girth now being 150 cm of g.b.h.

*Forest Extractions in Andaman and Nicobar Islands*

| Date | Average Annual Extraction in cum |
|---|---|
| Pre-1950 | |
| 1869-1929 | 15,300 |
| 1930-1950 | 49,700 |
| Post-1950 | |
| 1951-1962 | 88,800 |
| 1968-1983 | 1,18,800 |
| 1986 | 1,45,000 |

Among the subsequent refinements to these prescriptions was the use of light ground fire to encourage the more valuable deciduous timber species in preference to the evergreen.

The assumptions as to growth rates and rotation cycles need to be revised on the basis of factual data. The calculations should consider not only the four species exploited in 1950 but also the 40 species being extracted now.

The rate of extraction and the girdling and thinning in the NRA blocks have brought about a reduction in the total biomass and have adversely affected the species diversity. The ecological impact on soil and water have not been quantitatively assessed. Nevertheless, the rapid run-off during the rainy season, the erosion on steep slopes and the degradation of soil are evident in many parts of the Andamans.

There are three new threats to natural regeneration. The invasion by the exotic climbing weed *Mikania cordata* and its rapid spread is likely to pose a problem. The weed smothers saplings in worked areas. The damage it has caused to forest regeneration in the northeast of mainland India is well known and could be repeated here. Secondly, cattle, goats and deer have been introduced into islands devoid of native carnivores. The uncontrolled multiplication of these herbivores could be a threat to the natural regeneration in forest areas. The third and most serious threat comes from man. The forest area is continually shrinking because of diversion to non-forest uses. There is increasing pressure to convert forest lands into revenue lands. Illicit encroachments in North, Middle and South Andamans are substantial. They have reached even Rutland. An area once opened up by well-laid forest roads might be totally lost to forestry.

*Industrial Units in the Andamans*

| Industry | South Andaman | Middle Andaman | North Andaman | Total |
|---|---|---|---|---|
| 1. Wood based | 81 | 7 | 5 | 93 |
| 2. Agro based | 37 | 10 | 3 | 50 |
| 3. Marine based | 25 | 2 | 2 | 29 |
| 4. Food based | 28 | 6 | 5 | 39 |
| 5. Mineral based | 16 | 1 | 1 | 18 |
| 6. Chemical | 20 | — | — | 20 |
| 7. Leather based | 4 | — | — | 4 |
| 8. Coir based | 1 | — | — | 1 |
| 9. Eng. & Misc. | 103 | 5 | 1 | 109 |
| Total | 315 | 31 | 17 | 363 |

*Source*: Basic Statistics, 1985.

There are about 363 industrial units in North, Middle and South Andamans. Of these 315 are concentrated in South Andaman. The six major units are all wood based.

Environmental problems due to industries are more often caused by: (1) resource utilisation, (2) energy needs, and (3) disposal of wastes.

Wood is the most important land resource and wood based industries the most important in the Islands. The two Government saw mills one at Chatham (Plate 41) and the other at Betapur in the Middle Andaman cater to the needs of the A.P.W.D., the defence establishments, the Industries Department and the needs of the general public.

About a decade ago the installed capacity of the three private plywood units in terms of wood

consumption was only 47,000 cu m. Over the last few years this has almost doubled. Such a rapid growth disregarding availability has already resulted in significant underutilisation of capacity and increase in logging intensity on the part of the lessees. The Forest Department is aware of the situation and has put limits to the volume of timber being extracted. It has also decided to take over the extraction by itself or through the Forest and Plantation Development Corporation. However, neither the Corporation nor the Department have the necessary manpower, equipment and resources to immediately take over all extraction work. Hence the practice of the lessee or forest contractor undertaking the extraction will continue for some time. In order to utilise its idle capacity, the plywood industry has already been negotiating for import of Malayan and other timber. A Customs House is being set up to facilitate this import.

*Requirements of 34 Wood-based Industries in Andaman & Nicobar Islands*

| Industry | No of Units | Annual Wood Requirements in cu m |
|---|---|---|
| Plywood | 3 | 90,000 |
| Saw Mills | 24 | 70,000 |
| Match, Pencil | 7 | 29,200 |
| Total | 34 | 1,89,200 |

The energy needs of the industrial units are met either by diesel generators or by fuel wood. The former is expensive since the diesel has to come from the mainland. Fuel wood in the form of lops and tops is plentiful in the forest areas where extractions are taking place. But the transportation costs being high, this fuelwood is not being lifted.

The mangrove fuel is of high calorific value and easily accessible. It has been customary to use this mangrove fuel both for industrial and domestic needs. Apprehensions of serious ecological damage have been expressed because of the depletion of the mangroves. A total ban on its extraction has been imposed since December 1986. The plywood industry has been encouraged to use wood shavings and sawdust to fire their boilers.

THE FOREST AND PLANTATION DEVELOPMENT CORPORATION

In accordance with a national policy some of the responsibilities of the Andaman Forest Department have been handed over to the Forest and Plantation Development Corporation (F.P.D.C.). The Corporation has begun extracting timber in Little Andamans. It has also developed a rubber plantation in Katchall and a red oil palm plantation in Little Andaman (Plates 43 to 45).

*Red Oil Palm Plantation*

The Forest Department initiated work on a red oil palm plantation (*Elaeis guineensis*) in Little Andaman in 1975. The plantation was taken over by the F.P.D.C. in 1980. Since then 1,593 ha have been planted and an additional 208 ha clearfelled but not planted. This was consequent on a moratorium imposed on further expansion of the plantation by the Government of India.

The statistics supplied by the Corporation indicate a steady increase in F.F.B. (fresh fruit bunch) which was 321.48 mt in 1982-83 and is reported to have gone up to 1845.95 for the first five months of 1987-88. The reported recovery of palm oil has risen from 25.76 mt in 1982-83 to 281.05 mt for an equivalent period. The percentage of recovery has doubled from 7.80 to 15.22 per cent.

There have been hurdles in the plantation operations which have been overcome with a fair degree of success. The rodent menace is reported to be under control. A weevil *Elaeidobius kamerunicus* has been introduced as a pollinator thus increasing the fruiting

There are further problems to be faced. The present oil mill is working to capacity but cannot handle the entire crop. As a consequence some of the crop is not being harvested. In the absence of a nut-cracking unit, the kernel oil is not extracted by the Corporation. Better use needs to be made of the 208 ha of clear-felled land. Immediate action is called for.

The important point at issue is whether a unique type of vegetation that now covers the island should be destroyed for the sake of a commercial crop even if in itself it is economically viable. This unique forest type once destroyed will in all probability be lost for all time.

*Timber*

Timber extraction in Little Andaman is being carried out by the FPDC. 12,000 cubic metres of timber are being shipped to the mainland for use by the railways. Another 3,200 cubic metres are supplied to the four wood based industries in Little Andaman. Free Royalty Timber is made available to the settlers. The Corporation itself uses timber for its housing needs. Thus about 12,500 cubic metres of timber is being extracted annually. Another 36 per cent of the biomass is left behind as lops and tops. The total reserve forest area in the Little Andaman (including the tribal reserve) being only 671 square kilometres such a rate of extraction might not be sustainable.

**Agriculture**

Agriculture in the islands has been at the expense of forest land. Up to 1901 the area cleared was 10,198 hectares of which 4,198 hectares were cultivated. The area under cultivation in 1981 was 16,544 hectares. This excludes the 18,000 to 20,000 hectares under plantations in the tribal areas. According to the Department of Agriculture the area cleared for agriculture, plantations and horticulture in all the islands stands at 48,000 hectares.

The main categories of agricultural crops are: (1) non-vegetable field crops (2) vegetable field crops, and (3) plantation and fruit crops.

Since rice is the staple food of many of the settlers, the largest area is set apart for paddy cultivation. Twelve thousand hectares of more or less flat land is used to raise one or two crops a year. This land was converted by clearing and even burning the giant trees of the lowland Giant Andaman Evergreens.

It was soon found that part of this area was prone to floods during the monsoon period. Further, the alluvial soil is highly leached and has poor water retaining capacity. The humus and phosphorus content is low. Consequently, the production is low. Attempts are being made to augment the yield by increasing the use of fertilisers, pesticides and improving irrigation facilities by the construction of tanks, weirs and check-dams. High-yielding rice varieties which respond better to application of fertilisers have been identified and are popular with the farmers. It is hoped that double-cropping and rotation with oilseed and pulse crops would improve matters.

Hand tools and wooden ploughs drawn by animals have been in use in most places. There are reports that agricultural animals are subject to 'hump sore' caused by stephanofilarial nematodes transmitted by insect vectors especially *Musca* spp. Control measures have not been successful. There is therefore a proposal to import tractors. The freightage for transport from the mainland, it is suggested, should be paid by the Government and the machines be distributed to the lucky few at half their market value. The proposal to add to the already debilitating subsidies will only increase dependence instead of developing initiative among the farmers.

The increased use of pesticides might set in a chain reaction. Given the high rainfall and prolonged rainy season, the agricultural chemicals are liable to be washed into the sea which is always close by. The accumulation of chemicals in inshore waters and their bioamplification by living systems are well-known consequences. These should be carefully avoided especially in the Andamans with their rich marine flora and fauna.

Vegetable growing has met with some success. The markets have a number of locally grown vegetables and fruits. North Andaman, Little Andaman and Neil Island are the more important centres. Banana, drumsticks and sweet potato are common. Tomatoes are available in season. Potato has not been a success. The giant african snail (*Acatina fulica*) a harmful introduction into the islands, is a serious pest on all vegetables.

Mango, citrus, papaya and sapota have been tried. Cinnamon, clove, nutmeg and pepper are grown in about 560 hectares in the islands. Oilseed crops and pulses planted in rotation with rice have been remunerative. Areca is popular.

There are 8094 agricultural holdings in the Andamans. On an average each household has two hectares of paddy land and two hectares of hilly land. As the Director of Agriculture observes "They have hardly put the hilly land into proper use". The hilly land is deforested even when the slope is high. Except for a few banana plants the soil is exposed and eroded within a season. Some hillsides have become wastelands, either invaded by noxious weeds or remaining as ugly scars on a once beautiful island setting. The trials on multiple cropping on hillsides carried out by the Department of Agriculture at Sippighat and Jirgatang are promising. However this technology has made only a small dent on the local agriculturists.

Despite the enthusiasm and dedication of the officers of the Department of Agriculture and the scientific help from CARI, the success of field and plantation crops is not encouraging. The utilisation of land and water by the farmer is not efficient and so farming becomes uneconomical. A track record of over 20 years shows that the land which could support the giant evergreen forest has not been able to support worthwhile agriculture (Plates 46-53).

## Fisheries

The fisheries potential in the Andamans is enormous. Fishing operations in the island waters have been reported since 1908. A private company was floated in the forties. It was wound up despite its reporting that the "potential was enormous". Another operation, started in 1951, also failed. The Department of Fisheries was set up by the Andaman and Nicobar Administration in 1955. Since the islands did not have a non tribal population of local fishermen, a "fishermen settlement scheme" was initiated in 1955 and families of fishermen from Kerala and Andhra were brought and settled in the Andamans. Something has been done but much more has yet to be done. Estimates place the annual available catch at 50,000 to 4,74,000 tonnes. The actual catch in 1986 was 10,638 tonnes.

Several techno-economic surveys on fisheries potential have been conducted. The need for harbours and processing plants has been recognised. A joint Tata-Thai venture for deep-sea fishing was launched from Port Blair in 1978-79. Indian as well as international investigative research on oceanography and marine biology has been carried out by several vessels over a span of several decades. The CMFRI established a research centre at Port Blair. This was subsequently taken over by CARI and forms its Division of Fisheries Science.

| *Fisheries in Andaman and Nicobar Islands* | | |
|---|---|---|
| Fishermen (1986) | | |
| | Full time | 2,261 |
| | Part time | 435 |
| | Occasional | 203 |
| Fishing Fleet (1987) | | |
| | Country craft | 1,082 |
| | Mech. boats | 88 |
| Fishing Equipment (1986) | | |
| | Trawl nets | 6 |
| | Gill nets | 714 |
| | Cast nets | 574 |
| | Anchor nets | 26 |
| | Shore seine nets | 28 |
| Fish Landing Centres | | |
| | Andamans | 38 |
| | Nicobars | 16 |
| Facilities | | |
| | Ice plant | 5 tonne capacity |
| | Chilled storage | 15 tonne capacity |
| Fishermen's Training Centre | | 1 |

*Source* Department of Fisheries, Andaman and Nicobar Administration

Shell-fish form an important marine product in the Islands. The Z.S.I. has carried out several studies on the *Trochus* and *Turbo* fisheries as well as on the giant clams of the genus *Tridacna* of which four species are found in the Andaman and Nicobar seas. As a result of these studies, shell-fishing has been regulated by the Fisheries Regulation Act of 1938 and the Shell Fishing Rules of 1978. Rights to fish for shells in nine identified fishing areas are auctioned by the Andaman and Nicobar Administration which also controls extraction and export of the shells to overseas markets (Plates 51-58).

| *Fish Landings in Andaman and Nicobar Islands* | |
|---|---|
| | tonnes |
| 1950 | 44 |
| 1955 | 69 |
| 1960 | 129 |
| 1965 | 224 |
| 1970 | 500 |
| 1975 | 1,104 |
| 1980 | 1,803 |
| 1984 | 6,226 |
| 1986 | 10,638 |

Besides fishing in coastal and deep-sea waters, there is scope for mangrove and fresh-water fisheries. Prawns, lobsters, mussels and crabs are available and are being fished in limited quantities. There are 19 species of prawns. Their catch in 1986 was estimated at 211 tonnes.

Fresh-water fishes have been introduced into the Islands since the Bengali settlers have a preference for fresh-water fish. About 300 private pisciculturists require two to three lakh fry every season. The Department of Fisheries has initiated induced breeding experiments for the major carps by injecting pituitary hormones. This could increase the supply and keep costs down.

The CMFRI has conducted studies on the possibility of different types of mariculture. Given the proper infrastructure mariculture could very well be the most promising industry in the Islands.

## ECOSYSTEM LINKAGES

As indicated earlier, the major natural ecosystems in the Islands are: (1) the forest ecosystem, (2) the marine ecosystem, and (3) the interphase, the mangrove ecosystem. The characteristics of each of these have been briefly dwelt upon. These systems are linked to each other by an input-output relationship. Each supports the other. When one system is degraded its effects are carried over to the others. Figure 2 gives a diagrammatic presentation of these linkages.

Linkages between the natural systems are governed by geological and physiographic conditions. Within each of these systems there are several interlinked subsystems constituting cycles of energy, matter and nutrients.

Under natural conditions there is a regulated flow of water and nutrients from the forest ecosystem to the marine and mangrove ecosystems. The mangrove ecosystem functions as feeding and breeding ground for marine organisms. Changes in forest land-use affect the physically contiguous mangrove and marine systems. Too much silt deposition changes the texture of the soil and salinity of the water, often resulting in the death of the mangrove trees. The effect on marine life, particularly of the corals is equally important. Change in turbidity due to increased silt loads alters the biological processes in the coral beds. This will adversely affect the scenic value, tourism potential and a host of other benefits.

Before the settlement of the islands and the large-scale immigration during the post-1950 period, the role of man-made ecosystems was very limited. The hunter-gatherer communities of the Negrito tribals formed an integral part of the natural ecosystem. Their impact on forest, mangrove and marine environment was insignificant. Rather, they proved to be better conservationists and prudent users than the later mainland arrivals.

With immigration, several economic activities were commenced either to meet local demands or to supply mainland markets. There has been a rapid increase in demand for timber both for local needs as well as for the woodbased industries that sprang up and expanded without thought of sustained supplies. Most of the plywood, match splints and timber serve mainland needs. The Forest Department has timber depots at Madras and Calcutta. Output from the forest ecosystem also goes to local households as fuel and timber. Value added during processing accrues partly to local households as wages. Industrial returns are partly ploughed back and partly repatriated to the mainland.

The forest ecosystem is closely linked to agriculture. All agricultural expansion involves conversion of forest land. Productivity of agricultural land depends on the availability of moisture, which in the absence of ground water, is largely regulated by surrounding forests. The water from the forests also brings dissolved nutrients. Litter and green manure are other important inputs from forests to agriculture.

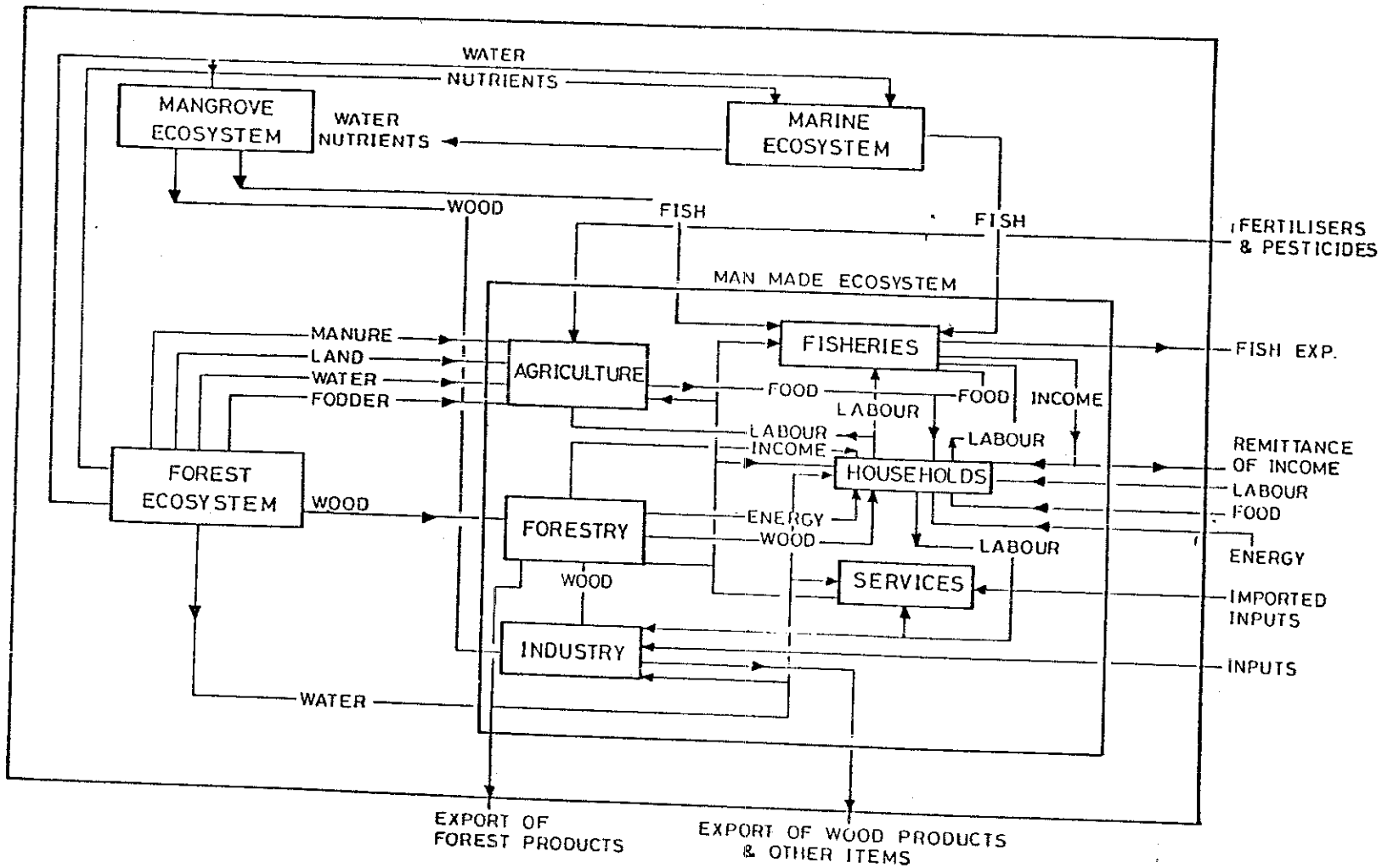



Fig. 2. ECOSYSTEM LINKAGES IN THE ANDAMAN ISLANDS.

How does the forest ecosystem benefit from the other systems in the Islands? The mangrove and marine ecosystems do not contribute much to it due to locational constraints. The role of agriculture is negative as it reduces forest land and lowers plant and animal species diversity. Animal husbandry, especially when animal density is high, causes degradation and prevents natural regeneration as a consequence of grazing. The activities of the mainly wood-based industrial sector deplete resources, open up hitherto inaccessible forest areas to encroachments and contribute to greater run-off and soil erosion. The household and service sectors supply labour for extraction, regeneration and protection.

There is a wealth of resources in the marine ecosystem that remains untapped. These have been alluded to in an earlier part of this report. It is surprising that no serious and successful attempt has been made to harvest these resources. Mariculture has immense possibilities if modern technologies are adapted to local conditions and developed with proper infrastructural facilities. ONGC and Oil India have begun exploratory drilling for oil and gas in the ocean bed. The studies initiated by NIO could be intensified to produce results.

The basic reason for this inertia in utilising the marine wealth is, according to those who were kind enough to respond to our questions, that our planning stems from a mainland viewpoint concentrating on a land-based pattern. If a country like Iceland can develop fisheries in the cold waters of the North Atlantic there is no reason why India cannot do the same in the seas around the Islands. Thailand which a few years ago was behind India in deep-sea fishing has outstripped us.

The ecosystem linkages show that the forest, marine and mangrove ecosystems sustain the many resources of the Islands. A preoccupation with 8,249 sq km of land surface has made us neglect 6,00,000 sq km of our exclusive economic zone in the sea. Encouragement to the right type of immigrant capable, with proper help, of utilising these marine riches would be advisable. It would at the same time relieve the pressure on the over-exploited forest ecosystem.

## TOURISM

Tourism is one among the major activities proposed for the Islands. The scenic beauty of sunrise and sunset, of beach and creek, of secluded islands and rich coral beds can attract visitors. An IUCN study *Ecological Guidelines for Island Development* by McEachern and Towle has given guidelines for the development of tourism in island settings (pp. 46-77). This development needs integrated planning at the highest level rather than become a single project decision made by outsiders insensitive to an island's distinctive characteristics.

The type of tourism and the strategy to be employed for its development should be decided in advance keeping in mind environmental values and infrastructural needs. The design, style and location of structures, control of litter and disposal of waste have to be foreseen and planned for. Adequate and fresh supplies of food and beverages have to be ensured. The density of tourists should not destroy the aesthetic and other values of the Islands. Access to beaches should be carefully balanced between overcrowding and the exclusiveness of a high tariff clientele.

Tourism in the Islands can destroy the very basis on which it is built. The "unspoilt" can be "spoilt" by the construction of large hotels and accessory facilities. The "waste loading" could exceed the assimilative capacity of the area. This puts off the visitor seeking peace, beauty and the enchantment of unspoilt nature. In the meantime, advertising increases the influx of a different type of tourist. To satisfy the demands of large groups with urban tastes, the promoters of tourism try to remake the face of the Islands. This has an impact on the culture and quality of life of the local people.

A third type of tourist follows. The visitor is rich, demanding, seeking diversion, distraction and self-satisfaction. Casinos and cabarets spring up. Saunas and massage parlours become euphemisms for vice-dens. Men and women are used for the entertainment and comfort of this type of tourist.

Figures 3 to 5 schematically represent the inputs/outputs of each of these types of tourism.

As far as the Andamans are concerned, the main attractions are their scenic spots and wilderness areas. There is good potential for water sport especially in the numerous protected creeks. These could deteriorate rapidly due to mass tourism. Providing infrastructural facilities to attract conventional tourists will require high investment. Water is the most critical local resource. Most other inputs will have to come from the mainland over a thousand kilometres away. To be profitable it may be necessary to promote large-scale tourism. This will only help degrade the environment.

*Tourist Arrivals in the Andamans*

| Year | Foreign Tourists | Indian Tourists |
|---|---|---|
| 1979-80 | 440 | 4,050 |
| 1980-81 | 845 | 7,500 |
| 1981-82 | 1,808 | 8,835 |
| 1982-83 | 1,721 | 12,721 |
| 1983-84 | 2,025 | 14,020 |
| 1984-85 | 976 | 16,000 |

*Source*: Basic Statistics (1985)
Data on arrival of Indian tourists pertain to calendar year

The above table on tourist arrivals is a pointer to present trends. It is likely that attempts will be made to divert the Indian tourist holidaying in Kathmandu, Bangkok and Singapore to the Islands and thereby stop the outflow of foreign exchange. An ecological, cultural and economic cost-benefit analysis at the highest level is urgently called for before sectoral interests decide issues.

In the light of international experiences and the local factors it may not be worthwhile to promote large-scale tourism, the success of which will be gauged by numbers and not by quality. Tourism zones should be demarcated and core conservation areas protected from outside pressures especially in the Marine National Park.

## A FREE PORT

We have not been able to examine the proposals for a free port in the Andaman and Nicobar Islands. Yet we were asked our views on the proposal. There was an indication that the free port could be located in the Great Nicobar.

The issues are complicated as there are political, strategic, commercial, socio-economic and environmental angles to such a proposal. Our remarks will only be with regard to the environmental impact of such a proposal.

The location of a free port in the Great Nicobar is unlikely to be in the Campbell Bay Area. This area is being rapidly deforested for the township, airstrip and defence establishment. The area is also subject to seismic tremors and tidal waves. (The latest incident was in February 1987 when part of the breakwater was washed away with the loss of an engineer's life and injury to others.)

South or Galathea Bay has been mentioned as another possible site. The Galathea river joins the sea here. Thickly wooded hills enclose a flat expansive beach.

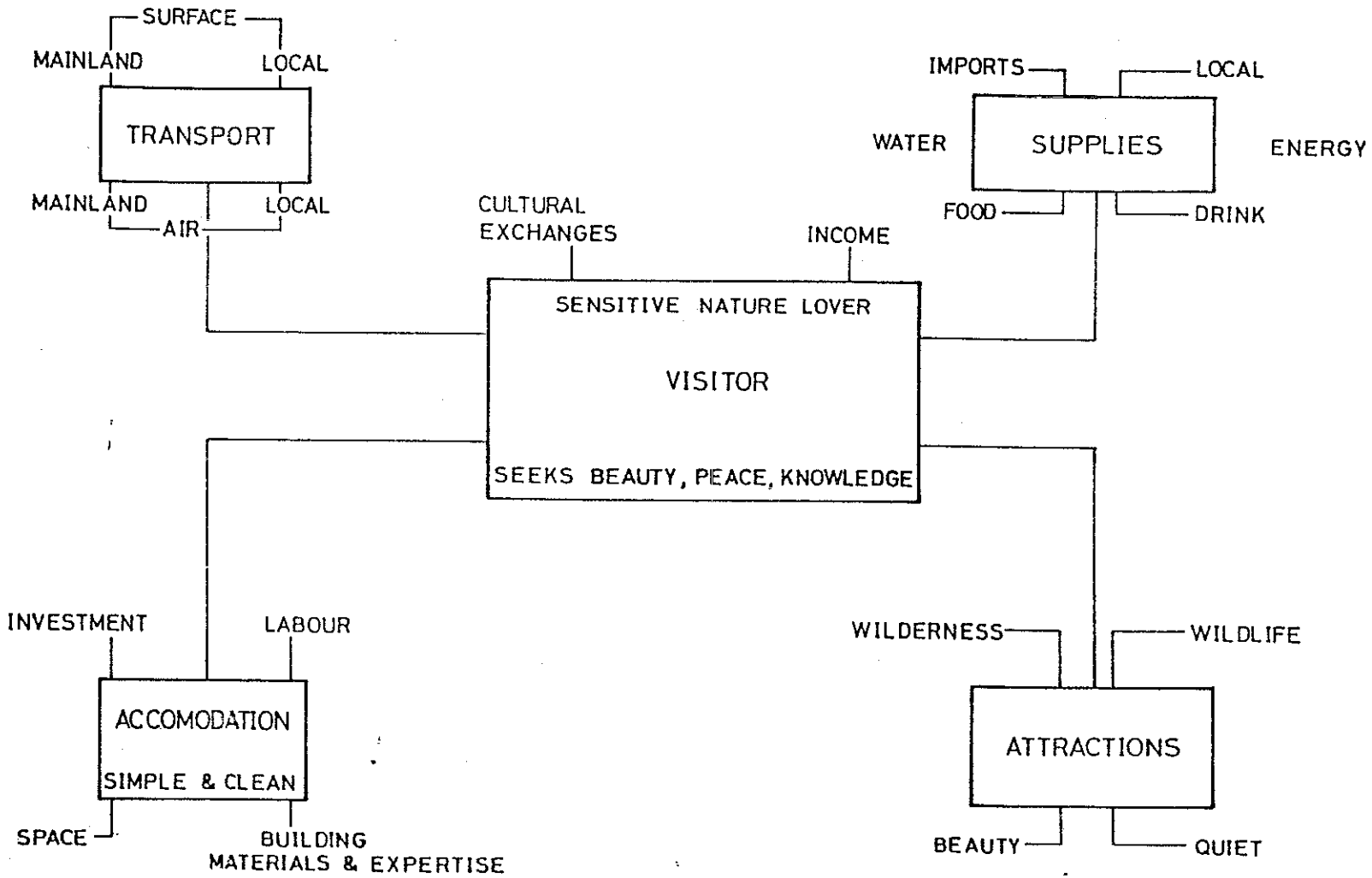



Fig. 3 ANDAMAN ISLANDS - TOURISM LINKAGES, TYPE I

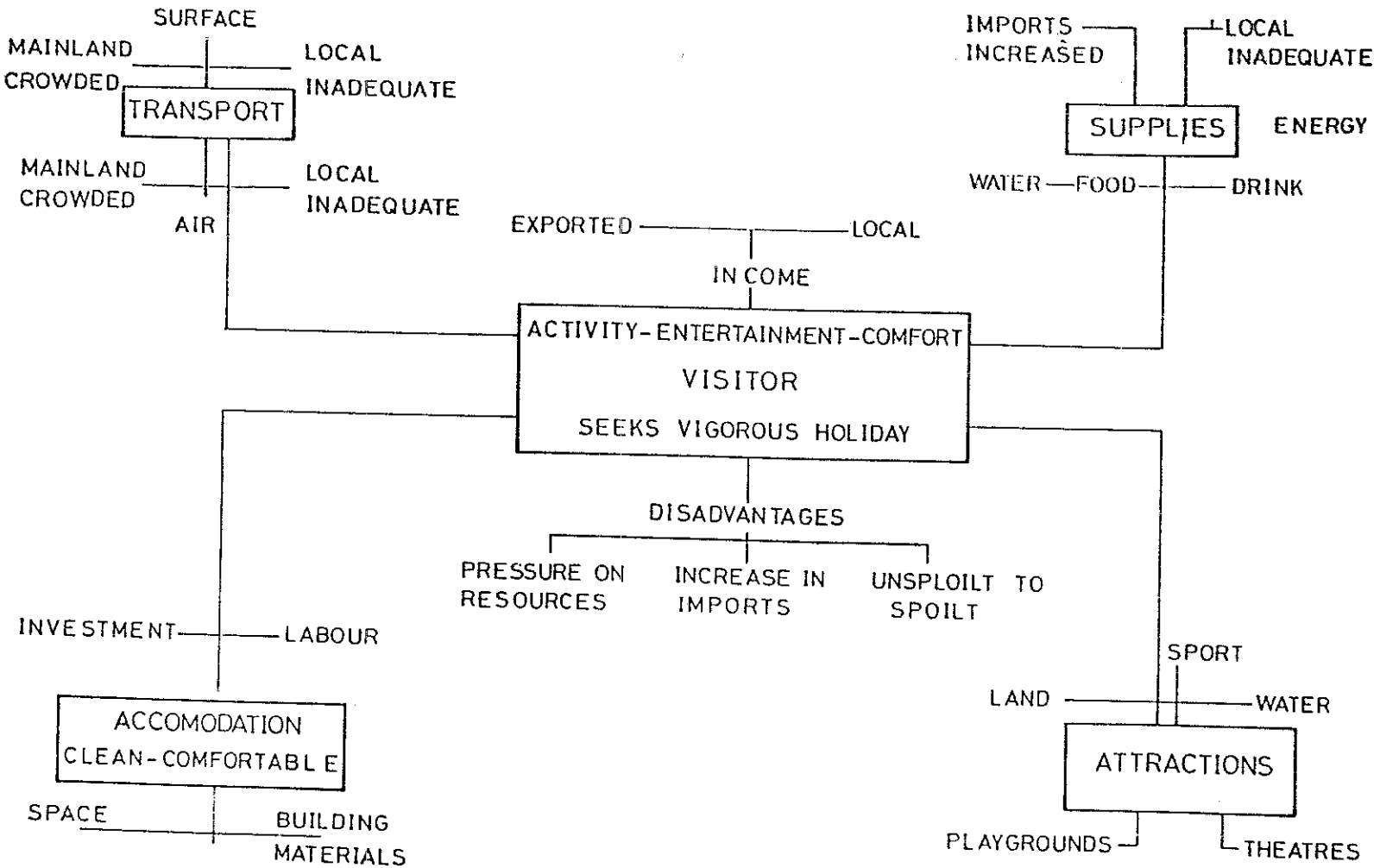



Fig. 4. ANDAMAN ISLANDS - TOURISM LINKAGES, TYPE II

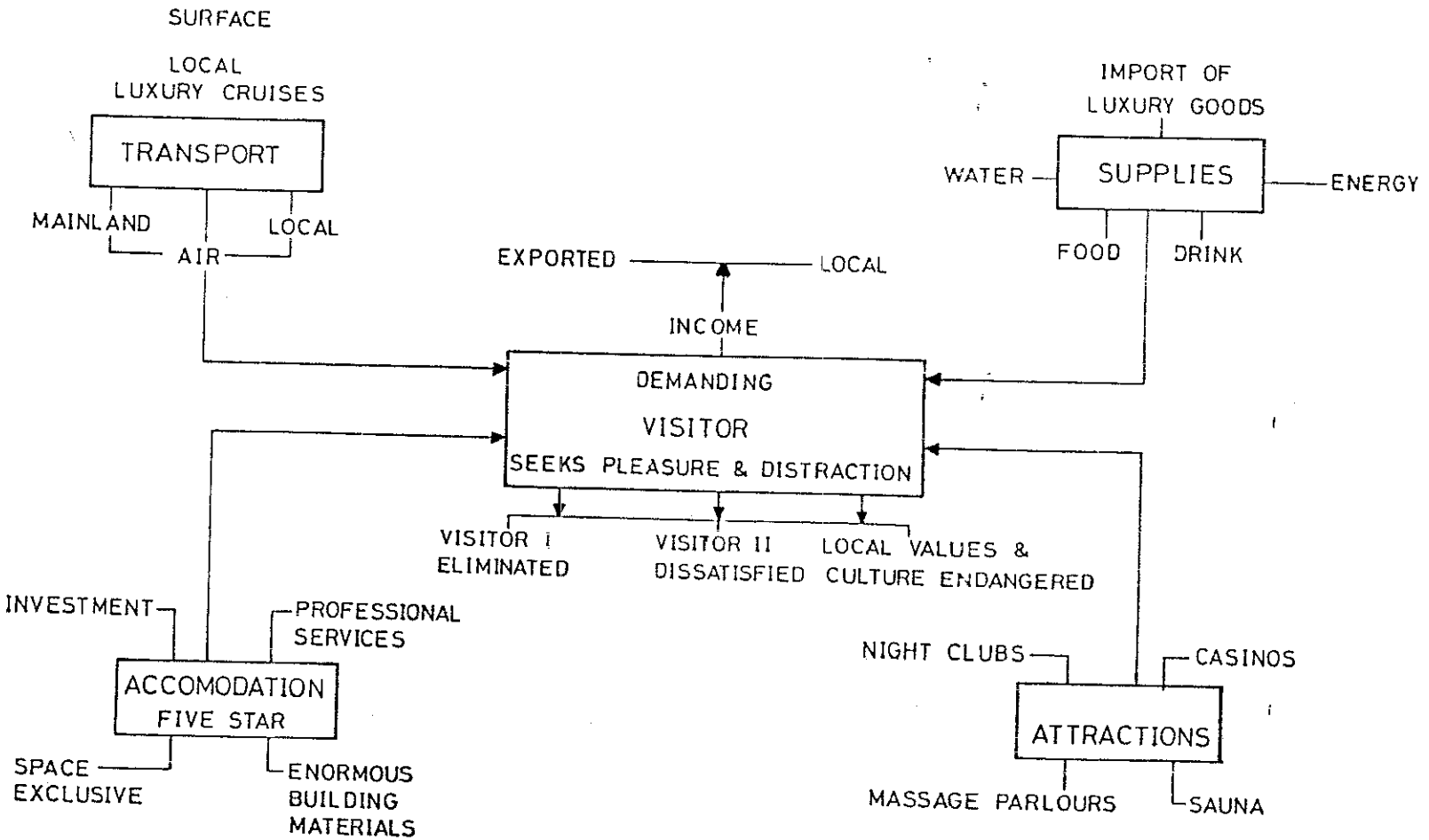



Fig. 5. ANDAMAN ISLANDS - TOURISM LINKAGES, TYPE III

The development of this area would mean destruction of the vegetation not only within the port area but also in the hinterland. The harbour and other construction works will make inroads into the surrounding areas for sand and stone, both scarce commodities.

The influx of a large population will need a chain of service facilities. As there is no local supply to meet the needs of such a port, most things, from food to fuel will have to be imported. Skilled manpower will also have to come either from the mainland or from the countries of southeast Asia. The free port will thus influence the whole Island if not the entire group of Islands.

The Great Nicobar is extremely rich in natural wealth especially in its unique vegetation. Not much of this will remain once the area is "developed".

Speculation about the possibility of a free port has already raised land values. The commitment of the settlers to farming is being further eroded because of rumours of a "Hong Kong type" of development.

## CONCLUSIONS

1) The Andaman and Nicobar Islands are endowed with a great deal of natural beauty. The flora and fauna is of a special type, rich in species diversity with high endemism. The forest ecosystem is fragile and easily degraded. The land surface is limited.

2) The Negrito tribals number about 450. The tribes that have been befriended are on the verge of extinction. The tribes that have remained isolated continue to be vigorous. The Nicobarese have fared much better and have increased in numbers.

3) There has been a large influx of mainland people. Their numbers are increasing rapidly. Besides those who are official settlers there are other unofficial or illegal entrants into the Islands.

4) The Islands are deficient in the resources needed to support such a number of immigrants. Most of the day-to-day needs are met by heavy imports, which do not reach most of the Islands in sufficient quantities and at the right time.

5) Travel and electricity are highly subsidised. Settlers are accustomed to large allotments of land and other subsidies. The land is underused and the subsidies are undermining personal initiative.

6) Forestry and forest-based industries are important aspects of the island economy. However, the increased rate of extraction consequent on the phenomenal growth in the installed capacity of the saw mills and plywood factories does not seem sustainable without causing severe damage to the island ecosystems. The Forest Department needs to be supported not merely for timber extraction but more especially in its role as a guardian of the natural riches of the Islands.

7) Agriculture cannot entirely support the population. Paddy cultivation needs to be improved. The hilly terrain given to farmers is in a bad state. The technology developed for hillside multiple cropping has not been taken up by the common farmer.

8) There is a vast potential for the development of inshore and deep sea fishing as well as mariculture. The deep sea fishing is initially capital intensive but coupled with proper processing and marketing facilities could form the mainstay of the island economy.

9) Passenger ships, inter-island vessels and ferry boats are the means of day-to-day movements. These should be increased, modernised and run economically. Inter-island cargo vessels with bulk transport facilities are inadequate and should be increased in number and frequency.

10) Land transport is being improved by the construction of roads and frequency of buses. However, the road through the Jarawa Tribal Reserve and the East-West Road in Great Nicobar are of debatable value.

## RECOMMENDATIONS

### Long term

1) The long-term developmental strategy needs a change in emphasis. Land-based planning should take a secondary place in the development of the Islands and exploitation of the resources from the sea should be given greater importance.

The marine wealth has to be harvested by deep-sea fishing through a well equipped and properly manned fishing fleet. An adequate infrastructure of fishing harbours, freezing, processing and canning facilities has to be created without delay.

Mariculture also has great potential. The Fisheries Department should adapt recent technologies to local conditions and in collaboration with CMFRI, CIFNET and other expert groups initiate work without delay. Here also facilities on land and in water should be built up.

Since earlier attempts at deep-sea fishing and mariculture have not been successful, the causes of this failure need to be identified and appropriate remedial measures undertaken.

There are two groups in the Islands which have exhibited familiarity with the sea—the Nicobarese and Karens. These should be motivated to participate in this development. Any new immigration into the island should be of specialised groups capable of exploiting the sea resources.

2) The land area and the land resources are basic for the survival of the Islands and their inhabitants. The present manner of utilising them is not conducive to prudent use. Given the ecological role and linkages of the forest utmost priority is needed in preserving the forest cover. Therefore : (a) there should be a progressive reduction in timber supplied to industries or to the mainland (including the Railways and Defence) (b) Protection of forests being necessary, adequate staff with required support and means to enforce the law needs to be provided.

3) Forest land should not be converted into revenue land except in very exceptional circumstances. Strict action against new encroachments must be taken.

### Immediate action

1) The present population of the Andaman Group of Islands exceeds the carrying capacity of local resources. Food, clothing, building material, paper and petroleum products come from the mainland and some of these are in very short supply. Fresh water, available only by precipitation, is in short supply during the dry months or during long dry spells during the monsoons. Therefore: (a) there is need to check immigration into the islands by instituting an entry permit for a specified stay even for mainland Indian citizens. (b) Households should be encouraged to store rain water and house architecture must include rain-water collecting and storing facilities. (c) Proper town planning and installation of sewage treatment plants should be part of urban growth especially in Port Blair, Mayabundar, Rungat, Campbell Bay, Malacca etc.

2) Inter-island communication (VHF or satellite) needs to be improved. So also inter-island shipping, both for the passenger and cargo traffic, needs to be modernised and improved.

3) Agriculture production needs to be encouraged. The know-how for better rice crops, vegetable gardens, hill-side multiple cropping should reach the farmers and be carried out on a larger scale. Farmer education and motivation needs to be improved. Unutilised excess land may have to be resumed by Government and redistributed.

Uncontrolled multiplication of low-yielding cattle and of goats is becoming a menace in urban agglomerations. Vegetable crops and tree saplings are being destroyed. The "hump sore" disease is spreading. Proper livestock improvement and control is needed.

4) A land use survey is being conducted by another group appointed by the Government. The enclosed land use map is based on information kindly supplied by the Andaman Forest Department. Revenue lands, tribal reserves and forest reserves are indicated in these maps.

5) Reserves set aside for the aboriginal tribals—Jarawa, Sentinelese, Onge and Schompen—should be inviolate whatever be the pressures for land and timber. Attempts at winning over "hostile" groups and in resettling the Onge and Schompens are suspect and must be immediately evaluated by the A.S.I.

6) Tourism of a selective nature, which does not harm the aesthetic and environmental values of the Island should be promoted. Attempts at easy gains through casinos and saunas should be seriously discouraged as they will destroy the Islands and the people. The area from Chirivatapu to Cinque Islands could be developed for international tourism.

**Conservation**

1) A greater appreciation of the natural wealth and beauty of the Islands must be inculcated among the young and old.

2) There are two major areas which should be set aside as *biosphere reserves* with appropriate legislation in Parliament and the necessary ground staff. Core areas and manipulation zones should be properly demarcated. Scientific studies should be encouraged (Fig. 6).

The areas recommended for biosphere reserves are:

a) The Central portion of the Great Nicobar including the catchment areas of the five perennial rivers as indicated by Dr. N.P. Balakrishnan.

b) The Marine National Park (1983) in the Labyrinth Islands at Wandoor. Here also core and manipulation zones should be clearly marked. The area should be out of bounds to tourists who should be confined only to Jolly Buoy and Grub Islands. The Fishermen's Colony should be relocated, while fishing is to be encouraged, poaching of protected sea turtles should be prevented. Support to the wildlife wardens is urgently needed.

3) *Wild Life Sanctuaries* as indicated by the Forest Department should also be legalised and protected, especially: (i) The Hornbill Sanctuary, (ii) The Indian Goat Sanctuary, (iii) The Crocodile Sanctuary, and (iv) The Megapode Sanctuary.

4) *National Parks* should be set up to preserve smaller areas in the larger Islands e.g. (i) The Mt. Harriet National Park in South Andaman, (ii) The Cuthbert Bay National Park in Middle Andaman, and (iii) The Saddle Peak National Park in North Andaman.

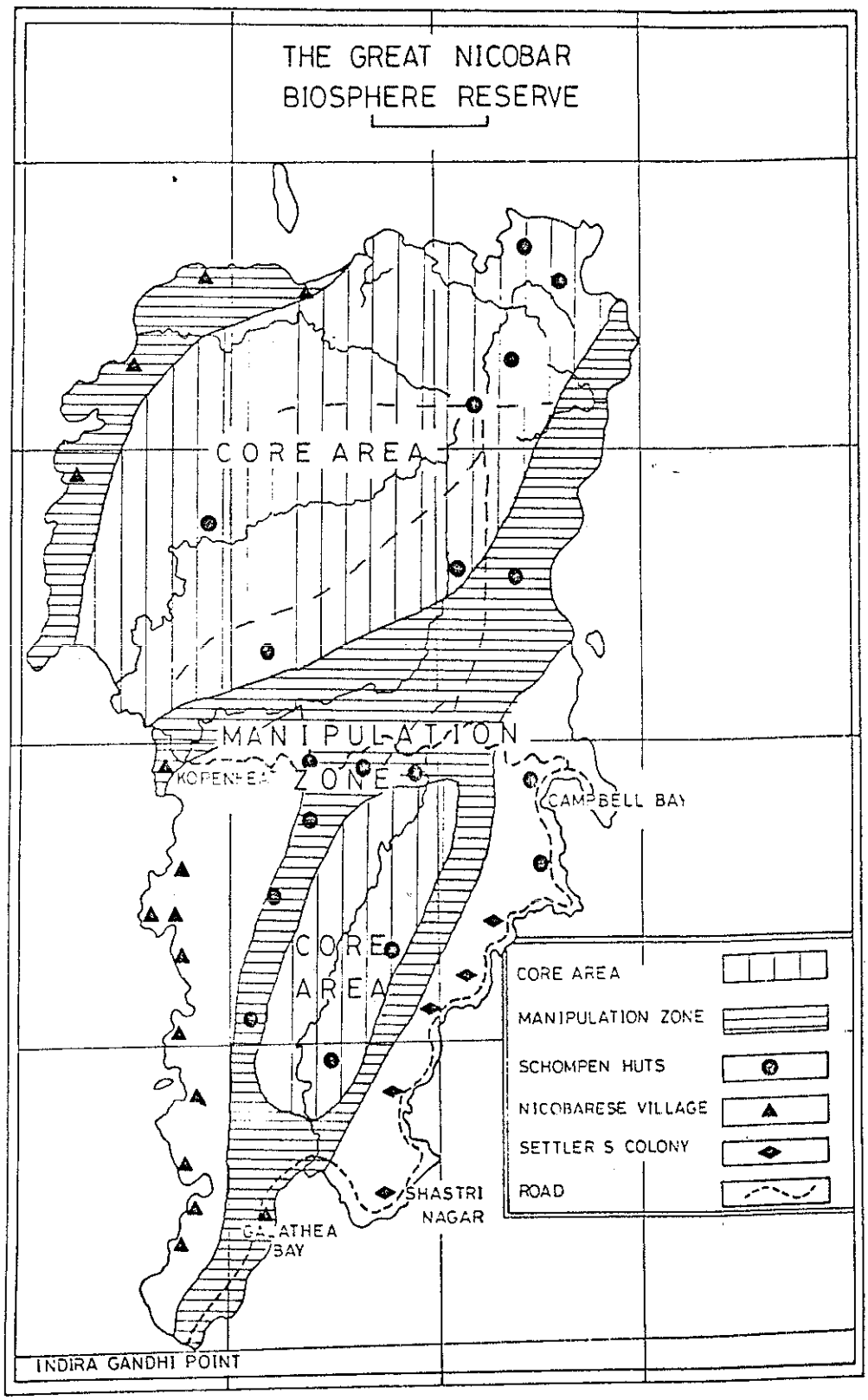
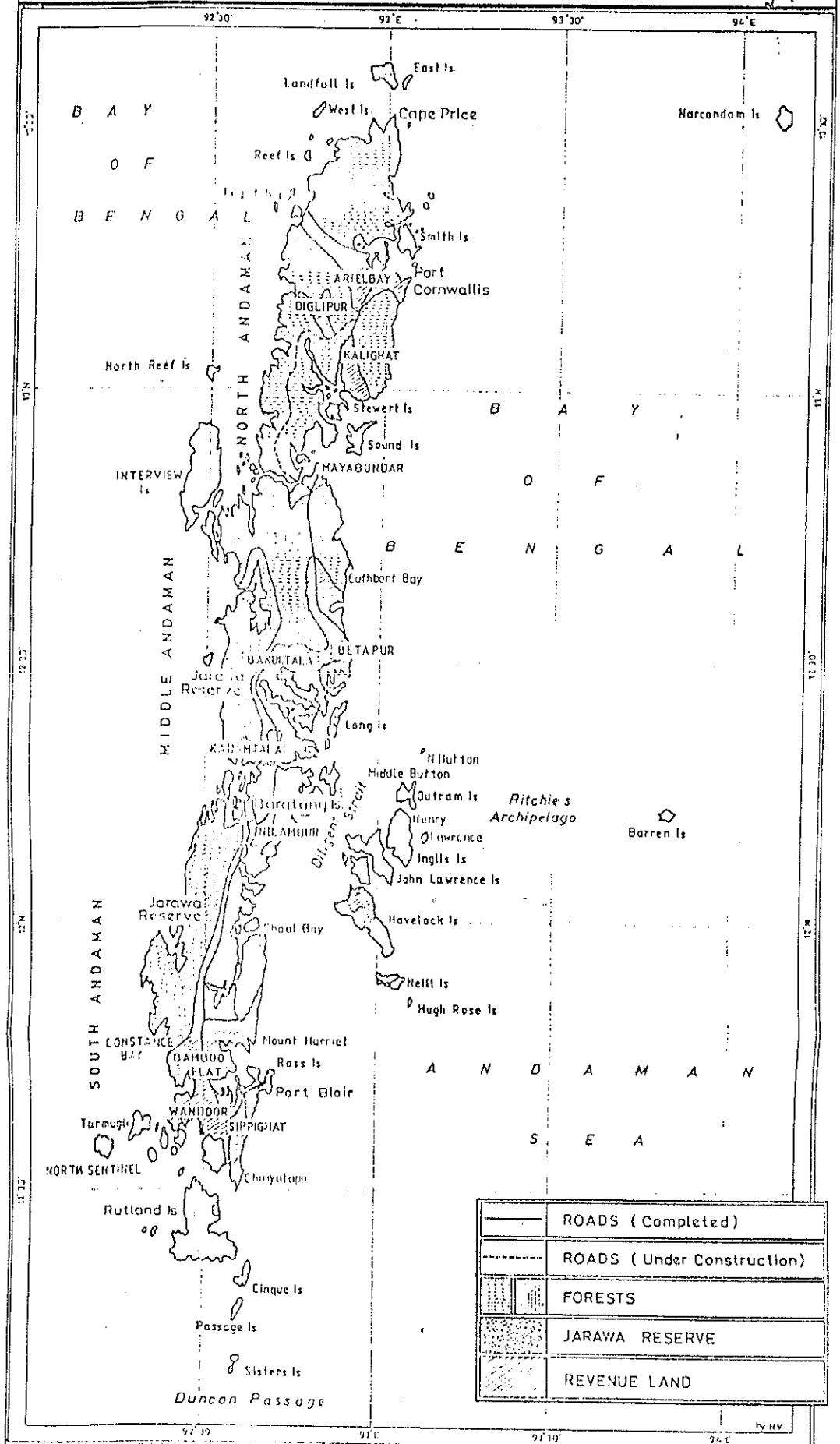

THE GREAT NICOBAR
BIOSPHERE RESERVE
CORE AREA
MANIPULATION
ZONE
KOPENHEN
CAMPBELL BAY
CORE
AREA
SHASTRI
NAGAR
GALATHEA
BAY
INDIRA GANDHI POINT
CORE AREA
MANIPULATION ZONE
SCHOMPEN HUTS
NICOBARESE VILLAGE
SETTLER S COLONY
ROAD

Fig. 6.

# ANDAMAN ISLANDS (NORTH OF DUNCAN PASSAGE)

ROADS AND LAND USE

Fig. 7



# PROBLEMS & PROSPECTS OF ENVIRONMENTAL SOLUTIONS IN THE RURAL SCENE

- Dr. L S Prahlada Rao

Environment has been defined as "the sum total of all conditions and influences that affect the development and life of organisms". This is a fairly comprehensive definition as it stresses the totality. At the same time it must be noted that every living organism has its own environment and interacts very subtly with the physical environment. Apart from this, the basic tenet underlying is one of very close interlinkage between organisms and the physical environment as also the interdependence amongst organisms themselves. Considering this it is incument to identify priority areas and the way corrective action could lead to sustainability in development. Time has come when sustainability in development has to enter in our planning process as one of the basic and permanent objectives. Time and again we have been talking about the predominantly rural netting of the country which comprises of well over 5,76,000 villages dispersed over the whole country. Considering this, indentifying the environmental problems and finding solutions would be a very important exercise with the rural scenario as the reference base.

Let us now consider some of the resources with reference to utilisation. Energy has come to occupy a central point of discussion. The vast potential of the photosynthetic process in this regard is worth considering. This process is essentially

the trapping of solar energy and storing it in plants. One of the natural assets of country is the abundant sunshine. The total solar radiation in India is estimated to be about $60x10^3$MWH. The plant life on earth uses about 0.1 per cent annually and the production of organic matter is about $2x10^{11}$ tonnes with an energy content of $3x10^{12}$J. The proper understnading and application of the aspects of photosynthesis can lead to an increased output of food, biomass and energy.

Terrestrial Bio-mass: In this context let us have a look at the biomass potential. Biomass has to be specially looked into as an additional source of energy. For this, one has to necessarily look at the rural scenario. The report of the 1979 stated that during 1975-76 nearly 43 per cent of the total energy used was from non-commercial sources like firewood, agricultural waste and cow-dung. The demand of non-commercial energy by 1990-1991 by way of Firewood and Charcoal, Dry-dung cake and vegetable waste would be of the order of 181 millions tonnes of coal replacement (Srivastava, 1980). This is an indicator of the utility of biomass production. There is also the other use of the 'Photosynthetic Model of Development' in that it is a convenient and efficient way of halting the increase in atmospheric $CO_2$. Thereby the increased productivity of vegetable raw material through photosynthesis becomes significant. The other method is the increased area under fuel/firewood plantations. Considerable work is being done in this area though the Correct Choice of species for a given area is not receiving the necessary attention. Also energy plantations should as far as possible be

on marginal but cultivable land and should not compete with agri-horticultural crops, pastures and natural forest.

Some of the possible advantages from fuel/firewood plantations in our country's context are:

1. Generation of an almost inexhaustible renewable energy system (local specific).
2. Harvesting times could be flexible hence energy can be recovered as and when needed.
3. Release of vast quantities of cowdung(about 65 million tonnes) now used as fuel towards bio-fertiliser or to generate methane and sludge.
4. Extra energy inputs reduced except transport from site, as compared to oil, alcohol.
5. Additional products like fruits, seeds, oils, honey from flowers, forage for livestock, medicinal plants.
6. Soil binding preventing erosion.
7. There are certain undesirable characters too which could be remedied by suitable technological inputs:
   a) Fuelwood has about 50% moisture and hence not utilisable immediately.
   b) Drying is rather slow.
   c) Enhanced removal of nutrients and organic matter from soil.
   d) Large weight and volume.
   e) Smoke.

Not withstanding the above, fire/fuelwood is a very vital source of energy in the rural sector.

The NBRI at Lucknow has successfully conducted 'Biomass production' using 'usar' land where alkali-tolerant species have been grown to raise a man-made forest.

From this one can easily see the validity of an integrated approach to agriculture and forestry (agro-forestry) which could help in meeting shortages of food, fodder and fuel and consequently employment.

Power Alcohol:

Power Alcohol derived from agricultural sources through fermentation is another promising alternative fuel in many countries. Gasohol (a blend of ethonol and lead free gasoline) has been used in USA currently. Indonesia too has gone for agricultural alcohol production to the extent of 30,000 to 60,000 Kl/day. Sugarcane is also the prime candidate for fuel alcohol production. India occupies the top place in sugar cane production (160 million tonnes). But this source of biological material to use ethonol from sugarcane as transport fuel is beset with many difficulties in our country.

Algal biofertilisers are now being closely looked into as very viable nitrogen-fixing biological systems. The Blue-green algae (BGA) technology for fixing nitrogen in rice fields has been successfully introduced as a package of practices throughout our country and is firmly established at village level (Venkata Raman, 1980). 10-15% increase in grain yield could be obtained through the algal application.

A consideration of the above indicates that a decentralised biomass energy system would be most relevant to rural situations. However, agriculture and biomass production have to form a "symbiotic" association.

There are distinct advantages in looking at 'Biomass' with reference to environmental concerns:

1. It is essentially a decentralised energy system being local specific.
2. Offers clean fuel/energy and keeps the environment clean. Helps in recycling carbon dioxide.
3. The importance of photosynthesis - every year 300 billion tonnes of carbon are fixed by this process in the form of terrestrial biomass and stores 10 times more energy than the world consumes in a year.
4. Labour intensive.
5. Improves soil and water retention capacity.

Biomass may not be the panacea for all our energy problems. But India being a predominantly agricultural country, a perceptible tilt in favour of the photosynthetic model of Development may be quite beneficial.

Animal Wealth:

India has an abundance of animals. Livestock wealth has a very vital role in the life patterns. It is said animal husbandry contributes directly about 5 to 6 per cent of India's national income. The rural scenario would be bleak without its

livestock wealth. 70 million bullocks, 8 million buffaloes and a million each of horses and camels is quite a mind boggling number. In terms of animal energy, at 0.5 hp per animal, the 'installed capacity' of the animal force comes to about 40,000 hp or 30,000 MW which is supposed to be equal to the installed capacity of electric power generation in the country. In terms of cost this is about 30,000 crores of rupees. As compared to this the figure is Rs. 10,000 crores for the investment infra structure for animals. But the greatest drawback is the availability of fodder. It is curious only 13 million hectares are classified as grazing lands! "Solving the grazing lands problem is the most difficult environmental problem in the country" (Digvijay Singh).

Integrated agriculture/forestry/grassland strategy would go a long way in solving this vital problem. I would not like to go into other aspects of environment like population, health, landuse and water as these require a more detailed treatment. I have tried to only take the crucial factors of the environment as related to Agriculture and Animal husbandry and tried to point out the ramifications of the different factors as relavent to the rural scene. I have dwelt at a little length on the aspect of Biomass as this could be a focal point to identify environmental problems in the rural context.

Here it may be relevant to just ponder over a very disadvantageous factor looming large on the environment. This is the unbridled growth of cities. A situation is developing where in the very near future the tentacles of the city could spread so

fast and gobble up all the areas that planning in a rural context might become an illusionary exercise. This is one aspect which one has to consider in all seriousness. [THAILAND (Bangkok) Indonesia, Bali Project]

With research in Biotechnology and genetic engineering leading to very great insights into the complex working of Biological systems, we need not despair of the future trends to bring in very optimal solutions to complex environmental problems. But it is very urgent and imperative to see that the good earth on which we exist doesn't dissappear before our very eyes due to our all conquoring and devastating actions without any concern for the environment. Let us give a chance to the Earth and to ourselves, a chance to survive.

kvn

# Managing Balance between Energy, Technology and Ecology Through Optimal Resources Management

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## Importance of energy

Since man learnt the use of fire for cooking and lighting, energy has come to play an important role in our life. Energy is needed for agriculture. Further developments resulted in the industrialisation of a country. Industries consume energy and other natural resources to produce outputs for use by man directly (like textiles) and indirectly (like agricultural implements) and produce wastes. Since the places of production and consumption are distant, transportation becomes necessary. Development of the transportation sector resulted in more energy needs. Similarly, industries required many natural resources like metals, water, etc. and the processing techniques required additional energy. This sequence shows that energy and development are related.

After meeting the primary needs of man, development process moved towards secondary and tertiary needs to improve the quality of life. The need for lighting increased and this definitely raised the level of life. Similarly, other needs cropped up - storage, refrigeration, food processing, post harvest technologies etc - to handle the temporal separation between supply and demand. Generation of wealth and innovations in technology introduced a new sector - information sector. This cumulative effect on energy has resulted in an exponential rate of growth.

Such high rates of growth on energy requirements have led to a high rate of consumption of natural resources affecting our environment. There is a feeling that this might lead to an instability of our environment. System Engineers use the concept of feedback to study the stability of a system. The above energy development-environment system has a positive feedback and this will lead to the instability of the system. Hence, as per system theory, we should introduce a controller such that the feedback becomes negative making the system stable. We are looking at some of the factors that should be introduced in our planning system so that the energy-environment system becomes stable.

Before illustrating certain planning and implementation strategies, let us have a brief look at our energy use patterns and their effects on our environment.

Energy forms, conversions and resources

Energy is obtained from resources and converted into a form desired by the end use. Energy forms are chemical, mechanical, thermal, lighting and electrical. Conversion of energy from one form to another results in a loss of useful energy. Hence it is essential to have a minimum number of conversions between a source and its use. For example, the use of thermal based electricity for cooking will take us through a series of conversions like chemical to thermal, thermal to mechanical, mechanical to electrical and electrical to heat. Whereas cooking in a stove with firewood goes through only one conversion - chemical to thermal.

Secondly, energy resources can be classified as renewable and depleted. Renewable energy sources are available every year (replenished) whereas depleted ones are stored energy sources (stored over a period of millions/thousands of years) whose usage will deplete their availability over a period of years. Coal, oil (kerosene, petrol, diesel), etc. are depletable energy sources. Renewable energy can be obtained from sun either directly or indirectly. Direct forms of usage are heating the earth, providing light and drying of grains and other materials. Another way of looking at direct usage is through the use of solar collectors for heat generation (hot water, cooking etc.) and photovoltaic cells for electricity generation. There are many indirect forms - these are

(i) wind, hydro, ocean waves and ocean thermal energy
(ii) biomass - photosynthesis effect.

Firewood, produced via photosynthesis effect, can be looked at as a renewable source or depletable one depending on the amount of usage. If we use more firewood than that being produced then it is a depletable source; else, it is a renewable source. Agricultural residues are another important biomass source for energy.

The second rule for planning suggests that for sustainable development, we should restrict our energy sources to the renewable sources as far as possible.

Thirdly, we associate with each energy source and end use a quality aspect which can be approximately described using a temperature scale. On this scale, electricity is a high quality source and agricultural residues and waste heat

from a boiler are low quality sources. Similarly, electroplating needs a high quality energy requirement and hotwater preparation (for bathing) has a low quality energy requirement (low temperature). A third rule can be framed as follows: match the quality of an energy resource to that of the end use so as to increase the efficiency of energy use.

Finally, let us look at the devices. All devices that consume energy are energy converters. They do not convert the entire input energy into useful output work. The percentage of useful energy converted is called the efficiency of use. The fourth rule for optimal energy resource is to get a device that gives a maximum efficiency. This leads to energy conservation.

Energy sources can be grouped into three classes: (i) organic energy sources (ii) inorganic and (iii) direct solar source, the first two dealing with stored (long term/ short term) forms and the third dealing with direct form. Organic sources like biomass from forests, agricultural residues and industrial organic wastes contain carbon compounds, energy conversion can be direct or indirect combustion of these materials (in solid, liquid or gaseous forms) or biological digestion into a gas (methane plus carbon dioxide) which can be converted further either directly or indirectly. Inorganic forms are based on hydrogen and uranium etc. and conversion is based on nuclear reactions. Whenever we want to increase the quality of a source, we go through quality improvement techniques like pyrolysis, wood gassification, and fermentation (to ethanol).

Energy Consumption Patterns

Before we identify solutions to our energy problem, let us consider the existing energy scenario in our country. Consumption can be looked at sectorally as industrial domestic, agriculture, transportation etc. or based on the economics of energy sources like commercial and non-commercial. Similarly, we view urban and rural energy scenes separately.

Many energy studies have been conducted in several villages to find out the consumption patterns for energy in a rural place. Table 1 gives the energy source - end use matrix for a group of six villages studied by ASTRA, IISc. Energy units have been normalised for comparison purposes. Table 2 is a reformatted one containing the percentages. From this table, we can see that domestic energy constitutes the most important end use and firewood is the dominant source. About 81.6% of energy of these villages comes from firewood. Human energy (especially women and children) has been used inefficiently in activities like firewood gathering, cooking, fetching water, grazing cattle; Thirdly, kerosene is a major source for lighting. It provided a very poor illumination and the cost/month/house on kerosene was also quite high - about 15 rupees in some cases. (Compare this with the cost of electricity for lighting - Rs.2-5/ month.)

The perspective planning division of Karnataka has done studies on energy consumption in the rural and urban domestic sectors. Some of the important facts brought about by this study are:

(i) Percapita firewood consumption varies from 13.69 kgs in D.K. District to 73.35 kgs in U.K. District. Average expenditure is 58.69 rupees/month/person. This shows that economically also energy constitutes an important component in the rural budget.

(ii) Urban people have an energy expenditure equivalent of Rs.80 per person per month. Again firewood is an important source. The percapita firewood use varies from a minimum of 14.12 kgs for Bangalore city to 66.39 kgs for the cities in U.K. District.

(iii) To see the contrasts in urban and rural energy, Bangalore city uses 6.28 units of electricity whereas Bangalore rural area uses 1.09 units. Similarly, kerosene usage varies from 1.83 litres to 0.71 litres. Expenditure varies from Rs.99.36 ~~and~~ to Rs.55.98.

(iv) The average kerosene usage is 0.98 litres for urban areas and 0.54 litres for rural areas.

A third study on Bangalore city's firewood requirements is more revealing. Firewood is used in households, hotels, hostels, canteens, bakeries, and industries. Some of the findings are: (i) Bangalore's firewood requirement/day is equivalent to the firewood from a forest area of 10 hectares (ii) Transportation of the firewood involves energy expenditure- about 2.2 million litres/year of diesel - a high quality fuel which is imported.

Many industries consume energy from firewood. Traditional industries like bricks and tiles, tobacco curing, bakeries,

rice mills, jaggery and sweets manufacture, etc. use firewood. Estimates for firewood consumption in Karnataka show that tobacco curing uses 1,24,000 tons/year, and tile manufacture uses about 1,00,000 tons; Industries like Harihar Polyfibres uses more than 60,000 tons; paper mills use 30,000 tons each per year.

The above factors show that firewood is a dominant source of energy in our country. From this, we can also infer that a major form of end use is the thermal form in houses, organisations and industries. Table 3 illustrates these aspects - it shows Karnataka's energy scane. We can see that commercial energy constitutes only 48.54% of the total energy and firewood is the dominant source - 41.29% of energy comes from firewood. Agricultural residues provide 9.34% of the energy. For the entire country, commercial energy for the year 82-83 is around 83.4 m.t.o.e. and traditional energy is around 161.1 m toe. This also confirms the importance of firewood as an energy source. Despite all this, our planning exercises do not include strategies to meet this requirement.

Effect on Environment

As shown above, the country obtains its major energy from firewood-around 250-300 million tons. This is more than the energy coming from commercial energy sources. Many estimates show that about 70 to 80% of this comes from our forests. This is leading to a large scale deforestation.

Environment means natural resources like soil, water, air, biological resources and minerals. The major component-

nucleus-of our environment is the forests. Forests play a vital role, and interlinks various resources. This can be seen from the following factors: (i) forest is a naturally evolved ecological system containing millions of different species living in harmony and stability; (ii) it is a treasure house of biological resources; (iii) it provides many resources needed by us - firewood, timber, manure, organic components like resin etc; (iv) it reduces soil erosion and floods; (v) it collects water from rain, stores it and releases it in streams; (vi) biological resources maintain atmospheric balance for oxygen and carbon dioxide; (vii) many species which have an ecological function and which are useful to us are generated and maintained in forests (viii) hydroelectric and irrigation projects come up in forest areas because of water storage.

Because of the above, it is important to maintain forests, and it is desirable, according to ecologists, to have about 30% of land area covered by forests. Due to over-exploitation, to meet our land, power, energy, and agricultural requirements - we are loosing large areas of forests. Such levels of deforestation, in addition to environmental changes, might lead to instability in maintaining our life system.

We saw that energy is needed for development and the main energy sources - firewood and hydroelectricity - affect our environment. Hence, it is desirable to effect a balance. The question is how to meet our energy needs such that our environmental quality is maintained. We will discuss various methodologies to create a balance between energy and environment.

Energy trends

Currently, the per capita energy consumption in India is less than 1 ton of coal equivalent/year. Whereas the percapita consumption in developed countries varies from 5-10 tons of coal equivalent/year. If we assume that we have to follow the same path as that of developed countries, (this need not be true) then our requirements will be around 3500 million tons of coal equivalent. We need to get this amount of energy from our system without deteriorating our environment further. If we continue in the current practices, then deterioration will increase exponentially and also it may not be feasible to obtain energy sources to meet these requirements.

Since the magnitude is very large, energy sources, forms, and enduses are many and user organizations are varied, there is a need for an integrated energy policy for the country, an integrated energy planning for the country and an innovative and new management strategy to implement the plans. Let us look at environmentally sound approaches to energy planning and later management strategies to achieve these planning approaches.

Some rules of energy planning like matching the quality of energy sources and end uses, use of renewable resources, minimisation of the number of intermediate conversions between source and use, etc. have been discussed already. Let us look at other approaches like energy conservation, use of no waste technologies, recycling and identification of resources.

Energy Conservation

Energy conservation means that we can reduce the energy requirement to do a task without affecting the quality of the output. To find out the possibility of energy conservation, we introduce an index called specific energy consumption -(SEC)- energy units required to produce a unit of output. SEC can tell us whether we are using energy efficiently or not. Incase, SEC is higher than a norm, then we say the process is inefficient and by various methods we can decrease SEC thereby conserving energy.

Let us look at the SEC for industrial sector in India. we conducted a survey of industries in Karnataka. Table 4 gives a summary of results for various groups of Industries. It also illustrates the average, maximum and minimum values for SEC for each group. The variations suggest that it is definitely possible to improve energy efficiency and thereby conserve energy. Table 5 has further evidence on this. It describes the dynamics of SEC variation with time for some individual industries. Increases in SEC (for the same amount of production) shows a high energy elasticity identifying the need for conservation.

Many developments are taking place in energy conservation. Basically two approaches are possible done - one to improve the efficiency of a device and another to go in for better management practices. An interesting example is the wood based stoves used for cooking. Traditional stoves have efficiencies of the order of 10%. Today, many improved stoves are available that have efficiencies of the order of around 25-30%. Use of these stoves will reduce firewood

consumption considerably (to less than half). Another area is pumps. Better design of irrigation pumps might increase efficiency from the present 13% to around 50%, thereby reducing electrical energy and power requirements. A third example is the use of solid state speed controllers for industrial drives. Again in this case, losses are reduced and efficiency is increased. Several examples can be cited in similar vain.

Management based on energy audit is also important in energy conservation. For example, regular cleaning of conveyor belts, crushers and mills will reduce energy needs in addition to increasing the longevity and availability of the machines. Survey conducted on some textile spinning industries shows that the number of motors burnt varies from a minimum of one/10000 for 3 months to a maximum of 20/10000 for 3 months. Similarly, another survey shows the burn out frequency varying from 1.7 to 60 for six months.

The next approach to balanced energy planning is to go in for new technologies which minimise energy requirements.

New technologies and manufacturing processes

Another approach to energy reduction is to go in for new technologies and processes that reduce energy consumption. This is possible not only for the industrial sector, but also in other sectors like communications, transport, services and information. Let us look at some examples:

(i) Use of no waste technologies in paper, textiles and chemical industries reduces energy consumption in addition to conservation of other resources.

(ii) Digital and satellite based communications have reduced the energy required not only for communications but also for the manufacture of the subsystems and equipments. For example, a digital telephone exchange will need less than one tenth of materials required by an analog telephone exchange. Same is true regarding instruments and lines.

(iii) Computers are now used extensively in instrumentation, control, communications and information activities. Use of computers changes the various faces of manufacture and sometimes, the product itself. This reduces consumption of various resources and maximises the quality and availability of machines. For example, computerised numerical control of a lathe or milling machine can reduce not only the energy needs but also the material requirements in addition to improving the quality of the product. Use of fly by wire systems in an aircraft can reduce the mass of control systems required as well as increase the accuracy of flights. Computer integrated manufacturing reduces the natural resources requirements considerably.

(iv) Design of computers has gone through quantum leaps. What is a lathe for industries of today or a radio/TV to a house will be a computer for houses, industries and organisations tomorrow. We will have, in addition to power and water lines, also information lines connecting houses, industries and organisations.

(v) Superconductivity can again change the face of our energy related activities in a very significant way. We may be able to reduce losses in transmission, losses in devices and reduce the size of devices like motors and generators thereby further reducing energy and resource requirements.

(vi) Changes in types of technologies - moving from analog to digital or electronics to optics - will also reduce costs and materials requirements and consequently energy requirements. For example, digital TVs will operate on 1 - 2 watts compared to the requirement of more than 100 watts by analog TVs.

(vii) Transportation technology and management is also going through sweeping changes which will introduce energy conservation. There are developments in design of transportation devices like automobiles, aircrafts and ships, in the operation of these vehicles, in the design and operation of pathways, and in the optimisation of transport networks which will lead to increased energy efficiencies.

(viii) Office automation techniques leading to paperless offices and optical storage mechanisms leading to paperless books and magazines will reduce paper consumptions considerably. This will result in the savings of several million tons equivalent of trees/year used for paper production. In addition, energy used in paper production (in millions of units) will also be saved. (paper consumption in 1985-86 is 1.517 million tons).

(ix) Optical technology is now coming up. The adoption of optical technology in communications, instrumentation, information storage, control and computational activities will reduce costs by a factor of 20. In addition, it can replace many chemicals, thereby further reducing energy needs and pollution.

(x) Recycling technologies are in use today which are useful in the conservation of natural resources and energy.

(xi) There are many environmentally sound technologies. These technologies use alternatives so that environmental degradations are minimum. This is true especially to those pertaining to the housing sector. Replacement of teak by fibre boards is an example. Similarly, soil cement blocks can be used instead of bricks thereby reducing energy consumption. Introduction of alternate roofing techniques, partitioning techniques and materials will lead to a sustainable life system. (resulting in a cost and energy reductions of the order of 60-70%)

(xii) The development of advanced instrumentation and control techniques have led to optimal resource and energy utilization. Just as CNC machines can reduce materials use and consequently reduce energy and wastage, similarly use of control techniques will increase the quality of materials like paper, textiles, steel, chemicals, etc. and reduce requirements on energy, materials and wastage. Other examples are introduction of automatic switch - based on illumination level-for street lights, introduction of voltage controls at all transformer stations to eliminate the need for voltage stabilizers, introduction

of modern controls for power systems resulting in better reliability, and introduction of separate power lines for computer and hospital installations leading to the avoidance of uninterrupted power supplies.

Proper voltage control will reduce the number of motors and I.P. pumps burnt out/year and thereby increase production as well as reduce energy consumption. Industrial motors and fans in textiles, steel, sugar, chemicals and other industries can obtain laboratory efficiences if good control is maintained and effective maintenance is done.

New Energy technologies

In order to meet the demands on energy, we need a two pronged attack - one is to conserve energy, another is to look for additional sources and technologies. Here, the second aspect is being considered.

As already stressed, biomass is a major energy resource. By biomass, we refer to agricultural residuces like straws, husks, shells etc., energy plantations providing fuel woods, energy plants to produce ethanol, household organic wastes, industrial wastes, aquatic weeds and forest produce. Biomass is generated through photo synthetic means; it converts solar energy into a stored energy form. We are including industrial organic wastes also as biomass because of the similarity in their energy characteristics. We can get biomass (naturally) accidently or as a byproduct or produce biomass through an organized cultivation process in an energy farm. Example of Natural biomass is firewood from forests or village woodlots.

Today, we cannot depend on only natural means. Since, our requirements are of large magnitudes, we have to take up biomass production on an organized, industrial basis using innovative techniques in technology and management.

From a hectare of land, we can get one ton equivalent of wood or hundred tons/year. The productivity depends on (i) increased inputs (ii) better management and (iii) use of newer technologies. Use of biotechnology can help us in identifying basic factors that accelerate productivity. Today, this technology has advanced to a level that we can go in for biomass generations on a large economically viable scale with minimum requirements on land. Such kind of activities will have many advantages: (i) it becomes an organised activity and can generate employment; (ii) requirements on land become less; (iii) forests need not be over exploited; (iv) it can blend with many existing activities; (v) employment will be distributed.

Another approach is to go in for large scale tapping of solar energy directly either through photo voltaic cells or thermal collectors. Development of new technologies for photovoltaic cells will lead to a substantial reduction in the cost and energy requirements for their manufacture. Photo cells will improve efficiency of conversion. Coupled with improved batteries, they can provide decentralised electricity in remote areas.

There are many similar technology developments taking place today which will lead to optimal utilisation of natural resources. Even though, some look like science fiction, many of them will become realisable soon. One interesting idea is to station a large satellite and reflect

sunlight over a city during night. Such an activity will reduce energy requirements for a city. It can also change the life style.

The current energy conversion technology used in biogas digestion processes converts a very small fraction of the input carbon into methane, a major portion being wasted. Development of new technologies can lead to increase the carbon content in the output.

Innovative Management Approaches for Energy Systems

Management strategies undervent a change with the introduction of computer based information, control and decision support systems. Recent developments in distributed, flexible workstation based manufacturing will herald additional changes in the approaches towards managing the different sectors. Branching off took place when service and agriculture/horticulture sectors got organized.

We would like to look at some principles of management applicable to energy systems. These are enumerated below:

(i) It is desirable to organize a sector. For example, consider biogas plants. The activity of putting biogas into practise consists of several steps like technology generation, prototype testing, analysis of plants and rectifications, climatization of plants, materials selection, sizing, information dissemination, servicing and repairs to biogas systems, operations training, surveys of proper usages etc. This involves linkages among many organizations, creation of new-organizations or service centres, establishment of information and monitoring centres and coordination of

various stages. One of the main reasons why biogas is not popular is the failure of biogas plants in many houses. This may be due to poor design, wrong sizes, non climatizations breakages of components and nonavailability of replacements and services. In contrast, bicycles are popular because service facilities are available in a village or in the neighbourhood.

(ii) Certain changes in our beliefs are needed. Till a serious drought comes on the scene, grass for cattle is considered a free resource. But people loose cattle during a severe drought because of the nonavailability of cattle feed. Hence, it is desirable to propagate the idea of biomass farms. Land should be earmarked, people encouraged to take up farming based on latest bio technology results, processing units be set up to segregate lignin and, cellulose based biomass and others, decentralised energy centres be set up to use these biomass items in the neighbourhood and proper coordination should be initiated.

Agricultural operations obtained a higher success rate and productivity because of several factors like availability of inputs and coordination. But one of the main reasons is the concept of extension work coupled with demonstration farms. It is desirable to set up extension units at several places suitable for biomass production, feed them with information on latest technologies and inputs, attach several farms to this unit for experimental and regular production, allow these units to advice farmers in the neighbourhood on various aspects of cultivation, and to monitor the progress closely.

Similarly, service centre is another important component for success of the energy centres. Hence, it is desirable to set up service centres at important areas to handle service of equipments, machines and instruments.

(iii) Conceptually individual based (motivated by an individual) units have succeeded compared to large organizations. Hence it is desirable to encourage a setting up of a large number of small units loosely coupled under an umbrella or consortium which will coordinate, assist and provide information.

(iv) Mission oriented activities have enjoyed success in our country compared to routine work. Hence it is desirable to go in for the concept of missions coupled with permanent setups for services, extensions, operations, and technology generations.

(v) Convenience and timelyness, sometimes, play a role in the options. For example, truck transport is preferred to trains because of these two factors eventhough rail movement of goods will be economical from the energy view point. Streamlining of rail system, improvements in operations to guarantee transportation to minimize additional delays, introduction of many computerized booking systems and door to door delivery systems, augmentation of railsystem, introduction of water transport systems will improve energy efficiency, reduce pollution and reduce the cost of transportation. Similar management strategies are desirable for movements within a city also.

TABLE 1

Energy Matrix (Normalised-X$10^6$K cals)

| | Agriculture | Domestic | Lighting | Transport | Industry | Total |
|---|---|---|---|---|---|---|
| Human | 165.30 | 584.02 | ... | ... | 39.52 | 789.02 |
| Bullock | 270.04 | ... | ... | 30.70 | 3.5 | 304.60 |
| Firewood | ... | 8140.00 | ... | ... | 426.00 | 8566.00 |
| Husk | ... | 3.50 | ... | ... | 0.97 | 3.47 |
| Veg. Wastes | ... | 397.00 | ... | ... | 10.70 | 407.70 |
| Coal | ... | .. | ... | ... | 25.80 | 25.80 |
| Kerosene | ... | 6.4 | 208.00 | ... | 10.40 | 224.80 |
| Electricity | 36.10 | ... | 20.60 | ... | 5.53 | 62.23 |
| Diesel | 1.33 | ... | .. | ... | .. | 1.33 |
| Total | 473.13 | 9131.1 | 228.6 | 30.7 | 522.42 | 10385.95 |

TABLE 2

Pattern of Village Energy
(sourcewise and sectorwise)

| A) Sourcewise | Percentage Energy |
|---|---|
| Human | 7.7 ± .5 |
| Animal | 2.7 ± .5 |
| Firewood | 81.6 ± 2.6 |
| Kerosene | 2.1 ± .2 |
| Electricity | 0.6 ± .5 |
| Others | 5.3 ± 2.9 |

B) Sectorwise consumptions

| End use | % |
|---|---|
| Agriculture | 4.3 ± 1.0 |
| Domestic | 88.3 ± 4.1 |
| Lighting | 2.2 ± .2 |
| Transport | 0.5 ± .1 |
| Industry | 4.7 ± 4 |

TABLE 3

Consumption of Energy-sourcewise:Karnataka: 1979-80 and 1982-83

| Sl. No. | Item | Consumption for 1979-80 in MTCR | % | Consumption for 1982-83 (partial) in MTCR | % increase |
|---|---|---|---|---|---|
| | Commercial Energy | | | | |
| 1. | Coal | 0.952 | 3.51 | | |
| 2. | Oil | 5.518 | 20.33 | 7.371 | 33.36 |
| 3. | Kerosene | 1.739 | 6.40 | 2.313 | 33.00 |
| 4. | LPG | 0.110 | 0.4 | ... | ... |
| 5. | Electricity | 4.858 | 17.90 | 6.413 | 32.00 |
| | Total of commercial energy | 13.177 | 48.54 | | |
| | Non-commercial | | | | |
| 6. | Firewood | 11.208 | 41.29 | 15.50 | 38.30 |
| 7. | Cow dung cake | 0.224 | 0.83 | ... | ... |
| 8. | Agro-wastes | 2.536 | 9.34 | ... | ... |
| | Total of non-commercial energy | 13.968 | 51.46 | | |
| | Total | 27.145 | 100 | | |

TABLE 4

Specific Energy Consumptions for some sectors

| Sector | Total energy (m.units) | Energy in units/Re of Production | | | | SEC for electricity only (avg.) |
|---|---|---|---|---|---|---|
| | | Avg. | max. | min. | Std. Dev. | |
| 1.Engineering | 37.3 | 0.22 | 1.48 | .011 | 0.65 | .081 |
| 2.Metallurgical I | 203.6 | 0.26 | 0.36 | 0.05 | 0.10 | 0.164 |
| 3. " II | 1766 | 1.73 | 1.78 | 1.59 | - | 0.45 |
| 4. " III* | 49.4 | 19.4 | 25.0 | 14.4 | | 7.98 |
| 5. Paper* | 1358.4 | 16467 | 17245 | 12510 | 5511 | 2220 |
| 6. Textiles* | 232.1 | 5567 | 8102 | 5345 | 1865 | 1450 |
| 7.Sugar* | 844.2 | 9657 | 11162 | 5264 | 3514 | 44.53 |
| 8.Chemicals I* | 351.7 | 2689 | 7013 | 2511 | - | 1172 |
| 9.Tiles* | 19.9 | 5.05 | 7.65 | 4.55 | - | 0.071 |
| 10.Oxygen | 8.31 | 0.41 | 0.46 | 0.27 | - | 0.41 |

* - The SEC - values are energy in units/unit of production.

TABLE 5

Variations in SEC in five years in some industries

| Type of industry | SEC for 1979-80 | SEC for 1983-84 | Percent Increase |
|---|---|---|---|
| Engineering | 0.006 | 0.011 | 83.3 |
| " | 0.045 | 0.074 | 64.4 |
| " | 0.02 | .04 | 100 |
| Heavy Engg* | 51.45 | 131.3 | 155.2 |
| Electrical | 0.019 | 0.01 | -47.4 |
| Metallurgical | 0.19 | 0.23 | 21.1 |
| " | 3.1 | 1.6 | -48.4 |
| " * | 126.9 | 148 | 16.6 |
| Paper | 1.02 | 0.93 | - 8.8 |
| Textiles | 0.57 | 0.38 | -33.3 |
| " | 0.51 | 0.65 | 27.5 |
| " | 1.3 | 0.90 | -30.8 |
| Sugar* | 14883 | 111.62 | -25 |
| Agromachines | 0.027 | .034 | 25.9 |
| Oxygen | 0.33 | 0.46 | 39.4 |
| " | 0.44 | 0.27 | -38.6 |
| Glass | 2.14 | 0.92 | -57.0 |

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## ENERGY AND ENVIRONMENT

T.R. SATISHCHANDRAN

Friends,

When we talk of energy and environment, energy covers a very wide range from nuclear energy at one end, to animal and human energy at the other. In this lecture I shall try to give a sketchy picture of the relationship between energy and environment.

Let me begin by taking a rather obvious point that energy is a vital input for economic development. Indeed energy plays a role in economy, agriculture and industry where it is the input for production. Whereas in the household sector it is consumed as such and it is required for the energy of life. When we speak of development, there is no getting away from the fact that the country's economic development lies in this where there is inescapable need for more and more energy and this is true of not only developing countries but also of developed countries.

You have the two terms, the commercial and non-commercial. Broadly the term commercial covers any modern forms of energy like coal, oil, petroleum etc. Non-commercial is the term used to cover traditional forms of energy namely firewood, cowdung and agricultural wastes. What is significant here is, first of all, as the per capita income has gone up, the total consumption of energy has also gone up in per capita terms. Secondly, the share of commercial has gone up very steadily, not only has it increased in gross terms but also in absolute terms. But it has replaced non-commercial energy. Among the commercial energy, the electricity shows the highest growth, which is followed by hydro projects, largely oil, gas etc. Solid fuel like coal shows the lowest growth. For electricity production certainly lot of coal is required. About 70% of electricity generation is from coal. In order to avoid double counting, norms of power sources of all the countries have been found. The important point is this - while historically it is this aspect that as economic advancement takes place, energy consumption takes place. What is also a factor which activates a problem for a country like India is that non-commercial traditional fuels have been replaced by modern fuels. Therefore the elasticity of growth of consumption is substantially well above one and perhaps remain quite so for sometime to come. I shall just take a couple of minutes explaining the current situation in India because that provides a background to look at the impact of energy on environement.

A look at the energy consumption pattern in terms of primary

energy, i.e. without taking into account commercial forms like coal, oil or electricity, we find here that if we look at our sources of energy as far as commercial energy is concerned, coal and lignite form our major sources which are formed by Hydrocarbons are partly imported and partly domestic. The share of natural gas has been rising. When you look at the primary energy, electricity forms a very small fraction. But this is before conversion. If you look at the traditional forms of energy, fuel wood is the single largest source of energy followed by equal proportions of cowdung and agricultural wastes. Even today the traditional forms of fuel still account for a large amount of energy consumption and firewood is the largest source of energy in rural areas and has major implications both from energy and environment aspects. To give an idea of absolute quantities involved over current annual consumption of wood in India is 100 million tonnes. This enormous quantity has made its implications both from energy and environmental points of view.

A look at the sectoral energy consumption reveals that as far as the pattern of consumption of modern forms are concerned, such as coal, oil, electricity, industry accounts for almost half the total energy consumption followed by transport. These two together account for almost 3/4 of the total commercial energy consumption in the country. These are the major implications. The significance is that as far as commercial energy is concerned, the bulk of the consumption takes place in the productive sectors of the economy. They are vital to sustain economic growth. If you project future commercial energy, the share of agriculture is about 1/4 which comes to about 8.45%. These projections are taken from the recent exercise done on panel connections which gives alternative scenarios for different growth rates. It is not a suggestion that these are based on whole varieties of assumptions. They do give us the idea of the enormous amount of energy which we shall need to maintain economic growth. 6 percent growth rate which the previous government had really predicted would imply that at the turn of the century electricity will go up by 3 times and coal a little over double. Petroleum products consumption will be twice what it is today. This is the kind of picture which you get from these projections not only in regard to environment but on energy policy.

One point has to be made clear at this stage, namely there is no energy technology which is totally free from environmental consequences. The degree may be a little different, but with any kind of environment technology, even with renewable forms of energy, is not wholly free from some kind or the other kinds of diverse environmental effects. Let me now look very briefly the environmental consequences which different energy technologis have. First of all one must distinguish between 3 types of environmental impacts, localised impact, which all of these could be short term, medium term and long term could be localised. As per instance, an acid. The extent of effects can be on a region.

The phenomenon of Acid Rain arising from coal combustion can have global impact. As for instance even the so called 'Green House Effect' also resulting from coal combustion. Most environmental studies as for as energy economies are concerned, take into account the environmental impact, the general tendency has been to take into account cost benefit studies, only those consequences which are quantifiable by cost benefit analysis. There is tremendous amount of human trauma involved in this.

Let me now look at the technology specifically hydro power generation. First of all, the question of accidents. Even hydro generation is not free from the possibility of accidents. These figures about some of the nature accidents which have taken place in the world over. One of the worst being in India, in Gujarat 3 years ago. The most serious issues are loss of forest wealth. These are the ideal sites for storing water in the areas of heavy rainfall such as hilly plains in the Himalayas, Western Ghats, etc. These are the places where we have the richest forests. It is at these points where we have reduced forest wealth, the serious ecological problems in hydro generation followed by human displacement. The problem has been appreciated only in the recent years. Other problems arising from storing water are logging of flora and fauna. One has also to remember that hydro power is non-polluting. It is a source in which India is relatively well-off. So far we have exploited around 15-16% of our hydro potential and an issue which had to be necessary, which we are already facing in projects like Vishnu Prayag in UP, and this was the reason when silent valley project was thought of in Kerala.

The major source of energy is coal. In India the share of coal is about 70%. The whole process beginning from mining, there are problems of accidents, human displacements, serious health problems arising from coal mining and combustion. The two major problems are the phenomenon of Acid Rain. Coal contains some sulphur and when it is burnt $SO_2$ ia emitted. This combines with rain water and form $H_2SO_4$ and is washed down to the soil. Similar things happen with oxides of Nitrogen. This is a major problem in Western countries. Fortunately in Inida except in Assam, the phenomenon of acid rain has not been a major problem. In western countries the problem is not only national, but also international. Sweden for instance is critical of West Germany, Canada is critical of United States of America. These are the figures pertaining to USA which show that major $SO_2$ portion is on account of coal burning. Similar of oxides of nitrogen. The biggest culprit here is not coal, but transportation, automobiles in the modern world. As I said in India perhaps we do not have to worry about the phenonomenon of acid rain, unless we go in for higher power generation.

The other most serious issues of global concerns is the

Green House Effect. When combustion takes place, large quantities of $CO_2$ are released into the atmosphere. The consequences of this is that $CO_2$ accumalates in the upper atmosphere which prevents reflection of heat from sun. During day time, sun's rays are partly reflected into the atmosphere in the form of infrared. As a consequence of this, the earth is gradually warmed up. So the green houses are used. According to some studies prior to industrial revolution, the concentration of $CO_2$ in the atmosphere was 270-290 parts/million. By 1984 it was 340. Rate of accumalation is 1.2 parts/million/year. The primary source is combustion of coal. Some studies indicate that if the perdentage of $CO_2$ in the atmosphere is doubled, the global average temperature may go up by 3 $\pm$1.5°C. More disturbing point is increase in temperature will not be uniform all over the world. In polar regions it is expected to be 8-10°C. There will be lot of melting of polar ice caps and the sea will be fed with more water and the level of the sea will go up. If this happens 18% of Bangladesh will go under water. Similar is the case of Maldives also. These are the problems which are coming into vogue. These are the possible consequences of green house effect. These are based on mathematics and no one can say these ar very precise and accurate. Some will become wetter and some drier. India will become wetter, may be for the good. I must say that today the most important issue which is being discussed and which is clearly due to expansion of coal as such in the conventional form is the green house effect which is really worrying a lot of people all over the world. So there is a lot of emphasis on this, on the other kinds of technologies in the use of coal.

Let me move on to oil and gas. Here again the problem is acid rain and green house effect.

Coming to nuclear power, nuclear power is a source of energy. One should distinguish the use of nuclear fuel from nuclear power. Purely as a resource of energy, roughly today in the world 1/6 of the total electricity generation account for nuclear power. In the electricity sector the share of nuclear power is 70%. In the case of nuclear energy, there are certainly major concerns arising from accidents which can result in radiation hazards. As far as accidents are concerned, studies have been carried out in Europe and United States and the probability of accidents on various forest types have been found. one study, a well known study, gives details about the probability of accidents, if there were 100 nuclear power plants up to date. The points also refers to others like dam failures, chlorine release, air crashes etc. According to this study, the probability of deaths and injuries refers to the American situation. In USA, the extent of deaths and injuries from nuclear power is far less than air crashes, chlorine release, dam failures etc. If you compare coal and nuclear energy, because for power generation these two are major options. An American document shows that injuries on account of coal is more than

With regard to lighting, we have proposed a 20 watt compact flourescent lamp which gives you light as much as 60 watts bulb. Almost 58% of the electricity is used for lighting in Non AEH and 14% in AEHs. About 18% is for cooking and about 28 for water heating in All Electric Homes. We have proposed to have LPG for it.

In the irrigation sector, for irrigation pumps we have suggested to use frictionless pumps to ensure 30% efficiency energy saving consumption. None of these are new or revolutionary. If these efficiency improvements are implemented, you find very interesting figure of 47,520. Much lower figure that has been given this year is 27,433, less than half the demand. We are able to achieve this through demographic projections. By the year 2000, we would have electrified all irrigation pumps. We are assuming that all the workers would be employed in LT industries. We have assumed that every single home in Karnataka will be elctrified and with this we come out with very low demand figure. The reduction is due to two reasons - 1) Development focus 2) Due to efficiency improvement. 17,000 million units compared with 90% growth figure can be achieved with the development focus and efficiency improvements. The main energy savings have come in the HT, AEH and Non AEH sectors. Now this is as far as the projections are concerned. Whereas the official figures assumes that we should have something like 47,520 million units. We are talking of 17,471 million units, whereas they are talking of 9,397 MW. There are other benefits. The benefits are much lower. It is far more environmentally venine. A great deal of industrial modernisation has to be achieved. 14.5 million flourescent lamps have to be installed, half a million solar water heaters have to be installed and half a million irrigation pumps have to be provided. Massive employment generating exerise should be undertaken. We are also talking of industrial modernisation. At the time the documents were presented, we did not look at the supply side. But if you want to go to the supply side, there are several options before us. Main options are to save on energy services, keep energy constant, increase energy input etc. I want to reject all the three extreme positions - excessive focus on decentralisation, excessive focus on centralisation and excessive focus on conservation. How do you integrate this ? Well. There is a methodology which I am going to present to you will also deal with some of the common objections of efficiency in process. The first opposition says conservation is very good, but it is so expensive that you can not achieve very much. Even if it was not very expensive consumers won't accept it. They say conservation is no solution to our problems. So we have to come out with an approach which I would like to call Least Cost Planning, taking all the technologies, centralised, decentralised and conservation technologies and cast them on a common footing. This is very important because the costing is not done on common footing to ensure several things. Start with all the technologies. We find that the centralised are the more expensive, decentralised in the middle and nuclear power, the most expensive of all. I think

can not say that your consumption is equal to your demand. You have to ask, what would be the consumption had there been no power cuts ? I was shocked to know that what they have done in Karnataka is to add up the contract demand rate (KVA) of industrial sector. We all know 2 things. The first thing is we all exaggerate our requirement. Even when there were no power cuts, the capacity utilisation was never 100%. I believe facing your best demand on the contract is an exaggeration. It is an overestimation of the true demand. So they have adopted certain approach to the basic demand which involves going back and allowing T & D, removing power, going from the basic consumption and taking a decision regarding whether there should be a power cut or not, whether it would be possible for them to manage their activities without affecting their activities if there is a low consumption. We know that confederation of industry, an industrial organisation went to the Government and said, if you make a power cut of 15%, it won't make a difference at all. In conservation theory concepts are switch off your fan when there are no people, switch off the lights when there are no people etc. Instead of a base demand of 15,500 units which was used by Official Government Committee have used something of the order of 12,000. This is the first part. The second part of the exercise depends on how you make the demand projection. Most official planning exercise is to take the growth rate in consumption and extracolate it to the future. If you put the growth rate on consumption figures, you are assuming that the present inefficiency of the energy use will continue into the future. We have taken a different approach. We must put the growth rate only on categories of consumers and incidentally when you put the growth rate on consumers that is where your development projections can be reflected. And once you put the growth rate on the categories of consumers, you can bring in energy consumption norms to reflect improvements. So you have the Development focus and End-use focus and New Vision focus.

## ENERGY CONSUMPTION IN KARNATAKA

As usual, half the consumption is by industries. We also have significant amount of consumption by all electric homes. These are the main components of the electricity plan that electricity should be used for basic needs. There should be a structural shift to non-power intensive employment generating industries. There should be efficiency improvement. There should be substitution of electricity with other resources of heat, load management, reduction of T & D losses, decentralised electricity generation for villages, co-generation of electricity in sugar factories and augmentation of electricity supplies.

Conservation is reducing over-heads or improving efficiency. About 70% of industrial electricity is used in motors. By the year 2000, Karnataka industrial norms would match with the norms of industrial etablishments of the world today.

nuclear power. Coal is a much larger source of deaths and injuries than nuclear power. This is also another interesting information. Here the issue is those working in the plant and those around would increase radioactivity lead to increased incidence of cancer. American data shows natural background information. This data is used to argue that in India, for instance, the average background radiation is estimated at 146 million. In Kerala the background radiation arising from nuclear power, compared to the natural radiation, the increase in rate on account of nuclear power is negligibly small and suggests no harm. There are some unsolved problems, for which satisfactory solutions can not be said to be available at the moment. On the other hand, nuclear power has many advantages, most important of which is neither the problem of acid rain or the green house effect, but in terms of land requirement. It requires least amount of land. I know I am entering into a rather controversial area. I am certain that in the long run as the world runs out of oil resources the world will have no choice but to go in for nuclear power.

If you look at the conventional sources or the firewood problem, it is the problem of deforestation of not only forest wealth but also of tree cover. Consequences are soil erosion, water run-off etc. Apart from this, there is also considerable evidence that the use of firewood in the traditional way is the major source of disease of the eyes and of lungs. This is what I meant when I said there is no energy technology traditional or non-traditional that is really free from environmental consequences. What about the renewable forms of energy like solar, wind etc. ? Here again there is not really enough time to go into detail. The study of these technologies is very expensive and their total contribution to the energy needs of the country is still quite small essentially because of its cost and because of their instability for applications such as industry and transport, where you require large amount of energy. But in terms of environmental impact, energy generation, for instance large scale for use, wind mills of large size have serious problems of noise pollution. And that has been in California, where large sizes of wind mills have been established and there has been compensation to it from the local people. While electricity generation from the cells may not be polluting, manufacturing of cells involves some of the most hazardous and toxic chemicals and they are also highly material intensive. Now they want to compare the environmental impact of all kinds of technologies including conventional as well as non-conventional, solar technologies which show higher environmental impact like natural gas. Let us not be under the impression that renewable resources are free from environmental impacts. Having paced before you some of the environmental technologies, the question that can be asked is can we have more and more energy with obvious need to minimise environmental impact. Solution is measures for pollution control. This is an obvious step to be taken as far as acid rain is concerned. Technologies are being developed like fluid acid bed combustion, gasification etc. of

sulphur. Apart from control of pollution, energy conservation must also be regarded as a major relevant strategy for minimising environmental impact. In our country there is no sector of the economy where there is no scope for energy conservation in an efficient manner where modern fuels or traditional domestic chula are highly efficient. I shall not go into details as to what specific steps to be taken.

The other obvious step is, in any kind of investment of new projects, ther must be evaluation of costs and benefits. Beginning has been made in this country. You know that good amount of effort is being made. But there are some methodoloy problems. Anyone familiar would know that the cost benefit has to be dealing questions on discount rate will become relevant and any kind of discount rate ignores effects beyond 20 years or so. It is a serious limitation when one tries to assess the long term impacts which is very relevant in the case of technologies. So also the question of non-quantifiables refers to land also. Now the question can be asked, can we not make the process of grwoth itself less energy intenstive ? This is a suggestion made by many scholars including one from this Institute (Prof. A.K.N. Reddy) who is a very straunch opponent that the energy intensive economy can not be brought down drastically. Reasons are several. Very briefly, the common argument put forward is in the western countries. The situation today is that the rate of growth of energy consumption is lower than the rate of growth of GDP. The elasticity has gone beyond 1 and is still around 1.6 in India. But for commercial energy it is slightly high. In India I donot think we can bring down the elasticity so sharply. Our population growth rate is higher than in western countries. Income levels have to go up for large sections of the people. Growth has been the major objective of the western world. In our country it is both agriculture and industry which has to contribute. Therefore I for one donot foresee a very radical decline in the energy intensive sector but over a period of time. What I want to present before you is that one must bear in mind that one has to evaluate at every stage the implications of our projects.

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## ENERGY PLANNING FOR KARNATAKA

A.K.N. REDDY

Today I am going to prescribe to you some of the work that we have done in Karnataka for energy planning. This work was done as a part of a report on a Perspective Plan for Karnataka which was prepared by an expert group set by the previous Government of karnataka under the Chairmanship of Smt. Lakshmi Jain, Subsequent to that report, we have gone much further and I find that in the papers given to you, you have got a copy of 1988 report, we have gone a step further.

Describing what in my view is the conventional "wisdom" of energy planning. It can be caricatured in the following way: Development = Growth = Energy = Electricity = Centralised Generation + Grid Transmission. This is the underlying principle of the energy planning in India. What I want to submit is that every step in this logic is questionable, suspect falls and must be challenged. Development is a process with 3 components - satisfaction of the basic needs starting from the needs of the poorest, environmental soundness and self-reliance. The question of growth being related to energy the basis of which is the famous energy GDP correlation. And with regard to energy = electricity, the energy ministry is really an electricity ministry. The question of centralised generation is very important because in all questions of rural electrification, it is assumed that the only way of doing it is by having centralised generation followed by grid. If you adopt this approach, you have following situation where development is related to growth. This means energy consumption becomes an end in itself. Then the main task is to project the demand. The moment you project the demand, very next task is how do I arrange for the supplies. In this process you completely ignore conservation. The moment you adopt this approach, you get landed in a trap, a trap of environment development dilemma. The developers try to promote what they call as development, but it is nothing but indiscriminate growth which require energy. The moment you try to expand your energy supplies, there are several cosequences. Firstly the most important thing is mounting cost. You have skewed self-reliance as a result of this mounting cost and environment degradation which is opposed by environmentalists. In order to do that effectively they must oppose energy projects. Thus you have development Vs energy. For mounting cost, the basic way of looking at it is what we call electricity GDP ratio or GDP of elasticity ratio = Energy = Growth$^{\alpha}$. There are problems. The annual investment required for electricity sector = product of the starting installed capacity which is about 58 deca watts in case of India x elasticity x growth rate in GDP x unit cost of power. Simplifying we can say that Annual investment = initial capacity x growth rate in electricity sector

x unit cost of power. Based on the calculations of 1989, where they show if you add up all the results of the developing countries, it works out to be 100 billion dollars/year.

The Government of India plans in electricity sector are not very different. They are asking for 100,000 crores to expand the caapacity by 38,000 mega watts, an electricity-GDP ratio of about 1.5. I am sure the conventional approach in electricity planning is more physically responsible. What is the alternative in this situation ? Before we go into that, let us take a concrete case in power in 1957 in Nagpur. They project that by the year 2000, Karnataka would require 47,520 million units and corresponding to that would require an installed capacity of about 10,000 MW. This must be compared with actual consumption of 7,500 million units in 1986 and an installed capacity of 2530 MW. The interesting point is most Government and official projections will never reveal as to how to arrive at the number. But if you go into it as we have gone into it, we have found that all these are using 90% as growth rate and I am afraid the Government of India exercise also for power projection is based on something as simplicity. If you have a simple growth rate approach we have 2 numbers, an initial demand and we have growth rate percent. Most of the demand projections are done to justify particular types of supplies strategy. What does this projection imply for Karnataka? Which implies massive infrastructure development. It requires massive centralised power generation, atleast 1000 MW. With the first two reactors ay Kaiga, it comes to about 2000 MW. power. That is a great progress. 25,000 crores is all they have asked for. In order to get 25,000 crores what is their scheme ? We get 8 from the sample government and 8 from world bank and to get more in state's annual budget. This is the description of the power sector. What do they promise you at the end of all this ? If they promise solution, then expenditure will be incurred. They promise that energy shortages will continue upto or even after the year 2000 and with little hope thereafter. All this exercise was to guarantee you that shortages will continue. It is the most gloomy projection. This raises the question of whether there are alternatives ? And we believe there are alternatives which can solve the problem of environment. We would like to have a scheme where development = growth + 3 components - basic needs, human needs, self-reliance and environment harmony. To satisfy we have to achieve certain measure of decoupling from GDP, growth rate, electricity must come down. How can it come down ? There are ways in which we can bring it down. If you achieve decoupling and your demand goes down and you can begin to scree technologies and see whether they are environmentally venine and you can choose an environmentally venine technology so that you get a positive approach. Is this a dream ? I am sure this is not a dream. I will describe an alternative exercise made. The first thing is you have to be careful about your facial demand. The conceptual problem is that if your consumption is not supply constraint, then you can measure your consumption and say this is equal to your demand. If your consumption is supply constraint, then you

there is some practical economy involved here and the centralised technologies are backed by the ministry. You have the ministries, departments and the advisor. We should scrub those technologies where they are most expensive and implement Least Cost Approach. What is this Least Cost Approach ? You start with the cheapest technology and the width depends on how much potential is there in that technology. When its potential is exhausted, use the next less expensive technology. With this you come to the conclusion that package of your technology should also have a time frame to reach the goal. In fact you can go a step further and find the cost benefit and the gestation period required to reach the energy goal by constructing cost - supply and time - supply curves. In the case of least cost analysis it takes about 6 years whereas the maximum cost approach requires 10 years. The maximum cost approach leads to about 150 times of 2 1/2 crores more than the least cost approach. The least cost approach leads to lower cost, lower environmental impacts and lower gestation period.

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## AGRICULTURAL DEVELOPMENT AND ENVIRONMENT

G.V.K. RAO

The basic problem of agriculture is related to environemnt which has 4 components - land, water, air and most important component is man. Agriculture as well as environment is for man. I would try to say something on these 4 components which I do hope would assist you in the discussions.

The basic problems of agriculture particularly in India can be broadly classified ino food, fibre, oilseeds and fuel. Administrators may have some ideas about the development process, particularly in the rural areas, where these are the basic needs - cereals, food, fibre, oilseeds and I would also add fuel because fuel is also one of the important component I had proposed to talk to you about. What are the requirements of food in this country ? To take cereals, cereals also includes pulses. Today what is happening is an IAS officer in his career does not spend much time in the districts. In about 30-35 years of service only 5-8 years are spent in the districts or in handling problems pertaining to district administration. Although in the ideas of the people partiularly those associated with parties and administration they still think IAS is not important so far as the rural area is concerned.

The food requirement in the country as indicated in the various plan documents, as in the last plan document (which is supposed to end in March'90) has indicated that our requirement is of the order of 183-185 million tonnes. Of course it may also reach 172 million tonnes also. And in fact we did not do very well for the first three years. There is a lot of satisfaction in the electricity generation. What we achieved in 1972-73 is quite a major achievement. In the currect year 89-90 I have a feeling that it may not exceed by 1 or 2 millions and not very much more. Reasons are inputs have not gone up. Consumption of fertilizer has not gone up. I will briefly refer to fertilizer also later because it is also one of the important inputs for agriculture. Last year the increase in fertilizer consumption has been by and large increased by 10.5 millions tonnes and credit also has not gone up. Last year the credit for agriculture has been of a very high order, for that actually agriculture particularly in the last 2-3 years did not go up at all. And Government Reserve Bank chairman issued loans particularly the loan melas which went on absolutely mad to provide loan for agriculture to increase production was improperly used and that is why there is a reaction today that there are lot of loans. But the major money was not meant for agriculture. It was made in compulsion and also for achieving objectives which were not economic at all. Apart from this, the hard fact is credit for agriculture both short term, and long

term did not go up in the last 2-3 years. The area under irrigation also did not go up. A lot of money was spent on this. So the production may not go up beyond 100 million tonnes. There is lot of hesitation in presenting these figures. Obviously people do not want to announce some of these figures. It is quite clear because the figures were somewhat damaging.

In the godown no procurement has taken place on both rice and wheat. In case of rice it is marginally better. The stock today is only of the order of 10 or 13 million tonnes and consumption distribution system is not very high. The plan document itself indicates that it would reach a figure of 226-235 million tonnes by the end of this century. The National Commission on agriculture in their report has indicated a figure of about 239 million tonnes. Some economists have put it as 235-240 million tonnes. Some of my collegues have made some studies and they felt that the pattern of consumption had changed, particularly a large number of people, lower middle classes and when this happens the pattern of consumption changes. The so-called coarse grains like jowar, ragi are quite good grains. Many a time when your income goes up when you change from ragi to jowar than to rice. So consumption patterns have changed. According to our studies requirements of this country may be even of the order of 255-260 million tonnes. Even if you have to increase the production of cereals and pulses in this country in the next 9 or 10 years by 70 million tonnes or even 80 million tonnes, it is only 175. Normal increase in the production over the last 2 or 3 decades in 1947 or 1952, it was only 50 million tonnes. The normal rate of increase can be put at about 3.5 million tonnes/year. There is no doubt about it. In my view unless very radical changes takes place at the research institutes and authorisations and in the attittudes of the policy paradise of the country itself, this development process, we are not likely to achieve this kind of increase of 7 million tonnes/year and we donot know whether we are going to have a severe of problems. Particularly now with an open society and lot of changes taking place in Eastern Europe, Middle East and Latin America and all these changes are going to have thier effects here. The kind of pressures that would be generated for participation is to be shared thereof and recent political changes are also an indication of that. A lot of forces have to work. In fact nobody reads the election manifesto. The election manifesto of all six national parties and the resluts of the last election was practically the same. The shift in the consensus of the country is more of the benefit to the country as in the two governments of West Bengal and Kerala. Some of them are still living in the conservation of thier own. I think so far as India is concerned, they are not far from it and that is one of the reasons why Communist parties of India have made their statement clear. I made this statement because I would like to reflect on some of these issues also. Everybody have not assessed the meaning and obviously there are no rules in the communist parties of India. They still have not realised that agriculture and rural development is extremely down. West Bengal and Kerala in

which there is a lot of import of foodgrains from outside states. If any state imports to reconstitue this, the percapita money goes up. That is not realised. Industrial development can not give jobs, about which I shall make reference lateron. That is the problem which we have. We have achieved something during the last 2 or 3 decades and for this very pragmatic views have to be taken.

The basic problem in this country is to see that we produce enough food, fuel, fibre and oilseeds enough to meet our requirements. If we donot, we are in trouble. Because you have to consider the imports which we did in the first two decades of our times and that also means part of our dependance. In fact we know the famines which we had in 1968-69. We had to go to the United States for food. On such conditions imports have come up. In my personal view one of the most important is that the country achieve self-reliance in food. There is need to produce more food. For this we want more fertilizers. To avoid the pollution problem, we thought that green manure was the solution to all problems. Now how a single officer can set back the development of the country ? Planning Commission had ordered bulk green manure on the slopes and prevented the import of fertilizers and for 10 years we had to import foodgrains on a massive scale from the United States. Seeds were imported without having been invested. If we have to import foodgrains to that extent our freedom to manage our affairs particularly internal problems as well as our foreign policy both would be sold to dogs. We should be self sufficient in foodgrains.

In fibre we have done fairly well. A lot of scientists have done good work both here and in Gujarat. Today we have a production of 115 lakhs as against 16 lakhs and on the other hand we are not importing, but we are exporting.

Oil seeds have been in my personal view, importing is not necessary at all. Everything is done because of the big corrupt industries and politicians. In prices also it is the best intensive. The best fertilizer is high priced. The price of the groundnut oil last year went down very steeply in Gujarat and I donot know why. And actually Soyabean has become a very good crop in Madhya Pradesh. Sunflower is quite a good crop in Tamil Nadu and there is no reason why we should import edible oils at all. Real problem so far is to increase production of food.

In my view the real pollution in this country is poverty and unemployment. It is not other kinds of things which needs talking about. Straightaway you can take care of yourself. You can pay your taxes and with little more taxes we can manage our environment. The biggest pollution which we have is poverty and unemployment. We do have pollution. Our industries do not follow their rules very strictly. Lots of gases are let into the

air particularly of the paper mills and other pollutants, all that is true. But th scale of industrialization in this country is not so high as in the west. And the pollution that takes place here is still not of that order as in the west. Unless we get id of poverty and unemployment, we will be unable to take care of the environment. That is where the link between agriculture, employment and environment comes along.

The industrial development in this country has been very good compared to other countries. No doubt about that. But what kind of employment it provides ? The total employed force in this country is of the order of 300 million, with the population of 830 million in the age group of 20-60. The number of people who come to the job market every year is of the order of 7-10 millions. What are the number of jobs being created in this country in the organised sector, public sector and also in the private sector ? The number of jobs that we have in most of the government, central and state is of the order of 30 million or 35-40 million. Actually it is not more than 30 million, whereas the number of people in the employment market is of the order of 300 million. It is the number of people that drops. It is only 30-35 millions. Other have to be self employed in activities like agriculture including horticulture. Maximum number of jobs have to be found in agricultural and other sectors.

The number of jobs created last month per weak was only 24% or 500,000 per year. And one of the things which happened particularly in the last decade is industrial production has gone up. But the employment opportunities have not gone up, because most of the industries have gone in for modernisation. But today because of the high technologies the number of jobs created is not very high. Although the industrial growth is 8%, the number of jobs went up by only about 1-1.5%. That is why there is a lot of trouble in this country, the problem in Punjab, the problem in Jammu and Kashmir. Basically many of these problems are economic problems. Many of the educated graduate people are not getting jobs. The society can have satisfaction only when there is cultural environment. So the problem is to creation of more jobs in the field of agriculture and also reaching the kind of targets which we need. How do we do it ? The only way to increase producion is to make use of modern science and technology. There is no other way. We have to become more modern. We have to use more of fertilizer, pesticides properly, and not over use them. We should also use more water. We should also take more modern implements. All these require a lot of investment. If we donot do it, I think we are going to have a lot of problems.

Some studies have been made on this. We made some studies on Planning Commission for employment. Bangalore is supposed to be a highly industrialized cities of India. The total investment made in industries in Bangalore is of the order of 300,000 crores or so or even double. The number of persons employed is 150,000 including those people who are more than necessary in HAL etc.

To create a job in the industry require a minimum investment of 4 lakhs and we can not really afford it. A factory which may look for 100% export oriented unit, the investment is 13 crores, but the number of people employed is 100. To create one job requires an investment of Rs. 30 lakhs. You seek one well which may cost Rs. 25,000-50,000 which creates 5 jobs. Sericulture is one industry which is encouraged in a big way. 1 acre of mulberry produces 5 jobs. Investment is not more than 10,000. These are the kinds of choice we have. In the long time we have to depend on agriculture in the largest sense of the term to create jobs and also to remove poverty.

Land is a basic source for agriculture and it can not be expandable. There is a lot of misuse of land, soil erosion, water run off, good lot of silting is true, on which the crops have to be grown. There is tremendous fragmentation of land. The number of holdings was 15 million about 100 years back. Today this is of the order of 85 million. It would be 100 million by the end of this century. But the point is our law is such a type. Fragmentation is more than 50 million holdings or less than 1 ha particularly in a state like Kerala. The lands are so small that we can not do any cultivation. That is why in Kerala the production has not gone up above 35 million for the last 35 years. They have not understood the importance of agriculture and there are intolerable tensions in Kerala. These are economic forces at work. If fragmentation of land is not prevented, it is one of the things which will come in the way of increasing production, creating employment opportunities and in a way it creates problems to environment also.

Water is very important resource. The area under irrigation has gone up in a very big way from 35 million ha at the turn of the independance. Now it must be of the order of 70-72 million ha gross. In our country, water management is poor. All our interest is in constructing dams, canals etc. Nobobdy is interested in constructing distributeries. The worst engineers are posted there. Water management is very very severe casuality in India. It is not a subject for Civil Engineers or B.Sc. (Ag). It is very casual. It is subject not interesting to anybody. But unless we get results from the large irrigation projects it should be possible for us to get 5 tonnes/ha atleast. But the average is only 1.7 tonnes/ha.

Water is very important political factor and extremely difficult in the states of Punjab, Haryana and UP. It is extremely difficult to enforce because we are not managing very well. Giving a lot of water makes soil saline, there are water loggings in Punjab and Haryana. It has become a problem in Andhra Pradesh, Karnataka and we have not found any proper way of irrigating black soils. It is true that this is one of the areas in which we donot manage it properly. When discussing the problems of development particularly with reference to the

environment, the first and foremost thing to say is that there is harmony in society.

Talking on fertilizer which goes in for a lot of criticism. Without fertilizer we can produce in natural ways. Some have done it. In Pondichery it has become very successful. They have yields of 5 tonnes/ha. I will leave everything to you. All kinds of rubbish and biogas and cattle, they have done its. They can be repeated everywhere. Fertilizer is an input. If you donot give the input, you don't get the output. We have found that consumption of fertilizer is more than 100 Kg/ha only in 15 districts. For sometime in Assam the consumption was as low as 1.5 Kg/ha. Consumption of fertilizer in this country has gone up from 2.5 million tonnes to 50 million tonnes now. Local production capacity has gone up. But compared with China in which consumption of fertilizers is 20 million tonnes, the area under cultivation is only 2/3 of that of India. We have more cultivable land in China and the climatic growth is better in India is better than China. But what has happened in China is 20 million tonnes of fertilizer consumption produce a production of 350 million. It is just that. Fertilizer input goes up. There is importance in the use of fertilizer. But the basic factor, consumption of fertilizer in this country must go up above 20 million tonnes. If it does not go up above 20 million tonnes we can not survive. In eastern India the consumption of fertilizer is 1.75 Kg/ha, it is less than 10 Kg in Bihar. In Orissa also it is the same. That is one of the reasons why production has not gone up. Land reforms have not been done. There is no political will. These are the kinds of problems we have.

Pesticides, particularly with increased use of fetilizers and with increase or better technology, you have got more pests. Nutrient between good crop pests have to be controlled. Pests can be controlled by biological methods also. Proper use of both mixture of biological and chemicals is necessary. To increase use of pesticides is essential to get increased output particularly for crop like Cotton. There has to be a proper and balanced increase in fertilizer use and pesticides use, in making use of modern science and technology to increase production to remove poverty and unemployment.

There are a number of other things. Some problems are there in administration also. The administrative structure for increasing production is very crude. It is extremely poor. Those of you who have worked in the districts would have seen a very big proliferation of the department of agriculture which is very weak. The contact with people like University people is very poor and revenue administration is very weak. Maintenance of land reforms is very poor Abolition of land revenue has been done. That is the only priority the farmers has. I would even destribe this abolition of land revenue as a trick employed by the dominant castes to get rid of minority groups. He should be

sensitised to some of these problems. If we lose our components and efficiency in understanding problems, then it is a very sorry day for the country. Gopal Gandhi has written an interesting article on the monocracy on seminars. He has classified the services into three categories - 5%, 55% and 45%. He has also stated that a new position is coming up between politicians and the technical people. Particularly in the last decade use of few technical things, in fact it is a great danger to the environment. Laws regarding maintenance are also made.

One of the problems which has happened in this country is the cultivator caste. They have all got problems. Even the green revolution, what has happened all over India, in the North, in the East and in the West, land has been taken away from the minority people. Backward caste people have all lost their lands and have got into the hands of dominant castes in Punjab and Haryana. They have today a loan as high as Rs. 50,000/acre. This is an indication of the minority caste having lost their power.

These are in my view some of the hard problems related to agriculture and environment. We should pay due respect to it. The basic problems are unemployment, poverty and see that agriculture in this country becomes a strong important force providing social security to the people.

Fish is another important aspect of food production. We are producing about 3 million tonnes of fish. 1.7 million tonnes is from marine and 1.3 million tonnes is from inland fisheries. Our potential is around 4.5 million tonnes in marine. From 1.7, we have to go to 4.5. That means we have to improve. Vessels have to be improved; deep fishing should be undertaken, by which only we can come to that limit of 4.5 million tonnes. There is a lot of potential in inland fisheries. The subsidy is 1.5 million ha and few big lakes and reservoirs. This is about 3 million ha and rivers, about 29,000 kms. If we improve the inland fisheries in rivers we can definitely increase production. We can reach 15 million tonnes/year.

In case of Horticulture, we have not given any importance to horticulture at all. Horticultural food crops accounting about 2.5 million ha and production of about 40-45 gms. food per person. That means we are just producing 1/2 of them and we will require about 300 gms. These are the statistics.

The main problems that we are having are the food production requirement and the other is the spatial problem. How to increase the food production ? The only thing is efficient use of water. We have to think about it. As I said earlier in the major irrigation projects, we are not able to use water efficiently. I donot know how or what exactly I have to deliver. We suggest construction of dams for storing water and then preparing them in canals. The utilisation of these canals will not even be 25%. The persons who are very near are getting first. So much so, the tail enders donot get water. The second things is we have not educated the farmers on how to use water efficiently. And because of this inefficient management of water, the land becomes useless. We have no proper way of irrigating black soils, which gradually becomes saline and the yield goes on reducing. And the other thing is when the minor irrigation projects come, the enlightened farmers can grow with water in excess, following crop reduction and when the land becomes useless, they leave the land and go away. This is another aspect of irrigation. Only with efficient use of water, we can increase food production. I think we must give more importance to irrigation aspect.

Since the farmer is interested in taking the maximum profit, he will grow the crops which gives maximum profit. For eg. in Punjab and Haryana, rice has become the major crop there. The non-traditional area will get the maximum or all the profit and that they have stopped growing pulses. And pulses is so important crop. So how to use this ? One thing is we must see that pulses are grown in sequence along with these crops, so that the profit will be maintained. Another thing is that the farmers would be dry land agricultural farmers. They will have to work only in a particular season. He will have to work for about 100-

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## CAN WE SUSTAIN AGRICULTURAL GROWTH ?

R.K. HEGDE

Friends,

Today I would like to talk about "Can we sustain agricultural growth ?" I have made some attempt to give some idea about this topic.

When we got our independance our food production was hardly 50 million tonnes and in 1988-89 we got 171 million tonnes. By the middle of 60's, we said we had green revolution. Our target was 150 million tonnes. Only in 1988-89 we got 171 million tonnes. How did we achieve this then and what will be the requirement for 2000 A.D. ? How can we achieve this ? What are the problems and how shall we overcome these problems ? On these aspects I would like to talk.

The first thing is the land is a limited resource. Fragmentation of land is quite common and this we can not stop it. Nearly 70% of the farmers are marginal rural farmers and any attempt we do is for them. Whether we like it or not, fragmentation is still existing. Unless and until the owner farming is there, technology which is there will not reach the farmer. For eg. in Punjab and Haryana, most of them are rural farmers. Unless the technology reaches the farmers, we will not be able to obtain the food production as much as we desire. When you take the land, about 173 million ha is the net cropped area and about 23.5 million ha is not cultivable. And we have a forest area of about 22% which is much much less. As Dr. Saldanha was telling we must have atleast 33% of area under forests which otherwise will affect our ecological balance. Around 43 million ha of land can come under the control of greens with proper management of soil, water and other things, we can bring under pasture land or social forestry and other things. These are the land available to us for food production. If you just take up the total area that is available, the food production as I mentioned reached 171 million tonnes. out of that 121 million tonnes is by 22 crops, grass by 31 million tonnes and mostly the staple food. Our potential is about 135 million ha and our target is 2.5 million ha. It is very difficult for us to do it and most of the area will be major and medium irrigation projects and they have thir own problems. Water use efficiency is low in case of major and medium irrigation. In case of minor irrigation it has been much better. Now regarding the market, I think we are producing around 48 million tonnes. Therefore any improvement we have to do is for marginal farmers. It is true that around 1980 we tried land agriculture. The watershed management has come in 1984. These are doing some benefit, but are not great.

150 monsoon days. In the remaining season, he will be idle. We have to give encouragement for industry for all the remaining 150 days so that his income will increase. He should have diverse crops and and also other subsidiary occupation. He should be given sericulture. He can be given other things so that he will have engagement throughout the year. By this productivty will also increase.

When they migrate from one place to another land will not be taken care of. So in such cases dry land horticulture can be made use of. It is a very important thing and it is catching up now. Say crops like Sapota. These things with very little irrigation will establish and once they estblish they will be yielding where the crop completely fails. Therefore in minor land we must give importance to those which increase in food production and also the income of the farmers.

Another important thing is Sericulture. It is grown on a area of 2.4 lakh ha and the production is 871 tonnes. Mulberry plant can be easily established and even with 24% rain fall we can get good yields. If you just divert 1% of the total area under cultivation, we can increase silk production by 5,000 tonnes. This is another important thing by which we can increase the yield of silk and also increase the earning capacity of the farmers. So we have to take care of these aspects.

Now how to do it ? Whatever technology in developing agriculture is there, it does not reach the farmers. Only about 15-20% reaches the farmer. What is the reason ? There are several. One is whether the remaining 80% is really suitable for adoption ? If you say 20% has reached, where 80% is also really adoptable by the farmers. The second is, is there any agency to take these and deliver it to the farmer ? Even if the remaining 80% is also adoptable and agency is there to give it to the farmer, it is of no use. This should be taken into consideration. The third thing is even if you take it to the farmer, whether the farmer is in a position to take it ? Here again are some problems. One is education and the other is finance to adopt these things. Then you may ask, if finance is given, will he adopt these technologies ? My personal opinion is whenever you give subsidiaries to the farmer, he will adopt that technology as long as you give subsidiaries. The moment you stop giving him the subsidiaries, he will not. So we thought that this policy is not correct. One of the things which I thought is that we must know what is it that is necessary for them. First what is required by them ? We are simply trying to give them the technology that we know and want to impose it on them. First find out what is the technology required for them and then plan our technology transfer in that direction. It may be possible. And for the poor farmers it does not reach at all. We have to device a method to see that it is reached.

Another important thing that is happening in sericulture is that we have good technology for production to some extent. But after this production, till it is marketed, during transmission and storage there is a lot of damage. In case of grains 10% of produce is lost ,in storage. For this purpose the processing units installed in villages, we may be doing two things. One is large number of educated youths go into the urbn area and stay there. Second is it is reinvestment for the villages to be made more useful. We must also establish many agro based industries, small scale industries in the rural areas, transport raw materials and processed materials should be shifted. We can think about on these aspects also.

Another thing which needs encouragement is the gomalas and waste tank and they are of no value to the cattle and other things. It is very difficult to graze. What we have today is in the process of increasing production/unit area which should be left alone. We have to use the technology to increase food production in the unit area. I think we can sustain growth to the requirement of the population growth and we can balance between these things only when we use all these technologies properly.

effective operationalisation, each watershed is divided into sub watersheds of varying sizes depending on the terrain, from 1,000 to 6,000 ha. The planning, phasing and implementation has been phased out by preparing the project plans for these sub watersheds which are by themselves independant catchments within the district watersheds.

4.4. For preperation of a project document, the basic requirement is the definition of the project area coming under Project IV. The defined area will be comprising of sub watersheds or a part of sub watershed to be tackled under Project IV. We are aware that implementation of each of the project is phased out over 4 to 5 years. Thus activities under Project - 0 is phased out for implementation from 1984-85 to 1988-89, Project - I from 1985-86 to 1989-90, II from 1986-87 to 1990-91 and Project - IV will commence in 1988-89 and will complete by 1992-93. Thus, during the first year operation of project IV there will also be committed and definite programmes phased for second year under Project - III, thrid year of Project - II and fourth year of Project - I., Looking into the staff available and the funds likely to be made available during 1988-89 it will be possible to find out the likely amount available for the first year Project IV after making the provision for phased programmes of earlier projects. Based on experience of previous projects, the rough size of the Project-IV area which will need this balance amount for its first year phasing can be found out. The approximate project area to be taken up by each watershed development team will be communicated to the DLDBs and WDTs, who will select sub watershed or sub watersheds or a part of sub watershed in that range.

4.5. Looking into the phased out works of Project-I,II,III and IV for 1988-89 under Agriculture, Forest, and Horticulture sectors if by chance the phased out works of Forestry is too heavy then select sub watersheds for project IV having less non arable and gullied lands. Similarly, if phased out works under Agriculture sector is more, sub watershed selected will be such that non arable lands are more than arable lands. Thus looking into the staff, phased out workds of previous projects etc. the project IV area will be defined.

4.6. As soon as this project area is delineated, it will have to be marked on the Map of Watershed drawn on a toposheet. The delineated map of the Watershed will help the project team as well as the authorities like DLDBs/Heads of Departments to verify whether the delineation of watersheds and sub watersheds is properly and scientifically done, so that there is single drainage point for each of these areas. This will also fix up location of Project IV with reference to land marks existing in the watershed. This will also help the inspecting officers in locating the Project-IV area and the speific works.

4.7. To take up further works this drainage area of Project IV is to be sub divided into identifiable portions. Identifiable marks on the fields are the survey numbers as marked out by the Revenue Department. Therefore, the Project IV area need to be superimposed on the revenue map of the area and thus the entire Project IV area will be defined in terms of villages and survey numbers which are easily identifiable to fix up the boundaries. This will help the project team in planning and implementing and also the inspecting officers in locating the works. The Project team will prepare a statement indicating the villages coming in the Project area and the extent of land of the villages falling within the project area. This will also provide description of existing status of the land. Another statement is prepared which will provide further details with survey numbers covered partly and fully. While filling upto of this proforma it will be sufficient if initial and final survey numbers are mentioned.

4.8. After the project area has been demarcated, a team of officers from Agriculture, Forest and Horticulture sector will go around this project area from ridge to the valley and identify survey numberwise treatments required to e given. A book will be carried by each of the sectoral officer for noting down the treatments for each of the survey numbers. While indicating the treatment the objectives and the approach given in the general guidelines will be kept in mind. The treatments recommended are to be preferably low cost. High cost treatments may be recommended only when they are absolutely necessary.

4.9. If the Project IV area is too large for a single team to survey, the area can be further delineated into micro catchments and 2 or 3 teams constituted to go around these micro catchments seperately. Though the survey team consists of Officers other officers/staff should also be requested to go along with the team and try to understand the process of preparing treatment plan.

4.10. Some of the likely treatments in each of the sectors are as follows:

4.10.1. FORESTRY SECTOR:

Trenching and planting; pitting and planting; establishment of contour hedges with bushes or with grass like khus etc. planting in gully and nala beds; farm forestry in marginal lands; seeding/planting on bunds; avenue plantations; shelter belts: grass/pasture land development; brush wood dams; raising seedlings; for distribution, planting of khus in gullied areas, along water courses and along the FRL of tanks etc.

4.10.2. HORTICULTURAL SECTOR:

Trenching and planting; pitting and planting; planting in gullies and nala beds; dry-orchards in private marginal lands; school gardens; planting around water harvesting structure; planting on bunds, raising of grafts/ seedlings etc.

# WATERSHED DEVELOPMENT PROGRAMME - EXPERIENCES OF KARNATAKA

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## I. INTRODUCTION:

### WORLD BANK AIDED KABBALANALA WATERSHED - PILOT PROJECT

1.1. Development of rainfed/dry land farming has been treated as one of the priority areas in improving the lot of vulnerable sections of the society and the less endowed regions and was included in the New 20 point programme of Economic Development launched in 1982. In pursuance of this policy initiative, efforts on dry land agriculture were intensified. Watershed development came to be adopted as a national strategy for sustainable development of rainfed areas. It was during this period that the world bank aided pilot project for rainfed areas was negotiated in November 1983 and became operational in June 1984 in Karnataka along with the other three States of Andhra Pradesh, Maharashtra and Madhya Pradesh.

1.2. The pilot project in Karnataka with the World Bank aid was launched in June 1984 at Kabbalnala watershed which falls in the medium rainfall red soil region. The project is under implementation and I can say that we have been able to achieve the objectives with which the programme has been started. We have been able to show to the country that the watershed approach to the rainfed farm areas is a cheap, affordable, simple and replicable technology.

1.3. The pilot project is designed in a comprehensive way and aimed at an integrated development of arable non-arable lands in the watershed for increasing and stabilising production of crops, forage, fuel, timber etc. by introduction of improved soil and moisture conservation measures, better crop and range land husbandry practices and reforestation. The specific objectives of the pilot project are:

i) Large scale verification of available technology;
ii) Selection of components and working out technical criteria;
iii) Identification of investment limits and cost structures; and
iv) Evolving a delivery system - organisational framework for rapid replication of project activities on large areas.

DRYLAND DEVELOPMENT PROGRAMME:

1.4. Three-fourths of the cultivable are in Karnataka is dry land much of it is without any prospects of even being able to receive irrigation facilities. It is felt that the dry land farmer has been neglected very badly, though the State depends upon the dry land farmer for nearly half of its food grains production. The new technologies have been farm tested and it is recognized that the planning of dry land development on the watershed basis would provide the potential for doubling yields under farm conditions and add substantially to the income of the dry land farmers.

1.5. In order to bring the new technological developments especially planning on a watershed basis, into a practical frame work of project/implementation, the State Government had sponsored a National Seminar on Dryland Development in collaboration with the UAS, (University of Agricultural Sciences) Bangalore on 29th and 30th of October 1983. The Seminar highlighted the need for tackling the dryland development on the watershed approach. On the basis of the recommendations of the Seminar, the State Government has decided in 1984 to implement the Dryland Development Programme as a programme of water and land management on watershed basis. Accordingly, Dryland Development Boards have been constituted for each revenue division of the state. Thus, the State started implementing pilot watershed projects in all the districts of Karnataka mainly to test and prove that dryland development on watershed basis is an affordable, simple and replicable technology with greater reliance on land and water management.

1.6. Thus, in Karnataka, "District Watershed Development Programme for Rainfed areas" has been instituted as a project in 1985. In short, it is generally referred to as "District Watershed Development Programme (DWDP). The title fully indicates that this programme is not a mere soil water conservation or forestry programme, but a programme to increase the overall productiviy of a given area dependent on rainfall. 18 watersheds one in each district has been selected in the State. These watersheds, being developed as model watersheds, are financed both by the State and Central Governments.

SALIENT FEATURES OF THE PROGRAMME:

II. CONCEPTUAL:

2.1. A watershed is an area having common drainage. This means that the rain water falling on an area coming within a ridge line can be harvested and will flow out of this area through a single point. There is no prescribed size for the watershed but it depends on topography of the area and the drainage point. Some people refer to this as catchment, basin, etc. However, we are using the terminology "Watershed". Though

watersheds can be of any size, say from 500 ha. to even more than a lakh hectares, in each of the districts we have requesed the officers to identify one watershed of the size of 25,000 ha. for development on the concept of watershed because of following reasons:

2.2. A district watershed is supposed to be developed over a period of 5 to 6 years. If a watershed is of the size of 30,000 ha. each year about 5,000 to 6,000 ha. will be covered. The staff provided basically belong to three disciplines namely one Agricultural Officer (A.O.) unit, one Assistant Conservator of Forests (ACF) unit and one Assistant Director of Horticulture unit and these units are capable of treating the area of 5,000 to 6,000 ha in a year. Further, the average cost of development of one hectare of land works out to Rs. 1,500 and roughly about Rs. 60 to 70 lakhs are needed annually for each watershed. This amount is provided by the Government. The size of 25,000 ha. is also a fairly big to give an idea of all the types of problems the Watershed Development Programme is likely to face.

2.3. As already defined, watershed within a ridge line receives only the rain water falling on that area and the harvestable water flow through a common drainage point. Similarly, rain water falling outside the ridge line will not enter this watershed area. Thus, if we know clearly the total rainfall and its distribution, we can estimate then total quantity of harvestable water in the watershed.

## III. OBJECTIVES OF THE PROGRAMME:

3.1. There are several objectives for the watershed development programme for rainfed areas. The major objectives have been listed hereafter as follows:

### 3.1.1. RAIN WATER MANAGEMENT:

Under this:

a) Treatment of non-arable lands for moisture conservation;

b) Alternate land use to prevent ploughing of steep slopes and thereby reduce runoff;

c) Efforts for moisture conservation in-situ (interbund management) and

d) Soil conservation structures like bunds diversion drains, water ways, gulley checks, etc. are being thought of.

The first three measures ensure maximum moisture conservation in situ during normal or scanty rainfall, whereas in abnormal rains the fourth measure will ensure draining out excess water safely and slowly out of the land to the drainage. Moisture conservation or rain water conservation incidentlally ensure soil conservation.

3.1.2. PRODUCTION MANAGEMENT

Based on the land capability classification in the watershed and taking into account the moisture conservation practices as planned by treatments mentioned above, new land use pattern is proposed. For example, a land on which single crop was grown, now being recommended for double cropping or inter cropping, motivating farmers presently using local seeds to use improved seeds, fertilisers etc. thus the proposed land use pattern which is better than the existing land use pattern will ensure better productivity and higher income to the farmers.

3.1.3. USE OF MARGINAL LANDS

Through the treatment of non-arable lands (like forest, gomal and community lands, nalas etc.) and also through alternate land use (depending on land capability) the programme envisages to produce maximum possible fodder, fuel, fibre, timber and fruits in the watersheds looking into the needs of the area. Thus, this objective can later lead to the subsidiary occupation like dairying, fibre extraction, carpentry etc.

IV PLANNING

4.1. Planning is the most crucial aspect in the Watershed Development Programme, planning for Watershed Development is more a resource or need-based programme rather than a budget oriented programme. Therefore, the guidelines are intended to make officers appreciate the philosophy of need based planning and to understand how to prepare them and dovetail it into the funds position as projected each year by the Government.

4.2. For each district watershed, a document based on baseline survey providing all the available details of basic resources was prepared. This baseline survey will also serve as a bench mark for future evaluation of the Watershed Development Programme. Based on the base line data, the objectives of the Watershed Development Programme on the technologies available and suitable for the areas, a master plan was prepared which gave the broad outline of the development approach for each watershed area. These approaches are general in nature and therefore, the master plans themselves do not provide operational details.

4.3. The district watersheds are of the size of about 30,000 hectares. Looking into the staff available and the funds earmarked, it has been found that the entire watershed can not be planned and implemented at once. Therefore, in order to ensure

4.10.3. AGRICULTUREAL SECTOR:

Graded bunds, contour bunds, land smoothening, land levelling, bench terracing; land shaping strengthening of existing bunds, farm ponds, grassed waterways with drop structures, diversion channel/bund; gully checks; nala bunding, vegetative bunds with khus, small section bunds, ridges and furrows, compartment bunding, contour cultivation, fall ploughing crop systems recommended etc.

V. ORGANISATIONAL:

5.1. The State Dry Land Development Council is headed by the Chief Minister, which would issue policy directives to the Divisional Dry Land Development Boards. The entire programme is under the administrative control of the Secretary, Agriculture and Horticulture.

5.2. State Watershed Development Cell (SWDC) is headed by the Director, Watershed Development Programme. The cell has a multi-disciplinary cell having expertise in Agriculture, Land use planning, Forestry and Economics to plan and co-ordinate the entire programme.

5.3. Four Dry Land Development Boards (DLDBs) have been constituted to each of the revenue divisions, which is being headed by a non-official Chairman. The Divisional Commissioner is the Administrator of each Division who will be assisted by the Multi-disciplinary cell having the technical expertise. The composition of the DLDB was shown at Annexure-I.

5.4. At the district level, Watershed Development Team headed by a senior scale KAS Officer or an officer from the related departments. The details of the watershed development team are shown at Annexure-I itself.

## ORGANISATION OF WATERSHED DEVELOPMENT PROGRAMME

### STATE WATERSHED DEVELOPMENT COUNCIL

STATE WATERSHED CELL

TECHNICAL COMMITTEE

| DLDB, Bangalore | DLDB, Mysore | DLDB, Belgaum | DLDB, Gulbarga |
|---|---|---|---|
| Dist. Watershed teams | Dist. Watershed Teams | Dist. Watershed Teams | Dist. Watershed teams |
| 1. Kolar | 5. Mysore | 11. Belgaum | 15. Gulbarga |
| 2. Tumkur | 6. Mandya | 12. Dharwad | 16. Bidar |
| 3. Chitradurga | 7. Kodagu | 13. Bijapur | 17. Raichur |
| 4. Shimoga | 8. Chikkamagalur | 14. Uttarakannada | 18. Bellary |
| | 9. Dakshinakannada | | |
| | 10. Hassan | | |

DRY LAND DEVELOPMENT BOARD

| Chairman: Non-official member | Administrator Divisional Commissioner |
|---|---|

| Multi-disciplinery cell | Monitoring & Evaluation Unit | Administration |
|---|---|---|
| J.D.A.(corps) | D.D.(Stat) | Administrative Officer, |
| J.D.A.(Soils) | A.D.(Stat) | Accounts Officer, |
| C.O.F. | Statistical Assistants | Staff. |
| Economist | | |

WATERSHED DEVELOPMENT TEAM

| Soil Cons. | Forest | Horticulture | Office Staff |
|---|---|---|---|
| D.D.A.(SCN) | A.C.F., | A.D.H., | |
| A.O.(SCN) | Rangers, | A.H.O., | |
| A.A.Os. | Forest | H.As., | |
| A.As. | Extension Works, | Garderners | |
| | Guards. | | |

## VI. ACHIEVEMENTS:

1. 18 watersheds in all the ten agro climatic zones have been started.

2. Inter sectoral integration has been achieved.

3. Task forces set at the district, divisional and state level are able to plan and coordinate well.

4. Peoples participation has been achieved.

5. Increase in the agricultural production has been noted in the treated areas compared to the non-treated areas.

6. There is an increase in the underground recharge.

7. Major objective of ecological restoration is achieved by preventing soil erosion to a large extent and silting of the reservoirs was also prevented.

8. The local, cheap and affordable technology has been identified and been able to replicate it in all the agroclimatic zones, covering all the districts.

9. An instrument of effective planning for taking care of the services and input supplying to the farmers at the optimum time of requirement at village level.

10. Khus (vetiveria grass) has been shown as a possible effective means of vegetative barriers in soil conservation measures.

11. The programme has been able to motivate the field staff (cutting edge) of all the departments to work under certified command by understanding the needs of the local people and planning the natural resource management in a scientific concerted and co-ordinate way.

12. The programme has become the foundation stone for the future land use policy of the state. An attempt has been made to refine the programme by integrating all the sectors and arriving at an overall development of the villages through the comprehensive land use Management programme.

# THE PALANI HILLS AS A WATER SHED

- Zafar Futehally
President, Palani
Hills Conservation
Council, Kodaikanal.

Like all mountain areas the Palani Hills play a crucial role in conserving water in the hills, and supplying water to the plains through streams and underground storage. In this connection the Palanis are specially important because they receive both the South West and the North East monsoon. The total rainfall is approximately 60" per year, spread out from April to November. The Palni Hills are the Eastward off shoot of the Western Ghats, with a maximum East West length of 65 km., and a maximum North South width of 40 km. The total area is approximately 2068 sq. km.

Judging from the vegetation, these mountains are of very ancient geological formation. The Upper Palanis consist of undulating hills orignally covered with extensive grasslands, interspersed with dense patches of ever green forests known as sholas, in the valley and also wherever there was adequate depression to protect the trees from rain and wind.

It must be noted that " the compact network of roots (of the grasslands) prevented soil erosion", and provided much better protection to the soil than the recently planted commercial species of trees like eucalyptus, wattle and pine. It is this replacement of the natural vegetation - the grasslands and the sholas - by commercial plantations which is the main reason for floods and droughts in the plains.

The sholas " consist of ever green trees mostly under 20 meters, profusely branched, supporting a large number of mosses and ferns. The extent to which the natural vegetation has been replaced by commercial plantations can be judged by the following figures of 86-87:-

| | | |
|---|---|---|
| Wattle | ---------- | 11825 HA |
| Eucalyptus | ---------- | 8332 |
| Pine | ---------- | 1990 |
| Alder | ---------- | 34 |

Fruit Trees:

| | | |
|---|---|---|
| Oranges | ---------- | 2093 |
| Pears | ---------- | 1232 |
| Bananas | ---------- | 1157 |
| Plums | ---------- | 435 |

Cereal:

| | | |
|---|---|---|
| Paddy | ---------- | 629 |
| Wheat | ---------- | 110 |
| Coffee | ---------- | 7297 |
| Potato | ---------- | 2030 |

It may be mentioned that the Hill Areas Protection Act meant to protect the natural features of the hills, specifically states that no potatoes and similar agricultural produce should be grown in slopes above $10^{o}$. However, the situation is very different, and potatoes continue to be grown on the steepest slopes. It is evident therefore that unless a specil Hill Areas Authority is created as an autonomous body to look after the ecological interest of our mountain areas, the position is not likely to improve.

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## WILDLIFE CONSERVATION IN INDIA

BHOJA SHETTY
Forest Consultant

Resources of the earth may be broadly classified into organic and inorganic. Organic resources which include wildlife, are renewable and they can be utilised or harvested in perpetuaity provided removals do not exceed the regeneration potential of the resources. Air, sunshine, soil and water are the bases on which organic resources are built. Hence, wildlife conservation cannot be viewed in isolation but should take into account the total environment. Wildlife must have an environment suited to its needs, if it is to survive.

### DEGRADATION AND DENUDATION OF FORESTS:

Forests form an important and a major habvitat of wildlife but in India this habitat is being disturbed and destroyed on an enormous scale and wildlife resources are being depleted at an alarming rate. Data published by the National Remote Sensing Agency, Hyderabad indicate that only about 14 percent of the land area is under forest cover, against 23 percent shown in official statistics. During the period 1972-80 deforestation occurred at the rate of 1.3 million ha/year. Destruction of habitat is a serious threat to the survival of wildlife in the Country.

### CAUSES FOR THE DESTRUCTION OF WILDLIFE:

The principal cause for the destruction and diminution of wildlife in India is the explosive rate of increase in human population. India has 16 percent of the world's human population but only 2.5 percent of the land area. Excessive human population exerts enormous pressure on land and there is relentless demand for the release of forest land for other uses like agriculture,industry hydroelectric and irrigation dams, housing and many other purposes. Cattle are another major contributory factor for the depletion of wildlife resources. With 234 million cattle, India accounts for nearly 15 percent of the world's cattle population. A large number of these cattle resort to forest areas for grazing, which causes degradation of forests, deprives wild animals of their fodder and grazing needs, besides being responsible for the transmission of diseases like rinderpest of foot and mouth. In the past shooting had been a significant cause for the reduction of wild animals, one of the notable examples being tiger whose population once bordered on the verge of extinction. However, currently, it is the commercial exploitation which is a serious threat to the survival of several species. In recent years tuskers among elephants have been shot by poachers in large numbers on account of prevailing high price for ivory. The demand for rhino horn, mainly on account of its spurious medicinal properties, has brought down the population of the great one-horned Indian rhinoceros to a dangerously low number. Musk deer is yet another species which

has been hunted indiscriminately in large numbers because musk obtained from this animal commands a price of nearly US $ 50,000 per Kg in the perfurmery market. Many more examples can be cited to highlight the threat posed by commercial exploitation to the survival of species. Accelerated soil erosion is also an important factor in the degradation of wildlife habitat. Consequent sedimentation of streams, rivers, and reservoirs causes enormous damage to fish and other aquatic life.

Indiscriminate and uncontrolled use of weedicides and pesticides in agriculture and forestry is very destructive to wildlife. Considerable study on the effect of these chemicals on wildlife has been done in USA and a few other countries, which led to the banning of the use of harmful chemicals like DDT but in India there is hardly any attempt to control their use.

Air and water pollution can cause extensive destruction of wildlife. The damage inflicted on forests and wildlife by acid rain in Europe and Canada in recent years is a grim reminder of the threat posed by pollution to wildlife.

EXTINCT AND ENDANGERED FLORA AND FAUNA:

The process of evolution with natural selection and survival of the fittest, brings about extinction of certain species. In the past, geological upheavals, sudden and drastic changes in climate and environment have also been responsible for mass extinctions. But the pace of extinction has been hastened in recent times all over the world due to onslaught of man.

Some well known examples of animals which became extinct in India in recent times are the cheetah and the lesser one-horned rhinoceros among mammals and pink-headed duck and mountain quail among birds. Although Jerdon's course was once presumed to be extinct, this bird has been recently rediscovered in Andhra Pradesh after several decades.

International Union for the Conservation of Nature and Natural Resources (IUCN) has published a Red Data Book on endangered animals and a similar publication on endagered plants is proposed. Schedule I of Wildlife Protection Act, 1972 enacted by the Government of India gives a list of endangered animals but this is by no means either comprehensive or complete. The list has to be up-dated based on available data and a detailed survey is needed throughout the country to determine the present status of wildlife, both animals and plants. A list of endangered and endemic plants also should be compiled and special reserves should be established, wherever necessary, to save them from extintion.

INDIAN BOARD FOR WILDLIFE:

An important landmark in wildlife conservation is the establishment of the Indian Board for Wildlife in 1952. With the Prime Minister as the Chairman and the Minister of Govt. of India

in charge of Forests, Chief Conservators of Forests and other experts on the Board, it plays a crucial role in laying down guidelines regarding policies and programmes for the conservation of wildlife in the Country.

On the recommendation of the Indian Board for wildlife, Government of India set up an Expert Committee to review the existing situation in wildlife Conservation and to suggest measures for conservation and management of wildlife. One of the major recommendations of the Committee was to set up national parks and sanctuaries in different parts of the Country, which could receive special attention in the proper management of wildlife. The Committee also recomended that atleast 4 per cent of the land area may be set apart as national parks and wildlife sanctuaries.

ESTABLISHMENT OF NATIONAL PARKS AND WILDLIFE SANCTUARIES:

Action was taken to establish national parks and wildlife sanctuaries in different parts of the country. Upto 1985 there were 55 National Parks and 247 Wildlife sanctuaries, with a total area of about 90000 sq.km. which is about 12 percent of forest area and 3 percent of land area.

However, it must be admitted that in a majority of these national parks and wildlife sanctuaries no proper scientific management has been introduced to improve the habitat and to give special protection to wildlife. Often exploitative forestry is being continued to the detriment of wildlife. It is essential to prepare scientific management plans for each of these areas and ensure their strict implementation.

In constituting National Parks and Wildlife Sanctuaries, attention needs to be paid for the preservation of unique and rare vegetation types and ecosystems. Vegetation types such as mangroves are fast disappearing. Under ill-conceived reclamation plans many swamps and welands have been drained and brought under agriculture and human settlements. Wetlands play an important part in drainage and maintenance of water rigime. They are also biologically very productive sites and are needed as wintering grounds for migratory birds.

In most States and Union Territories separate wildlife wing have been created in the Forest departments. The technical personnel in wildlife wing should receive specialised training in wildlife management and transfer of trained persons fromt eh wildlife to other branches of the Forest department should not be permitted in order that their training and experience are not wasted. It may even be advisable to have a separate wildlife cadre.

EX-SITU CONSERVATION:

National parks, Wildlife sanctuaries and nature reserves are specially protected areas for in-situ conservation of species.

But in cases of highly endangered species it may be advisable to take up ex-situ conservation measures also be captive breeding. Outstanding success has been achieved in the case of all three species of crocodiles in India and there is now a fairly large population bred in captivity.

Recently it has been possible to reintroduce Oryx back into Saudi Arabia from the captive bred stock in U.S.A. Captive breeding can be an important tool in saving species from extinction and it should form a part of wildlife management.

Zoological gardens also can play a useful role in captive breeding of endangered species. Similarly for plants, botanical gardens and germ plasm banks can act as centres for the conservation of species and varieties.

TRADE IN WILDLIFE AND WILDLIFE PRODUCTS:

The danger of indiscriminating commercial exploitation to the survival of species has already been stressed in this paper. Convention on International Trade in Endangered Species (CITES), which has been signed by over 80 countries, bans trade in endangered species and other prohibited wildlife products between the participating countries. India's Wildlife Protection Act, 1972 has adequate provision to control trade in wildlife products but its enforcement is somewhat lax, perhaps due to inadequate enforcement staff.

RESEARCH AND EDUCATION:

Research should form an important part of wildlife management. Without basis data wildlife management is likely to be adhoc and arbitrary. Setting up the Wildlife Insitute of India at Dehra Dun is a good beginning. Kerala Forest Research Institute at Peechi has a wildlife division which is doing useful work. There is need for setting up wildlife research divisions in the wildlife organisations of States and Union Territories. Facilities should also be created for on-job training of personnel in the wildlife organisations. Universities should be encouraged to undertake research on wildlife and for this purpose wildlife organizations may grant fellowships, as well as suggest topics and problems for investigation and study.

No doubt there is considerable awareness among the public regarding the importance and necessity of wildlife conservation. But it is the co-operation of the people living within and in the vicinity of wildlife areas which is essential for the success of wildlife conservation. Suitable development programmes like social forestry, cattle improvement and creation of fodder resources should be initiated in such crucial areas with a view to minimise the dependence of people on sanctuaries and national parks and to avert, as far as possible, conflict between humans and wildlife Tribals, in particular, should be actively associated in all wildlife conservation programme.

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## TRIBALS, FORESTS AND WILDLIFE

DR. SUDARSHAN

I would concentrate more on the tribal people of Karnataka and share with you my experience with the tribals for more than 1o years.

In Karnataka the tribal population is less than 1% of the total population and we have about 40 types of tribals. I am working with Soligas. They are about 15,000 mainly in Mysore district. First I would like to give a brief account of the Soliga tribal people and then go on to their problems. They have worked trditionally as shifting food gatherers and hunters and this was going on till 1978-79. Various Forest Conservation Acts have affected them. Before I go into the well known facts about tribals, I would like to highlight some of the things which will not be carried on. I would like to emphasise the whole concept of local wisdom.

I am a graduate from Bangalore Medical College and after my graduation I decided to work at B.R. Hills. When I went there, I thought these people knew nothing and I had to be saviour to these people. Soon after I went there, I found that though I could help them in their emergencies like pneumonia, snake bites, fractures etc., the major problem was malnutrition. More than 50% children were malnutritioned and I had no facility to cure malnutrition. This opened my eyes and I felt that I had to go beyond the concept of theoretical doubt and look more into their problems of poverty, with which many of them were associated was generated bcause of his not being given access to the resources. The local wisdom I found there was very surprising to me. To tell you we have achieved some very good results. After going there, infant mortality has come down. The traditional concept of health of the tribals which I had to learn from them was a gradual education process to me and I shall narrate it to you. As a Doctor trained in modern medicine, I opened a clinic there. My first case was a pregnant lady. When she was brought to my clinic, I asked her to lie down on my table. But the tribal woman refused to lie down on my table. It was very difficult to convince her. She explained that she wished to deliver by squatting or sitting position and mothers would not lie down and the whole process of delivery was done in this position. This opened my eyes. Later research has shown that squatting or sitting position is much more convenient to mothers because the gravity helps. The local wisdom that I found there was thus startling. We are having tables because it is convenient for doctors and nurses.

Again we had a programme in B.R. Hills and were trying to

cater to the needs of the people of 30 villages with about 15,000 population, emphasising the concept of community health. In our base hospital we have trained in about 30 villages the local dayees. This was very much responsible to reduce infant mortality. It was a very educative process to me, the type of qualities they had inherited. These are the traditionl qualities they have learnt. Of course, there were many superstitious and bad practices of cutting the umbilical cord. which were not very hygienic and of course we have now taught them. The herbal medicines which they have been using are very relevant. They have been using 213 herbal medicines. Some of them were very good antibiotics, antiseptics etc., much better than 65,000 formulations we have in the market in India today. What we need is only about 220 essential drugs. Most of them are again unwanted and we are most interested in producing unwanted medicines that contain nothing but 10% alcohol or high potency vitamins which go into the drainages. We have hospitals where all types of transplantations are done spending 3-4 lakhs and make him survive for another few months. But in rural areas there are people who are dying of Hooke worms in India today. This is the contrast that we find in the nation today.

Going back to the local wisdom, we have a school from I to X standard. We have a text book in their own language where it is more about the forest and environment. The concept is that they learn in the first two years in their own language and then switch over to Kannada. When they were asked to name the flora, the trees and the plants, the boy who got the first prize could ientify as many as 280 species. At present children in schools have identified 420 species. So there is a lot of local wisdom.

When we talk on the concept of tribal development, we feel that we know all about them, we plan for them and we dictate terms. Development projects are made at State or Central levels.

Now to briefly tell little more about the community health, I found that community health is not enough, but the major problem being poverty. We have also taken up some economic projects and the forest department has taken up some schemes. Taking the situation of tribals in Karnataka, this is also true of India, the major problem is the tragedy of displacement of tribals. There are 15.5 million people who hae been displaced by Project Tiger, wild life sanctuaries, conservation projects etc. Whether it is wild life sactuaries or any other thing, the unfortunate thing is that people exist for the government only as long as they have patta lands or without it they donot exist according to the law. Rehabiliation shows that they are not cared for. Kabini project in Karnataka is no exception and tribals have not got any compensation, when replacement was done. I am not against development. But development at what cost ? At what ecological cost ? Whatever development we do, we should see that tribals are also a part of it. We shoul see that these

people also become the true partners in this development programmes. This is my view point.

Again we have just been telling that Project Tiger was very successful. But the tragedy of human beings, people who have been displaced from there is also worth considering. The whole concept that we pity them and we sympathise them should be stopped, because they are the real owners of the forest. I think every tribal is a citizen of our country and has a right to livelihood. He can not be displaced without his permission, without meaningful role in the development programme. And you can imagine the whole situation in India where 65,000 National Parks are there. So many national difficulties are created. And what would be the magnitude of the problem of displacement of the tribals ?

Again the Forest Conservation Acts. The shifting cultivators were forcibly removed from there using elephants to destroy their huts. In Andhra Pradesh I heard that they are using bulldozers to scare them away from the forest areas. Cattle grazing was avoided in wild life sanctuaries.

Again confining to B.R. Hills, the population of tribals is 2500 in about 600 or 1000 sq. kms. Now if these people remain in the forest, what climatic disaster can happen ? What can happen to the biomass production ? Why not we consider the local needs of these tribals ? They have been living in these forests for long in perfect harmony with nature. Kaiga plant is also going to displace some tribals. Now we are in the third world and I think we have gone to the extremes of pushing these tribals into the fourth world that we are creating within our country.

The tribals have been living in perfect harmony for centuries in these forests. When they were asked how they were able to live in harmony with the wild animals, they said that they have been living in perfect harmony with the wild animals for ages. But the only thing was that sometimes they ate the wild animals and some other times, the wild animals ate them up. So they said, why do you seperate us ? This simply explains the concept of tribal development. We feel that tribal are a nuisance to conservation and therefore we keep them away and not consider them as our partners. But my viewpoint is that they also should be actively involved in the development programmes.

If there are some development programmes which is going to displace the tribals, let us plan systematically. We feel that is not our primary concern, but a secondary concern. That is why in future development programmes which causes displacement, due consideration should be given to the people who are living there and they should be actively involved in development programmes.

The most important factor which I feel important is to consider them as our partners in wild life or ecological conservation. Our conservation is mainly based on western concepts. The whole modern concept is to specialise and to forget the humanity. We have suggested actual joint sector plantation. When Birla can be handed over such huge lands just because he has capital and why not it be given to the tribals just because he has no money ?

Tribals are actively being involved in recent times. Recently we had the Westernghat development programme to see the development of tribals in westernghats. Regarding wild life management, it is my real hope that some strategy atleast with only the forest people conserve the forest and not the tribal people, if we have faith in people's desire, we should make some experiments. Why not we change our attitude and involve them in such enterprise ? From the voluntary organisation I feel that firstly tribal development can takes place only by empowering them, by making him self-reliant. That includes making him aware about his access to the resources. Secondly when considering awareness about tribals, their culture, meaningful development is necessary. Thirdly having good officials at various levels.

I can summarise it in two lines. I have been in soical work. Now again in education, let us have a plus two course in forestry for tribals, wherein they would be involved as foresters or guards and wild life management would be one of the objectives of the course. Coming to the ecological sound development, they are the only people who look at nature with reverence.

# FORESTRY ON ENVIRONMENT PERSPECTIVE OF A FORESTERS

A.N YELLAPPA REDDY

In the year 1908, Dr.Theodore Roosevelt in the conference on the conservation of Natural resources said "we have become rich through lavish use of our natural resources, and we have just reason to be proud of our growth. But the time has come to inquire seriously what will happen when our forests and other natural resources are exhausted, when the soil has been impoverished and washed into the streams, polluting the rivers, denuding the field".

2. In our country since four decades pollution due to human, Social and Economic activity as irreversibly changed the eco-system. Most of the damage has infact been done in the past 20 years, but the 19th century saw a massive contribution to habitat pollution.

Forest Department came into existence in the year 1864 in our country, the policy and management principles have been laidout giving priority for the utilisation of the resources, and foresters were compelled to exploit few species for war supplies ignoring ecological principles. After independence, popular Governments had more priority issues like food, irrigation etc., than ecology environment.

3. The slogan of Environment & ecology commenced only during 1970's and deliberated all over, as every part of the world environment is polluted: the air, the sea, fresh water, the soil, polar ice, the tissue of both plants and man and other animals.

4. Environment quality is a term which is a different things to different people, to some an environment of the highest quality would be an unspoiled wilderness. i.e. a habitat of natural order not significantly altered by human intervention. For

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an urbanite it would be a beautiful city rich in culture and human achievements. For agriculturists it would be productive orchards, fields vineyards etc., Many others define environmental quality in terms of electricity, airconditioning, labour saving devises etc., For few more it is clean air, clean water, natural vegetation, wild life, peace and tranquility.

5. The popular writer Robert Rodale has listed some of the things contrasting living eco-system with man made eco-system:-

| Natural Ecosystem | Man-made System |
|---|---|
| 1. Captures, converts, and stores energy from the sun converts $CO_2$ into carbohydrates. | 1. Consumes energy from fossil and nuclear fuels, consumes fuelwood increases carbon-dioxide. |
| 2. Produce oxygen and consumes carbon dioxide. | 2. Consumes oxygen and produce carbondioxide. |
| 3. Produces carbohydrates and proteins;accomplishes organic synthesis. | 3. Produces solid waste and toxic substances. |
| 4. Filters and detoxifies pollutants and waste products. | 4. Produces waste materials which must be treated elsewhere. |
| 5. Is capable of selfmaintenance and renewal. | 5. Is not capable of self-maintenance and renewal. |
| 6. Maintains silence. | 6. Invariably creates noise. |
| 7. Maintains beauty if not disturbed. | 7. Usually causes unsightly deterioration if not properly engineered and maintained. |
| 8. Creates rich soil. | 8. Destroys soil. |
| 9. Stores and purifies water. | 9. Invariably contributes to water pollution and loss. |
| 10. Provides wildlife habitat. | 10. Destroys wildlife habitat. |

6. Although we have advanced on industrial frontier and become self sufficient in meeting the food requirement of the growing population. We have undoubtedly lost substantial ground on the ecological frontier in our country. We have over 150 million ha. of waste land and our forest percentage in the country is only 10% of the geographical area. For ecological security nearly 1/3rd of the land in plains and 2/3rd in the hilly areas should have adequate forest cover.

7. Air pollution:-

7.1 Over the past 15 years the rate of accumulation of the $CO_2$ in the atmosphere has been about 1.5 ppm (Parts per million) per annum. During the last 2 years this rate has increased to 2.5 ppm. At present, combustion of fuelwood, fossil fuel, coal, other gases like methene, Nitrous Oxide, etc., is increased due to industrilization and automobiles. At current rates of emission, global warming will increase by 0.22 to 0.5°C. every decade, sea level raise of the order of 5 to 24 cms. per decade can be expected. The burning of fossil fuel alone will result in the release of about 20 billion tonnes of $CO_2$ in the atmosphere annually.

7.2 Deforestation contributes to increase $CO_2$ in the atmosphere both due to decreased carbon fixation and increased carbondioxide emission. A minimum of 4 lakhs square kilometre of new forest will be needed to absorb one gigaton of $CO_2$ per year.

7.3 The earths vegetation and the soil store almost 3 times the amount of the Carbondioxide held in the atmosphere. When the vegetation cleared and burned forest releases much of their Carbon adding Carbondioxide build up and hastening global warming.

7.4 Only vigorous efforts to protect the remaining forests and to plant billions of trees each year can reverse the dangerous trend of global warming to a great exteat.

7.5 Tropical forests are highly fragile & rich global heritage:

The tropical countries has to reduce the deforestation and they should increase planting systamatically to meet the energy requirement and to reduce the carbon level in the atmosphere. Immediate need is expansion of forest cover is vital for many other reasons like protecting and preserving the existing natural forests to preserve biological diversity, to meet biomass requirement and to check further deterioration of environmental quality. Every year atleast 2 billion trees has to be succesefully established in our country to prevent further deterioration.

7.5.1 The tropical forests of the world is having maximum diversity. Although they occupied 7% of the land surface of the globe, they hold 40% of all known species a greater range of animal and plants than any other terristrial habitat.

7.5.2 76 tropical countries have nearly 3000 million ha. of natural vegetation on an average over 11.3 million ha. of natural vegetation is depleting every year. i.e. nearly 10 ha. of virgin forests disappear every minute.

7.5.3 Our Western Ghats are the richest habitat having high species diversity and multiple endemic which hold over 600 bird species out of which nearly 120 are endemic. It also hold over 2000 plant species 180 orchids, 50 palms, rare primates, reptiles etc., Yet our western ghats is the most endangered habitat today. Because many developmental activities are being contemplated in and around Western Ghats. The eco-system which is supporting tall massive stretches of clean boled trees having chrasteristic crowns. This vegetation is surviving mainly due to rapid recycling of rotting vegetable matter, at which insect, fungi and bacteria are all hard at work, is the process by which nutrients are liberated for quick absorption by plant roots. But valuable minerals and salts deposited

on soil subject to such high rainfall are almost immediately leach out. It remains intact only when there is climax vegetation. Rain forests plants are without exception extremely sensitive to minute variation in humidity and heat. Any developmental activities which brings in climatic changes may have to be considered carefully as we have only 1.2% of the evergreen forests in Karnataka and around 3% of semi-evergreen and 5% of monsoon forests, the senario is no way better than this in the neighbouring states.

7.5.4 Normally temperature at ground level rain forests is often 10° to 15° C less than on ground when compared to the ground exposed to the full force of the tropical sun.

7.5.5 In tropical rain forests we can come across tremendous variety of species which exist together in intensive mixture of individual trees, different species shown evident differences in their need for light mutual protection, nutrient supplies at different depth of soil profile.

7.5.6 The eco-system normally have strong predominance of perrinial plants, large number of symbiotic, epiphytic and parasitic form of life.

7.5.7 In Karnataka many dams were built for hydro-electricity and irrigation, since 2 decade the same is used for water supply also. The submersion and rehabilitation work has destroyed more than actual submersion. Forests in upstream and down stream also denuded.

8. <u>Need for priority shift to produce non-conventional energy</u>:

8.1 Acoording to the survey, that half of India will become desert in the next 50 years if the rate of which degradation of forest takes place is continued.

8.2 Out of the 329 million hect. of land in the country, about 50% had already been degraded.

8.3 Energy had been a major constraint in the economic development of the rural areas. Benefits from conventional energy sources were not flowing to the rural areas. Although over 35% of the plan outlay is spent till end of 7th plan for generation and supply of energy, the benefits largely went to the industry and urban populations.

8.4 Today in the rural environment the difficulty of finding firewood near villages is one of the current crisis point in our country. The villagers are to walk many miles each day. Normally it takes nearly 150 to 200 woman day each year to gather firewood for one family.

As the vegetation starts depleting water supply also affected and soil erosion is accelerated. Many of the perennial stream of our major rivers have become seasonal and the water table all along the river courses also started diminishing due to lack of continuous recharge.

8.6 The environment in urban centres is also deteriorating the urban development institute says about 1700 pollutants are absorbed into air daily and environmental quality, is affected in all metropolitan centres. The sewage and garbage is polluting many rivers ponds, lakes, etc.,

9. Need of forest and wild life conservation:

Any human meal depend entirely on genetic resources. Only from few ingredient such as table salt have not come from animal or plant. All these food stuff derive from genetic resources, i.e., so may from wild domesticated or cultivated will be available to the mankind as long as their stocks are maintained with an adequate genetic diversity, in an environment in which they can thrive. They

are all components of the eco-system, if their stocks are to be maintained, their eco-systems must be protected and also carefully managed. Any loss of forest implies the loss of habitat nurturing biological diversity.

9.1 The man has learnt to use 3000 plant. species for food. Today great majority of people are actually fed by only about 15 plant species, but atleast another 75,000 edible plant species are not being exploited. According Dr.Swaminathan today there are several threats to sustainable agriculture. One of the main threat is gradual diminition of biological wealth of country. Because of the loss of forest habitat which is nurturing biological diversity. The generation of superior genetic material is basic to crop and livestock improvement. The conservation of plant and animal genetic resources their evaluation for desirable genes and utilisation in crose breeding and genetic engineering programmes are essential for acnieving a continuous improvement in yield and quality.

9.2 Habitat or eco-system destruction is the major cause of species depletion and extinction today. Destruction of the primeval climax eco-system that had evolved before the agriculture was invented, secondary and successional habitat produced by primitive farming methods such as slash and burn more or less remained stable productive and supporting wildlife as preforced they have adopted themselves to the secondary habitat.

9.3 The situation of ecological destruction increased to many folds due to biotic interferences like grazing and fire resulting is thinning of natural regeneration and depletion of herbs, shrubs and ground cover. The ground cover is becoming barren and floor is cemented loosing soil physical, chemical and biological properties.

10. Development without destruction:

10.1 The experts are of the opinion, that soil erosion and desertification can be prevented when proper re-afforestation efforts are made. Only thing required is innovative methods of soil and moisture conservation and planting of suitable species to ~~am~~ ameliorate the deteriorating environment.

10.2 Immediate steps to be taken to stabilise population, and consumption levels are brought into balance with environmental capacities, failing which it will be diffioult to promote development without destruction.

10.3 A small biota plays disproportionately important role in the ecological processes that maintain life on earth. They are called ecological key species( Ex:Mangroves in Marine ecosystem, leguminous species in tropical and monsoon forests)

People normally use few species only which has become a part of their culture, called socio-economic key species (Herbal plants, nonwood resource yielding species i.e. fruits, nuts, oil,perfumes, flavours, essences etc.)

In reafforestation programme species schedule has to be carefully prepared to meet fuel, fodder and other socio-economic key species and also ecological key species has to be integrated carefully in the package of enrichment planting and eco-restoration efforts.

10.4 First we are not afford to loose any more time in preventing soil erosion and upgrading the degraded soils. Second important area conservation and sustainable management of water resources. Third preserving biological wealth to fullfill all the above three needs, lastly to cap our barren areas with permanent vegetation.

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# NOTES TOWARDS A DEFINITION OF CONSERVATION EDUCATION

—Man Mohan Singh*

What kind of a world are we going to bequeath to our children when they grow up? The basic question in Conservation Education is one of the kind of world we are shaping or for that matter misshaping into being in terms of future perspectives. In a sense, we are living in a state of void or perhaps a schism of beliefs. The most crucial imperative of our times is the decline and in some cases, complete disintegration of traditional beliefs in conservation and the failure of science and contemporary education to fill that void. Conservation which was once upon a time a question of an integral faith has now perhaps become a set of words and jargon.

Today we talk of inducting elements of Conservation Education into even the non-formal system of education. Yet there was a time when Conservation Education in a non-formal sense was transmitted from one generation to other. The scenario then was different from the contemporary situation. On trees in wildernesses then there dwelt owls and other predator birds. Many of these traditional trees were close to holy or dreaded places. They were a kind of forbidden area, protected by ghosts and spirits. But behind this was a sense of respect attached to these clusters in areas which could otherwise have not grown grain, and which gave shelter to the predators. These birds preyed on rodents and reptiles and scavanged the areas of carrion. That was when men and fables, ghosts and birds, promoted the cause of conservation in the most closely knit web of harmonious existence.

The temples and holy places brooded over the world of nature like some presiding spirits. That perhaps was the theological—natural—ornithological syndrome as many species of birds were enshrined as images of exquisite beauty in Holy Books. A demoiselle crane or the *koonj* was protected because in the folk

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song it came to areas in the North having fallen in love with some bird here In the holy hymn of another saint the *koonj* was a symbol of wanderlust, a restless spirit in *Birha*, separated from the Infinite The bird was also a symbol of faith in that it left the chicks behind in the cold North to the divine care, the Great Creator Himself.

Around the temples and the Gurdwaras there dwelt in the trees and ponds birds like snipes and coots, dabchicks and lapwings fraternising sometimes with the snobbish mallards teals and pintails wintering there year after year But to harm even a tiny feather of a bird was a taboo and accursed be the man who hurt them So, shy birds like mallards and the graylag geese, became familiar winged companions, a part of the congregation of bipeds that assembled to pay homage to the Creator in a conservationist North-South dialogue

At the conservation seminars we rave eloquently about linkages between human beings and plants, between man and animals Such linkages, not only existed, but were a part of life and living, a part of a humanistic faith These were known and felt on the pulse and in the blood, but there were no words or textbooks for them In that way of living even the superstition had paradoxically some scientific basis To kill a hoopoe (supposedly a bride in the previous incarnation having been nailed to death by her greedy in-laws) was a curse Then there were no conservation statutes

Then that appearance of ants in the evening was welcomed an offering of flour to them Perhaps the ants had some kind of sensitivity to rising humidity in the air which by some kind of highly developed collation of data portended rain or change from one season to another That was when people listened to the *pied crested cuckoo* and the promise of monsoon clouds bringing nectar-like drops to a parched landscape Today the meteorological forecasts fail or are as non-committal as the birth-day forecasts! The pied crested cuckoo comes and goes as its uncanny weather forecasts go unheeded too The wagtails portending early or late arrival of winter bow out of human scenario and perhaps only some crazy old man in the village knows what they signify in the symphony of seasons Then conservation was not a

conscious concern but a part of a faith There was no reasoning to it in clinical or systematic terms

That was like reading the very Book of Life itself The rivers and rains were like gods and if they were angry, they could be propitiated The mood of the river, the curl of the waves on its brow was a sign to watch Every lad whether going to a formal system of education or not understood it In turbulence, the roar of the river at midnight was a sign of the flood building up far away in the hills The colour of its waves portended the rise or fall of the water levels Today, these signs go unheeded, the rivers in many cases are dammed and perhaps damned too! They rise in fury and with the slap of their waves wipe out houses and hutments The hydrological tests would perhaps forecast as much of the water levels of a river as the shades and hues and fading colours, the roar of thunder or the silent ripple on the face of the waves.

What does one infer from this? Firstly the traditional pattern of living was based on a subtle and silent relationship of complete integration with nature Secondly, the only conservation instruction or education if that be a correct description that the tradition had was the set of fables and folklore, the myths and superstitions As against this we have today armed ourselves with words and vocabulary of conservation and in the process have upset the linkages though perhaps soothed ourselves with an air of pretended concern Thirdly we have taken debate on conservation to an alien setting where it does not really matter Conservation should begin where it hurts people's livelihood We living in the urban areas have cornered not only wealth but also drained the village by a process of economic incursions Till the village has become an appendage in a strange kind of city-village serfdom Fourthly, the Third World in its understandably relentless pursuit of progress can think of conservation while it moves ahead in the process of development We in the Third World are very unfortunately placed as we can neither pay the price of upsetting the balance of nature nor the price of post surgery conservation therapy.

Why I went over such a large arc like spectrum of tradition was out of my strong faith that Conservation Education must reckon with these traditional beliefs That is however not to minimise in

any way the fact that in the last two decades concrete attempts have been made in India to frame curriculum and strategies in the introduction of environmental education A special UNESCO Regional Office Report from Bangkok represents the best account so far of environmental education in Asia and the Pacific We have undoubtedly come to a point where environmental education at the primary, middle, secondary, university and non-formal education levels has come to acquire a meaning, a pattern and the articulation of a system My purpose in this paper is not to delineate the programmes concerning teacher education and the preparation of special teaching materials I am more concerned with our limitations and yet with the immense possibilities even in the context of financial, structural, administrative and institutional constraints My long experience in educational administration has led me as if inexorably to one unshakable belief that very often what we need more desperately in educational planning is not the liquidity of finance but the solidity of imagination

Let us look at the sheer gigantic statistical scenario of education in India We have today half a million primary schools, 1 20 lakh middle schools, 53,000 secondary schools These cater to literally 12 crore students As against this the total budgetary allocation in monetary terms accounts for barely 2 5% of the total Central and State budgets and education in this context for reasons of other higher priorities tends to take the back chair or perhaps the back floor seat As against this, we had a 1980 survey of efforts in Environmental Education in which one national institution (NCERT) very gallantly attempted pilot and trial workshops, regional workshops and a few hundreds of field centres Then we have had attempts though looking sporadic at organising of nature exhibitions, conservation drawing competitions and at places such technological innovations as tape and slide sequences designed specifically for the use of training of the teachers We also have NCERT films on learning science through environment dealing with fauna and flora as also with rocks and soils

But whom are we trying to reach? It is not so much a student in a public school in an urban setting As it is, he or she would tend to carry the message of Conservation Education from the urban setting into the drawing room This is not to minimise in any way the significance of urban sector of population being

conservation oriented. We have to think of a way-side school in rural setting, far away from even the reach of a road. There under the shade of a tree in a school without a building you have a small child. How do you ever teach him the significance of conservation? Once upon a time his father and grand-father who had not gone to school at all worshipped trees, birds and animals. Now that scheme of values has been undermined. While returning home he probably has to pass through a cluster of trees, cut a few branches or even a sapling for his evening meal for all that it is worth. He should be the hero and focus of our Conservation efforts. How do we reach him?

My basic questions are: Is our Conservation Education currently and predominantly urban oriented? If conservation be a question of saving our natural heritage of fauna and flora the proper canvas for operation is the rural scene. No model, least of all the western can help us though they may look extremely attractive and well designed. In this context I was very impressed when I viewed the other day an album showing Environmental Education Teaching Resources Problem by the Fish and Wildlife Service of the United States Department of the Interior. In one of its model lessons concerning an endangered species, a part of the exercise relates to the measurement of temperatures, the habitats sunlight and water pollution in terms of life requirements. A visual is to be enacted through slide projections and eventually the data to be compiled in terms of a computer and the solution to be flashed on the black-board through yet another projector. The basic question in the Indian context is that let alone our teachers being trained, we have very often even a semblance of black-board missing from the school scenario. According to a conservative estimate of the coverage of Conservation Education, if we were to reach all the school children in all the rural primary schools it may take us yet another decade or may be the end of this century. But can we wait and will not much of what we treasure end by the end of this century?

The situation is not as depressing as it may sound. In life as in any planning one cannot escape from stark and brutal realities. My faith in our capacity to face the challenge still centres around our traditional value system. In my survey of the contemporary efforts at Conservation Education I found that there has been a

distinct departure from conservation as a part of poetry in favour of prose lessons in language books I am not suggesting that we should not build up Conservation Education as a system of scientific exhibitions, population education courses or lessons on biology and on the life sciences. The basis of conservation has to be eventually a kind of a faith verging on the holiness of beliefs. A great part of one's respect for values of conservation in the rural context sprung from traditional beliefs and text books, poems or fables I am not again implying that we should use Keat's Nightingale and Shelley's Skylark as conservation poems There is nevertheless need to build into our textual structures readable and suitable illustrated material, which impart lessons in subtle manner on trees and birds and animals and reptiles More often in the rural areas one acquired a solid core of conservation faith from early primary school exposures to poems on a sparrow of that matter from a very moving and pathetic description of separation of a Koonj (in fact a Sarus Crane) from her mate My basic point is that till we are able to invest more in Conservation Education in technological and in financial terms, we have to rely heavily on building up beliefs and faith

I could not have again remotely implied that we return to the middle ages and to bird images in our folk poetry or in our religious books The Indian scenario in Environmental Education presents a picture of the void referred to above While attempts have been made to build up the three strands in terms of education for about and through environment a mass and pervasive application of these has not yet been achieved The attempts made within institutional framework are faint and very often inarticulate The attempt so far has been to publish journals hold exhibitions include component of population education in courses and achieve it to some measure in terms of new teaching aids in some selected areas on a pilot basis.

I am not even for a moment suggesting that we should accept mythical beliefs in the origin of life and there are any number of stories concerning how pigeons parakeets and peacocks originate or why hoopoe has a crest on its head In a sense most of these superstitions and belief had unmistakable basis in conservation and respect for all living things Only the message was reached through a myth or fable.

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Back again to the Western conservation theology I used the word theology as many western orations on ecology have lately tended to be pontifical In a recent issue of *Natural History* there is a centre spread on human wants and misuse of lands with reference to the need to combine development with ecological protection in the Third World Here are two very pungent paragraphs:

> The rural landless have their counterparts in the slums and shantytowns of Third World cities Because the urban poor are much more visible and politically threatening, they tend to receive disproportionate attention from the media and politicians in comparison with the more numerous and usually worse off, rural poor Nonetheless, hundreds of millions of city dwellers live in abysmal environments That the urban areas of the Third World have been growing at a rapid pace is well known Urbanisation is one of the great social phenomenon of the century with the proportion of the world s people living in urban settlements rising from 14 per cent in 1920 to 41 percent in 1980 In Latin America, as in the developed regions the process is more advanced and more than half the population already lives in cities In Asia and Africa the proportion remains lower; about 30 per cent of the Third World's population now resides in cities But about one third of these live in slums and shantytowns

In this rather incisively treated theme, there are some very profound observations:

> Culturally rural people fare little better Where physical extinction no longer threatens, cultural extinction remains a constant possibility Insensitive educators, along with modern technologies and communications, can destroy the traditional culture without providing a workable new spiritual basis of existence

> Even more valuable than their intricate knowledge of particular species may be the understanding of the dynamic ecological systems that some tribal people have Modern man has had great success in finding sustainable ways to use the rain forests and the desert fringes Many of the native dwellers of these zones have, by necessity, developed a sensitive understanding of the ecological interdependencies and seasonal variations, and know how to exploit the land without destroying it But

the ecological knowledge of tribal (and rural) cultures, most of which lack written languages, is seldom recorded on paper. It is passed by word of mouth. As the culture disintegrates, the accumulated knowledge of centuries is lost to humanity forever.

That was precisely the point I have been trying to make. There yet remains a vast and pervasive area of darkness In a conservation sense, the situation is one of a world being dead and the other being powerless to be born. The battle lines are drawn in starkly brutal and realistic terms between means of livelihood aspirations for economic development and the effort to achieve those economic objectives in harmony with nature and ecological balances I still feel that we need to evolve an integral faith concerning the whole domain of human consciousness and the answer to this is an integral conservation ethics In our myths and fables, folklore and legends a whole web of morality is perceived in wildlife and is preached in terms of human virtues. What is the kind of world that we are evolving towards? We have human language to flaunt and proclaim acts of human virtue and devotion. Animals have them too and birds possess them and yet they do not have the language Sometimes one wonders if these creatures follow just some physical reflexes of limbs and muscles and that perhaps these aggregate towards an animal morality in action. Who knows that they do think, that they do grieve and that they sorrow for the dead, that they are hurt though they cannot compose odes on melancholy? This kind of conservation education costs very little and achieves enormously much more than laboratories and exhibitions can.

The aim of conservation education should therefore be inbuilt in a subtle manner in the process of assimilation of information and knowledge. The United Nations Declaration of the Rights of the Child should be so interpreted as to prepare a child to inherit a world free from pollution and degradation of physical and natural landscape. This inevitably implies duty of the present generation to so shape the system of education as to make the child aware of his role in the world in which he would be required to play a dynamic role In a sense the right of the child to inherit a peaceful world should not be interpreted as merely a question of a condition of absence of war or hostilities The world that we owe to him is

a world free from ecological disturbances and tensions which we can overcome by conscious efforts. We owe it right now to children in terms of Malta Declaration of the Child's Right to Play, a sense of priority to playfields in the planning of human settlements.

Yet where do we go from here? The tasks that lie before us have certain conceptual imperatives. These are:

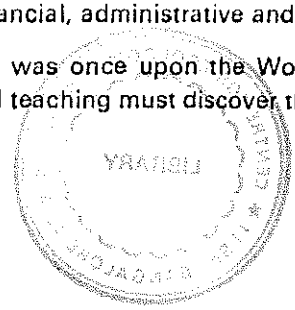
(a) the need to evolve subtle and inexpensive teaching aids;

(b) over a period of time there has to be a change in Curriculum that focuses on conservation Education as a faith and code of conduct;

(c) participative aspect so as to use the learner's concern for the world he is growing into in terms of inducing in him a consciousness of personal stakes.

(d) to work out a long term plan which envisages a comprehensive approach for meeting these objectives in terms of their financial, administrative and institutional implications.

Conservation was once upon the Word itself. All our efforts at instruction and teaching must discover that Word which we have lost in words.



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## MAN AND THE ENVIRONMENT

## THOUGHTS ON EXTINCTION AND CONSERVATION

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Art thou a bird or a wandering voice? That is how Wordsworth paid his tribute to Cuckoo. Why is the flapping, noisy, restless Koel black? It is because the bird is like a wandering human soul, burnt out in separation from the Divine Creator. This is how Sheikh Farid creates an image of magnificient spiritual grandeur out of a common bird.

From the earliest cave drawings of animals to Mare Chaggall's painting of a dove spreading its wings of peace in a symbolic gesture over human beings, wildlife has figured prominently in human consciousness and creativity. Whether it is a cuckoo figuring in Beethovan's famous Sixth symphony or a Black Buck sharing pangs of birha with a lovelorn maiden in a Kangra miniature painting, our heritage is the richer because of wildlife. It is, however, ironical that the same human beings who used wildlife for images of tremendous poetic beauty have also systematically exterminated many species of wildlife.

Those were the golden days. How is it that just within a century wildlife scenario has changed as it had not done perhaps for a million years? Thanks to human ingenuity that man has emerged the most terrible predator species of life. Perhaps this was the way the process of evolution tended to shape man red in tooth and claw. To Wordsworth the meanest flower that blew gave me thoughts that were too deep for tears. The perishing of little flowers and birds, in many cases unknown and unsung, gives one thoughts that bring an effusion of tears.

What was once upon a time the golden scenario like evokes visual images of an exquisite kind. It was the age of passenger pigeon darkening the American skies in numbers that were literally like the stars in galaxy. Back home in Punjab we had Salara pigeons, coming in large numbers like the locust swarms descending almost vertically in swift swoops and settling on trees in noisy flapping. You could hardly see that leaves and the branches as the trees bent in homage to this winged phenomenon of nature's bounty. When it was the age in America of herds of bisons that thundered past, blocking railroad traffic for days, it was the age here of the herds of black buck. Nearer home here not long time back, a herd of black bucks roamed areas

of Punjab and was appropriately named the "Nau Lakhi dar". Not that any one had ever counted the "nine lakh" black bucks in the herd. Yet it indicated what a multitudinous glory it must have been leaping across the countryside, in movements that define perhaps the ultimate in nature's streamlining of a living form.

Where have all these flowers gone? Gone with the pink headed duck, the mountain quail and Jerden's Courser. There are yet many that would go their way, the way of all wild life. Not the way of all flesh, that describes the mortality of individual human beings. The wildlife way of going unlike the Homo sapiens is the extinction of a whole speicies and not individual members.

What was out wildlife heritage like. There are a number of rough guesses. But they all describe the rich treasure that we inherited and the recklessness with which we have depleted it. In the age of statistics, wildlife with its back to the wall has its digital images too. According to the estimates of a well known conservationist, we have 10 million species of animals, plants, insects. Despite researches we have yet not checklisted more that 1 1/2 million of these species. The bird species alone account for 8600. They of-course number 30,000 if sub-species are also included. Of these India alone has about 2000 of which 300 are guest migratory birds.

It is the rate and pace of extinction that is alarming. The contrast between numbers and their expeditious disposal is a human phenomenon that has no match in its sheer barbarism. While species have been evolving and dying, the timeframe spans millions of years. In the normal course of evolution no species numbering a million would perish in a century. It is the short circuiting of the evolutionary process that manifests human criminality. No measure of pleading would adore for this on the Day of Judgement.

The indictment of man has its statistical evidence. It is well known that during the last 2000 years of man's existence the first recorded extinction of species was of the European Lion who vanished exactly 19 centuries back. The process of extinction accelerated as we move out of mediveal ages and into the age of emancipation, abolition of slavery and dawn of freedom. From 1600 A.D. to 1900 A.D., the rate of extinction picked up with one bird or animal species vanishing at the rate of one species per decade. Since then, thanks paradoxically to our increasing awareness of the values of conservation, one species per year has been bowing out of existence. Strangely and perhaps ironically, the stages and rates of economic growth have their dark reverse side in the stages and rates of extinction of species.

The basic difference is that none of these species perished after waging a long struggle. Whether it was the Dodo or the Passenger Pigeon, the Pinkheaded Duck or the Indian Cheetah, the

guns and relentless felling of trees did not give the species a damned sporting chance to fight it out on equal terms. Man's awesome gadgetary of guns and harpoons can now wipe out a helpless velvity Mollusks as quickly as a snorting trumpeting Mammoth. The fastest animal like Cheetah running on the surface of the earth has no chance of survival along with Moby Dick whale diving down to depths of the murky seas.

With forest areas receding at the rate of million acres a year, what chance do you give to elephants or mynas, green pigeons or Rhinos? man's greatest contribution to wildlife has been that he has unified them all, humble or might, flying or diving, in just one single knotted noose. The question is how soon and at what rate will they all perish one day.

Some more exact accounts of the impending danger have been now compiled with the alarming recession of forests. 1000 birds and mammals are already on the red list of the endangered species. The situation is much worse in the plant kingdom with approximately 30,000 flowering plants alone featured on the red list. In the kingdom of birds 100 birds species are now reckoned having dwindling population of less than 2000 members per species.

It is the rate with which these species are going out that is alarming. Each year lesser number of Siberian Cranes visit Bharatpur sanctuary. When the sanctuary dries up they disperse to adjoing areas and are perhaps shot. The whooping Crane is similarly place. So are the tigers having declined sharply from 40,000 at the turn of the century to less than 3000 now.

Run, Rhino, run. For extinction is for ever. That was an excellent alarm signal put out by Save the Rhino Wing of World Wildlife Fund. Here too it is the rate of dwindling numbers and the speed with which their doom is closing on them, that is of the utmost concern. This has a factual evidence to it. The rare Northern White Rhino of Africa number no more than 250 now. The Black Rhino of East Africa has been slaughtered so relentlessly that its population has gone down to 10% in 5 years. In one year alone in Tanzania the number of 76 Black Rhinos was slaughtered down to 26. In Asia according to this estimate Jawan and Sumatran Rhino have come to critical population of less than 300. In the normal course of evolution it would have taken very long. Perhaps the lecherous sought Rhino horn would have dropped off the Rhino's head. Or man could have thought of a more potent herbal or chemical aphrodisiac. Evolution would have definitely given Rhino a chance to dispense with the horn or perhaps drop it off like some lizards drop off their tail when pursued by predators. That was however, not to be.

Man does everything however, on principle. He cuts off forests on farming principles. He takes away Rhino's horn on sexual principles. He kills a crow pheasant on medical principles as it heals persistent cough. And he mourns the vanished species on consumation principles.

In the process the subtle principles of ecological balance and interlinkages are thrown away. It was for nothing that Donne said that Europe would be the less if a clod be washed away. Whatever we do on earth or by altering its plantation, use of pesticides and insecticides, the impact of it is there all over the world. And such is our communication system that you can literally kill a Penguin in Antartica by using excessive insecticides in Texas. Industrial effluents and its consequential seemier discharge of effluent can kill marine life hundreds of miles away in a stream, a river or the far away sea. An oil tanker leakage can be messenger of doom to the far off shores. It is amazing how we can deliver death to species through an ingenous system of sewers sprays and oil leakages.

Wildlife can marshall as much evidence or can marshall much more impressive statistical evidence in its self-defence than for its prosecution brief. In any case, who is afterall going to listen to its indictment? You cannot drag man to the law courts on the charge of cumulative predators impact on the future of species. Our folk-lore, religious belief and local customs were far more conducive to the cause of conservation. That is why Vishnois of Abohar and Fazilka area of Punjab look after the Black Buck in a manner that a battalion of game warden can never do. An Egyptian Pharoah had much better idea of the importance of an Egret who saved cotton crop by eating harmful insects. That is why killing of Egret in Egypt under his rule was a capital offence, summarily tried and the offender promptly executed.

In their self-defence wildlife would muster arguments that is uncanny in its scientific veracity. No more is a Yellow-naped Woodpecker accused of drilling holes and wounding the trees. It has an important mission to perform. It is known to indicate by its drilling of holes that the particular tree is diseased, old or is decaying. As a carrier of pollination it takes care of the multiplication of plants. As a carrier of seeds to heights and slopes where no forest official would ever venture, it keeps the forest line from coming down hill. Of-course it helps them out by eating ants and other harmful insects. Least of all perhaps for some it is the woody woodpecker of children's comics and a beautiful presence too.

Equally revealing has been the recent study of the Mynah, by Dr. Sengupta of the Zoological Survey of India. With its diet of 30 grams of insects a day, 84% non-vegetarian content in its menu, and its food eating habits increasing in monsoon, it is a great friend whose extinction would spell doom for our already dwindling grain buffer stocks. Least of all again for some it is the teller of some juicy pithy tales with a moral appended at the end in our folk-lore.

And think of the wise owl eating on an average 3 rats a day to keep the rodent menace away. Think also of a pair of rats managing to multiply to 880 in a year. And imagine too how much grain would these rats have consumed. This strictly beneficial functional view of the owl apart from the creepy sensation it raises by its screaching and hooting is strong enough defence that it should live on as a species. Wildlife being a question of friendship between human beings and conservation is somehow being recognised with increasing measure of depth and understanding. They are even thinking of introducing menatee in lakes and canals which are choked with that pernicious weed, haycinth which meenatees eat most heartily.

Of course some of the animals turn man eaters. But why? It is now increasingly realised that man himself drives these animals into eating his fraternity. Animals and bird, even the most ruthless predators kill with a purpose. The purpose is either to ensure a measure of control on population of a species or for the exact quantity that is required for food. Men alone kill for sport of the utterly wanton kind. But whenever they kill like their extermination species is imminent. For soon the economic interlinkages between us and the wildlife become starkly aparent. Often the scavenging birds are being sucked in by the jets or hitting the propellers of planes. They do often that as pollinator carriers for weeds. But apparently they can get away with an overwhelming evidence of benefit that their existence means to us.

Where do we go from here? Somehow tragically the surging tide of interest in conservation coincides with the low ebb of hope for preservation of some endangered species. Yet pleas for conservation are getting a mass base, are getting institutionalised in the form of Departments of Wildlife and Environment and in such organisations as the World Wildlife Fund and the International Union for Conservation of Nature. There is that convention on Whales too. It is trying to impart some pattern of sense to man's murderous madness. Then there are anti-pollution Acts and a branch of Economic Ornithology now emanting from the traditional discipline of Systematic Ornithology.

Out of sheer humility Wildlife has very little to say of its aesthetic richness whether it is Keat's Nightingale, Shelly's Skylark Beethoven Cuckoo Papiha figuring in our own musical compositions. We have birds and animals painted so exquisitely in our miniature paintings. We have wildlife described and painted by great emperors. Anyone who hears Cuckoo call and connects with Wordsworth's famous line: "Art thou a bird or a wandering voice" is surely blessed with a sense of bliss and peace beyond the capacity of words to express it.

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No wonder then that Thoreau was right when he said that " in wilderness is our preservation". In Edwin Arnold's description of the dawn of wisdom which came to Gautam Budha the musical overture is provided by the birds. For sheer sublimity it needs to be reproduced:

Whereat there piped anthems
of all the birds,
The Koel's fluted son, the Bul-
bul's hymn,
The "morning, morning" of the
painted thrush,
The twitter of the sunbirds star
ting forth,
To find the honey ere the bees
be out,
They grey crow's caw, the par
rot's scream, the strokes,
Of the green hammersmith, the
myna's chirp,
They never-finished love-talk of
the doves:
Yea! and so holy was the in-
fluence.
Of that high Dawn which came
with victory,
That, far and near, in homes of
men there spread,
An unknown peace.

-----EDWIN ARNOLD

When will the wisdom of conservation dawn on us in its full radiance?

kvn

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# PEOPLE'S PARTICIPATION IN PROTECTION AND SUSTAINABLE USE OF ENVIRONMENT

S.R. HIREMATH

During the last decade, environmental issues have been receiving increasing attention in all spheres of life, including greater coverage in the media. There is also a growing awareness of the need and importance of involving people actively in the protection of environment and management of the natural resources of their locality. While the disasters, like the Bhopal tragedy and Chernoby aaccident, have heightened the awareness among the general public and the governments as to the grave dangers posed to mankind, both present and future generations, the most significant contribution of the nascent environmental movement in India has been to bring into sharp focus the vital connection between growing poverty of vast numbers of marginalised people and the accelerating environmental degradation and the need to involve the people especially the affected people actively in the protection and managemnt of the natural resources, especially the Common Property Resources (CPRs), like forests, rivers and grazing lands.

Environment is not just "pretty trees and tigers". It is marginalised people who are the focus of the environmental movements as they are very much part of the environment and depend on it for their critical basic needs. So environmental conservation and restoration of ecological balance must include not just rivers, forests, and soil but also the humans, who are very much a part of the eco-system.

In this article, an attempt has been made to present specific ways of how people - especially the marginalised people, like women, fisherfolk and landless persons - have been involved actively in two people's movements in Karnataka, to identify the basic reasons for accelerated environmental degradation in India based on the experiences in most parts of the country, and evolve general methods of people's participation in the protection and sustainable use of environment, based on experiences in Karnataka and elsewhere in India.

## TWO PEOPLE'S MOVEMENTS IN KARNATAKA

For over seven years, the Samaj Parivarthana Samudaya (SPS) has been actively associated with two people's movements, viz., the one against pollution of Tungabhadra river and air by two industries, Harihar Polyfibres and Gwalior Ryon, both part of

GRASIM Industries; and the other for reclaiming of large tracts of common lands given to a joint sector company, called the Karnataka Pulpwood Limited (KPL), whose sole purpose is to grow Eucalyptus and other fast growing species on 75,000 acres of common lands in six districts for captive consumption of Harihar Polyfibres (HPF), therby depriving over five lakh of people of thier basic needs,like fodder, fuel, small timber, green manure, raw material for artisans and fruits. In addition, the SPS has also played an important role in organising broader environmental events, like coordinating, at the state level, the now well known movement clled "Save the Western Ghats March" (SWGM) and the Kanyakumari March and facilitating dialogue on policies for common lands through symposia and seminars where the affected people, government officials, and urban experts are brought face to face.

The systematic movement against pollution of Tungabhadra river, a major lifeline of Karnataka, began in 1983. Earlier, some of us now working with SPS were actively involved in a rural development organisation since 1979, in the same area, organising the rural poor around projects of their interest, such as Preventive Helth Project, Shepherding Community project involving shepherds, spinners and weavers, and Diary Project involving poor women. It is during this time that we were first exposed to the impact of pollution of Tungabhadra river and air and the adverse effects of the same on the health of people, cattle, sheep and aquatic life. The gains being made by the rural poor as a result of the various activities they had undertaken in the area of health of people, cattle, sheep etc., with the help of the voluntary agency - were being negated to a great extent in the villages on the bank of the river Tungabhadra. Those exposed to the polluted air, e.g., women, children and men who drank river water (there was no other source many a times) got afflicted with intestinal and other diseases and an unusually high number of persons had stomach operations. The sheep which drank river water had a very high rate of abortions or still births and there were also fishkills and continuous fish depletion due to the heavy pollution, especially during summer months when the riverflow is very lean.

Villagers, especially the poor, used to believe that only the politicians and ministers can solve this pollution problem. After several bitter experiences of having been let down badly by the politicians and also the newfound confidence the people had gained through their own organisations with the help of voluntary agency, people were beginning to feel that they can themselves do something about this terrible problem. It was, at this time, that after careful thinking among ourselves and also by visiting other places like Mavoor near Calicut where a similar Gwalior Rayon factory part of GRASIM, (owned by the Birlas) and learning from the experiences of the Kerala Shashthra Sahitya Parishad (KSSP), who had tackled the pollution problem by organising the local people, we decided to form a new voluntary agency, the

Samaj Parivarthana Samudaya (SPS) and to work with the affected people, concerned scientists and lawyers by evolving a comprehensive approach to the problem.

The basic approach evolved by SPS included: facilitating formation of Village Environment Committees in all affected villages with priority for women, fisherfolk, shepherds, etc., who are most affected. It is these Environmental Committees from various villages which have formed an apex organisation, called the Tungabhadra Parisara Samiti, which is in the forefront of the movement against pollution and makes all decisions about people's actions.

The Samaj Parivarthana Samudaya (SPS) basically plays a supporting role to the people's organisation by helping organise environmental camps and jathas, conduct scientific studies of the pollution and common lands, and file public interest litigations in the local courts, High Court and Supreme Court and also training in non-violent direct action of people (Satyagraha) as the last resource to redress the injustice.

The people's participation in the movement against pollution grew steadily from Padayatra in the affected villages, the environmental camps, dialogue with the management of the factory and the Karnataka State Pollution Control Board (KSPCB) officials and vigil lines and Satyagraha in front of factories and KSPCB regional office. Eminent persons like Shivaram Karanth, Gnanapeeth Award Winner, and Justice D.M. Chandrashekhar, former Chief Justice of Karnataka High Court, addressed the people and supported the movement. A team of concerned scientists have conducted a detailed study of pollution and its effects with participation of Village Environment Committees in data gathering. People have promptly reported fishkills, therby documenting the specific instances. Fifteen fishermen have filed cases against the factory in the local court of Ranebennur, claiming compensation for fish depletion and fishkills especially a massive one in February, 1984. A major Satyagraha in front of the factory on October 2, 1984 awakened the State Government because of wide spread coverage of the event by news media and made it send a high level delegation of officials, who invited affected people and voluntary agency representatives to join. The KSPCB officials of the regional office have now come closer to the people and show films in the awareness campaign organised by the TPS in a famous festival called Mailar Jatra.

The increasing participation of the affected people in the movement supported by scientists and other concerned people has put sustained pressure on the government and the factory authorities with the result that Tungabhadra is less polluted today then before. The sincere government officials and affectd people have come closer for protection of environment. However,

during summer months, when the river flow is very lean, the intensity of pollution is very high. The affected people are now advocating that the factory should take its water (both for factory and drinking purposes) from downstream (i.e., after the effluents of the factory join the river), which will automatically put sustained pressure on the factory to treat the effluents properly, and to reduce production of the factry during the summer months. They also advocate appointment of an Independent Citizens Committee to monitor the pollution level. Most of all, the affected people want the information of pollution level and treatment details on a regular basis.

## COMMON LANDS ISSUE

On November 14, 1984, the Government of Karnataka, through its Karnataka Forest Development Corporation (KFDC) with 51 per cent shares, and the Harihar Polyfibres (HPF) a unit of GRASIM industry, with 49 per cent shares, signed an agreement to form the joint sector company called the Karnataka Pulpwood Limited (KPL).

The sole purpose of KPL is to grow eucalyptus and casuarina as captive plantations for Harihar Polyfibres on 75,000 acres of"C" and "D" class lands that the rural people have depended on or meeting their basic needs of fodder for cattle, fuel for cooking, small timber for housing and agricultural implements, green manure, raw material for artisans and fruits. These vast tracts of village common lands are spread across six distrits of Shimoga, Dharwad, Belgaum, Chickmagalur, Uttar Kannada and Hassan. All are in the high rainfall areas of the Malnad belt, including some lands right in the heart of Western Ghats. They have been the major source of meeting the basic needs of over 5,00,000 villagers, most of whom are poor. With one stroke, this act of the Government of Karnataka is depriving most of this vast section of the people of their only available village common land, as in Kusnur cluster of villages. It is Rs. 30 crore project and is financed by National Bank on Agriculture and Rural Development (NABARD) through the nationalised banks.

It is this act of the Government that prompted the SPS and other organisations to begin this awareness building process with the affected people, helping them to organise through local organisations themselves to protest against KPL and try to recliam their common lands. The movement started in 1985 in the Shimoga district, where the lands were first given to KPL and later spread to Dharwad and other districts as the KPL moved to the other districts in 1986. The movement went through various stages from petitioning the local government officials, to meeting the Chief Minister, pleading to cancel the KPL agreement. When all this did not yield any results, affected people in several places held a weeklong series of protest meetings and

demonstrations in 1986 beginning on November 14th, the day KPL was formed two years before.

The basic approach on the issue of common lands has been the same as in the case of the movement against pollution. Local people's organisations have been formed, e.g., the Guddanadu Abhivrudhi Samiti (Hill Area Developement Committee) in 13 villages around Kusnur village in Hanagal taluk, Dharwad district where the people's movement has been the strongest. All such local organisations have combined to form the Samuhik Bhoomi Sanrakshana Kriya Samiti (Action Committee for the Protection of Common Lands - (ACPCL).

The affected people, supported by SPS, with Shivaram Karanth as the first petitioner, filed a major public interest litigation in the Supreme Court of India in December, 1986. A division bench of the Supreme Court consisting of the Chief Justice gave a stay order on March 24, 1987 preventing Government of Karnataka from transferring lands to the KPL which came as an important judicial support for people's movement as only 10,000 acres out of 75,000 acres were transferred to KPL at that time.

However, the KPL continued planting on large scale on lands not given to it in flagrant violation of the stay order.

The people's movement took a vital turn leading to an innovative Satyagraha called "Kittiko - Hachchiko (Pluck and Plant)" on November 14, 1987, thrid anniversary of formation of KPL. In this Satyagraha, affected people and their supporters plucked eucalyptus as symbol of exploitation of rural people by government and industries and planted utilitarian saplings of fodder, fuel, etc., like jack fruit, tamarind, neem, muttalele and mango. This and subsequent events, including a major Satyagraha on August 8, 1988 (Quit India Day), have made Kusnur a well known name, and this people's movement has been made known among concerned people by articles in all major newspapers and magazines and also a 30 minute Doordarshan film entitled "The Kusnur Satyagraha" under the series called"Citizen and the Law" telecast on August 3, 1989. The Save the Western Ghats Movement, Karnatala (SWGM - K), the Samaj Parivarthana Samudaya (SPS) et al have published a 134 page book entitled *Whither Common Lands ?* which has been very well received all over the country. As the people's movement grew stronger, the Government invited the SPS representatives for a meeting on June 3, 1988 and agreed to appoint a one-man Commission comprising Madhav Gadgil and to suspend KPL operations people were also to suspend their Satyagraha. While people kept their word, the Government did not. People had to resort to Satyagraha again. The movement has been spreading to other areas systematically with the result of portest in all the six districts. People have also taken to new forms of Satyagraha of boycotting rayon clothes.

The contempt of Court and prejury petitions filed by SPS document presenting effectively the flagrant violations of the stay order of the Supreme Court and lying under oath have been admitted by the Supreme Court on October 13, 1988 and notices issued to the alleged contemners and prejurers.

All this had important effect on some sincere Government and Bank officials. This has resulted, as of July 1989, in the denial of both further funds and lands to KPL by the Banks and some Government Officials, therby bringing the KPL operations to a grinding halt.

People are also concerned about learning how to make the common lands more productive. The local people are beginning to experiment on common lands of Hirebasur village and the Lambanis (semi-nomads) of Janamatti Tanda have also come forward to work on thier common lands.

## CAUSES OF ENVIRONMENTAL DEGRADATION

There are several causes of environmental degradation. However, the most important one is the taking away of the control and management of Common Property Resources from the local people, largely due to Governmental policies since the British days, as the Statement of Shared Concern at the end of the Second Citizens Report on the State of India's Environment states:

> The process of transforming India into a wasteland, which began under the British rule, has continued under the post-independance governments. The most brutal assualt has been on the country's common property resourcs, on its grazing lands, forests, rivers, ponds. lakes, coastal zones and increasingly on the atmosphere. The use of thes common property resources has been organised and encouraged by the state in a manner that has led to thier relentless degradation and destruction. And sanction for this destructive exploitation has been obtained by the state in the name of "economic advancement" and "scientific management".
>
> Nature can never be managed well unless the people closest to it are involved in its management and healthy relationship is established between natuer, society and culture. Common natural resources were earlier regulated through diverse, decentralised, community control systems. But the state's policy of converting common property resources into government property resources has put them under the control of centralised bureaucracies, who in turn

have put them at the service of the most powerful. Today, with no participation of the common people in the management of local resources, even the poor have become so marginalised and alienated from their environment that they are ready to discount their future and sell away the remaining natural resources for a pittance'.

It is very important to relaise that persons like Jyotiba Phule working with the poor recognised this problem as early as 1882 as expressed in his book Shetkaryacha Aasud (Cultivator's whip-cord) in the following words:

> In the past the peasants who had small pieces of land who could'nt eke out enough from it for their survival used to eat fruits from the nearby forests and used to collect leaves, flowers and dried tree branches and by selling these to others supplemented their income. They also used to maintain a couple of cows or goats and were living happily in their villages depending on the village common grazing land. But H.M's Government's conspiratorial bureaucracy have used their foreign intelligence and have newly established the great forest department and have incorporated all mountains, hills, vallies along with barren lands, and village common grazing lands in this department, thus making it impossible for the goats of the poor peasants to find even breathing space in the forests .....

All the large scale projects, like Tehri Dam and Narmada Dams, the Nuclear Power Plants and Joint Sector Companies, like KPL, involve corruption and leakage of public money benefitting only a small section of people while passing on the social and environmental costs to large sections of the poor, i.e., displacement of large numbers of tribals and rural people, submersion of large tracts of forest lands and drastic change of environment in which the tribals and the poor find it very hard to adjust.

## CONCLUSIONS

Based on our experience, the best way to arrest environmental degradation and promote sustainable use of environment is to ensure the central participation of the people, especially the tribal and rural poor, in the control and management of natural resources. This would include organising of the affected people to prevent environmental degradation, like the issues of pollution, common lands, big dams, nuclear reactors, etc., and finding out meaningful ways of involving people in the control and management of natural resources with the governmental agencies playing the role of an enabler, like the present Agriculture Department, and unlike the Forest

Department, which tries to play the role of producer of trees and in the end serves only commercial needs. As we have found, the quality of life of local people and health of the resource base (river, grazing land, etc.) is closely related to each other and the people would be more motivated than official agencies to manage these resources better. Also, the local people have considerable location - specific knowledge of the resource base and they use it in a manner that would be helpful in better management of the same. The local people are also in a better position to monitor closely what is happening to the resource base.

The policy of the government should be first to meet the needs of local people by making the resource base (grazing land, river, fishstock, minor forest produce, etc.) more productive and accessible to the local people, specially the poor. It should facilitate their greater involvement in all stages, especially decision-making e.g., deciding how to manage a piece of grazing land, what species to plant, their protection and the just sharing of produce).

All this requires a basic commitment of voluntary agencies and all other concerned people to the process of empowerment of the poor and finding out innovative ways of involvement of local people (e.g., Village Level Common Lands/forest Management Committee. There is also an urgent need for greater freedom under information act so that the government policies and programmes, especially large scale projects - like big dams and nuclear power plants - are thrown open for widespread and meaningful debate based on facts and figures and what alternatives are there which would involve the local people centrally, be cost effective and environmentally sound, and sustainable. The role of Science and Technology in the present and alternate development strategies needs to be carefully and critically assessed.

These are very urgent areas that the nascent Environmental Movement and all others concerned need to address themselves to by learning from some innovative programmes, like the Chipko Movement, Sukhanajory experiment and the common lands movement in Karnataka, and developing maningful ways of involving people, especially the poor, in the control and management of natural resources.

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## FOREST MANAGEMENT

S. SHYAMSUNDER

Chirapunji with 1.080 cm. of rainfall, one of the wettest places on earth, today, shorn of tree cover, faces drinking water problem for over 5 months in a year.

India receives 400 million hectare metres of precipitation of which nearly 180 million hectare metres is the run off of which only 17 million hectare metres is impounded in 4 reservoirs.

India and Bangladesh account for 70% of the world flood damages.

In India flood damages during the last 25 years is estimated at 247 crores. The annual loss of soil is estimated at 600 million tonnes valued at Rs. 6000 crores. The nutrient loss in the process is about 8.4 million tonnes almost as much as the total quantity of fertilizer used.

16% of the total geographical area of the country is drought prone.

1/3, the area under forests, 2/3, under agriculture and the whole of the area under common privileges are prone to soil erosion.

Economy and ecology are two sides of the same coin.

Japan has 67% of its land under forests, Sweden 52%, Russia 42%, North America 40% and Europe averages 31%. The forests in these countries are in optimum condition and belong to individuals, companies and government. It is the dictates of the scientific land use that results in forests being developed and maintained. As against in this, in India, 23% of land are being under forests is by legal classification and belongs to government. 50% of this area is badly degraded or has no tree cover. Per capita forest area in India is 1/10 of the world average.

The population of India during Chandragupta's time was 10 crores, 20 crores during 1890's - at the time of reservation of forests, 35 crores during 1947 and is today around 84 crores.

Cattle population has also trebled since the time of reservation and today with the man, cattle ratio of 2:1 is the highest in the world.

It was the report of the Collector of Kanara district in 1848 that the forests in the slopes of Western Ghats were mostly destroyed and that many rivers had ceased to be navigable within living memory and of Dr. Clegphora from Shimoga that sun could not be seen for days on and because of smoke from the burning forests had initiated steps towards conservation of forests. The reservation was through a Revenue officer and the principles applied in Germany that when a block is reserved, sufficient area had to be left out to meet the rural needs of firewood, small timber, fodder and mulch were applied. This generally resulted in equal extent of forests in the hill areas and thrice the extent in plains being left out.

It is unfortunate that most of the extention in agriculture has been at the cost of this community privilege area, disregarding the purpose for which it was set aside.

The Conservation aimed at protecting the forests from fire, limiting the grazing and free removal of firewood. Today the fires are annual features, grazing is three times its carrying capacity and removal on headloads is uncontrolled.

The requirement of wood for use as timber and as industrial raw material of the country today is 27.6 million $M^3$ of which, 15.6 million $M^3$ is the deficit. As against this, the requirement of firewood is 235 million $M^3$ and the deficit is 144 million $M^3$. The deficit of firewood will increase to 209 million $M^3$ by 2000 A. .

Addressing the International Conference on Conservation for Development, held in Madagascar in 1985, the Minister of Livestock, Fisheries and Forests clarified that self-sufficiency in food would not save the ecology of Madagascar. It had to be self-sufficiency in food and fuelwood.

Improved chulas could bring down the demand for firewood by 50%.

Japan, twice the size of Karnataka, harvests 35 million $M^3$ from the forests against the departmental harvesting of 1 million $M^3$ in Karnataka. 4 to 5 million $M^3$ is harvested on headloads. Sweden 1/8 the size of India, produces 8 to 50 times the forest based industrial produce of our country.

The extent of reserve forests under full departmental control at the time of independance was 25.32 million hectares. Today it is 40.18 million hectares. The increase was by the addition of areas classified as forests in the 4 ex-princely states and the proprietory Jahagir and man forests. Most of these were and are in bad shape.

Only 10-11% of the land area of our country has good forest cover. 52% of the area with some tree cover, there is no regeneration.

Investment in the forestry sector has been less than 1% of the plan allocation. If the allocation for commercial energy in the 7th Plan was 54,000 crores, to the entire forestry sector it was 1700 crores, though 29.25% of the total energy availed in the country is from firewood.

A major extent of allocation to the forestry sector is for social forestry, implemented outside the reserve forests. There is practically no investment on the natural forests.

In the developed countries there are tax incentive laws for promoting forests. In India coffee, tea, cardamum, lavender and rubber are exempted from local civiling laws but not forests.

If people were to depend on the jungles, fowl and wild boar for the table, these species would have been extinct long back. It is the dependance on wild resource for wood - most of it for burning, that has virtually wiped out our forests.

We are in the tropics. We have more than 90 million hectares of badly degraded land. A large population of the country is unemployed. Together, these three factors could result in each hectare of wasteland producing a minimum of Rs. 800 per annum instead of being the cause of a loss of Rs. 400 per annum.

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# PEOPLE'S PARTICIPATION IN MANAGEMENT OF ENVIRONMENT

S.R. RAMASWAMY

When we look back on what has been happening in the forestry sector in recent decades, we are driven to conclude that we are an over-governed country. Solutions to the present problems must be sought in bringing greater vigour, dynamism and rationality to the supply side, rather than in over-controlling the demand side.

Partly because of the divergence of perspectives as between people and the bureaucracy, and because of the rapidity of environmental degradation resulting from pursuit of short term goals, the administration today finds itself out of depth in dealing with the various dimensions of interaction among people, State and Nature.

No doubt, the expression "people's participation" has gained much currency in recent years. However, considering what has passed for people's participation in the past, the expression needs to be defined with some sharpness.

There has been much participation by the industrialists, contractors, village chieftains and urban elite. But what has been missing is direct participation of the poor from the stage of decision making onwards.

People's participation has been viewed by bureaucrats as a mechanism. It is rather a process : an active process by which the existing or potential beneficiaries control the implementation of a development activity in a manner which would ensure enhanced income and greater self-reliance.

More "information - sharing" can not be called participation. (Sadly, often even information-sharing is absent). Information-sharing should lead to consultation on an equal footing, and that should lead to decision-making and subsequently to implementation.

If development and conservation should go hand-in-hand, people's participation through greater empowerment than at present is inveitable.

There has recently been much talk of decentralisation. Even the erstwhile Union Government, during its last days, revived the concept of strengthening the village level institutions.

However, it must be emphasized that "people's participation" in a true sense operates at a much wider level than Mandals and Panchayats. The participating institutions needed are of a quality and kind conducive to local-level resource management, ensuring greater justice at the distributional level.

Standardised solutions which marked the earlier Five Year Plans had to make way for eco-specific programmes such as Drought-Prone Area Programme, Tribal Development Programme, etc., after the Fifth Year Plan. Ironically, centralisation continued to be strengthened through programmes like Integrated Rural Development Programme even during the Seventh plan period.

Situational specificities must be respected. For instance, does drought affect all classes of people equally ? Should not the State policy discriminate between people with assets and people in deficit ? Is it prudent to concentrate all energies and resources on preventing immediate and visible misery, while continuing to maintain long-term anti-poor bias in different programmes ?

Now about participation. Participation at the macrolevel implies right to elect panchayats etc. This is but a small though important facet. The real test of participation is in the equitable sharing of the benefits of programmes and in a decisive role in planning itself.

Empowering the poor implies cultivating the capability to adapt programmes to widely divergent conditions with a measure of in-built performence-orientation.

Investments in poverty - alleviation have been considerable. The drawback has been in directly responding to the demands of the poor and in enforcing accountability at the implementational level.

Let us look at a few other biases.

That the productivity of forests has been declining is clear. Between the beginning and middle of the 1980s the fall in supply of dressed wood in Karnataka was about 66%, according to Government reports. It would, therefore, be illogical to pursue the same hazardous policies backed by wild projections.

The tendency to go on increasing allocations to wood-based industries needs to be questioned.

Every other day, one hears the paper mills loudly

proclaiming raw-material shortages. Let us take a look at facts. The Seventh Plan Working Group on Paper Industry had projected the raw-material requirement by the year 2000 at 14 million tonnes. (The availability in 1985 was around 4.5 million tonnes). This increase over a 15 year time span would mean additional pulpwood plantations to the extent of some 2.4 million hectares, if we calculate productivity at 4 tonnes per hectare. But because of accent "farm forestry" and on industrially useful species during the present decade, more than 2.5 million hectares of land has been brought under eucalyptus alone, not to mention acacia etc. In such a background, cries of raw-material shortage by paper industry make little sense.

Are the present policies based on rational assesment ?

The deficit of pulpwood is estimated by Karnataka Forest Department at 0.2 million tonnes, while the shortage of firewood is placed at over 4 million tonnes. The priority indicated by this estimate does not appear to be reflected in the programmes and policies.

And is there equity at the distribution land ?

When asked, the CCF of Tamilnadu said a couple of years ago that only 5.7% of the total wood rpoduced in "social forestry" and such other programmes was actually made available to the rural people; all the rest went to industries and urban centres.

This ratio is also confirmed by the avilable Government of India figures. For instance, around 1961, out of the then total requirement of fuelwood (60 million tonnes), only 10 million tonnes came from recorded forest sources; the rest-some 50 million tonnes - came from private and revenue lands.

Effects of "raw materialism: are far - reaching.

It is significant that for raising industrial raw-material, the Forest Department is ever ready to parcel away forests and revenue lands. Whether, in the present state of environment, we can afford to divert any land anywhere for industries of doubtful utility, is a root point. If land must be made available for such use, why not go after degraded lands in the possession of private owners ? Speaking for Karnataka, the so-called degraded lands in forests (2.0 million hectares) and Revenue Department (1.1 million hectares) total up to 3.1 million hectares, whereas there are degraded lands of the order of some 2.9 million hectares under private ownership.

Why do industries prefer government land to private land ? The only conclusion one can draw is that the industries foresee profits only in governmental mechanism and arrangements. It is precisely this nexus which has caused the plethora of problems at present.

Continued adherence to in-built biases as in the past can only result in further degradation.

Why do not people raise and nourish trees ?

It would be unrealistic to expect local people to develop interest in tree-planting unless they are assured of a reasonable share in the final as well as the intermediate produce. Merely paying people a prescribed wage for on-site work can hardly act as a powerful incentive for tree-rearing.

To our knowledge, in no region has a formal agreement been entered into in order to legally ensure the entitlement of people to the unsufruct. Sometimes, when questioned, the forest nureaucrats come out with the argument that legalising such arrangements will contravene the provisions of various Acts such as the Forest Conservation Act. This argument is curious and untenable, since the very same Forest Department does not have the slightest hesitation in entering into agreements with industries to which thousands of acres of forest land and village community land are leased out.

People's participation has in the past been limited to providing the needed labour for plantation activity: nor have the people had any say even in choosing the species being planted.

This is not to imply that rural communities have maintained grazing-lands or village-forests in an exemplary manner. There has definitely been on-land neglect. But the single most inhibitive factor which has disenthused people is the gradual and inexorable curtailment of privileges and consequent shrinkage of the size of common property resources.

Assertive action by the affected people is the factor which catalyses more meaningful participation of the target communities and, consequently, more collaboration between people and governmental agencies. In the context of land and forest resources, such catalytic processes have emerged in various parts of the country. What is needed is a positive response from administration at various levels. The response has to be in two directions: 1) more sincere implementation of accepted programmes and inculcation of a definite pro-people bias, and 2) the requisite system changes at the legal and asministrative levels.

For this to happen, there should be honest recognition of the inadequacies of the past strategies and of the greatly altered ecological scenario.

It should also be recognised that regeneration of minor forest products can also produce employment far beyond the scope of present "Social Forestry" programmes.

Instances are not wanting of successful people's participation in afforestation activities - from Sukhomajri in Haryana to Hunsur in Sagar Tq (Shimoga dist) of Karnataka. Fodder cultivation and Kisan nursery programmes of voluntary organisations in Kolar, Bellary and a few other districts have also been programatically effective. But the forest bureaucrats have a tradition of dismissing any such successes as anecdotal.

People's intitiatives are extremely important; but they can not be expected to provide alternatives. The most that they can achieve is to secure slightly greater devolution, through sensitising the fovernmental structures. But the endeavours of the grassroots organisations is frequently matched with even larger counter-efforts by the elite.

Non-governmental organisations have had considerable impact on local communities, within their obvious limitations. Governmental programmes too have achieved comparitively more success in regions where voluntary action has taken roots.

In the long run, this co-existence should lead to collaboration.

The advantages that voluntary agencies command in reaching out to remote areas and settlements of people shoudl be recognised. While many NGOs do directly deliver the services, thier real strength is in motivating people and in mobilising demand for services and benefits.

There is no reaon why poverty-alleviation programmes should not be contracted out to established NGOs. A couple of years ago, a massive World Bank aided housing programme was entrusted to a local NGO in El Salvador.

The success of a voluntary rural banking project in Bangladesh led to its being adopted by Government as a major programme.

A major reason for the worsening of the environmental situation is a tendency among bureaucrats to look upon environmental maangement as yet another sectoral issue, like education or commerce or health, instead of as an activity encompassing practically all fields of life. Let us hope future planning and strategies will be informed by such a holistic vision.

TRAINING PROGRAMME FOR I.A.S. OFFICERS' ON

"MANAGEMENT OF ENVIRONMENT"

# FOREST MANAGEMENT

- Shri. K M Hegde
Sahyadri Parisara Vardhini
Yadahalli, Sirsi (U.K).

The district Uttara Kannada which is in the heart of the Western Ghats is known as the forest district. In the early days of this century the forest area of this district was really covered with dense vegetation.

In those days population was scarce and it was mainly concentrated on the coastal region of the district. In the hills Malaria was a problem. In those days roaring of tigers near the villages was common. Freely roaming elephants had devastated many Areca gardens in the valleys of the hill region.

Unhealthy climate, lack of transportation and communication problem of non-availability of labourers, havoc by wild animals and pests had made the life of the people miserable. Because of these, people were forced to think that the forest was the main obstacle for any type of development of the region.

But now a days, in the name of the development our forests are overutilised, for timber and fuel supply for the supply of raw materials to the industries, etc. And large area is submerged for various hydel projects, and vast forested area is also cleared for transmission line, roads and town expansion, and for cultivation. The community forest lands known as minor

forests and leaf manure forest (Soppina Betta) lands are also degraded due to over exploitation.

Now at the fag end of this century we can see an entirely different seenario. Population has increased and the number of cattle has also increased beyond the carrying-capacity of the grazing land. In the coastal area a woman has to walk 15-20 Kms., just to bring a handle of fuelwood. The cattle have neither grass to graze nor shelter to rest in the summer months. In many parts of the district even availability of drinking water is very much limited during summer months. Soil erosion has increased and there is a change in climatic conditions also. Even in the heart of Western Ghats most of our hill regions have become harren. Our district is still called a forest district just considering the ownership of land of which 82% vests with forest department.

It is clear that one cannot go back to the situation at the beginning of the century. Inspite of massive efforts in population control one cannot expect that the population increase would come to a halt in the near future. Similarly owing to our typical situation it is also not possible to bring down the cattle number over might according to the carrying capacity of our graxing lands; and it is evidant that even at the beginning of the 21st century we have to depend upon our limited natural resources for our increased demands of various biomass products.

The only way of meeting our increased demands is revegetation of our barren lands. In our country two different

approaches are being advocated to achieve this goal. Though their ultimate goal is the same their directions are opposite to each other. One approach is to leave everything to the local people removing all the restrictions. The other approach is to keep away the people from the public land by imposing strict conservation policy. But this has to be seen from a different angle of social as well as economic conditions prevailing in our countryside.

There are large number of landless people and small and marginal farmers. The are solely depending upon forest resources for their various needs such as fuel, fodder, green manure, raw materials for village artisans, medicinal plants etc. It is clear that varied needs cannot be met by the existing depot system.

These poor people are the main sufferers from the degradation of the natural resource base. We may not succeed either in forest conservation or in the welfare of the people, if we simply impose more and more restrictions on the local people to keep away them from land and forest without involving these people in the developmental activities. With this experience partaining to Uttara Kannada, application of forest management to whole of country like India appears to be feasible.

In the coming years, the pressure on the natural resources will certainly increase due to increase in population as well as in demands. And our developmental needs are also bound to increase. And in future under Indian conditions the number of

small and marginal farmers may increase because of further fragmentation in land holdings. Hence the management of forests as well as other natural resources in our country cannot be considered as a mere technical problem of afforestation. Instead we have to consider this as a techno-socio-economic problem.

We cannot just look at the forest development programme from a technical or a departmental view point. We have to consider the various needs and the unavoidable dependance of the local people on these lands. For this it would be appropriate to look at the whole issue from the angle of the watershed development.

And all the developmental activities within the watershed unit should be so designed that they should be integrated and made to supplement each other to achieve the goal of eco-restoration in this unit. For example, if take up the animal husbandry programme only from the point of increasing milk production without considering its effects on ecological balance of that area it may prove harmful in a long term. If this activity is integrated with proper manure production, and suitable fodder grass and fodder trees production, and these vegetations for soil and moisture conservations etc., then this will supplement other beneficial activities and also helps proper recycling of the byproducts. Because of increased population and increased local demand for food, fodder, fuel etc., more and more land is brought under plough. Now lack of organic matter in our agricultural lands is posing a serious threat to the productivitity of our farms. Traditionally the farmers were dependant upon the nearby forest or the common lands for their

needs of green manure fodder and fuel. Now because of severe degradation of these lands, pressure on reserve forests for these needs has increased very much. If we are really interested in minimising the biotic pressure on our forest lands we must seriously think of providing alternate sources fo these local needs. Therefore there should an integrated approach in agro-forestry, farm forestry, social forestry, plantation forestry and natural forestry programmes. It is also very much needed to take up various forestry programmes simultaneously in the different categories of the lands coming under a watershed unit having different ownership pattern.

The land coming under a watershed area can be divided into three broad groups according to different ownership pattern.

i) Land under private ownership. This includes aerable and non-aerable lands owned by individuals. Like cultivated lands, drylands, uplands, marginal lands, grasslands etc.,

ii) Land under community ownership or where the local community has got certain rights or previlages to collect fodder grass, fuel wood etc. The gomals and other grazing lands, panchayat lands, minor forest lands can be included in this group.

iii) Land under the exclusive ownership of the state and managed by the department such as reserve forest and other public lands.

It is very important to involve the people of various socio-economic status of the particular locality especially of the poorer communities who are more dependent on these resources. It is also necessary to involve these local people at various stages of development such as planning, implementation, monitoring and protecting operations. For this it is necessary to have certain organizational set up from village to district level with specific powers.

At the grass root level a village level committee should have to be constituted. In this committee more weightage has to be given to the poorer class people, women and the artisans who are more dependent on forest resources.

And one representative of the local mandal panchayat must be also included in this. This committee should involve the village level officers of the forest and the animal husbandry departments. Non-official members of this committee have to be either selected or elected by the gram sabha. It should be responsibility of this committee to regulate the open access to the common lands, the forest lands and other public lands.

To make these village level committees to work effectively and efficiently there should be some more organizational set up at the tahashil and district level. These higher level committees can supervise the working of the village level committees and can provide technical and other managerial help. The village committee should be answerable to the gramasabha and the higher level committees for playing its different roles

properly. Some impartial outside presence from Govt. administration and scientific institutions would also be necessary to help the committee discharge its duties adequately, to convert the open access resource use to the community controlled resource use. The role of these committees to different categories of lands should be as follows:-

a) Private land:- It is very important to create awareness among the local community about the needs of the eco-restoration. Proper extension services can be provided through this committee to take up tree cropping along with the farming activities.

In many places even slopy and marginal lands are being brought under plough which are best suited for tree crops cultivation. These lands being utilised for field crops cultivation because of increased pressure on cultivated land which is neither economically nor ecologically suitable. Various fruits, fodder, fuel wood and green manure yeilding trees can be grown in these areas along with many useful bushes shrubs and creepers to get higher income from these marginal lands. Nevertheless by properly developing these lands it is possible to provide needed green manure to the cultivated fields and fodder to the cattle and fuel wood to the farmer. And this would help to increase the production in the cultivated land and to minimise the biotic pressure on the forest lands.

After meeting the local demands it is also possible to utilise these lands for producing raw materials for forest industries by growing bamboo, soft wood species etc.

In addition to providing extension needs to the farmers through these committees the following institutional help is also needed to boost up the tree crop cultivation on non-aerable private lands.

i. Timely technical guidance and adequate inputs supply should be ensured.

ii. Long term financial help should be available on easy terms.

iii. Simplified marketing facilities through some non-governmental instiutions should be provided.

If possible all these facilities can be provided through a single agency.

With the above, financing and marketing facilities these village level committees can play very important role by providing extension services to develop these lands. Now these lands which have become a burden for the farmer can be transformed as economically and ecologically profitable asset.

The same committee has to play a different role in the case of common lands. Because of over-exploitations most of our common lands are much degraded. The Government is also taking steps to develop these lands under various types of social forestry programmes. If these lands which are developed investing huge amount, are opened up for free access then they will become barren again within a very short period. These committees should take the responsibility of managing these lands.

The Govt. may have to initially invest to generate biomass on these common lands. However most of this investment would be in the form of human labour and should be used to generate employment to the local people. In the long run however Govt. should not have to go on investing in biomass production from these lands. Instead all members of the local community must pay for resource use either in cash or through labour input. Such charges should be so adjusted as to be adequate for long term maintenance of these lands. It should be the responsibility of this committee to manage these lands. It should ensure the proper production, distribution of the products and the protection of these lands in a sustainable fashion. In short these committees should work as the joint managers of the common lands with the Govt. departments.

The third category of which is owned and managed by the Govt. only, at present, can be subdivided into two groups. (i) Reserve forest lands which have no access to the local people but which provide for the needs of the urban people and the wood based industries. (ii) Biosphere reserves to maintin plant and wild life diversity.

In olden days many poor people were earning their livelihood by collecting various non-wood forest products without harming the tree growth, such as wild fruits, sikkakai, soapnuts, honey etc. Many tribals are still dependent on these lands. After independence much emphasis is given to supply industrial raw materials from these lands than providing livelihood security to the poorrer people. Of course in the interest of the national as

well as of the local ecological consideration open access to these reserve forests should be restricted.

We must therefore think of other kind of income generation from these lands. Such income generation could come from the very large number of non-wood forest produce. Enrichment of the reserve forests with such species would generate long term economic activity for the local people, without resorting to any felling of the trees. Evolving a proper management system involving the local people for raising, protecting, harvesting, processing and distributing, these forest produces, should become as important component of our reserve forests development programmes.

Then the local people will also have a stake in protecting these forests. The village level local committee can play an important role in helping the department to develop and protect these reserve forest lands. Without active co-operation of the local people it is impossible to protect these vast areas only by Govt. machinery. These committees can provide very useful fire in keeping away the smugglers, poachers and forest fire and stray cattle from the reserve forest area. In this way this committee can play an important role of protecting forest wealth in the reserve wealth in the reserve forest areas.

Our traditional system of genetic resource conservation was through sacred grooves but these have unfortunately been disrrupted. By the introduction of the Pavitra vanas the Govt. is also trying to revive this system. After the development of these

Pavitra vanas the village level committee should take up the responsibility of protecting these mini biospheres. Nobody should be allowed to disturb these patches. And local people also should be encouraged to plant medicinal and other useful plants on these lands which are known to them by tradition.

Thus the local people may be involved through these organizations to play an important role in developing, managing, protecting and conserving our forest resources. Good management of biomass production as well as utilization would call for substantial technical inputs. District level machineries should be set up to provide these. Such a network of village level committee should be created on countrywide basis with appropriate adjustments for different agro-climatic zones. A strong legislative frame work at state and central level would have to be created to ensure that the integrity of this network is fully guarded against encroachment at all levels from local cultivators to Govt. enterprises.

IAS Officers Training Programme

ON

*MANAGEMENT OF ENVIRONMENT*

COURSE DIRECTOR'S REPORT:

1. Conducting a training programme for the IAS Officers at Institute is a marked departure from our usual courses which are oriented towards the scientific and the academic community. It has turned out to be a very interesting experience indeed to attempt to get across a wide range of issues on a subject of such an all embracing scope as environment to administrators with very varied backgrounds from the many different parts of our diverse country.

2. The course has primarily aimed at tracing a variety of issues relating to environment and development. This time during afternoon we had a panel discussion on various topics like;
   1. People's participation in managing the environment,
   2. Watershed development,
   3. Pollution and
   4. Forest management.

   I believe that we have been successful in treating whole range of issues in the context of environment and development. This has generated considerable awareness among the participants.

3. The faculty of the course was a mixture of administrators, academics, and gross-root workers involved in the many problems of environment. I believe that the involvement of the gross-root workers was widely appreciated by the participants. It would have been useful to have included some legal experts and political leaders as well.

4. The faculty were largely restricted to the state of Karnataka. The participants have suggested to have a wider coverage from different parts of country. However, it would be quite impossible to invite a larger number of people from other parts of the country, if the course fee is restricted to Rs. 30,000/-. The course fee provided this year is insufficient to;

   1. prepare backgound material of the training programme,

   2. providing lecture nnotes to all paarticipants,

   3. honorarium, TA/DA of the guest lecturers,

4. taxi charges for pick up/drop of participants & faculty,

5. field trip during training programme.

5. Field trip to Kabbalanala watershed project organized this time was well appreciated by all participants. The Director, Watershed development programme accompanied us and explained explained about;

(a) watershed management programme in Karnataka,

(b) treatment of water resources,

(c) soil conservation,

(d) meeting fodder requirement of the region,

(e) afforestation programme,

(f) involvement of school children and farmers in their programme and for planting khus and other seedlings,

(g) contour sowing techniques, etc.

6. The participants felt that a trip our field stations where our field research is being carried out (Sirsi, Western Ghats region and Masinagudi, Nilgiri Biosphere reserve) should have been organized and attempts would certainly be made in this direction in future. However, this would again be difficult to be managed with in the course budget of Rs. 30,000/-.

7. Other suggestions of the participants regarding the subject content and inclusion of panel discussions could easily be acted upon in any future course.

8. Panel discussions has brought together a widely divergent set of views. Presentations of panelists covering voluntary agency workers, Government agency workers, practising farmers.

9. The participants prepared group reports on their perceptions of how environmental concerns could be incorporated as a part of planning and implementation of development in the following sectors:

a) Forestry

b) Energy & Industry

c) Tribal Development

d) Urban Development

e) Water Resources

f) Rural Housing

g) Agriculture, Land use

h) Big Dams: Blessing or Damnation

i) Strategies for Eco-benign Development

j) Civic Duties & Conservation of Environment

h) Urban Forestry

Some participants have suggested that some exercies specific to different areas could be given to participants to work out solutions themselves. They preferred having group discussions on the third/fourth day instead of last day. Other suggestions of the participants regarding the subject content could easily be acted upon in any future course.

10. The level of interest and participation by the participants was very high.

## SUMMARY OF THE EVALUATION REPORTS

1. The participants felt that the course objectives have been achieved partially, and in a few cases totally.

2. The participants felt that the course was on the whole very relevant to their work/area of interest.

3. The faculty mix between academicians, practising administrators and in this case gross-root workers was considered to be very good by most participants.

4. The programme designed was felt to have good or very good conceptual framework, and good or very good coverage. The orientation to paractical problems was felt to vary between very good to fair and the training methodology was by and large considered to be good.

5. The participants benefitted from intereactions with other participants by and large to a substantial or fair degree.

6. The course material and lecture notes were perceived to be good or very good.

7. A reletively very small proportion of the sessions were thought to be rather ineffective and could be dropped.

8. The participants found a number of sessions to be very effective.

9. The extent of useful knowledge/skills acquired from the course was perceived to be fair to substantial.

10. The inclusion of panel discussions and field visits this time was well appreciated by the participants of the course. The case studies and exercises were considered to be effective or very effective.

11. The main suggestions for improving the effectiveness of the course was that we should cover material from outside of Karnataka. It was also suggested that we may have fewer lectures, more panel discussions, more case studies from the participants themselves and involve some legal experts and political leaders.

12. The accommodation and food was largely considered to be very good and the library facilities to be good.

13. Good proportion of the faculty were noted to be either effective or very effective and a minority to be ineffective. 14. 70% of participants have asked for course material one month in advance which will be looked into in the future courses, provided department of personnel and training gives list of participants (atleast 70% confirmed) and course fee at least 5 months in advance.

15. Overall 72% of the participants found the course to be very useful and 25% useful. One of the participants felt that the course was partially useful. None of them thought it to be not useful.

16. Some participants have suggested to provide a residential doctor at Hotel.

Training programme on Environmental Management

for IAS Officers

During February 12-17, 1990.

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