



REGIONAL WOOD ENERGY DEVELOPMENT PROGRAMME IN ASIA  
GCP/RAS/154/NET



# THE WOODFUEL SCENARIO AND POLICY ISSUES IN INDIA

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS  
Bangkok, April 1997

This publication is printed by  
the FAO Regional Wood Energy Development Programme in Asia,  
Bangkok, Thailand

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## FOREWORD

Woodfuels play an important role in India as they do in many other parts of Asia. Annual consumption in the country as a whole is estimated at 220–300 million tonnes, worth some nine billion US dollars, and this amount is increasing. At present, woodfuels account for 20–30 per cent of all energy used in India, and more than 90 per cent of this is in the domestic sector. However, woodfuel is more than just a commodity being consumed: it is being supplied, processed and traded. This has many implications, economically, socially, environmentally and otherwise. Furthermore, India is a vast sub-continent with widely varying geographical, agro-ecological and socio-economic conditions, and therefore aggregate data can tell us little. The complexity and heterogeneity of woodfuel-related issues in India present policy-makers with major challenges because they are associated with a range of intricate problems, particularly involving small farmers and the landless poor. At the same time, however, the potential of wood energy extends beyond subsistence, providing sound and viable options for modern development and applications. The central questions are then: to what extent and in what manner can woodfuel be subject to policy making? who should make the policies? and on whose priorities should they be based?

It is not an easy matter to address these issues. However, the FAO-RWEDP is fortunate in having a long-standing cooperation with Dr N C Saxena, an eminent social scientist and administrator with a good deal of experience in social forestry programmes, who takes a deep interest in the social and human problems at stake. Dr Saxena was in a position to give an independent overview and critical analysis of the many aspects of fuelwood, ranging from sources of supply to the people involved to end-uses. The present document gives an account of his findings.

The subject is of far more than academic importance. Initially, this material was prepared as a comprehensive briefing for the Foundation Course for All India Service Officers at the Lal Bahadur Sastri National Academy of Administration in Mussoorie, India, in which Mr Tara N Bhattarai, Wood Energy Resources Specialist at the RWEDP, has provided invaluable assistance. However, as the RWEDP believes that the same material will be of great help to other institutes and organizations in India and beyond, it is published as a field document for wider distribution.

Dr W S Hulscher,  
Chief Technical Adviser,  
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# 1. WOODFUEL AS A SOURCE OF ENERGY

Wood is a heterogeneous product. Depending on the intended use, there are different price ranges and different processing requirements. Even a single species, such as eucalyptus, can be sawn for timber or used as pulpwood, poles or fuelwood. These products are processed differently, sold by different traders, and fetch different prices, the highest being for timber and the lowest for woodfuel. Although the use of logs has increased<sup>1</sup> in recent years (Natarajan, 1996), the fuelwood used generally consists of fallen wood, smaller pieces, twigs, wood shavings, saw dust, bark and roots, which cannot be used elsewhere. Thus, fuelwood is an inferior form of wood and often a by-product. In this paper we are concerned with the use of wood as fuel, and not as a raw material for pulp, furniture etc.

The total primary energy consumption in India in 1991 was 356–425 Mtoe (million tonnes of oil equivalent<sup>2</sup>), with the share of biomass energy ranged from 36–46 per cent, as shown in Table 1. Thus, woodfuel alone accounts for a share of about 20–30 per cent of the total energy consumption in the country. More than 90 per cent of the total quantity of woodfuel used is in the domestic sector, for cooking and heating water. In addition, woodfuels are used for cremation, in hotels and small eating places, in the manufacture of household materials such as bricks, tiles and lime, and in agro-processing, such as jaggery-making and the curing of tobacco.

As regards domestic woodfuel use, Table 2 shows that woodfuel is used by all sections of rural society, but its use in urban areas has declined with higher incomes, being replaced by commercial fuels such as electricity, soft coke, kerosene and LPG. Even in urban areas, poor households are heavily dependent on woodfuel. However, unlike in rural areas, where most of

Table 1: Primary energy use in India

Fuels	Quantity	Per capita energy (GJ/yr)
Coal	217 million tonnes	7.49
Oil	53.7 million tonnes	2.71
Natural gas	17.9 billion m <sup>3</sup>	0.79
Electricity	77.8 x 10 <sup>9</sup> units	0.33
<b>Total commercial</b>		<b>11.32</b>
Fuelwood <sup>3</sup>	227–298 million tonnes	4.03–5.29
Crop residues	97–156 million tonnes	1.77–2.68
Cattle dung	37–114 million tonnes	0.60–1.85
<b>Total biomass energy</b>		<b>6.40–9.82</b>
Total energy		17.72–21.14

(Ravindranath and Hall, 1995: 15)

<sup>1</sup> This is more in areas where farm forestry produce could not be sold as pulp or poles, and therefore had to be used as firewood.

<sup>2</sup> Energy conversion: one Mt coal = 29.15 PJ; one Mt oil = 42.0 PJ; one tWh electricity = 13 GJ; one t dung = 13.7 GJ; one billion m<sup>3</sup> natural gas = 37.19 PJ; one t air dry fuelwood = 15 GJ; one t air dry crop residue = 13 GJ (Ravindranath and Hall, 1995: 15).

<sup>3</sup> There are several estimates of consumption of fuelwood, as explained in Section 4.

the fuel required is gathered, the poor in urban areas have to buy their biofuel. This is burnt in low-efficiency devices and the cost per unit of useful energy is much higher than that obtained from modern fuels. The urban poor and middle classes also use wood charcoal, the share of which in total urban fuel consumption is about 2.3 per cent. An old report (GOI, 1979) gives the annual consumption of charcoal in absolute terms as 8.6 million tonnes.

*Table 2: Fuel used by urban and rural households in different income categories in 1991-92*

*(The figures show the per cent share of each fuel in terms of useful energy)*

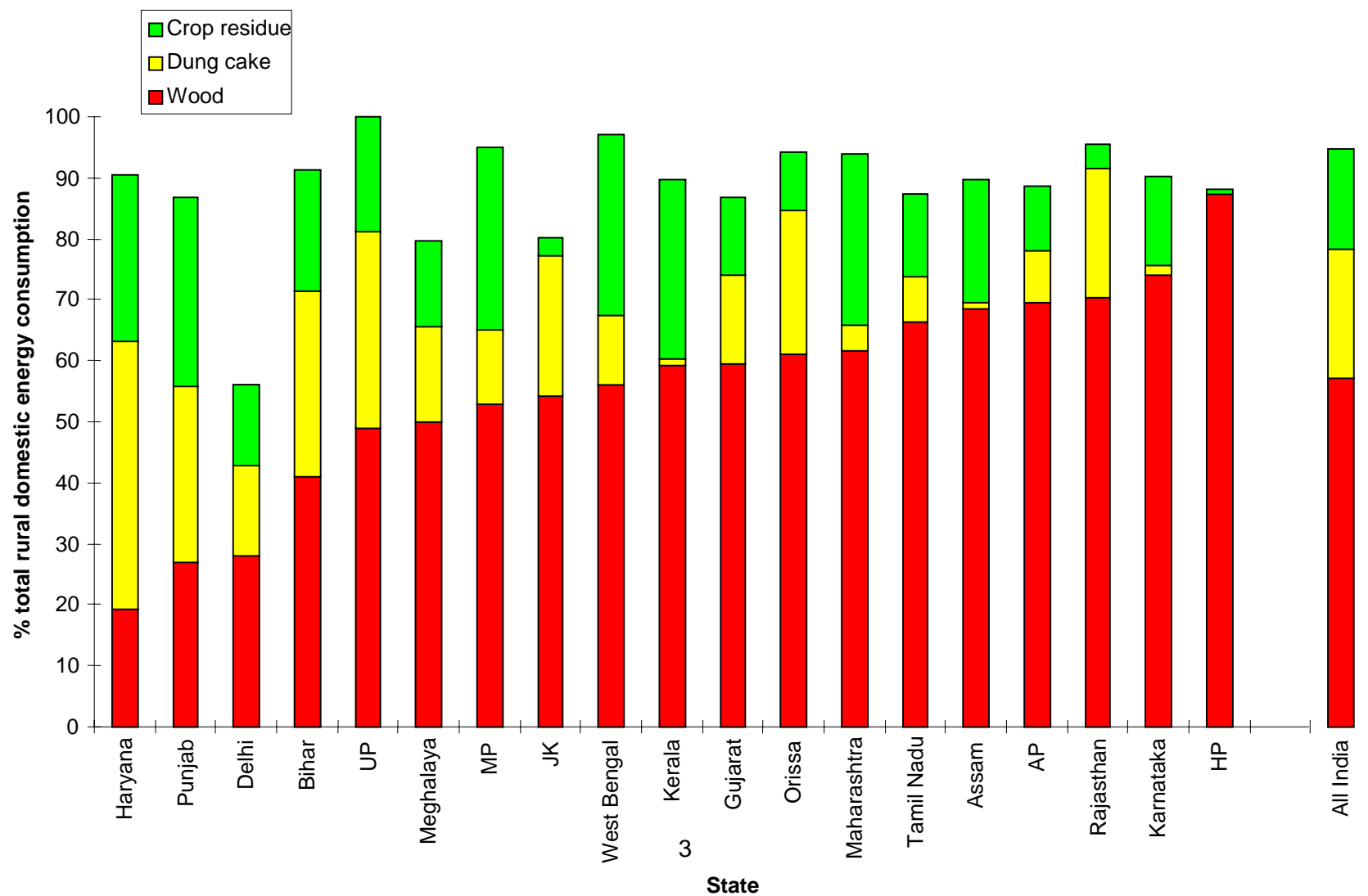
<b>Annual household income (Rupees<sup>4</sup>)</b>						
<b>Fuel</b>	<b>Up to 3,000</b>	<b>3,000– 6,000</b>	<b>6,000– 12,000</b>	<b>12,000– 18,000</b>	<b>18,000 and above</b>	<b>Average</b>
Rural						
Soft coke	1.3	1.6	4.7	4.9	7.3	2.1
Kerosene	2.7	2.6	2.3	1.8	1.8	2.6
Electricity	0.2	0.4	0.6	0.9	1.0	0.4
Firewood	60.8	59.0	56.8	53.5	49.3	59.2
Vegetable wastes	16.1	14.6	15.6	18.2	16.6	15.6
Dung cake	18.9	21.8	20.0	20.7	24.0	20.1
<b>Commercial</b>	<b>4.2</b>	<b>4.6</b>	<b>7.6</b>	<b>7.6</b>	<b>10.1</b>	<b>5.1</b>
<b>Non-commercial</b>	<b>95.8</b>	<b>95.4</b>	<b>92.4</b>	<b>92.4</b>	<b>89.9</b>	<b>94.9</b>
Urban						
Soft coke	14.9	23.6	31.1	20.0	19.8	23.2
Kerosene	19.4	23.8	19.6	17.7	14.8	21.1
Electricity	0.8	1.7	2.6	3.5	4.9	1.9
LPG	-	5.2	15.9	34.0	41.3	9.8
Firewood	54.9	37.3	22.8	16.7	13.9	35.5
Vegetable wastes	2.6	1.4	1.4	2.7	1.1	1.7
Dung cake	5.2	4.5	3.9	4.1	2.3	4.5
Charcoal	2.2	2.5	2.7	1.3	1.5	2.3
<b>Commercial</b>	<b>35.1</b>	<b>56.8</b>	<b>71.9</b>	<b>76.9</b>	<b>82.7</b>	<b>56.0</b>
<b>Non-commercial</b>	<b>64.9</b>	<b>43.2</b>	<b>28.1</b>	<b>23.5</b>	<b>17.3</b>	<b>44.0</b>

(TERI, 1996: 191)

<sup>4</sup> 34 Indian Rupees = 1 US\$ in 1996



Figure 1: Percentage share of biofuels in total domestic energy consumption in rural areas, by state



## 2. WOOD – LARGELY TRADITIONAL, BUT NOT PHASING OUT

Table 2 tells us that wood was meeting 59.2 per cent of total fuel needs in rural areas and 35.5 per cent in urban areas in 1991–92. The main non-commercial energy sources combined – woodfuel, dung and agricultural residues – met 95 per cent of fuel needs in rural areas. Of these, dung and agricultural wastes are widespread as fuels in agriculturally prosperous regions with fertile soils and controlled irrigation, such as Punjab, Haryana, UP and north Bihar, (see Figure 1), but wood continues to be the main domestic fuel in less endowed and poorer regions (NCAER, 1985).

In the past, biomass resources were virtually the only energy forms used in India, even in urban areas. This situation has changed significantly during the last 50 years. Energy-use patterns in urban areas are changing, with greater use of LPG and kerosene. In a study by NCAER in 1985, it was found that firewood consumption had declined from a level of 16.5 million tonnes in 1978–79 to about 9.5 million tonnes in 1985, despite a large increase in the urban population over the same period. During this period, fuelwood consumption dropped in urban India by 40 per cent, but kerosene and LPG consumption rose by 57 per cent and 98 per cent respectively (Natarajan, 1990). The extent to which this trend will continue is uncertain, and will depend to a large extent on government policies as regards their supply and pricing. It is unlikely that fuelwood will be completely replaced, as poorer sections of the community may lack the cash resources to purchase the minimum amount of kerosene or LPG, or appliances which use these fuels. They may also lack the security to keep such fuels or appliances while absent from their living quarters, forcing them to purchase woodfuel in more expensive small amounts on a regular, perhaps daily, basis, and use cheaper and less efficient cooking appliances.

In rural areas, there seem to be three main trends in domestic energy. One involves the increasing use of modern forms of energy for productive and household activities, including irrigation pumping and lighting. A second is that in some areas rural people, instead of switching up the energy ladder to modern fuels, are switching down it to straw, leaves and twigs. The use of inferior fuels for cooking by some rural people has implications for their quality of life. It is also possible that their general purchasing power has gone down.

The third trend is that the relative importance of the three major biofuels has changed over the years in rural areas. The animal population has grown very little in the last two decades. Also, more than one million bio-gas plants have been installed during the last 15 years. It is therefore likely that the quantity of dried dung used as fuel might not have increased significantly. With an increase in overall energy consumption, the share of this fuel might have come down. The last 15 years have also witnessed a big increase in agricultural production. This has been mainly in foodgrains. New crop varieties yield less husk and straw. Their by-products are used, for the most part, to feed animals. The yields of crops like cotton, pulses etc., whose stalks are used as fuel, have not grown much. Therefore, the share of crop wastes is also likely to be less than the pre-Green Revolution level.

This is confirmed by Table 3, which shows that between 1978–79 and 1992–93, the share of woodfuel in total energy consumption increased from 54.57 to 61.60 per cent, although the share of non-commercial fuels in rural areas went down from 94 to 92 per cent.



*How much deforestation results from her woodfuel use?*



*Animal dung: the main fuel source in some parts of India*

Table 3: Energy consumption in rural households

Item	% share in 1978–79	% share in 1992–93
Coal/soft coke	1.92	0.38
Kerosene	2.55	4.44
Dung cake	22.51	17.00
Firewood logs	18.95	32.49
Firewood twigs	35.62	29.11
Crop waste	17.41	13.35
Others	1.03	3.23

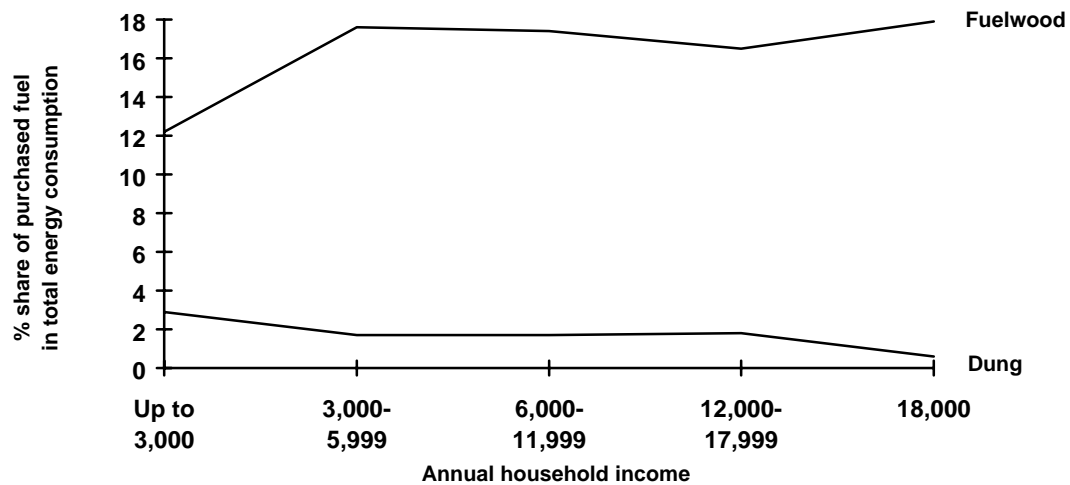
(Natarajan, 1995a)

It follows, therefore, that the share of firewood in fuel consumption must have gone up significantly. This should cause concern, for more wood means more collection, leading to an acceleration in the diminution of tree cover.

In the context of a possible improvement in poverty levels over the next 25 years, a question arises whether many rural people might prefer acquiring fuel from the market, rather than use their time and energy to collect it. This is, however, not considered likely for several reasons. First, as Figure 2 shows, the share of purchased fuels in total fuelwood and dung cake consumption presently does not change much as incomes increase. Rather, higher rates of bought firewood indicate extreme deterioration of the natural environment, and are not linked with household prosperity.

Second, the agriculture-based rural economy has slack seasons, and lends itself to seasonal peaks in gathering. Third, as wood resources increase locally (either due to implementation of government policies or natural spread of *prosopis* shrubs), time taken in fuelwood gathering

Figure 2: Per cent share of purchased fuel in total fuelwood and dung consumption, by income group



(NCAER, 1985)

and its opportunity cost will decline. Fourth, only rich farmers produce sufficient crop residues to serve as a significant fuel source. Being a private resource, the poor have little access to it, especially with the monetization of the rural economy.

Lastly, the supply of LPG is not sufficient to meet even urban demand. It is therefore not easily available to villagers. Kerosene is used in villages, but mainly for lighting. Its use as a cooking fuel is rare, and it is also not favoured for heating in villages. Since firewood is obtained almost free of cost, there is no inducement for villagers to change. Thus their dependence on fuelwood is likely to continue for a long time to come.

Referring to the high dependence of the Indian population on wood-based energy, Shah (1988) predicted that firewood would continue to be used as it is (a) the least expensive fuel; (b) consistent with cultural patterns and living habits; (c) environmentally sound; (d) easy to propagate and/or regenerate anywhere; (e) amenable to minimum intervention for production and utilization; (f) socially acceptable; (g) sustainable; (h) responsive to low inputs and low maintenance; and (i) liable to improve site and soil conditions progressively.

### 3. PEOPLE INVOLVED IN FUELWOOD COLLECTION AND USE

In most Indian rural communities, it is generally women who dominate in carrying out the time-consuming tasks of fetching water, fuel, fodder and leaf litter, in addition to performing household chores and raising children. Poverty in India is generally considered to be linked with lack of private land, or land with low productivity. Changes in gathering from public lands go largely unnoticed, and are not accounted for in GNP (CSE, 1985). However, gathering is an important economic activity for poor women. Much of the hardship suffered by women and forest dwellers in India is due to deforestation, which has removed the resource on which their livelihoods were previously based (Dasgupta, 1988: 7). In a study of the Orissa and Chattisgarh areas, which were heavily forested a few decades back, the average journey required to collect fuelwood has increased four-fold in 20 years (Fernandes and Menon, 1987: 15). The receding tree line means that only adult community members can now go to forests for wood collection. Diminished supplies force them to shift to inferior fuels such as leaves (which cause more smoke), as they must market a greater proportion of their collection of fuelwood (Fernandes et al., 1988: 116, 124).

The results of some other studies on human hours spent per week per household are summarized in Table 4 (Ravindranath and Hall, 1995). The authors estimated that at the national level, the average number of hours spent on gathering biomass was about two hours per day per household. If only 50% of rural families are assumed to be involved in this activity, the total labour spent is 50 million x 2/24 = four million man-years. Such human effort for gathering may increase with declining supply and may have important social and economic consequences for women and children, the principal gatherers. Self-employment of this magnitude is, however, distress employment, as it is at the cost of the gatherers' health and the children's education, and when it brings cash, it leads to environmental damage.

*Table 4: Human effort in gathering fuelwood for domestic use*

<b>Location</b>	<b>Human hours spent/week/household</b>
Six villages (Karnataka) (1977) <sup>a</sup>	15.1
Dhanera, 10 villages (Gujarat) (1988)	11.2
Dhanwas (Haryana) (1984)	14.3
BNPura (Orissa), (1986)	35.0

<sup>a</sup> The year given in parentheses refers to the period of study.

(Ravindranath and Hall, 1995)

A study (Agarwal and Narain, 1985: 189) of 170 households in nine villages in Ranchi district (Bihar) showed that headloading (collecting fuelwood from public lands by the poor, and then carrying it on their heads to the nearest market) had emerged as an important profession in the previous 15 years; and more than a fifth of the households in the surveyed villages reported headloading as their major occupation. Another study (Agarwal, 1987: 181) estimated that at least three to four million people were involved in this profession, making it India's biggest source of employment in the energy sector. In Rajasthan alone, 400,000 families are to be engaged in extraction of firewood from forests reported (NWDB, 1988: 15). From Madhya Pradesh forests, six million tonnes of firewood are taken out every year for sale in towns and

cities (exclusive of wood collected for domestic use). It is a low paid and a high risk occupation, as pilfering wood from reserved forests for sale is an offence (collecting wood for own consumption from protected forests is permitted on paper, but frowned upon by the forest staff in practice).

A study described the working conditions of women in South Bihar as follows:

*Every day, some 300 women firewood pickers disappear into the forests. They cut timber and greenwood, which is illegal. Sixty-eight per cent of them have been hurt either by the axe or by wild animals while collecting wood. They earn around Rs 120 a month, and half of them are always in debt. They have a two-day cycle, walking as much as 12 km to collect fuelwood and then travel by train to the town for sale – along the way, others make money off them: the railway man who allows them free on trains, the village headman who takes a cut, and the forest guard who looks the other way when forests are being axed. (Ninan, 1981)*

The vagaries of weather also worsen the hardship of collection and use of the fuels. The monsoon months are particularly troublesome in gathering of forest-based fuel. With the lashing of incessant rain and water everywhere, not only collection but also drying of wood and animal dung, usually done in the sun, becomes very difficult. The need for storing of fuel become acute and shortage of storage space in the house also makes storing difficult.

### **3.1. Traditional vs Improved *Chulha* (Cookstoves)**

The use of traditional cookstoves has wide-ranging health implications (Nanda and Khurana, 1995). Eye and lung disease caused by kitchen smoke are common, particularly among female household members, who spend long hours in close proximity to hearths. Prolonged exposure to smoke emission and soot, especially from wood, biomass and cow dung, aggravated by ill-designed hearths and stoves, lack of cooking space, improper arrangements for the release of smoke, shortage of rooms and overcrowding, cause heart ailments and chronic bronchitis. Carbon monoxide, an important constituent of woodsmoke, reduces the haemoglobin content of the blood and increases the risks of anaemia, particularly to the poor, illiterate, malnourished rural women who are the hearths' and stoves' main users. Another constituent, formaldehyde, also causes irritation of the eyes, nose and throat, damages lung tissue and exacerbates the problems of skin wounds (Sugumar, 1990).

The impact of these conditions on the life expectancy and quality of life of the women involved is severe. The danger to their physical health can be reduced through better designed stoves, and a programme to introduce improved chulhas (ICs) has seen the number of ICs installed grow from 0.8 million in 1985 to over 12 million by the end of March 1992 (Natarajan, 1995b). Against the low thermal efficiency of around eight per cent characteristic of conventional chulhas, the ICs claim to have an efficiency of between 24 and 26 per cent. Improved chulha models provide a chimney to let out smoke from the kitchen. Cleaning and cooking vessels is made easier as carbon deposits are considerably reduced. The ICs could also be inexpensive if made of local materials, so even poor households could afford them.

Yet, this programme, a decade since its initiation, has not achieved the level of success one would expect, considering the number of positive aspects. Also, a survey (Natarajan, 1995b)

showed that only 12 per cent of the working ICs could claim 16 per cent or higher thermal efficiency, whereas 50 per cent of them worked at 10 per cent or less, thus showing no saving of fuel over the traditional models. One-third of the chulhas installed became non-functional within the first year of installation. About 15 per cent of chulhas did not survive the first three months.

The main reasons cited for disuse were construction and installation defects, with the result that the ICs' performance turned out to be worse than that of the traditional chulha. Improper maintenance is another important factor for the non-functioning of the chulhas. It is recommended that the chimney should be cleaned once a fortnight to remove the carbon deposits, but this was frequently not done.

One of the reasons for this indifference on the part of the beneficiaries is that they have little or no financial stake in the chulhas installed in their houses. They do not value the asset acquired. The cost of the chulha for the beneficiary is barely Rs 10, while the market price of the chimney pipe provided along with it is more than Rs 50. Some households have opted for the chulhas only on the attraction of the subsidy in the form of pipes, iron grates etc. In a number of cases the chimney pipes have even been misused as parts for sanitary latrines, irrigation channels etc., or even sold in the open market after being removed from the chulha.

In contrast, another device propagated by the Ministry of Non-conventional Energy Sources, using bio-gas, has been accepted by the villagers and is in fact demanded by them. Though there is an element of subsidy involved, the financial commitment of the beneficiary is fairly high – over Rs 5,000 – but they are willing to pay. They are convinced of the usefulness of bio-gas, which is not true of the improved chulha. The perceived benefits associated with the ICs are not as substantial as they should be. This is down to two major problems: faulty construction and poor maintenance because of indifference. Both are to be corrected.



## 4. ESTIMATES OF DEMAND FOR FUELWOOD

Several estimates for fuelwood demand are available, but these vary so widely that a degree of agnosticism is in order. The Forest Survey of India (FSI, 1988: 46) estimated that there was a gap of 130 Mt between demand and internal production of firewood in the country in 1987. There are differences even in the figures of actual consumption estimated by different agencies. An earlier estimate (GOI, 1962) gave the consumption of fuelwood in 1960–61 as 60 Mt. This was being met with 10 Mt from recorded forest sources and 50 Mt from private and community lands and from unrecorded removal from forests. A survey in 1981 (Table 5) gave a figure of 94.5 Mt as fuelwood consumption in 1978–79. From these figures, the annual rate of growth in fuelwood consumption between 1960–61 and 1978–79 works out as 2.5 per cent, which appears reasonable. However, an NCAER survey in 1959 estimated consumption of fuelwood in 1963 as 97.2 Mt. As this would suggest that there was no increase in fuelwood consumption during the period 1963–79, which is unlikely, we think the lower figure of 60 Mt of fuelwood consumption in 1960 could be closer to reality.

There are several possible reasons for the differences in the various estimates of demand and consumption. Firstly, it is difficult to be precise about demand for an item which is mostly collected and where substitutions occur: smaller twigs and leaves can be substituted for larger sticks and logs, and where fuelwood is easily accessible and opportunity cost of rural labour remains low, fuelwood can replace other non-commercial and commercial fuels, leading to higher estimates of needs. Secondly, there are difficulties in assessing the direct and indirect impacts of various causal variables such as product price, prices of substitutes, size and location of user households, price and income elasticities of demand, and likely changes in the causal variables themselves.

Thirdly, consumption of fuelwood varies greatly with availability. It is generally a function of the cost of obtaining the fuelwood (Deweese, 1989: 1161). For instance, the annual amount of wood used in Raipur, which is surrounded by dense forests, was almost one t per household, whereas in Hyderabad, a metropolitan town, it was less than 0.5 t per household (Dunkerley et al., 1990). Variations in total consumption of cooking fuels by households and the mix of fuels used were influenced by household income, accessibility and prices of the different fuel supplies, climate, resource endowment, size of city, household fuel preferences, social characteristics, food habits and regional cooking styles.

In spite of such problems, several attempts to estimate the demand for fuelwood and other sources of household energy have been made over the last three decades. We discuss one of these in some detail and summarize the others.

The first attempt to estimate and forecast total energy consumption and sources of supply was made in 1965 by the Energy Survey Committee of India (ESCI). Data on consumption of non-commercial fuels were derived from household sample surveys in Bombay, Calcutta and Delhi conducted by the National Council of Applied Economic Research in 1958 (NCAER, 1959). The surveys estimated the average per capita domestic energy consumption to be 0.38 tonne of coal equivalent (tce) and 0.40 tce in rural and metropolitan areas respectively. Income elasticity of demand for domestic energy was estimated only for the city dwellers and was 0.4 for the group with a per capita income above Rs 300 each year. Since energy use estimates for urban areas other than the three metropolitan cities were not available, the committee assumed it to be 0.39 tce per capita. The committee also assumed that energy consumption during the

preceding decade had increased by 4.5 per cent, i.e. equivalent to the income elasticity of energy demand in the cities. To derive the figure for estimated non-commercial energy use, commercial energy consumption (for which relatively better data were available) was subtracted from the estimated total energy consumption. Within non-commercial sources, estimated contribution of fuelwood, animal dung, and agricultural residues was based on the assumption that their relative shares did not change over time.

*Table 5: Observed household consumption in 1979 (according to NCAER, 1985) and ESCI projections for 1981 (GOI, 1965). Figures Mt, except for electricity, where TWh.*

Description	Actual consumption in 1979	Projections of demand for 1981
Electricity	7.3	17.0
Soft coke	6.5	28.0
Oil products	4.2	10.2
Fuelwood	94.5	131.0
Dung cakes	71.1	63.0
Agri-residues	30.6	62.0

(Gupta and Ahuja, 1992)

A comparison of columns 2 and 3 of Table 5 shows that the ESCI demand forecasts were not validated, as the 1979 actual consumption figures were substantially below those projected for 1981. At the same time, animal dung's observed use in 1979 was significantly higher than the estimate for 1981. This may mean that dung continued to be a preferred source of household energy due to its inherent characteristics, such as slow burning, its relatively certain supplies, and the perception of dung work as an integral part of normal household chores, even in land-owning families in rural India.

In addition to the above, demand forecasts for fuelwood were made in several other studies, such as those by the ESCI (GOI, 1965), the NCAER (1985), the Fuel Policy Committee (GOI, 1974), the National Commission on Agriculture (GOI, 1976), the Working Group on Energy Policy of the Planning Commission (GOI, 1979), and the Advisory Board on Energy (ABE, 1985). Table 6 presents a summary of their forecasts as regards likely fuelwood consumption for different years.

*Table 6: Demand forecasts for fuelwood in Mt (one Mt fuelwood = 0.95 Mtce)*

Studies	1971	1976	1981	1983	1991	1993	2000	2005
ESCI	121	130	131	-	-	-	-	-
NCAER	-	70	-	-	-	-	-	-
FPC	-	-	132	131	122	-	-	-
NCA	105	116	129	141	-	-	158	-
WGEP	-	-	-	140	138	131	97	-
ABE	-	-	-	-	-	-	-	300-330

Not only for fuelwood, but for other biofuels too, the estimates of consumption vary a great deal, as is shown below:

Table 7: Estimates of biofuel consumption in rural households in million tonnes/annum

Surveying agency	Years of survey	Fuelwood	Dung cake	Crop residues
NCAER	1978–79	93.3	83.2	36.7
REDB	1985–92	181–309	40–115	32–166
IREP	1990–91	169.0	54.2	62.8

(TERI, 1995: 56)

As for future consumption, estimates for 2000 vary from 97 Mt by the WGEP to 300–330 Mt by the ABE. As already stated, the demand projections of these studies for future years have often not been matched by the figures of actual consumption in those years, and the predicted demand has been found exaggerated, often by a factor of two to four, compared with actual consumption. This suggests that the methodology for estimating demand followed in these studies perhaps requires some critical scrutiny. Firstly, the term *demand* should be clearly defined and distinguished from needs and requirements. It would be more precise to use the term *consumption*. Secondly, discussion of quantification of demand should take into account prevailing or anticipated prices – the present estimation process makes no reference to prices. Under normal market conditions, where price is not controlled, there should not be any difference between demand and supply, as the price level adjusts itself to ensure that whatever is demanded is supplied at a price which covers the full cost of production. The situation where a difference exists between supply and demand will exist generally when the price is controlled by government or is depressed due to gathering, such that the supply takes place at a price which does not cover the cost of replacement.

Thirdly, fuelwood markets, which have not received the attention of researchers so far, may have a great influence in shaping demand. To the extent that markets integrate producers with consumers, they facilitate commodity production, as producers allocate their resources on the basis of signals they receive from markets. Thus the demand is communicated to the producers (and gatherers) through the medium of markets. If market conditions are changed, demand for the product will change, even if other conditions remain undisturbed. Thus demand, and even supply, is influenced by the nature of markets, and quantification of demand cannot be done in isolation from market factors. Market conditions for wood are highly distorted due to government policies, as discussed in Sections 10 and 11. The experience of a glut of eucalyptus wood in several north Indian markets when shortages existed elsewhere shows that the gap between supply and demand cannot be bridged by simply enhancing production; other constraints may be equally relevant. Hence the importance of discussing both demand and supply in the context of prices and market conditions – in isolation, the terms *demand* and *supply* may signify little.

## 5. PRICES

The price of fuelwood rose fast during 1975–85, as shown below:

*Table 8: Retail price of firewood in rural India*

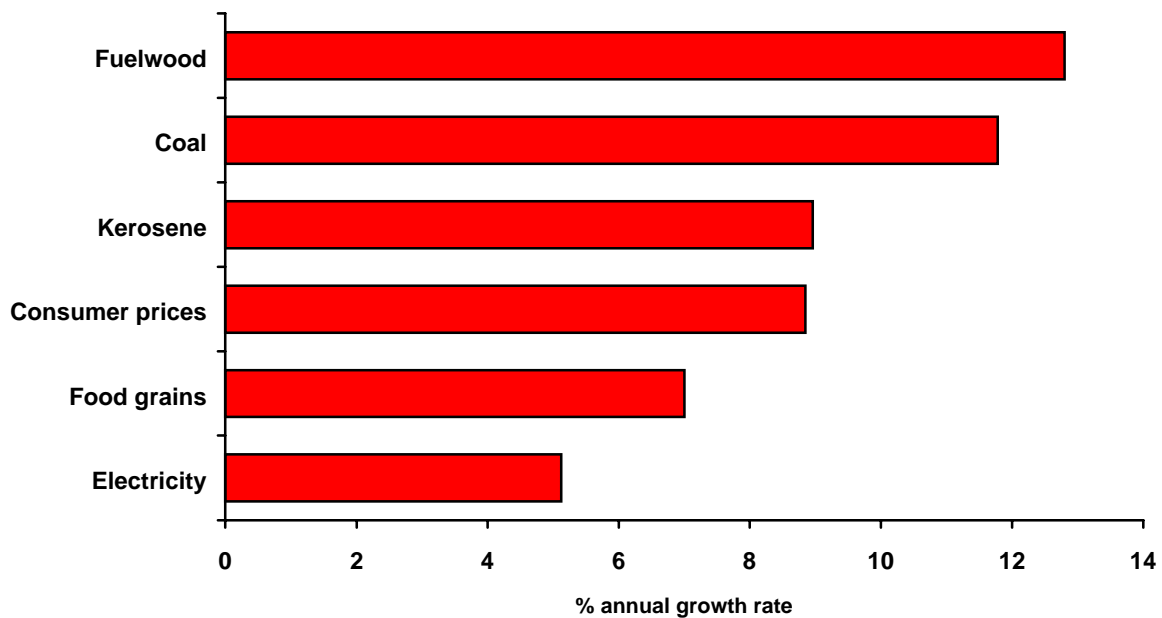
Year	All India average retail price of firewood Rs/tonne	All India wholesale price index (1970–71 = 100)	Firewood prices Rs/tonne at constant (1970–71) prices
1973	91	140	65
1978	182	185	98
1985	438	350	125

(UNDP, 1986: 113)

Thus, during the period 1973–85, firewood prices almost doubled at constant prices. According to Leach (1987), the real price of fuelwood increased by 34 per cent in 10 major cities of India during 1970–82, but another study of 41 towns showed a 50 per cent increase during 1977–86 (Bowonder et al., 1988). The same study compared the movement of fuelwood prices with those of other commodities over the years, as shown in Figure 3.

Thus, fuelwood experienced the highest annual rise in prices in 1972–86, 85 per cent higher than the rises for wheat and rice.

*Figure 3: Annual rates of growth (%) in prices between 1972 and 1986*



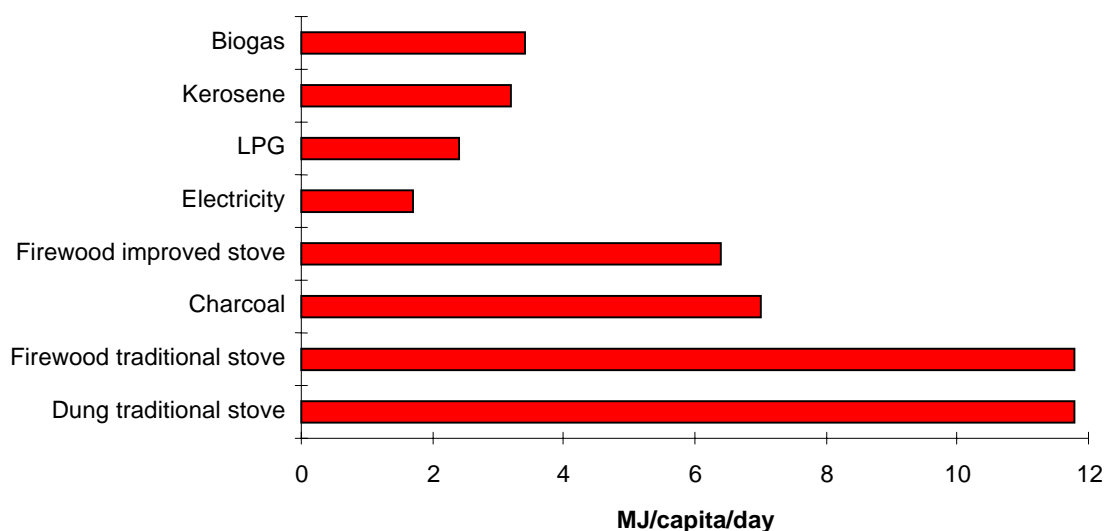
## Inter-city variation in prices

Bowonder's study (1988) quoted above also indicates that in 1986 the price of fuelwood was more than Rs 600 per tonne in all centres with more than one million inhabitants and more than Rs 900 per tonne in all centres with more than five million inhabitants. This shows that the size of an urban centre is a major variable in determining the fuelwood price, quite apart from the extent of forest area in the vicinity. The proportion of the population using fuelwood is higher in larger cities, since the proportion of population living in squatter settlements (low income) is also higher (Von Oppen, 1979; Agarwal and Narain, 1985, Bowonder et al., 1986). In India there has been a sharp rise in the number of people living in squatter settlements – estimates indicate that around 30 per cent of India's urban population live in them. In other words, the issues of fuelwood use in urban centres are intricately connected to poverty, low income, unemployment and frequency and number of days of work, cash in hand, and rural migration.

The relative increase in price of fuelwood should have implications for inter-fuel substitutions. In reality, despite the consumers using fuelwood paying more per unit of energy delivered (net energy consumed) they do not shift to other cheaper fuels. In 1960 and 1977 the cost of unit energy for kerosene and fuelwood were similar. In 1987 the consumer had to pay twice as much per GJ of useful energy for fuelwood as for kerosene. Fuelwood is costlier since the efficiency of burning is of the order of seven to 10 per cent (Gellar, 1983; Gupta, Rao and Prema, 1983), whereas a kerosene-burning stove has an efficiency of 30 to 40 per cent. In Delhi, the consumer has to pay four times more to get one unit of useful energy from fuelwood than from kerosene.

In the case of cooking, which is one of the chief energy-using activities, the primary energy required to cook a given quantity of meal declines significantly with a shift from traditional to modern fuels by a factor of four (Figure 4), according to differences in the efficiencies of the devices.

Figure 4: Energy required for cooking a meal in South India in MJ/capita



(Ravindranath and Hall, 1995)

Thus the poor not only use more expensive form of wood, but they use it less efficiently. This is due to a number of factors: (i) poorer sections of the population consider fuelwood to be a cheaper fuel; (ii) in a fuelwood-burning stove, it is possible to use other biomass fuels and agricultural wastes, and this is done by many poorer income groups; (iii) fuelwood stoves are very inexpensive and kerosene stoves cost almost 10 times more (the capital market is very flawed for poorer sections of society); (iv) kerosene is an item which is controlled by the government and the maximum quantity sold to one household is not enough to manage both cooking and lighting; (v) those residing in temporary squatter settlements prefer not to invest in items that have to be taken with them when they move to another settlement, (vi) a large proportion of the poor, who live in unauthorized slums, cannot claim even these inadequate supplies since they are unable to get ration cards that grant them access to the public distribution system; and (vii) real cost in terms of the number of visits required to government-authorized shops, the waiting period and its opportunity cost may be much higher.

Fuelwood prices are monitored by the Labour Bureau, Shimla. According to their records, fuelwood prices in some of the major towns of India remained almost constant during the period 1985–90 (see Saxena, 1995, for district-wise changes in fuelwood prices). Despite the fact that degradation of forest lands has continued unabated, and social forestry on community lands has not been a viable programme, fuelwood prices in India after 1985 have not gone up for two reasons. First, farmers in the commercialized and surplus regions of India produced a great deal of eucalyptus wood, which had to be sold as fuelwood, being surplus to the need for poles and pulpwood. Second, the greatest potential for supply of fuelwood at little opportunity cost is through shrubs. These positive developments, though unconnected with government policies, still leave out a large proportion of rural population for whom fuelwood is scarce.

As a consequence, to speak of a 'fuelwood problem' in India is somewhat misleading. Land production capabilities and access to biomass vary from region to region and this has an impact on whether energy for cooking is a problem for people in the rural areas. One way to classify regions with respect to fuelwood availability could be:

- Regions with proximity to forests;
- Fertile and irrigated cultivated land;
- Areas with access to shrubs;
- Areas where farm forestry has been successful; and
- Areas where dung must be returned to fields to maintain productivity;

Although empirical data on each of these regions is sadly lacking, one could hypothesize on the basis of field experience that fuelwood is an acute problem more in the last type of region, which may cover roughly half of India's geographical area. In forest regions, the issue is not of physical scarcity but of lack of income, which drives the poor to do headloading. In regions two and four, there would be a class dimension too, that is, the poor and landless may face shortages, even when it is not an issue for the surplus farmers.

Even if the poor have land, their immediate preoccupation is the need for quick solutions to desperate food and income deficits (Cecelski, 1987), and they cannot be expected to use their

lands for the production of fuelwood. Thus the earlier social forestry projects, in focusing only on fuelwood, proved insufficient in defining what was needed at the project level.

Probably the most seriously affected region in India from the point of view of demand for fuelwood and fodder is the Deccan Plateau. In this dry region with little ground water, people have used up most of the woody materials either for construction or fuels, and they are dependent on straw and dung as fuels. Typically these regions have poor agricultural production, which may be partially caused by not returning the straw and dung to the field. These regions deserve top priority in fuelwood production schemes.



*Prosopis juliflora: Nature's gift to the poor and landless?*

## 6. SOURCES OF SUPPLY

Fuelwood is generally gathered by rural people on both public and private lands. The share of each source of fuelwood supply at the consuming point in 1978–79, based on an NCAER survey (1985), is shown in Table 9.

A more recent survey of the primary sources of woodfuel shows that the total consumption of wood in 1991 was 172.5 million tonnes, as shown in Table 10.

Table 9: Sources of supply of firewood in India in 1978–79 in Mt per year

	Rural			Urban			Grand total
	Logs	Twigs	Total	Logs	Twigs	Total	
<b>Collected from</b>							
i. Own land	5.2	9.1	14.3				14.3
ii. Neighbour's land	0.3	3.0	3.3				3.3
iii. Forest land	4.6	18.9	23.5				23.5
iv. Roadsides etc.	1.3	24.4	25.7	0.4	1.6	2.0	27.7
<b>Total collected</b>	<b>11.4</b>	<b>55.4</b>	<b>66.8</b>	<b>0.4</b>	<b>1.6</b>	<b>2.0</b>	<b>68.8</b>
Purchased	8.7	3.3	12.0	11.1	2.6	13.7	25.7
<b>Total</b>	<b>20.1</b>	<b>58.7</b>	<b>78.8</b>	<b>11.5</b>	<b>4.2</b>	<b>15.7</b>	<b>94.5</b>

(Leach, 1987)

Table 10: Sources of supply of woodfuels in 1991 in India

Source	Details	Total Fuelwood Contribution in Million Tonnes/Year
Forests	Felling of trees	19.0
	Lopping of twigs and branches	42.0
	Logging wastes	9.5
Shrubs on degraded lands and roadsides		46.0
Tree planting on 17 million hectares during 1975–90 through social and farm forestry programmes	tops, twigs, small branches and poles	40.0
Homestead gardens	twigs and branches	16.0
<b>Total</b>		<b>172.5</b>

(Ravindranath and Hall, 1995)



These two tables show that a good deal of fuelwood is still gathered and then consumed by the gatherer, and thus fuelwood continues to be by and large a non-monetized commodity. Even when firewood is traded, studies show that rural wood markets are small, localized and lack capital and hence buying capacity (FAO, 1987). The fuelwood supplied to these markets comes from farmers' produce as well as from head-loaders, bullock carts and merchants who buy wood from forest auctions. The fact that fuelwood markets supply just 25 per cent of the total fuelwood which is consumed has two implications for the production of fuelwood as a farm crop. First, gatherers can always undercut producers in the pricing of fuelwood; the producers would be price-takers, rather than price-makers. Second, the market price of fuelwood would always be lower than its social cost for replacement of growing stock through investments in plantations. These considerations make production of wood by farmers for fuelwood markets a non-viable proposition. These considerations indicate that the fuelwood gaps can be met only through such trees on public lands which produce a lot of twigs and branches that can be gathered, and not through commercial production on farm lands. In fact French (1985) has argued that in developing societies with plenty of open public lands and poverty, producers will have no incentive to produce wood on farm lands in view of depressed prices of wood due to gathering.

## 6.1. Supply of Wood from Farm Lands

The above two tables also show that non-forest lands are a significant source of fuelwood. Production of fuelwood from farm lands can be considered under two heads: from traditional agroforestry and homegardens models, and from the new activity of farm forestry which was initiated in the late 1970s.

### Traditional agroforestry patterns

Trees are protected, planted and managed on farm lands in India in a variety of situations. In Kerala, a region of high rainfall and good soils, farmers plant trees on homesteads and on farms to maximize overall returns from land. In arid western Rajasthan, farmers protect *khejri* (*Prosopis cineraria*) and *bordi* (*Zizyphus* spp.) trees to increase soil productivity and land sustainability. These trees recycle nutrients and provide both fodder for cattle and mulch and shade for crops, and thus complement farm production. In the hills, trees are maintained on farm boundaries for subsistence products, like fodder and fuelwood. Casuarina plantations for urban fuelwood have been a part of the rural landscape in southern coastal India for more than a century now (Hill, 1982: 159).

In addition to the three well known patterns above, there are scattered studies from other regions describing the nature of tree-crop interaction on farm lands. *Prosopis juliflora* occurs widely on all wastelands of Tamil Nadu, but in Ramanathapuram, where rainfall is confined to the north-east monsoon and substantial saline patches occur, prosopis is used to reclaim fallow lands. These are allowed on farmlands for four years, after which an annual crop is taken for two years, and again prosopis is allowed to invade the field. It is also used for making charcoal, and it is estimated that 15,000 tonnes of charcoal are transported annually from Ramanathapuram to Madras.



*A poplar plantation under agroforestry*



*Woodfuel for the poor*

## Farm forestry

Due to the popularity of growing trees on farm lands, with a view to earning income or avoiding the supervision problems associated with irrigated agriculture, the availability of fuelwood has considerably increased in certain regions of India. The shares of total collected firewood represented by the different sources of collection have also undergone a change due to higher production of wood on farms, as shown in Table 11. In 1978–79, own farms and nearby forests were the two major sources, each contributing to one-third of the total collection.

On the other hand, nearly half of the households collected wood from their own farms in 1992–93. The share originating from forests shrank to half of the 1978–79 figure, mainly because of the legislation enacted by the state governments banning the felling of trees in forests in many parts of India.

Table 11: Major source of collection of firewood (percentage of households)

Items	1978–79	1992–93
Own farm	35.14	48.50
Roadside bushes and trees	23.90	29.80
Forests	35.42	17.00
Others	5.54	4.70
<b>Total</b>	<b>100.00</b>	<b>100.00</b>

(Natarajan, 1996)

## 6.2. Fuelwood from Non-forest Public Lands

Village commons, roadsides, tank foreshores and other such open access lands are the traditional sites for collecting fuelwood among rural people. Often these degraded lands offer only woody shrubs, such as prosopis (*Prosopis juliflora*) and lantana (*Lantana camara*). These are not favoured species, because of the presence of thorns in the case of prosopis and low density in the case of lantana. Yet the absence of commercial interest in these species helps the poor in their access to such shrubs. In many semi-arid regions the natural spread of prosopis shrubs provides excellent fuelwood for both consumption and sale at almost zero opportunity costs to the poor. According to a field study (Ravindranath and Hall, 1995) in five villages of the semi-arid district of Anantpur (Andhra Pradesh) 86 per cent of households met more than 75 per cent of their cooking needs from prosopis alone. Here gathering of fuelwood from degraded public lands has become a cottage industry, as much of it goes to the nearby metropolitan town, Bangalore. As much as 10 per cent of the local population gets employment from this activity (Agarwala, 1990: 197).

Some of the positive features of prosopis from the point of view of its use as fuel are hardiness, wide adaptability to various types of problematic soils, its self-productive mechanism, profuse seeding, self-dissemination and propagation, high calorific value, charcoal, non-browsability by cattle and goats, nitrogen fixing qualities, resistance to prolonged periods of droughts, and coppicing capacity (Verma, 1987).

### 6.3. Problems in Gathering Fuelwood from Forest Lands

Despite forest policy being timber-oriented, forest lands during the colonial phase provided twigs and branches as fuel to the people, and with adequate supplies from forests it was possible to satisfy the market demand as well as meet the people's demand. There is however evidence to show that people's access to forests for meeting their basic subsistence needs has deteriorated, and that this is fairly widespread (Chambers et al., 1989). Some of the processes which have caused this are:

- Deforestation;
- Priority being given to man-made plantations in place of mixed species;
- People's lack of awareness about their rights and privileges.

Forests are subject to intense pressure from human beings, livestock and urban markets. FD officials argue that since commercial and industrial requirements are low as a proportion of the total demand for wood, at less than 20 per cent (World Bank, 1988a: 26), people's demands put an unbearable burden on forests (Shyam Sundar, 1993). The almost continual lopping for fuelwood and/or fodder as well as cattle and goat browsing that occur in many areas and prevent adequate regeneration must play a major role in forest destruction (Blockhus et al., 1992: 31).

On the other hand it is argued that giving industries priority and subsidized supplies has reduced availability for the people and resulted in their further alienation from the forests, turning them into an open access resource. Often the two processes of industrial extraction and use by the people follow each other. The selective logging of a few large trees creates openings in the crown cover leading to better grass production, which invites cattle and goats. Their browsing makes regeneration difficult, and then the area is invaded by exotic, non-palatable weed species.

Some authors (Bowonder et al., 1986; 1988) make a distinction between use of fuelwood by rural people, which is largely twigs and branches and hence potentially sustainable, and by urban sector. The greater use of logs and larger branches in the towns means that fair sized trees are sought after and cut, possibly in large patches, thus having a more degrading effect on the forest than may be the case with cutting for village needs, which can be met more often from pruning or pollarding the branches of trees or even bushes in a limited area. Thus collection of fuelwood for sale in urban areas is the cause of much destruction and degradation of forests.

#### **Industrial plantations**

While the adverse effect of deforestation on local economies is well understood, the impact of industrial plantations is not so well documented. Plantations are usually of single species, equally entailing loss of diversity and of access, are often on a large scale, and in practice hardly pursue an objective of benefiting the local people, beyond providing wages<sup>5</sup>.

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<sup>5</sup> Even wage employment becomes insignificant after the first year of plantation.

A plantation offers little of the product range of the old forests. In Ganjam district (Orissa), it was noticed by the author in 1991 that due to the small area of the village woodlots, unlikely to satisfy the fuelwood needs of the village, people continued to depend on nearby forest areas, which were, however, being used by the Forest Corporation for timber and cash crops like teak and cashew, thereby depleting the availability of fuelwood which could be gathered by the people. Popular pressure, however, endangered the success of commercial plantations. It was ironic that millions of Rupees were being spent to create new fuelwood resources through small woodlots, while the existing much larger potential fuelwood areas on forest lands were being diverted for non-fuelwood commercial plantations. It would have been cheaper to rehabilitate the existing forests for the purpose of meeting people's demands. Unless creation of woodlots and rehabilitation of nearby forests were both undertaken in an integrated manner with the specific objective of satisfying people's needs, the long-term viability of village woodlots was in doubt.

### **Rights and privileges**

Rights and access which the people, especially tribals, earlier enjoyed, remain uncurtailed on paper, but people are far from fully informed about what they can legally collect from forests, and what is prohibited. There has hardly been any attempt by the FD to publicize peoples rights; partly due to the fear that it would aggravate degradation, and partly due to the administrative culture of the FD of keeping the people in dark. It suits traders and petty officials if tribals are not aware that they are entitled to collect fuelwood. Uncertainty about rights alienates the people from forest lands, and inhibits their participation in joint management.

## **6.4. Estimated Supply Potential**

In addition to the existing production of 172.5 Mt of fuelwood, there is immense potential for increasing production of fuelwood by afforestation of degraded lands. In some cases, such as farm lands, fuelwood would perhaps be a by-product. The area where additional trees can be planted without adversely affecting agricultural production fall into four categories:

### *Cultivated lands*

The area available for agro-forestry and growing trees on cultivated lands is difficult to estimate. All, or almost all, cultivated land can grow trees, and private tree planting depends on many factors, such as complementarity with agriculture and opportunity costs of land and labour. Degraded lands can give a lower boundary to any estimate, since on degraded lands trees usually have the clearest advantages compared with other land uses. Bhumbra and Khare (SPWD, 1984) estimated net sown land subject to wind and water erosion to be 38 million hectares (m ha). Any figure is bound to be highly speculative, but we take the additional potential of agroforestry on one third of the total degraded area, i.e. 13 m ha.

### *Strip lands*

These include farm bunds and boundaries, roads, railway lines, canals and drains. The Fuelwood Committee (Planning Commission, 1982) estimated the potentials of these as follows: 60 of the 142 m ha of cultivated land presented scope for planting along bunds and boundaries (which, at two per cent of the area, would amount to 1.2 m ha); and 1,224,000 km of roads, 60,000 km of railway lines, 150,000 km of canals and 20,000 km of drains also

provided suitable strips, amounting to 0.9 m ha. The total strip land available was therefore in the order of two m ha.

### *Degraded forest lands*

The Forest Survey of India (FSI, 1993) has estimated that almost half of the forest area has a crown density of less than 40 per cent. The National Wastelands Development Board's estimate that 36 m ha out of the total of 67 m ha of forest land are degraded (NWDB,1988: 26) and are therefore capable of growing additional trees which can provide fuelwood.

### *Uncultivated degraded land*

Land statistics are well developed for cultivated and forest lands, but not for non-forest and non-cultivated lands (Romm, 1981). Information needed for assessing their potential, like ownership, extent and type of degradation, and present and possible future uses, has never been collected on a systematic basis for the entire country. Elsewhere the author has estimated that of the 55 m ha of the non-forest and non-cultivated degraded land, 33 m ha can be used for growing trees (Chambers et al., 1989).

Thus the total availability of land in India where afforestation could be taken up is about 84 m ha. Its ownership is shown in Table 12.

Assuming a low productivity of two Mt per ha per year of fuelwood (besides poles and timber etc.) it would lead to additional production of 168 Mt, thus almost doubling the total availability from 172.5 Mt to 340.5 Mt, besides creating decentralized employment for the poorest.

Why has this biological potential not been achieved? What have been the main constraints in afforestation of the three categories of lands? This is briefly discussed in the next section.

*Table 12 : Ownership of degraded land available for tree growing (m ha)*

<b>Category of cultivable land</b>	<b>Total area</b>	<b>Available for trees (for new plantation)</b>	<b>Private</b>	<b>Forest Dept</b>	<b>Revenue/ other depts</b>
Cultivated	142	13	13	-	-
Forest	67	36	-	36	-
Uncultivated/ non-forest	55	33	21	-	12
Strips	Included in the above	2	1	-	1
<b>Total</b>	<b>264</b>	<b>84</b>	<b>35</b>	<b>36</b>	<b>13</b>

(Chambers et al.,1989)

## 7. GOVERNMENT PROGRAMMES IN THE LAST TWO DECADES

Fuelwood plantations on village and farm lands were undertaken as a result of the report of the National Commission on Agriculture (GOI, 1976), which recommended growing trees to meet subsistence needs on lands accessible to village people. In terms of sheer plantation of new trees, the Social Forestry programme has been immensely successful. Between 1980 and 1987, the government claims to have raised 18,865 million trees (Chambers et al., 1989). Even in the post-1990 period, about two m ha is claimed to be afforested annually through government efforts (Kapur, 1991). This is by any standards an impressive achievement, and is reflected in the steep fall in the price of poles and stabilization in the price of fuelwood after 1985 in some regions of India (World Bank, 1990).

However, this success was due to the popularity of farm forestry in commercial regions. Tree planting on village lands, with some exceptions, failed to meet the people of the villages' fuelwood requirements. The shortcomings in the way the programme was conceptualized and implemented led to marked divergence between the stated objectives of Social Forestry and the actual outcomes. Briefly these shortcomings were:

- Local people were not involved, leading to high tree mortality;
- Village *panchayats* (local elected councils) perceived the woodlots as sources of communal income, rather than as sources of fuelwood to meet village needs. The nature of species was also such that it tempted the panchayats to sell in the markets, rather than distribute in the villages;
- Panchayats could not enforce the discipline required for managing plantations;
- Projects were designed around the ultimate felling of the planted trees, but degradation often set in after the trees were harvested;
- The targeted area under village lands could not be made available for afforestation because of encroachment, competition from other departments, competition from grazing and other existing local uses and poor productivity;
- There was no continuity in the management and control of thousands of scattered pieces of planted village lands, creating enormous problems of protection;
- Projects failed to define, establish and publicize rights to the trees and the procedures for marketing and allocating benefits. The shares which would go to individuals, villages, panchayats and the Forest Department were not clearly laid down. Insecurity about benefits led to indifference on behalf of the people.

### **Wood from farm forestry**

The salient features of the farm forestry programme (USAID, 1988; World Bank, 1990; SIDA, 1990, Saxena, 1993) are:

- More trees were planted in commercialized and surplus-producing agrarian regions than in subsistence-oriented eastern states, despite the fact that rainfall and soil conditions were more favourable to trees in the east rather than in the low rainfall (but irrigated) north-west.
- Eucalyptus was the most favoured tree with the farmers, as it grew straight, had a small crown and thus allowed more trees to be planted per unit of area, and caused little shading when planted on field boundaries. It did not attract birds, was non-browsable – making it easy to protect – and yielded straight poles which were perceived to have a good market. Eucalyptus accounted for 71.6 per cent of all seedlings distributed under farm forestry (IIPO, 1992).
- Eucalyptus was planted more for sale as small timber, poles or pulpwood than for use as fuelwood, although because of glut conditions it was often sold as fuel to brick kilns and fuelwood depots.

And finally, farmers' enthusiasm to plant eucalyptus declined after 1988, as the tree failed to generate the kind of returns farmers were expecting. The disenchantment stemmed from the poor quality of produce from the eucalyptus, good enough only for fuelwood; the lack of sufficient demand for poles and resulting steep decline in prices; the loss of agricultural production due to plantation of the trees; and problems in marketing. Even when the trees gained girth, timber from eucalyptus was found to be far inferior in quality and durability to other timbers, and hence fetched a low price.

Much of the eucalyptus wood is now being sold as fuelwood at less than the expected price. As fuelwood, the farmers' produce competes with wood supplies from government, and with coal and petroleum products. These commodities have administered prices, and in relation to fuelwood, the price of kerosene declined by 17 per cent, and of LPG gas by 100 per cent during 1970–84 in India (derived from prices quoted in Leach, 1987). It also competes with supplies of fuelwood brought to the market by gatherers from public lands. In forest areas, fuelwood is sold from forest depots at a subsidized rate. Because of this competition, fuelwood prices have remained low since 1985. Thus farmers could not get the expected price for their output, and further planting declined after 1988.

Subsidies exist not only for pulpwood supply to industries, but also for supply of fuelwood from government forests, thus reducing incentives for farmers to produce fuelwood. For instance, fuelwood markets and marketing in Orissa are quite complex. A three-tiered price system exists – the heavily subsidized price applicable to rural people for their own use, the administered price paid and charged by the Orissa Forest Corporation, and the free market price. The situation is complicated further by a multiple supply system: headloaders, merchants, contractors and the Corporation.

One effect of the subsidized prices is to create a very low-cost source of potential fuelwood, priced at well below the cost of replacement of growing stock through investment in plantations. As long as this source is available, growers are unlikely to be able to sell their trees as fuelwood to middlemen, at a price that would be commensurate with the costs they have incurred.

The low value of fuelwood also means that in most situations it is likely to be a less profitable crop for farmers than the growing of trees for sale of poles, construction timber, and fruit (Deweese, 1989). It is likely that fuelwood production will be profitable only in a few special



situations – for example, on the agriculturally marginal sandy soils of the coast, close to markets; or when the farmers can themselves sell directly to markets, so benefiting from the much higher prices for the new product as compared with the price for the tree.

## **7.1. Fuelwood from Forest Lands**

As regards the area of public lands available for planting of trees, Table 12 shows that as compared to only 12 m ha of village lands there is three times this area of degraded forest lands. Hence the main responsibility of meeting fuelwood needs has to come from forest lands. There is plenty of sunshine, and adequate rainfall in most part of the country, due to which trees can grow fairly fast. There are sufficient funds for the forestry sector, at least since 1980, thanks to assistance from multilateral and bilateral donor agencies. Notwithstanding failures, funding for this sector has continued on a liberal scale.

Fund availability for forest lands had become quite precarious during the Social Forestry phase. As state funds have been locked into meeting the matching contributions required for external assistance for projects on non-forest lands, forest lands got starved of funds, with several adverse effects. The neglect of forest lands hurt forest dwellers and tribals, and they had to travel even greater distances to collect fuelwood. It reduced timber supplies to the markets, resulting in price escalation, which further increased smuggling from forest lands. Price increases for both timber and fuelwood have been highest during the period 1975–85, as compared to either before 1975 or after 1985.

The favourable biological potential and availability of financial support is buttressed by a change after 1988 in the policy framework governing the management of forest lands, which is more conducive to sustained development of woodfuel resources than the previous policies. According to the new policy, the requirements, in terms of fuelwood, fodder and small timber, of the tribals and other villagers living in and near the forest are now to be treated as first charge on forest produce. Equity and environmental considerations will be given more weight than mere earning of revenues.

Therefore social forestry in India should be extended to reserved and protected forest lands by changing the nature of species from teak, eucalyptus and pine to usufruct and fuelwood species. These should be supplemented with shrubs and bushes to yield fuelwood and fodder in the shortest possible time. This would strengthen access of the poor and women to forests if species suitable for individual gathering by households were planted, and benefits would go directly to the poor.

An area of confusion in relation to forest lands has been as to what constitutes fuelwood species. There are two different perspectives. For the foresters, fuelwood is obtained by felling trees which have a high calorific value, or as lops and tops from timber trees. Casuarina and eucalyptus, therefore, seem perfectly justifiable species on public lands. However, the poor generally obtain their fuelwood from the twigs and branches of living trees, not by felling trees, and in reality often get little from the felling of so-called fuelwood trees. Casuarina and eucalyptus may be justified on farm lands if they improve farm incomes on a sustainable basis. But raising them on public lands hardly benefits the poor.

Thus there would be a world of difference between the plantation of eucalyptus and of prosopis on roadsides: eucalyptus really benefits urban markets and industry, whereas prosopis can not

only solve the fuelwood problems of poor families, but can also generate self employment for the poor. *Prosopis* is a neglected tree in conventional forestry. Although the Forest Department ignores it in social forestry projects, it grows naturally on degraded soil. Field studies made by the author in dry areas with low employment opportunities in the slack season, like Anantpur in Andhra Pradesh (CIDA, 1988) and Mathura in UP (Saxena, 1989), show that *prosopis* has on its own solved the fuelwood crisis, besides providing employment to many who prune the branches and sell them in urban areas.

A study shows that its yield on degraded soils in Bhavnagar was as high as three tonnes per ha per year (Patel, 1987). *Prosopis* produces double the biomass that eucalyptus does on similar soils (Banerjee, 1986), and yet is considered by the Forest Department to be a low-value tree. In the Central Board of Forestry papers (GOI, 1987) it has unfortunately been described as a weed. One may recall that bamboo was also described as a weed until the first two decades of this century, when its use in the paper industry was discovered, leading to bamboo cultivation on a large scale.

Another way of looking at the issue of afforestation on forest lands is to opt for species which have high proportions of branches and twigs relative to stem wood. Given the inefficiency of administration and the 'soft' character of the political system, one could generalize that from a typical tree, the stem goes to the rich and the towns, while the branches and twigs belong to the poor. The proportions of stem wood and branches calculated for some trees are presented in Table 13.

The table indicates the superiority of *prosopis* to eucalyptus on the grounds of both equity and of potential biomass per ha. But despite the Government of India's clear instructions to discourage eucalyptus on public lands, its percentage in 1986–87 in UP on non-private lands was still 21.2. *Prosopis*, on the other hand, accounted for only 1.8 per cent (IIPO, 1988: xiv), though even on technical grounds it is a more suitable species for the saline/alkaline wastelands of UP.

A further advantage of planting 'trees of the poor' (which are essentially employment-augmenting trees as they require labour for gathering and collection, unlike trees which are clear-felled) on forest and village lands is the likelihood of improved cooperation. People are reluctant to protect trees which will be auctioned or felled, to the benefit of the government,

*Table 13: Proportion of stem wood and branches in trees*

Species	Percentage in total biomass		Total biomass in dry tonnes/ha
	Stem wood and bark	Branches and twigs	
Eucalyptus	81	19	17.4
Subabul	77	23	23.0
Acacia Nilotica	47	53	31.6
Prosopis Juliflora	30	70	32.2

(Reddy, 1987)

contractors and forest staff. They are much more likely to collaborate in the protection of trees from which they, much more than others, are in a position to benefit. Protection by the people and greening of degraded forests through regeneration (as opposed to artificial planting) would reduce the overall cost of afforestation, so that more degraded area could be given over to fuelwood production.

## **8. THE ROLE OF OTHER AGENCIES IN WOOD PRODUCTION**

### **8.1. NGOs**

There are a variety of NGOs working in India today, ranging from those organized for immediate relief and charity to those that fight directly against entrenched interests, with 'delivery system' NGOs being the largest in number, aiming to offer more effective and sensitive development and social services than the government provides. These NGOs show a higher level of motivation and dedication, as well as creativity and innovation, than government officials. They have far greater face-to-face interaction with local people. They are more responsive to people's aspirations, are more sensitive to equity and gender issues, and their sanctions are based on consensus and social pressure rather than on coercion backed by state authority. They have greater organizational flexibility and generally follow a more holistic approach than is found in the sectoral, departmental government systems.

Several NGOs are active in India in the field of forestry, and there are many reasons for this. Forestry concerns the subsistence needs of the poor, and hence attracts NGOs. It requires little capital and as it takes place only on uncultivated lands, the opportunity cost of this economic activity is minimal. Also, it is easy to get national and international funding for forestry-based activities. However, no all-India survey has been done which would indicate the overall results in terms of extra fuelwood of the efforts of these NGOs. There are, of course, micro-level studies on the nature of the NGOs' involvement in forestry. Below we describe the efforts of two NGOs, one on forest and village lands and the other on private degraded lands.

#### **Bruksha O Jeevar Bandhu Parisad, Orissa**

Bruksha O Jeevar Bandhu Parisad (meaning 'Friends of Trees and Living Beings') has been working since 1970 in about 300 villages of Nayagarh district, Orissa on land and forestry issues. It has received several awards for its excellent work in raising awareness about environmental issues and improving supplies of fuelwood through self-protection by the villagers. Even when plantation has been raised by the FD, the NGO has helped the government by motivating people to protect the planted area and refrain from illegal cutting.

Each village in the region where the NGO has been active had its own method of meeting its domestic energy needs. The primary source of fuelwood was within the village boundaries. Some hamlets/villages had demarcated certain areas, which included portions of village forest and pasture land, for fuelwood collection. In some villages, while one area was being protected, indiscriminate fuelwood collection was taking place in other parts of the village forest and pasture land. Thus, while vegetation flourished in the one part, degradation continued in adjacent patches. Often the village forest was seen as the property of the village whereas the RF (reserve forests) belonged to the Department, so while protection of degraded village forest was adopted, the well stocked RF was left as open access. As a result, this forest is in many cases now reduced to open scrub vegetation (ODA, 1994).

This raises a question as to what happens with respect to fuelwood availability if the total area around a village is protected? In such cases, the fuelwood pressure shifts to two other places. First, to those distant reserved forests with good growing stocks which are managed without community protection. Cycle-loads of fuelwood are illegally extracted everyday from such reserve forests by people of those villages with only a very small and highly degraded, or even

none at all. Conflict has often emerged between cycle-loaders and the people of the villages through which they generally pass. Cycle-load trading became a lucrative business as demand for fuelwood increased and supply curtailed due to protection efforts in the cluster.

The second type of pressure shift has been to those PF (protected forests) and RF where the village committees were found to be less effective in their protection activities. Lack of effectiveness was due to internal conflicts, financial constraints and lack of leadership.

### *Equity issues*

Leadership in village committees promoted by the NGO is with the richer households, which are least dependent on the forest. Because of their relative status and authority, even NGOs who initiate community protection have pragmatically sought their active involvement in forest protection. To have such people on their committee was useful for dealing with other villages and external authorities.

One particular problem area is those households which are wholly or partially dependent on the collection and sale of firewood for income. Such people cannot stop cutting wood in forest areas even after the introduction of forest protection in their area. Sometimes wood-cutting has been displaced to more distant, unprotected forests. Often it has persisted in the same village, albeit under continuing pressure to stop from the other members wishing to protect the forest in question. In both cases, wood-cutting families are paying the costs of protection in increased walking distances or in harassment and fines.

In one village, the idea of establishing a firewood plantation to meet the needs of wood cutters was rejected on the grounds that the best firewood trees could not be grown in plantation. It also seemed that the allocation of any special usage rights for forest areas to particular groups would inevitably cause problems, because it would open up the possibility of other groups making special private claims on common land.

In another village, a group of 35 to 40 potters who use wood to fire their pots are directly dependent on the forest. It would be ideal if an area of land could be allocated for the use of these potters, but this advice was rejected by the community in favour of a policy of total protection. According to the potters, they need about three quintals of wood every month to fire 300 pots. Now they are having to purchase wood from the Corporation depot and collect brushwood from a forest 10 km away. At the same time they are not obtaining enough wood to maintain their past production levels. In this village, forest protection is not a win-win situation. The basic issue is of the alternative livelihoods available to those dependent on the forest, and that does not seem to have been addressed by the FD.

### *Gender issues*

When women were asked for their preferences as regards tree species for plantation, a marked difference was found between the better-off castes and the poorer *Harijan* (low-caste) women. The better-off women expressed a preference for teak and *sal* trees, which can be used for furniture, whereas the poor *Harijan* women preferred fuelwood and fruit-bearing trees. This was for their own consumption and in some cases for sale. The better-off women, who have the purchasing power to buy fuelwood, did not see the need to protect forests in order to meet their fuelwood requirements.

### **Sadguru Water and Development Foundation, Gujarat**

Sadguru Water and Development Foundation (SWDF), a local NGO, has been working in the Panchmahals district of Gujarat state since 1976, in the predominantly tribal and poor talukas of Dahod and Jhalod. Nearly all the tribal people are cultivators and the overwhelming majority own land. There is very little landlessness. Most agriculture in the area is rainfed, with irrigation covering only four to 10 per cent of cultivated land. As a result, most farmers are only able to grow one crop a year, and the rest of the year sees heavy seasonal migration. SWDF's objectives are to strengthen the livelihoods of poor tribals; make seasonal migration unnecessary; and end poverty. Its main programme activities so far have been lift irrigation and social forestry (Conroy, 1992).

SWDF initiated a social forestry programme in 1982, encouraging tree planting as an appropriate land use system for private marginal land not well suited to agriculture. Eucalyptus was the only species planted in 1982 and 1983, although since then SWDF has encouraged participants to plant other species as well. In 1985, around one million of the 1.8 million seedlings planted were eucalyptus. So far more than 28 million seedlings have been planted, covering 28,167 acres of land and 24,075 families (SWDF, 1996). The survival rate is roughly 60 percent.

As the social forestry programme has been in existence for 14 years, it already has substantial experience of how the earliest participants have used their trees. There are three principal direct, regular uses: house construction, fuelwood and making agricultural implements. The majority of people gave agricultural implements as their highest priority for use of wood, followed by fuel, with house construction as the third priority. This seems to reflect the fact that the first two uses are essential to survival, whereas a new or extended house may not be. Eucalyptus was the species most commonly used for all three, though women ranked it highly for use in roof construction and as fuelwood, but not for making ploughs. The most frequently mentioned one-off needs were for funeral and marriage ceremonies. The programme has helped increase the incomes of the tribals, as well as improving the availability, and hence increasing consumption, of fuelwood.

## **8.2. Involvement of the Private Sector in Wood Production**

According to the 1988 Forest Policy, forest-based industry should not depend on government forests for its raw material supply, but should be asked to establish links with farmers, who will produce the materials. In turn, industry should provide extension as well as offering a fair price for the materials, which reflects production costs. With greater production of wood, lops and tops could be used as firewood, while the main product would be consumed as industrial raw material.

One success story is the linking of poplar growing farmers with a match factory in northern UP. This experiment showed that, with technological back-up, timber-size trees could be raised on farm lands within eight years. In fact, the farmers' enthusiasm for growing poplar has increased supplies to such an extent that several plywood factories have been established in the area, thus providing considerable downstream employment (Ghosh, 1994). In addition to plywood, the paper industry can also get involved in farm forestry, as it demands eucalyptus and bamboo, which are both short rotation crops and eminently suitable for the farm sector.

One paper company, ITC Bhadrachalam Paperboards Ltd in Andhra Pradesh, has been distributing seedlings under a social forestry programme since 1982, and regular farm forestry/agroforestry plantations were started in 1987. The project envisages the planting of fast-growing tree species such as eucalyptus and casuarina on 1,500 ha of marginal agricultural land, owned by individual farmers, in eight districts of Andhra Pradesh. Trees are planted along field bunds, boundaries and irrigation channels in rows, and as blocks combined with intercrops. ITC Bhadrachalam provides the supply of high-quality seedlings (from improved stock), extension services, a buy-back guarantee for pulpwood, assistance in loan procurement, and research and development support to farmers within the project. The project is eminently successful, though its impact on fuelwood supplies is not documented (Lal et al., 1993).

There are a number of possible transitional problems in establishing links between industry and farmers, and these have been noticed in the case of supplies of farmed eucalyptus to paper mills. Firstly, many mills are designed for bamboo, and not for eucalyptus. Because of a shortage of bamboo, the mills are closed, or running at low capacity, but are unable to use the new supply of eucalyptus. Secondly, many mills requiring wood are located in the East and South, where there are Forest lands and where eucalyptus plantations were first started on Forest lands. However, the supply of eucalyptus in these forests is degraded, obliging the mills to look elsewhere for the wood. For them to transport wood over a distance of more than 200 km from the North and West would be uneconomic, hence the paradox of abundant availability of raw material in the North and West, and low-capacity operation of mills in the east and south continues. A practical solution would be to split the processing units: to establish new pulp-making plants close to farm forestry areas, and then transport the pulp to the mills.

Thirdly, buying small lots of wood from a large number of dispersed farmers requires the establishment of a new marketing infrastructure, whereas paper mills like to get large-scale consignments from forest depots. And lastly, it is not easy to obtain government permission to move wood bought from private sources, as restrictions exist on transport of wood in many states. But these are temporary problems and can be sorted out by the mills with the help of the government.

The issue of the leasing of wastelands to industry for afforestation has been a raging controversy in India in the last couple of years. One would whole-heartedly support the involvement of industry in the reclamation of non-forest wastelands, such as the desert lands of Rajasthan, the *bhal* (saline) lands of Gujarat, the ravines of MP and the saline lands of UP, which are so degraded that they no longer support the livelihood needs of the poor. The total area of such barren wastelands could be about 20 million ha, out of which one or two million ha can easily be leased or sold to industry. These lands have the advantage of being available in contiguous patches and hence amenable to economies of scale. However, several state governments have in the past offered barren lands on lease to industry, but no interest was shown.

There are also problems in extending this argument to degraded forest lands. Such lands may have a low tree density, but satisfy the fuelwood and fodder needs of a large populace. In fact, these lands are degraded because they suffer from extreme biotic pressure, and require neither capital investment nor higher technology. Instead, they need protection and recuperation, which can be done only by working with the people, where industry has neither expertise nor patience. Secondly, if industry produces its own raw materials, who would the farmers sell to? Where is their market, if not industry? Sixty per cent of farm land is owned by affluent farmers, who are market oriented and can be trusted to fulfil the requirements of industry. Since the overall

demand of industry is limited, if it were allowed to be met by leasing, it would adversely affect the farm forestry programme, which is one of the cheapest and most sustainable methods of producing wood. More production of pulpwood in the farm sector would also increase the availability of fuelwood, which could then be consumed or sold.

### **8.3. Wood Production in the Cooperative Sector**

In addition to NGOs and the private sector, there are many cooperatives which are encouraging farmers to plant trees on their degraded lands. The oldest and most successful is the Nashik District Eucalyptus Growers' Cooperative Society in Maharashtra, conceived in 1983, which was the first of its kind in India. The cooperative was organized primarily to cater to the needs of less-privileged farmers in terms of availability of irrigation facilities. Most farmers, with uncertain labour availability and markets for seasonal agricultural crops, needed an alternative to the conventional agricultural cropping pattern which could ensure economic returns in a short period. With the goal of quick financial relief to farmers, the cooperative started cultivation of fast-growing trees like eucalyptus on rotations of five and six years. Eucalyptus had the advantage of coppicing well and efficiently using limited water resources to produce maximum biomass. Eucalyptus has an assured market in the pulp and paper industry, and can be made into many other products, including posts, poles, firewood, charcoal and particleboard.

Any farmer can become a member of the Society in Nashik district by paying a fee of Rs 1000 per acre. By amendment of the relevant by-laws, this fee was relaxed for poor farmers who found it beyond their capacity. For them, the amount was reduced to Rs 50 per acre, enabling the poor farmer to secure membership in the society.

The Society now includes 2,413 farmers in Nashik district, and eucalyptus trees have been planted on 4,216 ha. It organizes supply of planting materials to farmers in collaboration with the State Forest Department and the Social Forestry Department. It also provides farmers with technical guidance regarding eucalyptus cultivation.

For three years, the Society has organized harvests of five-to-seven-year-old eucalyptus trees. Farmers are advised not to harvest if the trees are not mature enough, but the final decision is left to each farmer. Once the decision to harvest is made, the Society and farmer agree on a date for felling. On that day, the Society's specially trained team of farm workers conducts the harvesting operation. The number and size of poles are recorded in the field. The poles are then transported to the Society's sales depot. There the poles are categorized according to length and girth classifications, with each class placed in separate lots. The poles are sold at prices fixed by the Society for each length and girth class. Since 1988–89, the Society has evolved a system of marketing. During the first year, sales of eucalyptus poles amounted to 1.2 million Rs. During 1989–90, the poles fetched a total of 4.5 million Rs.



## **9. ECONOMIC ASPECTS OF WOOD AND FUELWOOD UNDER DIFFERENT PRODUCTION SYSTEMS**

Output and financial results from wood growing projects depend on many factors, such as soils, climate, moisture, species and technology. But the most important factor is protection. On private lands it is usually moderate to good, and hence the cost of protection can be controlled or predicted, but on public lands lack of protection is often a major weakness. This makes it easy to quantify economic results from wood growing on private lands, but much harder on public lands.

As survival and protection of the trees vary due to factors beyond the control of the Forest Department, output from similar lands and similar investments can vary by a factor of as much as 10, so isolated examples of cost-benefit analysis can be misleading. Some production results are even derived from laboratory conditions, without the field problems of cattle and human pressure, meaning that they are not replicable. In other words, a study of factors impinging on the long-term survival of plants on public lands may be more useful than a cost-benefit analysis in which protection cost is calculated by multiplying the number of hired workers by their wage rates. While discussing the financial results of obtaining fuelwood from forest lands, we have kept the above precaution in mind.

### **9.1. Wood from Forest Lands**

Compared to village lands, degraded forest lands have better root stock and soil structure, and therefore the dependence of local populations on them is higher. To what extent people would permit a fuelwood plantation on forest lands to succeed depends on several factors.

According to Ostrom (1994), the reasons why different groups cooperate by not over-grazing or illicit felling while others do not are linked to both internal and external factors. The internal variables include the total number of decision makers; inter-dependence among the participants; the discount rate or risk perceptions of the group; similarities of interest; leadership; information about expected benefits and costs; and shared norms and opportunities. The external variables are related to government policies, especially regarding security of tenure. If governments are able to create exclusive rights over forest produce for a given group, people in that group may forgo immediate consumption in favour of better yields in the future. Blueprint thinking (that is, imposition of uniform solutions to a wide variety of local problems), over-dependence on external sources of help, and corruption or other forms of opportunistic behaviour on the part of external agencies are likely to cause threats to the sustainable community governance of common property resources.

During the period of protection, people have to limit extraction to allow for sustained supply in future. This may mean that additional labour is spent in the short run on collecting fuelwood from further away. Also, participation entails the enforcement of rules and regulations, which also requires labour. In the cost-benefit analysis, it is therefore necessary to ensure these costs are taken into account and covered by the eventual return.

Such benefits will in turn depend upon:

- Future wood yield – rate of growth of trees, unit value, gestation period;
- Annual harvest of twigs and branches and other NTFPs – biological productivity, unit value;
- Amount of effort required to get fuelwood and other products, ease in gathering;
- Marketing infrastructure for wood and NTFPs; and
- Alternatives available for household labour in agriculture, non-farm employment, migration etc.

Costs and benefits from protection will not be uniform for all concerned, and may differ from situation to situation. In particular, some vulnerable groups, such as headloaders, women, graziers and the landless poor, are in danger of losing their livelihoods or means of sustenance when protection of a degraded forest begins.

A study (Femconsult, 1995) of the impact of protection on various groups in a Gujarat village calculated the net worth of the benefits from protection at 12 per cent discount rate over a period of 30 years, and compared it with another village under departmental plantation where protection by the people had not been undertaken. The results are shown in Table 14.

The overall gains to the village are thus tremendous. This is primarily because the village forest had valuable teak as the main species. When a similar calculation was done in a West Bengal village with sal as the main species and where villages get 25 per cent share in the final harvest as opposed to 50 per cent in Gujarat, the corresponding gains were much less. In both cases, headloaders emerged as the biggest losers. In the latter

*Table 14: Economic gains<sup>6</sup> from protection compared with non-protected situation*

Beneficiary	Net worth in 000 Rs at 12% for 30 years			
	With protection	Without protection	Increment	% change
Revenue to the village	2,242	0	2,242	-
Employment	562	0	562	-
Headloaders	108	583	-475	-81
Livestock owners	611	608	3	0
NTFP collectors	1,270	240	1,029	429
Net in kind	2,551	1,431	1,120	78
<b>Total benefit to the village</b>	<b>4,793</b>	<b>1,431</b>	<b>3,362</b>	<b>235</b>

<sup>6</sup> These have been calculated on the assumption that protection in the JFM village will continue by the people throughout the 30-year cycle. This in itself will depend on a number of variables. However, no account has been taken of these factors while calculating the economic returns, making the conclusions somewhat suspect. The inadequacy of this type of economic analysis is apparent from the fact that JFM is more successful in West Bengal than Gujarat, though the financial analysis given here suggests otherwise.

case, graziers and gatherers of NTFPs also lost, as closing of forest canopy led to reduced grass and *tendu* production. Often in sal forests, leaf sweeping needs to be controlled in order to induce regeneration. This too hits women and the poor. Failure to compensate losers may disrupt the consensus over protection, and thus one would need income-generating programmes for them until the trees mature.

Integration of protection with other rural development programmes may be necessary even in villages which are homogeneous in nature. A study (SPWD, 1992: 40) of an NGO-inspired JFM initiative in Gujarat noted that a major reason for success was the existence of many complementary activities alongside JFM, such as:

- Biogas installation under the Gujarat Agro Industries Corporation's scheme;
- A fodder plot programme, under which green fodder was provided and villagers were able to stop open grazing in forests;
- Village nurseries under DRDA were started in order to create peripheral plantations; and
- Homestead garden scheme was adopted under the Tribal Area Sub Plan.

Thus whether protection will succeed, and where, may often depend on other rural development programmes or on efforts made to increase the productivity of land other than degraded forests: private lands, non-forest village commons and forests remote from villages. If programmes to make these lands productive are taken up simultaneously with or prior to protection, they may meet the employment and income needs of the people during the period they are required to reduce their consumption of fuelwood etc. from specific forests.

## **9.2. Wood from Non-forest Public Lands**

The area available in this category of land for wood production has been estimated in para 6.4. Being close to habitation, such lands are also subject to human and cattle pressure, the implications of which for long-term sustainability have been considered above. In addition, these lands are more degraded than forest lands, and to increase their productivity would often require investments in irrigation and soil improvements in addition to the normal costs of seedlings, plantation and protection. Reclamation costs and yields were estimated for non-forest wastelands by the Agriculture Finance Corporation in 1986 as shown in Table 15.

Thus an investment of 9,000 to 15,000 Rs per ha (at 1987 prices) would increase the productivity from almost nil at present to between four and eight Mt (or six to 12 m<sup>3</sup>) per

Table 15: Cost of reclamation of wastelands as estimated by the Agriculture Finance Corporation: costs, species and yield

Name of district	Area of waste land in ha	Cost per ha (Rs)	Main species proposed	Av. yield in Mt/ha/year
1. Chittoor (Andhra Pradesh)	500	10,100	Eucalyptus, subabul, teak, bamboo, mango and grasses	8
2. Srikakulum (Andhra Pradesh)	600	9,600	Eucalyptus, subabul, cashew and casuarina	6-8
3. Surat (Gujarat)	1,251	8,600	Eucalyptus, subabul, teak and bamboo	4-6
4. Sabarkantha (Gujarat)	976	8,900	Same as above plus prosopis juliflora	4-6
5. Hassan (Karnataka)	400	10,300	Mango, sapota, eucalyptus, casuarina and tamarind	5-7
6. Meerut (UP)	625	15,000	Poplar, eucalyptus, babul, sheesham, mulberry	4-8
7. Raibareli (UP)	434	13,500	Prosopis juliflora	6-7

(NWDB,1988)

ha per year, which is eight to 16 times higher than the present productivity of government forests<sup>7</sup>.

The ratio of yields to costs of planting trees on farm bunds, roadsides and canal banks would be much more favourable, as they generally have good moisture and are more productive than revenue wastelands. The costs of planting trees in 1988 in various state social forestry projects, at Rs 4,000 to 8,000 per ha including overheads, have also been lower than the average for the AFC reclamation projects. The impact of such an investment on fuelwood availability and employment would be tremendous.

The most cost effective way of producing fuelwood is from those wastelands which have already been infested with coppicing shrubs such as prosopis, where the cost of plantation and replacement is almost zero. Production here requires only human labour, and marketing costs are confined to transport. We consider an example below.

A study was conducted in Raichur district in Karnataka to investigate the economics of the cutting from public lands and selling of prosopis wood as fuel. Almost all landless and many small farmers were engaged in this activity, cutting fuelwood and transporting it in their own carts to the nearest market. The average number of family members involved over a year was

<sup>7</sup> For forest lands, two varying estimates of current productivity are available. On the basis of remote sensing data, Warner(1982) estimates current productivity for the entire 67 million ha of forests at 0.4 m<sup>3</sup> of wood per ha per year. However, the Forest Survey of India (FSI, 1988: 31) estimated a productivity of 0.7 m<sup>3</sup> in 1985. The FSI estimate includes both recorded and unrecorded removals from forests, and hence would seem the more accurate.

Table 16: Returns from gathering prosopis per family per year

Item	Cost/Return in Rs
<b>Actual expenses incurred</b>	
Municipality fee	128
Misc. expenses (snacks and tea at market, repairs etc.)	600
<b>Total paid out cost</b>	<b>728</b>
<b>Returns obtained*</b>	
Av. quantity of wood sold (no. of cartloads)	64
Av. price/cartload of wood sold	152
<b>Gross returns</b>	<b>9711</b>
Profit over paid out cost	8983
Net return over paid out cost/family/man-day	17
Employment provided/adult family member (man-days/year)	250

The average price per cartload is actually 151.74, and therefore the gross returns are  $151.74 \times 64 = 9711$

(Hugar et al., 1989)

2.1, and the total number of mandays per family engaged in the activity every year was 522. The returns and employment generation on a per family basis per year are given in Table 16.

It was observed that the people involved in cutting and selling of prosopis, on average, sold 64 cartloads in a year, each containing about five quintals, at the rate of Rs 152 per cartload, by engaging about 522 mandays of family labour. The net returns accrued to a family engaged in the activity worked out to be Rs 17 (8,983/522) per manday, which was far above the off-season agricultural wage rate of six Rs per day in that area at the time of the study (1988).

Owing to the absence of land as well as their poor asset position, people engaged in the activity were denied institutional finance, making them resort to private money lenders for credit to secure bullocks, bullock carts and other materials. The majority of the people also complained that they were committed to selling their wood to a wholesale-cum-retailers at the price quoted by him, in view of the advance received. These problems need attention.

### 9.3. Cost-benefit Analysis of Eucalyptus on Farm Lands

The cost of establishing energy plantations on private lands depends on several parameters, such as soil type, water source, climate, labour, etc. It has been estimated that in 1989 the cost of raising plantations, from nurturing seedlings in the nursery to transplanting them into the fields to maintaining the plantation for a rotation cycle of five years, ranges from Rs 10,000 to Rs 13,000 per hectare. A conservative estimate of the biomass yield from one hectare of irrigated plantation is about 15 tonnes per year. Thus a one-hectare plantation, on a five-year cycle, can yield 75 tonnes of biomass, which at a rate of Rs 500 per tonne could fetch Rs 37,500 in five years, against an initial investment of Rs 10,000.

These are, however, theoretical estimates only. For better estimation one must look at field results. A large number of studies are available on the results of cost-benefit analyses of trees planted on farm lands. Fuelwood in such cases is generally a by-product, and the main product is pole or pulpwood. As the results depend on species, soil and region, for the sake of comparability we summarize the results on eucalyptus planted on irrigated soils in NW India in Table 17.

These studies suffer, however, from a number of infirmities. Apart from the fact that none of the studies in Table 17 explains the methodologies used adequately, there are other problems in accepting the results of these studies. First, high returns from bund plantations should not have led to a decline in planting levels in that area. Second, the data in many studies (Mathur et al., 1984; Chatterjee, 1985; World Bank, 1988b) do not seem to emanate from actual farm conditions, as the figures for both yield and returns have been taken from government plantations. Such studies are, at best, ex-ante analyses, although they do not admit to be so. Third, the year of field work has often not been mentioned, making it difficult to relate the high price per tree given in the study with the actual field conditions prevailing in northern India after 1987.

Despite these serious flaws, it appears that the financial results from block planting were not as good as from bund planting. For instance, Chatha et al. (1991) found bund plantation extremely profitable in the Punjab, but for block plantings the same study estimated net annual returns as only Rs 2,500 per ha, where field crops would have yielded Rs 10,000 per ha on a similar plot (both figures being undiscounted). This difference may be partly due to the bund trees claiming better access to sunlight and water, but in most cases of bund plantations given in Table 17, the assumption behind the financial analysis needs to be questioned. These studies have either ignored the effect of eucalyptus on field boundaries on crop production (Mathur et al., 1984; Singh, 1988; World Bank, 1988b; Chatha et al., 1991), or have categorically denied that there is a loss. Later research (Suresh et al., 1987; Shah, 1988; Ahmed, 1989; Chaturvedi, 1989; Malik and Sharma, 1990; Shukla, 1991) has conclusively proved that eucalyptus causes crop loss, which needs to be taken into account while calculating financial results.

The author's own research (Saxena, 1991) on bund planting of eucalyptus in western UP showed that the variability in density of trees, wood output and other indices was quite large, as indicated by the standard deviation in Table 18. We found that even for similar spacing, tree girth and crop losses have varied a great deal, presumably because of the genetic deterioration in the status of *E. hybrid*, the uneven quality of seedlings, or the nature of the species itself.

As the B-C ratio was never less than one, all farmers were better off after planting eucalyptus, although results were not as promising as other studies showed. Farmers were disappointed with the meagre profits as they were expecting heavy windfalls from planting of eucalyptus. One of the reasons for low profits perhaps lies in the nature of markets, which is discussed in the following chapter.

Table 17: Summary of financial analysis of eucalyptus plantations on farms in NW India<sup>8</sup>

Author	State	Type	Density per ha	Space (in m)	Expenses per plant (Rs)	Age at felling (years)	Weight per tree (kg)	Price per tree (Rs)	IRR	B-C
<b>Mathur et al. (1984)</b>	UP	bund	200	-	4.6	8	-	90	-	7.2 at 15%
<b>Chatterjee (1985)</b>	UP	"	200	2	0.1	-	-	100	Add'l profits were Rs 1507/ha; add'l investment only Rs 12	
<b>World Bank (1988b)</b>	UP	"	200	-	0.4	4-6	-	90-100	ERR was 100%	
<b>Ahmed (1989)</b>	Haryana	"	250	1.8	2.2	8	190	94	47%,	9.0 at 15%
<b>Chatha et al. (1991)</b>	Punjab	"	-	2.5	1.1	-	-	13	-	10 at 0%
<b>Mathur et al. (1984)</b>	UP	block	-	4 x 2	-	8	-	90-100	96%	-
<b>Singh (1988)</b>	Haryana	"	2023	-	13.0	8	-	58	-	3.3 at 12%
<b>World Bank (1988b)</b>	UP	"	4000	-	0.7	4-6	-	90-110	ERR was 100%	
<b>Rawat (1989)</b>	UP	"	2000	4 x 1.25	4.4	8	30-35	25	27%	1.2 at 12%
<b>Aulakh (1990)</b>	Punjab	"	1200	3 x 3	11.0	10	100	20	Loss as compared to annual crops	
<b>Chatha et al. (1991)</b>	Punjab	"	1900	-	0.7	7	50	19.6	Loss as compared to annual crops	

(Saxena, 1994)

<sup>8</sup> Undiscounted, does not include harvest and post-harvest expenses; ERR = Economic rate of return.

Table 18: Mean, standard deviation and range of key variables (N = 28)

Variable	Mean	Std dev	Minimum	Maximum
1. Land owned (ha)	5.87	3.27	38	13.33
2. Annual crop production/ha (Rs)	13231	3174	8540	20349
3. Space between trees (m)	1.41	0.65	0.3	3.0
4. Density trees per ha	219	207	21	800
5. Survival of plants in %	76.38	12.53	50	100
6. Width of loss in the 4th year and after (m)	5.18	2.33	2	10
7. Direct expenses per plant (Rs)	1.52	0.79	0.56	3.60
8. Crop loss per tree during the entire rotation (Rs)	8.23	4.16	1.50	15.6
9. Value of twigs (Rs) per farmer	267.36	201.62	0	722
10. Sale price/tree (Rs)	45.20	19.85	10.0	100.0
11. BC-ratio	1.79	0.87	1.01	4.63

Note: Rupee values have been discounted for the year of planting of trees at 15 per cent for items 7 and 8, while undiscounted values have been shown for items 2, 9, and 10.



## 10. FUELWOOD MARKETS

Wood markets in India have not been studied systematically so far. On the other hand, agricultural markets and their role in rural welfare have been widely discussed. It is now generally agreed that farming systems and production conditions vary a great deal from region to region in India, and so does the level of information among the peasantry, their political clout, and infrastructure for marketing. Markets in eastern regions, which are paddy growing and subsistence-oriented, are relatively underdeveloped as compared to markets in the commercialized wheat or cash crop growing regions (Kahlon and Tyagi, 1983). Markets in NW India are considered to be competitive, sensitive to the laws of supply and demand, and efficient (Von Oppen et al., 1979). Thus it is reasonable to expect that wood markets in different regions would also behave differently.

However, there are fundamental differences between agricultural products and wood products. We discuss below the main points of divergence between the two products.

### *Diversity of use*

As already stated in Section 1, wood is a heterogeneous material and is capable of giving multiple products. For instance, for eucalyptus, the thickest portion of the trunk can be used as timber, if the girth of the trunk, with bark, is more than 70 cm. Poles are used for scaffolding support and as roofing material. The dimensions of logs for use as poles should be three to six metres in length, and 30 to 70 cm in girth. Cut pieces of similar girth but shorter in height are used as pulpwood in paper mills. All smaller pieces, twigs, bark, and roots, which cannot be used elsewhere, are used as fuelwood. Thus there is no single wood market, conceptually and spatially, in a town. The structure and conduct of each market differs from others depending upon species, and the purpose of use of wood.

### *Processing*

Unlike foodgrains, no processing of wood takes place on the farm, in the household or by the panchayats. Trees are generally sold in situ, or brought to the market without any processing, which increases the dependence of wood producers on middlemen. For use as fuelwood, wood is split into convenient, smaller pieces, either manually with an axe at the fuelwood depot, or at a sawmill for use in brick kilns. Thus, processing takes place at the retail point.

### *Competition with government produce*

Third, unlike agricultural products which are supplied only from private farms, the government is a big supplier of wood. In fact, until the harvesting of social forestry plantations started in the mid-1980s, the government had a substantial share in the supply of woodfuel, both formally and informally through gathering. Considerations of prevention of theft from government forests led to the imposition of a number of controls on free marketing of woodfuel, which have inhibited the growth of wood markets.

### *Bulk consumers of eucalyptus*

In matters of consumption, too, woodfuel has some peculiarities. For foodgrains, most consumption is restricted to households. For woodfuel, in addition to households and small establishments, there are bulk consumers, such as tile manufacturers and brick kilns, who buy fuelwood.

These and many other issues of government policy have influenced the evolution of woodfuel markets, which determine the flow of wood and the incomes of farmers (Saxena, 1991).

### *Market information*

Evaluation studies of Tamil Nadu and Karnataka Social Forestry Projects showed that very few farmers were aware of market conditions and the price they could expect for their product (SIDA, 1988; ODA, 1989). Ignorance was more rampant among the smaller than among the larger farmers (ILO, 1988). Even those who had harvested and sold some of their produce were not sure whether they had got the right price for it. For agricultural crops, such as groundnut, local newspapers published prices daily, but there was no such mechanism for fuelwood (FAO, 1988). These studies give the impression that whereas in a competitive and efficient market information should circulate freely, for marketing of fuelwood, farmers' and panchayats' awareness about buyers and the prevailing market price was weak.

### *Market access*

Only a few farmers brought their wood produce to the markets. In most cases, the standing wood crop was sold to the middlemen or contractors, who then arranged to fell the trees, graded them, made payment to the farmers, and took it to the market (ORG, 1990a; Chatha et al., 1991). In Rajasthan, where there is no paper mill, and poles are generally imported from Haryana, small farmers found that there were no buyers for eucalyptus trees, whereas the large-scale farmers, with 10,000 or more trees to sell, had to locate buyers from other states through newspaper advertisements (USAID, 1990). Thus, farmers did not have a choice of many buyers, whereas in a competitive and efficient system there are large numbers of buyers and sellers.

### *Number of intermediaries*

Between the producers and retailers there were about three to four layers of intermediaries. In West Bengal, marketing was done through a three-tier hierarchy of middlemen, called agents, merchants and wholesalers. Sometimes, there are large agents between village agents and merchants, thus increasing the number of middlemen to four (IMRB, 1989a). Similarly, in Dharmapuri, Tamil Nadu, the village contractor makes an advance payment to the farmer, and buys his produce on maturity. The contractor in turn sells wood to a commission agent, who charges four per cent commission on sale. The produce reaches the retailers from the commission agents via another category of middlemen, called subagents (IMRB, 1989b). For fuelwood in Hyderabad, which originates from the Forest Department, there are three middlemen between the Department and consumer: the forest contractor, commission agent, and the retailer (Dunkerley and Gopi, 1985).

Farmers in western UP, who are politically more aware than in subsistence regions, have been following several marketing channels for eucalyptus, the important ones being:

1. Farmer–direct to brick kiln or paper mill
2. Farmer–village agent–paper mill
3. Farmer–village agent–sawmill–brick kiln
4. Farmer–village agent–fuelwood depot–consumer
5. Farmer–village agent–sawmill–partly to furniture maker and rest to fuelwood depot
6. Farmer–village agent–commission agent–sawmill–brick kiln

A farmer's share in the final price paid by the consumer would vary in each case (if only because of the costs of breaking bulk). A significant part of the farm produce was disposed of through routes three and four above, each involving only two intermediaries, while in many cases the number of intermediaries was even less than two. In some cases farmers took the produce themselves to a brick kiln or the paper mill. In many cases of route three, the sawmill and the brick kiln were owned by the same individual and established at the same site, thus further reducing the number of intermediaries.

#### *Marketing margins*

One of the ways to measure efficiency of wood markets is to estimate the difference between the retail price and the price obtained by the farmers, and to determine whether the existing margins are excessive in relation to the costs of services rendered. In Haryana the prevailing market price for fuelwood in 1989 was Rs 250 to 300 per tonne, whereas farmers got Rs 120–150 a tonne for fuelwood-sized trees. The difference was more pronounced in the case of timber-sized trees, for which the farmers got only Rs 220–230 per tonne, as against a market price of Rs 600–750 per tonne (Athreya, 1989).

In a study of fuelwood markets in Hyderabad, where wood came from government forests, it was calculated that the final price paid by the consumer consisted of the following components:

Price to Forest Department	18
Transport	25
Middlemen's margins	57
<b>Total</b>	<b>100</b>

Thus middlemen's margins were quite high. However, the same may not be true of areas where markets are well developed. In a study of farmers' disposal of eucalyptus from the western UP region, the gross margin of all intermediaries was worked out to be Rs 82 per tonne (Singh and Gill, 1988). Another study of the entire state of UP calculated the trade margins in farm eucalyptus as 19–23 per cent of the price paid to the farmer (ORG, 1990b). Further, in none of the transactions in western UP did farmers take loans from traders. Thus, inter-locking of capital and output markets, a characteristic of eastern India, was not a feature of western UP wood markets. Many of the farmers selling eucalyptus were first-time sellers. It was also seen that farmers' information about market practices and their confidence in negotiating with traders improved with experience. Those who had already sold trees were more knowledgeable and had better access to markets.

### *Restrictions on free trade*

In order to protect forest wealth from pilfering, many state governments have imposed restrictions on the movement of wood from farm lands. In UP, farmers required a transit permit up to 1991<sup>9</sup> if they wished to transport eucalyptus. Permission is also required in many states for harvesting and felling a tree. Sometimes, as in Bihar and Himachal Pradesh, the product can be sold only to a designated government agency. These rigid rules are designed to prevent illicit felling from government forests, but they also act against the interests of producers, as they form a barrier between the producers and the market, and bring uncertainty in the operation of sale transactions. This set of laws has been the single most important factor behind the unpopularity of farm forestry programmes. Even when some laws were liberalized, the changes were not publicized, with the result that harassment continued as usual.

In West Bengal it was noticed that the system of obtaining a permit for felling trees was time-consuming and involved bribes. The movement of an application through various channels was as follows:

Application----> village panchayat and the pradhan----> standing committee consisting of the BDO, range officer and some elected members----> range officer----> local land reforms officer to verify ownership of land----> the range officer to estimate the value of the plantation (this decides who in the forest hierarchy would issue the permit)----> the buyer to make an affidavit, and obtain a court order----> now the buyer can cut trees, and apply to the range officer for a transit permit----> the range officer (or his superior, depending upon the value of plantation) to inspect and hammer the trees, and then issue the transit pass.

What added to the harassment of agents, and consequently to the low prices paid to farmers, was the fact that the officials involved were located in different places, and hence agents had to approach several offices for clearance.

In Tamil Nadu too, restrictions on movement of wood are a major irritant. It takes three months to obtain a permit, in which time wood tends to lose weight. Many producers would like to market their trees themselves, and so would large urban merchants, but both have to depend on middlemen because of the permit problem. This increases the gap between producer price and the market price.

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<sup>9</sup> The law was amended in 1991 freeing farm eucalyptus from transit regulations.

Under the Bihar Forest Produce (Regulation of Trade) Act, 1984, farmers can sell wood to the State Trading Organization only, and all sales in the markets are considered illegal. A study revealed that getting permits from government often required interventions from ministers, and sometimes even such recommendations did not expedite sales.

In many states it is very difficult to obtain a new license for operating a sawmill, as the state governments consider sawmills responsible for deforestation. There are many mills which operate without licenses. This causes uncertainty in the operation of the processing units and increases corruption.

## **10.1. Different Categories of Traders in Western UP**

In any given market, firms trading in wood are likely to be economically and socially diverse. Table 19 describes the different type of agents found operating in wood markets in western UP (north-west India), and their characteristics. The traders dealing mainly in fuelwood are generally different from those dealing in more expensive species. The latter are generally well-established and large traders, with access to capital, education and the bureaucracy. There is a good deal of grading and processing to be done in wood from species like mango, sissoo and teak, which increase their value at each step. These are sawn into rounds and flats, and then used for making furniture. They are also used in plywood and veneer factories. The finished products are stored for long periods and are transported far and wide, sometimes more than 1,500 km. These products have an all-India market. On the other hand, the poorer traders, such as village agents, fuelwood depots and some commission agents, are involved in fuelwood. This requires little processing – its final use is either in brick kilns, small restaurants or households, so it is not important for the logs to be straight, smooth or free of knots. Because value addition was little, quick turnover of capital was possible. These characteristics suited the small traders.

### *Entry Barriers to Trade*

Licenses are required from the Market Committee, the Forest Department, the Forest Corporation and the Municipal Corporation for conducting business. As in the foodgrain trade, many functionaries in the wood trade combine in themselves several roles, and hold different kinds of licenses.

As a result of a high degree of specialization, and thus of asset specificity, in western UP wood markets there is a high degree of repeat and relational trading among different traders dealing in timber and poles – wholesalers, sawmillers, carpenters and retailers – both in supply of material and of credit, with the result that it is almost impossible for a newcomer to start in the timber trade if others do not permit. The traders learn skills, gained experience and established contacts with others in the trade as apprentices first, before launching their own independent enterprises. The inter-dependency is stronger if there are caste or communal linkages between

Table 19: Characteristics of different types of wood traders in western UP

	<b>Timber wholesalers</b>	<b>Saw millers</b>	<b>Commission agents</b>	<b>Retailers</b>	<b>Village agents</b>	<b>Fuelwood depots</b>
Interest in farm eucalyptus	Nil	Marginal	Medium to high	High	High	High
Main species	Teak, sissoo imported sal, government eucalyptus	Same as wholesalers, mango, farm eucalyptus	All, including farm eucalyptus	Sawn wood and farm eucalyptus	Mango and farm eucalyptus	Farm eucalyptus and mixed wood
Source of capital	Banks	Banks and informal	Banks and informal	Informal	Informal	Informal
Education	High	Average	Average	Low	Low	Low
Social status	High	Average	Average	Average	Low	Low to average
Religion/caste	High-caste Hindus and Muslims	Mixed	Mostly Muslims	Muslims or low-caste Hindus	Muslims or low-caste Hindus	Muslims
Location of business	Urban towns	Large and small towns	Urban towns	Large and small towns	Small towns and villages	Large and small towns
Main source of raw material	Forest Corporation, imports	Wholesalers, village agents	Village agents, farmers	Village agents, farmers, saw millers	Farmers	Village agents, millers, commission agents, headloaders
Annual turnover in Rupees	0.2 to 2 million	0.1 to 0.5 million	0.1 to one million	50,000 to 500,000	20,000 to 100,000	20,000 to 100,000
Change in number in last five years	Declined	Increased	Increased	Increased	Increased	Same or declined

different sections of the trade. Social ascription facilitates entry, as money is often borrowed from family sources, or from the firms where apprenticeship was obtained. For instance, in Jaspur market, which specializes in processing eucalyptus wood as timber, almost all traders are Muslims. Muslim entrants in this market have the advantage of training within the family in assessing the quality of wood, and of access to other traders. A few Hindu and Sikh traders who have attempted entry have ultimately sold out to Muslims. Collaboration between different sections of the trade dealing in timber and poles is on both a professional and a social basis, which discriminates against socially unfamiliar new entrants.

By contrast, village agents have traditional links with other traders operating in the town, involving exchange of goods on credit. Their number has greatly increased, and many relations of commission agents and retailers have started visiting villages to negotiate with farmers. Lately some large farmers have joined the trade as village agents for supplies of farm eucalyptus to the paper mills, or to brick kilns (their owners are mostly non-Muslims). This transaction generally does not involve any other intermediary or processing, and there are no trade barriers to their entry. Such exchanges are always in cash.

The fuelwood stalls have a locational monopoly. There are physical entry barriers, as new shops would not be able to get the kind of open space required for a fuelwood retail trade. Because of problems of space, some stalls are set up on encroached public lands.

Between sawmillers and wholesalers, and between retailers and sawmillers, there are often interlocked contracts involving long payment delays. Thus sawmillers appear to be vertically integrated (Hill and Ingersent, 1977) with both suppliers of raw material and retailers, but such an integration is non-existent or weak when the produce is supplied from farmers to brick kilns or paper mills in UP.

## 10.2. Case Study of a Fuelwood Market<sup>9</sup>

Rudrapur is a block-level market in the Kichha *tehsil* of Nainital district, UP. The town is easily approachable from other main markets in the area, like Haldwani, Kichha, Rampur and Kashipur. Settled after independence, Rudrapur is fast becoming a modern town, attracting people from different parts of the country.

The distribution of wood traders in this town is as follows:

Type of trader	No. of traders
Sawmill owners	3
Sellers of firewood	9
Plywood factories	5

<sup>9</sup> Based on author's own research carried out in 1990–91

The market receives its supply from an area encompassing 100 km<sup>2</sup>. About 10,000 *quintals* of eucalyptus from farm lands is purchased by firewood stalls (or *taals*) to meet the local needs of the town. Sawmill owners receive their annual requirement of 7,000 quintals of sheesham, teak, sal and mango wood from the Forest Corporation. The plywood factories buy from both the Forest Corporation and farmers who sell poplar, mango and semal (silk cotton) to the factories through traders.

The transportation of all of the firewood is done using cycles, *tongas*, bullock carts, rickshaws and tractors, but very little sawn wood is transported by traditional means – trucks and tractors are generally used instead. The plywood factories use trucks for transporting their raw materials and finished products.

A traders' committee functions here for the entire market, but there is no separate committee or association for merchants dealing in wood. Sawmills, plywood factories and timber merchants are widely spread out in different parts of the town and therefore the traders do not know each other.

In spite of the inherent difficulties of this trade, two women are also engaged in this business. These women have opened *taals* on the public footpath, which amounts to illegal encroachment. Because they are women, they are not subjected to harassment by Corporation staff and the police to the same extent as the male stallholders are. The husbands of both these women have small *paan* (betel) shops in nearby kiosks and occasionally they help their wives in the business. Their children also help.

Out of nine firewood stalls, only three are on the stallholders' own land. Of the others, one is on a rented plot and the remaining five are on footpaths or vacant public land. Because of an acute shortage of space, these *taals* can only store 400–500 quintals of firewood at a time. Firewood stored in larger quantities may lead to the stalls causing an obstruction. Some of the firewood stallholders keep their stock with the farmers for weeks together, and transport it to their stalls when there is available space. The stalls have a crowded appearance, with prospective buyers and sellers of firewood vying to get fast service.

All the stallholders are above 25 and under 50 years old. Most are illiterate. Only one of them, Lekhraj, has been educated up to primary level. Six out of the nine are not educating their children. Most of the stall owners do not possess any agricultural land, but have side businesses. For most of them, it is not an hereditary trade. In fact, most of them have abandoned their traditional livelihoods and then adopted this particular vocation. Only one, Karnail Singh, is following in his father's footsteps. Most of the non-Muslim taal owners settled in Rudrapur only after 1970. Karnail Singh is the only one who moved there with his father, settling down in 1950 after migrating from the Punjab. His father started a career as a carpenter and Karnail Singh is also engaged in the same trade, though on a limited scale.

#### *Pattern of purchase*

The firewood bought by the stalls consists of twigs and branches of less than six inches diameter. The stallholders buy wood from contractors and farmers, and not from the Forest Corporation, despite the fact that supply from the Forest Corporation is received on credit of one month. This is because they are uneducated petty traders and lack large capital. They do



not have the confidence to deal with a government organization, which involves a lot of paperwork. They fear harassment and difficulties in buying their requirement from the Forest Corporation. The Corporation has in recent years reduced its total firewood sales, and now concentrates more on timber. The farmers sell standing trees to traders and contractors who buy wood at the rate of Rs 30–35 per quintal and sell it at Rs 45–50 per quintal to the firewood stallholders after paying three rupees per quintal for cutting and two rupees per quintal for cartage. Some stalls buy directly from gatherers who collect wood from forest lands and bring it by cycle, rickshaw and tonga. They collect twigs and branches of sheesham, teak, sal, sakhoo, mahua, pine, eucalyptus, poplar and whatever else is easily available from public lands. Sometimes they spend the night in the shops and in the morning proceed to the forests to gather wood. They take their payment once in three or four days. The firewood stalls buy their requirement from them at rates varying from Rs 35 to 40 per quintal. The stallholders engage labour for chopping the wood, for which they pay two rupees per quintal. On average, the hired labourers are able to cut about 10 to 15 quintals of wood per head in a day. The stallholders then add 30 per cent for drying and 20 per cent profit to the cost, which comes to  $45 + 15 + 10 = 70$  Rs per quintal, the sale price. The stalls do not buy standing trees from the farmers. Some, like Lekhraj and Smt. Shakuntla Devi, go to the villages, but buy only the wood left with the farmers by the contractors because it is unsuitable for pulp or poles.

When the firewood taal owners go to the farmers to buy, the consignment is weighed at the farmers' premises. But when the farmers bring their own wood to the taal owners, it is weighed at the taal. Farmers are paid in cash by the taal owners. As the prices of all types of wood are fixed according to weight, the traders buy and sell different varieties of wood, namely logs, firewood and poles, on a per quintal basis only.

None of the firewood stall owners have any facilities for manufacturing furniture etc. from logs. They do not possess their own transport, and are thus entirely dependent on contractors for their transport requirements. They also do not keep any account of their sales and purchases. After taking care of domestic expenses, all earnings are invested in the business.

The percentage of different types of wood arriving in the firewood stalls is as follows :

Eucalyptus	85%
Poplar	5%
Mango	2%
Sheesham	2%
Sakhoo	2%
Pipal	2%
Others	2%

Most of the traders are hesitant to borrow money as working capital from the banks. Because of their limited capital and comparatively small investment, they cannot get a loan exceeding Rs 5,000 from the national banks. Some of them, however, borrowed Rs 5,000 from the banks to start their businesses, with 15–18 per cent interest on the loan. Sometimes they also borrow



*Woodfuel for the urban poor: piles of wood waiting to be taken for sale in urban markets*

money with interest from the village moneylenders. These moneylenders give money only to those who are known to them or who can produce sureties.

#### *Pattern of Sale*

Firewood received by the stalls is generally moist. As the buyers prefer dry wood, the stalls store dry wood on one side and moist or freshly arrived wood on the other, so that the buyers are not put to any inconvenience. Once the dry wood is exhausted it is supplemented from the first pile, the oldest being sold first. Thus in this cycle, the buyers get wood that is dry and one to two months old. Eucalyptus dries more than the other varieties of wood. Fully dried eucalyptus weighs 30–40 per cent less than the freshly felled wood. In order to make sure they can sell dry wood during the rainy season, the stallholders cover their stock with tarpaulin or thick polythene.

During the months of May and June, the stallholders come to possess large stocks, because farmers prefer to sell in those months, their fields being empty. As a result, twigs and branches are received in the shops on a massive scale. The leanest stock is in the month of August, because fewer trees are felled during the rains, and it is difficult to arrange for transport during this season.

The percentage of eucalyptus consumed for different purposes in the town is as follows:

1. As domestic fuel	75%
2. For cremations	5%
3. For burning at road crossing by the municipality (during winter)	2%
4. In brick kilns	10%
5. In restaurants	5%
6. In kiosks and house construction	2%
7. Other purposes	1%

Thus the vast majority of eucalyptus is used as domestic fuel. The firewood sold in the shops is bought by the daily-rated wage earners, who do not possess modern gadgets such as gas stoves to cook their food. About 50% of the town's 40,000-strong population use wood for cooking. Besides, it is used by shopkeepers selling cooked food and sweets, and by the crematorium for cremations. Poles of eucalyptus are used by the local populace in house construction. The municipal corporation also burns a large quantity of wood at street corners to stave off cold.

#### Prices

Since the consumption of eucalyptus in this town is much less than that for pulpwood in the nearby paper mill, it is the latter which sets the price, and the stallholders' buying rates are adjusted as per the scheduled rates of the paper mill. Compared to the firewood taal holders, the rural traders have a better understanding of price trends. They keep themselves abreast of the prices at Haldwani, Lalkuan, Rampur, Nainital, Kichha, Bareilly etc., as they sell their wood in these markets also.

The sale and purchase prices prevailing in this market during the last five years are shown in the following table:

*Table 20: Changes over years in the purchase and retail sale prices of fuelwood*

Year	Sale price of dry wood*	Purchase price of wet wood *	Retail price index for town dwellers
1978	Rs 35	Rs 20	188
1980	Rs 40	Rs 25	212
1982	Rs 45	Rs 30	255
1985	Rs 50	Rs 35	315
1988	Rs 60	Rs 40	405
1990	Rs 70	Rs 45	495
<b>Increase during 1978-90</b>	<b>100%</b>	<b>125%</b>	<b>163%</b>

\* Rate per quintal

This shows that the rise in the purchase price of wood has been slightly more than that in the sale price, so trade margins have declined. Possible reasons for this include gluts of eucalyptus; general stagnation or decline in fuelwood prices all over western UP; a faster rise in per capita income of the town population and concomitant shift to modern fuels; and greater coverage of gas and kerosene in the population of Rudrapur (as it is classified as a hill town, and gets several facilities, such as subsidies for fuel substitution, not available to other towns). These figures are, however, taken from the stallholders, and suffer from the usual problems of recall.

The price of firewood does not vary from shop to shop in Rudrapur. The current retail price is about Rs 70 per quintal. When purchases are made in large quantities, a discount of five rupees per quintal is given provided a minimum purchase of at least 100 quintals is made. If 50–100 quintals is purchased, there is a discount of two rupees per quintal.

Until about five years back, farmers did not produce any wood on their own farms. Eucalyptus, sal and teak wood, which were being used for poles and beams, came from the forest to the market. Villagers, too, had to come to the market if they needed beams for house construction, or poles for ceremonies. However, due to the plantation of eucalyptus by farmers on a massive scale, these are now freely available in the village itself, which has led to a shrinking of demand in the market for poles. Their prices have also fallen: formerly, poles used to sell for Rs 200–300 a piece, but now the price has fallen to Rs 40–45 a piece.

#### *Dealing with government*

For conducting fuelwood business, licenses are required from the following organizations:

1. The Market Committee;
2. The Forest Dept; and
3. The Municipal Corporation for storage on public premises.

It is compulsory for all retail and wholesale dealers to obtain licenses from nos 1 and 3, however, sawmills and plywood factories also require a license from the Forest Department, as they buy their raw materials from the Forest Corporation.

According to the traders, the greatest threat to their business is the constant harassment and prosecution threats from government departments. This often needs to be pre-empted by paying bribes. In addition, modern gadgets like gas stoves also pose a potential threat to their business. The risk of fire during the summer is another problem, as thin twigs and branches ignite easily.

## 11. CHARCOAL MARKETS

While woodfuel markets in western UP are comparatively less flawed, markets in many other regions are quite exploitative. We discuss<sup>10</sup> below the economic condition of charcoal makers in tribal Maharashtra, where there are around 4,000–5,000 families engaged in charcoal making, mostly as labourers. Around 80 per cent of these families belong to poor Katkari tribes originating from the districts of Raigad and Thane. These people are very poor, illiterate and also subjected to severe exploitation, being quite unorganized. They live in a condition of virtual bonded labour. The government appears to be quite unaware of this situation, or at least is unwilling to acknowledge that this kind of exploitation exists.

Up to 1950, most charcoal was used as domestic fuel in urban areas such as Bombay. While this demand declined due to the availability of alternative fuels, there was an increasing demand for charcoal from industries producing rayon, rubber tyres, textiles and carbides. At present about 75 per cent of charcoal is being used by industries, and the rest is used as domestic fuel.

Charcoal labourers are controlled by traders, who sell the produce to stockists in Bombay. About half a dozen wholesale stockists operate from Shivadi market in Bombay. This small group, who come from Uttar Pradesh, control the entire manufacturing and trading of charcoal. Generally, in the months of August and September these stockists advance to traders between 50 and 100 per cent of the final value of the coal to be sold to them. The price of the coal is determined in advance at this time, when it is normally 25 per cent less than the prevailing price in the winter months. Charcoal manufacturing starts from November onwards, and traders supply the charcoal to stockists. These stockists hold the entire stock and deal with industries on their own. Normally a trader keeps business relations with more than one stockist at a time. However, the stockists control the price and movement of coal and also have an important lever in the form of the money they advance to the traders, the mechanism through which the whole system works. Charcoal is normally sold at prices ranging from Rs 95 to Rs 125 per quintal. It is estimated that the original tribal labourers get around just 10 per cent of the final value in the whole production activity.

The traders are engaged in the illicit cutting of trees from public lands, which is ignored by the local-level government functionaries in the Revenue and Forest Departments. The seasonal migrant families whose major occupation is charcoal making migrate to remote forests where the charcoal is made. The jobs performed by these families are cutting of trees; cutting the woodlots down to the appropriate size; collecting firewood and carrying it over to the kiln site; arranging the kiln; plastering, setting fire to and then cooling the kiln when the charcoal is ready; and ultimately packing it in gunny bags. Normally, charcoal making starts around the end of November and continues until May. All the families reported that they undertook seasonal migration every year for this activity. In the normal course of events, the traders engage the labourers in their village by making advances during the monsoon period, when these tribals are in need of consumption loans. This contract continues year after year, unless disputes arise at the time of final settlement in May which compels them to go to other contractors.

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<sup>10</sup> Based on Saathe (1988); prices relate to 1986–87

All the labouring families perceived that they were being cheated and exploited by the traders. Sixty-one per cent of families felt that they were deceived in the weighing of charcoal in gunny bags. Sixty per cent of the respondents believed that they, being ignorant and unorganized, were deceived in the final settlement of payments. About 87 per cent of the respondents stated that employment in charcoal making was not rewarding or worthwhile, nor in their best interest. However, they had no other options for meeting the needs of survival and were forced to accept seasonal migration and the employment in which they were thoroughly cheated.

### **11.1. Charcoal Production from Prosopis in Gujarat and Tamil Nadu**

A study by IIM Ahmedabad of charcoal makers in Gujarat (IIM, 1993) showed that the simple operation of converting prosopis into charcoal, which can give employment to thousands of people, requires several permissions. Harvesting, conversion and transportation are all subjected to departmental controls involving cumbersome and time-consuming procedures. For instance, the government of Gujarat has banned harvesting of prosopis from forest areas, so the production of charcoal is carried out in individual or private lands. The procedure established for harvesting and converting prosopis into charcoal is controlled by the Revenue and Forest Departments. The steps followed are shown below:

- First Step: Application submitted by individual farmer/producer/institution to the Revenue Department seeking permission for harvesting.
- Second Step: Revenue authorities visit the site and give permission for harvesting.
- Third Step: Application submitted to the Forest Department for permission to convert prosopis into charcoal.
- Fourth Step: Forest officials visit the site to estimate the likely quantity of charcoal that would be produced and give permission for conversion.
- Fifth Step: Farmers/producers then apply to the Forest Department for permission to load and transport charcoal.
- Sixth Step: In the presence of forest officials, charcoal is loaded in trucks. The number of the truck carrying the charcoal, bags loaded, destination, route, time of departure and estimated time of arrival are all indicated in the pass issued for transport by the forest officials.
- Seventh Step: Charcoal is carried to the specified market with the transit pass.

These constraints reduce production and increase the cost of supply of charcoal. Many households and some of the industrial consumers have stopped using charcoal as fuel because of rising prices. One kilogram of charcoal costs more than one kilogram of grain. Rising price is a function of both short supply and increased demand. However, charcoal continues to be used by laundry units, charcoal briquette manufacturers, lead extractors, metal processing units, coriander seed processors, incense manufacturers, food vendors and hostels in Ahmedabad city. Increased supply would certainly change the situation and benefit all types of charcoal users.

In Tamil Nadu too, another area of abundance of prosopis, charcoal producers faced several problems. In January 1986, the Tamil Nadu government authorized forest officers to issue a certificate of origin for the transport of charcoal to other states after verifying its origin. However, charcoal producers had difficulty in implementing these orders and in satisfying the issuing authorities about the origin. Charcoal is prepared at the felling sites by small producers who are constantly on the move. They sell it at their sites or cart it to bigger producers who buy it, pool it and grade it for transport to other states. The same thing holds good for wood which bigger producers buy from different sources and convert into charcoal. The small producers are not able to give any information about survey numbers, much less certificates from the village officers. They also cannot afford the 'incidental expenses' incurred in getting a permit.

Charcoal making was perceived to have contributed positively to the general economy of the district. A sizeable number of agricultural labourers who used to migrate temporarily to Thanjavur district to work on paddy fields in order to supplement the meagre incomes they could earn in their own area, have found enough employment locally to stop migrating. Harvesting of prosopis generally begins some time in June–July and goes on up to August, the time the people used to migrate. Now, September, October and November also provide employment, as plantation and sowing operations are carried out before the onset of the rains. Increased employment has been a welcome gain in the region.

Charcoal not only offers higher economic returns, but also many advantages in terms of convenience. It was observed that prosopis as a woodfuel (a) was bulky to carry; (b) had poor shelf-life; (c) involved higher transport costs; (d) involved higher administrative workload, as each truck needed official permission; (e) could not be stored, unlike charcoal, in anticipation of higher prices; (f) was not preferred by customers if it contained thinner pieces; and (g) was problematic because of its thorns (IIM, 1993). Customers also did not prefer fuelwood as it (a) tended to be wasteful to some extent; (b) blackened utensils; and (c) gave off smoke.

On the other hand, the above case studies demonstrate that (a) charcoal production based on *prosopis juliflora*, a species that generally concentrates in low-rainfall and high-risk ecological regions (where agriculture is not a major supporter of the household economy), can be economically viable; (b) charcoal making has the potential to generate gainful employment to poor families in regions where it was most needed; (c) the supply pattern of charcoal varied greatly but could be stabilized and improved with organizational innovations; (d) charcoal making is most suited to areas having sizeable wastelands; (e) charcoal making is based on local resources which have a value addition potential; (f) there is a need to promote the application of science and technology in prosopis cultivation in problematic soils and in charcoal making practices; (g) charcoal making can support married women, as the help of all family members is instrumental; (h) charcoal making need not displace existing workers; (i) the

economics of prosopis-based charcoal production are more favourable than that of marketing prosopis as fuelwood; (j) charcoal making does not have any competition from the established industries, as it is a decentralized rural activity; (k) it is sustainable, as *prosopis juliflora* is renewable; and (l) the marketing of charcoal should not be difficult because industrial demand is expanding (IIM,1993: 34).

Comprehensive changes are needed in government policy on charcoal. Currently, charcoal policy lacks a broader perspective. Prosopis provides a good opportunity to make wealth out of wastelands, promote employment opportunities, improve land use pattern, and make available raw materials needed by industries.



## 12. FUELWOOD PRODUCTION POLICY IN PERSPECTIVE

Up until the beginning of the 1970s, forest policy in India did not give adequate importance to fuelwood supplies. How, then, does one explain the 'discovery' of a woodfuel crisis by policy makers in the mid-1970s? Two explanations have generally been advanced (Agarwal, 1986: 3). One is that the oil crisis of the early '70s led the developing countries to a general re-assessment of their energy options in favour of biofuels. The other is that deforestation, land degradation and other ecological consequences were linked in the minds of policy makers with insatiable demand for fuel-gathering by rural people. This put increased pressure on reserve forests, and in order to reduce this pressure, policy makers decided that fuelwood production had to be increased.

In the 1980s, two assumptions dominated official thinking on fuelwood. Firstly, that there was a huge gap between supply and demand for fuelwood, so much so that India may have sufficient food for its population, but not enough fuel to cook it. And secondly, that planting of trees through social forestry programmes on non-forest lands was the most appropriate response to the fuelwood shortage.

Over the past decade, understanding of the ways in which rural people use trees and forests has improved considerably. In addition, several fuel surveys and evaluation reports are available now. It may therefore be worthwhile to analyse the new evidence in order to reassess these earlier assumptions.

Studies done by the NCAER (1985), Leach (1987) and Natarajan (1990) show that domestic fuel shortages are much smaller than were initially understood. Part of the miscalculation was because official output from forests was assumed to be the major source of supply, and other sources of fuel like agricultural wastes and dung were forgotten. Also, much of the wood used as fuel actually comes from twigs and branches, and that too from non-forest lands. Third, sources of fuelwood change: in the past 10 years, more fuelwood has come from *Prosopis juliflora* than from social forestry plantations. In Tamil Nadu alone, the total yield of *prosopis* for fuelwood alone accounted for 75 per cent of the total fuelwood consumption.

This should not be interpreted as an argument that fuel shortages do not exist in India; they still do in many parts for the poor, and, in some ecologically fragile areas like the hills, for many rural households. But it is necessary to understand the nature of the problem more accurately if we are to define appropriate interventions. Moreover, urban and rural fuelwood problems are completely distinct, and require different solutions (Shepherd, 1990). For the poor, the shortage of fuel does not generally feature high among their priorities, for if they are short of fuel, they are most likely to be even shorter of income, cash and food supplies. The poor would certainly like better opportunities for gathering of twigs and branches, not because they burn it all, but because they can sell them and bring the much needed cash to the family. In *prosopis*-abundant districts, sale of *prosopis* twigs has emerged as a cottage industry for the poor, especially for women and children.

The problem is more severe in agriculturally depressed areas which do not have the benefit of either dense forest or natural growth of shrubs like *prosopis*. Why has social forestry done little to reduce fuelwood shortages for rural consumers in these areas?

Although social forestry projects were designed to produce fuelwood, in practice, market-oriented trees have been planted which have done nothing to improve consumption of fuelwood by the rural poor. The main product of community and farm forestry has been eucalyptus poles, the benefits of which could never reach the rural poor. On top of this, half of the social forestry has been on private lands. As fuelwood has not been seen as income-generating, farmers have preferred more commercial trees, and continued to collect twigs and branches from public lands as before. Farmers have shown very little interest in using their scarce land and capital resources to generate a low-value product they could collect. It is unfair to load social concerns on farmers if they see no economic returns. Actually, in the states of Punjab, Haryana, Gujarat and UP, where eucalyptus glut has forced the farmers to sell their trees at fuelwood prices, they have stopped growing trees, as the fuelwood prices hardly cover production costs.

What policy prescriptions follow from the above analysis? First, a distinction must be made between fuelwood from logs and fuelwood from twigs and branches. The former, even if produced on public lands, is out of the reach of the rural poor since it gets marketed and at best helps the urban poor. The rural poor have access only to twigs and branches, which require the labour-intensive process of collection and hence are not picked up by contractors along with the log.

Second, such material is best made available to the poor through shrubs and bushes, and not from large trees whose value lies in their stem. Third, as fuelwood shortages are not as pervasive as was earlier thought, the objective of social forestry should be not only to produce twigs and branches, but also to generate self-employment for the poor through the gathering of consumption goods like minor forest products, wild fruits and mulch. Fourth, the concept of social forestry must be extended to reserve forest lands, where usufruct trees would be planted along with short-gestation grasses, shrubs and bushes. Fifth, wastelands should be utilized for fuelwood plantations of suitable species, such as prosopis, so as to increase the availability of fuelwood in the shortest possible time and with little investment. Finally, farm forestry should be geared to meet the farmers', rather than national, priorities.

### 13. SUMMARY OF RECOMMENDATIONS FOR DIFFERENT CATEGORIES OF LANDS

Rapid expansion of forestry programmes has taken place in India in the last two decades without the growth of systematic knowledge about how and why they affect rural people. Because of a lack of clarity about the likely outcomes of the policy, neither of the two initiatives taken by the government in the last two decades – industrial plantations on forest lands and social forestry on village lands – were able to stop the degradation of India's natural forests, or to provide more fuelwood to the rural people. The success of farm forestry has certainly brought prices down, but still the poor satisfy their needs through gathering and do not budget for fuel. The present document, written as a supplementary reader for trainees at the National Academy of Administration, Mussoorie, seeks to review the existing policy and implementation issues, and makes practical recommendations for improving the availability of woodfuel to the poor. These are summarized in this section for different categories of lands.

#### *Forest lands*

- Between Revenue and Forest lands, the latter should get a higher priority for funds. Compared with departmental forestry on Revenue lands, they have obvious advantages of scale and protection. The ambiguities of ownership which have plagued social forestry would not apply. Forest soils are generally better than the soils on Revenue lands. Costs would be lower. Also, the morale of the Forest Department would be higher, since the trees would be planted in territory they are familiar with.

The two main components of afforestation – farm forestry and afforestation of degraded forest lands – should have different objectives and approaches. Farm forestry and agroforestry should aim at maximizing sustained economic returns from land, whereas public forestry should aim at maximizing welfare through production of such commodities as fuelwood, fodder and NTFPs, which are needed by the people. The choice of species, though subject to agroclimatic and technical considerations, would also be different for the two programmes. Short-duration exotics, which give high market value, would be suitable for farm forestry, whereas species which have their value in the crown and not in the stem would be suitable for public forestry.

- As timber is a product of the dead tree, whereas people collect branches for fuel from living trees, allowing the stem to perform its various environmental functions, and as gathering is more labour-intensive than mechanized clear-felling, fuelwood-based forestry would be more sustainable than timber-based forestry in poor regions.
- This would be reversing the traditional perception of what is the main product and what is the by-product, so choice of species and management should be radically changed to suit the new policy. From forest lands, leaves, twigs and dead wood should become the main intended products, and timber would be a by-product from large multipurpose trees. For quick benefits to the poor, long-gestation trees should be supplemented with an understorey of bushes and shrubs, which could satisfy their immediate needs. Multiple objectives to maximize outputs from many products will require innovative and experimental silviculture,

which must focus more on the management of shrub and herb layers, and on forest floor management to enrich the soil and encourage natural regeneration.

- In Joint Forest Management (JFM) areas, settlement and usufruct rights should be reviewed in order to put them in harmony with the care-and-share philosophy which is the basis of JFM.

#### *Revenue lands*

- The FD's present practice of taking over common lands should be stopped, or drastically reduced to experimental projects. Funds for afforestation should be transferred to the village community. The role of the Forest Department would be mainly extension and technical support.
- Generally, only a small area of Revenue land is available in each village. If afforestation were left to the panchayat, it would take up only a small portion of this, and plenty of land would be left for use by the poor for grazing.
- Where panchayats represent several villages, single-village organizations should be created. Finally, distribution of produce is better done on the basis of one household: one share.
- Model afforestation schemes should be prepared for implementation by the panchayats. These should be widely circulated, and panchayats should be encouraged to apply for funds.
- Often degraded lands are available in larger chunks, but these are not taken up as the cost of reclamation would be high. However, in the long run, it is better to afforest these, as they have better demonstration effect, satisfy local demand and offer better management possibilities.
- Extremely degraded lands are best suited for undertaking fuelwood plantations using species like prosopis. Research should be undertaken to develop a thornless variety so as to facilitate gathering.

#### *Farm forestry*

- Private forestry requires security of land and tree tenure, and secure access to markets. The restrictive laws on harvesting, movement and sale of forest products must be abolished.
- The government should stop subsidies on its own supply of wood to industries, thereby forcing industry to buy from the farmers at a realistic price. The new Forest Policy endorses this suggestion, but in many states, subsidies still continue. Since the demand for marketed wood in India is limited, by duplicating the same species on Forest lands and on farm lands, such as eucalyptus, we are ultimately cutting into the farmers' profits, and thus undermining

the farm forestry programme itself. Also, from lops and tops of farm trees, wood for fuel would be produced.

- Farmers should have a range of other short-rotation, high-value species beside eucalyptus and acacia on their land, which meet their various needs and spread the risk to their income from the collapse of any one market. The economics of each model should be worked out for several years ahead. Diversification of species would also be better for the environment.
- New uses of wood should be promoted, such as power generation via gasification. This would improve the profitability of wood production on degraded farm lands.
- Administrative and legal controls over charcoal making from prosopis should be removed, as the activity does not lead to deforestation and is labour intensive.

Finally, the main barriers to afforestation in India are institutional: those concerning empowerment of local communities, proper land and product tenure to them, and involvement in decision making (Saxena,1995). These issues deserve urgent attention.

## 14. GLOSSARY

<b><i>babul</i></b>	<i>Acacia nilotica</i> ; a small evergreen tree, can stand periodical flooding, hence ideal for tank foreshore afforestation
<b>bamboo</b>	<i>Bambusa arundinacea</i> and <i>Dendrocalamus strictus</i> are the two most common species; wanted by both the paper industry and the poor
<b>cashew</b>	<i>Anacardium occidentale</i>
<b>casuarina</b>	<i>Casuarina equisetifolia</i> ; widely grown in coastal areas for poles and fuelwood.
<b><i>chulha</i></b>	Small open stoves which use wood, dung cakes or charcoal for cooking
<b>coppice</b>	Re-sprouting of trees after felling
<b>forest dwellers</b>	People living inside or in the close vicinity of forests
<b>Forest land</b>	Lands under the control of the Forest Department
<b><i>mahua</i></b>	<i>Madhuca indica</i> ; occurs most commonly near tribal habitations in central India; flowers and seeds are rich in oil, and are eaten
<b>mulberry</b>	<i>Morus alba</i> ; leaves are used as food for silk-worms, fruit is eaten, and its wood is used for sports goods
<b><i>panchayat</i></b>	Village council; the lowest form of local government; consists of elected members headed by a chairman
<b>pasture</b>	Open-access lands meant for grazing; often highly degraded
<b>poles</b>	Wood of 20–25 cm diameter, which is generally used for scaffolding and as posts
<b>poplar</b>	An agroforestry tree; has grown well in Haryana, Punjab and western UP; timber used for matchwood, veneer and sports goods
<b>Revenue lands</b>	Lands under the control of the Revenue Department; these are non-Forest Department and non-private lands, often highly degraded
<b>rotation</b>	Time interval between regeneration of a tree and its felling
<b><i>sal</i></b>	<i>Shorea robusta</i> ; a common but slow growing large tree in Indian forests; yields both timber and important minor forest products like seeds and leaves
<b><i>sapota</i></b>	<i>Parkia roxburgii</i> ; yields fuel, fruit and medicines
<b><i>sheesham</i></b>	<i>Dalbergia sissoo</i> ; a favourite road-side tree in northern India; wood used for wheels, boats and furniture

<b>social forestry</b>	Programme of growing trees to satisfy rural needs of fuelwood, small timber and fodder
<b><i>subabul</i></b>	<i>Leucaena leucocephala</i> ; a fast growing nitrogen fixing tree; yields both fodder leaves and fuelwood; despite efforts its plantation has not been successful outside Maharashtra
<b>tamarind</b>	<i>Tamarindus indica</i> ; an evergreen, multi-purpose tree; yields edible sour fruits, fodder and timber
<b>teak</b>	<i>Tectona grandis</i> ; highly valued for quality timber used in furniture, house building and cabinets
<b><i>tendu</i></b>	<i>Diospyros melanoxylon</i> ; used as wrappers of tobacco to produce <i>bidi</i> , Indian cigarettes
<b>tribals</b>	People who until recently lived by hunting and gathering of forest products, or practised shifting cultivation

## 15. ABBREVIATIONS

ABE	Advisory Board on Energy
AFC	Agriculture Finance Corporation
AP	Andhra Pradesh
CSE	Centre for Science and Environment
DRDA	District Rural Development Agency
ESCI	Energy Survey Committee of India
FD	Forest Department
FPC	Fuel Policy Committee
FSI	Forest Survey of India
GNP	Gross National Product
GOI	Government of India
ha	hectare(s)
IREP	Integrated Rural Energy Planning
IC	improved cookstove
IIM	Indian Institute of Management
IIPO	Indian Institute of Public Opinion
JFM	Joint Forest Management
LPG	liquid petroleum gas
m ha	million hectares
MP	Madhya Pradesh
Mt	million tonnes
Mtce	million tonnes of coal equivalent
NCA	National Commission on Agriculture, 1976
NCAER	National Council for Applied Economic Research
NGO	non-governmental organization
NTFP	non-timber forest produce
NWDB	National Wasteland Development Board
ORG	Operation Research Group
REDB	Rural Energy Data Base
RF	reserve forest



Rs	rupees
SIDA	Swedish International Development Agency
SPWD	Society for Promotion of Wastelands Development
SWDF	Sadguru Water and Development Foundation
TERI	Tata Energy Research Institute
TN	Tamil Nadu
UP	Uttar Pradesh
WGEP	Working Group on Energy Policy

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