

SCIENCE AND ENVIRONMENT FORTNIGHTLY

Down To Earth

Rs 20.00

MAY 31, 1998



FIREWOOD CRISIS

Contrary
to all
predictions,
it may be
waning

Fresh water: yet another debate in New York
Foul air: more benzene in your air now
Far out: does life exist in outer space?

False predictions

The firewood crisis has not resulted in a forest crisis. For years, energy experts and foresters have believed that the poor will eat away the forests of the developing world like locusts in order to meet their ever-growing firewood demand. But how much do we really know about the poor and how they meet their needs, about rural ecology, and about how human-nature relationships are changing over time? The latest survey of the National Council of Applied Economic Research based in New Delhi has thrown up numerous doubts about our long-held perceptions about rural firewood consumption and its impact on the country's forest. An assessment by ANIL AGARWAL

Vanishing green

The twig gatherers of India would ultimately denude the landscape or so the forest bureaucracy believed

Soon after the oil crisis hit the world in 1973, the government of India set up a Fuel Policy Committee to assess the country's energy scenario. The committee noted in its report submitted in 1974, "Nearly one-half of the total energy consumed in the country comes from non-commercial sources such as firewood (including charcoal), cowdung and vegetable waste. The dependence on these fuels is maximum in the domestic sector. This has led to large-scale denudation and destruction of forests."

This belief of Indian foresters and energy experts has been built on a simple premise. On one hand, energy consumption surveys have consistently shown a very high order of firewood consumption and, on the other hand, the forest departments of various states of India have consistently shown very low levels of legal firewood production from Indian forests. Given this data, the obvious question has been: Where is the remaining firewood coming from? In the absence of good surveys, experts have rushed in to argue that the remaining firewood consumption is coming illegally from forests, which is slowly denuding them.

The Fuel Policy Committee noted in 1974: "The recorded fuelwood output (from Indian forests) in 1969-70 is about nine million tonnes (mt). The actual consumption of firewood is, however, reported to be of the order of over 100 mt, the balance of over 90 mt coming from unrecorded logging

(from forests) and removal from 'treelands' outside the forest area." The report went on to warn the country that a serious firewood shortage would emerge by 1985 unless a massive programme to plant fast growing trees was not taken up by the government or efforts made to discourage the use of firewood by popularising substitute fuels. State-level studies also painted more or less the same dismal scenario. For instance, a study published in 1977 pointed out that 30 out of 45 districts in Madhya Pradesh — after taking into account the gross forest area and human population — were already suffering from a firewood famine. At that rate of demand, the study argued that forests in all but 16 districts of the state would have disappeared in another 20 years.

In 1990, nearly two decades after the dire predictions of the FPC had been made, I Natarajan, senior energy economist at the National Council of Applied Economic Research (NCAER) based in New Delhi in a paper published in *Margin* entitled 'Firewood Balance in the Nineties', concluded, "...the gap between the demand and the supply from authorised sources for firewood is not likely to be bridged. It is likely that the rural poor would continue to encroach upon public land and forest for obtaining fuel for use in their kitchens.... The demand for firewood has exceeded its supply in the past. This has led to large-scale deforestation with associated harmful effects."

Natarajan pointed out in his paper that whereas many earlier studies conducted in the late 1970s and 1980s had shown that towns and cities were witnessing a transition from biomass-based fuels (like firewood and cowdung) to petroleum-based fuels (like kerosene and liquefied petroleum gas) resulting in a drastic decline in urban firewood consumption — from 16.5 million tonnes in 1978-79 to 9.5 million tonnes in 1983-84 — even though the urban population had increased during that period, such a change was not discernible in the

The survivors: the poor of India have managed to wade through the so-called firewood crisis





ANIL AGARWAL / CSE

The importance of crop residues in rural household energy consumption has grown

villages. Natarajan argued that the switchover had become possible in urban areas, firstly, because most of the biomass-based fuels consumed in urban areas had been purchased, and, secondly, because subsidies provided to kerosene and LPG had made them cheaper than firewood. But in rural areas practically all the biomass-fuel consumed was collected. Not just the poor but also the rural rich met their cooking fuel needs through collection. “Under these circumstances,” Natarajan concluded, “bio-fuel would continue to dominate the rural energy scene.”

Based on his past surveys, Natarajan went on to estimate

the future firewood demand for India for the years 1994-95 and 1999-2000 assuming a GDP growth rate of 6 per cent per annum from 1989-90 onwards. He also assumed that as the country’s cattle population had not shown any growth in the recent past, cowdung availability would remain stagnant. Natarajan arrived at a total firewood demand ranging from 146.2 mt to 164.6 mt for 1994-95 and between 183.6 mt to 216.4 mt for 1999-2000 depending on the availability of kerosene in urban areas.

Natarajan argued that it is unlikely that firewood plantations can meet the estimated firewood demand. Nor will the

How the forests were left untouched

Changes in rural household energy consumption between 1978-79 and 1992-93: coal has dropped, firewood logs and kerosene have increased, while other sources have remained about the same

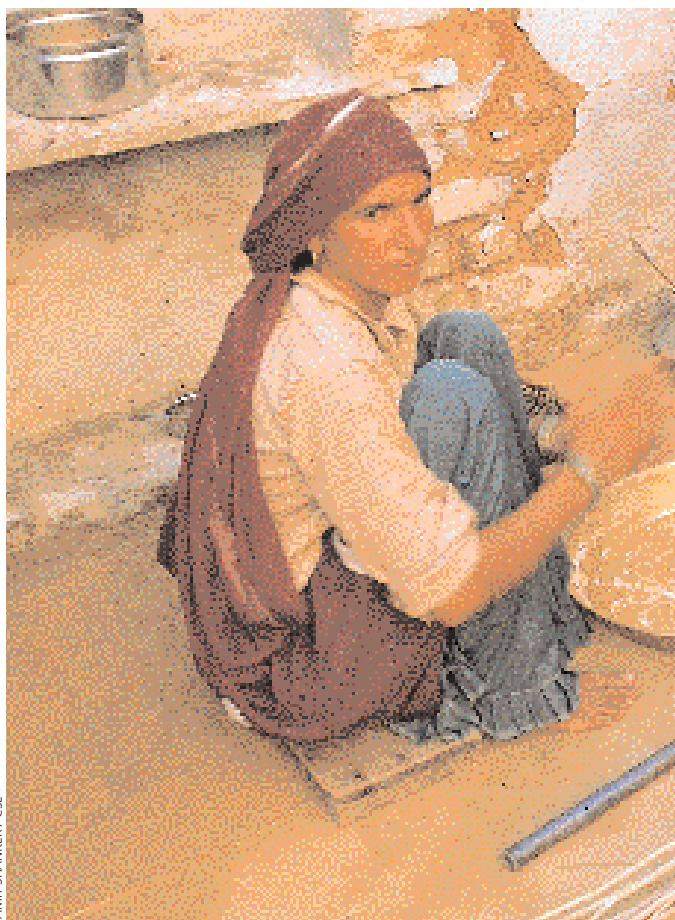
Items	Quantity	1978-79		Quantity	1992-93	
		Tonnes of coal replacement (million)	Percentage		Tonnes of coal replacement (million)	Percentage
Coal/ soft coke	1.143 mt	1.713	1.92	0.429 mt	0.584	0.38
Kerosene	414 million litres	2.279	2.55	1103 million litres	6.831	4.44
Cowdung	66.76 mt	20.087	22.51	86.73 mt	26.151	17.00
Crop Residues	29.53 mt	15.531	17.41	34.955 mt	20.530	13.35
Firewood logs	20.11 mt	16.905	18.95	57.96 mt	49.989	32.49
Firewood twigs	58.74 mt	31.774	35.62	73.42 mt	44.785	29.11
Others		0.913	1.03		4.971	3.23
TOTAL		89.202	100.00		153.841	100.00

mt: million tonnes

Source: I Natarajan 1995, *Trends in Firewood Consumption in Rural India*, in *Margin*, National Council of Applied Economic Research, New Delhi, October-December.



Solutions for a small planet: cow dung is a valuable substitute to fuelwood; and (right top) in the paucity of fuelwood, twigs keep the kitchen fires alive



AMIT SHANKER / CSE

biogas plant programme be able to do so. With just over one million biogas plants operating at the time of writing the paper with an average capacity of four cubic metres, the biogas plants could produce only about 5 million tonnes of coal replacement (MTCR) of cooking energy. (One MTCR means one million tonnes of coal will be needed to replace the use of a different fuel). But as an evaluation conducted by NCAER had shown that the capacity utilisation of biogas plants is only 30-40 per cent, the total availability from biogas plants was unlikely to be more than two MTCR. Though the theoretical potential for family size biogas plants is estimated to be about 15-16 million, it is unlikely that such a massive increase will take place in their numbers in the near future. Efforts to improve energy conservation programmes through the introduction of efficient wood stoves during the 1980s had resulted in the installation of over five million *chulhas* by the late 1980s. If their numbers increased to 30 million, a potential saving of 15-20 MTCR of firewood was possible. But given the speed with which these programmes are progressing, Natarajan concluded that greater pressure on public lands and forests appeared to be inevitable.

For the first time the Census of India collected data in 1991 on the type of fuel used by different households. The census results also confirmed that of the 151 million households in India in 1991 (39.5 million in urban areas and 111.5 million in rural areas), 92 per cent in rural areas and 39 per cent in urban areas were dependent on bio-fuels.

Dramatic shift

Strangely, rural people are using higher quality biofuels such as logs

Given this background, the results of the latest survey on firewood consumption pattern in India's rural areas published by Natarajan in 1995 are quite stunning. This survey generated data for the year 1992-93 whereas the last comprehensive energy consumption survey conducted by the NCAER had presented data for 1978-79. No other agency conducted a nationwide survey in the interim period. There were six interesting findings of the survey:

- *The estimated firewood consumption in the early 1990s was comparable to some of the optimistic estimates made earlier.* After the second oil crisis hit the world in the late 1970s, the Planning Commission had set up a Working Group on Energy Policy which had projected firewood consumption figures in its report submitted in 1979. The report had argued that nationwide firewood consumption would rise to 140 mt in 1983 but would slowly thereafter fall to 138 mt in 1991, 131 mt in 1993 and 97 mt in 2000 because of government programmes aimed at substituting fuelwood. Later, however, the Advisory Board on Energy, a think tank set up by the government of India, in its report submitted in 1985 had projected firewood consumption of the order of 300-330 mt.



The share of fuelwood went up in rural household energy consumption, while the percentage of households using cowdung has remained stagnant

wheat and rice residues are mainly used as cattle feed because of the nationwide shortage of fodder. Natarajan points out that the production of crops like cotton and pulses whose stalks are widely used as fuel has grown only at 1.8 per cent per year which is much less than the rate of population growth in rural areas. Therefore, the share of cowdung and crop residues in rural household energy consumption should have fallen over the years. Not surprisingly, the NCAER 1992-93 survey shows that though cowdung consumption increased from 66.76 mt in 1978-79 to 86.73 mt in 1992-93, its share fell from 22.51 per cent to 17 per cent. Crop residue consumption also increased slightly from 29.53 mt to 34.96 mt but its share fell from 17.41 per cent to 13.35 per cent.

● *The most surprising finding was that even as the share of fuelwood went up in rural household energy consumption, people were using more superior biomass fuel in 1992-93 as compared to 1978-79. When firewood availability becomes difficult, studies from various parts of the world show that rural people tend to switch from using logs to little twigs and branches and when even twigs and branches are not available they will move towards crop residues, cowdung and even dry leaves. In Midnapore and Purulia districts, for instance, where firewood availability was extremely scarce, rural women were collecting leaves of *Acacia auriculiformis* to use as fuel in the mid-1980s. In 1992-93 as compared to 1978-79, the NCAER survey found that not only the share of cowdung and crop residues had gone down, the share of firewood in the form of twigs had also gone down — from 35.62 per cent to 29.11 per cent — whereas the share of firewood in the form of logs had gone up dramatically*

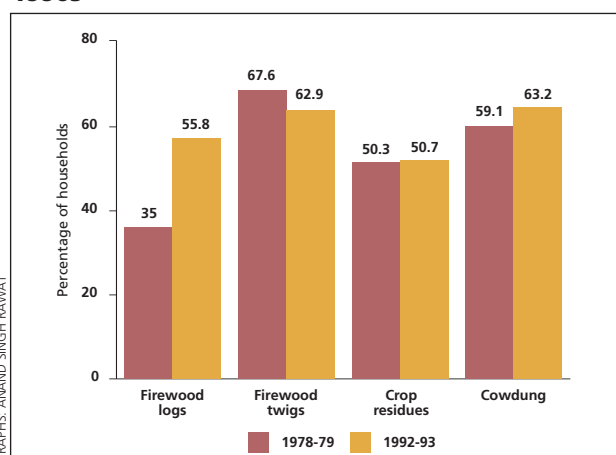
The NCAER survey found that the total household energy consumption in rural areas in 1992-93 was 153.8 mtcr. The average annual growth rate between 1978-79 and 1992-93 was around 4 per cent whereas the number of rural households increased by 2.5 per cent, as a result of which the average household energy consumption had increased from 1047 kilogram of coal replacement (kgcr) to 1329 kgcr. Firewood consumption in the meanwhile had increased from 78.85 mt to 131.37 mt at an average annual growth rate of 4.76 per cent. This level of firewood consumption is quite close to the projections made by the WGEF in 1979 though the reasons, to be discussed later, appear to be quite different.

● *The NCAER found that the predominance of bio-fuels in rural household energy consumption remained the same with the share of bio-fuels staying at 92 per cent. In other words, unlike the urban areas, there was no switch from bio-fuels to petroleum-based fuels in rural areas.*

● *The NCAER survey confirmed fears expressed by energy experts that the share of bio-fuels like crop residues and cowdung would not keep pace with the growing rural household energy demand. As the cattle population has remained steady for some time in India and there is an acute fodder shortage for India's livestock, it is unlikely that dung production will increase in the near future. At the same time, with the installation of biogas plants, there will be lesser availability of dry dung for burning. Even the availability of crop residues for fuel purposes has not increased dramatically over the last decade or so though there has been a big increase in agricultural production. This increase has mainly been in foodgrains like wheat and rice but*

The log chart

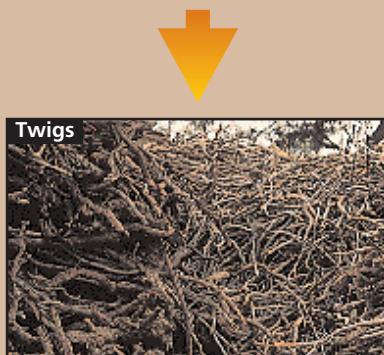
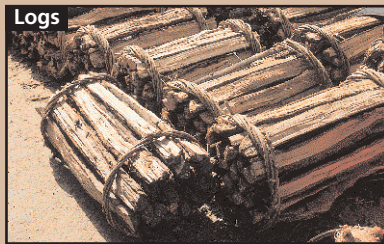
Changes in the percentage of rural households using biomass-based fuels between 1978-79 and 1992-93: more households are using logs in the 1990s



Source: I Natarajan 1995, Trends in Firewood Consumption in Rural India, in Margin, National Council of Applied Economic Research, New Delhi, October-December.

Hierarchy of fuels in rural India

While the rural rich use logs, lower down the economic ladder, cow dung and leaves are preferred



*When firewood availability becomes difficult, studies from various parts of the world show that rural people tend to switch from using logs to little twigs and branches and when even twigs and branches are not available they will move towards crop residues, cowdung and even dry leaves. In Midnapore and Purulia districts, for instance, where firewood availability was extremely scarce, rural women were collecting leaves of *Acacia auriculiformis* to use as fuel in the mid-1980s*

from 18.95 per cent to 32.49 per cent. The percentage of households using firewood logs also went up dramatically from 35 per cent to 55.8 per cent. In other words, what was often described as a 'rural energy crisis' in the 1970s and 1980s had begun to ease by the early 1990s. *The data shows that people are moving up the rural energy ladder by using higher quality fuels like logs which is quite unexpected. For a large part of the country this finding can be explained by farmers planting more trees on their own lands and by the invasion of fuelwood giving exotic species like *prosopis juliflora*. But it is still not clear what is the reason in many other parts of the country.*

- *This was another surprising finding. The NCAER survey found that a smaller percentage of households was now purchasing firewood logs. In 1978-79, a third of the households were purchasing firewood logs. But in 1992-93, just about one-sixth were doing so.*

- *The survey showed that the percentage of households collecting firewood from forests had halved between 1978-79 and 1992-93 whereas the percentage of households collecting firewood from their own farms had gone up from about one-third to one-half. In other words, the fear that people will encroach upon forests and public lands to meet their growing firewood hunger and destroy the country's tree cover has not proved to be true even as a larger percentage is using more superior quality biomass fuels.*

Numerous rural energy consumption studies had been conducted in the 1970s. They had revealed three important issues.

- *Rural firewood consumption was unlikely to be a major cause of deforestation because it was largely in the form of twigs and branches rather than logs. Therefore, rural people were indulging more in lopping branches rather than logging trees to meet their fuel needs. On the other hand, urban firewood consumption was largely made up of logs rather than twigs and was, therefore, a source of pressure on forests and treelands. In a paper published in September 1985, B Bowonder, S S R Prasad and N V M Unni published data on the state of the forest cover within an area of three million hectares surrounding 30 major urban centres of India. The study using*

satellite imagery found that between the two periods of 1972-75 and 1980-82, there was decline of 1.73 million hectares — about 15 per cent — in the forest cover in the case of 27 urban centres. Only in the case of Sambalpur in Orissa, Monghyr in Bihar and Darjeeling in West Bengal did the surrounding forest cover go up. This study reinforced the argument that urban firewood consumption leads to forest depletion.

- *Studies had shown that the role of forests in meeting people's wood needs had been greatly overestimated.* A detailed study conducted by the Kerala Forest Research Institute revealed that even in relatively well-forested state like Kerala, forests provided only five per cent of people's wood needs, including unrecorded removals. By comparison, homestead trees provided 80 per cent of the wood needs. (see *Mistaken Perception Forests yield little Kerala*)

- *The studies revealed that the dependence of rural households on firewood varied from one ecological region to another.* In the plains, where agricultural production was better, the share of firewood in household energy consumption was about one-third, the remaining being about equally shared by cowdung and crop residues. With agriculture being good, rural households either had stalks to burn or they had considerable amounts of crop residues which they could feed animals which in turn increased cowdung availability. Thus, people were not so dependent on firewood in agriculturally prosperous areas. But in deserts and in the hills and mountains, where agriculture was not so prosperous, people were far more dependent on firewood, its share being about two-thirds of the total household energy consumption. Ironically, it was in the deserts and in hill and mountain regions that it was most important to protect the tree and forest cover. And it was precisely in these regions that the firewood demand was the highest and thus a serious threat to the tree cover.

Unexpected relief

Nobody expected farm forestry and exotics to become a major source of firewood

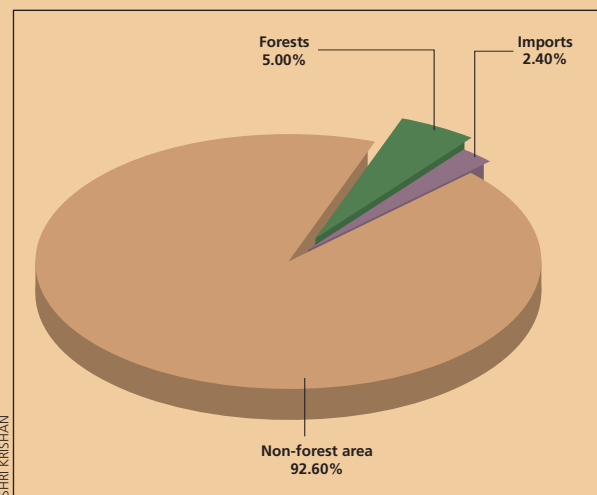
The question today, therefore, is: Is the rosy picture presented by the NCAER survey of 1992-93 equally applicable to these areas? The 1991 census also shows that states with large tracts of hills and mountains like the Northeastern states and those with dry regions like Rajasthan are still heavily dependent on firewood. Whereas states with large plains are less dependent on firewood. Why have the dire predictions about severe deforestation not come true? There can be several reasons for this. One would be the government effort to promote the plantation of trees by farmers on their farms. Another would be the invasion of exotic species — an unexpected boon.

Farmers' own trees

One major factor for the transition from non-firewood biomass fuels to firewood and from inferior firewood to more superior firewood appears to be the success of the farm forestry programmes initiated in the 1980s by the various forest departments under the social forestry programme. Farmers had largely planted trees on their farms to earn a high income by selling the wood as construction poles or as pulpwood to paper mills. Eucalyptus was their choice species. Between 1980 and 1988, some 18 billion trees were estimated to have been planted of which 10 billion were planted on farmlands. Of these ten billion, some seven billion were eucalyptus trees planted

Mistaken perception

Kerala is a land full of trees — both in forests and on farmlands and homesteads. Agricultural land in Kerala is dominated by several perennial trees such as coconut, rubber, jackfruit, mango, tamarind, cashewnut and other fruit trees which need a variety of needs like timber, firewood, fruits,



green manure and shade. Trees such as murukku (*Erythrina stricta*) are grown together with other crops for shade. Teak, rosewood (*Dalbergia sissoo*), anjily (*Artocarpus hirsutus*), matty (*Ailanthus triphylla*), maruthu (*Terminalia paniculata*) and irul (*Xylia xylocarpa*) are traditionally maintained in homesteads and they yield firewood and timber.

In 1988-89, C N Krishnankutty of the Kerala Forest Research Institute in Peechi conducted a sample survey to estimate the volume of the growing stock of trees in the homesteads of Kerala. He estimated that the total number of trees grown in Kerala's homesteads was 347.23 million. This did not include trees grown in rubber and other plantations common in Kerala nor trees grown in non-agricultural areas such as roadsides and compounds of public buildings. In a separate study, Krishnankutty had calculated the total wood supply in Kerala in 1987-88 which was about 14.820 million cubic metres (mcum) of roundwood equivalent. When he put the two findings together, he found that the role of forests in meeting the wood needs of Kerala was almost negligible — only five per cent. Some 80 per cent of the wood supply came from the trees in homesteads. An important finding that illustrates that the role of forests has been greatly overestimated in meeting domestic wood needs of households leading to the common impression that the country's wood demand is denuding the forests.

The wood and the branches
Proportion of stem wood and branches in
different plantation species

Species	Percentage in total biomass	Total dry biomass (tonnes per hectare)	
		Stem wood and bark	Branches and twigs
<i>Leucaena leucocephala</i> (subabul)	77	23	23.0
<i>Acacia nilotica</i> (babul)	47	53	31.6
<i>Prosopis juliflora</i>	30	70	32.2
Eucalyptus	81	19	17.4

Source: A K N Reddy 1987, *On the loss and degradation of tropical forests*, Department of Management Studies, Indian Institute of Science, Bangalore, quoted in N C Saxena 1997, *The Woodfuel Scenario and Policy Issues in India*, FAO, Bangkok.

forest expert N C Saxena estimated that they would have given about 25 million tonnes of wood annually compared to the 10 mt that is provided legally as firewood by all the country’s forests.

But in large parts of India this programme suffered a serious setback when the government of India reduced import duties on import of pulp and timber in order to reduce pressure on Indian forests in the mid-1980s.

The government’s farm forestry
programme fueled the transition
from non-firewood biomass fuels
to firewood in the 1980s

Meanwhile, the forest departments continued to supply wood to paper mills from forest lands. As a result, farmers found that the construction pole market, being small, quickly got saturated while the pulpwood market slipped away from them. Numerous farmers pulled out their young saplings, others who were considering going into farm forestry refrained from doing so and those who had full-grown trees sold a lot of their wood as firewood. With the urban fuelwood also shrinking because of the transition to petroleum-based fuels, it is possible that a lot of the wood that was generated through farm forestry was consumed by the farmers themselves as firewood.

An indirect evidence of the increased supply of firewood to urban markets in the late 1980s is provided by the fact fuelwood prices began to become steady in the 1985-90 period whereas they had risen rapidly in the period between 1973-85 — a near doubling in real terms. Whereas the annual rate of growth in prices for foodgrains between 1972 and 1986 was only 7 per cent, it was nearly 13 per cent for firewood. In the



Bearing fruit of a different kind: a *Prosopis juliflora* tree in Gujarat that is a non-browsable species

The increased supply of firewood to urban markets in the late 1980s was evident when fuelwood crisis became steady in the 1985-90 period

five year period from 1982-83 to 1987-88, while wholesale prices rose by 41 per cent, timber prices increased by 148 per cent. By contrast, in the succeeding five year period from 1987-88 to 1992-93 wholesale prices rose by 56 per cent but timber prices increased by only 30 per cent. In other words, timber prices did not even keep pace with inflation in the latter period.

In 1986, a study of 41 towns found that the price of fuelwood was more than 60 paise per kg in cities with more than one million inhabitants and more than 90 paise per kg in cities with more than five million inhabitants. With the number of people living in slums and squatter settlements increasing rapidly, there was a ready market for firewood in urban areas. And in the absence of subsidies, the cost of a unit of useful energy delivered by firewood as compared to kerosene doubled by 1987 whereas it was the same in 1960 and 1977. (Useful energy is calculated taking into account the efficiency of the device in which the fuel is being used. While wood stoves have an efficiency of only 7-10 per cent kerosene stoves have an efficiency of 30-40 per cent.) But a later study found that in some of the major towns of India fuelwood prices remained almost constant during the period 1985-90.

The NCAER 1992-93 survey could have easily captured

the developments relating to farm forestry as they mostly relate to the late 1980s and early 1990s. But it is difficult to say what is the current and future contribution of farm forestry to rural firewood supply because government efforts to promote farm forestry have declined and there is

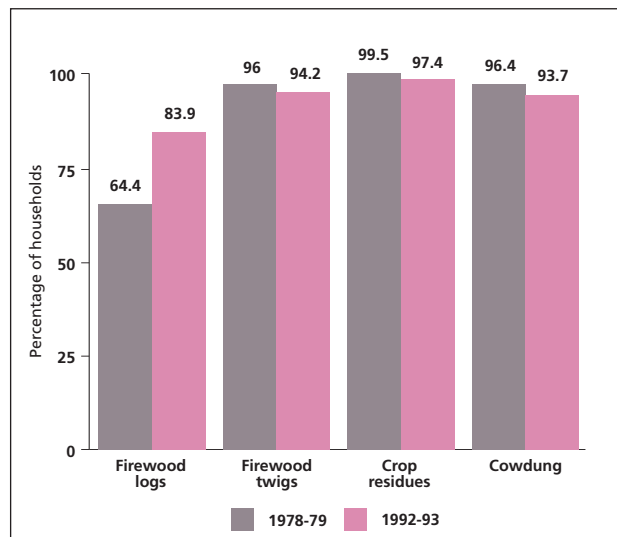


Selling firewood in urban Bihar markets was once a major occupation, but urban firewood demand is dropping



In-house fuels

Changes in the percentage of rural households collecting biomass-based fuels between 1978-79 and 1992-93. More households are getting firewood from their own farms



Source: I Natarajan 1995, Trends in Firewood Consumption in Rural India, in Margin, National Council of Applied Economic Research, New Delhi, October-December.

no survey available of areas in India where farm forestry is still being practised or where it is beginning to take roots.

Exotic invasion

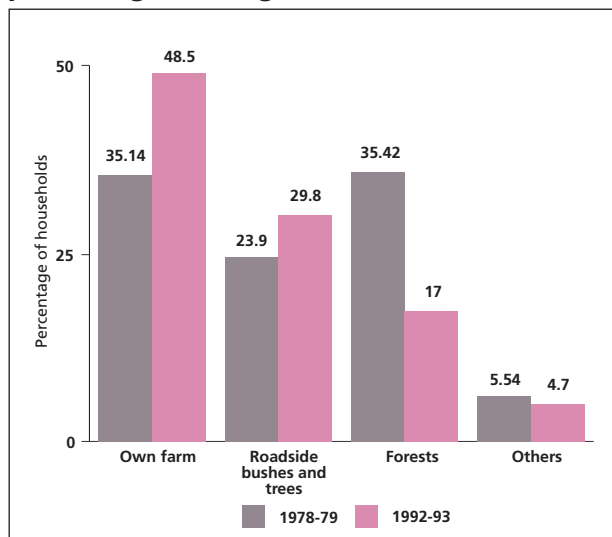
The second factor that appears to have contributed to increased firewood supply is the increased acreage under exotic species which can be heavily lopped — a development which has little to do with government programmes. In several hill areas of the country, an exotic species called *Lantana camara*, and across large tracts of drylands, another exotic species called *Prosopis juliflora*, have spread rapidly over the last few decades. Both these species are non-browsable and can therefore withstand the heavy grazing pressure in the country and spread rapidly on degraded lands. *P. juliflora* today can be found in drylands all the way from Gujarat to Tamil Nadu.

P. juliflora, known as mesquite and commonly found in South America ranging up to southwestern US, was first introduced into India in 1877 to check the spread of desert sands. Seeds were brought into India from the Kew Gardens in London. An attempt was made to grow it in Sholapur district of Maharashtra in 1879 but the effort reportedly failed. The first large-scale plantations were attempted in Gujarat and Punjab in 1894. In the 1950s, the Gujarat forest department took up a scheme to plant 1200 ha of *P. juliflora* every year at the edge of the Little Rann of Kutch to prevent the desert from spreading. Today it has spread far into the vast expanse of the Rann of Kutch, a large grassland, creating *P. juliflora* forests and affecting the ecology.

It today occurs widely even on all wastelands of the

Log out

Changes in the percentage of rural households collecting firewood from different sources between 1978-79 and 1992-93. Households are purchasing fewer logs



Source: I Natarajan 1995, Trends in Firewood Consumption in Rural India, in Margin, National Council of Applied Economic Research, New Delhi, October-December.

southern state of Tamil Nadu. In Ramanathapuram, where substantial saline patches occur, it is even used to reclaim fallow land. Farmers allow it to grow on farmlands for four years, then take an annual crop for two years, and allow *P. juliflora* to invade the land again. It is also used to make charcoal. It is estimated that 15,000 tonnes of charcoal are transported annually from Ramanathapuram to Chennai. A field study in five villages of the semi-arid district of Anantpur in Andhra Pradesh found that 86 per cent of households met more than 75 per cent of their cooking needs from *P. juliflora* alone. *Prosopis juliflora* is much better than eucalyptus in providing firewood because it can grow easily on degraded lands, it provides 32.2 dry tonnes of biomass per hectare (t/ha) as compared to 17.4 t/ha from eucalyptus, and 70 per cent of its total biomass is branches and twigs as compared to 19 per cent in the case of eucalyptus. Forestry expert Saxena argues that *P. juliflora* appears to have solved the fuelwood crisis "on its own".

Thus, eucalyptus-based farm forestry which has largely taken place in relatively well-endowed agricultural plains, and an exotic like *P. juliflora* which has invaded degraded private and public lands in the dry regions of the country, appear to have supplemented each other in easing the firewood crisis as shown by the 1992-93 NCAER survey.

Unexplained questions

But as *P. juliflora* has largely invaded public lands and has been grown along roadsides, especially in the dry regions of the country, it is unlikely that it could have contributed much to the increased supply of firewood logs, especially from people's

Eucalyptus based farm forestry and exotics like P Juliflora seem to have resolved the fuelwood crisis on their own



ANIL AGARWAL / CSE

Necessity, the mother of invention: a girl gathering dried leaves for burning in West Bengal in the 1980s

Firewood usage in rural India

States by percentage of rural households using firewood

Percentage of rural households using firewood	States
90-100 per cent	Tripura, Nagaland, Kerala, Assam, Arunachal Pradesh, Meghalaya, Manipur, Andhra Pradesh, Himachal Pradesh, Tamil Nadu, Karnataka and Mizoram
80-90 per cent	Madhya Pradesh, Rajasthan and Sikkim
70-80 per cent	Orissa, Gujarat, Maharashtra and Goa
60-70 per cent	Haryana
50-60 per cent	Uttar Pradesh
40-50 per cent	Bihar, Punjab and West Bengal

Source: Census of India 1991

own farmlands. While farm forestry could have played such a role, it is unlikely that it had a nationwide role as the success of farm forestry was restricted to a few regions of the country — almost all the districts of western Uttar Pradesh, Haryana and Punjab; select districts of south Gujarat like Kheda and Mehsana; Kolar, Bangalore and Tumkur districts of Karnataka; and, Midnapore, Bankura and Purulia districts of West Bengal.

Is there, therefore, any other factor that has contributed to the increased supply of firewood logs, especially from farmers' on farms, other than the government-sponsored, eucalyptus-based farm forestry programmes? And what about those regions which have not been invaded by *P. juliflora* or have seen the success of farm forestry — the hill and mountain regions of India, for instance, ranging from the northeastern part of India to the western Himalayan states, various districts covered by the Eastern and Western Ghats, and the plateau regions of India like the Chottanagpur plateau districts of Bihar and the Deccan plateau of Maharashtra and Andhra Pradesh? In many of these regions and states, the 1991 census data shows that a large number of urban households also continue to use firewood as a source of cooking energy. *It is quite possible that urban and rural firewood consumption is still exerting a pressure on trees in forests and public lands, which may, therefore, demand an appropriate government programme to prevent the growing ecological crisis?*

Rational responses

Are some Indians becoming more interested in trees?

One factor that no study has been able to analyse is to what extent the farmers of India have reacted to the firewood crisis and started to grow trees on their farmlands and private fallow lands or protect their forests. Surely, one would expect a rational economic response from farmers facing a firewood crisis. Though no such study has come to our notice from India, one study from Nepal, which shares similar characteristics with many Himalayan states of India, does show that farmers have been growing more trees both on their private and adjoining common lands. A study of a 14,000 hectare catchment using aerial photographs taken in 1972 and 1989 showed that the tree crown cover had increased in all the land-use categories — from 1.7 per cent to 2.3 per cent in irrigated terraces, from 30.8 per cent to 36.5 per cent in unirrigated terraces, from 66.9 per cent to 78.8 per cent on non-cultivated farmlands, and from 61 per cent to 80.9 per cent on common lands. Quite contrary to a 1978 World Bank report which had predicted that there would be no trees left in the hills of Nepal, D A Gilmour and M C Nurse of the Kathmandu-based Nepal-Australia Community Forestry Project found that Nepalese villagers were responding to the ecological crisis by planting trees along the edges of the terraced farmlands and in the non-cultivated patches lying amongst the agricultural patches. Economic changes were also helping the process of greening the hills. With less

The urban bane

States by percentage of urban households using firewood

Percentage of urban households using firewood	States
70-80 per cent	Nagaland and Kerala
60-70 per cent	Tripura and Manipur
50-60 per cent	Assam, Arunachal Pradesh, Orissa, Tamil Nadu and Mizoram
40-50 per cent	Madhya Pradesh, Rajasthan, Andhra Pradesh and Karnataka
30-40 per cent	Uttar Pradesh, Meghalaya and Goa
20-30 per cent	Haryana and Bihar
10-20 per cent	Himachal Pradesh, Punjab, Gujarat and Maharashtra
0-10 per cent	Sikkim and West Bengal

Source: Census of India 1991

labour available for the arduous task of collecting wood and leaves from the forest, people were cultivating more trees closer to their homes. And the growing demand for milk in Kathmandu had encouraged farmers to give up free-ranging cattle in favour of stall-fed buffaloes. Furthermore, the relaxation of government regulations on the felling of

Farmers transporting crop residues, an important fuel in the Thar desert



trees on private lands had encouraged farmers to grow more trees like *Alnus nepalensis* to sell wood in the market.

Studies undertaken in India by reporters of the Centre for Science and Environment have also shown that many village communities in India, especially in Orissa, the Chottanagpur region of Bihar and the Panchmahal district of Gujarat, have in recent years begun to undertake forest protection to meet their biomass needs on their own initiative without the intervention of any governmental or non-governmental agency. Giriraj Singh, director of Social Action for Rural and Tribal Inhabitants of India (SARTHI), a NGO based in the Panchmahals district of Gujarat, which has been documenting this process of self-initiated forest protection told a reporter in 1994, "No forest department, no NGO and absolutely no outside interference, motivated the efforts." SARTHI has documented regeneration efforts in 70 villages but Singh feels that there may be many more in the area.

Bhubhaneshwar-based forest experts Neena and Kundan Singh also point out that there are hundreds of villages in Orissa doing the same. In a 1993 article written for *Down to Earth*, they said, "Efforts by Orissa villagers to protect their forests go back to the 1940s and intensified in the 1970s and 1980s. There is no comprehensive information about the state-wide movement and a 1990 consultant's report is the only systematic attempt to count cases. It says 1,200 villages are protecting some 75,000 ha, but our field observations suggest a more accurate figure would be 2,000 villages protecting about 150,000 ha."

Administrator Neeru Nanda found during her 1980s stint in Tehri Garhwal district of Uttar Pradesh, a region of the central Himalaya, similar to Nepal, some 140 villages voluntarily protecting 1872 hectares of forest land, of which 1698 hectares was government-regulated reserved forest land. The *gram sabha*, through a common resolution, would appoint its own *chowkidar* (guard) who was paid on at an average rate of Rs. 500 per month. Of the 42 villages she studied in depth, she found that 24 had begun this effort only in the last 20 years.

All this evidence suggests that the ecological crisis resulting in a firewood and fodder crisis is bringing forth a rational response both at the level of community action and individual action.

Studies have shown that the role of forests in taking care of rural energy needs has been greatly overestimated

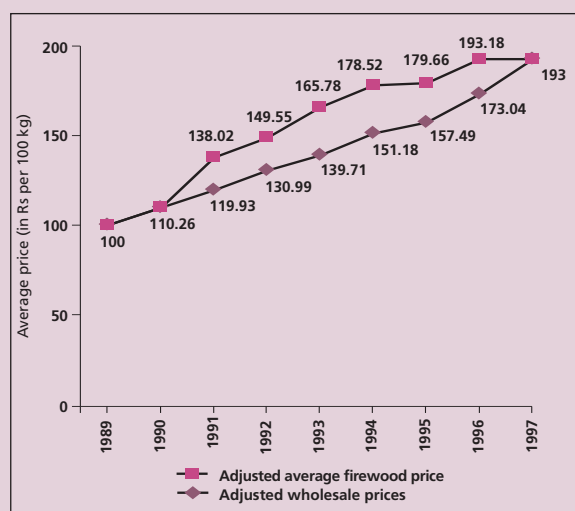
Unfortunately, no detailed studies are available to understand how deep and wide is this response and why it is taking place in some places and not in others. But people's own responses to the firewood crisis cannot be ruled out as a possible factor in the improvement of the firewood availability as depicted by the 1992-93 NCAER survey. It is obvious that the causes of this change should be studied in depth because then alone it will be clear whether this change is going to be of a short-term nature or of a long-term nature. The decline of farm forestry in the 1990s means that its contribution to the supply of firewood is going to be short-lived whereas the contribution of exotic

Light my fire

The rise in prices of firewood in most towns, has been at a slower rate than the rise in the average wholesale price in India

Anil Agarwal's analysis and findings confirm what I had always held: that the fuelwood crises is localised and in about one-third to half of rural India, fuelwood is not a scarcity item even for the rural poor. However, in many ecologically-fragile areas such as hills, uplands, forested regions, fuelwood still continues to be relevant, says N C Saxena, secretary, department of rural development.

Often it is not the lack of availability of wood for pur-



poses of cooking, but the fact that firewood can be sold for much-needed cash by the family, which leads to head-loading of firewood in forested areas. This should not be interpreted as a fuelwood issue but as a poverty issue. One finds that the rise in fuelwood prices for most towns for the years 1989 to 1997 is at a slower rate than the rise in the wholesale price index.

species like *P juliflora* and people's own responses to growing more trees on their own lands and to self-initiated forest protection is going to be far more long-lived. Improved understanding of this transition will also help to shape better responses from the forest departments and other government agencies.

It is obvious that there is a need for regular surveys to monitor the changing rural and urban energy consumption patterns, people's tree planting habits, especially on their own lands, including the number and type of trees planted by the people, and community interests and efforts to protect forests. This information will be particularly useful if it presents a clear picture of the changing situation in each of the country's diverse agro-ecological regions. This information can also play a key role in formulating national policies to promote afforestation keeping in mind the changing situations and the specific needs of each agroecological region. In the absence of such information, afforestation policies can only be adhoc and may even be inappropriate for many agro-ecological regions. ■