

# Restoring India's forest wealth

## Over-exploitation and degradation

India's green mantle lies in tatters. Fortunately, pockets of productive agriculture ensure self-sufficiency in food production for the country. But even these are plagued by problems of waterlogging and salination. Outside the tracts of irrigated agriculture, large areas of rainfed cultivation have increasingly encroached on marginal lands with poor rainfall or on steep hill slopes. Forest and grazing lands have suffered badly in this process.

Villagers desperate for cash are cutting down trees, like banyan and mango, that were previously protected on religious grounds or for their fruit. The lands still under forest department control are being progressively degraded for a variety of reasons. Where readily accessible, they are under excessive pressure of grazing and fuelwood extraction. Hasty programmes of clear-cutting natural forest stands to replace them with fast growing exotics have created man-made deserts where the latter have failed. And in more and more remote localities, gross over-exploitation to meet commercial demands is ruining forest cover.

This erosion of India's forest wealth is adversely affecting a whole range of services. Most people in India, including small landholders, landless agricultural labourers, rural artisans, tribals and herders, depend on biomass gathered from their surroundings to meet many of their basic needs. Their quality of life declines as the availability of this biomass diminishes. This also affects the industrial sector, but with its ability to raise prices and the large profits made possible by the subsidized rates at which it obtains raw materials, it is not bothered too much. This sector is also unconcerned with the erosion of biodiversity that has accompanied forest degradation:

only the poorer people depend on their immediate surroundings to provide them with a variety of services based on a diversity of plant and animal matter.

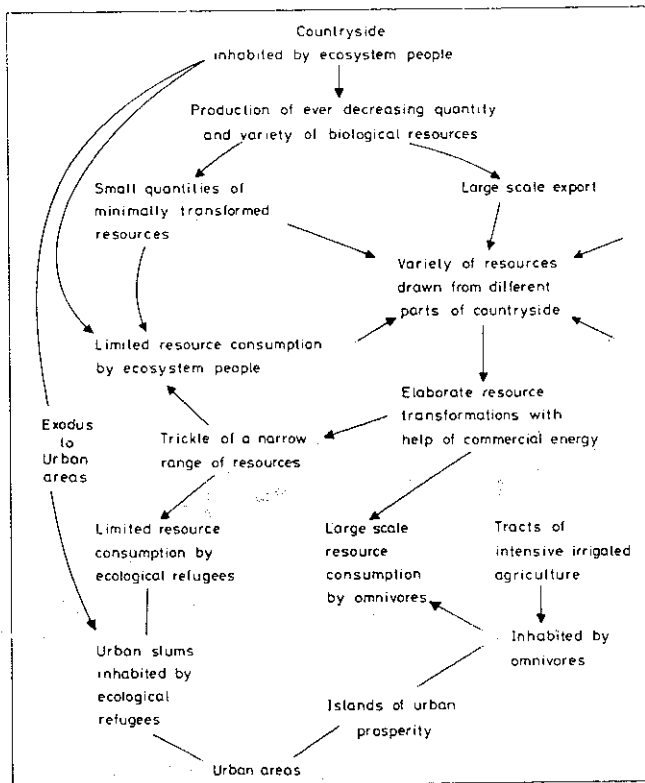
The urban-industrial sector, on the other hand, prefers that large tracts of land be devoted to the production of a small number of commodities of immediate commercial interest, such as teak or eucalyptus. It is only beginning to be worried about the serious impairment of the watershed regulation function of the forest cover. This is because the growing scarcities of water, despite massive state investments and the highly subsidized rates, are now cutting into the quality of life of urban residents and the profit margins of industry. Finally, few people in India appreciate the other possible services of forest cover, such as sequestering carbon and thereby reducing changes in the global climate.

## Ecosystem people, refugees and omnivores

The Indian population is best thought of as comprising three major segments in terms of its relationship to natural resources. The majority are ecosystem people, the relatively poor inhabitants of agricultural villages and tribal hamlets. Given their limited purchasing power, they must depend on gathering biomass and other resources from their immediate surroundings to meet many of their needs (Dasmann, 1988). They have always had very limited access to material goods but many abundant plant and animal species were used to meet their needs for food, drugs, fodder, organic manure, construction material, implements and baskets.

This resource base is now depleted because of a decline in overall biomass availability despite an increase in the numbers of ecosystem people and their livestock. This is because the diversity of plant and animal resources has gone down, and above all,

Madhav Gadgil (India), Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560012, India. Professor Gadgil has published widely on the socio-economic and cultural aspects of natural resource management, particularly in India.



**Figure 1** *Patterns of resource use in Indian society. Indian society may be divided into three components: ecosystem people, who depend on biomass gathered from their surroundings; ecological refugees, many of whom live in city slums and have limited access to resources; and omnivores, owners of larger tracts of irrigated land and city dwellers in the organized industry-service sector who have access to substantial amounts of resources drawn from all over the country.*

because ecosystem people are denied access to much of this resource base. These people do have some access to manufactured goods, but given their limited purchasing power this hardly compensates for the loss of their traditional resource base (Figure 1)

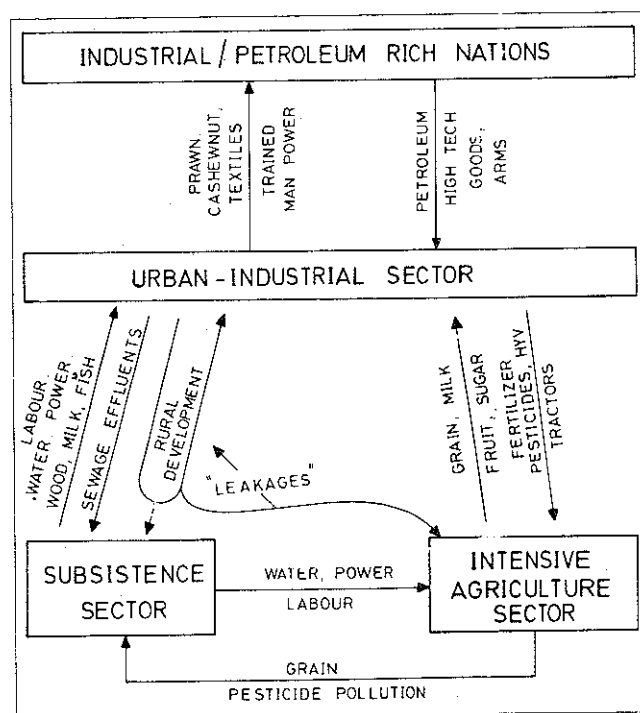
Ecosystem people deprived of access to the resources they need to survive have spawned the second segment of India's population: ecological refugees. Many of these people were uprooted when their lands were submerged under river valley projects or acquired for industry. Others, such as river fishermen, are suffering because polluted rivers yield few fish. Most such people flock to urban centres, although few succeed in entering the organized industry and service sector. They then swell the urban slums. These urban poor, with access neither to electricity or natural gas nor to wood that can be freely gathered, constitute a significant demand for commercial fuelwood. Both ecosystem people and ecological refugees may together be said to constitute the subsistence sector (Figure 2)

The third segment consists of people who may be termed omnivores. They consume everything from everywhere and are noted for their high levels of resource consumption. Water is brought to them from

dams tens of kilometres away and electricity from power stations hundreds of kilometres away. The food they eat comes from all over the country and the plywood used in their homes is manufactured from Malaysian timber. Industrial goods flow to them from all over the country and the technology that supports this manufacture is drawn from around the world.

How have omnivores, constituting a sixth of the country's population, managed to corner such a large share of its resources? Primarily by concentrating economic, political and administrative power in their own hands, and by organizing patterns of resource use that lead to further augmentation of this power. Omnivores are made up of three constituents: those in the organized industry and trade, those in the organized service sector (especially government bureaucracy), and those who own substantial tracts of irrigated land.

India now consists of a heterogeneous society based on a caste hierarchy with hereditarily determined traditional occupations. The ultimate unit of the caste system is a group within which marriages are confined (Gadgil and Malhotra, 1983). There are perhaps 50,000 such groups in the country today, organized in a few major clusters. On top of the hierarchy are the clusters of priestly, accountant, warrior and trader castes. In the middle are cultivator, herder, fisherfolk



**Figure 2** *Internal patterns of resource flows and those linking India to industrial/petroleum rich nations. Resource flows in India favour the more powerful interests and are responsible for exhaustive resource use in the countryside and impoverishment of people dependent on resources in their immediate environment. The rural development programmes meant to correct these imbalances often fail to do so; instead, their benefits flow to those in power.*

and some of the more prestigious artisan (e.g. mason, castes. At the bottom are the less prestigious artisan (e.g. leather-worker) and service (e.g. scavenger) castes who today live largely as landless agricultural labourers (Dumont, 1970).

In colonial times the upper castes became allies of the British in organizing the drain of the country's resources. The priests and accountants formed the bureaucracy, the warriors became landlords organizing the usurpation of the agricultural surplus to pass on a substantial fraction to the government as land revenue, and the traders served as partners of British merchants and industrialists. In the process, they consolidated their traditional supremacy within the Indian society.

Following independence and the growth of indigenous industry, irrigated agriculture and bureaucracy, the same upper castes came to monopolize these sectors. Industry is dominated by trader, accountant and priestly castes, irrigated agriculture by warrior castes, and the bureaucracy by the priestly and accountant castes. The omnivores of contemporary Indian society are thus largely the upper castes that have always dominated (Gadgil and Thapar, 1990). This caste division further reinforces the lack of concern on the part of omnivores about the current plight of ecosystem people and ecological refugees.

### **Subsidized resource flows**

The omnivores have served their own interests well by pushing for an ideology that equates development with organizing subsidized flows of resources to the urban-industrial-intensive agricultural sectors. This is the model that Jawaharlal Nehru, India's first Prime Minister favoured, putting aside the ideas of Mahatma Gandhi who believed that the independent nation must focus on empowering the ecosystem people and enhancing their quality of life.

Nehru wanted India to modernize, to industrialize and to catch up with the West. He was backed by the dominant upper castes as India launched itself on the path of economic development. The policy adopted was to industrialize at all costs, which meant subsidizing industry in every possible way. The state apparatus enthusiastically stepped into this endeavour and its bureaucracy grew apace. This was soon complemented by the drive to increase food production through intensive agriculture, which translated into the prescription of subsidizing all inputs to green revolution agriculture – water, power, high yield variety seeds, agrochemicals and machinery.

This process of economic development, which began in the 1950s, has intensified and channelized

resource flows, both within and outside the country. India has not been trapped into dependence on the export of just a few commodities like iron ore or coffee. It exports several, in addition to manufactured goods and trained labour. The developed or petroleum-rich nations receive these on highly favourable terms of exchange. Indeed, they acquire trained labour produced at great cost to the Indian exchequer, essentially free of cost.

Industry, the urban population in the organized sector and the intensive agriculture sector also obtain resources at high levels of subsidies. When water and power supplies are organized through river valley projects, the people displaced receive inadequate compensation. Although such hidden subsidies keep the costs low, even these are not passed on to the consumers. City dwellers barely pay 5% of the cost of bringing water to them and farmers with pumpsets generally pay a small, fixed charge irrespective of the power actually consumed (Gadgil, 1990).

But it is the biological resources that are most underpriced. Agricultural produce is undervalued by applying a far lower wage rate for labour on the farm, and forest resources have been made available essentially free to those in power (Repetto and Gillis, 1988). The British East India Company initiated such a system in the early 1800s by claiming full rights to extract free of charge teak that was growing anywhere – including on private farmlands (PPST, 1983). The system continued after independence with paper mills being granted bamboo at royalties as low as Rs. 1.50 per tonne, when market prices were higher by a factor of 2000 times (Gadgil et al., 1983).

In this system, the ecosystem people are systematically deprived of access to resources in order to ensure their supply at highly subsidized rates to the omnivores. This is converting increasing numbers of ecosystem people into ecological refugees. Furthermore, the wage rates for the ecosystem people in the countryside and the ecological refugees in the unorganized urban sector are far lower than those for the workers in the organized sector. This cheap labour is yet another way of subsidizing resource consumption by the omnivores.

### **The iron triangle of Indian society**

Power within society flows from control over its resources so people benefiting from highly subsidized resource flows have a substantial share of the power. They have used this clout to organize themselves into a system that continually bolsters the subsidies. It consists of three components: those who benefit from the subsidies; those who administer them and those who decide on who is to receive them and at whose cost (Repetto, 1986).

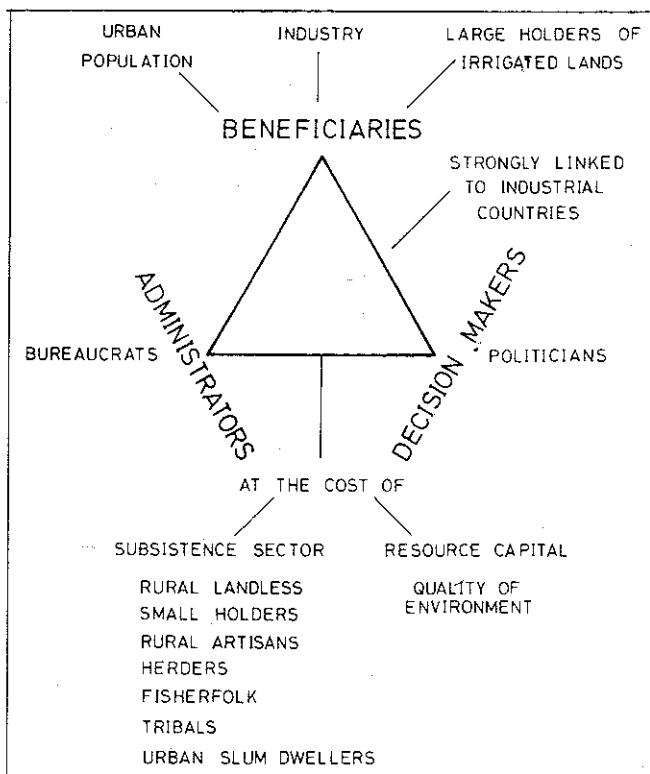


Figure 3 *The iron triangle governing resource use patterns in India. Large state-sponsored subsidies have created an iron triangle of components of Indian society benefiting from, administering and deciding upon resource subsidies. Constituents of this iron triangle are forcing the country into a pattern of exhaustive resource use at the expense of the environment and the majority of the people*

The direct beneficiaries of the subsidies are industry, intensive agriculture and the organized service sector especially the bureaucrats who also administer the subsidies. The politicians ultimately decide on who receives the subsidies, and they largely come from among the larger landowners and from those engaged in the organized industry and service sectors. Together these constitute the iron triangle governing the resource use pattern of the whole country (Figure 3)

### Sequential exhaustion of forest resources

The root cause of the decimation of the country's forest cover lies in the way the constituents of this iron triangle operate. Receiving resources at throw-away prices, they have little interest in their sustainable use. Theory tells us that renewable resources with high prices compared to harvesting and processing costs, would tend to be over-exploited (Dasgupta, 1982; Clark, 1990). It recommends adequate levels of taxation to curb this tendency. Exactly the opposite has been done in India, with resources already susceptible to over-exploitation pushed further in that direction through state sponsored subsidies.

Managers of a paper mill lucidly explained to me the logic of the system. The paper mill was receiving bamboo at 1.50 Rupees per tonne and had already made more than enough profit to justify its closing down if need be within a decade. Furthermore, management did not believe that the allotment of

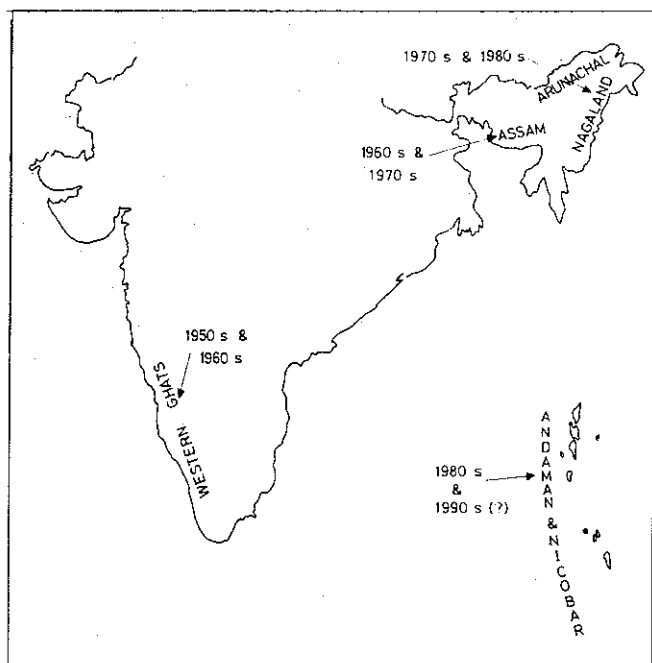


Figure 4 *Geographic shifts of the plywood industry in India. The non-sustainable resource use methods of this industry have kept it shifting over time to more and more remote areas of the country as resources from more accessible areas near exhaustion*

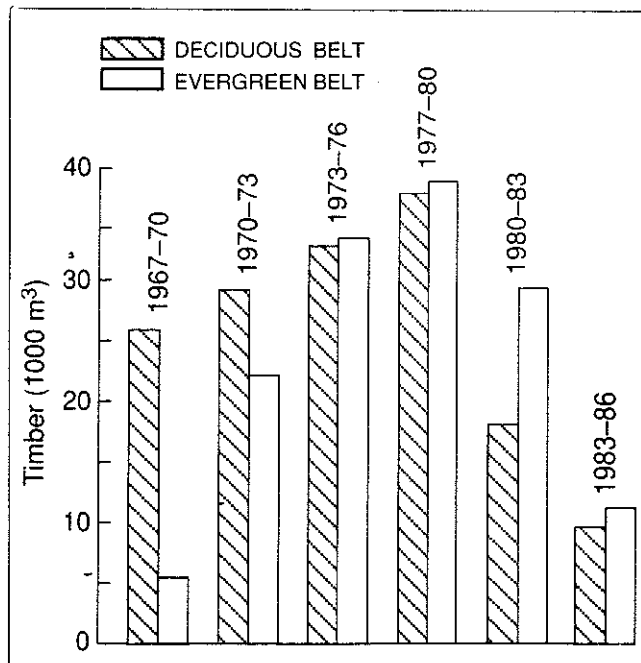
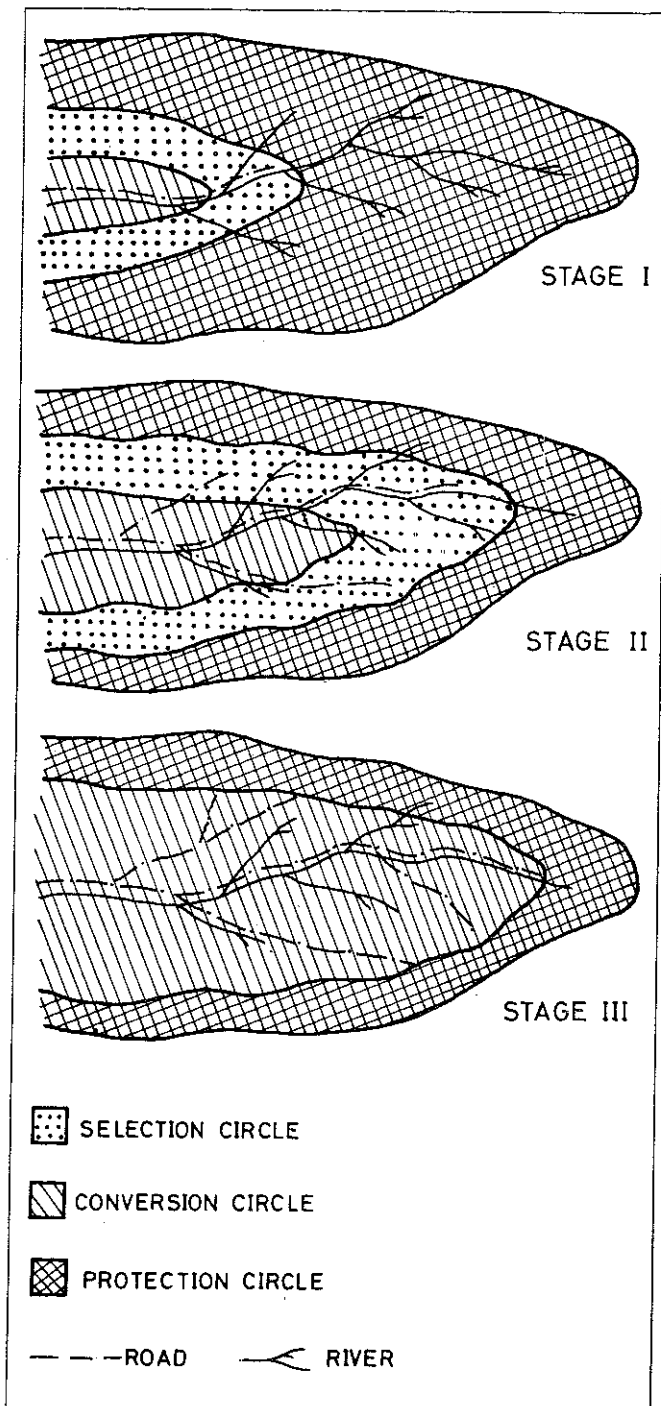


Figure 5 *Timber harvests by the plywood industry from the Uttara Kannada district of Karnataka State, 1967-86. It is evident that pressures of non-sustainable use have forced this industry to shift from more accessible deciduous forest tracts to less accessible evergreen forest tracts, and that timber supplies from both zones have fallen off.*

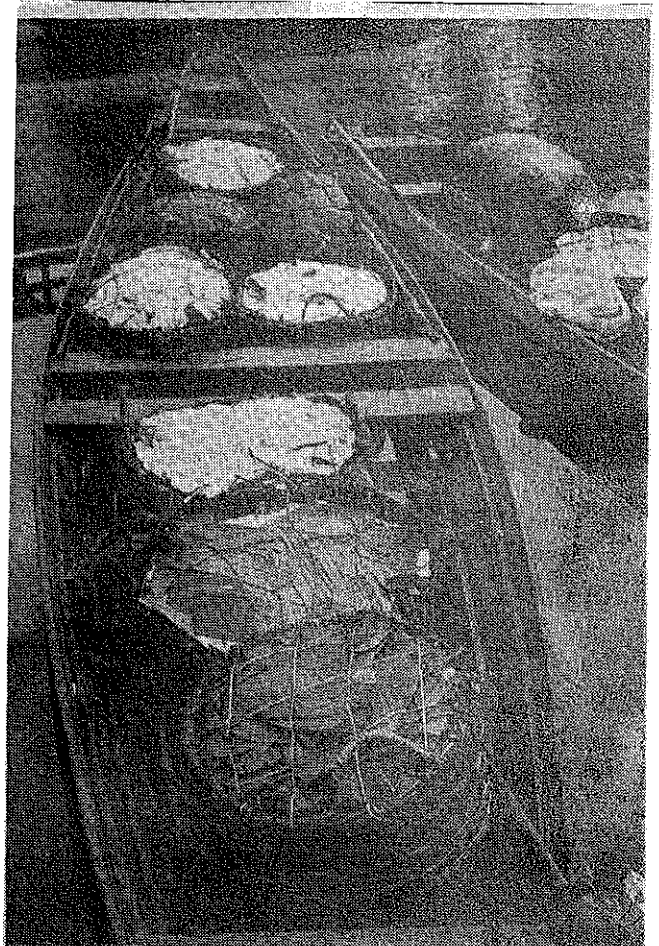


**Figure 6** Working plans of the Ranni forest division of Kerala, 1950-80. This Figure shows that the protection zone (set aside for watershed conservation), selection zone (earmarked for extraction of a limited number of trees on a sustainable basis) and conversion zone (devoted to clearcutting and raising of monocultures of commercial species) have kept on shifting in response to exhaustive resource use (after FAO, 1984)

bamboo at such low rates would continue indefinitely. It was also likely that pressures would build up and that the rate would be increased or some other party given the concession. In view of this uncertainty, the optimum strategy was not to use the resource in a sustainable way but in an exhaustive fashion, focusing on maximizing short-term profits.

Commercial use of forest resources by the industry and its contractors has followed this logic everywhere. The result has been a concentration on resource elements that would yield the highest profit at that moment, resulting in their exhaustion through excessive harvests, and followed by a switchover to the most profitable of the remaining resource elements. This is a process of sequential exhaustion (Gadgil, in press) that operates at many levels.

The Indian plywood industry has successively shifted its exhaustive use from Western Ghats to Assam to Nagaland to the Andaman and Nicobar islands (Figure 4). Within a given region, such as the Uttara Kannada district of Karnataka, it has shifted its focus of exhaustive use from more accessible deciduous forests to less accessible evergreen forests (Figure 5). Within the Ranni forest division in Kerala, working plans have successively converted hill-slope areas, originally meant to be left intact for watershed conservation, into a selection felling zone from which a proportion of trees is to be harvested on a sustainable basis. When this extraction proved to be non-sustainable, the area was converted for



Baskets of sorva, the gum produced from the sorva tree (*Couma spp.*), are delivered by canoe in the Amazon to the buyer who usually exchanges it for merchandise, taking advantage of his position by setting the prices of both commodities. This often results in a system of permanent indebtedness and exploitation (Photo: L. Emperaire)

clearcutting and raising of monoculture plantations (FAO, 1984) (Figure 6) Another example is the plywood industry in Uttara Kananda district. It initially used the most desirable species and as these were exhausted persuaded the government to add more and more to the list of species conceded to it for supply at highly subsidized rates.

## Of rights and privileges

This exhaustive pattern of resource use obviously has a major impact on the ecosystem people, whose enormous population is distributed all over the country. Indeed, except for a few uninhabited islands of the Andaman and Nicobar chain, there is hardly any forest area that is not used somehow by local people. This was a major bone of contention at the time of the declaration of reserve forests by the British Government in the 1860s.

This reservation of forests stemmed from the government's desire to take over as state property as much of the non-cultivated land in the country as possible by denying any rights to local communities. As a second step, it agreed to set aside part of state-controlled forest areas as protected forests from which local communities could meet their biomass requirements. When the issue of demarcation of reserve and protected forests came up, the Government of Madras maintained that there were no forest areas within its jurisdiction that were not under extensive customary usage by local communities. The proposed reservation would therefore amount to confiscation, not conservation (PPST, 1983).

This contention was rejected by the Governor-General of India, not on factual grounds but in the interests of the rulers. Consequently, substantial portions of forest areas, traditionally used and often well managed by local communities, were taken over by the government as reserve forest areas, to be dedicated to the production of wood for British interests.

Some of the forest areas, nevertheless, had to be conceded for use to the local people. These were constituted into state-controlled 'protected forest' or 'revenue' lands over which the local people had no rights and which could also be exploited by people of adjoining villages. The state thus deliberately created no-man's-lands which, subject to the tragedy of the commons, were often rapidly degraded. This was then used as an excuse to convert them into reserve forest lands (Gadgil and Iyer, 1989).

In a few parts of the country, e.g. the tribal Bastar, traditional community-based management of such lands continued. In a few others, e.g. the Almora district of the Himalayas, new community-based management systems were established. Even these

were mostly destroyed after independence, partly because the forest resources of these more remote regions were now attractive to the rapidly growing forest-based industry and partly because increasing population pressure, growing influence of market forces and increasing politicization of rural and tribal society had led to further breakdown of community-based institutions (Guha, 1989).

Ecosystem people have thus been compelled over the last century to meet their growing biomass needs from a shrinking resource base in a thoroughly unregulated fashion. The inevitable result has been a degradation of large tracts of lands that supported 'oceans of trees' at the time of British conquest. It nevertheless remains true that it is only the ecosystem people who have a genuine stake in the well-being of the country's vegetation cover. They are the ones directly dependent for their well-being on the production of vegetation from their immediate neighbourhoods. It is they who suffer the most if this vegetation is degraded and, unlike the omnivores, they have no other options.

## Science and pseudoscience

The forest management practices of a country naturally reflect the interests of those in power. These practices are largely shaped and wholly administered in India by a tightly knit bureaucracy, which claims to manage the forest wealth in the broad national interest on a scientific basis (Shyam Sunder and Parameshwarappa, 1987). But the national interest as defined above is equated to the short-term commercial interests of a narrow segment of Indian society - the omnivores.

The scientific basis is equally dubious. After more than a century of systematic forest management, few data have been collected even on growth curves of major timber species, and many of the preservation plots established for this purpose have been destroyed (Gupta, 1981). There are practically no scientific data on most other aspects pertinent to good forest management, be it forest soils, hydrology, or biomass needs of the rural population. In the early 1970s the National Commission on Agriculture (1976) had to note that it was given two different figures: 69 million ha and 75 million ha of land under forest department control and was unable to decide on the correct figure. There was even less documentation of tree cover under control of the department until the National Remote Sensing Agency (1980-82) demonstrated using satellite imagery, that a very substantial portion of this land had either zero or very poor tree cover.

Indeed, the general public has very limited and difficult access to information relating to forestry. This monopoly over all information by the Indian

**Table 1** *Proposed changes in patterns of forest use that would simultaneously enhance environmental services and benefit the weaker segments of India's tribal and rural population*

<b>Land category</b>	Hill slopes/arid lands under cultivation	Non-cultivated lands adjoining human settlements	Non-cultivated lands away from human settlements
<b>Current ownership status</b>	Privately owned or illegally encroached government land	State owned, often with user privileges assigned to local people; occasionally owned privately	State owned with few or no user privileges assigned to local people
<b>Current dominant usage pattern</b>	Subsistence agriculture responsible for continuing degradation of land and vegetation	Unregulated biomass harvests by local people and their livestock, encroachment for cultivation	Non-sustainable harvests to fulfil urban-industrial demands at highly subsidized rates
<b>Proposed management pattern</b>	Privately managed with links to urban-industrial consumers	Well organized community-based management with land ownership vested in the state	State managed with active involvement of local communities in sustainable use of non-wood products
<b>Expected vegetation cover</b>	Mono- or poly-cultures of trees or pastures in small pieces forming a rich mosaic	Good standing crops of indigenous multiple use trees, shrubs and grasses	Good standing crop of indigenous tree species enriched with a variety of species yielding non-wood products
<b>Expected services</b>	Supply of wood to urban-industrial consumers at prices fair to tree growers; enhanced environmental services	Fulfilment of biomass needs of tribal/rural population; surplus, if any, for urban-industrial sector; enhanced environmental services	Non-wood products for industrial needs; support to tribal/rural economy; enhanced environmental services

bureaucracy is of course a wider problem. The government machinery had for instance invoked the official secrets act in 1989 to suppress any debate on the impact of dams in the Narmada valley. This behaviour has obvious parallels in the prescriptions of the priests in olden times that lower caste people caught listening to the sacred Vedas were to be punished by pouring molten lead into their ears. The modern bureaucracy has formed a similar caste-like organization, stifling any wider debate on its performance, putting forward unjustified claims of scientific management and disguising the narrow interests it serves as national interests.

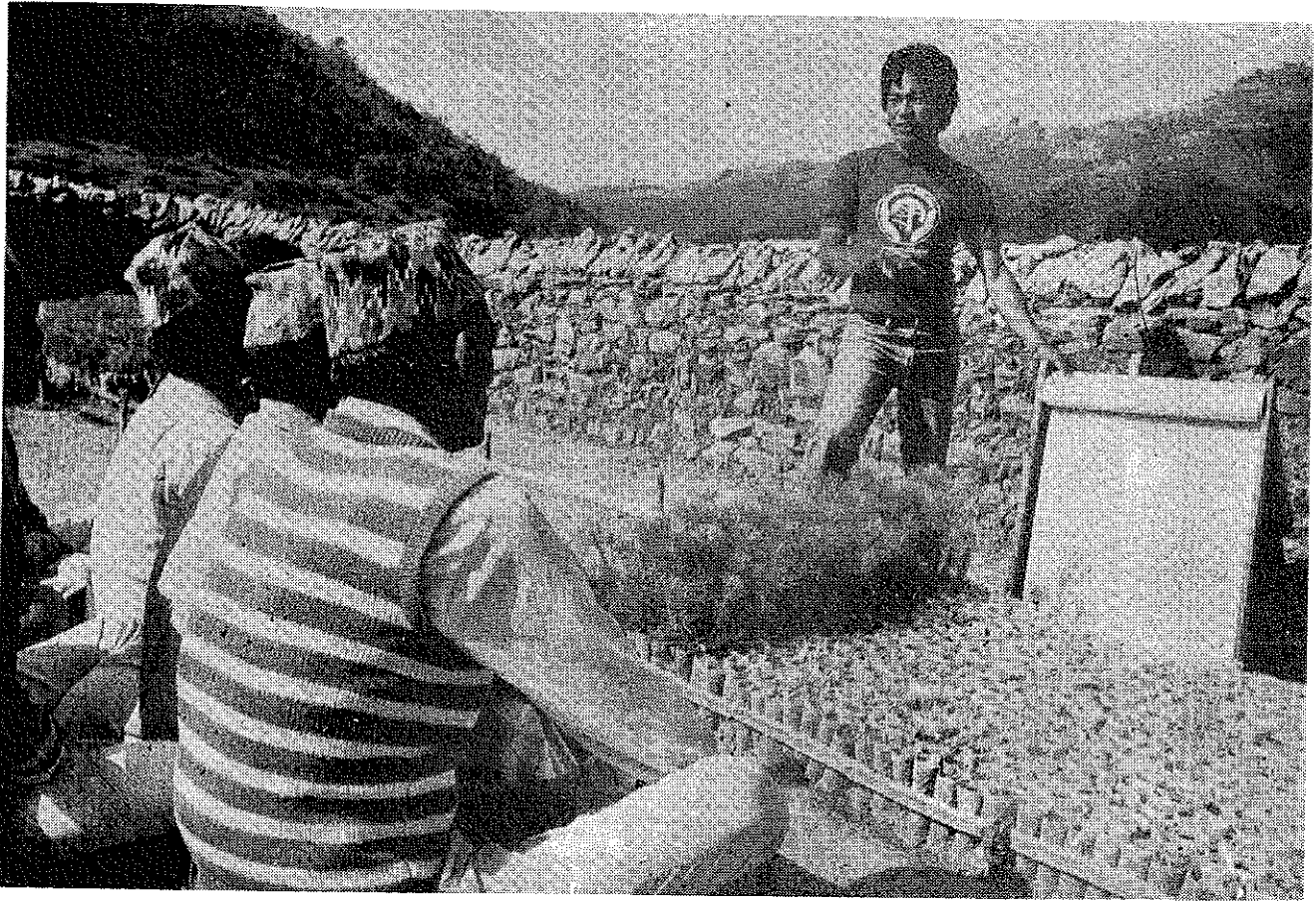
### A progressive alternative

How can this tide be turned back? Clearly by ensuring that the real interests of the masses of the people in the countryside, the ecosystem people, prevail. For they are the ones who suffer the most when the vegetation cover of their localities is degraded or destroyed. Furthermore, their demands on biomass are manifold, and they need a great diversity of species to meet them. In the district of Uttara Kannada in Karnataka, for instance, as many as fifty different species of plants are used as a source of material for making brooms, baskets, implements,

furniture and decorative articles. Fruits of about a dozen species are regularly consumed and the leaves of another dozen species are used as fodder. Up to twenty species provide non-wood products of commercial value. Over and above these are the hundreds of plant species used for medicinal purposes.

In every region of India there is a great variety of indigenous species including herbs, shrubs, climbers and trees, in whose survival and availability the local people have a genuine stake. Significantly, there are traditions of using these species without destroying the structure of the forest community itself. The primary interest of people is in non-wood products; even the firewood is extracted as small branches and twigs.

Trees are only occasionally felled to meet subsistence needs, unless of course the vegetation is highly degraded. The people may then be compelled even to dig out roots to cook their meals. It must be recalled that, apart from this, tree felling is invariably prompted by the commercial demands of omnivores, not by subsistence demands of ecosystem people. That is why the seemingly smaller quantitative demands for biomass by the omnivores have a qualitatively far greater impact (Gadgil, 1989; Gadgil, in press).



*Good forest management must also include access to appropriate seedlings from tree nurseries in addition to extension programmes geared for the people who will plant and protect new forests (Photo: FAO/Rights reserved)*

It is, of course, no easy matter to reorient India's forest management policies so as to reflect the interests of ecosystem people, who although being the majority, are utterly impoverished and disorganized. Indeed, the official version is that it is the biomass demands of these people that are the root cause of forest depletion and that the remedy lies in further alienating them from the resource base. The folly of this approach is being increasingly realized in the face of growing tribal and rural movements in forest belts (Centre for Science and Environment, 1982; 1985).

Fortunately, there are many hopeful signs that a genuine shift in forest policy in favour of the ecosystem people is in the offing. Such a policy should be based on the following elements (summarized in Table 1)

- (1) A network of community lands should be created throughout the country, drawing on common lands currently classed as revenue and protected forest lands, as well as reserve forest lands where necessary

Viable community-based institutions should be established with full legal, administrative and technical support of, but no undue intervention by, the state machinery. These institutions should be empowered to

plan the use of common lands, to decide on the plant species to be promoted, to plant, protect and to work out modalities of sharing the products (Poffenberger, 1990). There are some excellent models for such a system in the *ban panchayats* (forest councils) of Almora district in the Himalayas (Guha, 1989; Somanathan, personal communication)

- (2) All other state controlled lands – mostly reserve forest lands – should be devoted to serving the ecological functions of watershed protection, maintenance of biodiversity and carbon sequestering

This implies that there should be no artificial opening up of the canopy, no silvicultural operations like climber cleaning, and no commercial wood extraction. However, the modest collection of non-wood products such as seeds, resin and reeds would be perfectly compatible with the ecological functions. Such collection should be organized so as to benefit genuinely the rural and tribal populations of the area and thereby create a stake for them in good forest management. An excellent model for this system is the village forest protection committees of West Bengal (Bajaj, 1990; Government of West Bengal, 1988; Malhotra and Poffenberger, 1989). Where necessary, natural regeneration in such forest tracts may be



complemented by the enrichment planting of a variety of non-wood product species

- (3) The wood demands of the forest-based industry, urban populations and the fuelwood demands of rural areas without access to any community lands should be met from tree crops grown on marginal lands that are now under cultivation but would be much better maintained under a tree/grass cover.

Over half of the land surface of India is cultivated, although most of its food needs are met from a far smaller amount of land under intensive agriculture. Thus the diversion of steep lands and dry lands from cultivation to tree/grass production would not affect the country's food situation adversely. At the same time, this would generate more ecologically sound employment opportunities for the subsistence farmers in these areas. This would be a far more efficient system of production, as the level of wood produced from reserve forests is exceedingly low, a mere 0.5 t/ha/year. Studies indicate that while annual eucalyptus production levels from reserve forests of Karnataka Western Ghats were of the order of 0.5–2.0 t/ha, those from privately owned farm lands were much higher, 5–15 t/ha (Prasad, 1984).

### Managing forests in the people's interests

The alternative system of forest management described above has many positive features. It would

greatly enhance the quality of life of most of India's population, the ecosystem people, by securing their biomass needs, by generating economic opportunities in collecting, processing and marketing the non-wood products and by conferring dignity on them through involvement in forest management. Although it would certainly cut off the subsidies currently being enjoyed by the urban-industrial sector for wood supplies from state controlled lands, the efficiency of wood production to meet these demands would be vastly improved by the switch-over to private lands.

At the same time the ecological benefits would be tremendous. Under this system the level of standing biomass on community lands as well as state-owned lands devoted to non-wood products would increase substantially. It would also enhance many ecological functions, including watershed conservation, maintenance of biodiversity and carbon sequestering. As far as India is concerned, the longer term, broader environmental concerns would be best served by managing the forests in the interests of its ecosystem people.

### Acknowledgements

I am grateful to Kailash Malhotra, M.D., Subash Chandran and Ramachandra Guha for the many insights they have provided over years of fruitful collaboration. The financial support of the Department of Environment, Government of India is gratefully acknowledged.

### References

- BAJAJ, M. 1990 An Examination of the Potential for Investment in Natural Regeneration of Degraded Forests with Community Participation *Wastelands News*, 6 (1), 7-22
- CENTRE FOR SCIENCE AND ENVIRONMENT, 1982. *The State of India's Environment 1982 A Citizens' Report* New Delhi, Centre for Science and Environment, 189 pp.
- CENTRE FOR SCIENCE AND ENVIRONMENT, 1985. *The State of India's Environment 1984-85 A Second Citizens' Report* New Delhi, Centre for Science and Environment, 393 pp.
- CLARK, C.W. 1990. *Mathematical Bioeconomics The Optimal Management of Renewable Resources* New York, John Wiley, 386 pp.
- DASGUPTA, P. 1982. *The Control over Resources* New Delhi, Oxford University Press, 223 pp.
- DASMAN, R.F. 1988. Towards a Biosphere Consciousness. In: D. Woister (ed.) *The Ends of the Earth: Perspectives on Modern Environmental History*, pp. 177-88. Cambridge: Cambridge University Press.
- DUMONT, L. 1970. *Homo hierarchicus. The Caste System and its Implications* London, Weidenfeld and Nicholson, 488 pp.
- FAO, 1984. *Intensive Multiple-use Forest Management in Kerala* FAO Forestry Paper 53 Rome, FAO, 137 pp.
- GADGIL, M. 1989. Deforestation: Problems and Prospects *Energy Environment Monitor*, 5 (2), 3-47.
- GADGIL, M. 1990. Population, Resources and Environment. *Seminar*, 365, 52-6.
- GADGIL, M. India's Deforestation: Patterns and Processes. *Society and Natural Resources*, 3 (2) (In press.)
- GADGIL, M.; IYER, P. 1989. On the Diversification of Common Property Resource Use by the Indian Society. In: F. Berkes (ed.) *Common Property Resources Ecology and Community Based Sustainable Development*, pp. 240-255. London, Belhaven Press.
- GADGIL, M.; MALHOTRA, K.C. 1983. Adaptive Significance of the Indian Caste System: An Ecological Perspective *Annals of Human Biology*, 10, 465-8.
- GADGIL, M.; PRASAD, S.N.; ALI, R. 1983. Forest Management in India: A Critical Review *Social Action*, 33, 127-55.
- GADGIL, M.; THAPAR, R. 1990. Human Ecology in India: Some Historical Perspectives *Interdisciplinary Science Reviews*, 15 (3) 209-23.
- GOVERNMENT OF WEST BENGAL. DEPARTMENT OF FORESTS, 1988. *Project Report on Resuscitation of Sal Forests of South-West Bengal through People's Participation* Government of West Bengal, 31 pp.
- GUHA, R. 1989. *The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya* New Delhi, Oxford University Press.
- GUPTA, A.C. 1981. Preservation Plots in Karnataka. In: *National Seminar on Forests and Environment*, 13 December 1981, Bangalore.
- MALHOTRA, K.C.; POFFENBERGER, P. (eds.) 1989. *Forest Regeneration through Community Protection: The West Bengal Experience* Proceedings of the Working Group Meeting on Forest Protection Committees, Calcutta, June 21-22. West Bengal Forest Department, Calcutta 47 pp.
- NATIONAL COMMISSION ON AGRICULTURE. 1976. *Report of the NCA Part IX Forestry*. Ministry of Agriculture, Government of India, New Delhi, 457 pp.
- NATIONAL REMOTE SENSING AGENCY, 1980. *82 Forest Maps* National Remote Sensing Agency, Department of Space, Government of India.
- POFFENBERGER, M. 1990. *Joint Management for Forest Lands: Experiences from South Asia* A Ford Foundation Program Statement, 49 pp.
- PPST, 1983. The Story of Scientific Forestry in India: Some Highlights. *PPST Bulletin*, 3 (1) 31-67.
- PRASAD, S.N. 1984. The Productivity of Eucalyptus Plantations in Karnataka. In: J.K. Sharma, G.T.S. Nair, S. Kedharnath and S. Kondas (eds.) *Eucalypts in India. Past, Present and Future*, pp. 188-93. Peechi, Kerala Forest Research Institute.
- REPETTO, R. 1986. *Skimming the Water. Rent-seeking and the Performance of Public Irrigation Systems*. Research Report No. 4 Washington D.C., World Resources Institute.
- REPETTO, R.; GILLIS, M. (eds.) 1988. *Public Policies and the Misuse of Forest Resources* Cambridge, Cambridge University Press.
- SHYAM SUNDER, S.; PARAMESHWARAPPA, S. 1987. Forestry in India. *The Forester's View Ambio*, 16 (6), 332-37.
- SOMANATHAN, E. 1990. Personal Communication.