

Forest Management, Deforestation and People's Impoverishment

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Of Mangoes and Mahua

Exactly nine years ago, on a warm day in May, Kailash Malhotra, an anthropologist, and I trekked from the hill station of Pachmarhi in Madhya Pradesh to a Korku village eight kilometres away. There was good tree growth all along the way, and the walk was most enjoyable but for the disturbing sight of many ring-barked and dying trees just as we got out of the town. The number of such trees however quickly fell off and our joy was complete on running into a Korku lady who sold us a basketful of sweet wild mangoes with little pulp and large stones. We went on broadcasting the seeds into the forest, as nature had meant us to, and were surprised to realise that while the tree growth was extensive, it was dominated by just two species: mango and mahua. Over centuries the Korku tribals practicing slash-and-burn cultivation had undoubtedly spared them and as the forest came back they had gained the pride of place.

Mango and *mahua* are just two of the many trees that have signified much more than utility to the people of India over the ages. *Gathasaptashati*, an anthology of romantic folk verses of the first millennium A.D. from Central India, has many references to both these species (Joglekar 1956). Thus, one verse implores a young bride not to despair because her husband was about to embark on a long journey; after all when he saw the pot full of young leaves and inflorescence of mango, kept just outside the house to bid him goodbye, he was bound to realise it was spring and return to her! Every summer, all of India looks forward to feasting on mangoes, wild and cultivated, raw and ripe. Not that its timber is no good; on the contrary it is prized for building boats. But the seventeenth century Maratha king Shivaji

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made it a special point to order his officers never to cut mango (*Mangifera indica*) and jackfruit (*Artocarpus heterophyllus*) trees for his shipyards or any other work of the state, for, as he put it, these trees have been treasured and nurtured by the peasants for generations (Rane 1987). Our modern Governments have had no such qualms while conceding magnificent old mango trees to the plywood industry. Indeed, the highly subsidised forest-based industry has often paid for a mango tree less than what its fruit used to fetch for the local people year after year (Gadgil and Chandran, 1989). But then, as a manager of a plywood factory explained to me, all they were concerned with was multiplying money for their masters, and if mangoes had to be sacrificed to this end, so much the worse for the mangoes!

This total, all pervasive change in the way resources are viewed is also seen in the case of *mahua* (*Madhuca Indica*). *Mahua* is vital to tribal economy; as a major source of food energy in the form of sugar and alcohol and for its oil seed. It is also valued in the Ayurvedic *materia medica* for treatment of ailments relating to gas and phlegm (Gogate, 1982). Most of our tribal groups venerated *mahua*, and traditionally used only its usufruct in a regulated fashion. It was, therefore, a great blow to them when the British banned their shifting cultivation; but at the same time permitted contractors to cut down sacred *mahua* trees (Pressler, 1971).

Two Nations

The major thesis I want to advance today is that the root cause of the on-going disaster of deforestation lies in the radical transformation of the social system of resource use that took place under the British regime, and has become all the more firmly entrenched after independence. The hallmark of this system is the use of state power to systematically undervalue biomass, and even more so biological diversity and organise its supply to those in power at highly subsidised values. The elite also pay unfairly low prices for other natural resources, like grain, water and power. Those benefiting from such subsidies, for instance, forest-based industries, or citizens of Bangalore or Delhi; our political masters making policy decisions as to who will be subsidised at whose cost; and the bureaucracy that administers the subsidies have formed an alliance—the *iron triangle* as the Americans call it, which ensures that this system of resource use is perpetuated (Repetto 1986, 1988). In this system, those receiving the greatly undervalued biomass from all over the country, indeed all over the world have no motivation to ensure its sustainable use. The rural poor, at whose cost this whole system is being operated, form the bulk of our population. Depending as they do on the gathering of biomass

for fulfilling many of their basic needs, they could be motivated to safeguard and sustainably use the resource capital. They are however thoroughly disorganised and totally caught up in the day-to-day exigencies of survival. Hence, these major victims of deforestation have willy-nilly become its major agents as well.

Evidently, the rural poor play a significant role in the process of deforestation today. But does this imply that it is only the quantitative pressure of their demands for fuelwood and fodder, small timber and thatch that has brought about the transformation of India from the biomass-rich country of the pre-British times to the plight of today? I would contend that it is not so. For one, their demands are of a qualitatively different nature from those of the affluent sector. Our land is productive enough to meet these subsistence demands, if only it were managed prudently. It is the commercial demands growing without limit that are so much more difficult to fulfil. More significantly, the undervaluing of biomass to ensure its subsidised supply to the commercial sector has been achieved by abolishing the traditional rights of the rural society. Under these circumstances, the rural population cannot and will not co-operate in prudent management of our forest resources. It is my belief that it is this whole complex of interacting forces, the current social system of resource use, that has triggered the decimation of our natural biomass base; and not merely the quantitative pressure of subsistence demands of the rural poor (Repetto and Holmes 1983).

Systems of Resource Use

The Tribal System

Two major social systems of resource use prevailed in pre-British India. The older one, characteristic of hunter-gatherer-shifting cultivator societies covered the northeastern hill states and the large tribal tract stretching from Aravallis and northern reaches of Western Ghats, over Satpuras, Vindhya and the Central Indian plateau to the eastern reaches of the Eastern Ghats. In this system each homogeneous social group, the tribe, controlled a certain land area, its territory as community property. The social group as a whole organised the pattern of resource use on this land, including allocation of plots for cultivation in a given year. The flows of materials were largely restricted within the territory, though there would be some exchanges with the outside, for instance, honey and ivory for metal. However, such exchanges were quantitatively insignificant, so that the material cycles were largely closed over the spatial scale of tribal territories. This

meant that the tribal population had a real stake in the security of the resource base of their territory and evolved a number of cultural traditions to ensure its sustenance. These not only included long fallows in the cycle of rotation of shifting cultivation, but also selective retention of valuable trees such as mango and mahua while felling for slash and burn. Furthermore, certain areas of terrestrial as well as aquatic ecosystems were set apart as refugia, as sacred groves and sacred ponds immune to all human interference. The community woodlots often lay next to these sacred groves, so that they could be effectively regenerated from the climax vegetation preserved in the latter. There were a number of restrictions enforced by the community as to how harvests from common property resources such as community woodlots were to be made. Notably enough, even today in Mizoram the system of sacred groves and community woodlots is termed safety forests and supply forests (Malhotra 1988). Apart from sacred communities, individual species, such as *Ficus* trees like banyan, or other totemic plants or animals were also given full protection. There is abundant evidence that all of this enabled the tribal communities to use their resource base in a sustained fashion (McNeely and Pitt 1985; Berkes forthcoming). There were undoubtedly other factors in maintaining this balance; in particular the fact that much of tribal territory was highly malarial, thereby keeping the population at low densities. Furthermore, there were intertribal wars; thus Nagas hunted aliens, heads. Coercion and violence was then not unknown in these societies, but it was largely involved in continuing tribal control over its territorial land, not in organising flows of materials from one territory to another (Vayda 1974). Indeed the ability of a tribe to hold its own would have depended on the health of the resource base of its territory and promoted the evolution of traditions of prudent resource use (Gadgil 1987).

The Agrarian System

The greater portion of India, especially its fertile river valleys, was under a second social system of resource use, that of agrarian village communities. This society mirrored the tribal society in several ways. Each village was a partly autonomous social unit, with its own territory and its own internal administration. The village paid taxes, the surplus of its grain production, to the chiefs as a unit, not individually. Although the chiefs in theory may have owned all land, in practice land could not be alienated from the cultivators. The village community as a whole also controlled its non-cultivated land (Dharampal 1986). Thus, in western Maharashtra, members of an endogamous caste group called Mahars, served as village guards. It was their duty to accompany all

outsiders visiting the village from the village boundary to the village council building and to see them off. They held the responsibility for the safety of the village woodlot; their duties also included harvesting and supplying fuelwood to each household. Since the few Mahar families of any village expected to remain there and be discharging this function over generations, they would be motivated to harvest fuelwood in a sustained fashion (Aatre 1985).

Society had also retained a number of religion-based traditions of nature conservation from the hunter-gatherer times. This included protection of sacred groves and sacred trees such as banyan and *peepal*. A seal from Mohenjodaro, the earliest known agricultural civilisation on the Indian subcontinent depicts a *peepal* tree. Gautam Buddha is reported to have been born in a sacred grove, the Lumbinivana full of *sal* trees, and achieved enlightenment while sitting under a banyan tree. The agrarian villages of India had thus apparently retained the system of having a community-controlled supply forest, and a religiously-protected safety forest attached to each village, a system that persists even today in some of the remoter corners of the country, such as the Western Ghats (Gadgil 1985).

Resource Use Diversification

The agrarian society differed from the tribal society in one important way. Here each village was made up of a number of different endogamous caste groups, each with a definite status in social hierarchy. This was a highly inegalitarian system, with the lower caste groups undoubtedly suffering exploitation. Nevertheless, all these groups were linked together in a web of reciprocity, and each group shared in the well-being of the resources of whole village territory (Dumont 1970; Karve 1961). Notably enough, the different groups had so diversified their patterns of resource use, that a given endogamous group had monopoly over certain plant uses in any particular locality. To an extent, this system still persists and may be exemplified by our own study of the use of plant materials for structural purposes by nine different endogamous groups of Sirsi taluka, in the Uttara Kannada district of Karnataka. This figure shows the particular end use of a particular plant species by a given group. Thus Christians have a monopoly of using the cane, *Calamus* for making cane furniture in this taluk. Chamagars have the monopoly over making mats and brooms from *Phoenix*. Bamboo, *Dendrocalamus*, is on the other hand used by Badigars, Holeswars as well as Chamagars. Such diversification of resource use would undoubtedly have kept the level of competition for any particular resource at a low level, mostly within a

tightly-knit endogamous group and thereby promoted its prudent, sustained use (Gadgil and Malhotra 1983).

Bamboo, of course had other uses too; Kalidasa talks of the melody of wind whistling through a bamboo clump, and Venugopala, or young Krishna playing a bamboo flute is the most endearing figure of Indian mythology. The folk poets of Gathasaptashati have written many verses about it; one of them talks of the wonderful life enjoyed by hill people who can make love in the open without the least constraint, shielded as they would be by the thick clumps of bamboo swaying hither and thither with wind. But that apart, bamboo shoots are edible as are its occasionally produced seeds. Bamboo leaves are an excellent source of fodder for cattle in summer, and the Ayurvedic *materia medica* mentions several uses for its root, tender leaves and the silica crystals found in its hollow internodes. Bamboo is prime material for rural house construction, and where it is still abundant, I have seen tribals construct a spacious hut in just three days; a hut which had a totally leakproof roof too, which is more than what can be said of many of our modern RCC buildings. Bamboo baskets serve for storing everything, and bamboos go to make all sorts of implements from bows and arrows of tribals to seed drills of plough cultivators (Prasad and Gadgil 1985). Early British travellers wax eloquent about the wonderful bamboo groves to be seen in India, as they, as well as the first set of British Gazetteers prepared in 1860-90 do about the natural biomass wealth of most of India.

Like all ancient urban civilisations that of India was based on the surplus of agricultural production of the countryside. This surplus was largely siphoned off as tax or loot as was some of the produce of the non-cultivated lands: sandal, ivory, musk, pepper, cardamom. However, the non-cultivated lands primarily served to meet the subsistence needs of fuel and small timber of the villagers, and especially as a source of organic manure, both directly as leafy material and indirectly as dung of cattle grazing on the uncultivated lands. This organic manure was vital to the maintenance of soil fertility, and Volcaer, an agricultural chemist appointed by the British Government to enquire into the condition of Indian agriculture in the 1890's laments the ill-effect of loss of this supplement to agriculture brought about by British forest policies (Volcaer 1897). The non-cultivated tracts of the country were firmly committed to a role supportive of agriculture and were maintained well by the villagers as assets under community control. Many of these harboured what some early British travellers have called "oceans of trees", though parts of the country may already have suffered some deforestation.

British Conquest

On to this stage arrived the British, very much in saddle by the beginning of nineteenth century. The European conquest of the Americas and Africa was already well advanced by this time, a conquest whose significant fallouts included the genocide of American Indians and slavery for black Africans. But more pertinent to our theme are the remarks of Hugh Cleghorn, one of the early Conservators of Forests in India. In his book published in 1861, he says:

Of all European nations the English have been most regardless of the value of forests, partly owing to their climate, but chiefly because England has been so highly favoured by vast supplies of coal and the emigrants to the United States have shown their indifference to this subject by the reckless destruction of forests in that country, of which they now feel the want (see also Cronon 1983; Crosby 1986).

Europeans had of course made some remarkable advances by this time. They had progressed beyond the slow pace of growing knowledge through a process of trial and error of the old civilisations, and developed the much faster hypothetico-deductive method of modern science. They had applied the rapidly advancing knowledge of working of nature that this method had gained to practical ends. One result was the ability to effectively employ the energy tapped in fossil fuels like coal for a variety of processes, to manufacture many different goods and to transport them over large distances. The economic system of Europe had also changed radically with the availability of the vast resources tapped from the Americas serving as an important stimulus. In the new economic system a whole lot of goods had become commodities, demand for which could go on increasing without any limit (Polanyi 1968). The European economy had therefore, developed an enormous appetite for the resources of the rest of the world; to be acquired either totally free as with the loot of the gold and silver of Incas, or against European goods of manufacture with terms of exchange loaded in favour of the manufacture. The resources thus demanded from outside Europe were principally biomass, both cultivated and natural and mineral.

India had to fit into this scheme of things and become a supplier of raw materials and a market for manufactured goods. In North America and Australia this could be achieved by wiping out the indigenous population, in South America and South Africa by reducing them to serfdom. In India, with its ancient civilisation and a large population, this was not possible. Indians, therefore, had to be broken

down into accepting this arrangement while they largely continued to run the affairs of their own country. To this end they were to be brainwashed into accepting that all that the old Indian system represented was bad, all that the new system being imposed by the British represented was good. It was transparently clear that the scientific knowledge at the disposal of the British was in many ways superior; hence, all that the Indians were doing earlier was condemned as unscientific, superstitious and all that the British were trying to impose was scientific. This was the strategy employed in the forestry sector as well after the 1850s and it is remarkable how long the myth has endured, with wild guesses and arbitrary prescriptions passing off for scientific management.

What followed was drain of resources. Concentration in cultivated lands began to shift to commercial crops and in forests to teak and other timber species. Revenue was the motive and community control over these resources was abolished. The cultivated as well as non-cultivated land would produce material that was of little use to the rural population but was meant for the urban areas and ultimately to the profit of the colonialist. Shifting cultivation was banned and "scientific" forestry introduced. There would, therefore, be growing pressure on land to meet the biomass needs of the villagers. But state ownership of the resources would restrict its availability. The village commons would deteriorate as the British increased state control over forests. What they had initially termed rights would soon be turned into privileges.

After Independence

Subsidies and Vanishing Stocks

We do not need to go into the details of this process. Suffice it to say that the same process of mining timber, rather than treating forests as a resource has intensified after independence because of the industrial orientation of planned development.

Wholeheartedly accepting Sir Vishweshwariah's dictum that India must either industrialise or perish, and equally firmly rejecting Mahatma Gandhi's vision of an India made up of self-reliant vibrant village communities, the elite of independent India set it on a course of industrial progress under a mixed economy. The widely accepted notion that industry must be encouraged at all costs was translated in practice into a prescription that industry must be subsidised in every possible fashion. But this subsidy perforce has to be at somebody's cost. The subsidies of the electric power supplied at less than a tenth of its cost of production to aluminium industries, of bamboos supplied at less

than a thousandth of its market price to paper industry of the river and ocean water freely available for discharge of its effluents to the fertiliser industry had to be passed on in part to the future generations and very substantially to the weaker segments of the present generation. Having successfully accomplished this, the Indian industry has grown apace. But its progress has been, in the words of the famous economist, Gunnar Myrdal (1968), that of *an overheated engine*. Pampered with subsidies, sheltered from all outside competition, it has grown to function in a thoroughly inefficient manner. In particular, it has no concern for exhaustive use of natural resources supplied to it at throw-away prices. For, as resources of one region or one kind are decimated, resources of another region, or another kind are opened up for its use. If the resource costs go up in the process, they can be passed on to the consumer in the captive market. So the industry has gone on, consuming not just non-renewable, but also renewable resources to exhaustion in a sequence, always concentrating on those that can be most profitably used at any particular moment. The rural population forced to depend on open access resources, has also followed the same pattern, of first exhausting the most accessible, most desirable fuelwood species, and then progressively going on to less and less accessible, less and less desirable sources. This current pattern of forest resource use in India, is best described as that of sequential exhaustion along many different dimensions; at many different scales. Bamboos would be an example.

After waging a relentless battle against bamboos as a weed of teak plantations, workers at the Forest Research Institute in Dehra Dun discovered that its long cellulose fibres rendered it an excellent raw material for paper manufacture. Suddenly it became a resource that foresters claim had *earlier been in no demand* (Melkote 1981). This is an amazing phrase, because the manifold uses of bamboo and its critical place in rural economy are surely known to all Indians. As Cleghorn (1861) notes the forest department had itself started charging the basket weavers Rs 5 per tonne in 1860, undoubtedly realising some revenue. There was also a brisk commercial market in bamboos and by 1960 the market price of bamboo was around Rs 3,000 per tonne in Bangalore. It was at this time that West Coast Paper Mills was established at Dandeli in Uttara Kannada district. Following the policy of making all resources available to the industry at nominal prices, this mill was awarded bamboo at the rate of Rs 3.12 per tonne of paper, or about Rs 1.50 per tonne of bamboo, less than one-two thousandth of the market price (Gadgil and Chandran 1989). The three sides of the iron triangle—the politicians who made bamboo available to industry essentially free, the foresters who administered the

bamboo stocks, and the industry who used them to reap great profits were all happy. But the basket weavers of Karnataka soon found that their very livelihood was threatened by the exhaustion of the bamboo stocks that soon followed its industrial exploitation. It was then in 1976 that I had the opportunity of looking closely at the bamboo stocks and their management in the state of Karnataka (Prasad and Gadgil 1981).

There were two hypotheses as to why bamboo stocks had declined. One, that of foresters, was that it was the grazing pressure of the villagers and nomadic pastorals along with the fires set by them that had prevented any bamboo regeneration following its mass flowering in 1960. The second, that of basket weavers and villagers and pastorals that I talked to, was that it was due to the harvesting pressure of the two paper mills of the state, one at Bhadravathi, the Mysore Paper Mills and the second at Dandeli, the West Coast Paper Mills. Our investigations revealed that there was a qualitative difference in the way villagers traditionally harvested bamboos and the way the industry did. The villagers took out one or two culms at a time from each clump. This did not disturb the thorny cover of short branches that forms at the base of each clump. The mill on the other hand was silviculturally prescribed to remove a much larger number of culms from each clump, and in the process to carry out an operation of deliberately cleaning the thorny cover at the base of each clump. We found out that this supposedly scientific prescription was based on a mistaken notion. Firstly, we showed that the number of new culms produced in a clump is proportional to the number of culms already present. The prescription as to how many culms should be removed therefore resulted in maintaining the clumps at too low a size to realise its full growth potential. More importantly, the clearing of the thorny cover from the base of a clump exposed young shoots to grazing by pigs, monkeys, cattle and buffalo (Prasad 1985). This grazing seriously cut down on growth of bamboo clumps; to this extent the claim that grazing affected bamboo stocks was correct. However, this impact of grazing would be far less if the thorny cover at the base of clumps had not been cleared by the paper mill extractors. Our controlled experiments also revealed that contrary to claims of foresters, fires did not hurt bamboo regeneration or growth; though grazing had some effect on regeneration.

There were other significant findings. Field surveys showed that the Forest Resource Survey on which bamboo stocks had been estimated were consistently overestimates; the average level of overestimation being by a factor of ten. Thus the sustainable yields to the paper mills were estimated to be far higher than they possibly could be.

Furthermore while making these stock estimates no account was taken of the fact that bamboo populations tend to flower and die gregariously, although the information to take this into proper account was available scattered in literature (Gadgil and Prasad 1984). Because of all these factors it turned out that the bamboo stocks of Karnataka were clearly being overexploited, and that the demand of the paper mills was the major cause of this overexploitation (Gadgil and Prasad 1978).

Sequential Exhaustion

There were other factors too. The contractors supplying bamboo to the paper mills rarely adhered to silvicultural prescriptions. Notably enough the suppliers of the public sector Mysore Paper Mills were worse violators than those of the private sector West Coast Paper Mills. Instead of removing a fraction of culms from all clumps throughout a block taken up for exploitation, they would remove all culms from the clumps most accessible from the road made in the first year (Gadgil and Prasad 1978). Next year a fresh road would be made further inside the block and all clumps near that clearfelled, and so on in a sequence reaching into less and less accessible terrain. Thus exhaustion of bamboo in a sequence of accessibility in space was one dimension of sequential exhaustion by paper mills. The second dimension was distance. As the forest areas nearby the mill were depleted, supplies were drawn from further and further away. In case of the West Coast Mills this implied first going out of Karnataka to neighbouring Andhra Pradesh and then further afield to Garhwals of U.P., to Assam, to Nagaland. The third dimension was species. As the most suitable species for paper making, bamboo supplies dwindled, other species began to be tapped: first softer, and then harder and harder woods. A fourth dimension was plant parts; as resources dwindled, lops and tops earlier rejected began to be utilised. Finally, the fifth dimension was the ownership of land from which raw materials are to be derived. The first choice, of course, was reserve forest land, because supplies subsidised by the state could be most easily organised from this category of land ownership. The Mysore Paper Mills then shifted to the use of bagasse from sugarcane, the West Coast Paper Mills to eucalyptus grown on farm lands. Finally, Mysore Paper Mills has taken over large areas of protected forests earlier earmarked for meeting the biomass needs of village populations for raising their own captive plantations. This move has led to much conflict with village people and litigation.

Without going into too many details, one may mention here the parallel case of the plywood industry. Consider for this purpose the Indian Plywood Manufacturing Company, also located at Dandeli.

The industry earlier tapped the more accessible deciduous forest areas of Uttara Kannada; as these were exhausted it turned to the evergreen forests on the steeper slopes. It has also gone on tapping more and more species, as the most desirable ones, such as mango, have been exhausted.

Dwindling Fuelwood Supplies and Tree Growth

The patterns of sequential exhaustion are equally evident with respect to gathering of fuel for domestic consumption: Just after the visit to the Korku settlement that I spoke of at the beginning, I went to the village of Gopeshwar in Chamoli district of Garhwal Himalayas. Right next to the village is a nice patch of oak and rhododendron, the traditional village grove. Its extent had been significantly reduced in recent years by a road cutting through it. But the villagers still maintained the traditional restrictions on the amount of biomass harvested per family per week from this grove. This amount was, however, inadequate and most days women had to collect fuel and leaf fodder from elsewhere. This has meant going progressively further and further away, since outside of the village grove there has been no restraint on hacking and for kilometres around the forest vegetation has been devastated. Sequentially the degradation has been progressing in an ever-increasing radius from the village of Gopeshwar. As only more and more remote hills retain good vegetation, people from more and more villages congregate on them to gather what they can. It becomes progressively more difficult to manage any such woodlots as the number of people utilising them goes up.

Apart from villagers proceeding to more and more distant and less accessible localities, they also begin to utilise species and plant parts not touched earlier. Thus in coastal Uttara Kannada people used to avoid touching *Sapium* and *Holigarna* both of which have latex that causes blister and allergy. Today these too are beginning to be lopped. In the dry *maidan* areas of Karnataka people even sweep dry eucalyptus leaves to feed their hearths. Villagers from the dry *maidan* areas of Karnataka are also now beginning to cut down *peepal* (*Ficus religiosa*) and banyan (*F. bengalensis*) trees, earlier regarded sacred and therefore inviolate and *Pongamia* trees prized as sources of oil seed and leaf manure and rarely touched till recently.

A colleague of mine, Dr. N.H. Ravindranath has followed the fate of trees in a cluster of villages in the Tumkur district of Karnataka. Species of *Ficus* such as *peepal* and *Pongamia* constitute fully 60 per cent of the standing tree biomass in these villages; this has been built up to these levels because of the traditional nurturing and protection

of the species involved. Today 12 per cent of the trees are being cut down every year and *Ficus* and *Pongamia* figure amongst them in the same proportion as in the overall biomass. Most of this wood does serve as fuelwood; but for whom? Fully 78 per cent of it is exported to Bangalore city. Of the 22 per cent that is consumed in the village, one-fifth goes to fuel brick kilns that manufacture bricks exported to Bangalore; a third goes to timber for rural home construction. The balance, about 11 per cent of the total wood felled is used as fuelwood within the village, but only for special occasions such as marriages and cremation. What do the villagers use for their own cooking? They only use smaller twigs, even dry leaves and of course crop byproducts such as legume sticks (ASTRA 1982). The trees cut in these villages are basically to serve cash needs of the villagers. This is very clear from the yearly calendar of tree cutting. The peaks of cutting are in the months of March, June and July. March is the marriage season, June and July seasons of agricultural operation when cash needs are high. This qualitative difference in the way fuel needs of villages and cities are met has profound implications for the process of deforestation.

Encroaching on Forest Land

Commercial as well as subsistence demands thus exceed the productive capacity of the capital of natural plant biomass; the capital is therefore being progressively eaten into. Along with this is going on a process of alienation of land from being devoted to natural plant production. This alienation has been taking place for several purposes; land being brought under cultivation, submerged under river valley projects, being converted into locations of industries or human settlements. Conversion of forest lands and pastures into cultivation is an old process, which really accelerated with the construction of railways in the mid-nineteenth century. Huge areas of Gangetic plains were cleared of forests and settled at this time, the main stimulus for the clearance of these *sal*-dominated forests was the demand for railway sleepers (Moosvi 1988). A second major stimulus came with the "Grow more food" campaigns of the early decades of independence before the green revolution made us self-sufficient in food. What is however notable is that encroachment of forest and pasture lands for cultivation continues vigorously even after our agriculture has become productive enough to meet our food needs. This too has profound implications. It means that despite our industrial growth, the vast majority of our people still have to make a living tilling land, even when this land is totally unfit for growing seasonal crops. Encroachment

on forests for cultivation is particularly active in Kerala which has amongst the highest population densities in the country; although the lowest population growth rate, perhaps related to the high level of female literacy in that state.

The Current Scenario

A Land of Weeds

The process of deforestation thus continues inexorably along many dimensions. Within any given region, such as Himachal Pradesh localities closer to main roads or rivers are getting degraded first; only then does the pressure shift further afield. The Working Plans are amazingly converting the more difficult hill slopes earlier set aside as parts of a protection circle first into selection felling circle, and then, as degradation proceeds, into conversion circle earmarked for clearfelling (FAO 1984). As more desirable species are exhausted, less and less desirable ones are beginning to be tapped. Thus paper industry having exhausted bamboo, and then softer woods such as *Kydia calycina* is experimenting with the possibility of using weeds such as *Parthenium* for making paper. As trees of large girth are gone forever smaller and smaller ones are being plucked. Where forest cover nominally exists, the biomass is being degraded successively (Gadgil and Meher-Homji 1985). Instead of a land of deodars and oaks and rhododendrons, of *sal* and *mahua* of mangoes and *Cullenia*, of *peepal* *babul* and *neem*, of mangrove swamps and lotus covered ponds, India is becoming a land of fast growing, weedy species introduced deliberately or not so deliberately by man, of *Eucalyptus* and *Acacia auriculiformis*, of *Parthenium* and *Eupatorium*, of ponds choked by water hyacinth, of salt water marshes covered by the spiny *Acanthus ilicifolius*.

The Eucalyptus Story

The story of the age of clearfelling of vast tracts of natural forests and its planting with fast growing exotic species, especially eucalyptus is an instructive one. By mid-1960s the supply of raw materials to India's forest based industry, which had been rapidly increasing in capacity with scant regard for the availability of resources to support it on a sustainable basis, was running into difficulties. The supply thus far had largely been based on selection fellings i.e., fellings short of total clearfellings from natural forests. If this was insufficient, then of course it could be stepped up by clearfelling and then replacing the natural stands with stands of fast growing species. This was a solution advocated on many fronts, domestic as well as by foreign advisers.

The call was for abandoning the "cautious" approach of conservation forestry and become "aggressive". To clearfell at rates far greater than in the past for raising plantations. This was strongly supported by the National Commission on Agriculture and made operative by the Central Government providing special funds as part of the Five Year Plans to the states for rising these plantations (National Commission of Agriculture 1976; Gadgil, Ali and Prasad 1983; FAO 1984).

Typically there was no careful scientific research on which species would really succeed and what productivities could be realised. The genetically highly heterogeneous eucalyptus was declared the wonder plant and the best of our natural forest was clearcut, on the supposition that the new plantations would annually produce biomass of between 14 and 28 tonnes per hectare. A significant proportion of these plantations were a dismal failure, especially in the high rainfall tracts. They were infested by pink disease, cutting down their productivity to just 1 to 3 tonnes per hectare (Prasad 1984). Many steep slopes of Western Ghats of Kerala were laid waste as the magnificent old stands of evergreens gave way to miserable stands of sickly eucalyptus. Some enlightened foresters have admitted the mistake and phased out eucalyptus plantations, for instance, from the high rainfall tracts of Karnataka. Others still swear by it and continue planting it even in the high rainfall tracts, as in the Koyna valley of Maharashtra.

Eucalyptus from these plantations was of course to be made available at highly subsidised rates; there were agreements for its supply at around Rs 20 per tonne. This was well below what it was costing the Government just to raise these plantations, even without taking proper account of other losses, such as minor forest produce or watershed values of the evergreen forests they replaced. The heavy subsidies were now thus extended from mining of natural forest to actual man-made stands. But the promised eucalyptus yields failed to materialise, and the industry had to turn to agricultural land to meet its requirements. This prompted social forestry programmes that generated and supplied eucalyptus seedlings on large scale to farmers, especially the bigger landholders. The productivity of eucalyptus on their lands was substantially greater—around 10 to 15 tonnes per hectare per year, and the industry could acquire this raw material at around Rs 300 per tonne. This indeed was a good profit margin for the farmers and the area of farmland under eucalyptus has rapidly grown over the last two decades. But then the price of farm produced wood has stagnated as pressure by industry has opened up channels for importing wood and woodpulp from abroad. Eucalyptus plantations on farmland are therefore now on a downturn.

The Manifold Functions

We may pause here to look at how the various services offered by plant cover are faring in our country today, and how this relates to the interest of the rural versus the urban-industrial sector in these services. Any such survey undoubtedly involves gross simplifications. After all neither our rural nor urban society is at all homogeneous; for instance interests of Bihar landlords diverge greatly from Scheduled Caste landless labourers, and those of Bombay slum dwellers from bureaucrats of Delhi. Nevertheless I make bold to provide such a picture.

Evidently, the services of value to the rural sector have deteriorated far more rapidly than those of value to the urban-industrial sector. This in part is related to the greater magnitude of demands of the former, where more than two-thirds of our people still dwell. These are also people who are so deprived that they have little purchasing power, they must gather such fuelwood as they can to cook their meals. The exact quantitative value of their demand is of course not really known; but it can always be calculated by multiplying their large numbers by some crude average such as one kilo of fuelwood per head per day which gives a figure of about 260 million tonnes of fuelwood (Planning Commission 1988). Nor is the exact quantitative value of the many demands from the urban-industrial sector estimated at 28 million cubic meters, or about 20 million tonnes known (FS 1988). But here the demands are for commodities, not for basic subsistence needs. The per capita demand for commodities can escalate indefinitely. The dwelling for a person may employ anywhere between zero and several cubic metres of teakwood or plywood; he may consume not a kilo of paper or tonnes of it in all the containers and glossy magazines and toilet papers that he uses. It is therefore not possible to fix a simple figure such as that of fuelwood for such commodities, and difficult to glibly quote demand figures relating to biomass based produce of the commercial sector. Furthermore many articles of this sector are liable to tax, and given the rampant tax avoidance in our country, it is certain that biomass consumption in this sector is greatly underreported. I have personally seen godowns in paper mills full of paper that was never officially produced and it is on record that sandalwood oil factories of Kerala live entirely off wood smuggled from Tamilnadu and Karnataka. The gap between the quantitative demands of rural versus urban-industrial sector is therefore far less than what is made out to be; by how much is not clear (Shyamsunder and Parameshwarappa 1987).

I would like to cite some evidence of this discrepancy from a study of two felling areas of one hectare each in the Sharavathy valley,

an excellent evergreen forest on steep slopes of Western Ghats of Karnataka. Only 8 trees per hectare are supposed to be removed from this area; 16 and 17 large trees were cut in the two sampled quadrats. In addition there was enormous damage caused by the fall of these trees, as well as their being dragged down the slopes. More than 60 trees of 35 cm or more in basal girth had been destroyed per hectare in the process extraction. Furthermore concentrated fellings had produced large gaps in canopy, totally transforming the microclimate (Gadgil and Chandran 1989). There is no particular reason to believe that the Forest Department is involved any more or any less in resource mismanagement than the Public Work or Rural Development Departments. But any machinery working without independent checks and balances in charge of large assets is bound to mismanage it.

Qualitative Differences

Leaving aside quantitative issues, the impact of commercial demands on India's forest cover is qualitatively very different from that of the subsistence demands of the rural population. Commercial demands reach out far more quickly to remote, inaccessible areas. The demands of local people, including shifting cultivation, in Nagaland have little to do with the opening up and rapid drain of that state's forests in recent years to feed the plywood industries of Assam and the neighbourhood. The conversion of steep hill slopes in the Quilon division of Kerala from protection circle to selection and eventually to conversion is also due to the influence of commercial, rather than subsistence demands. Secondly, commercial demands lead to felling of large trees; while the subsistence sector depends much more on the harvest of smaller branches, of foliage, of fruits, nuts and gum. The large mango trees being extracted for plywood would be spared by the subsistence sector, who would instead prefer the fruits year after year. Even from their own lands, farmers fell old valued trees like *Pongamia* only when pressed by need for some cash. There is then every reason to believe that the commercial demands would have an influence on the country's forest cover far, far greater in magnitude than their quantitative share would indicate.

This becomes striking when one travels in the country which is just being rendered accessible to commercial exploitation. As one travels from Shimla in Himachal Pradesh to Jubbal on U.P. border, one sees total devastation in localities that have had good access roads for a long time. Then as one approaches locales that till recent times had only foot tracks, one begins to see some good forests. Beyond that where there are still no truckable roads are the stands still relatively well preserved, unless the area has a good riverway down which logs

could be floated. In that case the slopes of the river valley may be as barren as any near good approach roads. This correlation in space between access to commercial exploitation and the extent of deforestation also holds in time. People of Garhwal Himalayas still talk of the "wonderful change wrought in the landscape of the country" as Cleghorn would have called it brought about by the construction of good access roads soon after the war with China. As the roads came in the forest went out, exported to the Gangetic plains. The experience of Goa too has been very similar. The Portuguese had little interest in the commercial exploitation of Goa's natural resources. They therefore did not tamper much with the community-based management systems, the so-called "cumindad" lands. Till its liberation, Goa remained a treeclad land, with much of the non-cultivated cumindad land also retained their good tree cover. This, in spite of the fact that the population pressure had been slowly building up. Goa's forests were opened up for commercial exploitation shortly after its liberation and were depleted fairly quickly afterwards.

In all these cases, there is little change in densities of rural populations and their subsistence needs; the critical difference comes from the case of access and duration for which this has obtained. Unfortunately, there are no good empirical studies of this very significant relationship; as of most other facets of deforestation. It is this correlation that is the most convincing evidence of the overwhelming role of the commercial sector in the process of deforestation.

It was just this deforestation of the Himalayas following the opening up of border roads in the 1960's that precipitated the *Chipko* movement, which has been so important in shaping the debate on deforestation in the last decade in our country. But it was not just deforestation with the attendant landslides that roused people. A group of *Sarvodaya* workers of Garhwal was interested in setting up forest based industries as a part of rural development effort in Chamoli district. They thought of manufacturing turpentine from resin tapped from pine trees. To their chagrin they discovered that while the forest department was happy enough to supply resin at highly subsidized rates to a factory far away in U.P. plains at Bareilly, this small scale industry right where the pines grew would have to pay a higher price for the raw material. After all, they were not a part of the *iron triangle* (CSE 1985; Guha forthcoming).

Three Perspectives on Forest Use

The *Chipko* movement has been a watershed. There have been numerous forestry related protests earlier in the country. But all these

had focussed on demanding greater immediate privileges for the local people and not raised fundamental issues regarding the whole social system of resource use that underlay the crisis. The *Chipko* movement did so and as the debate developed two strands of thinking have emerged in the movement. One strand, with Sunderlal Bahuguna as an able expositor, would like to reject the whole modern economic system based on extensive use of fossil fuel, hydel and other energy sources and with an emphasis on the production and utilisation of commodities. It would like to see a restoration of the Indian agrarian society with largely self-sufficient villages taking good care of local resources. It tends to single-mindedly oppose all modern developmental projects, and so far has thought little of organising any alternative institutions on ground, believing that once the power over local resources is passed on to the villagers they would automatically tend to look after them well. After Lipton (1977), I would term this school *pastoralists*. The second strand of the *Chipko* movement, with Chandiprasad Bhatt as a leading figure may be termed *appropriate technologist*. This school of thought tends to question the modern technologies being pushed, but not reject them out of hand. It is willing to consider and absorb the more appropriate of the technologies. The criterion on which this appropriateness is determined is its impact on the weaker sections of rural society, half of our population that lives below the poverty line, that is still illiterate, that still must meet many of its needs from such biomass as it can gather. This school is conscious of the need to erect new institutions to organise these people to participate in a process of economic development and to take good care of the resources of their environment. It would be most instructive to closely examine the framework these schools suggest with respect to forest resource management, and to contrast it with the framework supported by those who would like to strengthen and continue the present system. I term the latter the school of the *iron triangle*.

The Choice Before Us

Point of Departure: Population Control

Which of these three frameworks would it be rational for us to adopt? I suggest one which would be most widely agreed upon, at least by the elite of the country. This is that we must strive towards creating a situation in which the growth of our already large population be brought to a halt. This has never been achieved by compulsion; even the much more disciplined society of China is finding it difficult to do so. Our people must therefore be motivated to limit the number of their children. People who are scrounging for a living find

children of help in their struggle for existence. At that level of subsistence they would never agree to limit them. It is only when the quality of life is a little elevated, when they do not have to worry about the next meal or the fuel to cook it with, when they have had some education, especially of womenfolk, that thoughts enter of the need to invest in each child. Only when investment in a child acquires a meaning, does limiting the number of children so that each child can be done justice to become an appealing concept. Only then is the motivation to limit the number of children generated, and demographic transition becomes possible (Becker and Tomes 1976).

This is now well established as a broad experience round the world, and supported by our own experience in Kerala where the *per capita* income is low, but where basic security of livelihood brought about by widespread land reforms and other social measures along with country's highest level of women's literacy is accompanied by a population growth rate of 1.1 per cent per year, only half as much as for the country as a whole. This example emphasises that the current trend of worsening of social and economic disparities in the country goes against all that is important for limiting our population. Gains of any such inequitable growth would instead be rapidly swamped by the burgeoning population. Our national interests therefore lie in providing basic security of livelihood and minimal health and education levels to the masses of our population; half of whom still live below the poverty line, 60 per cent of whom are still totally illiterate and at least a third without access to a source of drinking water.

This situation will not correct itself automatically. The society would continue to develop at their cost, it would remain a few islands of prosperity in an ocean of poverty, unless these people organise themselves, make their weight felt and pull themselves up by the boot straps. We must therefore provide for them something around which they could organise themselves. This something could be a resource, such as that of common lands or of employment guarantee scheme. Secondly, apart from devices for organising themselves they need employment, productive employment that would add to our assets. And thirdly they need security in fulfilling their minimal needs such as fuel, fodder, organic manure and small timber. If we accept this set of propositions which follows quite logically from our point of departure, we are fairly on way to defining how we should deal with our country's living resources. As a corollary, we also have pointers to how we should deal with other aspects of our society, in particular, with industrial development.

Meeting Rural Needs

Providing steady round-the-year employment for the large

rural population is the most difficult challenge before us. The industrial route has proven totally inadequate in this regard. In particular, dedication of reserve forests towards supply of industrial raw material may have had a net negative impact. The paper mills may have created fewer jobs than they destroyed with decimation of bamboo for thousands of artisans dependant on it. The plywood mills may have generated less employment than was lost through the liquidation of mango and many other minor forest producing trees. The rayon mills too may have provided fewer jobs than they destroyed by promoting the conversion of natural forests to eucalyptus plantations. Furthermore, each of these industries has perhaps destroyed further jobs, for instance, of fishermen by polluting the river. There has never been any proper accounting. However, we do broadly know that creation of an industrial job requires large investments, generally of several lakh rupees, while land/plant biomass based jobs can be created at far less investment. I am not suggesting that industrialisation should be abandoned, I shall make other proposals about it below. I do however suggest that in the interest of rural employment generation the burden of forest based industries on reserve forests should be totally removed; for all the evidence cited above shows that this burden is unsupportable.

I suggest that instead we go back to the old Indian tradition in which forests served as a source of usufructs which could be harvested without destroying the trees. There are myriads of these ranging from *tendu* leaves, bamboos and canes, myrobolan nuts to pine resin. An enormous number of people have been traditionally engaged in collecting and processing these. Our reserve forests should be nurtured back into diverse stands of trees, shrubs and climbers producing a variety of such produce and supporting large numbers of people in its collection and processing. The organised effort of state should go into this and in helping build institutions which would generate a reasonable return for forest produce collectors and processors such as basketweavers.

Eventual banning of all tree felling and wood removal from reserve forests would also have a very salutary effect for our attempts to conserve these as reservoirs of genetic diversity and for their watershed values. For as long as fellings continue in these forests, it would be very difficult to control illicit felling and destruction. A total ban would be far easier to implement, especially if we involve local people on a wide scale in its execution. For the moment some extractions may have to continue, especially from plantations such as those of teak and eucalyptus. But after the current cycle is over, these too should be reverted to diverse natural forests, albeit enriched by species of value in

production of minor forest produce. As we saw at the beginning, that is very much a part of the Indian tradition, a tradition that we need to nurture. If about 20 per cent of our land is maintained under such forest cover, we would also benefit greatly from its watershed services.

A fair proportion of our fuel and fodder needs is already being met from agricultural byproducts such as coconut shells, cotton and legume sticks and paddy and *jowar* straw. Our own estimates show that this accounts for 58.75 million tonnes out of a total fuel demand of 262 million tonnes, and 368 million tonnes out of a total fodder demand of 613 million tonnes. But this is the country wide picture. There are districts in Haryana where farm production can more than support the fodder needs, or in Kerala where the cocount orchards provide all of the fuel needs. However, over most of the country agricultural byproducts are quite inadequate to meet either fuel or fodder needs, forcing people to burn large quantities of dung and maintain half-starved livestock. For the country as a whole therefore we cannot think of meeting all the village biomass needs based on agricultural byproducts alone, even when augmented by some agro-forestry. This would necessarily have to be supplemented by biomass production on lands unfit for agriculture; the revenue wastelands and protected forest lands currently assigned for this purpose, added to where necessary by carefully selected degraded reserve forest lands (Planning Commission 1988, Gadgil forthcoming).

A National Network of Community Lands

These community lands from which the local population may meet their biomass needs should not above all else be *open access* lands. They should be lands to which access is carefully regulated by some group of people, Bureaucracy would have to help in this regulation; but it cannot accomplish it by itself. The Prime responsibility for it should be assigned to a small village community living in the immediate neighbourhood of the piece of land and organically dependent on it. Such a village community would not often be a cluster of villages constituting a revenue village or *mandal panchayat*. Rather it would be a smaller, more homogeneous settlement or hamlet. Fresh, careful surveys would have to be conducted to delimit such units and common land areas to be assigned to them. The management of the common lands would then be the responsibility of a committee elected by the *gramasabha* (village assembly) of this unit. Such a committee should give greater weightage to the poorer segments of the population more intimately dependent on the common lands, as well as to women. Special provisions would have to be made to ensure this, and to guard against the domination of the committee by the more

powerful segments of the village population. The committee should be accountable both to the *gramasabha* as well as to higher level committees at *mandal/tehsil/* district level. Some impartial outside presence from Government administration would also have to be involved to help the committee discharge its duties adequately; to convert the *open access* resources into *community controlled* resources.

The Government may have to initially invest in generating biomass on these common lands. However, most of this investment would be in the form of human labour, and should be used to generate employment for the local people. In the long run, however, the Government should not have to go on investing in biomass production from these lands. Instead all members of the local community must pay for resource use either in cash or through labour input. Such charges should be so adjusted as to be adequate for long term maintenance of biomass on common lands. Indeed such a system of users paying for the salary of a watchman or other inputs does exist in the few forest *panchayats* that are still surviving. The biomass produced from these lands should not enter the market; for as with forest lands it would be difficult to control exploitation once market forces come into play.

Good management of biomass production as well as utilisation would call for substantial technical inputs. District level mechanisms should be generated to provide these. Such a network of common lands should be created on a countrywide basis with appropriate adjustments for local conditions. A strong legislative framework at both state and central level would have to be created to ensure that the integrity of this network is fully guarded against encroachment at all levels; from local cultivators to Government enterprises (Gadgil and Guha 1989.)

Such a resource would provide a concrete asset around which the poor can become organised and play a catalytic role in winning them a better quality life. It would also go a long way towards ensuring them secure supply of their basic minimum needs.

Tree Farming

It would obviously be impossible to provide adequate common land to meet the biomass needs of each and every village, let alone all towns and cities. The biomass needs of this population, plus the biomass needs of the industry should be met from tree production on privately owned cultivated lands. These could either be encroached Government lands, lands under shifting cultivation, legally owned marginal lands unfit for cultivation of annual crops, or even better

class agricultural lands. The total biomass demand such land may be called upon to fill annually could be 80 million tonnes for fuel and 20 million tonnes for industrial requirements. These 100 million tonnes could very reasonably be produced on 10 million ha out of 150 million ha of land under cultivation in this country; a very reasonable level of demand. What would be necessary to make this possible would of course be a mechanism to ensure adequate financial returns for the free farmers and ways to take care of their subsistence needs in the years it takes tree crops to mature.

In the long run this would call for a firm policy for halting imports of wood pulp from Canada, timber for Malaysia and so on. Our farmers simply cannot stand competition from these sources, not because they are inefficient, but because biomass is deliberately undervalued in the world economy as well. As Repetto and Gillis (1988) extensively document wood is being sold at excessively low prices all over the world; hurting in the long run interests of countries like Malaysia and Indonesia as well. Developed countries on the other hand heavily subsidise their farmers to produce whatever they do: grain, dairy produce or tree crops and thereby keep the biomass prices low. Furthermore, India must pay foreign exchange for all such imported biomass; we are not in a position to accept ever increasing foreign exchange burdens on our economy, or on our environment for that matter. After all we are meeting a good proportion of our foreign exchange requirements by overexploiting our prawn stocks.

An employment guarantee scheme on the pattern of Maharashtra, but far better administered for the entire country could be the most vital component of providing a better quality of life for our rural poor. This scheme should be carefully designed to improve the productive potential of all lands, be they marginal farmlands, community lands or reserve forest lands. With modern technical inputs and careful planning it has immense potential for restoring the health of our land and its plant cover. With openness, loosening the hold of corrupt politicians and bureaucrats and more checks and balances from those employed on the scheme and voluntary agencies working with them, the EGS could also serve as an important cause around which the powerless could become organised and acquire some clout.

Conclusion

The whole thrust of our approach is to ensure that economic development that proceeds at the cost of the rural poor should come to a halt, and be reoriented to make a better quality of life for them its central concern. This is however no plea to stop running the engine

of industrialisation, only to stop overheating it. Biomass-based industry should grow, but on its own strength properly paying for the resources it can help tree farmers produce, adequately controlling the discharges of its polluting waste products. This would undoubtedly cut into its currently exorbitant profit margins, forcing it to become more efficient, which would be all to the good of the country.

Last but not the least, we must return to our cultural roots, with a respect for nature as a habitat for humanity, not contempt for it as a warehouse of commodities. We must move away from a society in which the influential can now down magnificent old mango trees to multiply money for their plywood mills, towards one that treasures its heritage, of culture and of nature. We must transform this inequitable society in which poor peasants are being forced to cut down the mango trees in their yards to fill their belly, into one in which they will be secure enough to continue decorating their houses with its tendre leaves and inflorescences to remind their brides and bridegrooms of the arrival of the springtime.

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