

India's Deforestation: Patterns and Processes

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Abstract *Precolonial India was largely a nation of people who relied on their immediate surroundings for a diversity of biological resources and who had evolved a variety of cultural practices of prudent resource use. This system was radically transformed under British rule when cultivated as well as noncultivated lands were dedicated to the production of a small number of resources to be exported out of the locality. All tracts of erstwhile community-controlled lands were taken over as state property; some of these were set apart as reserved forest for commercial timber production, others were permitted to be used by local communities for meeting their biomass needs. The latter were no longer under community control and as no-man's-lands began to suffer over-exploitation. This process of nonsustainable forest use has been intensified after independence with forests increasingly dedicated to highly subsidized supply of raw materials to the forest-based industry.*

Keywords: India, deforestation, tropical forests, traditional resource management systems, scientific forestry, colonial impact.

Introduction

Loss of tropical humid forest has emerged as a major environmental concern in recent years. Its magnitude is by now reasonably clear; our understanding of the social and economic forces behind it is, however, far from complete. A number of factors have been invoked, e.g., population pressure, land hunger, greed of business concerns, corrupt bureaucracies, and state subsidies (Myers, 1980; Repetto, 1988). Although each of these is undoubtedly significant in its own context, treating them one at a time can only lead to a very partial understanding. It is much more useful to consider them as components of an overall social system of resource use with tropical deforestation a consequence of the operation of such a system. In this paper I look at the problem of India's deforestation from such a perspective. It is my contention that the present situation is largely a consequence of the radical transformation in the system of resource use initiated under British rule and elaborated further in the four decades since independence.

Precolonial Scenario

Tribals

Two major social systems of resource use prevailed in precolonial India. The older one, characteristic of hunter-gatherer/shifting cultivation societies, covered most of

the hill tracts. 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 organized the pattern of resource use on this land, including allocation of plots for cultivation in a given year. The flow of materials was largely within the territory, though there were 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 a tribal territory. 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 fallow periods in the cycle of rotation of shifting cultivation, but also selective retention of valuable trees such as mango while felling for slash and burn.

Certain areas of terrestrial and aquatic ecosystems were set apart as *refugia*, or sacred groves and ponds immune to all human interference. The community woodlots often lay next to these sacred groves, so that the woodlots 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 the tribal hill state of Mizoram the two types of land in this system of sacred groves and community woodlots are termed, respectively, "safety forests" and "supply forests" (Malhotra, 1988). In addition, individual species such as *Ficus* trees 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, 1989). There were undoubtedly other factors helping to maintain this balance; in particular, much tribal territory was highly malarial, thereby keeping the population at low densities. Furthermore, there were intertribal wars. Coercion and violence was not unknown in these societies, but it largely involved continuing tribal control over territorial land, not organizing 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).

Settled Cultivators

The greater portion of India, especially its fertile river valleys, was under a second social system of resource use, that of agrarian village communities. Each village was a partially 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. Although in theory the chiefs may have owned all land, in practice land could not be alienated from the cultivators. The village community as a whole also controlled its noncultivated 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. 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, 1915).

This society had also retained a number of the religious traditions of nature con-

ervation of the tribal societies. These included protection of sacred groves and sacred trees such as peepal, *Ficus religiosa*. A seal from Mohenjodaro, the earliest known urban civilization on the Indian subcontinent, depicts a peepal tree. The agrarian villages of India had thus apparently retained the system of having a community-controlled supply forest and a semi-sacred, protected safety forest attached to each village, a system that persists even today in some of the remote corners of the country (Gadgil, 1985).

Like all ancient urban civilizations, that of India was based on the surplus of agricultural production of the countryside. This surplus was siphoned off as tax or loot, as was some of the produce of the noncultivated lands: sandalwood, ivory, musk, pepper, cardamom. However, the noncultivated lands primarily served to meet the subsistence needs of the villagers for fuel and small timber and especially for organic manure, both directly as leafy material and indirectly as dung of cattle grazing on the uncultivated lands. In precolonial agrarian India, then, the noncultivated tracts of the country were firmly committed to a role supportive of agriculture and were well maintained by the villagers as assets under community control. Many of these harbored what some early British travelers have called "oceans of trees," though parts of the country may already have suffered some deforestation. This is hinted at by the story of the Khejadli village near Jodhpur in Rajasthan, where some 500 years ago the then King of Jodhpur forcibly tried to harvest sacred khejadi (*Prosopis cineraria*) trees from a Bishnoi village, precipitating the original Chipko movement (Sankhala and Jackson, 1985).

Colonial Impact

Demand for Commodities

On to this stage arrived the British, who had made remarkable advances by the 18th century. They had progressed beyond the slow pace of attaining knowledge through trial and error and had developed the much faster hypothetico-deductive method of modern science. They applied this rapidly advancing knowledge of nature to practical ends. One result was the ability to employ effectively the energy available in fossil fuels such as coal for a variety of processes, to manufacture many different goods, and to transport them over large distances. In the new economic system many goods had become commodities, demand for which could increase without any limit (Polanyi, 1968). The European economy had therefore developed an enormous appetite for the resources of the rest of the world; these were acquired either without payment, e.g., the gold of Incas, or against European goods of manufacture with terms of exchange loaded in favor of the manufacturer. The resources thus demanded from outside Europe were principally biomass, both cultivated and natural, and minerals.

In precolonial India the cultivated land was producing a great variety of crops and the noncultivated land a variety of plant and animal products largely for fulfilling the subsistence needs of the local populations. Under colonial influence, cultivated lands began to produce only a few crops such as cotton, jute, and tea and the noncultivated lands to produce a few choice timber species such as teak (*Tectona grandis*), primarily for export to Britain. Teak was especially important for British ship building as Britain had exhausted its own oak forests by the 17th century. The early years of British rule were characterized by completely unregulated exploitation of teak wherever it occurred. Thus Munro, writing in 1838, states "The system of throwing open teak

forests to all who wish to cut, or giving them to contractors, is in the highest degree ruinous. They cut indiscriminately all that comes in their way; any range of forests, however extensive, would be destroyed if left to their tender mercies. They never think of planting and all that such speculators calculate on is present profit or loss, without troubling their heads about depriving future generations of the benefit they now enjoy" (cited in Stebbing, 1922). Not only were teak trees thus abstracted from noncultivated lands, the early British forest administration in Malabar, headed by one Captain Watson, declared all teak trees on farm lands and homesteads as the property of the East India Company as well. This, however, caused so much resentment that the forest department had to be temporarily closed down in 1822 (Patriotic and People-oriented Science and Technology, Madras, 1983).

Abolishing Community Control

With the British takeover the state no longer recognized the right of local communities to control and manage the noncultivated lands of their locality. Nor did it recognize the validity of conservation practices such as sacred groves. Francis Buchanan writing in 1801 of a sacred grove near Karwar on west coast calls it merely a "contrivance to prevent the Government from claiming the property" (Buchanan, 1870). Along with other measures initiated by the British that were destroying the cohesion of India's village communities, this meant that in the early period of British rule, all of India's noncultivated lands became open-access, common-property resources. Under these conditions, no party having an access to the resources had any guarantee that prudent use would benefit it in the long run. The future was therefore discounted, and everybody had a reason to extract as much as they wanted for the present without any restraint. This tragedy of the commons overtook much of India's forest lands in the early years of British rule (Berkes, 1989; Hardin, 1968).

Resource Outflows

Consider the kind of material flows that would prevail under this system. The noncultivated lands would not provide substantial flows of materials onto cultivated lands and local habitation. Instead, both cultivated and noncultivated lands would generate material that would flow out, to India's urban centers, and then often on to Britain. Much timber from forests was, of course, employed primarily to facilitate this flow of materials, in building ships, in building railway lines, and as fuel for the ships and railway trains. These outflows from cultivated and noncultivated lands of the countryside were balanced by counterflows of goods of British manufacture. But in material terms they made up only a tiny fraction of what was exported. Material was therefore being continually drained out of the countryside, impoverishing the land and the people who depended on the land.

"Scientific" Forestry

All of the noncultivated lands of India, now rendered open-access resources, thus suffered the tragedy of the commons without check until the 1850s when the British began to lay down the railway lines. The impact of this development, in the words of Cleghorn (1861), was to cause "an immense demand for timber, (which) entirely changes the features of the district through which (the railway lines) pass. . . . I may

specify the Palghat, the Shevrai Hills and the North Arcot hills; in these the old woods have everywhere fallen to meet the urgent demand for timber." At the same time as this increase in the demand for wood occurred, the British had succeeded in consolidating their power subsequent to the war of 1857. A more long-term view of forest resource management was therefore possible, with regulation of access to the non-cultivated lands. This ushered in the era of modern "scientific" forest management with constitution of reserved forests supposedly to be managed for sustainable yields (Stebbing, 1922-1927).

Sustainable yield management of the highly diverse natural forests of India would require a very extensive data base, which has never been collected (Waring and Schiesinger, 1985). Not only that, there has never been a serious attempt to collect it. For instance, many of the preservation plots set aside to collect data on girth increments of different tree species under different environmental conditions in the country are either poorly maintained or have been destroyed (Gupta, 1981). What "scientific" forestry primarily achieved was to ensure a free or highly subsidized supply of biomass to those in power. In the new system, the land was either owned privately, for which the individual would be liable to be taxed, or by the government. Only in the north-eastern hills and a few other remote tribal areas did community control continue. The forest department clearly set its sights on timber production for urban-industrial-military requirements and consistently viewed services to the rural population as a burden to be done away with. In the late 19th century, this attitude was strongly criticized by people as different as Jyotirao Phule, a great social reformer (Keer and Malshe, 1969), and Voelcker (1897), a British chemist appointed by the government to report on the condition of Indian agriculture. Both called on the government to recognize the vital function of India's forests as a basis for agriculture and animal husbandry. Voelcker pleaded that proper development of fodder and fuel reserves for the rural population would ultimately pay back the government through greater agricultural productivity and realization of higher taxes.

Rights and Privileges

Of course, some lands were set aside either as revenue lands or as protected forest lands to meet the biomass needs of India's village populations. However, no scientific data on actual biomass requirements of the villagers were collected until 1975 (ASTRA, 1982). The amount of such land was therefore arbitrarily fixed and enhanced or reduced from time to time depending on the political clout of the local population. In this tussle, by and large the villagers ended up having far less land to serve their agricultural and other needs than they were used to. Indeed, the Madras administration for a long time argued that there was no piece of forest not serving the needs of the rural population in the whole presidency, and therefore no reserve forests should be constituted. Under these circumstances, it contended that the constitution of reserve forests meant confiscation, not conservation. It was, of course, overruled and substantial areas of Madras Presidency were constituted as reserve forests (Patriotic and People-oriented Science and Technology, Madras, 1983). Not only were the villagers thus denied access to substantial areas that they were earlier using, their communities no longer had any control over the common property resources (Singh, 1986). The government insisted that they had no rights, but only privileges, although there was no one in a position to check abuse of privileges.

The period leading up to World War I, 1860-1914, was one of consolidation of

the power of Great Britain throughout the world, and the government naturally thought it fit to further step up its control over the country's resources. The area under reserve forests was, therefore, progressively increased at the cost of the areas set aside to meet the needs of village populations. Thus, the area of minor forests meant to meet these purposes in Uttara Kannada district was 780,288 ha in 1880, 718,592 ha in 1890, 256,000 ha in 1900, and only 35,328 ha in 1910 (Masur, 1918). Increasing population pressure, shrinking areas of land available to meet domestic requirements and requirements of agriculture and animal husbandry, and, above all, the open-access situation that had been created meant continuing degradation of these areas. Through all these vicissitudes some villages here and there throughout the country did manage to retain their hold on the village forests and to maintain them properly. In Uttara Kannada district, the forest settlement officer, Collins (1921), commended these and noted that the villagers on their own had been appointing watchmen to keep out nonresidents and to enforce regulated harvest by the residents. He went on to recommend that it would be desirable to emulate these villages and form group or village committees to look after the minor forests. These recommendations, however, had little effect (Gadgil and Iyer, 1989).

Reserve Forests

In the reserve forests as a whole the emphasis was on a few commercially valuable species of the moment, especially teak. Thus Pearson (1908) reported that the evergreen forests natural to coastal Uttara Kannada were "threatening to come back," to the peril of teak. Bamboo, which was of such great utility to the local people, was considered a weed, and the department continued to wage "a battle against bamboos" until the 1950s (Coelho, 1956). The trend everywhere was to pluck the more accessible, larger timber that had commercial value for the moment, with little thought for long-term sustainability of the yield of these species or for the possibility that species of little commercial value today might become significant in the future. An example of what was happening is revealed in the following quotation from a forest working plan of Uttara Kannada (Wesley, 1964):

In the Yekkambi-Sonda area the A coupes under Edie's plan and replacement felling areas under Garland's plan have resulted in total exploitation of all valuable species and these areas have only bamboos and useless growth. Most of the overwood of valuable species had been removed under the so-called "uniform system" over large stretches of reserve forest area in the false hope of inducing natural regeneration of teak and other valuable species. . . . As much as 30,834 acres were totally exploited of which 8235 were planted up. . . . Garland's replacement fellings under uniform system was a total failure as it failed to induce or establish natural regeneration of teak or other valuable species.

The management of forests under British rule thus placed no value at all on a very significant component of biomass, i.e., most of the species of that most diverse of biological communities—the evergreen forest—or on species of great utility to the rural populace, such as bamboo. The remaining species were valued only in relation to their cost of harvesting and processing, with no consideration of the cost of regenerating the biomass removed. Thus, this component of the biomass was made available

at highly subsidized prices to the influential component of the society that needed it. This principle was carried to its extreme after independence, when the forest-based industry, which had its halting beginnings under the British, underwent major expansion.

Since Independence

State Subsidies

After independence, the widely accepted notion that industry must be encouraged at all costs was translated in practice into a prescription that industry must be subsidized in every possible fashion. But this subsidy performance had to be at somebody's cost—to be passed on in part to 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 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 throwaway prices. For as the resources of one region or one kind are decimated, the resources of another region or another kind are opened up for its use. If the resource costs go up in the process, they are passed on to the consumer in the captive market. So the industry has gone on, consuming not just nonrenewable 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, first exhausting the most accessible, most desirable fuelwood species and then progressively going on to less accessible, less desirable sources, a process termed *sequential exploitation*. The current pattern of forest resource use in India is best described as that of sequential exploitation along many different dimensions and at many different scales.

Sequential Exploitation

After the battle foresters waged against bamboo as a weed of teak plantations, workers at the Forest Research Institute in Dehra Dun discovered that its long cellulose fibers rendered it an excellent raw material for paper manufacture. Suddenly it became a resource that foresters claimed had "earlier been in no demand" (Melkote, 1981). This is an intriguing 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 basketweavers Rs. 5/- per ton in 1860, undoubtedly realizing some revenue. There was also a brisk commercial market in bamboo and, by 1960, the market price of bamboo was around Rs. 3000 per ton in Bangalore. At this time West Coast Paper Mills was established at Dandeli in Uttara Kannada district. In accord with the policy of making all resources available to industry at nominal prices, this mill was awarded bamboo at the rate of Rs. 3.12 per ton of paper, or about Rs. 1.50 per ton of bamboo, less than 1–2 thousandths of the market price (Gadgil and Subhash Chandran, 1989). The paper industry then stepped in to harvest bamboo on a grand scale.

There was a qualitative difference in the way villagers traditionally harvested bamboo 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 had a silvicultural prescription to remove a much larger number of culms from each clump and, in the process, to carry out the operation of deliberately cleaning the thorny cover at the base of each clump. These supposedly scientific prescriptions were based on mistaken notions. 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 realize their 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. This grazing seriously cut down on growth of bamboo clumps (Prasad and Gadgil, 1981; Prasad, 1985).

Furthermore, field investigations revealed that contractors supplying bamboo to the paper mills have rarely adhered even to silvicultural prescriptions. Figure 1 depicts the fashion in which the Mysore Paper Mill suppliers were removing bamboo from a part of Ramanagaram range of Kollegal division in Mysore district. Instead of removing a fraction of culms from all clumps throughout a block taken up for exploitation, they removed all culms from the clumps most accessible from the road made in the first year (Gadgil and Prasad, 1978). The next year, a fresh road would be made further inside the block, and all clumps near that would be cleared, and so on, in a sequence reaching into less and less accessible terrain. As the forest areas near the mill were depleted, supplies were drawn from further away. In the case of West Coast Paper Mills, this meant first going out of Karnataka to neighboring Andhra Pradesh and then further afield to Garhwals of Uttara Pradesh (U.P.), to Assam, and to Nagaland (Fig. 2). As the most suitable species for papermaking, bamboo, was exhausted, other species began to be tapped, first softer and then harder woods. Similarly, as resources dwindled, lops and tops earlier rejected began to be utilized. Finally, there has been

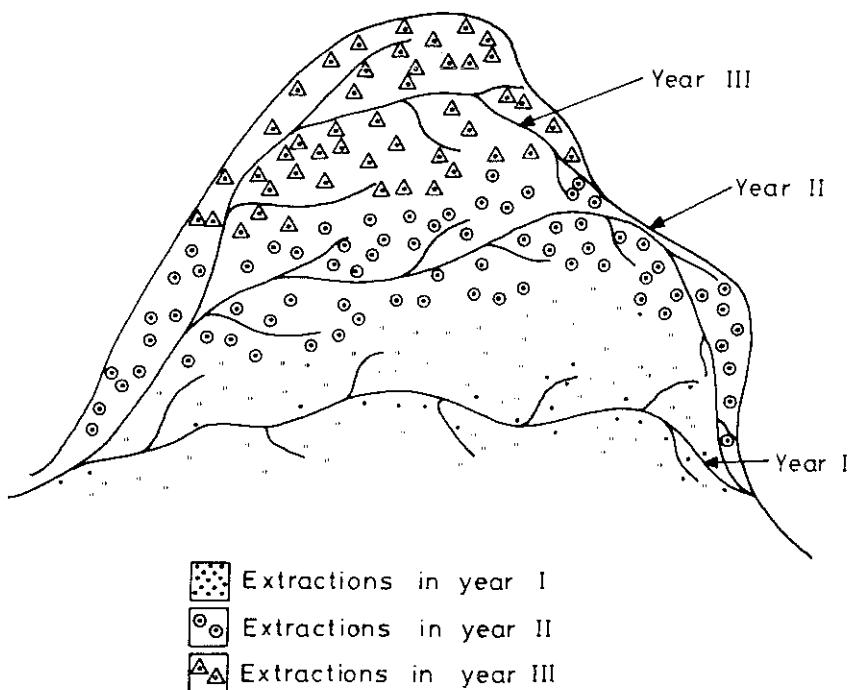


Figure 1. Schematic illustration of the pattern of extraction of bamboo by contractors of Mysore Paper Mills from Ramanagaram range of Kollegal division of Karnataka around 1977.

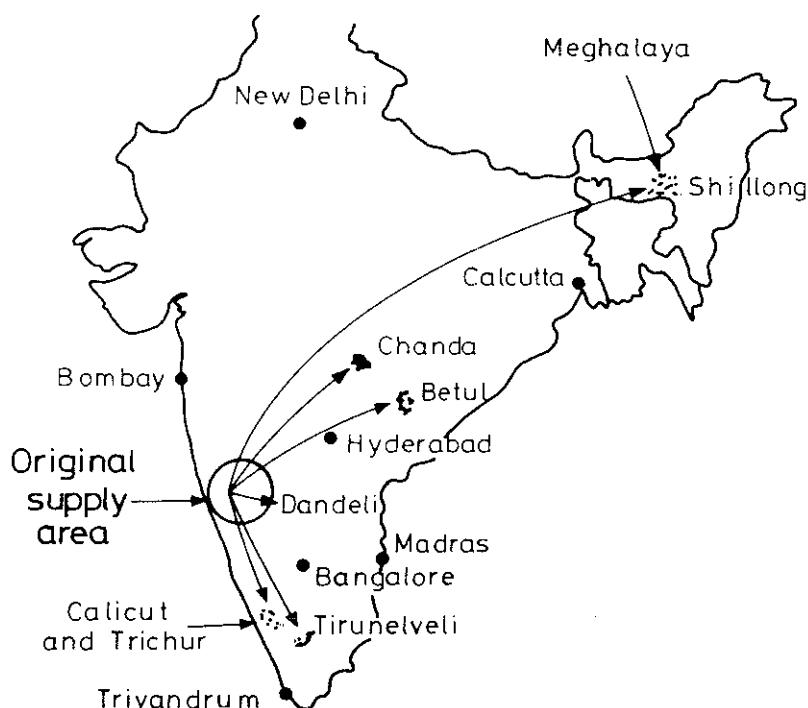


Figure 2. Areas from which the West Coast Paper Mills, Dandeli, began to draw bamboo in late 1970s.

a shift in the ownership of land from which raw materials are to be derived. The first choice of course was reserve forest land, from which supplies subsidized by the state could be most easily organized. The Mysore Paper Mill then shifted to use of bagasse from sugarcane and the West Coast Paper Mill to eucalyptus grown on farmlands. Finally, Mysore Paper Mill 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 has led to much conflict with village people.

The patterns of sequential exploitation are equally evident with respect to gathering of fuel for domestic consumption. Right next to the village of Gopeshwar in Chamoli district of Garhwal Himalayas is a nice patch of oak and rhododendron, the traditional village grove. It has been significantly reduced in recent years by a road cutting through it. But the villagers still maintain the traditional restrictions on the amount of biomass harvested per family per week from this grove. This amount is however, inadequate, and most days women collect fuel and leaf fodder from elsewhere. This has meant going progressively farther away, since outside of the village grove there has been no restraint on hacking and for kilometers around the forest vegetation has been devastated (Gadgil, 1985).

Apart from villagers proceeding to more distant and less accessible localities, they also begin to use species and plant parts not used earlier. Thus, in coastal Uttara Kannada people in the past avoided touching *Sapium* and *Holigarna*, both of which contain latex that causes blisters and allergic reactions. Today, these too are beginning to be lopped. Villagers from the dry *maidan* (plateau) areas of Karnataka are also now beginning to cut down *Ficus* trees, earlier regarded sacred and therefore inviolate, and *Pongamia* trees, valued as sources of oil seed and leaf manure and rarely touched until recently.

Conclusion

Quantitatively, the rural biomass demands are evidently much greater than commercial demands (Forest Survey of India, 1988; Shyamasundar and Parameshwarappa, 1987). However, 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. These demands also lead to felling large trees, whereas the subsistence sector depends much more on harvest of smaller branches, of foliage, and 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. Farmers cut old, valued trees like *Pongamia* from their own lands only when pressed by need for some cash. There is every reason to believe that the commercial demands have an influence on the country's forest cover far greater in magnitude than their quantitative share would indicate.

This becomes obvious when one travels in country that is just being rendered accessible to commercial exploitation. As one travels from Shimla in Himachal Pradesh to Jubbal on the 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 until recent times had only foot tracks, one begins to see some good forests. Beyond that, where there are still no usable roads, are stands still relatively well preserved, unless the area has a good river down which logs could be floated, in which case the slopes of the river valley may well be barren (Fig. 3).

Timing also played an important role in the relation between access and the extent of deforestation. For example, the Portuguese had little interest in commercial exploitation of Goa's natural resources. They therefore did not tamper with the community-based management systems, the so-called "cumindad" lands. Until its liberation, Goa remained a tree-clad land, with much of the noncultivated cumindad lands also retaining their good tree cover. This occurred 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 afterward.

India's deforestation continues inexorably. More remote parts of the country are deforested every day: from Assam valley to Nagaland to Arunachal Pradesh and from South Andamans to Little and North Andamans. Within any given region, such as Himachal Pradesh, localities closer to main roads or rivers are being deforested first; only then does the pressure shift farther afield. The Working Plans are converting the more difficult hill slopes, earlier set aside as parts of a protection circle, first into selection-felling circles (areas in which only a small proportion of trees are extracted), and then, as degradation proceeds, into conversion-circles (areas from which all standing trees are extracted for raising new plantations) earmarked for clearcutting (Food and Agriculture Organization United Nations, 1984). As more desirable species are exhausted, less desirable ones are beginning to be tapped. Thus, the 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 ones are being plucked. Where forest cover nominally exists, the biomass is being degraded at an accelerating pace.

This is a process being driven by the social system of resource use in which all decision-making power is concentrated in the hands of an elite comprising the urban-industrial sector, the bigger landholders in tracts of intensive agriculture, the bureaucracy, and the politicians. None of these depend directly on the health of the forest

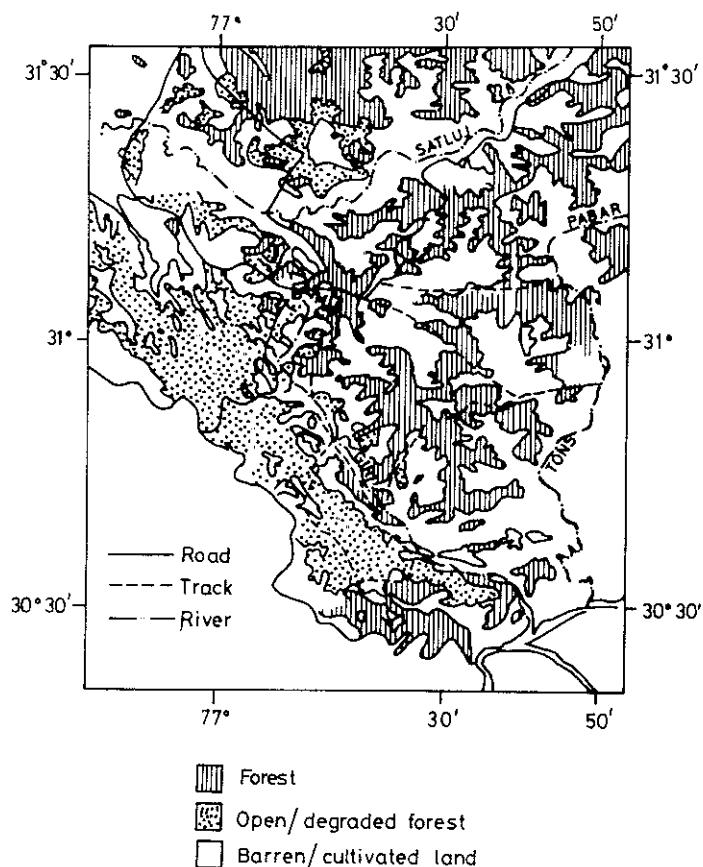


Figure 3. Land use in the hilly region in eastern Himachal Pradesh and western parts of the hill regions of Uttara Pradesh. Deforestation has been greater in areas more accessible for commercial exploitation either through roads or riverways (based on Landsat imagery as interpreted by the National Remote Sensing Agency)

resources in their immediate vicinity. Indeed, they have access to the forest resources of not only the whole country but other parts of the world, such as Malaysia. The elite are therefore shielded from all ill effects of deforestation; they are currently only engaged in grabbing whatever resources they can as cheaply as possible, often with the help of state subsidies. To facilitate their own access to resources, the elite have sabotaged all attempts at restoration to the rural populace of some authority over forest resources of their own locality. The rural people must, therefore, meet their biomass needs from resources under an open-access regime. The quantitatively large demands of the rural people, coupled to the compulsion to operate under an open-access regime, seemingly make the dominant contribution to the ongoing process of deforestation.

This process can only be turned around by a radical restructuring of the social system of resource use. Essential changes include, first, a restoration of appropriate authority to village communities over the local resource base and, second, withdrawal of subsidized resource supplies to the elite. The latter would be best achieved by a gradual switchover of all wood production to tree crops grown on private land. At the same time, all reserved forest land would be devoted to maintenance of a diverse stand of trees producing the nonwood products that would support the rural economy primarily. Only in such a system would the different segments of India's heterogeneous

society develop a real stake in the health of the forest resource base. Only then would a process of sustainable use and restoration of the forest stock become possible.

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