Ecology is for the People

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ABSTRACT: The paper provides a theoretical frame work of evolution of ecological prudence in human populations. It emphasizes the urgent need to understand the conditions that favour or militate against the exercise of ecological prudence. Evidence is presented to show that the Indian society had evolved a rich tradition of social restraints on resource utilization. It is suggested that ecological prudence could come to prevail in India only through the involvement of the people at the grass-roots level.

INTRODUCTION

Living creatures are very special and elaborate assemblages of molecules, that will rapidly break down if left to themselves. To retain intact their organization, they have to maintain a continual flow of energy through their bodies. This means that their very existence must affect the environment they live in. Such effects can be significant. Indeed, it is believed that early plants revolutionized the composition of the earth's atmosphere, from a reducing one full of methane and ammonia to an oxidizing one made up of nitrogen, oxygen and carbon dioxide. In the process the atmosphere became poisonous for the early organisms which could survive only under anoxygenic conditions, so that new species of organisms that could tolerate and use oxygen had to replace them. Modification of the environment, often drastic, is thus an inevitable consequence of the existence of life on earth.

It is therefore expected that the human species too would modify the environment it lives in perhaps to its own detriment. But man's impact on the face of the earth has ushered in a totally new era because of the unprecedented rate at which such a change is being brought about. At the peak of extinctions in geological periods that we know about, the earth was losing species at the rate of one per thousand years or so; today the rate has gone up to over one per year and could reach a 100,000 per year in the next few decades. This frightening rate at which man is changing the environment, has made it very difficult for him to cope with the changes, precipitating the ecological crisis. Confronted with this crisis, many have condemned the human species as the most destructive thrown up by the process of evolution.

While this is indeed so, we must also realize that human species is also perhaps the only species capable of prudent behaviour. Prudence, in this evolutionary context, may be taken to mean behaviour which contributes towards long term survival of the group as a whole, even though this may go against the immediate interests of the individuals making up the group. More specifically, in the ecological context, prudence, as opposed to

profligacy, may be taken to mean use of resources that sustain the species in such a fashion as to ensure long term persistence of the population of the species. The existence and evolution of such ecological prudence in the living world has been a matter of considerable debate since the publication of a thought-provoking book by Wynne-Edwards more than two decades ago. In this book Wynne-Edwards ('62) contended that many animal species have mechanisms that maintain their populations well below the maximal level permitted by the resources they depend upon. He further suggested that this maintenance of low population levels is favoured through a process of group selection whereby animal groups which had maintained such low population levels are selectively favoured in comparison with other local populations which grow to a higher level and thereby run a greater risk of extinction.

A great deal of work was stimulated by this contention of Wynne-Edwards that many animal species behave as prudent predators. It was shown that prudence may evolve not only through this process of selection amongst groups but also when groups were made up of closely related individuals (a process termed kin selection) or individuals having repeated interactions (a process termed reciprocation or reciprocal altruism). It was also demonstrated that the efficasy of group selection is much more limited than imagined by Wynne-Edwards, so that ecological prudence favoured by group selection is likely to be of very restricted occurence in the animal kingdom, except when it merges with kin selection (Boorman and Levitt, '80; Wilson, '80). This body of work implies that ecological prudence will be very rare in the living world.

In contrast to the other animals, human populations show many instances of restraints on the use of resources when removal of such restraints could have benefitted individuals in the short run. Thus, primitive hunting gathering tribals observe closed seasons when their favourite prey animals are not hunted; and modern fishing industry observes regulation on the mesh size of fishing nets. The incidence of such ecological prudence, is however, nowhere near universal, but is restricted to certain culture-resource complexes. We expect that such incidence must be conditioned by the biological and cultural heritage of the human species. A most significant question is then to understand the conditions that favour or militate against the exercise of ecological prudence by human groups. We propose here to examine this question with special reference to the developments on the Indian subcontinent. We believe that this analysis suggests that ecological prudence could come to prevail in India in the coming years only through the involvement of the people at the grass-roots level. Hence the title of this special issue, *'ecology is for people'*.

WHAT FAVOURS PRUDENCE?

Theories of biological and cultural evolution suggest that ecological prudence will be favoured by the following circumstances (Boorman and Levitt, '80; Wilson, '80; Cavalli-Sforza and Feldman, '81; Boyd and Richerson, '81, '82; Richerson and Boyd, '84).

(a) Social groups that involve long term repeated interactions amongst recognizable individuals, thereby favouing reciprocity;
(b) Social groups that involve closely related individuals thereby favouring kin selection;
(c) Accrual of considerable benefits in terms of long term survival and fertility for ogroups exercising prudence, as opposed to groups which are profligate;
(d) Ability of groups exhibiting prudent behaviour to resist infiltration by profligate individuals from outside the group. This and the previous condition bolster the operation of group selection.

Almost all human societies involve long term, repeated interactions amongst individuals known to each other, although the extent of this would vary from being very high in a territorial hunting-gathering tribe, to much lower in a modern metropolitan city. The occurence of groups of closely related individuals again decreases from being high in tribal or traditional agricultural societies to much lower in urban-industrial ones. The extent of benefit accruing to group exercising prudence will depend upon a number of factors, such as:

(a) Environments that are predictable in time, and not susceptible to catastrophic changes would better ensure that a human group practicing prudence will reap benefit from it at a later time;

(b) Environments that permit human populations being maintained close to the limits to carrying capacity set by resources would lead to larger benefits to prudent populations than environments in which the populations are maintained well below the carrying capacity, say through periodic epidemics;

(c) Human groups with sedentary habits are more likely to continue to reap benefits from their prudent behaviour than groups which wander over a large tract. The relatively sedentary groups will also be better able to keep others away from their territory, and thereby ensure that the benefits of their prudence are not usurped by some other profligate group;

(d) When technologies are stagnant human groups will continue to depend on the same resources, and are likely to de rive greater benefits from prudence than if rapidly improving technologies made possible the use of a new resource when a resource earlier in use was exhausted. Finally, the ability of a group exhibiting prudent behaviour to resist infiltration by profligate individuals will be greater the more closed the structure of the society.

This line of argument suggests that cultural traditions of ecological prudence are more likely to evolve in societies inhabiting stable environments, where populations are close to saturation, where populations are sedentary, territorial and closed and when technology is stagnant. These are very much the conditions characterizing tropical hunter-gatherer societies in which Rappaport ('84) has documented a very rich fabric of prudent behaviour. The societies may of course rationalize these practices, not on grounds of ecological prudence, but within another framework such as that of sacred rituals. On the contrary our analysis indicates that a social group such as a multinational corporation with option on the use of many different resources in different localities, employing changing technologies and measuring benefit in a single currency of money is very unlikely to evolve cultural traditions of prudence. Their profligate behaviour is rationalized in another framework, that of economic growth and technological progress.

TRIBAL TRADITIONS

Humans have lived as hunter-gatherers over most of their evolutionary history. In the relatively stable tropical and subtropical environments that have prevailed over much of the Indian subcontinent in the recent past, these societies would be organized into sedentary, territorial tribes with a closed group structure and with population levels close to carrying capacities. Their technologies must have remained stagnant since the human colonization of the Indian subcontinent 100,000 or more years ago to the beginning of cultivation 8000-3000 years b p. As mentioned above these are all conditions favouring the prudent use of resources over the territory of each tribe. We expect these traditions in the interest of the group to be rationalized as sacred, with shamans, or men possessed by spirits, serving to perpetuate these traditions. Such shamans would then be the first specialized group in primitive society with a division of labour other than based on age and sex. They would enjoy a special status which would enable them to enforce the prudent traditions. Even such primitive societies would exhibit trade, both in essential commodities such as salt and luxury articles like shells and feathers (Rappaport, '84). Any such trade may reduce the dependence on local resources and thereby weaken forces favouring prudence. However, at this level there would be little of such impact.

We expect little change in such traditions of prudence when the hunter-gatherers advance to the level of shifting cultivators, with the cultivation restricted to a defended territory of the tribe. We have evidence of many such traditions from the somewhat advanced tribal societies of slash-and-burn agriculturists from Central and Northeastern India (Presler, '71). The most notable of such traditions are sacred groves totally inviolate to any human interference and village groves where only limited and regulated use by members of a local community is permitted. Today, such groves occur in many parts of India, both in tribal tracts and outside of it (Gadgil and Vartak, '76; Gadgil, '84). As Kosambi ('62) has remarked, the nature of deities being worshipped today in the sacred groves outside of the tribal tract is highly suggestive of their origin in times of the hunter-gatherer societies. The tribals also worship and give protection to certain

plants and animals as sacred practices that extend outside the tribal tract as well.

DOMESTICATION OF PLANTS AND ANIMALS

Hunting-gathering, as well as more primitive shifting cultivation, especially of tubers, produces little surplus over and above the requirement of the local populations. But sedentary agriculture in favourable situations such as paddy cultivation in river valleys, or maintenance of large herds of cattle can produce substantial surplus over and above the subsistence needs of the peasant or the herdsman. Generation of such a surplus would promote a specialization quite different from that of shamans or traders that may have existed in the earlier tribal society. This would be the predatory groups specializing in physical coercion and usurpation of surplus — the warriors or Kshatriyas. The Kshatriyas would attempt to establish defended territories of a different type; those over which they have the exclusive right to usurp the surplus as tax. They would prefer to eliminate the territories earlier defended by tribals and settle them peacefully over a larger territory of their chiefdom. Since the more primitive tribal economies produce little surplus and little manpower for the armies, the Kshatriyas would try to eliminate the tribes and settle the land with more advanced agriculturists whereever possible.

Our knowledge of such attempts derives from times subsequent to the waves of the so-called Aryan invasions from West and Central Asia. These people, mobile in their horse drawn chariots and with iron axes could clear much more thickly forested tracts, and evidently proceeded to do so with vigour. Perhaps the most famous incident of such a large scale clearing of forest is the burning of Khandava forest on the bank of Yamuna to create a new settlement for the Pandava kings that is described in the epic Mahabharata. The entire forest is reported to have been burnt down, along with every creature that inhabited it. This included the tribals leading to a blood feud that resulted in their retaliating against Pandavas two generations later. But the epic Mahabharta also describes a dream that Yudhishthira, the eldest of Pandavas had when they were exiled to forest. One night the animals of the forest appeared in Yudhisthira's dream and appealed to him to move to another portion of the forest to permit the wild animal populations to recoup from the hunting pressure of the Pandavas. Pandavas agreed to this request and moved away (Karve, '67).

The agricultural and pastoral societies that thus followed the tribal societies on the Indian subcontinent introduced a totally new use of land and other resources. To the extent that this entailed destruction of forests and wild animals, they freely indulged in it. In fact, Karve ('67) documents the gradual deforestation of the Gangetic plains beginning at the northwestern end at the time of Mahabharata (1100 B.C.) to the southeastern end by the time of Buddha (600 B.C.). However, this new agricultural-pastoral society which came to be organized into sedentary, largely self-sufficient village communities seems to have retained an awareness of the need for ecological prudence, and preserved many practices from the tribal times. This was perhaps paralleled by the retention of many so-called pagan practices of nature conservation in pre-Christian and to a very limited extent in the Christian Europe (Frazer, '22).

Breakdown of tribal territories and their incorporation into larger chiefdoms, as well as generation of large surpluses by agriculturists and herdsmen at the disposal of the ruling classes would enhance the potentialities of trade. In fact, there is evidence of large scale trade especially in luxury goods such as spices, fine cloth and precious metals extending over the continents. This would strengthen the class of traders or the Vaisyas. The shamans of tribes would evolve into the priestly caste claiming a monopoly over codified knowledge — the Brahmins. The peasants would be the lowest group, the Shudras and the warriors the most powerful, the Kshatriyas. These are the four varnas in which the Indian society was supposed to be organized. It is, however, likely that a varna was not the basic genetic and cultural entity (Karve and Malhotra, '68; Malhotra, '74); these might have remained the original endogamous tribes, though a certain breakdown of barriers amongst them must undoubtedly have taken place.

BUDDHISM AND JAINISM

The Brahminical religion practised by this society called for extensive sacrifice of animals, especially oxen. Such sacrificial ceremonies

also necessitated extensive tree cutting for poles to tie animals and wood for the holy fire. As the Gangetic plains became saturated with cultivation, the amount of woodlands and pastures available shrank and oxen became critical as a source of power for agriculture. There was consequently a strong protest on part of the Shudras and the powerful Vaisyas against continued animal sacrifices and tree cutting, which found its expression in two new religions, Buddhism and Jainism in the sixth century before Christ (Kosambi, '65). The creed of respect for all forms of life and non-violence was taken to its logical extreme by Jainism, which forbids eating of tubers in the belief that this involves killing of a plant, restricting food intake to grains, fruit and milk. Followers of one sect of Jains, the Digambars, wear no clothes because these may trap and kill insects, wear gauze over the nose to prevent insects being breathed in and sweep the path clean as they walk barefoot to avoid trampling on any creature. It is notable that Jainism has its strongest hold in Rajasthan and western Uttara Pradesh, two regions where the dangers of over-exploitation are perhaps most acute.

The centuries following the full settlement of the Gangetic plain and the other fertile tracts of the country were periods of great empires such as those of Ashoka. Availability of large surpluses from agriculture and animal husbandry must have played an important role in making the consolidation of such empires possible. We may imagine that this happened because there were large tracts of land recently brought under the plough and hence highly fertile. The slow depletion of fertility of such soils is a process difficult to appreciate and it is likely that this happened over centuries gradually reducing the surpluses available to the ruling classes, as well as depressing trade.

Kautilya's Arthasastra, a manual of statecraft of 3rd century B.C., near the height of imperial expansion provides interesting insights into practices of ecological prudence followed by the rulers. These include maintenance of royal hunting preserves, and more importantly forests for wild elephants. These elephant forests in hill tracts near the border of the kingdoms were considered critical for supply of elephants to the army; and were strictly protected against poaching with death penalty for killing an elephant (Kangle, '69). The peasants must have continued many practices of ecological prudence, bolstered by Buddhism and Jainism in these centuries.

CASTE SOCIETY

The large empires of India began to disintegrate after 7th century A.D. along with a decline in trade and influence of Vaisyas. We hypothesize that this decline may have been caused by a gradual depletion of fertility of agricultural lands over a millenium. Along with the decline of large empires and trade, came a decline of Buddhism with the Brahmins responding to its challenge in a number of ways including an abandonment of ritual animal sacrifices and consumption of meat. They also gradually incorporated a whole variety of tribal deities into the Hindu pantheon. The barriers of endogamy again became rigid, leading to the elaboration of a caste society. This Hindu caste society led to an ouster of Buddhism, and assimilation of Jains as Hindu castes, a process that was completed by the time of Shankaracharya in tenth century A.D.

The castes in Indian society resemble tribes in being endogamous, traditionally self governing groups distributed over a restricted geographical area. Unlike tribes they do not occupy an exclusive territory, but overlap with other castes in their distribution. Unlike tribes, too, they have a specialized mode of subsistence, which used to be hereditary. For instance, in a region, one caste may catch freshwater fish, a second keep buffaloes, a third make salt from sea water, a fourth tap liquor from palm trees, a fifth carry on paddy cultivation and so on. Each small geographical region is a mosaic of population of a number of sedentary castes, on the order of ten to fifty living together, yet independently within that region. The same region would be visited by another ten to fifty nomadic or semi-nomadic castes of artisans, pastorals and entertainers. These nomadic castes would also have a fixed geographic region over which they would move. Traditionally all these castes had set up relationships of barter with each other.

A most remarkable feature of this caste society is the extent to which competition for limiting resources was regulated through diversification of resource use and intra-and intercaste territoriality. For instance, the high rainfall tracts of the Western Ghats of Maharashtra are primarily occupied by just

the two castes of Gavlis and Kunbis. The Kunbis cultivated the river valleys and lower hill slopes, and hunted wild animals throughout the tract. They kept almost no livestock. On the other hand, the Gavlis kept large number of livestock, did no hunting and cultivated only small patches of upper hill slopes (Gadgil and Malhotra, '82). Similarly, in the semi-arid tracts of western Maharashtra the three groups of hunters — Phasepardhis, Vaidus and Nandiwallas had specialized to hunt on very different prey animals. Thus Phaseparadhis had specialized on deer and antelopes, Vaidus on small carnivores and Nandiwallas on porcupines (Malhotra *et al.*, '83). Of the two groups of basket-weavers, Kaikadis and Makadwallas of the same tracts, the former exclusively used bamboos, while the latter employed only palm leaves.

Thus castes with a geographical overlap dependent on communal lands had diversified their ecological niches by specializing on different resources. The cultivator castes regulated competition through land ownership, which is a form of intracaste territoriality. The artisan and service castes did so by assigning to individual households exclusive rights of dealing with specific households of other castes. Nomadic castes such as those of shepherds assigned the privilege of grazing over a certain defined territory to different lineages within the caste (Malhotra, '82). Finally, two nomadic castes with identical modes of subsistence, such as Tirumal and Fulmali Nandiwallas of Maharashtra had distinct intercaste territories (Malhotra and Khomne, '82).

Thus, castes within Indian society, particularly the pastorals and nomads directly dependent on natural plant and animal resources had elaborated a pattern of resource utilization, which coupled with territoriality ensured that a particular limiting resource in a particular geographical region was more or less exclusively used by a particular lineage (Gadgil and Malhotra, '83). This would ensure that members of a lineage, or their descendents, would enjoy the deferred benefits of their ecological prudence with a very high probability. This would strongly favour the cultural evolution of ecological prudence.

Indeed, India, even today, abounds in examples of such traditions of prudence (Gadgil, '84). In the Yamuna valley just upstream of Mussoorie the villagers poison the river with a drug derived from a herb just once a year at the time of a festival. All the fish thus killed by poisoning are then consumed in a communal feast to the accompaninent of barley wine. The fish may be caught at other times of the year, but only with nets; anybody poisoning the river at any other time is excommunicated. The harvest of certain wild plants is ritually restricted to certain days of the year only, thus in the Uttara Kashi district of Himalayas, tubes of *Nakhdun* are harvested only at the time of a religious festival. Many rural localities boast large heronaries, sometimes on trees lining the village streets, and the local villagers accord the strictest protection to these birds. For instance, this is the case with a breeding colony of painted storks and gray pelicans which has been protected at a village known as Kokre-Bellur (literally—the good village of storks) near Bangalore in Karnataka over centuries. Incidentally the villagers are well aware of the value of bird guano as manure. Scattered through India are sacred groves and ponds where the entire ecosystem used to be strictly protected. Where the network of sacred groves has remained intact till recent times, as in the South Kanara district on the West Coast, they formed a network of islands of climax vegetation at densities of two to three per square kilometer, ranging in size from a small clump to several hectares. This must have been a very effective way of preserving biological diversity for we are still discovering new species of plants, species which have disappeared from everywhere else in these sacred groves, as for instance the recently discovered woody climber, *Kunstleria keralensis* (Mohanan and Nair, '81).

It is notable that in predominantly Islamic Bangladesh these traditions have been absorbed by that religion as well. The shrine of a Moslem saint at Byazid Bostami has a sacred pond attached to it. This pond now harbours the world's only known population of a turtle, *Trionyx nigricans*. It is believed that the Islamic shrine itself was built on a spot earlier occupied by a Buddhist shrine (Reza Khan, '80).

These practices of ecological prudence were based in the rural populace. The rulers too continued the maintenance of hunting preserves; thereby protecting substantial tracts of wilderness. The Maratha king Shivaji of 17th century realized the significance of forests in conferring advantage to his local army in the hill tracts of Western Ghats and ordered strict protection of forests on hill

forts. He also ordered that his official do not cut any fruit trees such as mangoes and jackfruit as this would be a great deprivation for the local population. His admiral, Kanhoji Angre, established teak plantations in the Ratnagiri district on the west coast for ship building as early as 1680, well before the British plantations in Malabar in 1840.

While a variety of such practices must have led to prudent use and conservation of much of India's living resources, after, of course the needs of land for cultivation were met, it is entirely possible that decimation of these resources must have continued at least at a slow pace, in many parts of the country. The northwestern arid regions, with their unstable environments and large populations of nomadic pastorals were perhaps most susceptible to such degradation. Interestingly enough, in this region arose a sect of Hindus known as Bishnois about 500 years ago (Gadgil, '80). The Bishnois afforded strict protection to all wild life, and to one particular tree, *Prosopis cinerarea*. This is by far the most useful tree of this tract, providing food in the form of pods, fodder in form of pods and foliage, thorny material for fencing and so on. It is recorded that 250 years ago 363 Bishnois permitted themselves to be killed in an attempt to prevent the soldiers of the local king from cutting down these trees for a limekiln for the king's palace. Today Bishnoi villages are islands of greenery alive with peacocks and blackbuck in an otherwise desolate landscape.

WESTERN TRADITION

It was suggested above that nomadic societies inhabiting unstable environments under harsh conditions that kept the populations well below carrying capacity are much less likely to develop cultural traditions of ecological prudence. The nomadic sheep and camel herders of the middle-east must have represented such societies, and this is perhaps at the root of the ethos of aggressive control over nature that pervades the Judeo-Christian tradition (White, '67). As Christianity spread over Europe, it attacked and destroyed the earlier pagan practices of nature worship, cutting down sacred oak trees to build churches in their place. Inevitably in Christian Europe the natural resources were depleted as time went on, starting with the mediterranean and proceeding northwards.

We have suggested above that the response of the Indian society to such a depletion of resources by 7th-8th century A D. was the elaboration of a caste society which then husbanded the resources left at its disposal in a prudent fashion. It is possible that the response of the European society to an analogous depletion of resources around 13th-14th century was a totally different one of looking for new lands to draw upon and elaborating new technologies of resource use. The result was the European age of exploration and a scientific and technological revolution. The technological revolution was founded in a more efficient use of fossil energy in the form of coal ushered in by the steam engine. This efficient utilization of fossil energy, cheaply available, permitted the generation of a much greater surplus from human labour than was possible in agriculture. The tremendous possibilities of trade opened up by the discovery of new lands with people at a less advanced level of technology, and the edge that industrial production held over agricultural production tilted the European balance of power away from landlords to merchants and industrialists.

This new European elite, depending as it did on resources being continually newly discovered in colonies and armed with rapidly changing technologies, was obviously nurtured in a cultural mileu that strongly favoured ecological profligacy rather than prudence. The famous massacre of bisons on the American plains unleashed by the white settlers was perhaps symptomatic of just this ethos.

COLONIAL ERA

British established their control over an India of largely self-sufficient, self-governing village communities which managed the natural resources on communally held lands, often with great restraint and prudence. To the British rules these communal lands represented resources which they had every right to take over and use as state property. This attitude is beautifully articulated by Buchanan writing of the West Coast of India 1801:

"The forests are the property of the gods of the villages in which they are situated and the trees ought not to be cut without having obtained leave from the .... priest to the temple of the village god. The idol receives nothing for granting this permission; but the neglect

of the ceremony of asking his leave brings vengeance on the guilty person. This seems, therefore, merely a contrivance to prevent the government from claiming the property" (Buchanan 1802; reprinted '56).

The village gods and the people had perforce to yield to the will of the rulers who claimed a lion's share of the natural resources so carefully husbanded by the local village communities over the centuries. This takeover was followed initially by completely unregulated exploitation to supply the timber needs of British ship building, army and cantonments. In fact, the District Gazetteers prepared between 1860-1880 uniformly record tremendous decimation of forest over the period since the consolidation of the British rule. The British also went on a great hunting spree in India they had conquered. Thus, the Asiatic Lion, which they found distributed over a substantial part of north India in 1800, was wiped out over most of its range by the end of the nineteenth century (Seshadri, '69).

RESERVATION OF FORESTS

The centuries following European renaissance were an era of rapid progress in man's understanding of the working of nature within the framework of modern science. This rise of science weakened the prestige of religious institutions, so that science gradually came to the fore as the predominant framework for rationalizing the way societies functioned. Inevitably this led to an awareness of man's impact on natural resources, and the need for their careful husbandry. This consciousness first arose on the European continent, triggered by the disastrous floods and landslides in the Alps in the midnineteenth century and later spread to the United States (Glacken, '56). Ramachandra Guha (in this volume) analyses the debate that has developed from these beginning first in the west and subsequently in India. Concurrently, with an awareness brought in by the floods the Europeans had been elaborating a framework for management of forest stands for obtaining sustainable yield. It was these scientific ideas that now came to provide the rationale for the management of natural resources in British India. The initial period of totally unregulated exploitation of India's natural resources ended with the rule of British East India Company with the war of 1857. The British now thought their power consolidated enough to take a longer term view of the colony's resources. This was also the beginning of the laying down of the great network of railway lines. These railway lines needed an enormous amount of timber and the Government realized that it would be impossible to meet this demand unless the harvesting of forests were regulated. Since Great Britain itself had no tradition of scientific forest management, the Government brought in several continental foresters to give shape to forest management in India.

There was a twofold rationale behind the new, presumably scientific management of forests thus being introduced. Firstly, large tracts of lands were surveyed and taken over as Government Reserved Forests. These were often lands traditionally managed by village communities, and in fact for several years the Governor of Madras Presidency refused to agree to any reservation of forests on grounds that there were no forests traditionally not used by village communities. In the end, about one-fourth of country's land surface was converted into Reserved Forests. This was done with much care. Secondly, these Reserved Forests were to be surveyed and managed on a sustained yield basis. The information base needed for this was created neither in British regime, nor thereafter, so that the so-called sustained yield management is still largely a myth (Gadgil *et al.*, '83).

While a major proportion of the previously communally managed land was taken over as Reserved Forests (for a detailed treatment on this subject see Roy Burman and Sharma in this volume) a smaller proportion was set aside for the use of village population as grazing and village forest land. However, the rights to this land now vested with the Government Revenue Department. In the meanwhile, the traditional economy and solidarity of the village communities were rapidly breaking down under the colonial rule. In consequence the villagers now began an unregulated use of the common land soon to lead to disastrous overexploitation, except in a few remote corners where the traditional management practices remained alive.

The resources of the Reserved Forests did not fare too well either. The British Government could not be expected to be overly concerned with long term health of resources in a land which had been conquered, but was never settled by their own people. The local village population had no longer any stake

in the good management of these Reserved Forests which were harnessed to meeting the needs of British ship-building, railways, military and the development urban-industrial centres. The local people therefore continued throughout the British rule to agitate for release of this land for cultivation and never provided willing co-operation in its management. The condition of Reserved Forests therefore inevitably continued to degrade throughout the British rule, especially during the two world wars. There was little actively done for the conservation of wild life either, except for the hunting preserves of the British planters. The British rule was then a period of continuing decimation of Indian's heritage of natural resources. Moreover it was a period of collapse of conditions which had fostered an ethos of ecological prudence amongst the Indian people over the centuries.

INDUSTRIALIZE OR PERISH

British interests lay in developing India as a producer of cheap raw materials and a market for manufactured goods. In consequence, they had deliberately held down the growth of Indian industry till the end of first world war and permitted only slow growth thereafter. This was accompanied by a deliberate destruction of India's handicrafts as well. Consequently, India's dependence on land and its production had increased while its resources were being rapidly depleted. The result was an unprecedented impoverishment of the land and its people.

There were two quite different responses of the Indian elite to this situation. One strand, symbolized by the great engineer, Sir. M. Visweswariah believed that the only remedy lay in industrialization and technological progress. The other, advocated by Mahatma Gandhi called for a restoration of the village autonomy and handicrafts. Gandhi's attitude towards industry was quite ambivalent. Although Mahatma Gandhi became the supreme leader of the country's independence movement, his economic philosophy had little impact on the nation. For the new Indian elite of merchants and industrialists, largely from the Vaisya communities, that was in formation, quickly perceived that their interests lay in embracing the path of technological progress and industrialization. This was also supported by the educated urban classes largely derived from the Brahmin communities who were providing the professionals. The third component of the Indian elite, the landowners and princes participated but little in this debate. The one component of Indian society who could have benefitted from the adoption of Gandhian philosophy, the rural landless, artisans and small landholders had little clout in spite of being numerically large. In the end the Indian nation opted overwhelmingly for the policy of industrialization on achieving independence.

When the nation launched on its quest for industrialization on independence, it adopted 'industrialize at all costs' as its guiding principle. This meant making available country's natural resources at a throw-away price to the industry. Thus the Congress Government of Karnataka and the Communist Government of Kerala vied with each other in attracting forest based industries to their state by promising forest raw materials at prices like one rupee per tonne of bamboo, when the bamboo was being sold on open market for thousand rupees a tonne or more. The industrial sector was also given land, water, and power all at highly subsidized rates. It was further sheltered from foreign competition by restrictive policies and could market its goods on a seller's market. The result was phenomenal profits in the industiral sector, far greater than anything imaginable in the agricultural sector. The industrial sector shared its profits with the politicians and bureaucrats through fair means and foul and thrived on the support given by them.

In this milieu the industrial sector had little reason to develop a culture of ecological prudence. It measured its benefits in a single currency — that of monetary profits. It had open many venues of generating such profits. If one venue dried up, the capital could always be invested elsewhere. More concretely, as one of the managers of a paper mill told us, the mill had made enough profits within the first ten years to justify the investment. Beyond that the owners could easily afford to write off the mill and invest in something else. The consequence was that the industry concentrated on immediate profits rather than long term health of its resource base such as bamboo stocks.

We ourselves became personally involved in one such episode of ecological profligacy in connection with the paper industry in Karnataka. The first paper mill of Karnataka

was established in the State sector in 1937, the Mysore Paper Mill at Bhadravathy. The second, a larger mill, was established in the private sector in 1958, the West Coast Paper Mill at Dandeli. Both these mills initially depended on the abundant bamboo stocks of the Karnataka forests as the raw material. Bamboo is a very vital raw material for our rural sector, and is the source of livelihood of a large community of basket-weavers. However, before its industrial use the state forest department regarded it as a weed. This 'weed' was made over to the industry essentially free ot cost, and was nearly wiped out within a few decades. This had a serious effect on the basket-weavers who launched an agitation in 1974. One of the results was an investigation on the causes of bamboo depletion taken up by us.

COMPULSIONS OF SUBSISTENCE

When we began our studies, there were two versions of what had happened to bamboo stocks. The rural population squarely blamed excessive exploitation by the industry; while the industry sought to put the entire blame on forest grazing by livestock, especially that of a community of forest graziers known as Gavli Dhangars The forest department largely, though not totally, sided with the industry. Our own studies clearly showed that there was merit in both the accusations. The paper mills indeed overexploited, often against regulations. But more importantly, their operations opened up bamboo clumps removing the thorny cover at base. The new shoots of such an opened-up clump were highly susceptible to damage by livestock. The result was a failure of bamboo clumps to put on expected growth, and eventual death. It was thus a combination of overexploitation by the industry and overgrazing by domestic livestock that was responsible for the decline of the bamboo stocks (Gadgil and Prasad, '78).

This example illustrates the two pronged attack under which the natural resources of the country are being wiped out. The urban-industrial sector is immune from the immediate consequences of such destruction and is therefore indulging in ecological profligacy in search of quick profits. The rural masses do indeed suffer the consequences of the decimation of natural resources, but are contributing to it in their struggle to eke out a subsistence. Thus, our study of Gavli Dhangars showed that this group of people, traditionally buffalo-keepers in the forests of Maharashtra's Western Ghats, could no longer derive an adequate subsistence. This was because the grazing resources, water and shade which their buffaloes require have all been drastically reduced consequent on the deforestation of their traditional habitat. As a result the Gavli Dhangars are taking more and more to keeping goats and shifting cultivation. Both these practices contribute significantly to the destruction of the vegetation in their habitat (Gadgil and Malhotra, '82).

Another instance of the impact of the destruction of resource base on a rural community is the case of the hunter-gatherer Phasepardhis mentioned above. Traditionally the Phasepardhis held near exclusive monoply of snaring deer and antelope over their territory. This also provided a service to the farmers for whom these animals were a pest. Since traditionally the Phasepardhis were assured of due benefits of their ecological prudence, they always let loose any fawn or pregnant doe snared by them. When they lost this assurance with the British military personnel and other communities taking to indiscriminate hunting, they too gave up their prudent practices. All of this massacre has resulted in all but wiping out the deer and antelope populations of their territory. As a consequence of this resource depletion the Phasepardhis, who always indulged in some thefts, have now taken to criminal activities on a much more extensive scale, leading to serious conflicts with other communities (Gadgil and Malhotra, '83). Vinod Vyasulu in this volume illustrates effectively how internal colonization has underdeveloped Koraput district in Orissa.

INITIATIVES FROM THE ELITE

All of this is not to say that there have not been continuing and new initiatives for good management of the natural resources in India. Several such initiatives have come, both from the elite and from the masses. One of these, the movement for nature conservation has its roots in the hunting preserves of the Maharajas. As mentioned above, such preserves were already known at the time of Arthasastra in third century B.C., and have continued unbroken through middle ages and in the native states under the British regime. The

British added their own preserves to this when they created hunting preserves like that for the Nilgiri tahr in the higher reaches of Nilgiris and Anamalais. Other than that the British took little interest in conservation *per se*, though they brought to India the modern tradition of natural history. Serious efforts for conservation began only after independence, spearheaded by the Bombay Natural History Society, founded in 1883 by a group of British naturalists to which a few educated upper class Indians were gradually attracted.

Naturally enough, the erstwhile hunting preserves of Maharajas formed the nucleus of the new wild life sanctuaries established after independence. These included the Tiger Reserves of Bandipur, Ranathambor and Simlipal, the last refuse of Asiatic lion in Gir, and the Keoladev bird sanctuary at Bharatpur. While such reserves have made a significant contribution to nature conservation in India, their elitist bias remains a disturbing element. Thus in Gir lions had coexisted with a group of pastorals called Maldharis and their buffaloes for a long time. The buffalo is a strong animal and was largely able to defend itself against the lion so that there was little conflict between the two On the contrary, the Maldharis did not themselves indulge in hunting and prevented others from doing so. Unfortunately our wild life managers decided without any careful study that the Maldharis and their animals were a major threat to Gir and in the late 1970's resettled them outside. This opened the way to cattle grazing by other agriculturists, as well as to poaching. The cattle, unlike buffalo, is susceptible to predation by lion and now their caracasses are poisoned by the cattle owners leading to deaths of lions. The bird sanctuary of Bharatpur has witnessed a similar tragedy brought about by the unjust prejudice of the scientists as well the wild life managers against the villagers and their livestock. Bharatpur is a large shallow waterbody on the cultivated plains of north India formed by a man-made barrage, and attracts an enormous number of waterbirds for breeding and wintering. The area has also served, at least for a century, as a grazing ground for thousands of local cattle and buffaloes. Three years ago the whole area was abruptly closed for grazing to the domestic livestock without any scientific investigation of the impact that such closure will have on the ecosystem, and without providing alternate fodder resources for the large population of livestock till then dependent on this area. There were local protests, even police firing and some deaths. Then the grazing was halted. Much to the chagrin of the managers, this closure has failed to benefit the waterbirds for whom the sanctuary is maintained. Quite to the contrary, the shallow waterbody is now being rapidly covered by tall grass growth rendering it quite unsuitable as a habitat for aquatic birds.

Another major conservation initiative by the elite has been a Central Act preventing the release of forest land for non-forestry purposes without consent of the Central Government. This ordinance, first promulgated some three years ago and subsequently passed as an act of the parliament has decidedly reduced the pace of release of land under the control of forest department. There has however been a major criticism of the act as coming in the way of providing simple amenities such as electricity lines to remote villages. The clearance of as little as a hectare of forest for this purpose apparently gets held up indefinitely for clearance. At the same time, it was ironical that the lobby of rich plantation owners of Kerala was able to blackmail the State and Central governments into release of thousands of hectares of forest lands in a matter of a few days.

A third and significant kind of initiative is that coming from the people's science movements spearheaded by the Kerala Sastra Sahitya Parishat. These movements aim at taking the scientific way of looking at issues and benefits of science and technology to the people. Gradually these movements have become aware of the fact that the benefits of science and technology are being cornered by a narrow elite, while the masses only suffer its costs, as from environmental pollution. These movements have therefore taken up objective scientific studies of issues such as the environmental impact of a river valley project like the Silent Valley project, and the pollution of an important river like Chaliyar by a rayon factory.

GRASS-ROOTS MOVEMENTS

These initiatives from the elite are no doubt important, but as we tried to show above, they have definite limitations. This is because the elite are well buffered from the costs of

decimation of our natural resources and have little at stake in their degradation. On the contrary a significant component of this elite can derive substantial benefits in terms of money — the only terms to which everything is being reduced — through ecological profligacy. The masses, on the other hand, still subsist at at levels at which many of them can barely afford to purchase food, let alone fuel, fodder, fertilizer or house construction material. They must therefore depend on natural living resources for the quality of their life, and have much at stake in preserving them; for further details see Anil Agarwal in this issue.

If only we could relieve them from the necessity to destroy these resources to eke out a subsistence, they can come to play a major role in their prudent use. This has been convincingly demonstrated in the last decade through the Chipko movement in the Himalayas. The Tehri-Garhwal tracts of Western Himalayas where this movement had its beginnings some ten years ago are a fragile range that come down in huge landslides burying wholes village when destabilized. These remote regions were cut off from the rest of the country and remained forested till the 1960's when the defence needs of India prompted the construction of a network of roads. The roads were unfortunately followed by excessive exploitation of timber and consequent deforestation. Bereft of tree cover the unstable hill slopes became ever more liable to landslides. At the same time the people, used as they had been to gathering much forest produce began to suffer in other ways.

In the early 1970's the Sarvodaya workers of Tehri-Garhwal had organized a co-operative forest based industry. To their shock they discovered that contrary to all professed policies the Government starved their industry based on forest resources while feeding another factory away in plains at subsidized rates. Coupled with their suffering from deforestation and the disastrous floods that were taking place, this led them to protest against the indiscriminate cutting of trees for the sake of industry. The Chipko movement thus born has spearheaded the creation of public awareness of India's current ecological crisis under the leadership of Shri Sundarlal Bahuguna. Even more significantly, it has developed an example of organizing the rural population for protecting the environment and revegetating the barren hills under the leadership of Shri Chandiprasad Bhatt (Bhatt, '80).

This initiative of the Chipko movement has been paralleled by other grass-roots movements, such as that of traditional fishermen — the Ramponkars — of Goa. These fishing communities of our sea coast have been harvesting the inshore fish and prawn stocks with simple craft and nets for centuries. It is estimated that they were taking of the order of 80% of the interest on the capital of the near-shore fish stocks, thus fishing in a sustainable fashion with a small, necessary safety margin. The 1950's saw the introduction of mechanization of the fishing industry with trawlers capable of catching fish much more effectively, but at the same time disturbing their environment in many ways as by dragging on the sea bottom. The mechanized craft were introduced with the idea that they will harvest the offshore fisheries unexploited by traditional fisherman. Unfortunately, the most lucrative catch, that of prawns, is close to the shore. Hence the the trawlers concentrated their fishing in the same near-shore zone being fished effectively by traditional fishermen. The result has been a destruction of spawning beds and overfishing of the stocks in this zone, sending the fish catches plummeting down. The near-shore fisheries have also suffered from pollution from chemical industries and siltation from mining activities. The sufferers in all this have been the traditional fishermen and the rural population consuming the fish. The trawler owners, with their larger catches meant for export have managed to prosper even in this deteriorating situation; and will no doubt find other avenues to invest their money once the fisheries are depleted to exhaustion.

The traditional fishermen have no such options, and have begun to agitate seriously against this profligate use of the sea. The result has been a movement in the coastal union territory of Goa which beginning with the fishermen has come to embrace other issues of ecological degradation as well. They have had limited successes, as with legal sanction that the trawlers must fish only beyond five kilometers offshore; but these limits are frequently breached.

THE DILEMMA

It is thus the masses of our population dependent for their very subsistence on the natural living resources of the land who have

a real stake in ecological preservation of the country. At the same time, they have now become a major force of destruction of these very resources in their day-to-day struggle to eke out a living. Basing themselves on this second fact, the elite of the country is projecting this as the principal, if not the sole cause of our environment degradation. From this prejudice follow actions like the whole thrust of the new forest policy treating tribals as the chief enemies of forest, or the unscientific closure of all grazing at Bharatpur bird sanctuary. Such actions aim at establishing more firmly the control of the elite over the natural resources of the country, excluding masses from any access to it. This we believe is most unwise and will ultimately lead to an ecological disaster for the elite are unlikely to exhibit much ecological prudence in the long range.

ECOLOGY IS FOR THE PEOPLE

What do we do then? It must be admitted that in their currently impoverished, divided condition the masses, on their own, are not in a position to take on the mammoth task of good management of the country's natural resources. It is also clear that given the present level of depletion of these resources and higher population pressures, the traditional methods of resource use, such as free range grazing by cattle, are no longer supportable. We must therefore develop new ways of good use of these resources, harnessing modern science and technology to do so, and we must work with the masses to develop a whole new framework within which the resources will be managed properly. Of course all of this must be motivated by a genuine feeling that ecology is for the people.

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