

TRENDS IN ENVIRONMENTAL PROBLEMS AND THEIR FUTURE IN INDIA

Jitendra S. Sharma
Chemistry Division
Oil & Natural Gas Commission
Sibsagar, Assam, India

ABSTRACT

In the continuing race between man and nature, the ecological balance has been upset. It is becoming increasingly important for the Indian people to combat the danger inherent in the growing deterioration of the natural environment, the degradation of land, poisoning of the air, rivers and reservoirs and the pollution of cities. A third of India's potential agricultural land and three-fourths of the non-agricultural land is lying practically useless. Besides, three-fifths of our total agricultural land is degraded and, on the whole, three-quarters of all the land under cultivation and in forests needs urgent care. Such a state of affairs is partly due to the poverty and overpopulation in our country, and is partly because of complacency, ignorance and lack of policy and organisation at the highest levels. It is a sad but undeniable fact that our forest departments have, by and large, failed to protect our 70 odd million hectares of forest lands against encroachments, unauthorised felling and denudation. It is estimated that 6,000 million tonnes of top soil are displaced every monsoon season by water erosion. The environment has begun to show obvious signs of the misuse of our natural environment. A classic example of this is the entire exercise in flood control in the Ganga basin. The silent valley controversy in Kerala focussed the nation's attention on the plight of the tropical evergreen forests. Silted-up reservoirs no longer have their original capacity.

1. DEGRADATION OF LAND RESOURCES

Exploitation of natural environment for useful material has always been an important facet of the man-nature interaction. Despite India's rich tradition and socio-religious background, the country has witnessed a depletion of its biological heritage on such a massive scale that it has become a matter of serious concern. There is evident of the neglect of land resources which are available wherever one might go in this vast country of ours. Denuded hillsides, ravines, waterlogged and saline lands, drought-stricken villages, silted tanks and drying wells are to be encountered almost everywhere. Floods ravage large areas of land year after year. The Rajasthan desert maintains its leeward creep. In the northeastern parts of the country, shifting cultivation patterns continue to strip heavily-forested slopes of all vegetation.

Let me first take a broad look at the way in which our land resources are being used or misused. The total area of the country is 305 million hectares. According to official sources, 18 million of these hectares are under urban or other non-agricultural uses. Another 21 million hectares are classified as barren and unculturable, being perpetually snowbound or rocky in nature. Of the remaining 266 million hectares, 17 million are classified as culturable wastes, and as many as 23 as fallow. This makes a total of 40 million hectares which, although capable of production by definition, are lying unproductive, apparently because of the degradation they have suffered.

Of the remaining area of 226 million hectares, 83 are classified as forests and permanent pastures and 143 as agricultural lands. However, it is well known that only about 35 million hectares out of the 83 described as forests and permanent pastures are actually under good tree or grass cover, the remaining 48 being more or less completely devoid of vegetation. If these 48 million hectares are added to the 40 which have gone out of production for one reason or another, we arrive at a total of 88 million hectares which are more or less completely unproductive. This represents about 33 percent of our total relevant area of 266 million hectares.

However, if we exclude the 143 million hectares of agricultural lands from consideration, this area of 88 million hectares represents as much as 72 percent of the 123 million hectares of non-agricultural lands. In other words: fully one-third of our total relevant land area and nearly three-quarters of our total non-agricultural area is today lying practically useless. These figures show how very sick our non-agricultural lands are. However, our agricultural lands are also not free from problems. According to the Ministry of Agriculture, as many as 175 million hectares, equivalent to 66 percent of our total relevant area, are affected by degradation caused mainly by serious soil erosion and waterlogging and salinity -- which are only two of the major ills the land suffers from. Since 88 of these 175 million affected hectares are more or less completely unproductive non-agricultural lands, it follows that the remaining 87 million hectares of sick lands are under cultivation. This represents 61 percent of the 143 million hectares which are classified as agricultural. In other words, over three-fifths of even our agricultural lands are degraded to some degree.

The actual situation is, however, even more alarming than what these statistics reveal, because they do not take two additional factors into account. The first of these concerns the vast areas which are ravaged by floods. According to the National Commission on Floods, the area affected by annual floods stands today at around 40 million hectares, compared to 25 million hectares some 30 years ago. The second factor involves the growing menaces of waterlogging and salinity in newly-irrigated canal command areas. It would not be unreasonable to assume that at least 10 million hectares out of our total irrigated area of around 40 million hectares are threatened by waterlogging and salinity and are in urgent need of attention if they are not to go out of production in the near future.

Even allowing for a great deal of overlap between these 50 million hectares and the 175 already listed as degraded, the total

area which needs attention cannot be less than 200 million hectares -- out of a total relevant area of 266 million hectares. This represents a percentage of 75.

These figures present a truly frightening picture even for the professional who predicts a great future for India as an agricultural power. To repeat: around three-quarters of our total relevant area is in need of urgent attention and a third is so sick that it is almost completely unproductive. In terms of categories, at least 61 percent of our agricultural lands and at least 72 percent of our nonagricultural lands are degraded to a greater or lesser degree. It is no wonder that we are so desperately short of food, fruit, fibre, fuel wood, timber, animal products and, indeed, everything that the land produces. It is no wonder that we can barely manage to produce 130 million tonnes of food grains from 143 million hectares of agricultural lands.

It is high time we realised the state we are in, for what we are witnessing is the unchecked erosion of our resource base--even as the demands on it from a steadily increasing population and steadily increasing expectations of a better life are rising rapidly. The Indian situation can indeed be compared to that of a leaking boat into which more and more people keep climbing, even as, unknown to the occupants, the hole in its bottom goes on increasing in size.

That this picture is not overdrawn will be clear when we consider, in some detail, the exact nature of the problems of land degradation which face us. As I have just mentioned, the two major threats to our land resources are waterlogging and soil erosion. According to the latest available information, the areas which have already gone out of production on account of waterlogging and salinity are 13 million hectares. Of these, perhaps half are situated in estuarine and coastal areas and have not been productive in recent times. However, at least 6 million hectares comprise lands which were productive until recently and have been lost to waterlogging and salinity on account of man-made situations.

The first, and lesser, of these situations arises from the impediments which have been created in the way of natural drainage by engineering works such as flood control embankments and road, rail and canal embankments. If, as is often the case, such embankments do not contain adequate cross-drainage works, water is retained against them and causes damage to the areas submerged. The answer to such situations, although expensive, is fairly easy. It lies in the construction of adequate cross-drainage works wherever these are required.

It is the second kind of situation, peculiar to canal-irrigated areas, which is much more alarming. Lands in canal areas of North India are often flat and poorly drained. Irrigation of these areas results in waterlogging and salinity over a period of time. This process is hastened by two other circumstances: Firstly, the application of canal water to crops is often far in excess of their needs. Secondly, wherever canals and distributories are not lined, as is often the case, they contribute heavily to waterlogging through seepage. The lining of canals and distributories is indicated, not only to save valuable lands from damage, but also to eliminate water losses which often amount to as much as 40 percent of the water released from the reservoir.

The reclamation of water-logged and saline lands which have already gone out of production is naturally even more difficult than the prevention of water-logging. Not only must drainage be provided to these lands but arrangements must also be made to leach saline soils and to carry out soil amendments and introduce suitable cultural practices. Here, as in most other situations, prevention is definitely better than cure. Even if we give a low priority to the reclamation of water-logged and saline lands which have already gone out of production, we must save the 10 million odd hectares of newly irrigated lands from damage. Such a programme will require an average of Rs. 10,000 crores for the area we have in mind. It will also require technical and administrative inputs of a colossal nature. However, we have no option but to mount such an effort and ensure that it is carried out successfully if we are to save some of our best lands from increasing infertility.

Let us now turn to the other major threat to the land, the erosion of the fertile top soil. It is estimated that the area seriously affected by wind erosion is around 50 million hectares while the area seriously affected by water erosion is around 100 million hectares.

The control of wind erosion lies primarily in the restoration of vegetal cover to denuded lands by curbing indiscriminate grazing by nomadic herds and the creation of wind breaks and shelter belts which reduce the velocity of strong winds and thereby also their erosive and desiccating effects. These are also the methods by which shifting sand-dunes can be stabilised and prevented from smothering vegetation, blocking up roads and railroads choking irrigation channels in their vicinity in Western Rajasthan. The control of wind erosion also carries with it the hope of ending the aridity of the desert and of finding a permanent solution to its problems. Studies indicate that one of the possible reasons why moisture-laden clouds pass over Western Rajasthan without precipitating their burden on it is the fine dust suspended in the air over the desert. This dust is, of course, the direct result of wind erosion.

Let us now turn to the erosion of the top soil by water, which undoubtedly constitutes the most serious threat to our land resources. This is so because apart from reducing the fertility of the 100 odd million hectares of land directly affected by it, it has a number of extremely deleterious side-effects. Thus, it leads to the siltation of reservoirs and tanks, the choking of estuaries and harbours, the occurrence of floods and finally to the loss to the sea of a great deal of priceless sweet water. The genesis of water erosion as of wind erosion lies in the ever increasing pressure of human and animal populations on forest and pasture lands in their search for fuel and fodder. In tribal areas, growing population pressures produce similar results by shortening the cycle of shifting cultivation. The cutting of hillsides for building mountain roads also contributes to erosion and landslides.

The over-exploitation of forests by commercial interests is yet another environmental problem. Unscrupulous forest contractors often cut down more trees than they are entitled to. The opening up of hitherto inaccessible forest areas by new all-weather roads and the easy availability of heavy duty trucks in recent years have

hastened this process greatly. It is a sad but undeniable fact that our forest departments have by and large failed to protect our 70 odd million hectares of forest lands against encroachments, unauthorized fellings, and denudation. This is partly due to the fact that they do not possess adequate legal powers over areas other than reserved forests, which constitute only about half of the total forest area. In the remaining half, described as protected and unclassified forests, Forest Departments have very little say indeed. As far as pasture lands, which constitute around 12 million hectares are concerned, these usually vest in village communities and have suffered enormous damage through encroachments and over-grazing.

According to an estimate made in the seventies, the quantity of top soil displaced by water erosion alone was 6,000 million tonnes a year. It was calculated that this represented a loss in terms of the major nutrients NPK alone that would require 5.37 million tonnes of inorganic fertilizers to replace at a cost of Rs. 700 crores. Our total losses due to erosion must, however, be still greater if computed in terms of the agricultural, animal and forestry production that we are losing year after year as a result of the continuing degradation of 150 odd million hectares of land.

Such losses must certainly be of the order of several tens of thousands of crore rupees a year. These losses show up unmistakably in the pitiable condition of our poverty stricken masses for land degradation. The indirect losses caused by water erosion are no less serious in nature. The premature siltation of our 5 lakhs odd tanks and of the 487 reservoirs of our major and medium irrigation and multi-purpose projects, on which the community has invested over Rs. 10,000 crores during the last three decades, is a particularly serious matter. Observations show that the average rate of sedimentation in most reservoirs is 4 to 6 times as high as the rate which was assumed at the time that they were designed and built. The life expectancy of these projects is, therefore, being reduced significantly by soil erosion in their catchments.

Another way in which the country pays dearly for soil erosion is through the losses it suffers as a result of floods, which occur because a great deal of the soil which is washed down from watersheds gets lodged in the beds of rivers and reduces their carrying capacity. According to the National Commission on Floods, the losses caused by floods during the three-year period from 1976 to 1978 amounted to Rs. 3,180 crores which works out to an average of over Rs. 1,000 crores per annum. However, these figures convey no idea of the suffering and misery caused by the loss of lives or of the toll taken of human and cattle health by the epidemics which invariably follow in the wake of floods. The only way to tackle the growing menace of floods is to control deforestation, denudation and soil erosion in the water sheds of rivers. Such a task must be undertaken on the most urgent basis particularly in the case of the Himalayan rivers, if certain disaster is to be avoided. If this problem is not tackled in time, it is not difficult to imagine a situation in which, thanks to increasingly frequent and intense floods, and the consequent rise in the level of river beds, large portions of the rich flat lands of the Ganga basin may be turned into undrainable swamps. Perhaps it is already too late to save the situation because while the denudation and erosion of the Himalayas is already far advanced and is growing rapidly.

Yet another extremely serious consequence of soil erosion is the havoc it plays with our water resources. This is so because the run-off of rain water from denuded surfaces is far greater than from slopes which are well-wooded and well-grassed. This means that a great deal of the water which would otherwise have been retained as sub-soil or ground water is lost to the sea, often after causing a great deal of damage in the process. This is the reason why springs and artesian wells in Siwaliks and middle Himalayas have dried up wherever extensive denudation takes place. How much would a total programme for the control of soil erosion over 150 odd million hectares require by way of financial outlays? Even if we assume, at a very conservative estimate, an average cost of no more than Rs. 1,000 per hectare, the total bill would be around Rs. 15,000 crores. Such an investment though colossal in size would certainly be justified if it can be carried out in a manner which is technically sound, and is supported by the local communities as well as by a stern political and administrative will.

Apart from these two major ills which I have examined in detail, the other threat to soil concerns the deterioration of some of our best soils which are cultivated intensively in situations of perennial irrigation and multi-cropping. Such deterioration can take place on account of the continued application of large quantities of inorganic fertilizers and pesticides and the depletion of trace elements and other micronutrients. The second threat concerns erosion by the sea which affects many parts of our long coastline but has so far drawn attention to itself only in some of the densely populated areas of Kerala where the loss of land to the sea is of the order of 2 to 5 metres per annum. The third problem relates to the desfigurement of the land by activities such as brick-making, quarrying and open-cast mining. The Indian situation is not static and the threats to the health and productivity of our land resources are of a continuing nature. What is more, these threats will become increasingly serious and interactable with the passage of time.

2. ECOLOGICALLY DESTRUCTIVE DEVELOPMENT

Ecologically Himalaya mountains are a most fragile and at the same time the most valuable area. The sudden changes in the topography, where erosion, drainage, etc., are rapid while the impact of climatic and other physical environmental factors are more severe, tend to make them vulnerable. By their capacity to exert considerable influence on the environmental conditions of the surrounding areas they are vulnerable as well as valuable. Similarly their peculiar physical environmental conditions result in biologically special systems which have inherent value. Difficulty of terrain, climate, etc., tends to make the mountains less suitable for human habitation. The low population density has helped retain their biotic wealth at least in some parts of the country while most of the plains and river valleys have been heavily degraded. The human communities that have survived in the mountains have been extremely self-contained and isolated from each other with cultural adaptations particularly suitable to their environment.

Developmental processes in the northern plains of India are bound to reach up to the Himalayas and cause modifications there also. Developmental processes in the mountain ecosystems are usually for the natural resources such as timber, minerals, etc., or use

elsewhere, tourism and other recreational needs, enhancing communication facilities through roads, etc. While some of these pressures have to be accommodated, others have to be outright countered. The judgement needs to be based on an impartial scientific cost-benefit analysis.

The Western Ghats provide interesting case-studies of ecologically destructive development that has been rampant in recent decades. These hills from the western water-shed in Peninsular India extending from Gujarat to the southern tip of the land parallel to the west coast leaving only a less than 79 km wide belt on the west coast. It controls the environmental conditions of Peninsular India considerably. India is a monsoon country receiving most of its precipitation from the south-west monsoon but for which most of the sub-continent would have been a semi-desert. Located directly across the south-west monsoon stream, the rainfall on the western slopes of these ranges is exceptionally heavy. The entire range had tropical moist forests, till recently of great resource potential, in addition to its scientific and indirect climate modifying value. The Western Ghats have particularly a direct bearing upon the human welfare of the entire southern region, i.e., Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala and their manifold influences transcend the state and other administrative unit boundaries. All the major Peninsular rivers, Godavari and Krishna, originate in the watershed of this range and flow east while a very large number of short rivers flow west having torrential courses. The geomorphology and its evolution in this tract have given the river a unique set of ecosystems with extraordinary productivity by any standards.

In spite of the tremendous population pressure on the western coastal strip, and the extremely severely degraded environment on the eastern Deccan Plateau, even today compared with any other part of Peninsular India, the Western Ghats retain some pockets of unmodified habitat, particularly in the South Kerala-Tamil Nadu part of the range. This invaluable biological resource needs total conservation for protecting its genetic diversity for study and future use of its economic potential. This region perhaps has the greatest number of endemic plant and animal wealth in the whole of India containing the remnant pleistocene refugia of tropical evergreen forests that once covered vast areas of Peninsular India. The Silent Valley controversy in Kerala focuses the nation's attention to the plight of the tropical evergreen forests.

During the latter part of the 19th century and early 20th century, the introduction and expansion of plantation crops, primarily coffee, tea, rubber, cardamom and pepper, have resulted in the modification or the destruction of extensive stretches of moist forests in the Western Ghats. The demand for wood during the second World War and the misguided grow-more-food campaign during the war years resulted in further destruction of the forests. Finally, the post-war years saw the extensive development of hydel and irrigation projects in the river valleys in the region and raising of vast scale monocultural plantations replacing natural mixed forests. Most of the developmental activities, carried out in an uncoordinated manner with inadequate preinvestment investigation, particularly on the long-term repercussions, have resulted in immense loss of resource potential and inadequate returns on the investments. Where development was unavoidable, the lack of sufficient ecological safeguards

have resulted in destructive shock waves in wider circles than in the immediate vicinity.

An example of the wide ranging disruptions from the runaway technology, based on inadequate planning is the story of Kuttanad in Kerala. Kuttanad is an extensive estuarine ecosystem, the dynamic equilibrium of which was under the control of a number of factors, the most important of which, the heavy inflow of fresh water during the rainy period extending over eight months from the Western Ghats through five or six rivers whose catchments were all covered with tropical forests with 5,000 mm or more of rainfall. The heavy runoff flooded the low-lying Vembanad backwaters and surged out through the Cochin Sand bar. But during summer months with little inflow of fresh water, the sea water flowed in and created brackish water conditions. Extensive mangrove forests with crocodiles and flocks of immigrant water-birds, extremely productive prawn and estuarine fish harvests characterised the interior backwater areas. In the shallower stretches, by creating temporary bunds and pumping out water, one bumper paddy crop was obtained. The back-water zone had vase coconut gardens. Life styles had evolved depending on local conditions and allround productivity was maintained. But, without understanding the dynamics of this wetland, developmental projects were initiated. Construction of massive permanent barrage named the Thannirmukkam Bund was undertaken to reclaim most of the shallow areas permanently keeping out the summer ingress of saline waters. Simultaneously dams were constructed higher up in the Western Ghats in all the rivers draining down to the backwaters and their catchment slopes thoroughly denuded or modified so that the annual fresh water inflow was severely reduced. The now stagnant water of the backwater which is also the dumping ground for untreated sewage from a number of large towns has excessive organic material. In addition, the water hyacinth has established itself and now covers up all open water areas. The dead plant material has reduced oxygen in the water, and the freshwater fishing has trailed off. The reclaimed lands were settled by people and multicropping introduced. Devoid of the original fresh-water inflow, when the reclaimed soil dried up, the sub-surface saline water rose by capillarity, and salination has become a major problem. The bacteria in the effluents are no longer killed by periodicity of the sea water and water borne amoebic and bacterial diseases have got out of control. Coconut root wilt disease has reduced coconut yield, adding to burdens on the regional economy. The water hyacinth has blocked all boat movements, the sole mode of transportation in the area. Periodically heavy rains result in destructive floods as river catchments shorn of original forest have no longer the water retentive capacity. The silted up reservoirs also no longer have the original capacity, hence man made flash-floods come down and inundate the now inhabited reclaimed land which was originally a natural flood water reservoir.

In short, the whole balanced, productive, unique system collapsed overnight causing more hardship and economic loss to the people than any profit overenvisaged as benefit from the developmental measures. There is little hope of putting things right since even the very gigantic dimensions of the problem has yet to be realised. The repercussions, not to mention the remedies, have to be identified and linked with causative factors. Though this example is extraordinarily spectacular, it has one characteristic worth serious consideration, i.e., the far-reaching consequences often

felt in placed least expected and the unexpected repercussions from ecosystem modification. Maybe it is wrong to label them unexpected because our existing level of environmental scientific knowledge is sufficient to sound the warnings, but it takes serious mishaps to convince the planners as well as people who have set their goals on development with unsound priorities. It will be only after many more calamitous errors that the vulnerability of tropical ecosystems to crude human manipulations will be accepted generally and caution exercised.

Meanwhile, the momentum of our present developmental processes themselves might push the whole system over the edge and contingency rear guard action plans need to be formulated. The first priority should be for identifying all remaining natural ecosystems and giving them total protection within Biosphere Reserves. This can be successfully achieved only through integrated development of the nearby human populations on an ecologically and economically sound basis, who would then no longer be forced to deplete their land resources. A network of Biosphere Reserves have to safeguard the biotic wealth of the western ghats for posterity.

Mountains have by their very nature communicational constraints and invariably any hill district development gives maximum priority to developing roads. It is taken for granted that roads bring prosperity. Apart from the ecological irreversible damage, if only one considers the maintenance costs of roads in heavy rainfall areas, sky rocketing petroleum prices, etc., it looks a dubious assumption. In fact one finds everywhere in the country the dismantling of the old ropeways and cable cars and disappearance of mules and ponies where there should have been greater reliance for such modes of transporting goods. In another approach, any project formulation needs to be made more broad-based taking into consideration first the ecological viability and then also considering costs currently not taken into account, such as value of soil, disruption of the life of the tribal or endoemic populations, etc. The Western Ghats hill area districts are considering backward in every sense of the word and often developmental projects are mooted with the proclaimed objective of developing those regions. Massive construction of industrial development labelled as redeemers of the backwardness, in fact in most cases become a curse on the land and only help further impoverishment and destruction. This destructive approach has to be changed. Vast stretches of Western Ghats are already so badly destroyed that massive inputs of developmental aids are obviously needed which can really percolate down to the villager or tribe and put to use on the land instead of being siphoned off by the contractor or soaked up by the bureaucracy. Ecological rejuvenation of the mountains through afforestation is one such field where there could be employment, development and ecological and economic profit too. But here also diversion or modification of the whole programme by vested interests for short-term individual benefit is a real threat.

3. IGNORANCE OF ECOSYSTEMS

Why is environmental degradation taking place in India? Why is it not controlled? Partly, of course, the problem is one of ignorance of how ecosystems work. This ignorance begins to be challenged when the environment begins to show obvious signs of misuse and problems are created for production and survival. A classic example

of this is the entire exercise in flood control in the Gangetic basin. Flooding of the Gangetic plains during the monsoons is not new. But in the past the population was prepared for this phenomenon with houses being built on high ground and the flood waters being permitted to spread over the land so as to deposit valuable silt on the farms. However, with increasing demands being made of the land and the population spreading to undertake agricultural activity, particularly with greater irrigation and inputs into intensive agriculture, the coming of the floods began to take problematic dimensions. There was both loss of life and property, as well as devastation of standing crops. The problem was compounded by the felling of trees in the lower Himalayas and, therefore, increased loads of water and silt that the rivers had to carry. For instance, in 1978 it was computed that the Ganga was the second-largest sediment bearing river in the world after the Huang river in China; 1451 million tonnes of sediment annually compared to the Huang's 1887 million tonnes and, in terms of sediment load in relation to the size of the drainage basin, the Kosi in Bihar ranked fourth and the Ganga fifth.

Consequently, the government of India, with its centralised planning machinery, decided to go in for flood control measures through a series of dams in the upper reaches and embankments in the plains. These worked well enough for a few years but soon the problem emerged in an even worse shape. With the increased siltation loads the reservoirs behind the dams began to fill up and the dam capacities lessened. Consequently, the dams had to discharge greater quantities of water than designed leading to further flooding. Secondly, the silt began to settle in the river beds as it was prevented from spreading into the surrounding farmland because of the embankments. Thus the river beds slowly became even higher than the surrounding area and floods took on an even greater magnitude as the old drainage patterns would no longer work. Thirdly, the land beyond the embankments could no longer drain into the river and so became marshy and saline. In sum, the intervention by man to control floods led to even greater environmental degradation as ecosystems had not been understood properly.

Similarly, the impact of Green-Revolution techniques in increased food production had been anticipated but no account had been taken of the effect in other areas. For instance, the development of fodder for animals. The introduction of shorter high-yielding varieties has seriously cut into this source. The other fodder source was from village grazing lands and other public lands. These have been extensively encroached upon for cultivation and the remaining lands have been overgrazed, eroded, and otherwise remained unproductive.

The Bedti project, Karnatak shows that the employment opportunities generated will be less than the employment opportunities lost as a result of submergence, and it emerges that the social and environmental disruption will be much larger than the socio-economic growth created by the projects. Another analysis of the NAICO aluminium project proposed to be set up in Orissa raises the points that there are major environmental problems associated with its bauxite alumina operation. Mining, as a recent study in Madhya Pradesh discloses, is a devastating operation that destroys the natural ecosystems, particularly if it is surface mining.

The associated problems of deforestation, waste disposal, water pollution, air pollution, dereliction, vibrations from blasting, land collapses and drop in water tables are, of course, marked. Nationalisation of all mining has only created a larger and more powerful centralised apparatus contributing to environmental degradation on a more massive scale. Forests, of course, are the first victims along with rivers of environmental imbalances. Delhi's largest stretch of forest, the Ridge, continued to be smaller. In spite of this concern for the forests, the National Forest Policy has not been successful in protecting the ecosystem. In the Palamau District of the Chotanagpur Plateau has been observed that during the last two decades, the pinch of erratic rainfall is much more evident. This state of weather and climate is evidently due to sharp environmental and ecological disturbances taking place in the area because of the very rapid rate of deforestation.

What, therefore, emerges is that in spite of, or perhaps because of, increasing centralisation of powers and authority, the environment is not only not being protected, but is being further degraded at a faster rate. This is true not only of forests and mining and water resources but of all resources. There is even a threat of water pollution to the Great Indian Desert. This is emerging from the polluted effluents being discharged by over 1500 dyeing and printing units into the dry riverbeds and canals around Jodhpur, Pali, and Balotra towns. In the name of development, the growth of these units has to be encouraged for the tourist trade.

Even though India is the world's tenth largest industrial power, half of the energy its people consume, excluding animal energy is spent on cooking food. The wood stoves that cook the food are extremely inefficient, however, energy planners in the Third World tend to overlook this essential need even though it is the most crucial for human survival and most sensitive to environmental conditions. In 1975-76, 133 million tonnes of firewood provided India with 28 percent of its total energy. Another 73 million tonnes of wood and 41 million tonnes of agricultural wastes are burnt each year. These non-commercial sources provide as much as 87 percent of India's cooking energy. Firewood provides half the cooking energy in Indian cities, 70 percent in villages. The situation is ecologically disastrous. For a majority of India's people the cooking energy crisis is there. The shortage of cooking energy not only causes problems with nutrition, but also spreads diseases. The already widespread incidence of scabies in India can certainly be attributed to inadequate supplies of water and fuel.

We have a large population which is not only growing at an appreciable rate but is also among the poorest in the world. Nearly half of our people still live below the level of poverty. The pollution of poverty, the worst of all the world's environmental problems exists in India. It refers to resource deterioration, squalid housing and inadequate sanitation and drought stricken villages. Poverty creates tragic sequences of environmental deterioration leading to greater poverty.

Industrial waste, considering its toxic and chemical nature, is an especially grave hazard to the people of Calcutta, Delhi, Bombay and Ahmadabad. However, in spite of this, the financial and political power of the industrialists, coupled with high costs of

Pollution control methods, ensure that very little progress is made towards checking and minimising this danger. Apart from the dumping of waste in water, industries also do their bit in polluting the atmosphere in India. Industrialists apart, even the government seems apathetic to the treatment of atmospheric pollution. The Indraprastha Power House, which has been continuing to belch out tonnes of pollutants every day in New Delhi is a billowing example of this.

The Union Government enacted fairly comprehensive legislation concerning the preservation of the natural resources of the country including the prevention and control of air and water pollution. If any progress in solving environmental problems is to be made, India has to make a radical change in moving away from the "Policing the Society Theory" to the "Managing the Society Theory" of jurisprudence. Such a legislation would also provide a major motivation for concerned citizens to organise themselves into groups to fight the environmental problems. This would be a big step in mobilising people's participation in preserving and bettering their environment. It would also be appropriate to set up an agency in the form of a suitably empowered Central Land Commission as has been recommended recently by the Committee on the Environment.

The environmental movement has been gathering ground in India. The environmental groups and organisations of people which are attempting to give a new direction to the protection of the environment. Among them are the Chipko and Apikko Movements in Uttarakhand and Uttar Kanaad to protect the trees from felling; the effort to save the Silent Valley from submergence; the movement against teak in Jharkhand and against pine in Bastar in Madhy Pradesh.

REFERENCES

1. Bajaj, S. (Ed.), Environmental Priorities within the United Nations - Developing Country Viewpoint, Environmental Services Group, New Delhi, 1982.
2. Gadgil, Madhav, and Malhotra, K.C., Report of the Field Study Conducted on Behalf of the Committee on Legislative Measures and Administrative Machinery for Environmental Protection, Department of Science and Technology, New Delhi, 1980.
3. Kalra, R.L., and Chawla, Impact of Pesticidal Pollution in the Environment, Journal of the BNHS, Vol 78:1.
4. Mann, H.S. and Prakash, Ishwar, Halting the March, Eco-development in the Thar, Department of Environment, New Delhi, 1983.