Demography India
Vol. 19, No. 1 (1990),pp. 71-78

C. K. Varshney*

Population and Environment ¡ A Growing Challenge

POPULATION concerns are among the most complex and controversial issues. There is, however, little disagreement that rapid population growth not only negates the gains of development but it is also seriously undermining the habitability of this planet. More land for agriculture and housing, more energy, more water, more fertilizers, growing pollution and greater investment in education, health and employment are critical issues characterising our present day society. Greater investments are needed to have an appreciable impact on the quality of life and special attention is required for finding innovative ways of producing more from available resources.

Population growth is seriously threatening the delicate balance between humans and their environment. Deforestation, desertification and water scarcity are already having devastating effects. Much of the environmental degradation is the result of the desperate search of the poor and the landless for such basic needs as fuel, food and water. Economic problems and widespread poverty are major consequences of rapid population growth. The 20th century is experiencing the greatest revolution in human numbers, the world has ever seen. In 1900, less than two billion people lived qn the earth; by the end of this century, there will be over six billion. There were over 200 million people living in urban areas in 1900; by the year 2000, there wall be three billion. The global population which grew by 13 million a year in early 1900, will increase by 90 million people a year by the turn of this century. Over 90 per cent of tin's population increase is taking place in developing countries. Decreasing mortality and continuing high levels of fertility are the main reasons for the soring numbers (WRI, 1988).

Our stakes in this game of human numbers are very high. India is the second largest populous country in the world. According to 1981 census the population of the country was 685 million and in 1988 it has crossed the 800 million mark. Every year over 17 million babies are born to be fed. At the current rate, the population will grow to one billion by the turn of the century and double in number by the year 2035.

Today India accounts for 15 per cent of the world's population while land area constitutes only 2.4%. Per capita availability of land in the country is 0.48 ha as against 4.14 ha in USA, 8.43 ha in USSR. Man-land ratio in relation to arable land is only 0.27 ha and it is likely to reduce further in the coming years. Already India is twice as densely populated as China

* Dr. C. K. Varshney is Professor of Ecology, and Dean, School of Environmental Sciences, Jawaherlal Nehru University, New Delhi.

putting heavy pressure on the environment, infrastructure and basic services. Providing basic human needs for such a large population will continue to remain a major task. There is a chronic shortage of safe drinking water both in rural and urban areas, about 20% of urban and 50% of rural population is still to be provided with safe drinking water.

The rapid growth of population neutralizes the gains of economic development (Varshney, 1984). Many of the problems posed by expanding population are analogous to the problems involved in trying to accommodate a growing family in a one-room house or a small plot. The size of the earth is fixed and its resources are used rapidly while their per capita availablity decreases proportionately. Few examples given below are intended to illustrate that rapid population growth leads to the shrinking of resources and degradation of environment.

Shrinking Resources

According to official records 23 per cent of the land in the country is classified as forests. The National Forest Policy of 1952, however, recommends that 33% of the land area should be under forests. Contrary to these guide lines, forests have been under increasing assault since independence. It is estimated that 1.3 m ha of forest is lost every year. Land under good forest had shrunk from 46.42 million ha in 1972-75 to 35-77 m ha in 1980-82. At present not more than 10 to 12 per cent of the land is believed to be under forest cover.

Excessive exploitation of forests and overgrazing by cattle, of which the country has the largest population in the world, have decimated our forest resources seriously. Degradation of Himalayan and other hilly areas has promoted soil erosion which affects river water quality, apart from promoting rapid siltation of dams and reservoirs.

Degradation of forests leads to the destruction of wild life habitats. Over one hundred species of wild animals need immediate protection as their populations have dwindled to dangerously low levels (Min. of Env., 1990).

Deforestation also creates crushing workload for rural communities, particularly for women and children who bear the brunt of the fuel, water and food collection burden. A study in Almora exemplifies the pattern. Agricultural production, once sufficient now feeds the villagers only seven months of a year as soil productivity has diminished and population has increased. Firewood and drinking water have to be hauled from longer distances, because forests have receded and the neighbourhood springs, that once abounded with sparkling fresh water have dried up, as a consequence of deforestation. Preoccupation with fuelwood collection and hauling of drinking water leaves little time for cultural interactions and socio-economic development.

The total cultivated land area in India is about 304 million ha and according to an estimate made by Ministry of Agriculture in March 1980 as much as 175 million ha is suffering from environmental degradation, the break up of which is provided in Table 1. The problems arising out of wind and water erosion, water logging, saline and alkali soils represent mismanagement of the resources and disregard to ecological principles. The land degradation of this order has serious economic and ecological implications for a country like India which has predominantly rural population and agricultural economy. For example, nutrient losses caused by erosion on account of NPK alone represents a loss of Rs. 700 crores per

TABLE 1 : LAND SUFFERING FROM ENVIRONMENTAL DEGRADATION IN INDIA

Nature of problem	*Area (million hectares)*
Serious water and wind erosion	150.0
Shifting cultivation	3.0
Waterlogging	6.0
Saline soils	4.5
Alkali soils	2.5
Diara land	2.4
Other culturable wastelands fit for reclamation	6.6
Total	175.0

SOURCE : Ministry of Agriculture, 1980, New Delhi

annum (Kanwar, 1972). Erosion of soil increases silt load and suspended solids in river systems adversely affecting the aquatic productivity apart from speedier siltalion of dams and reservoirs in which the country has provided a cumulative investment of over Rs. 10,000 crores. Siltation of dams reduces their effective life span (Kanwar, 1980) which has unavoidable implications for the economic and ecological systems of the nation.

On account of soil erosion and lack of proper planning, the floods have become an annual phenomenon in India. The total area affected by periodic floods has increased enormously involving mounting economic costs apart from loss of human and animal life.

Flora and fauna are priceless gifts of nature. They provide the essential underpinings for cultural, industrial and economic development of a country.

Nature has been very generous to India in providing a rich variety of colourful wildlife. The richness of the Indian wildlife can easily be compared with that of any other country of the world. More than 1200 species of birds and 500 species of mammals exist in the Indian region.

Rapid increase in human and bovine population (500m) has promoted large-scale habitat destruction by bringing more land under plough and developmental projects. To-day, the position of wild animals, in general, is alarming. Many species are endangered and fighting a losing battle for survival.

About 350 species constitute the mammalian fauna of India of which 81 are endangered. Examples of wild-life extinction in recent times are that of the Indian cheetah, probably of the lessor one horned rhino and shou Sikkim stag. Among the birds mountain quail, another probably tinet species and the Jerdon's courser. Over one hundred species of wild animals need immediate protection as their populations have dwindled to dangerously low levels.

Similarly, many plant species have suffered from the onslaught of human activities. A recent list prepared by the Botanical Survey of India shows that 135 species of plants need

immediate protection for their continued survival. It is feared that 10-20 per cent of the total vascular plants, i.e. over 2500 species are threained.

Apart from shrinking of the resource base, population pressure affects the quality of air, water and soil. Pollution of air, soil and water is growing throughout the length and breadth of the country. All our major rivers are highly polluted and are being freely used as sewers. Air in almost all urban-industrial complexes is unfit for breathing. Dust loads in the Indian cities are the maximum in the world. Pesticide residues specifically DDT in the body tissue of Indians is the highest in the world. In our anxiety to accelerate the pace of economic development against resource scarcity and mounting debt crisis, environmental aspects are not adequately stressed. Environmental legislations and various guidelines issued by the Government are poorly implemented.

A vicious circle of poverty and environmental destruction is at work. The victims of poverty destroy forests for fuelwood and growing populations overwork marginal farmlands. To stay alive, people destroy the very resources they will need tomorrow. The resulting degradation of the environment only deepens their poverty. Food production is promoted at enormous environmental cost, as valuable agro-ecosystems suffer from erosion, salinazation and environmental pollution caused by massive dosages of agrochemicals. Thousands face malnutrition and starvation. In short, environmental crisis imperils development and life itself.

The Urban Trap

The population of the world has not grown uniformly. Urban populations are growing about twice as fast as rural populations. The rate of population increase in industrialised countries has declined rapidly, while the least developed countries continue to have a high population growth rate. Between 1920 and 1985, the proportion of the world's inhabitants living in urban areas increased from 14 to 41%. The projected ratio of urban to rural population is apt to increase so that the urban population will consist of 43% of the world population in 1990,47% in 2000 and 57% in 2020.

Rapid urbanisation presents the environment population problem in its most dramatic form. More and more of the world's people live in cities. At the beginning of the industrial revolution only about three people out of every hundred lived in urban areas. Today it has gone up to 40 out of every hundred. By the year 2000, about half of the world's population will live in urban areas.

These urban dwellers will not be living in cities as we know them. By the year 2000, the world's cities will be much larger and much more numerous. There are now about 230 cities in the world with a population of one million or more; by the turn of the century there will be 440,284 of them in the developing countries. By the year 2000, according to the Food and Agriculture Organisation, 22 of the world's cities will have populations of 10 million or more. Half of them will be in Asia. According to the World Commission on Environment and Development (WCED) these projections put the urban challenge firmly in developing countries. In the space of just 12 years, the developing world will have to increase by 65 per cent its capacity to produce and manage its urban infrastructure, services and shelter — merely to maintain present conditions (WCED, 1987).

Based on 'global average' it has been calculated, very roughly, that a city of one million inhabitants consumes every day about 5,25,000 metric tons of water, 2,000 metric tons of food, and 9,600 metric tonnes of fuel, while at the same time generating 5,20,000 metric tons of waste water, 2,000 metric tons of solid wastes and 950 metric tons of air pollutants (Sadik, 1988).

Within almost all our cities there are stark contrasts between the extremes of affluence and poverty. For example, slums and shanties grow and survive alongwith high rise buildings and in posh localities, representing dramatic differences in space, health, disease, death and in quality of life. These contrasts are hidden due to lack of data, but where statistics are available and reliable, these portray an appalling situation for the slum dwellers in our cities (NIU, 1989). Innovative things and prudent environmental planning are needed to save the situation from further deterioration.

Human Impact on the Biosphere

Human impact on the biosphere is the product of the number of people multiplied by how much energy and raw materials each person uses or wastes (Watt et al., 1977). A recent study based on per capita energy consumption in various countries of the world shows that 42 countries with 24% of the world population consume 78% of the commercial energy and 128 countries having 76% of the world's population manage with 22% of the commercial energy. As a result, the impact of the people in high energy countries is much more than people in the low energy countries. Notwithstanding the disparities in the per capita use of energy and resources among different countries of the world, their impact is cumulative on our global commons and has to be shared by all. Global warming, ozone depletion and acid rain, which are elaborated below, are symptomatic of the collective impact of human activities on the life support system of our biosphere.

There is a growing evidence that due to excessive release of carbon dioxide from the combustion of fossil fuels, the average temperature will rise well above the normal.

In the atmosphere carbon dioxide is a natural constituent. It has a concentration of over 0.32% by volume having a ratio of 1: 450 with oxygen. In spite of its relatively small proportion carbon dioxide plays a very important role in the biosphere. On account of industrialization fossil fuel consumption is growing, as a result carbon dioxide concentration in the atmosphere is steadily increasing.

It is estimated that since industrial revolution the concentration of carbon dioxide in the atmosphere has increased from 270 ppm to 334 ppm amounting to over 25 percent increase over its pre-industrial level (UNEP, 1989).

Carbon dioxide is transparent to visible light but absorbs heat radiations. It lets the sun rays through to the earth but traps the heat radiations which would otherwise be radiated back into space. The global warming phenomenon is the cause of global green house effect.

The green house effect, is in fact normal to earth and essential to life, without it, the earth would be over 30 degrees Celsius cooler, and life as we know would not exist. It is the additional greenhouse effect, underway since the industrial revolution began, that poses the threat of global climate change.

In addition to carbon dioxide some other trace gases generated by industrial and agricultural activities also contribute to greenhouse effect. These greenhouse gases which include chloroflorocarbons (CFCs 11 and 12), methane, nitrous oxide and ground level ozone, have additive impact in promoting green house effect.

Precise predictions are difficult but the best model studies indicate that due to global increase in carbon dioxide the temperature of lower atmosphere is likely to increase by 1.5 to 4.5°C by the year 2030. This would lead to melting of polar ice caps which may ultimately result in the rise of sea level from 20 to 165 cm. Such an increase would bring about flooding in many coastal areas, induce salt water intrusion into aquifers and submerge coastal wetlands. At least 10-15% of the arable land and economic productivity of such areas could be lost. With the likelihood of rising ocean level, the proposed location or expansion of ports, cities, agricultural activities, coastal development etc. should be reconsidered.

An increase in the ambient temperature will induce long term changes. Climate shift will upset the present day cropping pattern over large geographical areas. Some animals will die out completely while others will migrate northward. Insects will breed faster and insect borne diseases may spread further and pose greater challenge to human health. Many wetlands will dry out. Some food chains will be altered and breeding time table of many species will be affected due to global warming. Warmer climate will promote evaporation of water, increase cloudiness and rainfall. Tropical cyclones will become more intensive and their ferocity will increase. Global warming will lead to large scale migrations of population. Many coastal areas of Bangladesh and Egypt are likely to be submerged, as well as islands like Republic of Maldives may be inundated completely.

The salty water of the rising seas would gradually' invade' brackish water estuaries such as Chilka lake in Orissa with the result that the breeding and nursery habitats used by valuable fisheries will be affected. Moreover, salt water would seep into aquifers and pollute the underground water supply on which millions of people depend.

One metre rise in ocean levels by 2035 would cause the seas to move inland along shores, thus reshaping the coastline. Millions of people would be forced to relocate; human stress, anxiety and discomfort would be severe. It has been estimated that a sea level rise of one metre before the end of the next century would affect upto 300 million (Sinclair, 1990). Global warming due to green house effect has a great potential of creating environmental refugees over wide areas.

The growing concern for the societal consequences of global warming has led policy makers to consider two possible responses. The first is, try to reduce the emissions of green-house gases. The second is to evaluate the likely impact to society of possible climate change and to try to mitigate the worst of them and adopt to the rest. The preventive actions aim at reducing the fossil fuel consumption by increasing energy use efficiency, greater exploitation of non-conventional energy sources such as, solar, wind, biomass, biogas etc. Reduction of CFC production and use has to be taken up seriously by all concerned. Protection of forests and natural vegetation and reforestation of degraded lands can be extremely helpful in scavenging of carbon dioxide from the atmosphere apart from preventing CO2 emission resulting from destruction of forests. The adaptive strategies include construction of dikes and various other sea defence measures. Action needs to start now to contain the impending global warming.

Acid Rain. Acid rain which has emerged as the great scourage of the industrial! countries, is an increasing threat to India, where emission of acidic gases is sharply incresising. In the last few decades the rain water has become acidic 'over large areas in Europe arid America. The term 'Acid Rain' is used to describe all precipitations—rain, snow, sleet, dew which is more acidic than normal. Environmental acidification is a man-made phenomenon. Emission of sulfurdioxide and oxides of nitrogen are prime contributors to atmospheric acidification as they readily dissolve in the atmospheric moisture forming sulphuric and nitric acid which make the rain acidic.

The ecological impacts of acid precipitation are far reaching, insidious and often produce irreversible changes. The acid rain has corroding effect on plant leaves and thus pre- disposes them to pests, pathogens and other environmental stresses. The soils become acidic—a condition which releases toxic heavy metal ions in the soil and promotes the loss of calcium and magnesium from the soil which are essential plant nutrients. The cummulative effect is the gradual decline of soil and forest productivity. In aquatic systems the acidic rain raises the levels of toxic heavy metals (such as aluminium, copper, zinc, etc.) resulting in fish kill and reproductive failure. Increased acidity of lakes and streams prevents hatching of fish and kills the young fry. Acidification in industrialized countries is responsible for making thousands of lakes unproductive and turning them into virtual biological desert.

A vast expansion of thermal power generation and other industral activities contribute to environmental acidification. Release of sulphur dioxide and oxides of nitrogen are rapidly increasing in the Indian environment and this trend is going to intensify in the future on account of two main reasons : 1) growing demand of energy, 2) extensive use of coal as primary source of energy. Systematic and sufficient date on the acidity of rain water in India are sadly lacking but occasionally acid rain has been reported from Bombay, Delhi, Nagpur, Puna and few other stations (Varshney, 1983).

Ozone Depletion. Ozone, a deep blue gas made up of chemically bonded oxygen atoms, is a minor constituent of the earth's atmosphere. It is found everywhere in varying concentrations between sea level and a height of 60 km. In the air we breathe ozone which is a health hazard, a constituent of air pollution that has a caustic effect on human beings. However, in the stratosphere ozone forms a delicate veil and it filters out harmful radiation from the sun rays entering.the earth's atmosphere. In fact the presence of a ozone layer in the stratosphere is vital for life on earth because it is the only natural shield against UV radiation which is'a potent mutagenic agent (WHO, 1990).

Recently, it has been discovered that the protective ozone layer is getting progressively eroded due to the impact of increasing human activities (UNEP, 1987). Significant reduction in the ozone layer over Antartica is already there. The major cause for the depletion of the Ozone layer is the worldwide emmission of man-made compounds called chlorofluorocarbons (CFCs). The chloroflurocarbons are used in refrigerators, air conditioners, aerosol sprays, cleaning of computer chips, craking rubber foam and polystyrene containers required for food packaging. CFCs are by and large chemically inert, having no direct effect on humans or other living organism. Increased dosage of UV will promote eye damage, skin cancer, aging in human beings and animals alike (WHO, 1990). Survival for any species depends upon a sustainable relationship with its environment. Growth in population and demand for higher consumption if not checked, will overshoot the limits of carrying

capacity. The environmentalprpblems get further complicated through the urban/industrial expansion coupled with increasing demand for energy which will contribute further harm to the physical environment. For most mankind, however, the problems become more cruelly apparent in the social environment The problem of poverty—malnutrition, disease, illitracy, inadequate housing and clothing are common to all developing societies. In the affluent societies breakdown of traditional values, drug abuse, are responses to unpredictable environment.

Human activities have influenced the environment since the first settlements were built and the land cultivated. At that time the changes were relatively small and were absorbed by the resilience of the environment Today, however, it is clear that the effects of unlimited growth of human population, and of recent unrestricted technological advances, have had much greater impact on environment and may well exceed its capacity to absorb them.

The concept of sustainability has emerged as a key issue in environment planning during the last few years. For example the World Commission on Environment and Envelopment headed by the Norwegian Prime Minister Mrs. Brundtland has used it as a key concept. According to the World Commission on Environment and Development (1987), "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts."

The major emphasis is on meeting basic needs for all and making possible a life of dignity in a viable environment It requires development strategies which anticipate environmental programme and take adequate measures to mitigate them.

In order to resolve the population environment conflicts, a major shift in our attitudes and development priorities is needed. Ecodevelopment through ecologising economy by respecting natural laws and processes needs to be designed to promote green development on sustainable basis.

References

Kanwar, J. S., 1972, Soil and water — Looking Ahead. Presidential Address at the 37th Annual General Meeting of the Indian Society of Soil Science. /. *Indian Sac. Soil Sc.* 20(8), 199- 206.

Kanwar, *1.* S., 1980, *Save the Soil—Save theNation,* ICRISAT.

Ministry of Environment, 1990, *National Strategy for Conservation and Sustainable Development,* New Delhi. NIU, 1989, *The Nature and Dimensions of Urban Poverty,* National Institute of Urban Affairs. Sadik, N., 1988, *The State of the World Population,* United Nations Population Fund. Sincair, J., 1990, Rising sea levels could affect 300 million. *New Scientist,* 1700; 27. UNEP, 1987, *The Ozone Layer,* UNEP, Nairobi. UNEP, 1989, *The Green House Effect,* UNEP, Nairobi. Varshney, C. K., 1984, Ecological Consideration in Economic and Environmental Planning. *In:* A. M. Johnson

(ed.). *Integration of Economy and Ecology—An Outlook for the Eighties.* Stockholm. Varshney C. K., 1983, *Acid Rain—An Invisible Threat.* Press Council of India, New Delhi. Watt. E. F., L. F. Molley, C. K. Varshney, D. Weeks andS. Wirosardjono, 1977. *The Unsteady State.* Hawaii Univ.

Press.

WHO, 1989, *Report of the Interregional Meeting on City Health: Tne Challenge of Social Justice,* Karachi, Pakistan. WHO, 1990, *Potential Health Effects of Climate Change.* WHO, Geneva. World Commission on Environment and Development, 1987, *Our Common Future.* Oxford. WRI, 1988, *World Resources,* World Resrouces Institute, Washington.