

Environment and Health in India

Dr. Dewaram A. Nagdeve

International Institute for Population Sciences,

Mumbai-88, INDIA

Paper will be presented at the IUSSP Regional Population Conference on 'Southeast Asia's Population in a Changing Asian Context at Bangkok, Thailand, 10-13 June 2002.

Author is thankful to Asian Meta Centre for financial support to present this paper in IUSSP Regional Population Conference on 'Southeast Asia's Population in a Changing

Asian Context at Bangkok, Thailand, 10-13 June 2002.

Abstract

Environmental pollution is one of the serious problems faced by the people in the country. Rapid population growth, industrialization and urbanization in country are adversely affecting the environment. Though the relationship is complex, population size and growth tend to expand and accelerate these human impacts on the environment. All these in turn lead to an increase in the pollution levels. However, environmental pollution not only leads to deteriorating environmental conditions but also have adverse effects on the health of people. India is one of the most degraded environment countries in the world and it is paying heavy health and economic price for it. The present paper is an attempt to examine population growth, increasing urbanization and its influence on the environment and health of the people. The secondary analysis conducted of changes and trends over last fifty years. The analysis reveals that rapid population growth plays an important role in environmental problems of the country, from deforestation to land degradation, air and water pollution to the spread of disease. The considerable magnitude of air and water pollution pulls up the number of people suffering from respiratory and water borne diseases and many a times leading to deaths and serious health hazards. The analysis suggests that there is a urgent need to control population and environmental pollution in the country for better health of present and future generation.

Environment and Health in India

Introduction

Environmental pollution is one of the serious problems faced by the people in the country, especially in urban areas, which not only experiences a rapid growth of population due to high fertility, low mortality and increasing rural-urban migration, but also industrialization which is accompanied by growing number of vehicles. In India, the rapid increase of human numbers combines with desperate poverty to deplete and pollute local resource bases on which the livelihood of present and future generations depends. Though the relationship is complex, population size and growth tend to expand and accelerate these human impacts on the environment.

According to the World Development Indicators report in 1997, 1.5 billion people live exposed to dangerous levels of air pollution, 1 billion live without clean water and 2 billion live without sanitation. The increase of population has been tending towards alarming situation. The world's population was estimated to be 6.14 billion in mid 2001 and projected 7.82 billion and 9.04 billion in the year 2025 and 2050 respectively. Contribution of India alone to this population was estimated to be 1033 millions in mid 2001 which has been projected 1363 millions and 1628 millions in 2025 and 2050 respectively. (2001 World Population Data Sheet). According to the provisional results of the Census of India 2001, the population of India on 1st March 2001 is 1027 millions. If the world population continues to multiply, the impact on environment could be devastating.

Population impacts on the environment primarily through the use of natural resources and production of wastes and is associated with environmental stresses like biodiversity, air and water pollution and increased pressure on arable land. India is the world's sixth largest and second fastest growing producer of greenhouse gases. Delhi, Mumbai and Chennai are three of the world's ten most populated cities. Two-thirds of city dwellers lack sewerage, one-third lack potable water. India grows equivalent of another New York City every year in its urban population. By the year 2000, more than 350 million Indians will live in cities. In 15 years, more than half of Indians will be urban dwellers; 1/3 will be slum dwellers and squatters (downloaded from [http:// www.usaid. gov/in/ programareas/ environm.htm](http://www.usaid.gov/in/programareas/environm.htm)).

India is one of the most degraded environment countries in the world and it is paying heavy health and economic price for it. According to a World Bank sponsored study, estimated environmental damage in the year 1992 amounted to about US \$ 10 billion or Rs. 34,000 crores, which is 4.5 % of GDP. Urban air pollution costs India US \$ 1.3 billion a year. Water degradation leads to health costs amounting to US \$ 5.7 million every year,

nearly 60 percent of the total environmental cost. Soil erosion affects 83 to 163 million hectares of land every year. Beside, land degradation leads to productivity loss equal to US \$ 2.4 billion or 4 to 6.3 percent of the agricultural productivity every year (UNDP 1998).

The lack of services such as water supply, sanitation, drainage of storm water, treatment and disposal of waste water, management of solid and hazardous wastes, supply of safe food, water and housing are all unable to keep pace with urban growth. All these in turn lead to an increase in the pollution levels. Also the unplanned location of industries in urban and sub-urban areas followed by traffic congestion, poor housing, poor drainage and garbage accumulation causes serious pollution problems. However, all these factors together not only lead to deteriorating environmental conditions but also have adverse effects on the health of people. The peoples in environment polluted areas are infected by pollution related diseases. Due to air pollution the incidence of respiratory diseases lead to increase and water pollution triggers the number of patients suffering from acute water borne diseases. Hence it have been the main areas of concern for demographers, ecologists, planners and policy makers over the recent past. The present paper is an attempt to examine population growth, increasing urbanization and its influence on the environment and health of the people.

Demographic characteristics of the population of India

India is the second most populous country in the world after China. India supports 16.87 percent of the world's population on its meager 2.4 percent world surface area of 135.79 million square kms. The selected demographic characteristics of the population of India are presented in Table 1. At the time of independence country's population was 342 million. The country's population size had grown from 361 million in 1951 to around 846 million in 1991 and 1027 million in 2001. The population of India almost tripped during the period of 1951-2001. The phenomenal increase in the population during the last fifty years has led to rapid industrialization and high rate of urbanization which have created tremendous pressure on natural resources like land, air and water. The urban population has increased three and half times, from 62.4 million in 1951 to 217.6 million in 1991 and it again increased to 288 million in 2001. The percentage of urban population increased from 17.28 percent in 1951 to 23.33 percent in 1981, 25.71 percent in 1991 and which further increased to 28 percent in 2001. The decadal growth rates of the population are irregular, as it increased from 13.31 percent in 1951 to 24.8 percent in 1971 and afterwards it marginally declined to 24.7 percent in 1981, 23.9 percent in 1991 and 21.34 percent in 2001. The urban growth lead to an increase in the pollution levels and exposes population to serious environmental health hazards. Environmental pollution in urban areas is associated with excessive morbidity and mortality. Overcrowding and inadequate housing contribute to pollution related diseases such as respiratory diseases, acute water borne diseases, tuberculosis, meningitis and various other diseases. Lack of opportunities for gainful employment in villages and the ecological stresses is leading to an ever-increasing movement of poor families to towns. Mega cities are emerging and urban slums are expanding. There has been three and half times increase in urban population

over 1951-1991. During the past two decades of 1971-91, India's urban population has doubled from 109 million to 218 million and is estimated to reach 300 million by 2000 AD. Such rapid and unplanned expansion of cities has resulted in degradation of urban environment. It has widened the gap between demand and supply of infrastructure services such as energy, housing, transport, communication, education, water supply and sewerage and recreational activities, thus depleted the precious scarce environmental resource base of the cities. The result is the growing trend in air and water quality, generation of wastes, and the proliferation of slums and undesirable land use changes, all of which contribute to urban poverty.

Poverty is said to be both cause and effect of environment degradation. The poor people, who rely on natural resources more than the rich, deplete natural resources faster as they have no real prospects of gaining access to other types of resources. Poorer people, who cannot meet their subsistence needs through purchase, are forced to use common property resources such as forests for food and fuel, pastures for fodder, and ponds and rivers for water. Clean drinking water facility through taps is available to only 35 percent of urban households and 18 percent of rural households in India. Other residents use unsafe water sources like wells, ponds and rivers. Population pressure driven overexploitation of the surface and underground water resources by the poor has resulted into contamination and exhaustion of the water resources. Urban population is also using rivers to dispose of untreated sewage and industrial effluent. The result is that health of those dependents on untreated water resources is increasing at risk. In the absence of capital resources, the poor are directly dependent on natural resources. Moreover degraded environment can accelerate the process of impoverishment, again because the poor depend directly on natural assets. Although there has been significant drop in the poverty ratio in the country from 55 percent in 1973 to 36 percent in 1993-94, the absolute number of poor have, however, remained constant at around 320 million over the years. Acceleration in poverty alleviation is imperative to break this link between poverty and the environment. The poverty and rapid population growth are found to coexist and thus seems to reinforcing each other. It also contributes to environmental degradation through over exploitation of natural resources like land, air and water. The deterioration of natural resources and unsafe living conditions affects the environment and health of the poor people.

Deforestation

Forests are an important natural resource of India. They have moderate influence against floods and thus they protect the soil erosion. Forests also play an important role in enhancing the quality of environment by influencing the ecological balance and life support system (checking soil erosion, maintaining soil fertility, conserving water, regulating water cycles and floods, balancing carbon dioxide and oxygen content in atmosphere etc. India has a forest cover of 76.52 million square kms. of recorded forest area, while only 63.34 million square kms. can be classified as actual forest cover. This accounts for 23.28 percent of total geographic area against 33 percent recommended

by National Forest Policy of 1988. Per capita availability of forests in India is much lower than the world average. In the year 1997, as compared to 1993, the total forest cover has decreased by 6710 Sq. Kms. The states, which have shown significant decline in the forest covers, are Andhra Pradesh and Madhya Pradesh. Whereas the states of Gujrat, Maharashtra, Rajasthan and West Bengal have shown an increase in forest cover (Table 2).

In 1981-83, only 11.2 percent of country's total land area, comprises dense forest with a crown density of more than 40 percent, thus reflecting a qualitative decline of forests in the country. The total forest area diverted for non-forestry purposes between 1950 and 1980 was 4.5 million hectares i.e. at an annual rate of 0.15 million hectare. To regulate unabated diversion of forestland for non-forestry purposes, Forest (Conservation) Act, 1980 was enacted. It has resulted in reduction of diversion of forest area for non-forestry purposes considerably and the present rate of diversion is 16,000 hectare annually (Economic Survey of India, 1998-99). Continuing deforestation, therefore, has brought us face to face with a major ecological and socio-economic crisis.

Land/Soil degradation

Direct impacts of agricultural development on the environment arise from farming activities, which contribute to soil erosion, land salination and loss of nutrients. The spread of green revolution has been accompanied by over exploitation of land and water resources and use of fertilizers and pesticides and fertilizers have increased many folds. Shifting cultivation has also been an important cause of land degradation. Leaching from extensive use of pesticides and fertilizers is an important source of contamination of water bodies. Intensive agriculture and irrigation contribute to land degradation particularly salination, alkalization and water logging. It is evident that most of the land in the country is degrading, thus affecting the productive resource base of the economy. Out of the total geographical area of 328.7 million hectares, 175 million hectares are considered to be land-degraded area (Table 3). Water and wind erosion is the major contributor of 141.3 million hectares to soil erosion, with other factors like water logging 8.5 million hectares, alkali soil 3.6 million hectares, acid soil 4.5 million hectares, saline soil including coastal sandy areas 5.5 million hectares adding to the situ degradation. While soil erosion by rain and river in hill areas causes landslides and floods, deforestation, overgrazing, traditional agricultural practices, mining and incorrect siting of development projects in forest areas have resulted in opening up of these areas to heavy soil erosion. Ravines and gullies reported 4 million hectares, area subject to shifting cultivation reported 4.9 million hectares and riverine and torrents erosion due to floods and eutrophication due to agricultural run off reported 2.7 million hectares. The increasing intensification and extensification also results in salination, alkalization and water logging in irrigated areas of the country. For achieving and maintaining food security, sustainable forestry agricultural and rural developments controlling of land/soil erosion is very much necessary.

Environmental pollution

The term Environmental Pollution refers to ways by which people pollute their surroundings, air with gases and smoke, poison the water with chemicals and other substances, and damage the soil with too many fertilizers and pesticides. Also pollute the surroundings in various other ways. Environmental degradation is a result of the dynamic interplay of socio-economic, institutional and technological activities. Environmental changes may be driven by many factors including economic growth, population growth, urbanization, intensification of agriculture, rising energy use and transportation. Poverty still remains a problem at the root of several environmental problems. The pollution is widespread in the country and can be broadly categorized as flux type of pollution and sink type of pollution. The former refers to the pollutants dumped into the environment, either to air or in water; while the later is caused by accumulation either in soil or riverbed or also in ground water. In this paper an attempt has been made to study air and water pollution, which pose more threat to urban life.

Air pollution

The World Health Organization (WHO) defines air pollution as "substances put into the air by the activity of mankind into concentrations sufficient to cause harmful effects to health, property, crop yield or to interfere with the enjoyment of property". Some of the most important air pollutants are suspended particulate matter (SPM), nitrogen oxides (NO_x), carbon monoxide (CO), lead, sulphur dioxide (SO_2) etc. (Table 4). The urban air pollution has grown across India in the last decade is alarming. The main factors accounts to urban air quality deterioration are growing industrialization and increasing vehicular pollution, industrial emissions, automobile exhaust and the burning of fossil fuels kills thousands and lives many more to suffer mainly from respiratory damage, heart and lung diseases. According to a pollution related studies in the community and patients at the K.E.M. Hospital, Mumbai over the last twenty years have evaluated the full extent of the correlation and damage to human health (Kamat and Mahasur, 1997). According to a study, 84,000 deaths were directly attributable to outdoor air pollution in Indian cities (WHO, 1996). At the same time, indoor air pollution accounted for 496,000 deaths in villages and 93,000 deaths in cities (WHO, 1997). It is found that the area around RSP village, Jharia ranks fifth and FCI (Fertilizer Corporation of India) Hospital, Sindri ranks eighth among the top ten locations with highest annual mean concentrations of Nitrogen Oxides (NO_x), having 54 and 46 micro grams per cubic meters respectively. Apart from this, the suspended particulate matter (SPM) level in RSP College, Jharia is the fourth highest in India (Anon 1995). A study conducted by Center for Science and Environment from 1987 to 1998, to understand the trend of air pollution in Delhi based on three major pollutants: sulphur dioxide, nitrogen oxide and SPM. It shows an increasing trend, though fluctuations are noticed in terms of annual maximum levels. According to the studies conducted by Center for Science and Environment, total SPM levels are not only always above the standard but there are days when they have reached nearly seventeen times the standard. A World Bank

study conducted in 1995 revealed that if the air pollution is controlled in Calcutta according to the guidelines of World Health Organization (WHO), lives of 5726 persons may be saved from premature death and of 30 lakhs people may also to be saved to be admitted to hospital.

Vehicular pollution

Transport activities have a wide variety of effects on the environment such as air pollution, noise from road traffic. Transport infrastructure in India has expanded considerably in terms of network and services. Thus road transport accounts for a major share of air pollution load in mega cities. In most urban areas of India, air pollution has worsened due to traffic congestion, poor housing, poor sanitation and drainage and garbage accumulation. The environmental effects of fuels like oil and petroleum products are of growing concern owing to increasing consumption levels. The combustion of these fuels in vehicles has been a major source of pollution. With the increasing vehicles in country, the vehicular pollution has also increased and it accounts for a considerable share of vehicular pollution in India. The different factors are the types of engines used, the age of the vehicles, poor road conditions and congested traffic. They add to air pollution in cities, which is a major cause of respiratory diseases. The principal vehicular pollutants are Carbon Monoxide, Oxides of Nitrogen, Hydrocarbons, suspended particulate matters, a varying amount of Sulphur Dioxide depending on the Sulphur content of the fuel and lead compounds.. Table 5 presents the registered motor vehicles in India during 1950-51 to 1995-96. The total number of registered vehicles in India has increased from 3 million in 1950-51 to more than 33 million in 1995-96, of which about 28 percent are concentrated in the 23 metropolitan cities of India (Motor Transport Statistics of India, 1997). The number of registered two wheelers rose from just 0.27 million in 1950-51 to more than 231 million in 1991. The number of cars, jeeps and taxis also registered an increase from 1.59 million in 1950-51 to 41.89 million in 1991. The number of registered trucks and buses also registered an increase from 0.82 million in 1950-51 to 17.85 million in 1991 and 0.34 million in 1950-51 to more than 4.49 million in 1991 respectively. The major share is contributed by metropolitan cities in all registered vehicles in the country. An increase in vehicular pollution is associated with a number of environmental problems like air pollution and global warming. Technical pollution parameters suggest that two wheelers are more polluting as compared to other motor vehicles. Carbon Monoxide, Oxides of Nitrogen, Hydrocarbons, suspended and particulate matters, a varying amount of Sulphur Dioxide depending on the Sulphur content of the fuel and lead compounds are the major vehicular pollutants.

As a result of urbanization in India, pressure on urban transport is likely to increase substantially in this new millennium. It has been attempted to evaluate the future transport scenario to forecast the vehicle air pollution levels. Following are some of the points of due consideration:

- India is expected to have 31 metro cities by 2001 and 51 by 2021.
- The number of vehicles on Indian roads is estimated to increase by nine times by the tune of the century out of which 65 % to 70 % shall be two wheelers or three wheelers.
- Urban transport demand is expected to grow by 2.6 times by 2016 at the existing model split in larger medium sized cities.
- At the existing model split, the urban air quality is expected to deteriorate faster in the 21st century, as two-wheeler population would be as high as 86.13 % of the total vehicles used for passenger transportation.
- By the year 2001, CO emission levels are likely to rise seven times and that of hydrocarbons by nine times. The levels of other major pollutants are expected to go up five fold (Luthra, 1999)

Pollution from energy production and consumption in India

The environmental effects due to increasing consumption levels of fuels like coal, lignite, oil and nuclear etc. are of growing concern to various researchers. The combustion of these fuels in industries has been a major source of pollution. Coal production through open cast mining; its supply to and consumption in power stations and industrial boilers leads to particulate and gaseous pollution which can cause pneumoconiosis, bronchitis and respiratory diseases. The energy production/ consumption in India during 1950-51 to 1995-96 is depicted in Table 6. Energy production and consumption has increased steadily in India since 1950 onwards. The production of coal and lignite has increased from 32.2 million tons in 1950-51 to 292.27 million tons in 1995-96, an increase of more than 9 times. The production of petroleum products registered an increase of more than 22 times, from 3.3 million tons in 1950-51 to 74.7 million tons in 1995-96. The bulk of commercial energy comes from the burning of fossil fuels viz. coal and lignite in solid form, petroleum in liquid form and gas in gaseous form. In addition to emission of greenhouse gases, the burning of fossil fuels has led to several ecological problems and associated with health problems like cancer risk, respiratory diseases and other health problems. Burning of traditional fuel adds a large amount of carbon-di-oxide into atmosphere and increases air pollution. The production of electricity has increased from 5 billion KWH in 1950-51 to about 380 billion KWH in 1995-96. The shares of thermal power and hydropower changed substantially. The share of thermal power has increased from 51 percent in 1950-51 to about 79 percent in 1995-96 whereas the share of hydropower declined from 49 percent in 1950-51 to 19 percent in 1995-96. The share of nuclear power is nominal. This clearly indicates that burning of fossil fuels, especially coals, emits lot of carbon di oxide in the atmosphere and leads to global warming. The per capita commercial energy use in India has increased from 137 Kg of oil equivalent in 1980 to 248 Kg of oil equivalent in 1994 and it again increased to 476 Kg of oil equivalent in 1996 (World Development Indicators, 1997). The energy consumption in India would be quite high and thus stricter commands and controls, technical innovations and application of

efficient pollution abatement technology for vehicular and industrial air pollution could help in reduction of atmospheric pollution. A considerable amount of air pollution results from burning of fossil fuels. Moreover the resources for fossil fuels are also limited thus exploration of alternate energy resources would provide the way out. Thus increased population and increased per capita commercial energy use would worsen the national as well as global atmospheric pollution.

An automobile exhaust accounts a sizable part of pollution. Their effect on human health is particularly of concern. There is a strong correlation between average blood lead levels and the lead content in gasoline. Hydrocarbons present in the exhaust, particularly, in vehicles with poor combustion cause respiratory problems. Table 7 shows estimated annual episodes of illness and premature deaths due to ambient SPM in the air in four largest cities of India. It can be inferred from the table that both, the illness and premature deaths have risen significantly in less than five years. About 15 to 18 million children in developing countries are affected by high levels of lead in their blood, which could be the result of emissions from vehicle exhaust and are likely to suffer from related illness (Kapoor, 1997).

Water pollution

Water is among the most essential requisites that nature has provided to sustain life on earth. About 80% of earth's surface are covered by water. The deteriorating quality of water is creating various problems for the mankind. The growth in population, about 90 percent of which will occur in urban areas, will also increase the demand for water for domestic and industrial use and treatment of wastes. Water pollution from domestic and human wastewater is the main cause for much severe water borne diseases. The industrial water pollution is due to inadequate measures adopted in the industry for the abatement of pollution. Inadequate disposal of urban waste and open dumping of garbage contaminates surface and ground water.

Water and sanitation services are basic necessities of a community and are most essential conditions for development, as they play an important role in improving health and quality of life. Inadequate water and sanitation coverage is one of the most serious environmental problems (Sumeet, p 123). It has been estimated that 80 percent of the diseases in the world are associated with water usage or poor environmental hygiene (Sumeet p. xvii). In India, water pollution comes from three main sources: domestic sewage, industrial effluents and run-off from activities such as agriculture. The large scale use of pesticides may have revolutionized food production, but these chemicals are responsible for more than 2 million human poisonings every year with a resultant 20,000 deaths (WHO, 1986).

Polluting a river is dangerous because generally, rivers are the primary source of drinking water for towns and cities downstream of the point of pollution. Broadly, the causes of water pollution can be attributed to:

- Urbanization
- Industrialization
- Withdrawal of wastes
- Agricultural run-off and improper agricultural practices
- Religious and social practices

According to the scientists at the National Environmental Engineering and Research Institute, a staggering 70% of the available water in India is polluted. Only five states, Maharashtra, Gujrat, Delhi, Uttar Pradesh and West Bengal, generate more than 63% of the total waste water in India as they lack treatment facilities (Down to Earth, July 15, p.19). Sewage generated from 25 heavy polluting cities and towns account for about 75 percent of the pollution load in the river. The Yamuna with 200 million litres of untreated muck being dumped in it everyday by Delhi's Sewerage System has become one of the most polluted rivers in the world (Down to Earth, June 30, 2000, p.55).

The increasing river water pollution is the biggest threat to public health. The diseases commonly caused due to polluted water are cholera, diarrhoea, hepatitis, typhoid amoebic and bacillary, dysentery, guineaworm, whereas scabies, leprosy, trachoma and conjucvitis are some of the diseases associated with water scarcity. All these could be attributed to the rapidly increasing population and lack of water resources. Inadequate access to safe drinking water and sanitation facilities leads to higher infant mortality and intestinal diseases. More than one million children died due to diarrhoea and other gastrointestinal disorders in 1990s. In addition, around 90 lakh cases of acute diarrhoeal diseases have been reported in India, Uttar Pradesh reporting the highest number of cases (Central Bureau of Health Investigation, 1996). It is estimated that 73 million workdays are lost every year due to water related diseases. The cost of treating them and the loss in production amount to Rs. 600 crores a year (Citizen's Report, 1982).

Summary and conclusions

Rapid population growth continues to be a matter of concern for the country as it has manifold effects, one of the most important being environment degradation. The outcomes of excessive population are industrialization and urbanization. The study reveals that rapid population growth has led to the overexploitation of natural resources. The deforestation has led to the shrinking of forest cover, which eventually affects human health. The considerable magnitude of air pollution in the country also pulls up the number of people suffering from respiratory diseases and many a times leading to deaths and serious health hazards. The situation is also similar for water pollution, as both ground water and surface water contamination leads to various water borne diseases. From the various effects of environmental degradation on human beings, discussed in this paper, it appears that if human beings wants to exist on earth, there is now high time to give top priority to control pollution of all types for a healthy living. It

can be said that even after fifty years of independence, India is unable to achieve the desirable standards of health for its population as consequences of environment degradation.

There is a need to control population growth in the country. Special efforts should be made for educating the general mass and local leaders about the adverse effects of large population through specially designed IEC (Information, Education and Communication) activities. In order to increase green cover and to preserve the existing forests, afforestation and social forestry programmes should be implemented at the local level. Further, measures to control air pollution should be intensified throughout the country. Wastewater treatment plants be established in accordance with the need of time and its usage should be encouraged. The heavy penalty should be imposed on industries disposing off the wastes into the river. Moreover, the landfills are to be properly managed to prevent ground water contamination. Since slums are one of the major sources of water pollution proper measures should be taken to facilitate the slums with water and sanitation facilities. More emphasis should be laid on compulsory environmental education at the school level in order to make people aware of the environment protection. The environment protection should not be a responsibility of government alone but mass and local leaders should be encouraged to make dedicated efforts to eradicate the environmental problems.

To sum up, it may be emphasized that the environment is neither a free gift of environmental goods and services, nor it can be thought of as just a sink for depositing of waste products from houses, industries and other sources. It is the need of time to protect environment for the present and future generation.

Table 1: Selected demographic characteristics of the population of India, 1951-2001

Year	Population (in millions)*	Decadal Growth Rate (%)*	Urban Population (in million)*	% of Urban Population to total population*	Density (Per Sq. Kms.)*	% of Population below poverty line**
1951	361.1	13.31	62.4	17.28	117	54.88 ¹
1961	439.2	21.64	78.9	17.96	142	51.32 ²
1971	548.2	24.80	109.1	19.90	177	44.48 ³
1981	683.3	24.66	159.4	23.33	210	38.86 ⁴
1991	846.3	23.86	217.6	25.71	267	35.97 ⁵
2001	1027	21.34	287.6	28	324	

Source: * Census of India, Provisional Population Totals, 2001.

** Planning Commission Estimates refers to following periods:

¹ 1973-74,

² 1977-78,

³ 1983,

⁴ 1987-88,

⁵ 1993-94

Table 2: Forest cover in major states of India, (1993 and 97)

State	Area in Million Square Kms		Absolute Change	Percent Change
	1997	1993		
Andhra Pradesh	43.29	47.26	-3.97	-8.39
Bihar	26.52	26.59	-0.06	-0.24
Gujrat	12.58	12.04	0.53	4.43
Haryana	0.60	0.51	0.09	17.74
Himachal Pradesh	12.52	12.50	0.02	0.15
Karnataka	32.40	32.34	0.06	0.19
Kerala	10.33	10.34	0.00	-0.02
Madhya Pradesh	131.20	135.40	-4.20	-3.10
Maharashtra	46.14	43.86	2.28	5.21
Orissa	46.94	47.15	-0.20	-0.43
Punjab	1.39	1.34	0.04	3.28
Rajasthan	13.35	13.10	0.25	1.94
Tamil Nadu	17.06	17.73	-0.66	-3.73
Uttar Pradesh	33.99	33.96	0.03	0.10
West Bengal	8.35	8.19	0.16	1.99
ALL INDIA	633.40	640.11	-6.71	-1.05

Source: Forest Survey of India, The State of Forest Report 1997

Table3: Soil erosion and land degradation (million hectares)

1. Total Geographical Area	328.7
2. Area Subject to Water and Wind Erosion Area Degraded through Special Problems	141.3
3. Water Logged Area	8.5
4. Alkali Soil	3.6
5. Acid Soil	4.5
6. Saline Soil including Coastal Sandy areas	5.5
7. Ravines and Gullies	4
8. Area subject to Shifting Cultivation.	4.9
9. Riverine and Torrents	2.7
Total 3 to 9	33.7

Source: Economic Survey of India, 1998-99, Government of India.

Table 4: Some major pollutants, their sources and their related health hazards

Pollutant	Source	Effect on human health
-----------	--------	------------------------

Carbon Monoxide	Incomplete fuel combustion (e.g. two-stroke engine)	Fatal in large doses: aggravates heart disorders; effects central nervous system; impairs oxygen carrying capacity of blood
Sulphur dioxide	Burning of sulphur containing fuel like coal in power plants and oil by vehicles	Affects the functions of lungs
Suspended particulate matter	Smoke from domestic, industrial and vehicular sources	Small particles are poisonous. They are carriers of carcinogenic tracer elements
Nitrogen oxides	Fuel combustion in motor vehicles, power stations and furnaces	Affects the respiratory system, Irritation of respiratory tract
Volatile hydrocarbons	Partial combustion of carbonaceous fuels (two stroke engines, industrial processes, disposal of solid wastes)	Drowsiness, eye irritation, coughing
Oxidants and ozone	Emissions from motor vehicles, photochemical reactions of nitrogen oxides and reactive hydrocarbons	Causes increased sensitivity to infections, lung diseases, irritation in eyes, nose and throat, risk asthmatics, children and those involved in heavy exercise
Lead	Emissions from motor vehicles	Nervous system slow down and brain development is retarded
Aldehydes	Chemicals	Irritation of eyes, nose, throat, sneezing, coughing, nausea, breathing difficulties, carcinogenic in animals

Source: Compendium of Environment Statistics, 1998 and 1999.

Table 5: Registered motor vehicles in India. (in thousands)

Year	Two Wheelers	Cars, Jeeps And Taxis	Trucks	Buses	All Vehicles
1950-51	27	159	82	34	306
1955-56	41	203	119	47	426
1960-61	88	310	168	57	665
1965-66	226	456	259	73	1099
1970-71	576	682	343	94	1865
1975-76	1045	779	351	115	2669
1980-81	2599	1147	542	159	5336
1985-86	6207	1758	848	223	10490
1990-91	14047	3013	1411	333	21310
1991-92	15026	3130	1425	341	22583
1992-93	15241	3194	1538	354	19973
1993-94	18338	3617	1650	419	23605
1994-95	20831	3840	1793	423	30294
1995-96	23111	4189	1785	449	33557

Source: India Development Report, 1999-2000.

Table 6: Energy production/consumption in India, 1950-51 to 1995-96.

Year	Coal & Lignite (Mn Tons)	Petroleum Products (Mn Tons)	Natural Gas	Electricity (Billion KWH)			
				Total	Thermal	Hydro	Nuclear
1950-51	32.2	3.3	NA	5.1	2.6	2.5	
1960-61	55.23	7.7	NA	16.9	9.1	7.8	
1970-71	76.34	17.9	0.65	55.8	28.2	25.2	2.4
1980-81	119.02	30.9	1.52	110.8	61.3	46.5	3
1990-91	225.5	55	12.77	264.3	186.5	71.7	6.1
1995-96	292.27	74.7	20.82	379.9	299.3	72.6	8

Source: CMIE, Energy, September, 1999. Economic Survey, 1998-99, GOI.

Table 7: Estimates of annual episodes of illness and pre-mature deaths due to ambient suspended particulate matter (SPM) in the air by metro cities of India

Metro cities	Annual episodes of illness		Annual pre-mature deaths		
	1991-92		1991-92	1995	Increase
Calcutta	3022786	5446225	5726	10647	4921
Chennai	462966	680241	863	1291	428
Delhi	3990012	5197018	7491	9859	2368
Mumbai	2579210	4005538	4477	7023	2546

- Source :
1. Carter Brandon & Kirsten Hommann, 1991-92, Valuing Environmental Costs in India: The Economy Wide Impact of Environment Degradation, World Bank, mimeo.
 2. Anon, Tiny Killers, Down to Earth, Society for Environment Communications, New Delhi, November 15, 1997.

REFERENCES

- Agrawal, Anil, Sunita Narain and Shrabani Sen (eds.), (1999), "State of India's Environment: The Citizen's Fifth Report, Centre for Science and Environment, New Delhi.
- Anon, (1995), "Ambient Air Quality-Status and Statistics, Central Pollution Control Board, Delhi.
- Anon, (1997), "Dhanbad Water Supply Cut-Off', The Telegraph, Anand Bazar Patrika Limited, Calcutta, December 11, 1997.
- Anon, (1997), "Tiny Killers", Down to Earth, Society for Environmental Communications, New Delhi, November 15, 1997.
- Bhargava, Gopal, (1992), Pollution and Its Control; Mittal Publishing House, New Delhi.
- Bhargava, Gopal, (1999), "The Pollution Story in Black and White", Down to Earth, Sunita Narain Publications, New Delhi.
- Carter Brandon and Kirsten Honmann, (1991-92), "Valuing Environmental Costs in India: The Economy Wide Impact of Environment Degradation", World Bank, mimeo.
- Central Bureau of Health Intelligence, (1995 & 1996), Health Information of India, Ministry of Health and Family Welfare, Government of India, New Delhi.
- Central Statistical Organisation, (1998 & 1999), "Compendium of Environment Statistics", Department of Statistics, Ministry of Planning and Programme Implementation, Government of India.
- Central Statistical Organisation, (1998), Proceedings of the National Workshop on Environment Statistics, 1998, 12-13 January, Goa, Department of Statistics, Ministry of Planning and Programme Implementation, Government of India.
- Central Statistical Organisation, (2000), Proceedings of the National Workshop on Environment Statistics, 2000, 6-7 April, Hyderabad, Ministry of Statistics and Programme Implementation, Government of India.
- Centre for Science and Environment, (1999), "Spewing Pollutants", Down to Earth, November 30, 1999, p. 10.

Centre for Science and Environment, (1999), "Dirty States", Down to Earth, July 15, 1999, p. 19.

Centre for Science and Environment, (2000), "Asthama and Allergy", Down to Earth, May 15, 2000, p. 33.

Chatterjee, P., (2001), "Environmental Pollution and its Impact on the Incidence of Morbidity and Mortality Pattern: A Case Study of Delhi Mega City", Paper presented in Annual Conference of IASP, Visakhapatnam, February 22-24, 2001.

Dutt, D. et al, (1996), "Effect of Indoor Pollution on the Respiratory System of Women using different fuels for cooking in an urban slum of Pondicherry", National Medical Journal of India, All India Institute of Medical Sciences, New Delhi, Vol.9, No. 3.

Kamat, S.R. and A.A.Mahashur, (1997), " Air Pollution-Slow Poisoning" in The Hindu Survey of the Environment, Madras.

Government of India, (1999), Economic Survey: 1998-99, Ministry of Finance, Economic Division.

Kapoor, Sonia, (1997), "Vehicular Exhaust: Killing us Softly but Surely", Down to Earth, March 15, p. 63.

Mallik, Iqbal, (2000), "A Billion Strong or Weak?", Down to Earth, June 30, p. 55.

Luthra Ashwani, (1999), "Vehicular Emissions in India: Retrospect and Prospects", Environment and People, September 1999, Vol. 16, No. 4.

Pandey, M. R. et al, (1989)" Domestic Smoke Pollution and Acute Respiratory Infections in a Rural Community of the Hill Region of Nepal", Environment International, Vol. 18.

Pandey, M. R., (1997)" Women, Wood Energy and Health", Wood Energy News, Vol. 12, No. 1, Regional Wood Energy Development Programme, Bangkok, Thailand.

Population Reference Bureau, (2001), World Population Data Sheet, Population Reference Bureau, Washington, D. C., U.S.A.

Registrar General and Census Commissioner of India, (2001), Provisional Population Totals, Census of India, Paper 1 of 2001, New Delhi.

Srivastava, H. C. and Anjula Saraff, (2001), "Population and Environmental Health in India", Paper presented in National Seminar on The Impact of Environmental Degradation on Human Population in the New Millenium organised by R.S.P. (P.G.)

College, Jharia, Dhanbad, January 20-21, 2001.

The State of India's Environment, (1982), "Citizen's Report (Unpublished by the Centre for Science and Environment, New Delhi).

UNDP, (1998), "Unequal Impacts of Environment Damage", Human Development Report 1998, Oxford University Press, New York.

UNDP, (2000), Human Development Report, United Nations Development Programme, Oxford University Press, New York.

WHO, (1992), Our Planet, Our Earth, Report of the WHO Commission on Health and Environment, World Health Organization, Geneva.

WHO, (1997), Health and Environment in Sustainable Development: Five Years after Earth Summit, Geneva

World Bank, (1997 & 1999), World Development Indicators.

[http:// www.usaid.gov/in/programareas/ environm.htm](http://www.usaid.gov/in/programareas/ environm.htm).