POPULATION GROWTH AND ENVIRONMENTAL DEGRADATION IN INDIA

By

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ABSTRACT

The present paper examined the relationship of population to the environment and with growing population, poverty and urbanization the environment is degrading. Conducted an analysis of changes and trends over last fifty years. The study reveals that the country's population growth is imposing an increasing burden on the country's limited and continually degrading natural resource base. The natural resources are under increasing strain, even though the majority of people survive at subsistence level. Population pressure on arable land contributes to the land degradation. The increasing population numbers and growing affluence have already resulted in rapid growth of energy production and consumption in India. The environmental effects like ground water and surface water contamination; air pollution and global warming are of growing concern owing to increasing consumption levels. The paper concludes with some policy reflections, the policy aimed at overall development should certainly include efforts to control population and environmental pollution.

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Introduction

The rapid population growth and economic development in country are degrading the environment through the uncontrolled growth of urbanization and industrialization, expansion and intensification of agriculture, and the destruction of natural habitats. One of the major causes of environmental degradation in India could be attributed to rapid growth of population, which is adversely affecting the natural resources and environment. The growing population and the environmental deterioration face the challenge of sustained development without environmental damage. The existence or the absence of favorable natural resources can facilitate or retard the process of economic development. The three fundamental demographic factors of births, deaths and migration produce changes in population size; composition, distribution and these changes raise a number of important questions of cause and effect. Population Reference Bureau estimated the 6.14 billion world's population in mid 2001. Contribution of India alone to this population was estimated to be 1033 millions. It is estimated that the country's population will increase to 1.26 billion by the year 2016. The projected population indicates that India will be a first most populous country in the world and China will be second in 2050 (Population Reference Bureau, 2001). The increase of population has been tending towards alarming situation. India is having 18 percent of the world's population on 2.4 percent of its land area has great deal of pressure on its all natural resources. Water shortages, soil exhaustion, deforestation, air and water pollution afflicts many areas. If the world population continues to multiply, the impact on environment could be devastating.

As the 21st century begins, growing number of people and rising levels of consumption per capita are depleting natural resources and degrading the environment. The poverty-environmental damage nexus in India must be seen in the context of population growth as well. The pressures on the environment intensify every day as the population grows. The rapid increase of human numbers combines with desperate poverty and rising levels of consumption are depleting natural resources on which the livelihood of present and future generations depends. Poverty, is amongst the consequences of population growth and its life style play major role in depleting the environment

either its fuel demands for cooking or for earning livelihood for their survival. The unequal distribution of resources and limited opportunities cause push and pull factor for people living below poverty line that in turn overburdened the population density in urban areas and environment get manipulated by manifolds, consequently, urban slums are developed in urban areas.

The growing trends of population and consequent demand for food, energy, and housing have considerably altered land-use practices and severely degraded India's forest vis-à-vis environment also. The growing population put immense pressure on land extensification at cost of forests and grazing lands because the demand of food could not increase substantially to population. Thus, horizontal extension of land has fewer scopes and relies mostly on vertical improvement that is supported by technical development in the field of agriculture i.e. HYV seeds, Fertilizers, Pesticides, Herbicides, and agricultural implements. All these practices causing degradation and depletion of environment with multiplying ratio.

The relationship between population growth, resource depletion and environmental degradation has been a matter of debate for decades. The argument has been between those who view population numbers per se as the main culprit in increasing pressure on the environment and those who place more blame on economic development, non sustainable agricultural and industrial practices, and excessive and wasteful consumption. In fact, both population growth and non-sustainable development are cause for concern in India. Though the relationship is complex, population size and growth tend to expand and accelerate these human impacts on the environment. What is more concern, the number of population rise will increase to such an extent in future that it will cause overall scarcity for resources. Decades of economic expansion and population growth have degraded its land, air and water. The present paper examines the relationship of man to the environment and with growing population, poverty and urbanization the environment is degrading.

Population growth in India

India is the second most populous country in the world after China. Recently, the population of India has crossed the one billion marks. According to the Census of India 2001, the population of

India on 1st March 2001 was 1027 millions. At the time of independence, the country's population was 342 million. The number has multiplied three-fold in around five decades. The population growth of India from 1951 to 2001 is presented in Table 1. The total population size of India had grown from 361 million in 1951 to around 1027 million in 2001. The population of India increased by three times during the period of 1951-2001. The rural population of India has increased around two and half times from 298.7 million to 741.7 million during 1951-2001, whereas the urban population has grown 4.6 fold from 62.4 million in 1951 to 285.3 million 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. It declined to 24.7 percent in 1981, 23.8 percent in 1991 and 21.35 percent in 2001. The rural decadal growth rate of population varies from 8.79 percent in 1951 to 17.97 percent in 2001, whereas the urban decadal growth rate of population varies from 41.43 percent in 1951 to 31.11 percent in 2001.

There are various reasons for this variation in the trend of population growth rate in various censuses. The increase in population has been due to the improvement in health conditions and control of diseases. The density of population has gone up from 117 in 1951 to 312 persons in 2001 and it always shows an increasing trend over the census years in persons per square kilometer. Several push and pull factors are presumed to be operative towards distress out migration from rural to urban areas. This might be due to the declining resource availability per capita and shrinking economic opportunities in rural areas, and better economic opportunities, health and educational facilities etc. in urban areas, providing opportunities for higher level of human capital development could be the underlying factors for rural out migration.

Vital rates in India

The growth of population depends upon fertility, mortality and migration. The process of accelerated population growth in India till 1970s were observed to witness a marginal deceleration during 1980s, as the decadal population growth was 23.9 percent compared to 24.9 percent in 1970s. Further declines in fertility have been witnessed during 1990s and 2000s. The estimated birth, death, natural growth, infant mortality and total fertility rates in India is presented in Table 2. It is revealed from table that birth rate in India has declined from 33.9 per thousand populations in

1981 to 29 per thousand populations in 1991 and it further declined to 25 per thousand populations in 2001. At the same time crude death rate has also declined from 12.5 per thousand populations in 1981 to 9.8 per thousand populations in 1991 and it further declined to 8 per thousand populations in 2001. Thus, the natural growth rate of India's population has declined from 21.4 percent in 1981 to 17 percent in 2001. The Total fertility rate has also declined from 4.5 children per women in 1981 to 3.1 children per women in 2001. Infant Mortality Rate (IMR) per thousand in India has steadily declined from 110 in 1981 to 72 in 1991 but the IMR (66) in 2001 is still very high.

Trends in poverty and its environmental effects in India

Most of India's poor live in rural areas and are engaged in agriculture. India's poverty reduction through the anti-poverty and employment generation programmes along with overall economic growth planning efforts has helped to reduce the poverty ratio in the country. The trends in poverty in India are depicted in Table 3. The people below poverty line declined from 55 percent in 1973 to 26 percent in 1999-2000. The absolute number of poor have, however, declined from 320 million in 1973-74 to 260 million in 1999-2000. During the same period the fraction of population below poverty line dropped from 56.4 percent to 27.1 percent in rural areas and from 49 percent to 23.6 percent in urban areas. Over the period 1987-88 to 1999-2000, urban and rural poverty declined but more declines has been experienced by urban areas.

Poverty is said to be both cause and effect of environment degradation. 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. It also contributes to environmental degradation through over exploitation of natural resources like land, air and water. 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. Moreover degraded environment can accelerate the process of impoverishment, again because the poor depend directly on natural assets. The poverty and rapid population growth are found to coexist and thus seems to reinforcing each other. Poverty also affects the demographic characteristics of the

population and hinders the transition to slower population growth. Acceleration in poverty alleviation is imperative to break this link between poverty and the environment. The deterioration of natural resources and unsafe living conditions affects the environment and health of the poor people.

Environmental challenges

Population growth and economic development are contributing to many serious environmental problems in India. These include pressure on land, land/soil degradation, forests, habitat destruction and loss of biodiversity, changing consumption pattern, rising demand for energy, air pollution, global warming and climate change and water scarcity and water pollution.

Pressure on land

India faces the most acute pressure on agricultural land. Today every million hectares of land supports 7.27 million people. Forty three percent of the land is under cultivation, one of the highest in the world. A change in land utilization pattern implies an increase or decrease in the proportion of area under different land uses at a point in two or more time periods. Table 4 describes the land utilization pattern in India from 1951 to 2001. Over the past fifty years, while India's total population increased by about 3 times, the total area of land under cultivation increased by only 20.27 percent from 118.75 million hectares in 1951 to 142.82 million hectares in 2001. Most of this expansion has taken place at the expense of forest and grazing land. Despite past expansion of the area under cultivation, less agricultural land is available to feed each person in India. It shows variations in land use and a narrow range of fluctuations in the proportion of net sown area to total land in the country since 1951 to 2001. Out of total geographical area of 329 million hectares, only 306 million hectares is the reporting area (the rest being unadministered for various reasons). The land for non-agricultural uses (housing, industry and others) is increased from 9.36 million hectares in 1951 to 22.97 million hectares in 2001. More than 19.4 million hectares are snow bound and remote leaving only 237 million-hectare for agriculture, forestry, pasture and other biomass production. The area under cultivation had increased by about 30 percent until 1981 and thereafter depicts marginal decline. The net sown area increased from 119 million hectares in 1950-51 to 140 million hectares in 1970-71 mostly through reclamation of old fallow and culturable wastelands and

diversion of groves. The net area sown has increased only marginally from 140 million hectares in 1970-71 to 141 million hectares in 2000-2001, indicating that the private efforts have peaked and the intervention of the Government is required for further land reclamation.

The extent of agricultural intensification and extensification characterized by increase in cropping and irrigation intensity and higher use of chemical fertilizers, pesticides and insecticides. The process of agricultural extensification and intensification is leading to land degradation, overexploitation of underground water resources, increased use of chemical fertilizers leading to eutrophication and water pollution. Agricultural intensification because of increasing cropping intensity, irrigation intensity and excessive use of chemical fertilizers resulting into water logging, salinization and alkalinization of croplands and eutrophication of water bodies and ill health of oceans and thus reductions in biodiversity.

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 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 5). 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.

Forest resources

With less than 2 percent of the world's total forest area, the country supports 18 percent of its population. The total area under forests was 675.54 thousand square kilometers in 2001, which was 21 percent of the total geographical area, as against the National Forest Policy 1988 stipulation of a target of 33 percent. Even within this recorded area, only 416.81 thousand square kilometers, or only 12.68 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 comparative situation of forest cover in India is given in Table 6. Overall, the total forest cover had been increased by 35.43 thousand square kilometers (Sq. Kms.) from 640.11 thousand Sq. Kms. in 1993 to 675.54 thousand Sq. Kms. in 2001. In the year 2001, as compared to 1999, the total forest cover had increased by 38.24 thousand Sq. Kms. The states which shown significant increase in forest covers are Bihar, Himachal Pradesh, Karnataka, Tamil Nadu, Gujarat, Maharashtra, Punjab, West Bengal and Rajasthan. However, it has increased in 1999 by 3.90 thousand Sq. Kms. as compared to 1997. In the year 1997, as compared to 1993, the total forest cover has decreased by 6.71 thousand Sq. Kms. The states, which have shown significant decline in the forest covers, were Andhra Pradesh and Madhya Pradesh. Whereas the states of Gujrat, Maharashtra, Rajasthan and West Bengal have shown an increase in forest cover.

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). Forests are an important natural resource of India. They play an important role in providing raw materials to industries and generating income and

employment. 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. They have moderate influence against floods and thus they protect the soil erosion.

Declining per capita forest land and agricultural land

The population growth has resulted in a downward trend in per capita availability of forest and agricultural land since the 1950s. Per capita availability of forests in India is much lower than the world average. The per capita availability of forest land and agricultural land is depicted in Table 7. Overall, per capita availability of forestland had oscillated around 0.113 hectare during the 1950s, and then has consistently declined. The per capita availability of forest land declined from 0.124 hectares per capita from 1960-61 to 0.071 hectares in 1998-99 - a level that is extremely low compared to the world standards. The growth of population is expected to be faster than hoped for improvements in forest cover as well as quality. Over the last ten years, despite governmental initiatives of joint forest management, tree grower's co-operative movements and other efforts tangible results are still to be observed, and forest depletion and degradation is still increasing. Similarly, the per capita availability of agricultural land in rural areas has decline consistently from 0.638 hectare in 1950-51 to 0.271 hectare in 1998-99 and is expected to decline further as population continues to grow.

Net availability of food grains in India

The per capita net availability of food grains in India is presented in Table 8. The per capita net availability of food grains in India indicates that, there is an availability or shortage of food grains in the country. Increasing trends in per capita availability of food grains is largely due to cereals. Although, per capita availability of pulses seems to have gone down since 1961 but the availability of the edible oil, sugar and cotton cloth depict an increasing trend. Overall the per capita availability of food grains had gone up from 395 grams per capita per day in 1951 to 458 grams per capita per day in 1999-2000. The per capita availability of cereals increased from 334 grams per capita per day in 1951 to 426 grams per capita per day in 1999-2000. Furthermore, per capita availability of pulses

declined from 61 grams per capita per day to 32 grams per capita per day over the period. However, the per capita per day availability of pulses had gone down during the period but simultaneously the per capita per day availability of edible oil, sugar and cotton cloth has been consistently increased during the period. Of course, availability does not mean accessibility because of lack of purchasing power among poor sections of society. However, better organizational management can assure better distribution and thus consumption when the availability is assured.

Habitat destruction and loss of biodiversity

Protection of earth's biological diversity is an important goal in its own right. Biodiversity has direct consumptive value in food, agriculture, medicine, industry etc. It also has the aesthetic and recreational value. The greatest threat to biodiversity is not destruction of plants and animals per se, but rather the destruction of their habitat. India is one of the 12 mega-biodiversity countries of the world. From about 70 percent of the total geographical area surveyed so far 46,000 plant species and 81,000 animal species representing about 7 percent of the world's flora and 6.5 percent of the world's fauna have been described. Population growth leads to expanding human settlements and increasing demand for food, fuel and building materials. Modernization of agriculture also threatens potentially valuable local crops. Biodiversity the world over is in peril because the habitats are threatened due to such development programmes as creation of reservoirs, mining, forest clearing, lying of communication and transport networks etc. It is estimated that in the worldwide perspective slightly over 1000 animal species and sub-species are threatened with the extinction rate of one per year, while 20,000 flowering plants are thought to be at risk (Compendium of Environment Statistics, 2000).

Changing consumption patterns

The economic and industrial development is inevitably accompanied by changing patterns of consumption. The number of registered motor vehicles in India provides one useful indicator of expanding consumption and economic growth. The increasing vehicles in country, producing more air pollution, fuel consumption, traffic jams and demands for road construction-often at the cost of agricultural land. Table 9 presents the registered motor vehicles in India during 1950-51

to 2000-2001. The total number of registered vehicles in India has increased from 3 million in 1950-51 to 55 million in 2001-2002. The number of registered two wheelers rose from just 0.27 million in 1950-51 to more than 385 million in 2000-2001. The number of cars, jeeps and taxis also registered an increase from 1.59 million in 1950-51 to 71 million in 2000-2001. The number of registered trucks and buses also registered an increase from 0.82 million in 1950-51 to 2.95 million in 2000-2001 and 0.34 million in 1950-51 to more than 0.63 million in 2000-2001 respectively. The major share is contributed by metropolitan cities in all registered vehicles in the country.

The population of India in 2000 was just over 1 billion, and there were about 10 motor vehicles for every 1000 people, or a total of roughly 10 million motor vehicles in the country. In 2020, the population of India will be about 1.3 billion, and there will be about 44 motor vehicles for every 1000 people, making a total of 57 million vehicles (Energy Information Administration, 2001). An increase in vehicular pollution is associated with a number of environmental problems like air pollution and global warming. 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.

Rising demand for energy

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 2000-2001 is depicted in Table 10. 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 313.70 million tons in 2000-2001, an increase of 9.74 times. The production of petroleum products registered an increase of 29 times, from 3.3 million tons in 1950-51 to 95.6 million tons in 2000-2001.

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 500 billion KWH in 2000-2001. The shares of thermal power and hydropower changed substantially. The share of thermal power has increased from 51 percent in 1950-51 to about 82 percent in 2000-2001 whereas the share of hydropower declined from 49 percent in 1950-51 to about 15 percent in 2000-2001. 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 increasing population numbers and growing affluence have already resulted in rapid growth of energy production and consumption in India, and this trend can only be expected to accelerate in the future. 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.

Air pollution

Indian cities are among the most polluted in the world. Air in metropolitan cities has become highly polluted and pollutant concentrations exceeds limit considered safe by the World Health Organization (WHO). Suspended particulate levels in Delhi are many times higher than recommended by the World Health Organization (WHO). The urban air pollution has grown across India in the last decade are alarming. Some of the most important air pollutants are residual suspended particulate matter (RSPM), suspended particulate matter (SPM), nitrogen dioxides (NO_2), carbon monoxide (CO), lead, sulfur dioxide (SO_2) etc. (Table 11). 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. In the countryside, nitrates from animal waste and chemical fertilizers pollute the soil and water, and in the cities, the air is contaminated with lead from vehicle exhaust. In India's largest cities - Mumbai and Delhi - about one-half of children under age 3 show signs of harmful exposure to lead, defined as to or more micrograms of lead per deciliter of blood (IIPS and ORC Macro, 2000). The illness and pre-mature deaths due to ambient suspended particulate matter (SPM) in the air in mega cities of Calcutta, Chennai, Delhi and Mumbai have risen significantly in less than five years (Brandson and Honmon, 1992). The indoor air pollution may pose an even greater hazard for human health. Cooking and heating with wood, crop residues, animal dung, and low-quality coal produce smoke that contains dangerous particles and gases. When fuels such as these are burned indoors, using inefficient stoves and poor ventilation, they can cause tuberculosis, other serious respiratory diseases, and blindness (Mishra, Retherford and Smith, 1999). In fact, indoor air pollution from cooking and heating with unsafe fuels has been designated by the World Bank as one of the four most critical environmental problems in developing countries.

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).

Global warming and climate change

The country's large population and rapidly increasing energy use plays an important and growing role in global warming. Global warming can have major physical, environmental and socio-economic consequences, which can be both positive and negative. The estimation of these impacts is complex and marked with uncertainties. Climate change would cause changes in

precipitation patterns, ocean circulation and marine systems, soil moisture, water availability, and sea level rise. These would make an impact on agriculture, forestry and natural eco-systems like wetlands and fisheries. Also with rising temperatures, and subsequent increasing heat stress and alternation in patterns of vector-borne diseases, the global population would be more vulnerable to health problems, causing disruptions in settlement patterns and large-scale migration. All these would have significant socio-economic consequences (Compendium of environment statistics, 2000).

Water scarcity and water pollution

Water use in India has been increased over the past 50 years. Out of the total annual freshwater withdrawals, the largest share goes to agriculture - at 92 percent. Industrial use accounts for another 3 percent and domestic use 5 percent. However, not all the water abstracted is effectively used, there are sizable losses in conveyance and application of irrigated water, a large part of water used by industry and domestic purposes is returned to the streams as effluent waste; and most of the water drawn by power station is used for cooling purposes and is available for reuse. The use of fresh water increased rapidly. The amount of water available per person has declined in recent decades - primarily because of population growth and water scarcity is projected to worsen in the future. The water pollution in India comes from three main sources: domestic sewage, industrial effluents and run off from activities such as agriculture. Major industrial sources of pollution in India include the fertilizer plants, refineries, pulp and paper mills, leather tanneries, metal plating and other chemical industries. Levels of solid wastes increased in rivers and lakes and other water systems are also heavily polluted due to the intrusion of solid wastes. Largely because of widespread pollution, access to safe drinking water remains an urgent need as only 70.1 percent of the households in urban areas and 18.7 percent in rural areas received organized pipe water supply and others have to depend on surface and ground water which is untreated (Statistical Abstract of India, 1999).

Most part of the applied pesticides and fertilizers, irrespective of crop, applicator or the formulation used, ultimately finds its way into the soil. Before pesticides are completely inactivated, they may adversely affect the functioning of non-target microbes and other forms of

life inhabiting the soil. They may also be taken up by the plants or get translocated in the aquatic system by leaching or run-off, thus contaminating the plankton, fish, invertebrate and other forms of life using their water. Pesticide residues in food items have been a matter of considerable concern. Even small quantities of these residues ingested daily along with food can build up high levels in the body fat. The long term effects of these residues in the human body include carcinogenecity, reduced life span and fertility, increased cholesterol, high infant mortality and varied metabolic and genetic disorders (c.f. Compendium of Environment Statistics, 1999).

Traces of pesticides and fertilizers from the fields are washed into the nearest water bodies at the onset on monsoons or whenever there are heavy showers that add to water pollution. Consumers are affected by agricultural concomitants such as pesticides and fertilizers that run-off from fields into rivers. 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. The New Agricultural Policy seeks to sensitize the farming community with the environmental concerns. The policy lays that concerted efforts will be made to pool, distil and evaluate traditional practices, knowledge and wisdom and to harness them for sustainable agricultural growth (Downloaded from Internet, New Agricultural Policy, http\\www.nic.in).

The increasing river water pollution is the biggest threat to public health. The diseases commonly caused due to polluted water are cholera, diarrhea, 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 diarrhea and other gastrointestinal disorders in 1990s. In addition, around 90 lakh cases of acute diarrhea 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).

Policy implications

From the various effects of human beings on environmental degradation, discussed in this paper, it appears that if human beings want to exist on earth, there is now high time to give top priority to protect natural resources and environment. The creation of employment opportunities is essential in agricultural areas with high poverty, unemployment and landlessness. Poverty also affects the demographic characteristics of the population and hinders the transition to slower population growth. There is a need to control poverty and population growth below replacement level in the country. Unless significant measures are taken to incorporate environmental concerns into agricultural development, urban planning, technological innovations, industrial growth, and resource management, the situation is likely to worsen in the future. There is a need control pollution of all types for a healthy living. Special efforts should be made for informing and educating the people and local leaders about the adverse effects of large population through specially designed Information, Education and Communication (IEC) 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. There is a need for preventive and curative measures to control water pollution due to chemical fertilizers, pesticides and other wastes. Wastewater treatment plants should 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. 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 local people and leaders should be encouraged to make dedicated efforts to eradicate the environmental problems.

Summary and Conclusions

The outcomes of high population growth rates are increasing number of people below poverty line, an increasing population density, and pressure on natural resources. The study reveals that the country's population growth and poverty is imposing an increasing burden on the country's limited and continually degrading natural resource base. The natural resources are under increasing strain, even though the majority of people survive at subsistence level. It will

increasingly difficult to satisfy the basic needs of a growing population even at present levels of consumption, and the situation will deteriorate progressively as the per capita consumption of resources increases. Population pressure on arable land contributes to the land degradation, thus affecting the productive resource base of the economy. The increasing population numbers and growing affluence have already resulted in rapid growth of energy production and consumption in India and this trend can only be expected to accelerate in the future. The environmental effects like air pollution and global warming are of growing concern owing to increasing consumption levels. However, environmental pollution not only leads to deteriorating environmental conditions but also have adverse effects on the sustainable development and health of people. The considerable amount of both ground water and surface water contamination due to chemical fertilizers and insecticides in the country leads to various water borne diseases. The growth of population is a fundamental factor in its relationship to natural resources, environment and technology. To sum up, there is an urgent need to control population and poverty, conserve and protect natural resources and the environment for healthy human beings.

Table 1: Population Growth in India, 1951-2001.

Year	Population in Million			Decadal Growth Rate of Population in percent			Density of Population	Ratio of Population to 1951 Population
	Total	Rural	Urban	Total	Rural	Urban		
1951	361.1	298.7	62.4	13.31	8.79	41.43	117	100
1961	439.2	360.3	78.9	21.51	20.49	26.41	142	121.63
1971	548.2	439.1	109.1	24.8	21.86	38.23	173	151.81
1981	683.3	523.9	159.4	24.66	19.32	46.14	216	189.23
1991	846.3	628.7	217.6	23.85	20.01	36.47	267	234.37
2001	1027	741.7	285.3	21.35	17.97	31.11	312	284

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

Table 2: Estimated Birth, Death, Natural Growth, Infant Mortality and Total Fertility Rates in India, 1981-2001.

Year	CBR	CDR	NGR	TFR	IMR
1981	33.9	12.5	21.4	4.5	110
1986	32.6	11.1	21.5	4.2	96
1991	29.5	9.8	19.7	3.6	80
1992	29.2	10.1	19.1	3.6	79
1993	28.7	9.3	19.4	3.5	74
1994	28.6	9.2	19.4	3.5	73
1995	28.3	9	19.3	3.5	74
1996	27.5	9	18.5	3.4	72
1997	27.2	8.9	18.3	3.3	71
1998	26.5	9.0	17.4	3.2	72
1999	26.1	8.7	17.3	3.2	70
2000	25.8	8.5	17.3	3.2	68
2001	25.4	8.4	17.0	3.1	66

Source: Sample Registration System Bulletins, 1981-2002.

Table 3: Number and Percentage of Population Below Poverty Line in India: 1973-2000

Year	Rural		Urban		Combined	
	Number in Million	Poverty Ratio	Number in Million	Poverty Ratio	Number in Million	Poverty Ratio
1973-74	261	56.4	60	49.0	321	54.9
1977-78	264	53.1	65	45.2	329	51.3
1983	252	45.7	71	40.8	323	44.5
1987-88	232	39.1	75	38.2	307	38.9
1993-94	244	37.3	76	32.4	320	36.0
1999-2000	193	27.1	67	23.6	260	26.1

Source: Estimates of Poverty, Planning Commission, 1997.

Table 4: Land Use Patterns in India, 1951- 2001.

Classification	1950-51	1960-61	1970-71	1980-81	1990-91	2000-2001
I. Geographical Area	328.7	328.7	328.7	328.7	328.73	328.73
II.Reporting Area for land utilization statastics (1 to 5)	284.32	298.46	303.76	304.15	304.86	306.01
1. Forests	40.48	54.05	63.91	67.47	67.8	69.02
2.Not available for cultivation (a+b)	47.52	50.75	44.64	39.62	40.48	42.41
(a) Non Agricultural Uses	9.36	14.84	16.48	19.66	21.09	22.97
(b) Barren and Unculturable land	38.16	35.91	28.16	19.96	19.39	19.44
3. Other Uncultivated Land (excluding fallow land) (a+b+c)	49.45	37.64	35.06	32.31	30.22	28.49
(a) Permanent Pasture and other grazing land	6.68	13.97	13.26	11.97	11.4	11.04
(b) Land under Miscellaneous tree crops and grooves not included in net area sown	19.83	4.46	4.3	3.6	3.82	3.62
(c) Culturable Wasteland	22.94	19.21	17.5	16.74	15	13.83
4. Fallow Land (a+b)	28.12	22.82	19.88	24.75	23.36	24.91
(a) Fallow land other than current fallows	17.44	11.18	8.76	9.92	9.66	10.11
(b) Current Fallows	10.68	11.64	11.12	14.83	13.7	14.8
5. Net area sown	118.75	133.2	140.27	140	143	141.23
6. Gross cropped area	131.89	152.77	165.79	172.63	185.74	189.74
7. Area sown more than once	13.14	19.57	25.52	32.63	42.74	48.51

8. Cropping intensity*	110.1	114.7	118.2	123.3	129.9	134.30
III Net irrigated area	20.85	24.66	31.1	38.72	47.78	57.24
IV Gross irrigated area	22.56	27.98	38.19	49.78	62.47	76.34

Source: Department of Agriculture and Cooperation, Ministry of Agriculture, 2002.
P: Provisional, * : Cropping Intensity is obtained by gross cropped area by net area sown.

Table 5: Soil Erosion and Land Degradation, 1984-85.

(Million Hectares)

1. Total Geographical Area	328.7
2. Area Subject to Water and Wind Erosion Area Degraded through Special Problems	141.3
3. Watter 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.

Table 6: Comparative Situation of Forest Cover in India, 1993 - 2001.

States	Area in Million Square Kms				Change in 2001 (2-3)	Change in 1999 (3-4)	Change in 1997 (4-5)
	2001	1999	1997	1993			
1	2	3	4	5	6	7	8
Andhra Pradesh	44.64	44.23	43.29	47.26	0.41	0.94	-3.97
Bihar	28.36	26.47	26.52	26.59	1.88	-0.50	-0.06
Gujarat	15.15	12.96	12.58	12.04	2.19	0.39	0.53
Haryana	1.75	0.96	0.60	0.51	0.79	0.36	0.09
Himachal Pradesh	14.36	13.08	12.52	12.50	1.28	0.56	0.02
Karnataka	36.99	32.47	32.40	32.34	4.52	0.06	0.06
Kerala	15.56	10.32	10.33	10.34	5.24	-0.01	0.00
Madhya Pradesh	133.77	131.83	131.20	135.40	1.88	0.63	-4.20
Maharashtra	47.48	46.67	46.14	43.86	0.81	0.53	2.28
Orissa	48.84	47.03	46.94	47.15	1.80	0.09	-0.20
Punjab	2.43	1.41	1.39	1.34	1.02	0.02	0.04
Rajasthan	16.37	13.87	13.35	13.10	2.49	0.52	0.25
Tamil Nadu	21.48	17.08	17.06	17.73	4.40	0.01	-0.66
Uttar Pradesh	37.68	34.02	33.99	33.96	3.67	0.02	0.03
West Bengal	10.69	8.36	8.35	8.19	2.33	0.01	0.16
ALL INDIA	675.54	637.29	633.40	640.11	38.24	3.90	-6.71

Source: State of Forest Report, 2001.

Table 7: Per capita Availability of forest and agricultural land.

Year	Per capita Availability of Forest Land (in hectare)	Per capita Availability of Agricultural land in rural areas (in hectare)
1950-51	0.113	0.638
1960-61	0.124	0.503
1970-71	0.115	0.410
1980-81	0.099	0.356
1990-91	0.081	0.315
1998-99	0.071	0.271

Source: Selected Socio-Economic Statistics, India 2002.

Note: Estimates in this table have been worked out on the basis of area figures on land utilization published by the Ministry of Agriculture and Mid-Year Estimates of population based on the reports of Standing Committee on Population Projections and Technical Group on Population Projections constituted by Planning Commission.

Table 8: The Per Capita Net availability of Food Grains in India.

Year	Net availability of food grains per day (grams)			Per annum availability of		
	Cereals	Pulses	Total	Edible oil (Kilograms)	Sugar (Kilograms)	Cotton cloth (Sq. mtr.)
1950-51	334.2	60.7	394.9	NA	NA	NA
1960-61	399.7	69.0	468.7	3.2	4.8	13.8
1970-71	417.6	51.2	468.8	3.5	7.4	13.6
1980-81	417.3	37.5	454.8	3.8	7.3	11.0
1989-90	431.5	41.1	472.6	5.3	12.3	14.6
1990-91	468.5	41.6	510.1	5.5	12.7	15.1
1991-92P	434.5	34.3	468.8	5.4	13.0	13.7
1992-93P	427.9	36.2	464.1	5.8	13.7	15.6
1993-94P	434.0	37.2	471.2	6.1	12.5	15.9
1994-95P	457.6	37.8	495.4	6.3	13.2	15.2
1995-96P	443.4	32.8	476.2	7.0	14.1	16.3
1996-97P	468.2	37.3	505.5	8.2	14.6	16.2
1997-98P	417.3	33.0	450.3	7.6	14.5	15.9
1998-99P	433.5	36.9	470.4	NA	NA	NA
1999-2000P	426.6	31.9	458.5	NA	NA	NA

Source: Selected Socio-Economic Statistics, India 2002.
P: Provisional
+: Relates to actual release for domestic consumption

Table 9: Registered motor vehicles in India, 1950-51 to 2000-2001.

(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	23252	4204	2031	448	33911
1996-97	25729	4672	2343	484	37331
1997-98	28642	5138	2536	537	41368
1998-99	31328	5556	2554	540	44875
1999-2000	34118	6143	2715	562	48857
2000-2001	38556	7058	2948	634	54991

Source: Transport Research Wing, 1997 and 2003.

Table 10: Energy production/consumption in India, 1950-51 to 2000-2001.

Year	Energy production			Energy consumption*			
	Coal & lignite (million tons)	Petroleum products (million tons)	Natural gas (billion cubic meters)	Electricity (billion KWH)			
				Total	Thermal	Hydro-electric	Nuclear
1950-51	32.2	3.3	NA	5.1	2.6	2.5	NA
1960-61	55.23	7.7	NA	16.9	9.1	7.8	NA
1970-71	76.34	17.1	0.65	55.8	28.2	25.2	2.4
1980-81	119.02	24.1	1.52	110.8	61.3	46.5	3.0
1990-91	225.5	48 .5	12.77	264.3	186.5	71.7	6.1
1995-96	292.27	55.1	20.82	379.9	299.3	72.6	8.0
1996-97	293.93	59.0	21.26	394.5	316.9	68.6	9.0
1997-98	300.43	61.3	26.40	420.6	336.1	74.5	10.0
1998-99	296.51	64.5	27.43	448.6	353.9	82.8	11.9
1999-2000	304.10	79.4	28.45	480.7	386.8	80.6	13.3
2000-2001	313.70	95.6	29.48	499.5	408.1	74.5	16.9

Source: Basic Statistics on Indian Petroleum and Natural Gas 2003, Ministry of Petroleum and Natural Gas, Government of India, New Delhi.
*: Economic Survey of India, 1998-99 and 2002-2003.

Table 11: State of ambient air quality in 10 metro cities of India during 1991.

City	SO_2	NO_2	NH_3	H_2S	SPM	RSPM
Ahemadabad	16	7	17	1	285	122
Mumbai	27	26	51	2	226	91
Calcutta	62	39	93	4	394	180
Delhi	33	46	176	1	543	204
Hyderabad	10	19	10	2	156	56
Jaipur	8	14	29	2	338	108
Cochin	11	10	74	1	115	58
Kanpur	7	13	65	1	380	135
Chennai	8	13	33	2	101	67
Nagpur	9	9	70	1	173	82

Source: Compendium of Environment Statistics, 2000.
Note: Units are in 10^{-6} grammes per cubic meter

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