Current World Environment Vol. **4**(2), 335-340 (2009)

Population growth and environmental stress (A review)

JAMIL AHMAD

Department of Economics, Aligarh Muslim University Aligarh, Aligarh - 202 002 (India).

(Received: October 29, 2009; Accepted: November 27, 2009)

ABSTRACT

This paper examines population and enviourmental relationship and tries to find out the impact of population growth on enviourment. Population impacts on the environment primarily through the use of natural resources and production of wastes and is associated with environmental stresses like loss of biodiversity, air and water pollution and increased pressure on arable land. Population size and rates of growth are key elements in environmental change. At any level of development, increased population increases the energy use, resource consumption and environmental stress. Population growth and consumption are fundamental drivers of human environmental impacts.In the matter of population and environment, per capita income and per capita energy consumption have been considered. Final conclusion is that human population growth is the number one threat to the world's environment. Each person requires energy, food, space and resources to survive, which results in environmental losses.

Keywords: Population, environment, atmosphere, energy, water, food.

INTRODUCTION

Population is an important source of development, but it is also a major source of environmental degradation when it exceeds the threshold limits of the support systems. Population impacts on the environment primarily through the use of natural resources and production of wastes and is associated with environmental stresses like loss of biodiversity, air and water pollution and increased pressure on arable land. India supports 17 per cent of the world population on just 2.4 per cent of world land area. It's current rate of population growth is 1.85 percent(GOI,2009) that continues to pose a persistent population challenge.The growing population poses some serious environmental threats. More people means less forest, water, soil, and other natural resources, but more waste, pollution, and greenhouse gases.

Population factors can be linked to environmental impacts in India and around the world primarily when:

- There are rapidly increasing demands by a growing population for a fi nite resource (such as water or land), or beyond a renewable resource's ability to regenerate (such as fisheries or forests);
- The resource use by an increasing number or people spurs increasing quantities of contaminants to be put into a natural system beyond its natural capacity to buffer the toxin (such as burning fossil fuel causing rises in greenhouse gases), and;
- Natural habitats are degraded or destroyed by resource extraction and use, increasing development, and other activities to meet demands of a growing population. (U.S. National Report on Population and the Environment / 5)

Review of literature

Population-environment relationships are multidirectional, the majority of recent research focuses on population impacts on the environment. The literature on the subjects of population and enviourment is fairly large, while it is not so in the subject of population and environment which is a growing area of research. A few seminal contributions on the subject of study have been

reviewed to identify the major trends and to venture into a new area of research.

Malthusian theory (1798 and 1803, republished 1960) formulated before the agricultural revolution, is built upon the assumption that environmental resources such as land are fixed. Malthus did not foresee the technological changes that have accompanied modernization and allowed agricultural output to increase faster than population growth**. Boserup** (1965, 1976 and 1981), however, explicitly takes into account technological change. Moreover, Boserup suggested that in some cases population growth and resulting increased population density might induce technological changes that allow food production to keep pace with population growth. **Simon** (1981 and 1990) went further to suggest that population growth induces sufficient technological change to expand food output faster than population. The dominance of either Malthusian or Boserupian thought in the discussion of population-environment relationships has led to opposing "limits to growth" and "cornucopian"perspectives (Hogan, 1992a). It is important to note that neither Boserup nor Malthus specifically addressed population-environment relations, per se, but rather land use and food production in relation to population. Implications for population and environment relationships have, however, been inferred a posteriori from their work. Both the Malthusian and Boserupian perspectives imply linear relationships between population and enviourment.

As defined by **Higgins** and others (1982), this concept implies that the ability of land to produce food is limited. Exceeding those limits will, in the long term, result in degradation and declining land productivity. As a result, there are higher levels of population than can be supported from any given land area. Population ecology and human ecology ,which deal with questions of environmental carrying capacity, equilibrium and optimum population size, also reflect this prospective (Howley,1986;Drummend,1975).

Multiplicative perspectives present the view that population (size, growth, density and distribution) interacts in multiplicative way with other factors, such as levels of consumption and technology, to have impacts on the environment. One of the most frequently used multiplier approaches, is the "I=PAT" equation. Total environmental impacts (I) are seen as a product of population size (P), the level of affluence or per capita consumption (A), and the level of technology (T) (Ehrlich and Holdren, 1971 and 1974; Harrison, 1992; Commoner, 1991 and 1992).In the case of environmental degradation, ultimate causes are polluting technologies, high consumption levels, warfare, land and urban mismanagement policies, socio-economic institutions, and poverty (Shaw, 1989c; Hogan, 1992a). Population, in contrast, is viewed not as a cause but, rather, as an aggravating factor that multiplies the scale at which the ultimate causes of environmental degradation (polluting technologies etc.) operate.

McNicoll (1990 and 1992a) focused on social and cultural rather than policy factors that mediate population and the environment relations. In contrast to the direct relationship between other animals and the environment, he suggested that social organization and culture filter and focus the relationship between human populations and their environment (McNicoll, 1992a). He proposed that population growth might also alter the social structure such that new technologies or social forms arose which might change the relationship between population and the enviourment (McNicoll,1990).

In most developing countries, particularly India the population has been growing faster than food supplies. Population pressures continuously degraded the cultivable land. Population size and growth tend to expand and accelerate these human impacts on the natural resources and 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 sustainable development and health of people. 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. The projected population indicates that India will be most populous country in the world and China will be second in 2050. If the population continues to multiply, the impact on environment could be devastating. What is more concern, the rise in population will increase to such

an extent in future that it will cause overall scarcity for resources. The deficiency of natural resources will furthermore create environmental hazards in the world. India, with about 17 percent of the world's population on only 2.4 percent of its land area has great deal of pressure on its all natural resources including land. Decades of economic expansion and population growth have degraded its land, air and water.

Population and Atmosphere

The most fundamental effect of atmospheric pollution has been on the global carbon cycle. Carbon is a key element for life. It makes up half the mass of plants and animals (Siman J. 1990) and, as CO_2, it is a major "greenhouse gas" responsible for maintaining the atmospheric temperature at levels fit for those organisms. Global warming occurs because carbon dioxide and other gases trape the suns radiation and then dissipate the heat into space, leading to an increase atmospheric temperature. In the past 150 years human activities has released more than 350 billion tons of carbon into the air in the form of CO_2(MIF, GOI Oct.2007).

Table 1: Projected wood fuel Consumption and CO_2 emission in India during 1994-2010

	1994	2000	2010
Fuel wood consumption (in 000 cum.per year)	266,788	303,999	361,705
Annual growth Rate	2.07	2.20	2.80
CO_2 Emission	0.9	1.1	1.5

Source: FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS Bangkok, October 1997
-United Nations Millennium Development Goals Indicators - July 2009.

Above table clearly reflects the Fuel wood consumption and emission of CO_2. With an increase in the population of the country the number of household increases that leads to an increase in the annual fuel consumption. With the growth of the fuel wood consumption in the country as a result the quality of air deteriorated which created negative impact on health of people and ecological balances in the country. Over the year the increased number of people and their consumption pattern the emission of CO_2 has increased. The emission of CO_2 increased from 0.9 percent to 1.1 percent and projected to continue to increase in the year 2010by 1.5 percent. During the same period the fuel wood consumption increased from 266,788 cum. per year to 361,705 cum.per year.

Population and level of consumption

Population growth and consumption are fundamental drivers of human environmental impacts. Humans have changed the Earth's ecosystems more rapidly and extensively in the past 50 years than in any other period of human history. This is mostly due to the ever growing human demand for natural resources such as energy, food, water and wood. These changes have degraded almost two-thirds of the ecosystems on which humanity depends and have resulted in a largely irreversible loss in the diversity of life on Earth (Millennium Ecosystem Assessment, 2005).

The world's population doubled between 1960 and 2000 to 6 billion people and continues to grow, currently at around 1.2 per cent per annum. Despite a continuing decline in fertility levels, the global population is expected to reach 9 billion by 2050. In the same period (1960-2000) the Indian economy increased six-fold, resulting in a doubling or more of water use, food demand and wood harvests. While most developed nations have low and declining population growth, their personal consumption rates continue to increase, placing growing demands on the world's natural resources. Nations in transition to more industrialized

economies are creating a new and rapidly increasing consumer class, comprising 1.7 billion people and it is projected that this will lead to greatly increased global demand for natural resources (United Nations Population Fund, 2004). In contrast, nations in sub-Saharan Africa have the fastest rates of population growth but suffer some of the world's worst poverty, a combination which can lead to the degradation of their local environments (United Nations Population Fund, 2004). The disparate consumption between rich and poor nations remains a key environmental concern. Around 86 per cent of global private consumption expenditure is accounted for by 20 per cen of the world's population who live in the highest income countries (United Nations Population Fund, 2001).

In any economy population growth, distribution, and patterns of consumption, are drivers of many environmental pressures in the State, including loss of biodiversity, air pollution, impacts on water quality and waste generation. Reducing, or at least stabilizing, global population growth and consumption is a key requirement for sustainability and reducing environmental degradation from human activities.

Population and Food Grain Requirement

Food demand is proportional to population. In India the food grain availability is at present around 525 gms per capita per day. Assuming the same level of consumption, which although is supposed to rise with improvement in economy and resultant higher standard of living, the annual food grain requirement will be about 315 MT. If small raise is made in per capita consumption to 650 gms, the food grain requirement will be about 390 MT. Taking the projection of about 1640 million by 2050 AD as reasonable, it would require about 389 MT of food grain annually at the present level of consumption(table-2).

Table 2: Population Growth, Per Capita Net Availability of Food Grain (Per day) and Per Capita Water Availability in India.

Year	Population (In million)	Food grain (gram/capita/day)	Per capita Water Availability (cubic meter)
1951	361	394.9	5177
1955	395	444.0	4732
1991	846	510.1	2209
2001	1027	416.2	1820
2025(p)	1394	600	1341
2050(p)	1640	650	1140

P = Projected; Source: Ministry of Agriculture, Government of India Oct 2007.

Thus the question which needs to be asked is: are we capable of producing these amounts of food grains for the consumption in the country on a sustainable basis. This will mean a much greater use of available inputs such as water, energy, power, fertilizers, etc.

There is increase in water requirements due to increase in population. But the above table reflects the different situation in India. Groundwater and surface water are thus the two sources of water available for human consumption. Over the years due to swelling population, increasing industrialization and expanding agriculture the demand for water has multiplied. At the same time the available per-capita water resources have declined due to falling groundwater tables, inefficient use of water etc. Water availability in the country is continuously decreasing and reached to 1140 cubic meters/capita/annum. The availability of water per person in India will fall by almost 38 percent by 2050.

According to the fourth assessment report of the intergovernmental panel on climate change

(IPCC), gross per capita water availability in the country will decline from 1,820 cubic meters per year in 2001 to 1,140 in 2050.

The water availability in the county would reduce by almost 38 percent. Less rainfall, melting of glaciers due to climate change, and reduced groundwater recharging potential would help the deteriorating situation (IPCC Report 2006)

Water availability in any region or country is reflected by "*water stress index*" (Falkenmark and Widstrand, 1992). This index is based on the minimum per capita water required for basic household needs and to maintain good health. A region whose renewable fresh water availability is below 1700 cubic meters/capita/annum is a '*water stress'* region, while the one whose availability falls below 1000 cubic meters/capita/annum experiences '*water scarcity*'. The current national average per capita water availability figure per annum is 1140 cubic meters, implying that we are not even in the 'water scarcity' range as yet.

Energy, however, is intimately connected with environment and population, and as a result, we considered some environment-related and population-related energy issues. In the matter of population and environment, per capita income and per capita energy consumption have been considered.

Table 3: Income and Energy Consumption Per capita

Year	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	correlation coefficient=r
Per Capita Income	16729	17883	18988	21142	23222	25788	27776	R=0.996
Energy Consumption Per Capita	98	104	109	118	127	138	168	

Source: Economic Review, WB

Energy is generated from non-renewable fossil fuels (such as coal, oil, and natural gas), renewable sources (such as wood, biomass, wind, waves, and the sun), and nuclear power. India's energy consumption has reached 2.3 billion metric tons .These includes high level of household energy consumption, offices, stores, and factories, heavy reliance on motor vehicles for personal and commercial purposes, and relatively long distances over which electricity and raw energy have to be transmitted and transported (such as oil and gas).

CONCLUSION

The above study shows the degradation of air, land and water resources from ever-increasing numbers of people, ever-increasing demands for resources and ever-increasing pollution which is damaging the complex ecosystems and reducing the quality of life. Population size and rates of growth are key elements in environmental change. At any level of development, increased population increases the energy use, resource consumption and environmental stress. No policy can change the past. But addressing current population policy must be change according to the requirement of the people to provide better enviourmental condition to sustain human life. Government can not control population any more than the people can control people themselves. Support of education for girls and of economic opportunity for women would contribute to further decline in birth rates while improving individual capacities.

Global climate change is the most critical environmental impact imposed on the atmosphere by human pollution. Although world weather patterns are little understood, it is clear that global temperature in rising Worldwide carbon emissions and atmospheric concentrations of greenhouse gasses reached record levels in this period, as more people burned more wood, coal and petroleum

products, While the overall effects of human actions on the earth's weather patterns are uncertain, the negative impact of global warming is clear.

India's population is expected to increase by some 1640 million people by the year 2050 . At the same time, more nations – and billions more people - will achieve higher levels of economic development, production and consumption. This in turn will significantly increase usage of natural resources and energy.

Clearly, all nations and people are entitled to improve their living situations. However, if present trends continue, damage to the environment is certain to increase and accelerate. Only through a combination of population stabilization programs, conservation, and implementation of sustainable technologies and production practices can preserve the natural world, and our own security. Finally, we can conclude that human population growth is the number one threat to the world's environment. Each person requires energy, food, space and resources to survive, which results in environmental losses.

REFERENCES

1. Malthus, T. (1798 and 1803, republished 1960) "On Population (First Essay on Population", 1798; and "Second Essay on Population," 1803). New York: Modern Library and Random House.
2. Boserup, E. " The Conditions of Agricultural Growth. Chicago: Aldine" "Environment, population and technology in primitive societies" Population and Development Review (New York), vol. 2, No. 1, pp. 21-36 (1965).
3. McNicoll, G. "Social Organization and Ecological Stability under Demographic Stress" Population Council Working Paper, No.11. New York (1990). "The agenda of population studies: a commentary and complain". *Population and Development Review*. **18**(3), 399-415 (New York), (1992). "Malthusian Scenarios and Demographic Catastrophism" Population Council Working Paper, No.49. New York (1993).
4. Holdren, J. P. "Energy and the human predicament" In Population Resources in a Changing World, Kingsley Davis, (1989).
5. Higgins, G., and others "Potential Population Supporting Capacity of Lands in the Developing World Rome" Food and Agriculture Organization of the United Nations (FAO) (1982).
6. Harrison, P. "The Third Revolution: Environment, Population and a Sustainable World" London and New York: I. B Tauris & Company Ltd. (1992).
7. Commoner, B. "Rapid population growth and environmental stress: In Consequence of Rapid Population Growth in Developing Countries" New New York: Taylor and Francis, pp. 161-190 (1991).
8. Simon, J. "The Ultimate Resource. Princeton, New Jersey: Princeton University Press. (1981). Population Matters: People Resources, Environment and Immigration. New Brunswick, New Jersey: Transaction Publishers. (1990).
9. Hogan, "The impact of population growth on the physical environment" European Journal of Population (Amsterdam),vol. 8, pp. 109-123 (1992a).
10. Singh Kartar, Shisodia Anil. "Enviourmental Economics: Theory and Application" Sage Publication New Delhi. India: Addressing Energy Security And Climate Change Ministry of Environment & Forests Government of India October, 2007.