POPULATION AND ENVIRONMENT: AN IMPACT ANALYSIS FROM NEPALESE PERSPECTIVE

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1. CONCEPT

Human beings have direct relationship with their environment not only by way of breathing and food supply but also by the use of living place. In our science, the cultural theme of which is area differentiation, the dynamic and pivotal element is human life or population ...population is the point of reference from which the all other elements are observed and from which they all singly or collectively derive significance and meaning (Trewartha, 1953). Environment is the surrounding of human beings. As the Global 2000 Report defines, "Literally, the environment is the physical and biological surroundings... of the human species. Human-kind depends on this life supporting environment... so intimate is the linkage between human-kind and its' environment that the distinction between individual environment blurs" (Sharma, 1988). Unplanned population growth tends to impose severe stress on any nation's agricultural lands, forests, fisheries, energy resources, social services and the total environment.

In the above background, this article attempts to explore the impact of population growth on the resource depletion and creating pollution in Nepal.

1.1 Population, Growth and Resources Depletion

Nepal is suffering from environment problem with higher rate of population growth. At present, the problem of environmental deterioration in Nepal can be blamed

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less to industrialization but more to higher rate of population increases, poverty and development. The set of environmental problems arising out of population increase and poverty has been well summed up by Gamani Corea of Sri Lanka:

> Ours are the problems of poor societies: the problem of bad water, poor housing, diseases and sickness, lack of sanitation and sewage facilities, inadequancy of nutrition and vulnerability to natural disasters. These problems have not arisen from an excessive degree of development, rather they reflect the inadequency of development. Thus, while the rich countries may look upon development as the cause of environmental destruction, the poor countries can not but look upon development as the cure as the means of remedying basic environment problems. In this sense, therefore, the concern with environment in the developing world is but an aspect of the commitment to development. There is no inherent antagonism, conflict between the goals of environment and the goals of development. They are but facets of the same problem (UNESCO, 1981).

According to the census 1991, the population of Nepal was growing at the rate of 2.1 percent per annum between 1981–1991 census and reached to 18.5 million from 15.0 million in 1981 (CBS, 1994). This incicates the fact that 350 thousand people are added each year to the country's population. The population density of Nepal is 125.3 persons per sq. km. at present and with this rate of growth the population in Nepal must double within 34 years.

Other things remaining the same, greater the population, more significant are the changes brought about in the environment. More people make more demands, all of which lead to environment degradation. Poor quality or insufficient supply of food, poor sanitation, low coverage and poor quality water supply, housing, employment, and health related problems are common problems in Nepal associated with high rates of population growth[1].

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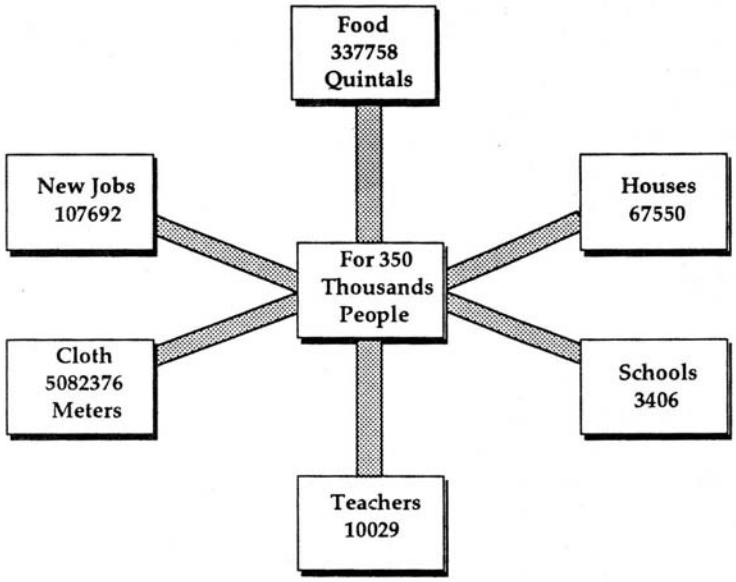
1 As an example, in India 13 million people are added each year to the country's population. For meeting the basic needs of their additional population, each year about 12,545,300 additional quintals of food (one quintal = 100 kilograms), 2,509,000 additional houses, 126,500 additional schools, 372,500 additional teachers, 188,774,000 extra meters of cloth and 4,000,000 additional jobs have to be made available (Sharma, 1988). It is comparable for Nepal due to higher rates of population growth. For instance, 350 thousands of people are added each year to the countries population in Nepal. The schematic figure overleaf shows the different needs for an additional people every year in Nepal.



Requirement of different resources for every additional 350 thousands population of Nepal.

In Nepal, majority of the people live at subsistence level. As production has not been able to keep pace with population growth, the trends towards c erting pastures and forests into arable land is being intensified. As a consequence, the ecological balance is upset, productivity is reduced and the forest resources of the mountain and Terai regions are being destroyed.

The increase in population and associated increase in demand for the 3 Fs-food, fuelwood and fodder has led to degradation of forest resources. Nepal is losing 84,000 hectares of forest annually (ESCAP, 1990). Currently per capita fuel consumption for Nepal is one cubic meter (640 kg) per year. It has been estimated that under current mixed farming system of Nepal not less than 1 hectare of cultivated land is required for growing food and at least additional 0.3 hectare is required for fuelwood alone for one family (Sharma, 1993). According to the forest Master Plan draft, the estimation of national demand for fuelwood in 2001 and 2011 would be 13.1 million and 15.5 million metric tons respectively. Annual productivity per hectare of natural forest are 2.3, 1.8 and 6.4 metric

tons for the Hills, inner Terai and Terai respectively (Jha, 1992). This production can never meet the fuelwood demand of increasing population.

Nepal's population is growing at an alarming rate which has compelled greater clearance of forest for cultivation, for fuel and for settlement. As a result, the land is over exploited, leading to soil erosion and as a consequence, considerable decrease in land fertility is apparent. Echkolm has aptly remarked "There is no better place to begin an examination of deteriorating mountain environment than Nepal. Population growth in the context of traditional agrarian technology is forcing farmers onto over steeper slopes, slopes unfit for sustained farming even with astonishingly elaborate terracing practiced there" (Gurung, 1989). It is generally believed that cultivating land with of slopes greater than 30 degrees, ploughing up and down the slopes, constructing terraces without proper consideration and drainage cause soil erosion. Accelerated erosion or man made erosion is characterized by the loss of top soil by sheet and rill erosion as a result of forest clearing, over grazing, poorly maintained arable and marginal land and forest fire hazards (Carson, 1985). It is estimated that 1.7 mm of fertile soil is wasted each year (TUCN, 1991). The four major rivers of Nepal with over 6,000 tributaries carry 240 million cubic meters of fresh fertile soil annually into the Bay of Bengal where 28 km long an immense new island is coming up from the 100,000 sq. km. of silt surfaced in the sea (Pandey, 1987). The topsoil washing down into India and Bangladesh is now Nepal's most precious export, but one for which it received no compensation (Gurung, 1989).

The Report of the NPC-appointed Task Force on Land Use Policy has predicted the development of a semi-desert type of ecology in the hilly region, if the present trend of land use is not checked in time. It is estimated that about 10,000 sq. km. of area in Dolpa and Mustang district are devoid of sufficient vegetation indicating the desertification process which is now extending to other areas (NPC, 1982). However, this indicates a chain of negative reactions between population growth and the environment.

1.2 Population Growth and Pollution

The word 'population' is derived from the Latin word 'pollutionem' which means defilement or to soil. Since the 18th century, the word 'pollute' has been used to imply an undesirable change in the physical, chemical or biological characteristics of air, land, water, a change that may or will harmfully affect life.

Dr Paul Ehrlich provides the following statement regarding these several but related factors: "Pollution can be said to be the result of multiplying three factors: population size, per capita consumption and an 'Environmental Impact' index that measures in part how wisely we apply the technology that goes with consumption." He appears to consider population size as the predominant factor into this relationship. His statement can be paraphrased as an 'equation' (Sharma, 1988).

Population Size * Per-capita Consumption * Environmental Impact per unit of Production = Level of Pollution

The pollution of the environment is a function of density of population (DP) and the size of gross national product (GNP). The index of pollution potential (IPP) can be calculated by using the following formula:

$$IPP = \frac{DP^2 \times PI}{K}$$

Where, IPP stands for index of pollution potential, DP stands for Density of Population. PI for per capita income and K is the constant = 100.

If we calculate the IPP of the SAARC countries based on the above formula, Nepal falls under the sixth rank (168.2 IPP) which has more than three times the IPP of Bhutan (44.2). Following table indicates the present situation of IPP of SAARC countries:

Country	Per Capita Income (US $)*	Population Density (per sq. km.)#	IPP	Rank
Maldives	440+	802	1,682.3	I
Bangladesh	220	810	1,201.4	II
Sri Lanka	500	270	603.7	III
India	330	273	495.9	IV
Pakistan	400	161	322.0	V
Nepal	180	125	168.2	VI
Bhutan	180	33	44.2	VII

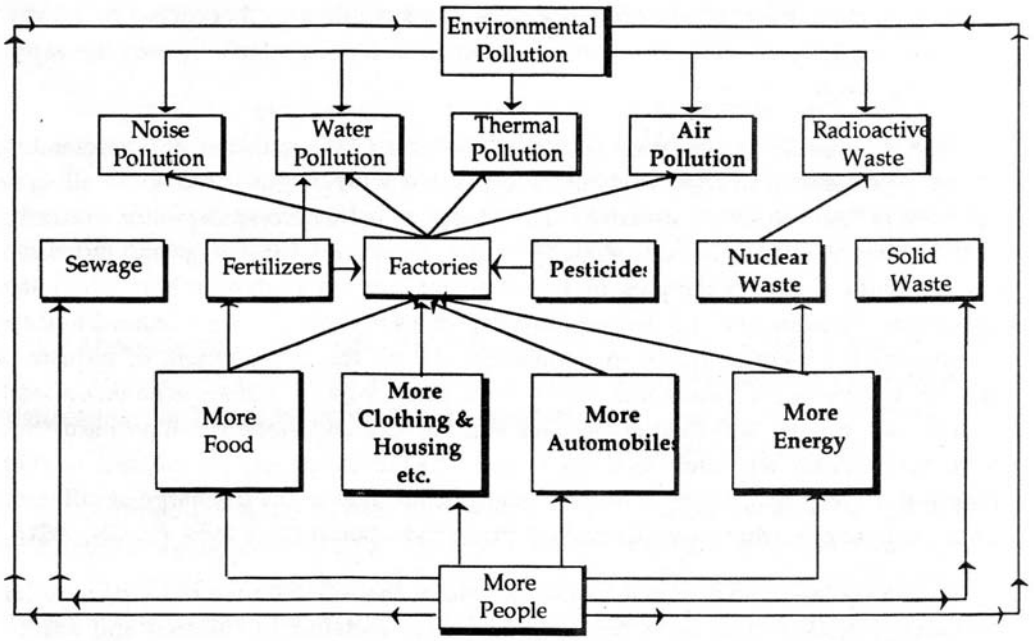
*Source: *State of the World Children, 1994.*

 # ESCAP Population Data Sheet, 1994.

+ Gewali, Damodar, Population Education, 1994.

CBS, Statistical Pocket Book, 1994.

Rapid population growth leads to environmental pollution. In order to get more food for the additional people, we need more pesticides and more fuel all of which have a negative effect on our environment. The problem of domestic sewage and solid waste disposal are directly related to the number of people. As the number of the people increase, the space per person for waste disposal decreases. Following figure illustrates the relationship between population growth and environmental pollution.



Relationship between Population Growth and Environmental Pollution[2]

From the above figure, it becomes obvious that more people need more food, more automobiles and more energy. To meet these growing needs fertilizers, factories, pesticides, fuel and nuclear energy are produced and used. These, in turn, lead to water pollution, thermal pollution and radioactive wastes which together with the sewage and solid wastes of people result in environmental pollution. Therefore, more people means more environmental pollution.

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2 Adopted with minor modifications from R. C. Sharma's "Population, Resources, Environment and Quality of Life", Dhanpat Rai and Sons, Delhi, 1988, p. 446.

2. PREVAILING POLLUTION SCENARIO IN NEPAL

2.1 Water Pollution

Water is never 'pure' in chemical sense. It contains impurities of various kinds – both dissolved (e.g. hydrogen sulfide, carbon dioxide, ammonia, salts of Calcium, Magnesium etc.) and suspended impurities (e.g. clay, silt, sand, mud etc.) and microscopic plants and animals (Park, 1994). A more serious water pollution is that caused by human activity – urbanization and industrialization which is the ultimate result of the rapid population growth.

In Nepal, while urbanization is crucial for industrial expansion and accelerated economic development, an unplanned but fast expansion of urban centers has been leading to congestion, problem of solid waste disposal, shortage of basic necessities (water electricity etc.) and environmental pollution. Water pollution resulting from sewage and industrial waste provides a clear examples of the effect of rapid population growth on the environment. The carrying and decomposing capacities of the rivers are sustained to their maximum by the increase in urban population and by the development of industrial complexes leading to the disturbance of river ecosystem. Among industries based on local raw materials, cement and marble factories and boulder and stone crushing industries pollute the environment and de-stabilize soil. Similarly paper, plastic, and leather pollute water. In Nepal, rivers frequently change color due to the discharge of effluents from those industries which use chemicals in their production process (NPC/IUCN, 1991).

Health statistics indicate that more than half of the total number of patients suffer from gastro-intestinal disease in Nepal. Worms are endemic in children and adults. Diarrhea and dysentery have been the main cause of deaths in children. Typhoid and cholera are almost endemic in urban areas in Nepal. The paucity of safe water supplies and adequate sanitation facilities have no doubt worsened the situation for which rapid population growth of Nepal is highly responsible. About 80 percent of the communicable diseases are caused by polluted drinking water in Nepal. Although, about 66 percent people of the urban area and 34 percent people of the rural area have been facilitated by safe drinking water in Nepal but available water is not hygienic. According to the recently surveyed report, the coliform bacterial level of water distributed by Nepal Water Supply Corporation was found 213/100 ML while the same from natural taps of Kathmandu was 2465/100 ML.

2.2 Air Pollution

The immediate environment of man comprises of air on which depends all forms of life. Truly speaking, there has never been pure air. Foreign susbstances have been present in the air all the times and at all places. The term air pollution is therefore applied when there is an excessive concentration of foreign matter in the outdoor atmosphere which is harmful to man or his environment (Park 1994). For an individual about 17 kg of air per day is needed.

Air becomes impure by respiration of men and animals, combustion of coal, gas, oil etc. decomposition of organic matter and trade traffic and manufacturing processes which give off dust, fumes, vapours, and gases. Air pollution is one of the major environmental problems of Nepal particularly in the urban areas. The typical pollutants are sulpher oxides (SO_2), nitrogen oxides (NO_2), carbon monoxide (CO), photochemical oxidants and suspended particular matters.

Atmospheric sulfur oxides result largely from the burning of oil and other fossil fuels. The pollution of the air by these substances is mostly caused by consumption of petroleum. In Nepalese context, main sources of air pollution may be regarded as deforestation and bio-mass burning followed by the utilization of fossil fuel.

Deforestation and land use change are the most important sources of carbon release in Nepal. Houghton et al (1987) estimated that the net release of carbon by deforestation and allied sources in Nepal was 6.9 Terra gram (per cubic meter 13 gram air pollution), which was 30 percent higher than that of Bangladesh, 16 percent than that of Pakistan, 25 percent than that of Sri Lanka and 4 percent than that of Bhutan. In Nepal, carbon emission by forest clearing and allied mechanism has been estimated 8.34 (minimum) to 15.45×10^7 tons (maximum) during the past 30 years (1960/61 – 1990/91) periods (Devkota, 1992) and eventually, CO_2 formation on average is 3.96×10^6 tons per year. On the basis of livestock numbers (CBS, 1991) and paddy area (1980/81 – 1989/90), annual emission of methane flux in Nepal has been estimated 1.3 million tons, out of which paddy area and cattle head contribute 62 and 38 percent respectively. WRI (1990/91) estimated that about 490 thousand tons of methane emit from livestock in Nepal. The annual emission of nitrogen oxide has been estimated 24.5 hundred metric tons, out of which fuelwood contributes about 67 percent and the remaining is contributed by transportation vehicles and industries (Niraula, 2049). Besides industrial emission pollution is caused by the

unchecked and uncontrolled exhaust fumes of the automobiles operating in the city. For instance, Kathmandu accounts for 73 percent of Nepal's fleet of cars and jeeps, 70 percent of Nepal's motor cycles/scooters, 86 percent of tempos and 32 percent of country's fleet of buses, mini-buses, and trucks. These vehicles plying in Kathmandu consume 79 percent of all gasoline and 27 percent of all diesel oil used in the country (Malla, 1995). The emission inventory shows that per capita contribution of conventional pollutants in Nepal on average is 274 kg of carbon dioxide, 1.4 kg of nitrogen oxide, 0.5 kg of sulphur oxide and 70 kg of methane per year (Devkota, 1992).

Air pollution affects human health. Some pollutants are actually toxic, for example, fluorides, hydrogen sulfide and arsenic. Most commonly, the results are irritation of throat and lungs, coughing, lesion of the respiratory tract, and in severe cases, death from respiratory failure. In regard to heavy metal, certain forms of mercury and lead attack the central nervous system, affect the lungs and antimony the heart. In addition, particular matter in the air has been linked with cancer of the stomach and prostate gland.

2.3 Noise Pollution

Noise is often defined as unwanted sound; but this definition is subjective because of the fact that sound for one man may be noise for another man. Perhaps a better definition of noise is: "wrong sound, in the wrong place, at the wrong time". As the population has been increasing rapidly, the intensity of noise pollution is also growing faster and faster in Nepal especially in the urban and industrial areas where the population agglomerates highly. The sources of noise are many and varied. These are automobiles, factories, industries, aircraft, and the domestic noises from the radio, transistors - all adding to the quantum of noise in daily life in Nepal. There exists positive relationship between population growth and the acceleration of noise sources i.e. urban centers, industries, radio, films, automobiles etc. The noise pollution greater than 60 dBA is conceived as hazard for man and when it reaches more than 80 dBA, it may cause losses in hearing capacity. Likewise, if a man works regularly about 8 hours in more than 100 dBA noise levels, he becomes deaf.

Acceptable Noise Levels (dBA)

Residential :	Bedroom	25
	Living room	40
Commercial :	ffice	35 - 45
	nference	40 - 45
	Restaurants	40 - 60
Industrial :	Workshop	40 - 50
	Laboratory	40 - 50
Educational :	Classroom	30 - 40
	Library	35 - 40
Hospitals :	Wards	20 - 35

Source: *Park, Text Book of Preventive and Social Medicine, 1994 P. 414.*

If we compare the situation of noise pollution in Nepal with the suggested acceptable noise levels (dBA), we find worse condition. According to the study of Miyosi (1987), the situation of industrial noise pollution in Nepal was as follows:

Industry	Noise Pollution (dBA)
Balaju Textile Industry	82 - 120
Hetauda Textile Industry	90 - 95
Nepal Synthetic Udyog, Hetauda	90 - 92
Hulas Steel Udyog, Simara	95 - 105
Himal Cement Company, Kathmandu	80 - 100
Bhrikuti Paper Industry (Nawalparasi)	80 - 85
Food Industry Pvt. Ltd.	90 - 100
Asian Paint, Nepal (Hetauda)	80 - 90

Source: *Mirmire, Ashadh - Shrawan, 2049, PP. 69-70.*

Placethe study conducted in 1985 and 1987 reveals the situation of noise pollution in different places of Kathmandu city, as follows:

Places	Noise Pollution (dBA)
Amrit Science Campus	75 - 85
Tri-Chandra Campus	80 - 90
Bir Hospital	90 - 95
Ratnapark	90 - 95
Teku	85 - 100
Lajimpat	80 - 89
Jhhouchhen	82 - 100
Putalisadak	82 - 98

Source: *Ibid, P. 71.*

A study conducted by Physics Department of Engineering Institute, found following results:

Place	Pollution (dBA)	
	Maximum	Minimum
Infront of RNAC	109	78
Kalimati	106	80
Maitighar	103	79
Bir Hospital Compound	89	66
Thamel Chowk	92	70
Chhetrapati	96	74

Source: *Gorkhapatra, Mangsir 22, Friday, 2052, P. 5.*

From the Tables, we can infer the fact that the degree of noise pollution in Nepal is highly excessive than the acceptable noise levels including industries to public places and hospitals. Deafness interference with speech, loss of efficiency, reduction of night vision, blood pressure, an increase in heart rate etc. are the effects of noise pollution on human health.

3. CONCLUSION

Nepal with high rates of population growth has suffered from severe environmental problems. At the present moment, the main problems facing Nepal are how to feed her people and to eradicate poverty. Nepal should adopt national strategies for technological and economic growth which would help to create the minimum of ecological, socio-cultural and environmental disruptions. A reduction in the rate of population growth should form one of the basic strategies for development and improvement of the environment. While pollution seems to be an ineviltable consequence of modern industrial technology, the problem now is to determine the level of pollution that permits economic and social development without presenting hazards to human health. Mahatma Gandhi once rightly said: "The earth has enough for every one's need but not for every one's greed".

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ERRATA

S. No.	Page No.	Para	Line	Incorrect	Correct
1.	21	1	4	(9.4)* (-3.5)* (-2.1)*	(-3.5)* (9.4)* (-2.1)*
2.	23	Foot Note	2 & 3	$F^* = \backslash f([\Sigma e \backslash s(2,p) - (\Sigma e_1^2 + \Sigma e_2^2)]/k, (\Sigma e_1^2 + \Sigma e_2^2)/(n_1 + n_2 - 2k)$	$F^* = \frac{[\Sigma e_p^2 - (\Sigma e_1^2 + \Sigma e_2^2)]/k}{(\Sigma e_1^2 + \Sigma e_2^2)/(n_1 + n_2 - 2k)}$
3.	25	1	11 & 12	$\ln RM_1 = -1.28 + .40 \ln y - .021 r + .683 \ln RM_1$ (-1.6) (2.5)* (-2.3)* (5.7)* (- 1)	$\ln RM_1 = -1.28 + .40 \ln y - .021 r + .683 \ln RM_1$ (-1) (-1.6) (2.5)* (-2.3)* (5.7)*
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6.	46	Table	10	1995	1995 (Estimates)
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