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STATUS OF ENVIRONMENTAL HEALTH IN NEPAL

Pashupati Nepal

Introduction

The study of diseases is really the study of man and his environment. The interplay and integration of two ecological universes- the internal environment of man himself and the external environment- determine the health status of an individual, a community or a nation, which surround him. World Health Organization (WHO) defines health as a state of complete physical, mental and social well being and not merely the absence of disease or infirmity. It is evident from the definition that there is rather an extension of elements of health as social well being than a limited general concepts of health as against sickness. In the modern concept, disease is due to a disturbance in the delicate balance between man and his environment. Three ecological factors (agent, host and environment) are responsible for disease. The disease agent of disease is usually identified with the help of laboratory. The host is available for study; but the environment from which the patient comes is largely unknown. Yet frequently, the key to the nature, occurrence. prevention and control of diseases lies in the environment. Without such knowledge, this key may not be available to the physician who desires to cure disease, prevent or control it (Park 1994). Hence, the study of diseases is really the study of man and his environment.

Many of the health problems have been perceived to be the direct fallout of the environment. The high incidence of heart disease and cancer, for instance, has been increasing linked to diet, lifestyle, exposure to toxic wastes, etc., all of which, can be controlled by changes in a given environment (Voluntary Health Association of India 1992).

Disease can not arise without the convergence at a certain point in time and space of two orders of factors: factors that take the form of an environmental stimulus...and second, factors that condition the response of the tissues. These stimuli, these challenges to adjustments, are not the same in every environment. They vary with...location (Husain 1994)

Population emplosion, deteriorating environmental conditions and resource constraints to tackle the key environmental health problems have affected human health and the health of the ecosystem. Planners and policy makers in Nepal are more concerned today than ever in the past about the deteriorating environmental h alth issues. The ability to link health and environmental data, and thereby to understand relationships between the levels of exposure and health outcome, is clearly vital in attempts to control

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exposures and protect health. This capability is particularly important for countries like Nepal where the issues of environmental pollution have traditionally taken a second place to demands for economic development (UNEP/WHO 1996). However, the present study attempts to present the environment health hazard pathway and the linkage between environment and health in Nepal with special reference to environmental pollution. Simultaneously, some recommendations are suggested to keep positive link between environment and health in Nepal.

The Environment Health Hazard Pathway

Environmental health hazards take many forms. They range from traditional hazards such as human faeces, in densely populated areas, to the wide mix of air pollutants emitted by road vehicles. The hazard pathway is described in Figure 1. In most cases, the starting point is some form of human activity and rarely, a natural process, which release pollutants into the environment (UNEP/WHO 1996)

Emission Sources and Processes: The process of release of pollutants is known as *emission*. The emission of pollutants due to the human activities are highly varied with time and space. The major sources of emission include mining and quarrying, energy production, manufacturing, transport, agriculture, domestic activities and waste management but other sources such as tourism, forestry and commercial services may also be important. There involve a wide range of emission processes. For example, energy combustion in vehicles, manufacturing industry, electricity generation and home heating is one of the most important emission processes, especially to the air.

Dispersion Processes: Pollutants may be dispersed through air, water, soil, living organisms and/ or human products (i.e. food) in the environment. The pathways of dispersion vary greatly. It depends mainly upon both the emission source and the pollutant concerned. Rates and patterns of dispersion also depend upon the environmental conditions to a large extent. For example, pollution dispersion in the air is affected by weather conditions (especially wind speed, wind direction and atmospheric stability) by the emission height and by the local and regional topography. Pollution dispersion in the soil is influenced by soil conditions, such as its texture, structure, and degree of compaction and drainage characteristics. Dispersal by living organisms or human products depends upon the patterns of movement, contact and exchange. The intensity of these different processes varies substantially over both time and space and often very short periods and distances. As a result, many pollutants show extremely complex patterns, especially in complex environments such as cities and towns where there are

a large number of emission sources and major variations in environmental conditions.

Exposure Processes: Pollutants enter the human body in a number of ways – by inhalation, ingestion or dose, dermal absorption. The amount of any given pollutant that is absorbed is often termed *the dose*, and may be dependent on the duration and intensity of the exposure. *Target organ dose* refers specifically to the amount that reaches the human organ where the relevant effects can occur. The first effects may be sub-clinical changes, which in turn may be followed by disease and in some cases even death.

Measuring exposures accurately and precisely is of great importance when seeking to establish exact associations with health outcomes. Almost all these measurements, however, are extremely costly and time consuming, and consequently cannot easily be applied to a large number of individuals as part of a population study. Therefore, more commonly, exposure is assessed indirectly, for example on the basis of measured pollution levels for a whole area. The measured levels are then used to give an exposure score to all individuals living or working within the area. Such an approach clearly ignores local or individual variations in exposures and results in missclassification of exposure level.

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Source: UNEP/WHO, Linkage Methods for Environment and Health Analysis: General Guidelines, 1996, p.8.

Environment and Health Problems in Nepal

General: Most of the health problems in Nepal are rooted in the environment. Communicable diseases are very much predominant in the country and a large number of them, are caused by microbes in water, food and air. Gastrointestinal disorders, respiratory tract infections, infections of eve, ear and nose, etc., are common in Nepal. Health statistics indicate that more than half of the total numbers of patients suffer from gastrointestinal diseases 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. About 80 percent of the communicable diseases are caused by polluted drinking water in Nepal (Nepal 1997). Infant mortality rate is still utmost high (102/1000 live birth). Diarrhea diseases still top the list in the country. Water available to an average Nepali is inadequate in quantity and poor in quality. Rivers and ponds are the major sources of water for all domestic purposes in most of the rural areas. Only few people use tube-well water. Pipe water is available to only about 66 percent people of the urban area and 34 percent people of the rural area. The state of sanitation, all over the country, is not satisfactory. The country has three broad distinct physiographic regions viz. Terai Region (17 percent), Hilly Region (68 percent) and Himalaya Region (15 percent)

The ecological destruction that has taken place in the Himalayas over the last half century has led to an unprecedented level of poverty and a serious decline in the health status of its inhabitants. Soil erosion, deforestation, landslides etc. have been threatening the people in the hills who are hardly able to survive on the local base. These hardships have impacted upon their health. Many of the poor are engaged in subsistence farming. A typical poor hill farming family is compelled to borrow loan from landlords or moneylenders to meet catastrophic circumstances. In such a family there is continuing malnutrition and illness. For women particularly, the excessive labour required in cultivating food crops and collecting biomass, fodder and fuel has weakened their health considerably in addition to the high incidence of worm infestation from contaminated water. For this reason, the people in this area are highly susceptible to Tuberculosis Women suffer from anemia and other gynaecological diseases like leucorrhoea, primarily because they lack the time to maintain their personal hygiene and to take rest adequately during their menstrual cycle and prognancy.

Floods have become a hazard primarily in Terai Region. The pressures on the resource base in the Hills with consequent deforestation and soil erosion prevent water from being leached into the soil. There is increasing run-off and hence an increased amount of water that flows into the plains. The water with large amount of silts raises the river beds and reservoirs, which ultimately creates flood hazards in Terai. The tropical and subtropical types of climate and depleted resource base have also contributed to different

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diseases in Terai Region. Malnutrition manifested in gastro-enteritis leads to higher mortality among children. Along with increased humidity come the vectors born diseases such as malaria. Increasing infrastructures development programs, forest depletion, use of marginal land, etc., have created an adverse environment and thus changed the relationship between people and land. It has threatened the means of survival especially of subsistence households, which in turn has resulted the high prevalence of different diseases.

Specific Environmental Health Problem

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). Water is polluted by various anthropogenic activities and natural events. But more serious kind of water pollution is that, caused by human activity-urbanization and industrialization, which is the ultimate result of rapid population growth. Increased water pollution is one of the major public health issues in Nepal. Diseases caused by contaminated water are the most common diseases in Nepal (HMG/DoHS, 1998). Factors contributing to deterioration in water quality are given in Fig. 2.

Fig. 2: Factors contributing to deterioration in water quality



Source: UNEP, Nepal: State of the Environment 2001, P. 23.

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

The anthropogenic activities are of serious concern in polluting surface water. Some traditional practices of disposing all forms of domestic waste into the river specifically, the disposal of night soil and solid wastes in near by open places, surface drains, yard and on the bank of the river has been a common practice in Nepal. Likewise, the ground water quality, particularly in Kathmandu valley, is contaminated. None of the ground water sources, such as dug-wells, deep tube wells, stone spouts, ponds and piped water is free from faecal contamination. Bacteriological water quality of the Kathmandu valley is given in Table 1.

 Table 1: Bacteriological water quality from different sources in the Kathmandu Valley

Faecal	V	alue as %	of sampl	aple units of 15						
coliform/100 mt	Dug well	Shallow well	Deep well	Spring	Stone spout	Pond	Pipe			
0	0	60	80	40	20	0	60			
1-100	40	30	15	30	40	0	20			
101-1000	30	5	5	30	40	0	30			
>1000	30	5	0	0	0	100	0			

Source: NHRC/WHO, Environmental Health in Nepal: Situation Analysis, P. 26, 2002.

Health statistics indicate that more than half of the total numbers of patients suffer from gastro-intestinal diseases in Nepal. Worms are endemic in children and adults. Diarrhea and dysentery are the main cause of the infant mortality. Typhoid and cholera are almost endemic in urban areas in Nepal. The paucity of safe water supplies and adequate sanitation facilities have no

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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. Although 66 percent people of the urban area and 34 percent people of the rural area have been facilitated by drinking water in Nepal available water is not hygienic.

Sporadic studies on water quality indicate the degradation of both river and drinking water supply. Such a deteriorations exists in urban and riverside settlement areas. Drinking water in most of the rural parts is also biologically contaminated (HMG/MoPE 1998).

Air Pollution: 'Air pollution' in general terms describes the admixture of potentially harmful substances in the air we breathe. 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, pavours and gases. Air pollution is one of the major environmental problems of Nepal particularly in the urban areas. The typical pollutants are sulpher oxides (SO₂), nitrogen oxides (NO₂), 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 use 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.

Evidently, the combination and concentration of outdoor air pollutants varies from city to city, according to the quantity and composition of fossil fuel used. But they also depend on other environmental factors such as geographical and meteorological characteristics of the area concerned (UNEP/WHO, 1996). The air quality monitoring result in the Kathmandu valley is given in Table 2.

Table 2: Air Quality Monitoring Result in Kathmandu Microgram per cubic meter (PM₁₀)

Date of		Statinon Name						
collection	Putalisadak	T.U	Thamel	Bhaktapur	Matchhegaon	Patan Hospital		
<u>Jan. 1999</u>	117	35	61	37	29	121		
23 Aug. 2003	102	16	58	31	17	124		
23 Aug. 2004	92	14	54	29	N.A.	162		

Source: CBS, Environment Statistics of Nepal, 2004, p. 19.

Indoor air pollution in same the situation is considered to be more serious than outdoor air pollution. This is due to the tendency of entrapment of pollutants indoors, resulting to higher concentration. In addition, most people spend a much larger proportion of their time indoor often in close proximity to indoor emission sources. Indoor air pollution is an especially serious problem in Nepal (UNEP/WHO 1996).

Information on indoor air quality is very limited. A recent study (NHRC/NESS 2001) indicates PM_{10} concentration for cooking place is utmost high where biomass (wood) is burnt and low at the places where kerosene and LPG are used as fuel respectively (NHRC/WHO 2002).

Various studies suggest that the high prevalence of chronic bronchitis is primarily due to the exposure to domestic smoke while using biomass as fuel in cooking. The information provided by CBS in 2001 shows that about 80 percent of total households still use biomass as fuel. The rural population depends mainly on firewood to meet their energy demand. The use of other traditional sources of energy like animal dung and agricultural residue are also in practice.

Air pollution affects human health. Some pollutants are actually toxic, 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, affecting the lungs and heart.

Noise Pollution: Noise is often defined as unwanted sound; but this definition is subjective because of the facts 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 various. 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 centres, industries, radio, films, automobiles etc. The noise pollution greater than 60 dBA is considered as hazard for man and when it reaches more than 80 dBA noise levels, he becomes deaf. Acceptable noise levels (dBA) is presented in Table 3.

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Table 3: Acceptable Noise Levels (dBA)

Residential	Bedroom	25		
	Living room	40		
Commercial	Office	35-45		
j	Conference	40 - 45		
<u> </u>	Restaurants	40 - 60		
Industrial	Workshop	40-50		
	Laboratory	40 - 50		
Educational	Classroom	30 - 40		
	Library	35 - 40		
Hospitals	Wards	25 - 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. Noise level in decibels (dB) in different areas of Kathmandu is given in Table 4.

Table 4: Noise	<u>level</u> in decibels	(dB)	in different areas of Kathmandu
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Noise Level equivalent	Noise level as % of samples				
(N leq)	NI10	NI ₅₀	Nl ₉₅	Nl _{max}	
78.97	80.97	75.34	69.04	97.11	
75.21	78.00	71.96	64.62	94.19	
69.67	72.00	67.04	62.34	86.82	
74.52	77.02	70.44	63.38	92.27	
	Noise Level equivalent (N leq) 78.97 75.21 69.67 74.52	Noise Level equivalent (N leq) N 78.97 80.97 75.21 78.00 69.67 72.00 74.52 77.02	Noise Level equivalent (N leq)Noise level 78.97 80.97 75.34 75.21 78.00 71.96 69.67 72.00 67.04 74.52 77.02 70.44	Noise Level equivalent (N leq)Noise level as % of same Nlso78.97 80.97 75.34 69.04 75.21 78.00 71.96 64.62 69.67 72.00 67.04 62.34 74.52 77.02 70.44 63.38	

Source: Nepal: State of the Environment 2001, UNEP, p. 35. Note: Subscript values indicate sample size,

The information given in Table 5 reveals the fact that the degree of industrial noise pollution in Nepal is highly excessive than the acceptable noise level.

Table 5: Industrial Noise Level in Nepal

Industrial Area	Activity	Noise (dBA)	Level
Balaju Almunium Industry	Spinning	90-98	
Plastic Industries	Molding	97	
Balaju Yantra Shala Industry	Gutting	104	
Birganj Sugar Mill Biganj	Turbine	105	
Hulas Steel Industry Pvt, Ltd., Bara	Galvanizing	94	
Courses CDC D		_1	

Source: CBS, Environment Statistics of Nepal, 2004, p.21.

Food and soil contamination: Environmental pollution can also be transmitted through food and via soil. The soil may be chemically contaminated with a wide range of pollutants, including pesticides and heavy metals such as lead and cadmium. Agricultural activities, industry, landfill, and emission from road transport are all main sources of soil pollution. Direct contamination of foodstuffs may also occur as a result of the deposition of pollutants from the atmosphere, through the use of contaminated irrigation water, by application of pesticides and other substances to growing crops or livestock, and through contamination during processing and distribution (UNEP/WHO 1996).

Nepal is one of the few countries where food adulteration is posing a serious threat to public life. It is creating havoc in the society, as the large numbers of people are becoming its victims. Many people, particularly from the lower and middle income earning groups, fall victim of different diseases, though no statistical account is available to substantiate the fact.

Nepalese society is gradually becoming modernized with people's dependence growing on foodstuffs prepared on street corners, restaurants and small hotels. The foodstuffs in such places are prepared in most unhygienic environment close to public toilets and garbage containers. Such scenes are seen in most part of the country particularly at the bus-parks. Quite often, the utensils used for serving foodstuffs or liquor are not properly washed or washed with dirty water. Besides, most of the foodstuffs are badly exposed to dust, dirt, flies and the fumes of the vehicular traffic. The foodstuffs are also contaminated with harmful chemicals, colour, food additives and preservatives, which are detrimental to the health of the consumers.

Of the 2000 to 3000 items identified by the Department of Food Technology and Quality Control, nearly 20 percent are either of below standard or adulterated. Among these items, the adulteration is utmost high in items like oil and ghee where there is serious violation of food safety measures. Most of the consumer items, including vegetable oils, vegetable ghee, milk and milk products, cereal grains, spices, sweets, confectionery, tea and mineral water are contaminated, though in varying degrees (NHRC/WHO 2002).

Conclusion

The natural environment is suffering from pollution in almost all important areas related to air, water; noise, etc. Outdoor air pollution is caused primarily by vehicular pollution and poor road conditions while biomass burning has contributed to severe indoor pollution. Improper discharge of industrial and domestic wastewater has contributed to surface and ground water pollution. The growth in traffic, establishment of certain industries in particular localities and modern ways of urban life styles have contributed to noise pollution particularly in urban areas. 84 CNAS Journal, Vol. 33, No. 1 (January 2006)

Though direct correlation is not found between the environmental degradation and the major diseases in Nepal, it can not be ignored that some of the diseases like diarrhea, meningitis, kala-azar, viral hepatitis, parasitic infection, ulcer, respiratory infection, etc., affecting public health and killing so many people in different parts of the country are caused by environmental degradation. As a result of these problems, the public health is affected predominantly. It demands rational and effective measures from the planners and policy makers to control and minimize the situation.

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RESEARCH NOTE

BUDDHA'S LIFE DEPICTED IN THE SCULPTURS OF KAKREBIHAR

Dilli Raj Sharma

The Context

For quite some time Kakrebihar has been an archaeological enigma for the students of cultural history of Nepal, more precisely of west Nepal hills. The site of Kakrebihar (28°34' north 81°38' east) lies in the southern fringe of the Surkhet Valley, almost three kilometers from Birendranagar, the headquarters of Surkhet district in the mid-western development region of Nepal. The ruined site of Kakrebihar is known for the conglomeration of its superb art and architectural remains associated with Hinduism and Buddhism.

This article is intended to identify some of the notable sculptures whose descriptions have not been published yet. More specifically, the rich art of Kakrebihar shows the distinct knowledge about the advancement of Buddhist religion and art skill that had long been fostered in the region.

The Valley of Surkhet was popularly known as the central point, an entrepot of trade in the medieval period. This valley links the northern Himalayas to southern plains of Nepalgunj bordering India. From Tarai the route enters the Surkhet Valley and then passing through the mountainous regions, embracing the towns of Dullu and Sinja, capitals of the Khasa Malla rulers of the medieval period, proceeds further north towards the Tibetan border. During the medieval period this area was important not only for trade and commerce but also for peculiar forms of culture and art.

The site of Kakrebihar, well known as the centre of Buddhist art and culture of medieval times, yields many masterpicce sculptures as well as designs carved on independent stone slabs of the frieze which must have been the part of old shrine. The temple, which might have been plunged by the attack most brobably from outsiders, indicates the northern Indian *sikhara* styled (i.e. curvilinear) temple fully decorated with Buddhist sculptural art and several other designs. The remains of carved doorjambs confirm the entrance of the temple was beautifully delineatd with several figures of minor Buddhist deities in the niches and decorative scroll motifs around. In the year 2003 the Department of Archaeology of Nepal excavated the Kakrebihar site and successfully unearthed the debris of ruined structure of a stone temple. Hence, many sculptures of the Buddha and Buddhist subsidiary deities are recordable. This made us possible to assess the popularity of the developed form of sculptural art in this region.

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