

ENVIRONMENTAL PROBLEMS IN THE KATHMANDU VALLEY: SOME ISSUES IN PLANNING AND MANAGEMENT

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The problems resulting from rapid urban growth, haphazard development, and general lack of planning have been apparent in the towns of the Kathmandu valley¹ for more than three decades. During that period, Kathmandu routinely experienced serious lack of access, deficiency of infrastructure, traffic congestion, and inadequacy of housing. These problems were compounded by the continuing damage to the valley's cultural heritage and the rapid loss of precious agricultural land to urban uses. In addition to these chronic deficiencies, severe environmental degradation now threatens the quality of life in the valley.

Of late, the Nepali government has recognized environment as an important agenda in the nation's development programs.² For example, the seventh plan (1985-1992) for the first time treated environment as an integral component of development. Even the new constitution of Nepal (1991) mandates environmental protection and conservation as national priorities for the state policy. Nepal signed the 1992 UNCED convention in Rio and firmly put environmental considerations in her eighth plan (1992-1997). However, little real action has been directed towards environmental protection so far. As a result, Kathmandu's environmental degradation continues unabated.

Since the publication of the Brundtland report, Nepal and the many international donors that support her development efforts have articulated environmental sustainability as a crucial objective in Nepal's development. This is evident from the numerous workshops, seminars, and publications sponsored by the Nepali policy makers and external donors in Kathmandu over the past few years. However, because Nepal is still struggling to achieve basic necessities of life, environmental issues are often ignored during project implementation. Given her delicate natural landscape epitomized by the fragility of the Kathmandu valley, it is critical to ensure that Nepal's development efforts are environmentally sustainable.

This paper provides an overview of the environmental problems in urban Kathmandu that are relevant from planning perspective, and suggests an approach to tackle them.

Aspects of Environmental Problems

Environmental decay in the valley is reflected in all aspects of the physical landscape and urban living: land, water, air, and noise.³ These problems are not mutually exclusive, and they combine to intensify their overall negative impact on the environment and quality of life in the valley.

Land Pollution

Kathmandu municipality's record of solid waste management so far has been dismal. Consequently, land pollution is evident in the heaps of uncollected solid waste, illegal dump sites, open landfills, and exposed human and animal excreta in the streets. Open latrines are common sights in the Kathmandu valley towns where many residents, especially children, use the sidewalks for defecating.

Frustrated by the lack of services from the municipality, some business groups in Kathmandu have often taken up their own solid waste collection and disposal programs. However, in the absence of proper landfill facilities, the debris thus collected eventually ends up on urban river banks and vacant lands, continuing the problems of land pollution for the residents.

Severe lack of greenery and open space⁴ in the urban areas intensify the impact of all these forms of land pollution.

Water Pollution

Surface water in the Kathmandu valley is severely polluted by the industrial effluence, waste dumping, and the discharge of untreated sewage from residential areas. Rivers in the valley including Bagmati, Vishnumati, Manohara, and Hanumante are all seriously fouled for this reason.⁵ Because human and other waste are routinely discarded in the ponds, still water in the valley is even more polluted.

Seepage from septic tanks contaminate ground water in most of the urban area. Virtually all the Kathmandu homeowners build private septic tanks in their generally tiny land plots – often covering just 60 square meters – without sufficient room for soak pits. The still toxic semi-treated effluent from the tanks cannot find adequate area for dissipation and concentrates in the residential yards.

Piped drinking water in Kathmandu is also polluted due to various reasons. Firstly, the water at the intake storage itself is improperly treated. Secondly, the intermittent urban water supply (supplied only a few hours a day) creates

suction in the water supply pipes during the run of water. Waste from ground sources and leakage from adjacent sewage lines, frequently enters the water supply system, contaminating the drinking water.

Empirical studies of drinking water throughout Nepal have found that the fecal coliform contamination in the water consistently exceeds WHO guidelines for water considered fit for human consumption.⁶ A report by an international consultant concludes, "Kathmandu's drinking water is hosting disease causing microbes and hazardous chemicals." According to the same study, the laboratory analysis of tap water from representative locations of the Kathmandu urban area disclosed that almost 90% of the sample was impotable.⁷

Air Pollution

Air pollution has so dramatically upsurged during the last few years that many people in the city areas wear face masks to protect themselves from the smog and dust. Increased levels of particulate matters, carbon monoxide, sulfur dioxide, hydrogen sulfide, nitrous oxide, and lead have drastically reduced the quality of air in the valley. As a result, Kathmandu is now routinely compared to heavily polluted cities such as Calcutta, Santiago, Mexico City, and Bangkok. Some reports have even claimed that Kathmandu is the second most polluted city in the world.⁸ The increased air pollution is a consequence of rapid growth in the number of motor vehicles,⁹ inferior quality of automobile engines, adulterated fuel products, and presence of polluting factories within the valley. The bowl shaped physiography and the resulting inversion effect in the atmosphere amplify the air pollution by trapping the foul air within the valley's immediate atmosphere. Furthermore, lack of dust control mechanisms in construction, industrial and business activities, cumulative dirt in the side walks, and household smoke all contribute to air pollution. Congestion and severe shortage of public open space and greenery in the urban area aggravate the air pollution problems.

Noise Pollution

Outdated vehicular engines, increased air traffic at Tribhuvan International Airport (TIA), and the siting of industries near residential precincts are fast turning noise pollution into a major problem in urban Kathmandu. Weak transportation planning, and virtual lack of traffic discipline on the part of the drivers result in near continuous sounding of horns in the streets of Kathmandu.

There are many reasons for the growth of noise pollution from the aircraft in the Kathmandu valley. First, TIA is located in close proximity to the centres of population. Second, the airport is experiencing a rapid growth in

air traffic,¹⁰ thanks to the increased economic and commercial activities in the valley and the nation. Third, the physiographic configuration of the valley limits choice of flight paths for the aircraft. Outgoing jet planes must circle the valley at least once to gain enough altitude to surpass the surrounding mountains of the Kathmandu valley. Incoming jet planes also circle the valley before landing. Thus the flight paths at take off and landing are located immediately above the dense urban settlements of the valley, exposing the population to aircraft noise.

Effects of Environmental Degradation

Environmental degradation of the urban area engenders the following the significant negative effects on the residents of the Kathmandu valley.

Poor Public Health

The first casualty of the environmental degradation in the city is the health of its residents. Deterioration of public health, especially due to increase in the respiratory and gastro-intestinal diseases, has already become a concern in Kathmandu Valley. A World Bank report confirms that the South Asian countries are facing increased health cost as a result of environmental degradation caused by industrial pollution, atmospheric emissions, land degradation, soil erosion and loss of bio-diversity.¹¹

Regarding solid waste, some reports have dramatically concluded that "the numerous uncontrolled waste heaps developed in close proximity to dwellings... constitute a massive threat to public health."¹²

Although, waterborne and airborne diseases have long been prevalent in Kathmandu, lately they have become widespread. Complaints by the residents of gastro-intestinal problems that are linked to contaminated drinking water are now commonplace in the valley. In addition, growing incidence of typhoid, cholera, diarrhea and hepatitis "A" are attributable to the polluted drinking water.¹³

The severe air pollution in the valley has been reportedly linked to the increased incidence of respiratory diseases such as asthma and chronic bronchitis in Kathmandu. Dust pollution causes frequent throat and bronchial infection, as well as other respiratory and skin allergies.¹⁴ "Smog Ozone" formed by the reaction of ozone and other pollutants in the air irritates lung membranes reducing its ability to resist heart problems.¹⁵

Although frequently accorded lesser significance than other forms of pollution, noise can have severe consequences on the health of the residents. A constant exposure to a high level of noise causes permanent hearing loss. Noise has also been linked to insomnia, ulcers, and hypertension.¹⁶ Increasing levels of noise pollution are already adversely affecting the health of many Kathmandu residents.

Decline in Tourism

Tourism, the major foreign exchange earner for Nepal, has suffered directly as a result of environmental degradation. Whereas Kathmandu was once hailed as enigmatic "Shangri-La," numerous articles and news clips condemning its poor environmental quality now regularly appear in both domestic and foreign press.¹⁷ Such publicity deters potential tourists from visiting Kathmandu, the main tourist destination and the hub of travel activities in Nepal. According to a report, the number of foreign visitors in 1993 was down by 15% compared to 1992, and was further reduced by 30% in 1993/94.¹⁸ Nepal's honorary consul general in Toronto, Dr. Kunjar Sharma, says: "After personally experiencing the filth in Kathmandu during my recent trip, I often feel uncomfortable in issuing visas to Canadian tourists wishing to visit there."¹⁹ If the image of "dirty Kathmandu" continues to grow on the minds of potential tourists, the lucrative tourism industry may suffer a big setback. The loss will directly and adversely impact Kathmandu's economy, reducing jobs and income for its residents.

Decay of cultural heritage

Although the decay of the much cherished cultural heritage of Kathmandu is not the exclusive consequence of environmental degradation, it is accelerated by this phenomenon. Corrosive chemicals in the polluted air attack the surface materials in buildings, consequently disfiguring and sometimes even destroying the facades of historic landmarks. Additionally, water pollution has adversely affected brick and stone paving in the public squares and stone water taps. Uncollected debris and untreated liquid waste taint the visual and olfactory charm of the grand public spaces and palace squares, for which the three towns of the valley have long been famous.

Declining Productivity

Labour productivity also declines as a result of poor environment. Increased absenteeism due to sickness and failing health can significantly cut worker productivity. Residents of Kathmandu already spend more time treating drinking water at home by manually boiling and filtering. Furthermore, agricultural productivity of land deteriorates due to soil contamination caused by chemicals in the fields.

Loss of Amenities

Public amenities such as parks, public baths, and play grounds are already severely limited in urban Kathmandu. When environmental degradation reduces their utility, these amenities are further curtailed for public use. For example, the polluted water in the Rani Pokhari and the Bagmati, waste pile

up in the Ratna Park, and filth in parts of Tundikhel has drastically reduced their public "amenity value". Pollution has also diminished the beauty of the valley's idyllic surroundings and hindered the aesthetic quality of Nepal's famous traditional architecture and design. For instance, the three palace squares of the valley, the Pashupatinath temple area, and old parts of the three major towns clearly exhibit the negative impacts of environmental degradation.

Additional Hardship for the Poor

Rapid urbanization has caused a proliferation in the number of poor residents in the Kathmandu valley towns. Traditionally, poor residents have occupied town fringes, flood-prone lands, and other environmentally fragile areas. The valley's deteriorating environment has worsened the plight of these residents.

A recent World Bank study has found that environmental degradation in a city disproportionately torments poor residents.²⁰ For example, the poor have to pay unduly high prices for water and other basic services, depleting their already meager earnings. Because poor are often forced to live in the hazardous and most polluted areas of city, they are least served by environmental infrastructure and services. Poor residents are also more likely to become routinely sick, as they inhabit hazardous locations in the city.

Reduced Property Values

Parts of city which are polluted or are in close proximity to landfill sites, polluted water and land are perceived by residents as "undesirable." Consequently, environmental degradation of an area causes decline in the property value of houses and land in the immediate vicinity. The perception of "undesirability" of the area for living and pleasure purposes can drastically reduce its commercial and residential potential and hence the real estate values in the surroundings. Some industrial countries have already experienced a dramatic reduction in the value of polluted land sites. Contaminated sites, in fact, can become liabilities to the owners because of their gigantic cleaning costs.²¹

Framework for Environmental Policy

At present, legislation affecting environmental protection in Nepal is limited.²² Appropriate public policies in national, regional and macro-economic levels are required to provide a framework to reduce the environmental degradation of urban Kathmandu. Detailed regulations in the following areas can be devised to alleviate Kathmandu's environmental problems.

- a. Decentralization and regional planning;

- b. Macroeconomic policies, such as privatization, poverty alleviation, and employment generation; and
- c. Comprehensive planning for the valley

Decentralization should be accompanied by proper regional planning to reduce the pressure of the existing uncontrolled urbanization in the Kathmandu valley by creating other centres of attraction for prospective businesses and residences. It should start a process of devolution of real power to centres away from Kathmandu. This could include moving much of the heavy industrial activities, relocating services such as banking, educational institutions, and even the international airport to outside locations. Shifting important activities immediately to potential satellite towns such as Banepa²³, Dhulikhel and Trishuli can help to relieve the current acute pressure in Kathmandu's environment.

Kathmandu's municipalities should undertake comprehensive planning to direct and control growth and development. All components of the plan such as transportation, business development, housing, and urban design should explicitly incorporate environmental concerns. Although many valley-wide urban development and planning studies have been developed in the past, a "planning act" is yet to materialize. Furthermore, until recently, these plans have not been implemented and in all such efforts environmental concerns have remained marginal.

Macroeconomic policies significantly impact the environment. Excessive environmental pollution has been linked to "market failures and policy distortions exacerbated by unemployment, landlessness, and poverty".²⁴ Privatization of certain services such as waste management, public transportation, and operation of public amenities such as parks, picnic spots, and sports facilities will help to maintain the environmental quality in urban area. For example, many residents in urban Kathmandu are capable and willing to pay for waste removal services. Private agencies under a contract from the municipality can profitably undertake such services on the basis of user charges.

Similarly, the few parks and open spaces that exist in the city have presently become the dumping grounds for solid and liquid waste, including animal and human excreta. In order to clean them up, municipalities may draw contracts with private providers for a sufficient period of time, allowing the agencies to charge the users on a commercial basis. International donor agencies such as the World Bank maintain that many municipal services can be efficiently and economically carried out by private contractors under various schemes, such as build-and-operate, long term contract, sub-contract, and concessions. Under such arrangements, private investors can undertake

significant clean up, improvement, and maintenance of the facilities to reverse their environmental degradation. For example, the Ratna Park, the Balaju Park, the Gokarna and Godavari picnic areas, and the sports stadium can be privatized in this manner.

Policy Instruments for Environmental Protection

Three types of policy instruments and tools have been tried internationally to protect urban environment: command and control, economic, and planning instruments. Each instrument has a specific utility, and together they are most effective when applied in a proper combination suitable for Kathmandu's situation.

"Command and Control" Instruments: These instruments attempt to protect the environment by specifying environmental standards and regulations. The government gets more directly involved in the preparation and enforcement of command and control instruments. Effective utilization of these instruments, requires highly skilled and well-trained manpower. Command and control instruments manifest themselves in various forms, most significantly:

Legislation: Legislation can be passed to establish environmental standards. They are enforced through, national and local government regulations.

Permits and Licenses: Permits and licenses are given to industries, businesses, and auto owners when the above standards are complied with. Permits are periodically renewed or revoked on the basis of whether the standards are continually being met by the industry.

Land and water use by-laws: These controls are devised through zoning, subdivision regulations, density controls and other by-laws and regulations.

"Economic" Instruments: These instruments attempt to influence the behaviour of polluters by offering economic incentives and punishments to achieve environmental protection. They can be highly effective in environmental protection if properly designed and implemented. The government is relatively less directly involved in the application of economic instruments. These instruments often manifest in the forms such as follows:

Pollution charges: These are based on "polluter pays" principle, whereby polluters such as carpet industries, and garbage generators pay charges to the

government for each specified amount of pollution generated. Penalties for excessive generation of pollution can be levied to modify the behaviour of such industries.

Deposit refund system: Deposit is collected on items that if disposed can generate garbage. It is refunded when the empty containers are returned to authorized locations. The classic examples are deposits on soft drink and beer bottles and cans and plastic milk containers.

Such deposits already exist in Nepal for soft drink bottles. Residents sell other bottles and containers to recycling vendors. Given the present level of economy, there is little room for expanding the "deposit return" system in the Kathmandu valley towns. But it will have increased applicability as the residents attain higher levels of income.

Taxes and subsidies: Taxes on environmental externalities have been recognized as legitimate intervention by government. Tax increases or rebates can be devised to encourage clean production procedures and discourage polluting technologies. According to a World Bank case study in Mexico and Indonesia, taxes on "dirty" fuels are the least costly instruments for efficiently reducing pollution.²⁵

Marketable permits: In some advanced countries, tradeable permits have been utilized to limit the total amount of pollution in a given geographic area. Each industry is given a permit for a prescribed amount of pollution which can be freely traded in the market. If an industry produces less pollution than is allowed, it can sell the remainder of the permit. Similarly, industries may buy permits for "right to pollute" from the market, making the use of pollution reducing technologies in their own interest.

User Charges: User charges raise revenues for public authorities and also modify people's behaviour to reduce and limit the pollution. For example, charges for sewerage connection and garbage collection can be levied on residents utilizing these services. A well designed charge system can both generate municipal revenue and help reduce the production of waste by the residents. For instance, in some states of the United States, a system of pay-per-bag of residential solid waste has effectively contributed to reducing the garbage generation.²⁶

Planning Tools: Planning tools include regulations, guidelines, negotiation, education, and public participation devised for the protection of

the environment. In Kathmandu, the few planning tools so far available have largely remained ineffective.

Although traditional urban planning, building design, and construction methods in Kathmandu followed environmentally sound practices in the past, they were always tacit. Given the gigantic scale of development in the valley today, explicit planning guidelines promoting environmental conservation are likely to yield desired results.

For example, air pollution can be reduced by restricting the use of automobiles,²⁷ revising the lay-out of residential areas, and expanding the exclusive pedestrian zones. Proper orientation and lay-out of housing, adequate ventilation, solar access, and landscaping in building projects can contain the effects of air pollution.

Education can be a strong tool for environmental conservation, especially in the long run. Environmental education both in public information level and also as a part of school and college curriculum can help the environment. Such educational strategy was experimented in Nepal in the eighties for the conservation of cultural heritage.²⁸

Negotiation with stakeholders in urban development, such as developers, builders, and industrialists, can effectively minimize the negative environmental impacts of growth. For instance, developers may be willing to provide extra open spaces and public amenities in exchange for additional floor space or zoning variance granted by the authorities.

The role of public participation in the process of environmental protection cannot be overemphasized. Traditionally, the decision making process in Nepal's planning arena has been top-down, without hearings, consultations, or negotiation with interested parties and the general public. The resulting decisions have often been unrealistic and ineffective, and as a result, have invited public apathy to the entire process.

If environmental protection is made an explicit agenda for all development and urbanization schemes, and the decision making process is made participatory, Kathmandu's residents are likely to support the environmental protection measures proposed by authorities. They will also become aware of the environmental problems of development and be more likely to take initiatives in protecting the environment.

Comparative Applicability of Policy Instruments

Table 1 provides an overview of the relevance, benefits, problems, and suitability of various regulatory, economic, and planning instruments that may be utilized in Kathmandu to achieve environmental protection.

Table 1

Instruments	Relevance				Advantages	Problems	Suitability and Relative Priority for Kathmandu
	Ground and Surface Water Protection	Air Pollution Control	Solid Waste Management	Noise Pollution Control			
Command and Control Ambient ground and surface water quality standards	x				Defines desired target levels and forms the basis for evaluating implementation	Requires advanced tools and technology for measurement and monitoring	A beginning has to be made to establish these standards; Moderate priority
Standards for the digging of shallow and deep tube wells	x				Provides locational criteria for obtaining safe water and to control depletion of ground water	Difficult to verify compliance	Much needed area of regulation in light of prolific well digging activities; High Priority
Minimum standards for housing plot size and shape	x	x		x	Provide open space, control density, and ground coverage for septic tanks	Inappropriate size will hinder affordability	Important to relieve congestion and control sprawl, Moderate Priority
Effluent standards for sewage	x				Regulates hazardous effluent dumped in drainage system	Expensive to enforce	Regulations desired suggesting a time frame; Moderate priority
Effluent standards for industrial discharge	x				Regulates hazardous effluent in surface water and rivers	Requires equipment and facilities to monitor	Important to reduce dumping by carpet, garment, and tanning factories; High priority

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Table 1 contd...

Instruments	Relevance				Advantages	Problems	Suitability and Relative Priority for Kathmandu
	Ground and Surface Water Protection	Air Pollution Control	Solid Waste Management	Noise Pollution Control			
Product standards for cleaning chemicals such as detergents and disinfectants	X				Limit and decrease surface and ground water pollution	Safe products are not generally available in the local market	Hazardous products can be banned within a given time frame; Moderate Priority
Emission standards from industries		X			Abundant international experience, proving their effectiveness	Implementation is complex, and monitoring is expensive	Immediately applicable to selected industries viz. cement factories and brick kilns; High priority
Emission standards for vehicles		X			Effective mechanism to control air pollution	High monitoring cost, costly inspection procedure	Already being tested; low enforceability; High priority
Product standards for petroleum fuel, kerosene, and gas		X			Effective means of pollution control, relatively easy to enforce	Expensive for private auto owners and transportation industry	Requires negotiation with foreign suppliers; High priority
Standards for garbage storage, collection and disposal			X	X	Relatively simple procedure	Facilities and equipment are required	Feasible; High priority
Recycling regulations		X	X		Simple regulations, effective in controlling pollution	Facilities and equipment are required	Some mechanisms already exist; Priority

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Table 1 contd...

Instruments	Relevance				Advantages	Problems	Suitability and Relative Priority for Kathmandu
	Ground and Surface Water Protection	Air Pollution Control	Solid Waste Management	Noise Pollution Control			
Product standards for containers: plastic bags, jugs, metal boxes, etc.			x		Relatively simple, feasible in the given technology	Bio-degradable plastic bags may be expensive	Feasible; Priority
Standards on the burning of refuse		x	x		Effective especially for bio-hazardous materials	Non-polluting technology is expensive	Feasible for selective materials
Noise standards for industries and aircraft				x	Establish targets, and educate industries	Monitoring and testing requires specialized equipment	A good start for the valley, Moderate priority
Economic Deposit return system for bottles, cans, containers			x		Very little government supervision required	Increased transportation cost for users, recycling facilities required	Existing for soft drink bottles, beer bottles and containers indirectly recycled; limited room for expansion
Marketable permits	x	x			Raise public revenue	Complex implementation and administrative system required	Not suitable at present

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Table 1 contd...

Instruments	Relevance					Advantages	Problems	Suitability and Relative Priority for Kathmandu
	Ground and Surface Water Protection	Air Pollution Control	Solid Waste Management	Noise Pollution Control				
User charges	X		X			Raise revenue, and offset service costs	Charge collection mechanism has to be administered	Feasible for solid waste and liquid waste disposal; Moderate priority
Tax increase and rebate	X	X	X	X		Relatively easy system to devise	Revenue lowered	Feasible; Moderate priority
Subsidies for "clean" products	X	X				Easy to administer	Loss in revenue	Can be tested in selected areas
Penalties and credits	X	X		X		Encourage compliance	Reliable implementation needed	Feasible, especially in case of excessive polluters, and clean industries
Zoning and land use regulations	X	X	X	X		Improve quality of life and control pollution	Standards and regulations should be appropriate for Kathmandu; often difficult to enforce	Existing ones are tenuous; private influence hampers enforcement; High Priority
Land use controls for siting of particularly high polluting industries	X	X		X		Provide advance warning to proprietors; effective in mitigating impact on residents	Require expansion of infrastructure and services; additional initial cost	Feasible; High priority

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Table 1 contd...

Instruments	Relevance				Advantages	Problems	Suitability and Relative Priority for Kathmandu
	Ground and Surface Water Protection	Air Pollution Control	Solid Waste Management	Noise Pollution Control			
Transportation planning, especially exclusive pedestrian zones		x		x	Effective in reducing pollution and mitigating its effects on residents	Open spaces required; difficult to implement in private developments	Desirable tool; Moderate priority
Guidelines for landscaping, open space, density, and layout		x	x	x	Provide prototypes, and encourage desirable development, no public cost	Difficult to regulate	Desirable tool; High priority
Education, participation, and negotiation	x	x	x	x	Effective approaches for environmental protection	Requires skilled, and well trained public administrators and managers	Feasible; High priority

Source: Adapted from Bernstein, J. (1993), *Alternative Approaches to Pollution Control and Waste Management, The World Bank, Washington D.C.*

Notes

- The author received a Doctor of Design (urban planning) from Harvard University, and is currently affiliated with Institute of Environmental Research (IER) in Toronto, Canada. Views expressed in this article represent those of the author.
1. Kathmandu Valley includes three major towns: Kathmandu, Lalitpur, Bhaktapur, and other urban settlements such as Kirtipur, Thimi, Sankhu, and Godavari. In this paper "Kathmandu" or "Urban Kathmandu" also denote this geographic constellation.
 2. See 7th and 8th Plans, National Planning Commission (NPC), Kathmandu. A "Ministry of Environment" was established by His Majesty's Government of Nepal (HMGN) in the eighties. The Environmental Protection Council (EPC) was set up in 1992 under the chairmanship of the Prime Minister. An "Agriculture, Forestry, and Environment Division" is organized within the NPC. HMGN is contemplating an act to mandate EIA studies for selected development projects.
 3. The Metropolitan Environmental Improvement Program (MEIP) in Asia, a World Bank-UNDP program, has included Kathmandu valley in 1993 among its six projects. It identifies, haphazard development, traffic congestion, and water, air, and solid waste pollution as priority planning areas for the Kathmandu valley. See MEIP booklet, The World Bank, Washington, D.C., 1993 (?).
 4. WHO recommends 11 square meter per person of green open space in the cities. The city of Kathmandu (pop. 360,000) alone would require about 400 hectares of green open space. Although exact figures are unknown, available open space in Kathmandu is significantly less.
 5. For a detailed account of Bagmati's pollution, see A. Dixit in *Himal*, Jan/Feb 1992, Kathmandu.
 6. See HMGN, EPC (1993), *Nepal Environmental Policy and Action Plan*, p. 51
 7. Water samples from five treatment plants revealed that 38% was undrinkable, 22% contained excessive levels of chlorine, and 18% was polluted by pathogens at the source itself. 34 samples of tap water from representative areas of Kathmandu showed that 72% was undrinkable, a further 16% did not meet WHO guidelines, and only 12% was drinkable. See *The Independent*, Kathmandu, Nov. 3, 1993.
 8. These reports are perhaps, technically inaccurate. According to a 1993 study by US scientists, average carbon mono-oxide emissions by vehicles in selected Asian cities were: Kathmandu-3.9%; Taipei-1.49%; Bangkok-2.2%; Seoul-0.84%. (See *Himal* Sept./Oct. 1993). As *Himal*

asserts, comparing Kathmandu with more developed cities is unfair. However, Kathmandu's emission level is close to that of Mexico City (4.3%), widely considered the most polluted major city.

9. In 1987, approximately 20,000 tons of pollutant were emitted by Kathmandu's 25,000 vehicles. This increased to 64,000 in 1992. See R. Arya in M. Dahal and D. Dahal ed. (1993), *Environment and Sustainable Development: Issues in Nepalese Perspective*, Kathmandu. For a baseline estimate of vehicular emissions in Kathmandu, see Dhamala B. (1983), *Proceedings of Seminar on Environmental Management*, Environmental Impact Study Project, HMG, Kathmandu
10. According to Japan International Co-operation Agency (JICA), the number of flights at TIA will grow at 3.4% per annum. See Halcrow Fox, PPK, Cemat consultants (1991), *Kathmandu Valley Urban Development Plans and Programs*, Kathmandu, p. 39
11. The World Bank (1993), *Annual Report*, Washington D.C. p. 45-46.
12. NPC/IUCN (1992), *Solid Waste Management in Urban Nepal*, Kathmandu, p. 7.
13. Conversation with Dr. Prativa Pandey, practicing internist in Kathmandu.
14. Conversation with Dr. B. N. Adhikari, physician at Tribhuvan University Teaching Hospital in Kathmandu.
15. Gay K. (1991), *Air Pollution*, Franklin Watts, New York, p. 18.
16. See Finney S. (1984), *Noise Pollution*, Franklin Watts, New York; and Stephen R., in Hartshorn T. (1992), *Interpreting the City: an Urban Geography*, John Wiley and sons, New York
17. For example, Kathmandu's dailies and weeklies frequently cover air pollution. Reputed magazines like Himal routinely carry articles about Kathmandu's increased filth, pollution, and environmental decay. Similar articles and news clips have appeared in the international press, including the *Far Eastern Economic Review*, *Los Angeles Times*, *New York Times*, *Washington Post*, and *Toronto Sun*.
18. 1993 data from news item from Oxford Analytica Pacific Daily Brief, Nov. 25, 1994. It states that tourism has been badly hit by "pollution in Kathmandu." 1993/94 figures according to *The Independent*, Kathmandu, Jan. 12, 1994.
19. Personal conversation. Dr. Sharma made this comment specifically about Kathmandu, as a constructive suggestion for concerned planners. He strongly encourages tourists to see Nepal, especially beyond Kathmandu.
20. See Leitmann, J. (1994), *Rapid Urban Environmental Assessment*, The World Bank, Washington D.C.

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21. For instance, cost of clean up for some building sites owned by the City of Toronto in Canada exceeded their land value, making them effective liabilities. (Author's personal experience while working for WoodGreen Community Housing in Toronto, 1992-93.)
22. For a comprehensive account of the existing Nepali environmental legislation and regulations and their inadequacy for a sustainable development, see Adhikari R. (1994), *Sustainable Development Through Environmental Regulation in Nepal: With Special Reference to Ecotourism*", Ph. D. Dissertation, Arizona State University, Tempe, Arizona
23. See Bajracharya B., in *Himal*, Jan/Feb, 1992, Kathmandu, for arguments to develop Banepa to counteract Kathmandu's growth.
24. See Munasinghe M. (1993), *Environmental Economics and Sustainable Development*, The World Bank, Washington, D.C.
25. The World Bank (1993), *Annual Report*, p. 91
26. Bernstein J. (1993), *Alternative Approaches to Pollution Control and Waste Management*, p. 55
27. In Santiago, Chile, personal use of vehicles in the city is restricted by allowing odd or even numbered plate, on alternate days of the week.
28. In 1985-86, Nepal Heritage Society, a local NGO conducted a national essay competition for high school students in order to arouse awareness about heritage conservation. With attractive prizes, it was successful in drawing numerous entries from across the country.

References

- Adhikari, A. 1990. "Appropriate Standards for Low Income Housing for Kathmandu, Nepal." Doctoral Dissertation. Harvard University, Cambridge, Massachusetts.
- Adhikari, R. 1994. "Sustainable Development Through Environmental Regulation in Nepal: With Special Reference to Ecotourism." Ph. D. Dissertation. Arizona State University, Tempe, Arizona.
- Bernstein, J. 1993. *Alternative Approaches to Pollution Control and Waste Management: Regulatory and Economic Instruments*. Urban Management Program (UMP). The World Bank, Washington D.C.
- Dahal, M and D. Dahal. 1993. *Environment and Sustainable Development: Issues in Nepali Perspective*. Nepal Foundation for Advanced Studies (NEFAS), Kathmandu.

- Dhamala, B. 1983. "Pollution Problems." *Proceedings of seminar on Environmental Management*. Environmental Impact Study Project, HMGN, Kathmandu.
- Environmental Protection Council (EPC), HMGN. 1993. *Nepal Environmental Policy and Action Plan: Integrating Environment and Development*. Kathmandu.
- Finney, S. 1984. *Noise Pollution: A Scientific and Psychological Look at New Hazard*. New York: Franklin Watts.
- Gay, K. 1991. *Air Pollution*. New York: Franklin Watts.
- Halcrow, Fox, PPK. 1991. *Kathmandu Valley Urban Development Plans and Programs*. Kathmandu: Cemmat Consultants.
- Hartshorn, T. 1992. *Interpreting the City: An Urban Geography*. New York: John Wiley & Sons.
- Leitmann, J. 1994. *Rapid Urban Environmental Assessment*. Urban Management Program (UMP), The World Bank, Washington D.C.
- Munasinghe, M. 1993. *Environmental Economics and Sustainable Development*. The World Bank, Washington, D.C.
- National Planning Commission/International Union for Conservation of Nature. 1992. *Solid Waste Management in Urban Nepal*, Kathmandu.
- NPC/IUCN. 1992. *National Environmental Impact Assessment Guidelines*. Kathmandu
- NPC. 1985. *Seventh Plan*. Kathmandu.
- NPC. 1992. *Eighth Plan*, Kathmandu.
- The World Bank. 1993. *Annual Report*. Washington, D.C.
- World Commission on Environment and Development. 1987. *Our Common Future*. Oxford: Oxford University Press.