Chapter 8

Urban Environment

Introduction

Urban areas play an important role in economic, political, and cultural development. The concentrated population and production in urban areas leads to greatly reduced unit costs in providing and managing basic infrastructure and services, better employment and livelihood opportunities, and easier participation in the political process. The same concentration, however, makes urban areas consumers of resources and producers of pollution, resulting in a wide range of environmental problems in the cities and beyond.

Historically, cities grew gradually over long periods of time, which provided time and opportunity to address their emerging needs. In the past half-century, the pace of urbanization in developing countries has accelerated greatly. Often, rapid urban growth has taken place without matching expansion of the infrastructure, services, and facilities necessary for an adequate and healthy urban environment, and without adequate planning or regulation. This has caused deterioration in urban environmental quality. Urban areas commonly face shortages of safe drinking water and inadequate provision of sanitation, solid waste collection and disposal, drains, paved roads; and other forms of infrastructure and services necessary for a healthy environment. This results in bad water and air quality, unmanaged or mismanaged waste, and increasing noise pollution. Urban areas also face problems in controlling encroachment into public spaces and degradation of cultural sites and heritage. Rapid urban growth in itself need not produce serious environmental problems provided environmental implications are considered in a systematic, timely, and adequate way.

Kathmandu Valley is the most urbanized region in Nepal and its urban areas have been important economically, administratively, and politically for hundreds of years. The urbanization of Kathmandu Valley goes back over 1500 years, and the old towns of the Valley are characterized by a strong cultural history and pattern—dense settlement with courtyards as in-town open space, squares as intervening open spaces, temples and other cultural sites, and greenery and open space at the periphery. The old settlements were located at relatively higher elevations and surrounded and separated from each other by agricultural land; almost all waste was biodegradable, and sewage was used in agriculture. Until fairly recently, except for sanitation, the environmental quality of the Valley towns was excellent (HMG/UNDP 1994). In the process of rapid growth, Nepal's urban areas now face all the above-mentioned problems of infrastructure and service deficiency, and environmental management.

Urban Growth and Features

Urban Settlements

The municipalities designated by the Ministry of Local Development are the areas in Nepal formally defined as urban. The criteria for designating municipality status have been revised several times since 1952 (Table 8.1). The current definition is given by the Local Self Governance Act 1999, which classifies municipalities into three hierarchical levels: metropolitan city, sub-metropolitan city, and municipality. At present there are 1 metropolitan city (Kathmandu), 3 sub-metropolitan cities (Biratnagar, Lalitpur, Pokhara, and Birganj), and 53 municipalities.

The density, contiguity, and occupational structure of the population—which are generally accepted criteria for defining urban areas—have never been considered in designating municipalities

NEFEJ

Crowded Kathmandu

Table 8.1: Criteria for Urban Status

Act or Guidelines	Criteria
The 1952/54[a] census	Identified 10 "prominent" settlements with populations exceeding 5,000 (but not formally categorized as urban areas).
The 1961 census	An area with a population cluster exceeding 5,000 and having an urban environment such as high school, college, judicial and administrative offices, bazaar, communication facilities, mills, and factories.
The Municipality Act of 1962	An area with a population exceeding 10,000 with an urban environment
Local Self-Governance Act 1999	Metropolitan city: a municipality with a "minimum population size of 300,000; annual revenue of at least NRs400 million ; facilities of electricity, drinking water, communication, paved main and subsidiary roads; provision of specialized health services; essential infrastructure for international sports events; adequate opportunities for higher education in different fields; at least one established university; adequate urban facilities, and an area that has already received the status of Sub-Metropolitan". Sub-Metropolitan city: a municipality with a "minimum population size of 100,000 ; annual revenue of at least NRs 100 million; facilities of electricity, drinking water, communication, paved main roads, education and health services of high standard; general infrastructure for national and international sports events, provision of public parks , a city hall , and similar urban facilities; and that has already received the status of a Municipality". Municipality (Terai): minimum population size of 20,000; annual revenue of NRs5 million ; and minimum urban facilities such as electricity, roads, drinking water, and communications Municipality (Hill/Mountain): minimum population size of 10,000; annual revenue of NRs500,000, and minimum urban facilities such as electricity, roads, drinking water, and communications

[a] Census of 1952/54 covered two Nepali years, approximately mid April 1952 to mid April 1954.
Source: Ministry of Law and Justice (1999); Sharma (2003)

in Nepal. Population size, revenue generation, and availability of facilities and services appear to be the basis for designating a settlement as an urban or municipal area. These criteria, however, have not been strictly and consistently applied over the decades in assigning municipality status to a locality. Some areas have been classified, de-classified, and re-classified as municipalities over the past 50 years, and the territorial boundaries of many settlements have been re-drawn to include surrounding rural areas to meet the population size criteria. This might have been motivated by political interests. As a result, significant parts of the territories of several formally defined municipalities may not exhibit an urban character, while other settlements like small or emerging towns not yet formally defined as municipalities may show a more urban character.

Population Trends

Nepal is one of the least urbanized countries in the world. In 2001, the last year for which reliable statistics are available, 14% of the population lived in urban areas. However, the rate of urban growth has been fast in recent decades: the rate of urbanization increased markedly from the 1970s onward and is among the highest in Asia and the Pacific. Between 1952 and 2001, the number of formally designated urban centers grew from 10 to 58, with a corresponding increase in urban population from 0.2 million to 3.2 million; a sixteen-fold increase. The urban population was only 3% in 1952 (Table 8.2). The ratio of urban population to total population has increased progressively, and the annual average growth rate of urban population exceeded the national population growth rates throughout the period from 1952 to 2001. One projection suggests that Nepal's urban population will be more than 6 million by 2011, the 58 municipalities will contain over 20% of the national population, and 16 towns will exceed 100,000 population (Joshi 1999). In general, urban growth is expected to continue rapidly. According to the ADB (2000), the major reasons for rapid growth in Nepal's urban population include the following:

(i) High levels of rural to urban migration: the general trend of migration in Nepal is from Hill/Mountain regions to the Terai (plain) and from rural to urban. The insurgency that began in 1996 has significantly accelerated rural-urban migration;
(ii) A high population growth rate;
(iii) Extension of existing municipal boundaries; and
(iv) Designation of new municipalities.

With increasing urbanization, the urban economy is growing at a rate of 6.4% per annum, more than double that of the rural economy, and the contribution to the national economy is estimated to be around 60% of gross domestic product (GDP) (Nippon Jogesuido Sekkei 2002).

Table 8.2: Summary of Urban Growth Trends in Nepal 1952/54 [a]–2001

Item	1952/54[a]	1961	1971	1981	1991	2001
Urban population ('000)	238.3	336.2	461.9	956.7	1,695.7	3,227.9
Number of urban places	10	16	16	23	33	58
Percentage of Urban Population (and Places) by Region						
Hill/Mountains	0	4.8 (3)	7.4 (3)	8.7 (4)	11.4 (8)	17.8 (20)
Kathmandu Valley	82.6 (5)	64.9 (5)	54.0 (3)	38.0 (3)	35.3 (3)	30.9 (5)
Inner Terai	0	0	3.5 (1)	10.1 (4)	9.5 (4)	12.1 (8)
Terai	17.4 (5)	30.3 (8)	35.0 (9)	43.2 (12)	43.9 (18)	39.2 (25)
Level of Urbanization by Region (Urban Population as % of Total Population)						
Hill/Mountains		—	—	1.2	2.5	6.4
Kathmandu Valley	—	—	—	47.4	54.1	60.5
Inner Terai		—	—	7.6	9.5	18.0
Terai	—	—	—	6.8	9.4	12.3
Nepal	**2.9**	**3.6**	**4.0**	**6.4**	**9.2**	**13.9**
Average Annual Growth Rates of Urban Population During Intercensus Periods (10 years)						
Hill/Mountains	—	—	7.78	9.27	8.73	11.58
Kathmandu Valley	—	—	1.36	3.86	5.11	5.22
Inner Terai	—	—	—	19.59	5.18	9.34
Terai	—	—	4.74	9.82	6.06	5.44
Nepal's Urban Area (overall)	**—**	**—**	**3.23**	**7.55**	**5.89**	**6.65**
Urban Density (person s per km^2)						
Hill/Mountains	—	—	—	—	—	550
Kathmandu Valley	—	—	—	—	—	10,265
Inner Terai	—	—	—	—	—	402
Terai	—	—	—	—	—	1,092
Urban Total	**—**	**—**	**—**	**—**	**—**	**985**
Rural Total	**—**	**—**	**—**	**—**	**—**	**136**

— = not available , km^2 = square kilometer
[a] Census of 1952/54 cover ed two Nepali years, approximately mid April 1952 to mid April 1954
Source: Sharma (2003) pp. 375–412.

Pattern of Urbanization

Urbanization has not occurred evenly throughout the country (Table 8.2). Kathmandu, the capital city, is the main urban center and dominates in terms of concentration of population and economic activities; it has been growing at a very high annual rate in excess of 7% (Nippon Jogesuido January 2002). The Hill/Mountain region remains the least urbanized in the country, and Kathmandu Valley consistently remains the most urbanized region, although its share of urban population has been declining and has been exceeded by the Terai region since 1981. In general, regions with low levels of urbanization have been experiencing faster urban growth and regions experiencing slower rates of urban growth are the ones where the existing level of urbanization is higher.

Over 39% of Nepal's urban population in 2001 resided in metropolitan and sub-metropolitan areas with populations over 100,000. Nepal currently has 45 urban areas with populations between 20,000 and 100,000, against only 6 in 1971. These contain over 54% of the urban population. Several of these are district headquarters, which have been important trade centers with long histories. In 2001, only about 4% of the urban population lived in the eight urban centers with populations between 10,000 and 20,000.

There are many small market towns with populations under 10,000. Although there is no adequate information available on their population and growth rates, it is clear that these are growing quite fast. They now frequently contain significant populations and appear more urban than the outskirts of many designated municipalities. These small market towns are not yet classified as urban areas. New roads, improved accessibility, and infrastructure development led to their emergence as towns, and several of the newly emerged small towns are on highways and feeder roads. Many of these had been only small rural trading centers, villages, or did not exist until a few decades ago. They generally lack basic infrastructure to

accommodate the rapidly increasing population pressure (newspaper articles, personal communication and observation, and Joshi 2000).

Only Kathmandu has reached a population of 500,000 inhabitants or more, and at present only five urban areas—Biratnagar, Birganj, Kathmandu, Lalitpur, and Pokhara—have populations exceeding 100,000. Except for Kathmandu, all have populations less than 175,000. Nepal's population size and urban-based economy are small and would not be conducive to larger cities. Migration is likely to be greatest to those urban areas where land for housing is comparatively cheap, where there are employment and livelihood opportunities, and where there are reasonable urban facilities such as education, health, and communications. This logic, and the past trend, suggests that urban areas with current populations in the range of 50,000 to 100,000 are likely to be the preferred destinations for migration. The trend in the last three decades also supports this argument: between 1971 and 2001, population in urban areas of 50,000 to 99,000 grew from 13% to 24% of the total urban population, whereas the percentage declined among all other sizes. The typical population of Nepalese towns in the next decade or so is likely to be 100,000 to 200,000. Most of Nepal's urban centers are unlikely to have populations exceeding 300,000 in the next 10 to 15 years.

Most urban areas are not very densely populated in terms of persons per unit area (Table 8.2). The urban areas of Kathmandu Valley are the most densely populated in Nepal. Urban densities in some of the municipalities, particularly in the Hill/Mountain region, are only slightly higher than that of rural areas. For example, the density of Triyuga and Amargadi municipalities is 172.8 and 132.5 persons per square kilometer, respectively, which is comparable with the rural density (Sharma 2003). Population densities may be higher in smaller or emerging towns that are not yet classified as urban areas. Several municipalities exhibit a more rural than urban character because of expansion of boundaries of the existing towns in the process of gaining municipal status to include population on the fringes that was hitherto classified as rural. Some municipalities are not even linked with the rest of the country by road, and the outskirts of many municipalities can be reached only by a walk of 3–4 hours.

Emerging Problems

Most urban areas of Nepal have cultural and heritage sites of varied nature including historical settlements, monuments, religious sites (temples, monasteries, and others) and ponds and public taps. These are of local, national, and international significance; some are listed as World Heritage Sites by the United Nations Educational, Scientific and Cultural Organization (UNESCO) (including the Pashupatinath temple, Boudhanath, Swayambhunath, palace areas of Hanuman Dhoka, Patan, and Bhaktapur, Changu Narayan temple, and Lumbini). However, according to IUCN (1999) "the physical state of the cultural and heritage sites and the monuments in Kathmandu Valley is fast deteriorating". The cultural and heritage sites along rivers are the worst affected.

Emergence of urban slums and squatter settlements in Nepal's cities is relatively new and still small in size compared with other cities in South Asia. There are no adequate data on slum dwellers in Nepal nor is there a definition of "slums". However, the number of squatter settlements in major urban areas has been increasing in the last few years; it is most conspicuous in Kathmandu Valley. In 1985 the number of squatter settlements in the Valley was 17 with an estimated 3,000 inhabitants; this grew to 33 with an estimated population of 15,000 in 1990 (Pradhan 2004); and to 44 in 2002 (Baniya 2002). Pathibhara is the largest recorded squatter settlement with 187 households and 2000 family members. All these squatter localities and some of the core areas of Kathmandu are said to be slums due to lack of basic sanitation and utility facilities. The emergence and expansion of the squatter settlements has been encroaching upon riverbanks, public lands, lands belonging to temples or other religious/cultural sites, agricultural land, and forest areas.

Urban Infrastructure

Roads and Traffic

In 2000, the total road length in the urban areas of Nepal was 2,051 km, of which blacktopped, graveled, and earthen road lengths were 930 km, 600 km, and 521 km, respectively (CBS 2002). There is considerable variation in the length and status of urban roads in municipalities depending on their size and location. For example, Waling has only 8 km of road within its territory whereas Kathmandu has 800 km (SWMRMC 2004). Some municipalities are completely devoid of blacktopped roads, and some are not even linked with the national road network.

Urban traffic in Nepal is typically a mix of traffic types including automobiles, cycle rickshaws (manual three-wheeler), bicycles, and even animal-drawn carts. The numbers and composition of traffic vary from municipality to municipality. Rickshaws and bicycles are most conspicuous in the Terai towns, whereas cars and motorcycles make up over

half of all motor vehicles in Kathmandu. Most of the growth in motor vehicle fleets is concentrated in Kathmandu Valley. In March 2004, for example, the number of registered automobiles in Nepal was 418,910, of which about half were in Kathmandu Valley (DOTM 2005).

Water Supply

In 2000, about 78% of the people living in urban areas had access to an improved water supply within 15 minutes of home (WaterAid Nepal 2004). However, there is significant variation in the coverage, service level, and qualities of supplied water between and within urban areas. A survey conducted in 2002 in nine municipalities outside Kathmandu showed that piped water supply coverage varied from 7% to 65% of households (Nippon Jogesuido 2002). Groundwater is the main source of water in the Terai and is generally adequate in terms of quantity; hill towns are served from surface sources and generally face serious water availability problems. Quality of supplied water is quite often a concern; arsenic content has become an alarming issue in many rural water supply schemes in the Terai, whereas biological contamination is generally the main concern where surface water is used. Except for a few towns such as Dhulikhel, Damak, and Mechinagar, water supplies are intermittent, with water available only a few hours a day (ADB 2000). Inadequate quantity, non-uniform distribution of water, unreliability of supply, and high rate of unaccounted for water (due to leakage and illegal connections) are major issues related to water supply in the urban areas of Nepal. The rate of unaccounted for water is particularly high in Kathmandu (IUCN 1999; ADB 2000).

Sanitation and Drainage

In 2000 sanitation coverage in urban areas of Nepal was 67% of the population (WaterAid Nepal 2004). The provision of sanitation infrastructure is generally very poor: a significant proportion of the urban population outside Kathmandu is still not connected to wastewater or sewerage systems. In smaller towns, households are either without sanitation facilities or served by septic tanks or pits, or illegally use storm water drains as sanitary sewers. Wastewater treatment facilities are very limited, and where provided they suffer from chronic disrepair, maintenance, and operation problems, and are often non-functional. For example, three sewage treatment plants in Bhaktapur and Lalitpur are not functioning.

Sewerage systems, often combined with storm water drainage systems, only exist in some urban areas; and their coverage is limited. The combined sewerage systems in Kathmandu, Lalitpur, and Bhaktapur cover approximately 13,000 households (ADB 2000). A 2002 survey in nine small towns outside Kathmandu revealed that, in general, only parts of town centers have storm drainage; some are covered but most are uncovered (Nippon Jogesuido 2002). In these towns, the total length of storm drains varied from 2 to 22 km. During the rainy season, drainage is a serious problem, particularly in the urban areas of the Terai.

Solid Waste

Solid waste is generally very poorly managed by municipalities in Nepal (ADB 2000). More than half of the municipalities have not even identified or proposed sites for land-filling their wastes, let alone carrying out proper land-filling. In general, waste is collected, transported, and disposed of by municipalities. Lack of resources—including human resources, infrastructure, and equipment—is a common problem faced by municipalities in attempting to manage solid waste. Siting and operation of landfills is highly sensitive and controversial. Many municipalities have worked in partnership with the private sector, nongovernment organizations (NGOs), and community groups in

NEFEJ

Abandoned Chamber Built for Burning Medical Waste

managing solid waste. They are particularly involved in awareness, waste collection, and street cleaning. Some NGOs have piloted door-to-door collection, composting, and recycling (NEFEJ 2004). One emerging concern is the management of hazardous wastes. There is no clear state policy on this. Medical waste, obsolete pesticides, batteries, effluent, and byproducts of industries are the main sources of hazardous waste. Few health institutions have autoclaves and incinerators: and where they exist they are quite often not in operation.

Urban Environmental Concerns

Solid Waste

Quantity and Nature

The municipalities of Nepal generate over 1,350 tons of solid waste every day. Kathmandu alone generates 383 tons/day, slightly less than one-third of the total municipal waste. Household waste constitutes about 75% of municipal waste. The municipal waste varies from 0.11 to 0.93 kg per person per day, with an average of 0.34 kg per person per day (SWMRMC 2004). The households on the outskirts of the smaller towns (which, although falling within the municipality boundary, are rural in nature) reuse most of their waste for feeding animals (pigs and cattle).

With the change in consumption patterns and lifestyle of urban inhabitants, the composition of solid waste has been changing over the years, from traditional organic materials to papers, plastics, glass, metals, and packaging materials. Even so, about two-thirds of municipal waste is still organic or biodegradable although the composition varies from municipality to municipality. A recent study (SWMRMC 2004) showed the following average composition of the solid waste generated in Nepalese municipalities:

(i) Organic material 66% by wet weight (with a range of about 39 to 95% from municipality to municipality);
(ii) Metal, glass, paper, and plastic combined, 20% by wet weight (range 5 to 50%); plastic alone constitutes 7.6% (range 1.6% to 21%);
(iii) Inert material 9.6% (range 0 to 37%); and
(iv) "Other" (including medical waste) about 5%.

Management Practices and Concerns

Solid waste is the most conspicuous environmental problem across Nepal's urban areas. According to ADB (2000), until the 1980s, municipal solid waste management problems were negligible other than in Kathmandu Valley—most of the waste generated being organic and thus managed at the household level.

Sweepers clean the streets and open spaces, collecting the waste into roadside heaps using brooms, picks, shovels, and wheelbarrows; waste is also picked up from roadside heaps or bins and transported to disposal points by tractors and trailers, power-tillers, rickshaws, or other waste transportation vehicles. However, the solid waste collection rate is generally low. On average only 35% of municipal waste is collected; but rates vary from about 7% to as high as 86% from one municipality to another (SWMRMC 2004). Disposal of waste is haphazard. Even the capital city dumped waste along the riverbanks until very recently. Almost all municipalities currently lack any landfill site; Pokhara municipality started disposing of solid waste at a landfill site after a long negotiation with the people residing in the neighborhood, and the Solid Waste Management and Resource Mobilisation Center recently reached agreement with the local people to dispose of the capital city's waste at Sisdole for two years, by which time a long-term site is expected to be ready at Okharpauwa.

NEFEJ

Sisdole Landfill Site for Kathmandu Refuse

Random and insanitary collection and disposal of urban solid waste in Nepal is the result of lack of long-term perspective; deficiency in the planning, provision and operation of infrastructure; insufficient public lands that can be accessed for waste disposal purposes; and absence of a holistic and integrated system for solid waste management. Solid waste management is generally understood as sweeping the street and dumping waste in places where it receives no public opposition. Hence, waste is commonly dumped on public land, forest, riverbanks, and other places ill-suited for this purpose. Irregularity of collection is common, with heaps of garbage found piled up on the streets.

Sanitary Landfill Site and Land-filling

Land-filling is a commonly used method for solid waste disposal. A landfill site is first selected considering present use and value of land; available area and potential life of landfill; the site's soil and topography, geology, and hydrology; haulage distance; and settlements near the site. The selected site is developed into a proper landfill site by providing drainage, access, and other structures and facilities necessary for a landfill operation. Operation involves laying the waste in layers, compacting it, and covering it with earth at the end of each day's operation. Many landfill sites around the world have been poorly engineered and operated, and hence face vociferous public opposition and criticism for their adverse environmental impacts. The decomposition of the organic matter in a landfill site produces highly polluting liquid, called leachate, and gases (mainly methane and carbon dioxide). Leachate can percolate down, causing groundwater pollution. Methane is a combustible gas and explosive when its concentration in air is between 5% and 15%. Methane can accumulate below buildings or other enclosed spaces on or close to a landfill, posing risk of explosion. Other common concerns related to land-filling are odor; litter blown by the wind; scavenger birds, rodents and insects attracted by the organic refuse; and dust and noise generated by the heavy trucks and equipment used in transporting waste and operating the landfill.

Because of the concerns arising from poor operation and management, siting and operation of landfill sites is a very sensitive public issue in Nepal. For a decade or so Kathmandu city has been facing a severe problem in disposing of its solid waste. In the early 1990s, people near the then-existing landfill site at Gokarna opposed the landfill and obstructed its operation many times, resulting in waste accumulation on the streets of Kathmandu for several days, or inappropriate disposal of waste along the riverbanks. Later when the life of the Gokarna landfill site was finished, no other landfill site could be identified within the Valley due to public opposition, and Kathmandu's refuse continued to be disposed of along the riverbanks. In 2005, authorities reached an agreement with local people to operate a short-term (2-year) landfill at Sisdol with a plan to prepare a long-term landfill site at Okharpauwa in the same locality.

Shortcomings in planning and design as well as poor operation and management are the primary causes of public opposition to landfill sites. State-of-the art practice requires improvements in the way landfill sites are planned, designed, operated, and managed. A landfill site needs to have a buffer zone separating it from settlements and public places, a liner should be placed at the bottom of the landfill site to control flow of the leachate to the groundwater, leachate should be collected and treated, and gases (particularly methane) need to be collected and either safely vented or used as fuel, in addition to compaction and daily covering of the waste put in layers. Besides, waste may be segregated into decomposable, reusable, recyclable, and the rest. Not all waste needs to be land-filled: decomposable waste can be converted into compost, and reusable and recyclable waste could be sold. The decomposable fraction of waste typically exceeds 60% in Nepal and is the one that produces leachate, gases, and attracts birds and insects. Separating this from the remaining waste not only reduces the volume to be land-filled (thus increasing the life of the landfill), but also reduces the chances of adverse environmental problems and public opposition.

Lalitpur Municipality

Open Dumping of Medical Waste

Such a state has many adverse environmental consequences. In the first place, it is aesthetically bad, causes bad smells, and is a nuisance to the public. Refuse also attracts animal scavengers and pests, can be a breeding place for disease-vectors, and can be hazardous to human health. Uncollected refuse gets into drains and blocks them, causing disruption to drainage and sewerage systems. Irregular collection encourages people to burn waste which contains plastics and chemicals—the resulting emissions have long-term health implications. The refuse also produces leachate that can contaminate surface water and groundwater if not handled properly. Haphazard solid waste collection is also a source of air pollution. Overall, unmanaged solid waste not only causes significant adverse impacts on public health and the environment but also deterioration in the quality of life of people.

In most municipalities, hazardous wastes are commonly mixed and dumped along with municipal waste. Most commonly, industrial waste is either burned, dumped, drained in a river, or mixed with municipal waste. Similarly, hospital waste is either burned in a chamber within the hospital compound or mixed with municipal waste (SWMRMC 2004). Mixing such wastes with municipal waste renders the latter hazardous and potentially infectious.

Solid waste in Nepalese urban areas could be better managed by adopting a more holistic and integrated approach that internalizes the concept of the 3Rs (reduce, reuse, and recycle). Some elements of this have been tried on a limited scale in Nepal, although these remain unguided, uncoordinated, or isolated and out of the mainstream solid waste management practice. For example, there are several small-scale recycling industries using waste plastics as raw materials, and paper is recycled in a paper mill and also by some NGOs (NPC and UNDP undated). Scavengers collect beverage bottles, which are mostly reused, and metal scraps, which are recycled in factories in India and Nepal. Bhaktapur municipality has been composting its solid waste for some time now; a compost plant of about 13 tons/day was operational until a few years back in Kathmandu, and several NGOs and community groups in different urban areas have initiated door-to-door waste collection and small-scale composting, including vermi-composting as well as briquette production (NEFEJ 2004). All these indicate that waste can be converted into a resource, provided the right policy and approach are followed.

Solid Waste Management by an NGO

The Women Environment Preservation Committee (WEPCO) is a nonprofit NGO formed in 1992 by a group of enthusiastic women from Kupondole, Lalitpur. From its beginning, WEPCO has been actively and continuously involved in solid waste management in the Kupondole area of Lalitpur Municipality. The solid waste management it practices and promotes is more than just collection and disposal of waste; it incorporates the concept of recycling and converting waste into resources. WEPCO provides door-to-door waste collection service to about 80% of the area households, for which each household pays a monthly charge. The biodegradable fraction of the waste is converted into organic compost. WEPCO also recycles paper collected from different sources. WEPCO has shown an example on a small scale of how "waste" may be better managed by also considering it as a "resource". WEPCO is also active in training and disseminating the experiences and lessons learned to other NGOs and community groups, raising community awareness on the 3Rs, and promoting composting at household level. WEPCO is working in partnership with Lalitpur Municipality and the private sector. In recognition of the work done, WEPCO was awarded the MOPE Environment Award 1996, UNEP Global 500 Environment Award 2003, and World Wild Fund for Nature (WWF) Nepal Program Abraham Conservation Award 2003.

(Source: personal communication with WEPCO).

Water Pollution

Water pollution is a serious environmental issue in Nepalese urban areas. Pollution of water bodies such as rivers, lakes, ponds, groundwater, and drinking water supplies are common.

Deficiency in wastewater and solid waste facilities and their mismanagement have often resulted in pollution of surface and groundwater. Using storm water drains as sanitary sewers is a widespread practice in Nepal. Sewerage systems, often combined with storm water drainage systems, exist in a number of urban areas such as in greater Kathmandu and Bhaktapur, although their coverage is inadequate and they are in a poor state of maintenance. Greater Kathmandu and Bhaktapur are the only urban areas with sewage treatment plants; however, these plants are not functioning and the untreated sewage is discharged directly into rivers. Major polluting industries, such as tanneries, sugar, paper, canning, cement, breweries, and pharmaceutical industries, are invariably located in or near urban areas and often dispose their waste,

NEFEJ

Stream Changed into a Sewer in Kathmandu

Bagmati River Pollution

The Bagmati River with its tributaries—the Bishnumati, Manohara, Dhobikhola, Icchumati (Tukucha), Nakkhu, Hanumante, Karmanasa, and Godavari—is the main river in Kathmandu Valley. The Bagmati River system is extremely important for both the Valley and downstream areas. The river system has been the Valley's main source of water for drinking and irrigation, and an important component of its ecosystem. It also has tremendous religious, cultural, and social significance—the river is worshipped by millions of Hindus in Nepal and India. Several temples (including Pashupatinath), ghats, and maths are located along the banks of the Bagmati River and its tributaries. People perform various religious and cultural activities and rituals, and take holy ablution there. It is often referred to as the Ganges of Nepal.

Over the last few decades, the Bagmati's condition has gradually deteriorated and it has become the most polluted river in Nepal. Direct disposal of untreated sewage and throwing garbage into the river system, withdrawal of sand, tapping river water to meet the water demand of the increasing population as well as of the increasing number of factories, and encroachment of the river banks are the main causes of the degradation and extreme pollution. During the dry season, the volume of water is so reduced and the river is so polluted that it looks like an open sewer. One study conducted by the Environment and Public Health Organization (Dhakal 2003) showed that the chemical oxygen demand (COD) is in excess of 400 mg/l within the city and immediate downstream areas. This is alarming, as the normal COD of river water is around 40 mg/l. However, as the river flows out from the Valley, the pressure on it reduces considerably and due to natural self-purification processes, the COD is reduced to 25 mg/l by the time it reaches Gaur in Rautahat.

The effects of this extreme pollution are many. The most visible is aesthetic: a highly polluted, sewage-filled, black stream flowing through the heart of the city obviously destroys the city's beauty. Pollution has also affected cultural and religious activities and rituals—ritual bathing is almost a thing of the past, and people do not use river water even when performing puja. The health of the people living along the banks is also at risk. Villagers immediately downstream of Kathmandu have now stopped using the river water for irrigation, and fishermen have stopped their traditional occupation, as there are no fish left in the river. The river is almost dead, and aquatic life is almost nonexistent when the river reaches Chobhar area (Dhakal 2003; Phuyal 2003).

including toxic waste, to roadside drains and open spaces. The only industrial wastewater treatment plant, at Hetauda, often encounters operational difficulties (ADB 2000; IUCN 1992). Thus, the rivers have become major places for disposal of untreated sewage and industrial effluents, as well as urban solid waste dumping. This is the principal cause of surface water pollution. As a result, many rivers in urban areas have practically become open sewers, especially during the dry season. The adverse effects of this are many, such as eutrophication affecting river ecology and aquatic life, and making the water unfit for most human uses including bathing and irrigation. The effects are not confined to urban areas, but can be felt for long distances downstream.

Groundwater in most urban areas is contaminated due to seepage from pits and septic tanks, and open defecation. Studies of water quality from shallow aquifers throughout Nepal have found that the fecal coliform contamination consistently exceeds World Health Organization (WHO) guidelines for water for human consumption (ADB 2000).

Drinking water supplies are often polluted through runoff into storage sites or cross-leakages between overloaded sewer lines and water pipes (IUCN 1991). Sewage is the primary cause of drinking water pollution. Nearly one-third of the urban population of Nepal do not have direct access to a piped water supply. The availability of improved

B. Pradhan

Waste Dumping along the Bagmati River in Kathmandu

water supply, including non-piped, within 15 minutes of walking distance is nearly 80% (WaterAid Nepal 2004; CBS 2004). Even those with access do not necessarily have adequate water. The quantity of water delivered by the water supply system is mostly below 50 liters per capita per day and the quality often falls below WHO recommendations (ADB 2000), mainly due to bacteriological contamination caused by poor sanitation facilities. Unserved households obtain water from traditional water sources such as wells, rivers, springs, or ponds. These sources are typically unprotected, and water quality is usually poor. Water pollution is the most serious public health issue in Nepal. Contaminated drinking water and lack of sanitation facilities result

in worsening public health conditions, deteriorating quality of life, and increased economic costs to society. While this affects people of all income levels, the poor are most vulnerable. They have few resources or alternatives to protect themselves from such adverse impacts as seasonal drying out of surface water sources, pollution of groundwater, or spread of sanitation-related diseases.

Drainage

Drainage to cope with surface runoff is often deficient in Nepalese urban areas. This is most evident during the rainy season; the limited lengths of drains that exist in urban areas are often filled with waste, including plastics and dirt. As a result, the surface runoff either infiltrates the ground or flows into natural drains through streets and lanes, leaving the towns muddy and dirty. Urban areas in the Terai (where the natural gradient is very flat) often experience serious drainage problems: flooding and rise in groundwater tables are common. This renders the existing wastewater disposal system ineffective. These deficiencies obviously pose a serious threat to the health and sanitation of the residents. Hill municipalities also suffer from lack of drainage, although to a lesser extent than the Terai towns. According to ADB (2000), more than 25% of households of greater Kathmandu and 32% of those of Bhaktapur suffer frequent flooding.

Air Pollution

Air pollution is emerging as a serious concern in the major urban areas of Nepal in general and in Kathmandu Valley in particular (see Chapter 7). The deterioration in urban ambient air quality results from vehicular emissions, industrial emissions, burning solid waste including plastics, construction work, poor maintenance and narrow roads, and adulteration of fuel. In urban areas total suspended particles (TSP) and PM10 (particulate matter smaller than 10 micrometers in diameter) are the major concerns. Other pollutants such as SO_2 and NO_x are also increasing although still below Nepal's Ambient Air Quality Standards and WHO guideline levels. In areas where traffic is high, TSP and PM10 generally exceed national and WHO guideline values. This indicates that the major source of TSP and PM10 is road traffic; the condition of vehicles and of the road surface are contributing factors in addition to the type and quality of fuel. Industries probably follow as the next major source of urban air pollution.


NEFEJ

Industrial Air Pollution, Kathmandu

Air quality monitoring in Kathmandu shows that the air is routinely not clean enough to breathe in places like Putalisadak, Patan, and Thamel. Pollution also regularly obstructs the visibility levels of the scenic landscape of the Himalayas. According to a study, the number of foggy days in Kathmandu has increased from about 35–40/year in 1970 to more than 60/year in 1993, the most recent year for which reliable statistics are available (URBAIR 1996). Kathmandu Valley is particularly vulnerable to air pollution due to poor dispersion chances in its bowl-shaped topography. In the smaller urban areas, indoor air pollution resulting from use of biomass fuel, firewood, cow dung cake, and crop residues is at present of more concern than outdoor air pollution.

Adverse effects of air pollutants on human health can be acute or chronic. Respiratory infection is among the top five diseases in Nepal, occurring mainly due to prolonged exposure to smoke and dust (CBS 1998). Acute respiratory infections (ARI) continue to be one of the leading causes of death among young children, causing over 30% of deaths in children under five years of age (DOHS 2001). In Kathmandu Valley, 3.6% of the respiratory diseases among children are estimated to be caused by TSP (IUCN 1999). Air-pollution-related ailments such as pneumonia, bronchitis, and asthma are now becoming very common in Kathmandu Valley (IUCN 1999).

Traffic Congestion

The number of motor vehicles in the larger urban centers has increased rapidly in recent years. This has not been matched by provision of roads and infrastructure, leading to persistent traffic congestion, particularly in Kathmandu Valley towns. Urban development is taking place without adequate planning or provision of transport infrastructure, and with inadequate consideration of the nature and composition of the traffic. Urban roads are commonly narrow and crooked, and the road network function is poor. There is no or insufficient parking space. The mixture of vehicle types, poor driving, bad parking, and roadside trading add to traffic congestion. The consequences of this are longer travel times, greater levels of air and noise pollution, and less efficient fuel consumption (ADB 2000; Adhikari 1998; UNEP 2001).

Noise Pollution

Noise is becoming a significant form of pollution in urban areas. It is a public nuisance and affects people's health physically and psychologically (by increasing irritation, tension, nervousness, and anxiety). Transport noise, industrial noise, and community or neighborhood noise represent the leading forms of noise pollution in Nepal (IUCN 1991). Prolonged exposure to high noise levels may cause permanent hearing loss. Industrial noise is also a significant occupational hazard. Many noise-sensitive sites such as colleges and hospitals are also subject to much higher levels of noise than acceptable.

Like air pollution, noise is on the increase in municipal and industrial areas. Sources of significant noise include traffic, industries, use of heavy machines and tools in construction and commercial activities, and use of loudspeakers for prayer in the early morning hours. Conflicting land use in urban areas has contributed to noise pollution where residential use is mixed with noise-causing industries (ADB 2000). Transportation is one of the predominant sources of noise pollution. Power tillers, buses, heavy trucks, and three-wheelers are significant contributors to noise pollution in municipal areas (UNEP 2001). Road traffic noise levels in Kathmandu range from 70 to 100 decibels (dBA). The noise level in industries such as textile, metal works, cement, and flour mills is very high, with noise levels exceeding 90 dBA (IUCN 1999). People living around airports are subject to high levels of noise produced by aircraft.

Impacts on Heritage Sites, Open Spaces, and Agricultural Land

In the urban areas of Nepal, open spaces traditionally exist in the form of public/community spaces around cultural and heritage sites as well as in religious forested clumps and pond areas. In many smaller towns, open space also provides fortnightly, weekly, or bi-weekly market sites. Provision of public parks, playgrounds, and green open space, although found in a few urban centers, is not common in Nepal's urban planning and development.

Traditional open spaces are treated as "no man's land". Heritage sites and open spaces are under increasing pressure as haphazard urbanization continues. The historical and cultural sites are deteriorating due to pollution, emerging building has defaced historical and cultural monuments, and encroachment of the open space and premises of these sites is common (HMG/UNDP 1994; Adhikari 1998; IUCN 1999).

Urbanization invariably brings about land-use change. Loss or degradation of fertile agricultural land as a result of unguided urban development is a long-term concern. Urban areas of Kathmandu Valley have expanded at the cost of agricultural land. According to Karki (1998), between 1984 and 1994, the urban area in the valley increased from 3096 ha to 8378 ha and 5282 ha of fertile agricultural land was lost in the process of unplanned urbanization. If this trend continues, by the year 2020, all the prime agricultural land in Kathmandu valley will be urbanized. The loss of agricultural land in Kathmandu Valley is an important indication of what may happen in other urban areas as they grow haphazardly.

Policies and Initiatives

Policy

There is no specific policy for the urban sector in Nepal, although the significance of the urban sector rises consistently. Urban development is multisectoral and the urban policy thrust can be derived from the sectoral policies. The sectoral policies, plans, and related legislation and regulations provide a basic framework for urban development and environmental safeguards in urban areas. Some relevant legislation and policies include the following:

(i) Local Self-governance Act 1999: empowers municipalities to administer and manage local resources, and to prepare and implement programs. The Act is intended to develop municipalities as self-governing autonomous urban local bodies playing an effective role in overall urban development.

(ii) Town Development Fund Act 1997: facilitates financing of urban infrastructure projects in municipalities or urbanizing villages.

(iii) Solid Waste Management and Resource Mobilisation Act 1987: regulates collection, recycling, and disposal of solid waste in municipal areas.

(iv) Industrial Enterprises Act 1992: controls the establishment of industries and regulates licenses for establishment, expansion, and modernization of industrial enterprises.

(v) Environment Protection Act 1996: requires environmental assessment of proposed projects, empowers the Government to provide incentives to any activity that has positive impacts on the environment, and has provisions for polluters to compensate persons suffering from polluting activities.

(vi) Ancient Monument Protection Act 1956: protects ancient monuments and other

objects of archaeological, historical, and artistic importance, and empowers the Government to declare any area where an ancient monument is located as a Protected Monument Zone.

(vii) Nepal Drinking Water Supply Corporation Act 1989: sets up Nepal Drinking Water Corporation, a body responsible for supplying clean drinking water to municipalities and to areas specified by the Government, and to manage drainage systems in municipal areas.

(viii) Local Administration Act 1971, Land Acquisition Act 1977, and Vehicle and Transport Management Act 1992 have provisions that are relevant for urban management.

(ix) The National Solid Waste Management Policy, National Water Supply and Sanitation Policy, and Shelter Policy are important in the planning, development, and management of urban infrastructure.

(x) The Nepal Urban Sector Strategy 2000 is an important step towards recognizing the increasing significance of urban areas in Nepal.

While these policies and legislation provide a basic framework for urban planning and management as well as environmental safeguards in urban areas, there are difficulties at the implementation level. First, these acts need to be streamlined, made coherent, and ambiguities removed. Provision of urban infrastructure in Nepal has been largely driven by central institutions such as the Nepal Water Supply Cooperation; Department of Roads; Solid Waste Management and Resource Mobilisation Center; Nepal Telecommunications Corporation; and Nepal Electricity Authority. As responsibilities are scattered and many agencies are involved in the planning, provision, and management of urban infrastructure and services, coordination is extremely difficult. Institutional confusion arising from provisions in various legislations regarding the responsibilities, authorities, and handling of resources is a prominent issue. Urban development and management in Nepal lack an integrated holistic approach, and long-term vision. Recently, after enactment of the Local Self-Governance Act, municipalities are being increasingly empowered to manage their urban areas and to assume the urban governance role. The municipalities, however, are generally constrained by a lack of capacity and resources. As a result, urban areas of Nepal continue to grow spontaneously and haphazardly.

At present there is no information available regarding the level of investment by municipalities in the environmental and infrastructure sectors. However, solid waste management, building drains, and plantation are some areas in which municipalities commonly invest.

Lack of financial resources is a critical constraint currently faced by Nepalese municipalities. Local development fees (LDF) and grants are the two major sources of revenue for municipalities (Table 8.3). LDF are collected by the central Government and transferred to the municipalities through the Ministry of Local Government. Almost all municipalities are highly dependent on LDF and grants; they are generally weak in mobilizing local revenue sources. Bhaktapur municipality has introduced a "Tourist Entry Fee", which generated more than 44% of its revenue in one

Table 8.3: Consolidated Revenues and Ex penditures of Municipalities FY 2004

Revenue		Expenditure	
Heading	**Amount (NRs'000)**	**Heading**	**Amount (NRs'000)**
Own source		Current/administrative	
Local development fee	986,099	Salaries	465,030
House/land and propert y tax	142,044	Allowances	55,873
Other tax revenue	109,072	Services	52,978
Fees and fines	359,770	Fuel	50,538
Property rental	82,666	Contingencies	63,549
Other revenue	85,841	Other	147,043
Miscellaneous income	63,370	Debt payment	62,478
Grants (HMG, D DC,TDF, and other)	288,986	Social program	243,991
Loans	26,348	Ordinary capital (furniture, equipment)	35,150
		Capital investment (Public expenditure)	983,523

DDC = District Development Committee, HMG = His Majesty's Government of Nepal, TDF = Town Dev elopment Fund
Source: Chhetri and Pradhan (2005)

Land Pooling for the Proposed Outer Ring Road in Kathmandu

His Majesty's Government of Nepal and the People's Republic of China recently agreed to construct an "outer ring road" (approximately 66 km in length) in Kathmandu Valley. The current ring road was constructed 30 years ago also with Chinese assistance. The outer ring road (ORR) is expected to connect old settlements of Kathmandu Valley, provide space for a bulk supply line for the Melamchi Water Supply Project and for electricity transmission lines, and at the same time relieve traffic pressure in the main city areas by providing alternative by-passes. The road will have 60 m as right of way; space will be reserved for fast-track vehicles, bicycle track, water supply and electricity lines, and a green belt. Over 325 ha of land is thus required. Acquiring this land giving compensation at market rates would be too costly, and at the same time acquisition would take a long time due to compliance with the acquisition and compensation process. Keeping this in mind, a "land pooling" approach has been proposed to readjust the land with participation of the affected people.

Land pooling is a participatory process of land readjustment and development that has been practiced for urban expansion in Nepal for the past few years. Using this approach, a corridor of 560 m width (250 m left, 250 m right, and 60 m wide road) will be temporarily taken from landowners for development purposes. The land will be developed providing access, constructing basic infrastructure, and separating space for the road, service track, open spaces, and bicycle track. The land owners will contribute the space proportionately, based on defined criteria, and in return will receive developed plot(s) of land. The project expects that obtaining the land required for the road through land pooling in the 560 m corridor would help control urban sprawl, as the returned land would be developed. Critics of the project, however, feel that the outer ring road will further damage Kathmandu Valley by stimulating uncontrolled urban sprawling as has been done by the existing ring road constructed three decades ago.

Source : Personal communication with Mr. Kishore Thapa, Project Manager, Outer Ring Road Land Development Project; Devkota and Ghimire (undated); Joshi (2004); DUDH (2005)

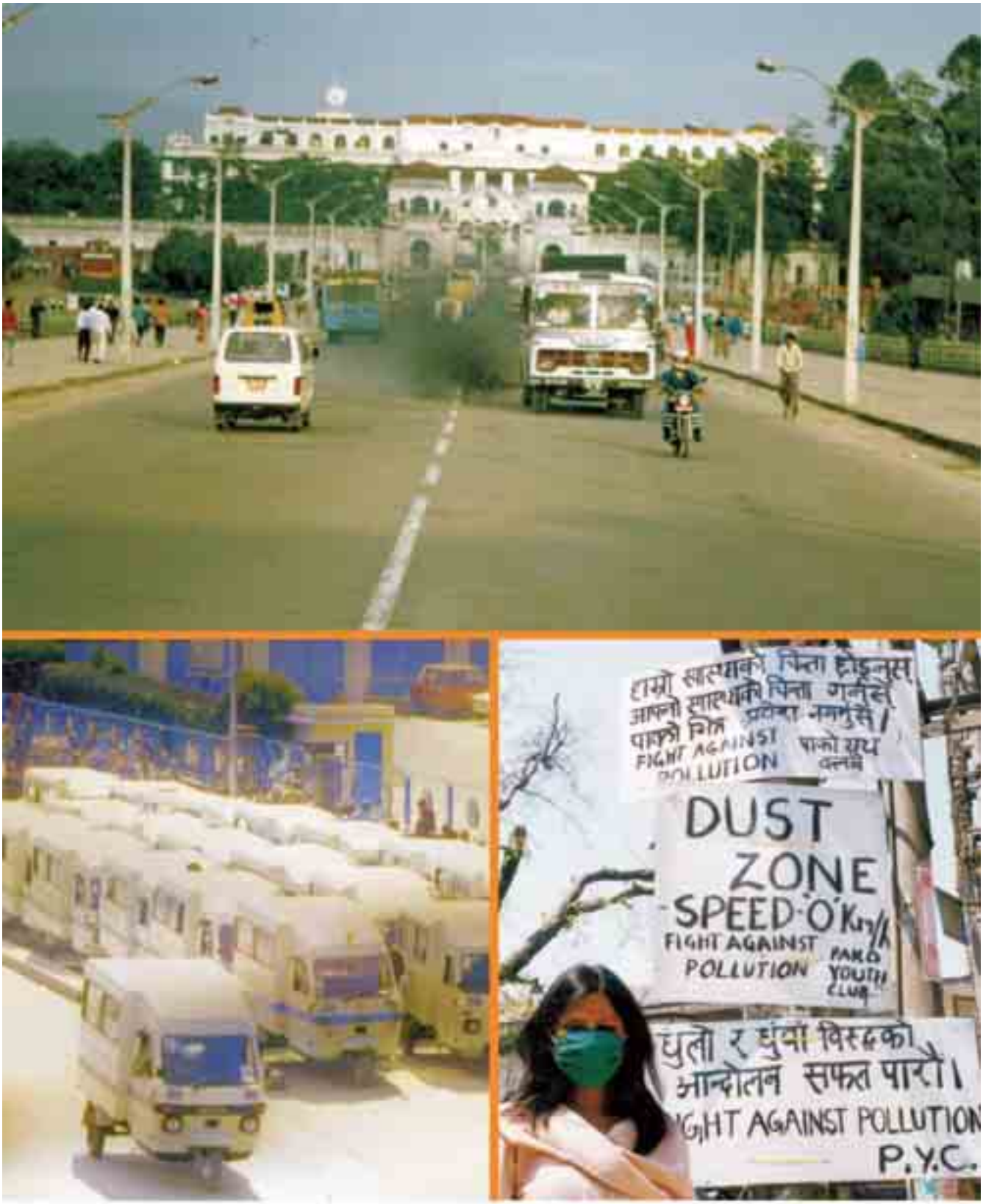
year (Chhetri 2004; Chhetri and Pradhan 2005). Nepal's accession to the World Trade Organization may require abolishing LDF, as this is against the spirit of the Organization. In the absence of LDF, municipalities will have further financial difficulties and many may be unable to cover administrative expenditures. Strengthening the financial resources of municipalities should therefore be at the top of the agenda of empowering and strengthening municipalities to meet environmental responsibilities.

There have been attempts in the past at planned development of urban areas. For example, Rajbiraj, Dipayal, Birendranagar, and Bharatpur were initially planned, but planning control quickly disappeared and they soon began to take haphazard routes to growth (Adhikari 1998). Tikapur town planning scheme, the only comprehensive effort to plan a new town in Nepal, was never implemented as envisioned (Adhikari 1998). Although master plans for Kathmandu have been prepared, implementation of these has been weak and generally unsatisfactory. Structure plans were prepared between 1988 and 1991 for all the 33 municipalities of the time. However, these were not adequate as the content was limited to general policy statements and details were not worked out (Joshi 2000).

Guided Land Development and Land Pooling are two notable government initiatives to plan and guide urbanization of some municipalities. These aim to facilitate adjustment of land plots in a participatory process so that space is provided for urban infrastructure—roads, water supply, drainage, electricity, and telephone. Integrated action planning is also practiced in several municipalities as an approach to planning urban areas by the people who live there. Community meetings are the cornerstone of this approach. Other features are mobilization and participation of the community in the identification, prioritization, and programming of municipal development activities and making the planning process more people oriented (Thapa undated; personal communication with the agencies concerned). Urban Development through Local Efforts is an initiative to strengthen municipalities in their roles and functions, and to promote participation by the people (UDLE 1992). There are several small-scale isolated initiatives in improving urban quality, e.g., in converting wastes into resources, and improving greenery (NEFEJ 2004).

Future Directions

The urban environment is broad and integrated and therefore urban environmental management should use a broad integrated perspective, rather than the conventional narrow approach of dealing with sectoral issues separately. There are obvious linkages among various urban infrastructures and services; synergistic positive effects could be enormous if these were to be integrated and coordinated properly. For example, solid waste management is linked with air pollution, functioning of drainage, public health, and aesthetics. A truly integrated and holistic approach should be promoted if urban



Min Bajracharya

B. Pradhan

NEFEJ

Vehicles are a major source of urban pollution: clockwise from top-bus in Kathmandu; protesting against pollution; clean SAFA tempos

environmental planning and management are to succeed in making urban areas better places to live. Obviously, this should not be limited to integrated and coordinated provision of infrastructure and services, but also include wider concepts of integration. It is necessary to:

(i) introduce land-use planning with due consideration to environmental attributes including urban ecology and heritage;
(ii) integrate and coordinate planning and management of urban infrastructure and services;
(iii) promote waste reduction, reuse, and recycling and other environmentally friendly practices;
(iv) raise awareness of people regarding environment, health, and appropriate practices and behaviors;
(v) promote participation and partnership with people, communities, NGOs, community-based organizations, the private sector, and civil society in environmental planning and management;
(vi) address urban poverty and needs of the urban poor; and
(vii) introduce the "polluter pays" principle.

Most past efforts in planning and providing urban infrastructure and services have been sectoral—uncoordinated rather than integrated. Important lessons regarding urban environmental management in Nepal can be derived from past activities including planning approaches and donor-supported programs as well as small-scale environmental activities of NGOs. The latter include converting wastes into resources (through composting, making briquettes from waste, paper recycling, management of solid waste by communities), promoting alternative approaches to waste/sewage treatment, and addressing the needs of the urban poor including those in slums and squatter communities. The informal sector can play an important role in urban life and livelihoods. Integrated urban management should also include strengthening this sector.

Municipalities, local bodies, and competent authorities must be strengthened if integrated urban environmental management is to be achieved. Appropriate tools, and human and financial resources must all be developed. Clear urban development policies and legal frameworks may be necessary for promoting land-use planning, participation by the stakeholders, and ensuring coordination and cooperation.

Quite often environmental problems are political and economic, arising not from shortage of environmental resources (e.g., land or fresh water) but from political or economic factors that inhibit certain groups' access to them. Most environmental problems cannot be solved without effective local institutions. In the long run, a competent, representative, inclusive, and democratic local government is the key for effective proactive environmental management in urban areas. Decentralization and empowering municipal governance are the top priorities if disjointed sectoral activities are to be coordinated under an able, technically competent, and financially viable urban management and development authority. To date, power lies with sectoral line agencies which control resources and influence legislation. This central control has not worked satisfactorily and is unlikely to improve in future. It is therefore essential for devolution of authority to take place in a very fundamental way, ensuring transfer of power and resources to local units, enhancing municipal capacity, ensuring participatory processes to working with communities, and fostering partnership with NGOs and the private sector.

Bibliography

Asian Development Bank (ADB). 2000. *Technical Assistance Final Report on Nepal Urban Sector Strategy, Volume 1: Main Report*. Kathmandu: His Majesty's Government of Nepal, Ministry of Physical Planning and Works, Department of Housing and Urban Development, and Asian Development Bank .

Adhikari, A. P. 1998. *Urban and Environmental Planning in Nepal—Analysis, Policies and Proposals*. Kathmandu: The World Conservation Union (IUCN).

Baniya, I.C. 2002. "Problems, Prospects and Policy Measures in Slums and Squatters: A Case Study of Jagriti Tole and Hyumat Tole, Kathmandu." A Seminar Report, Department of Architecture and Urban Planning, Institute of Engineering, Kathmandu.

Central Bureau of Statistics (CBS). 1998. *A Compendium on Environment Statistics 1998*. Kathmandu.

———.2002. *A Handbook of Environment Statistics, Nepal 2002*. Kathmandu.

———.2004. *Handbook of Environment Statistics 2003*. Kathmandu.

Chhetri, R. B. 2004. "Pros and Cons—Nepalese Municipal Finance." Unpublished report, Urban Development Through Local Efforts Project, German Technical Cooperation (GTZ), Kathmandu.

Chhetri, R. B., and S. Pradhan. 2005. "Financial Analysis of Nepalese Municipalities (1999/2000 to 2003/04)." Unpublished report, Urban Development Through Local Efforts Project, German Technical Cooperation (GTZ), Kathmandu.

Department of Health Services (DOHS). 2001. *Annual Report 2000/01*. Kathmandu.

Department of Transport Management (DOTM). 2005. Unpublished data accessed from record files, Department of Transport Management, Kathmandu.

Department of Urban Development and Housing (DUDH). 2005. "Outer Ring Road Land Development Project-Concept Paper." Third draft (unpublished), His Majesty's Government of Nepal, Ministry of Physical Planning and Works, Kathmandu.

Devkota, N. and D. Ghimire. Undated. "Outer Ring Road in the Kathmandu Valley—Part of Development Plan or a Plan in Itself?" Unpublished report, Kathmandu.

Dhakal, S. 2003. "Bagmati Under Threat." Spotlight (23)1 June 27–July 03. Available: http://www.nepalresearch.org/archive/ nature/pollution/ archive

His Majesty's Government of Nepal (HMG) and United Nations Development Programme (UNDP). 1994. "Urban Environment Program: Main Document." Unpublished report, Environment Protection Council, Urban Environment Management Committee, Ministry of Housing and Physical Planning, Kathmandu.

IUCN (The World Conservation Union). 1992. *Environmental Pollution in Nepal: A Review of Studies*. Kathmandu: His Majesty's Government of Nepal, National Planning Commission-National Conservation Strategy Implementation Programme.

———.1999. *Environmental Planning and Management of the Kathmandu Valley*. Kathmandu: His Majesty's Government of Nepal, Ministry of Population and Environment.

Joshi, J. 1999. *Housing and Urban Development in Nepal: Analysis and design of participatory development process.* Kathmandu: Lajmina Joshi.

———.2000. *Planning for Sustainable Development: Urban Management in Nepal and South Asia*. Kathmandu: Lajmina Joshi.

Joshi, P.S. 2004. "Future of Kathmandu Valley—The Planning Initiatives, Containment Policy and Proposed Outer Ring Road." In *Voices of Cities, 4(2)* edited by B. Mainali, Municipal Association of Nepal, Kathamandu.

Ministry of Law and Justice (MOLJ). 1999. *Local Self-Governance Act 2055 (1999)*. Kathmandu.

National Planning Commission (NPC) and United Nations Development Programme (UNDP). undated. "Sectoral Reports for Sustainable Development Agenda for Nepal." Draft report. His Majesty's Government of Nepal, National Planning Commission and United Nations Development Programme, Kathmandu. Available: http://www.scdp.org.np/sdan

Nepal Forum of Environmental Journalists (NEFEJ) and Environment Support Fund (ESF). 2004. *Project Completion Report*. Environmental Support Fund for Non-Governmental Organisations and Community-Based Organisations in Nepal, Kathmandu.

Nippon Jogesuido Sekkei Co Ltd Japan et al. 2002. "Urban and Environmental Improvement Project Nepal." Final Report: Volume I Main Report. Kathmandu, Asian Development Bank and His Majesty's Government of Nepal, Ministry of Physical Planning and Works, Department of Urban Development and Building Construction.

Phuyal, S. 2003. "How Have-nots are Forced to Pay for Crimes of Haves." *Kathmandu Post*, June 1. Available: http://www.environmentnepal.com.np/articles_d.asp?id=133

Pradhan, P.K. 2004. "Population Growth, Migration and Urbanisation, and Environmental Change in Kathmandu Valley, Nepal." In *Environmental Change and its Implications for Population Mitigation* edited by J. Unruh, M. Krol and N. Kliot Kluwer The Netherlands: Academic Publishers.

Sharma, P. 2003. "Urbanisation and Development." In *Population Monograph of Nepal Volume I*. Kathmandu: His Majesty's Government of Nepal, Central Bureau of Statistics.

Solid Waste Management and Resource Mobilisation Centre (SWMRMC). 2004. "A Diagnostic Report on State of Solidwaste Management in Municipalities of Nepal." Final Report. Lalitpur.

Thapa, Kishore (N.D.). "Urban Land Pooling Policies in Nepal and Experiences in Implementation, Kathmandu, Nepal." Unpublished.

Urban Development Through Local Efforts (UDLE). 1992. *Urban Environmental Guidelines for Nepal*. Kathmandu: Urban Development Through Local Efforts Project, German Technical Cooperation (GTZ).

United Nations Environment Programme (UNEP). 2001. *Nepal: State of the Environment 2001*. Bangkok: United Nations Environment Programme, Regional Resource Center for the Asia Pacific.

URBAIR. 1996. Urban Air Quality Management Strategy in Asia, Kathmandu Valley Report. The International Bank of Reconstruction and Development/ The World Bank, Washington DC.

WaterAid. 2004. The Water and Sanitation Millennium Development Targets in Nepal: What do they mean? What will they cost? Can Nepal meet them? Lalitpur.