

Country Background

Location

Nepal, with an area of 147,181 km², occupies the central Himalayas between the Palaearctic (Holarctic) and Palaeotropical (Indo-Malayan) regions. The country is located between the latitudes of 26° 22' and 30° 27' N, and longitudes of 80° 40' and 88° 12' E. The average length of the country is 885 km from east to west, the width varies from 145 km to 241 km, with a mean of 193 km north to south. Hills and high mountains cover about 86% of the total land area; the remaining 14% is composed of flatlands of the Terai which are less than 300m in elevation. Altitude within the country varies from 67m above sea level at Kechana Kalan Jhapa in the southeastern Terai, to Mount Sagarmatha at 8,848m, the highest point in the world. Nepal's biodiversity is a reflection of its unique geographic position and altitudinal and climatic variations.

Physiography

Wide altitudinal variations and diverse climatic conditions have resulted in four core physiographic zones in Nepal. The extreme altitudinal gradient has resulted in five levels and 11 sub-levels of bio-climatic zones, from Tropical to Nival, within a short horizontal span. According to Hagen (1998), Nepal has seven physiographic divisions from south to north: Terai, Siwalik Hills, Mahabharat 'Lek' (mountain range), Midlands, Himalayas, Inner Himalayas, and Tibetan marginal mountains.

The Terai belt is a flat and valuable stretch of fertile agricultural land in southern Nepal which forms part of the alluvial Gangetic plain. It lies at an altitude of between 67-300m between the Nepal-India international border and the first

outer foothills. The original forest cover in the Terai was dense; this is still so in western Nepal, but there has been a great deal of habitat destruction and ruthless deforestation in other parts.

The Siwalik Hills zone which rises abruptly from the Terai plains and reaches an elevation of between 700-1500m is wider in the western and far-western regions of Nepal and narrower in the east. This zone is primarily composed of sedimentary rocks and big boulders, and comprises the southernmost hill region of Nepal. The Bhabar rises from the Terai in the north and comprises a narrow but continuous belt of forest about 8-12 km wide (locally known as 'Char Kose Jhadi'). The Bhabar is formed by the accumulation of gravel, boulders, stone, and sand washed down from the foothills. Water is scarce in these parts throughout the year except during the monsoon, when sizeable streams rise up.

The Bhabar is not, however, an entirely independent range; in some areas the Mahabharat Lek which lies behind it to the north merges into the Siwalik Hills zone. In other areas the two ranges are separated by broad and gently sloping valleys called Dun valleys. Important Dun valleys are the Dang Valley in western Nepal, Chitwan Valley in central lowland Nepal, and Trijuga Valley in eastern Nepal. Dun valleys are under intensive cultivation and have been subjected to serious soil erosion due to uncontrolled deforestation in recent years.

The Mahabharat range lies between the Siwalik Hills to the south and the Midlands to the north. The range is well developed in eastern and central Nepal and underdeveloped in western Nepal. It is composed of hard rocks such

as granite, or quartzite, and limestone. The elevation of the Mahabharat range is from 1,500m to 2,700m. The major rivers, namely Kankai, Kamala, Trijuga, Bagmati, Babai, and Rapti rivers, originate from the Mid-hills or the Mahabharat range.

The Midlands lie north of the Mahabharat, and occupy the central region of the country. The average altitude is 2000m, with elevations ranging from 600-3500m. The Midlands include the high valleys of Nepal; eminent ones with very dense human populations are the Kathmandu, Pokhara, Trishuli, and Banepa valleys. Agriculture is intensive in these parts of the country; farmers have made terraces on the hillsides sometimes up to the tops of the high hills. Forests have been severely degraded in this region, and the rate of soil erosion is alarming. This area is also rich in hydrology. All the rivers that flow from the Himalayas down to the plains converge into three great rivers in this zone: the Sapta Koshi in eastern Nepal, Narayani in central Nepal, and Karnali in far-western Nepal. Geologically, the Midlands contain diverse formations and are rich in schist and quartz rocks.

The Himalayan zone lies in northern Nepal above 3000m in elevation, stretching from the east to the west of the country. It comprises sub-alpine and alpine climates where summer grazing pastures are found in lower elevations; high altitude plant species adapted to extremes of cold and desiccation are found in higher elevations. Heavy snowfall occurs in these areas during the winter months. Above 5500m, the Himalayas are covered with perpetual snow and no vegetation. Above 5000m, the region is considered an arctic desert or Nival zone (Table 2).

There are several inner Himalayan valleys with desert conditions, such as the upper

Kaligandaki and Bheri valleys, located at altitudes above 3600m. These valleys are exceedingly dry, and the effect of the monsoon is virtually absent.

To the north of the Dhaulagiri and Annapurna Himals is an almost tree-less plateau referred to as the Tibetan Plateau or arid zone. The zone includes parts of Dolpa, Mustang, and Manang, where the climate and vegetation is Tibetan in character.

Climate

A wide range of climatic conditions exists in Nepal, primarily as a result of altitudinal variation. This is reflected in the contrasting habitats, vegetation, flora, and fauna that exist in the country. Other important climatic factors influencing biodiversity and the distribution of flora and fauna include precipitation, humidity, temperature, and aspect.

Eighty percent of precipitation in Nepal occurs in the form of summer monsoon rains from June through September. Winter rains are more pronounced in the western hills. The average annual rainfall in Nepal is about 1,600 mm, but total precipitation differs in each eco-climatic zone. The eastern region is wetter than the western region. Taplejung (1768m) in the far-eastern Midhills receives an average annual rainfall of 2024 mm, whereas Baitadi (1635m) in the far-western region receives only 1037 mm. The southern flanks of the Himalayas, such as Pokhara, receive a higher amount of rainfall (3,345 mm), while the rain shadow areas of Dolpa, Jomsom, and Mustang receive considerably less (295 mm).

Temperature variation within topographic variations is pronounced. The average temperature is indicated to decrease by 6°C for every 1000m gain in altitude (Jha 1992). Winter temperatures in the Terai are between 22-27°C, while summer temperatures exceed 37°C. In the Midhills, temperatures generally remain between 12-16°C. Human interventions such as deforestation, industrialisation, and urbanisation have had adverse effects on the country's climate, and have influenced a pronounced rise in temperature in

Table 2. Physiographic and Bioclimatic Zones of Nepal

| Physiographic Zone | Surface Area (%) | Elevation (m) | Bioclimatic zones |
|-------------------------|------------------|------------------------|-------------------|
| High Himal | 23 | above 5,000 | Nival |
| High Mountains | 20 | 4,000-5,000 | Alpine |
| | | 3,000-4,000 | Sub-alpine |
| Mid-Hills | 30 | 2,000-3,000 | Temperate monsoon |
| | | 1,000-2,000 | Subtropical |
| Terai and Siwalik Hills | 27 | 500-1,000 below 500 | Tropical |

Source: LRMP 1986 and Dobremez 1975



River Narayani, Chitwan

R N Suwal

recent years. Aspect has an important influence on vegetation particularly at lower altitudes. In general, moisture is retained more on the north and west faces; the south and east faces are drier because of their longer exposure to the sun.

Soil

Soil formation is directly correlated to the physiographic zone. In the Terai, the soil is alluvial and fine to medium textured. In the Siwalik Hills, the soil is made up of sedimentary and conglomerate rocks sandy in texture, while in the Mid-hills it is medium to light in texture with a predominance of coarse-grained sand and gravel. The soil in the high mountains is shallow, stony, and glacial. Hill slopes, as a result, tend to lose their topsoil through erosion (HMG/ADB/FINNIDA 1988).

River systems

The major perennial river systems in Nepal are Mahakali, Karnali, Narayani, and Koshi rivers, all of which originate in the Himalayas. These great rivers contain water resources with tremendous potential for large-scale hydropower and irrigation development. The medium-sized

rivers include Babai, West Rapti, Bagmati, Kamla, Kankai, and Mechi rivers; these generally originate in the Mid-hills or in the Mahabharat range. The Terai region has a large number of small and usually seasonal rivers, most of which originate in the Siwalik Hills (HMG/ADB/FINNIDA 1988).

Land use

The latest physiographic data indicate that Nepal comprises around 4.27 million hectares of forest (29% of total land area), 1.56 million hectares of scrubland (10.6%) and degraded forest, 1.7 million hectares of grassland (12%); 3.0 million hectares of farmland (21%), and about 1.0 million hectares of uncultivated lands (7%). It has been reported that forest cover in the Terai and hill areas decreased at an annual rate of 1.3%, and 2.3% between 1978/79 and 1990/91, respectively (HMG/DFRS 1999). On average, forested areas have decreased at an annual rate of 1.7%, and scrublands have decreased at an annual rate of 0.5%. In terms of total land area, the Terai occupies only 23.1%, the hills, occupy 41.7%, and mountains 35.2% of Nepal's total land area.

Population and human development

The 2001 census of Nepal records a population of 23.2 million: 48.5% of the population lives in the Terai, 44.2% in the hills, and 7.3% in the mountains. Average population density is 157.73/km², with the highest density in the Terai (330.78/km²), medium density reflected in the hills (167.44/km²), and lowest in the mountains (32.62/km²). In relation to Nepal's five development regions,³ the Central Development Region accommodates 34.7% of the total population, followed by the Eastern Development Region (23.1%), the Western Development Region (19.6%), the Mid-Western Development Region (12.9%), and finally the Far-Western Development Region (9.5%). In relative terms, the mid-western and far-western development regions lag behind in terms of development performance. (source: MoEST, 2005)

Average annual population growth rate for Nepal was 2.08% between 1981 and 1991, but the figures from the 2001 census indicate a growth rate of 2.27%. The growth rate is highest in the Terai and lowest in the mountains. The rate of urbanisation in Nepal is low compared to other developing countries; 85% of the population still lives in rural areas with limited access to basic services including health and education. The average literacy rate is poor, but a positive trend is apparent: the 53.7% literacy rate in 2001 is a significant improvement from 39.6% in 1991, and from 14% in 1971 (MoEST 2005).

The 2006 Human Development Index (HDI)⁴ for Nepal is 0.527, which ranks Nepal as 138th out of 177 countries with data. In three specific dimensions of human development Nepal stands 129th, with 62.1 years life expectancy at birth; 118th, with 48.6% adult literacy rate; and 147th, with the purchasing power parity of US\$1,490. With a Human Poverty Index for developing countries (HPI-1) value of 38.1, Nepal ranks 68th among 102 developing countries for which the index has been calculated. According to selected indicators of HPI-1 Nepal stands 122nd, with 17.6% probability of not surviving past age 40; 108th, with a 51.4% adult illiteracy rate; 41st, with 10% of the population without access to an improved water source; and 134th, with 48% of children underweight for their age. Nepal's

Gender-related Development Index (GDI) value, 0.513, should be compared to its HDI value of 0.527. Its GDI value is 97.3% of its HDI value. Out of 136 countries with both HDI and GDI values, 119 countries have a better ratio than Nepal's (UNDP 2006).

Natural resources of economic significance

The economic potential of Nepal is closely bound to its natural resources: agricultural lands, wetlands, forests, protected areas, and river systems.

Although agricultural land comprises only 20% of total land area, agriculture is the major determinant of economic activities and the nation's socio-political identity, according to the 1998 Nepal Human Development Report (NSAC 1998). Agricultural land is unevenly distributed, with 55.7% in the Terai, 37.3% in the hills, and 6.9% in the mountains. Though farms are mostly subsistence-level, agriculture contributes over 50% of household incomes, provides employment for about 80% of the population, and exerts considerable influence on the manufacturing and export sectors of the economy. Freshwater resources are abundant in Nepal, with approximately 200 billion m³/s of water contained in various river systems. The commercial hydroelectric potential of these rivers has been estimated to be up to 45,000 mega watts (mw). The water also holds immense potential for crop irrigation, feeding an estimated 90% of cultivable land.

Forests are an important natural resource and cover some 29% of the land area. This is a mere fraction of Nepal's original forest cover which has suffered increasing population pressures and demand for arable land, pastures, fuel, fodder, and farm implements. The high demand for agricultural land has led to considerable deforestation and loss of ground cover. This, together with natural phenomena such as floods and landslides, is thought to contribute to annual soil loss of 20-25 tonnes/ha. However, in spite of the decline in forest cover, forested land is still one of the most valuable natural resources of Nepal through its attraction for eco-tourism. The majority of protected areas including major national parks

³ Nepal is divided into five development regions – eastern, central, western, mid-western, and far-western – each of which comprise a number of districts. The distribution of 75 districts in the five regions is as follows: eastern-16, central-19, western-16, mid-western-15, and far-western-9.

⁴ The 2006 HDI was based on 2004 data

are made up of forested land; their contribution to the national economy through foreign exchange earnings from export of forest products is of major importance.

Nepal's national bioresources currently traded internationally are mostly uncultivated and originate in the wild. As published in the **Nepal Gazette**, Nepal's 188 biomaterials commonly found in international trade consist of various parts of plants, such as root and tubers of 39 plants, barks of seven plants, leaves of 26 plants, flowers of 14 plants, fruits and seeds of 61 plants, whole plants of 12 plants, gum and resins of eight plants, and miscellaneous parts of 11 plants (NNC 2005).

Tourism is the second most important source of foreign exchange for Nepal. During the period from 1996-2005, over 45% of the total number of visitors to Nepal, on average, visited designated protected areas. Tourist arrivals in the country is projected to increase by 8-10% annually; visitors to protected areas are also expected to increase according to this ratio. Data indicates that approximately 60% of tourists visited Nepal's protected areas in 2004. Among the protected areas, the Annapurna Conservation Area and Chitwan National Park received 36% and 34% visitors, respectively. Sagarmatha National Park received 20% visitors, Shivapuri National Park (ShNP) received 5%, and Langtang National Park 3%. Three protected areas did not receive visitors at all: Khaptad National Park, Parsa Wildlife Reserve, and Dhorpatan Hunting Reserve (DNPWC 2006). This period coincides with the recent political conflict in Nepal; the number of visitors to various sites possibly reflect the accessibility of these locations and security concerns. As tourism related activities in and around protected areas generate revenue, tourism will remain central to the economic sustainability of the protected areas system.

Acts, regulations, and policies

Protected areas acts and regulations

The National Parks and Wildlife Conservation Act (NPWCA) 1973 and its ten associated regulations are the principal legal instruments that govern the management of protected areas in Nepal (**Box 1**). Section 3 of the NPWCA categorically prohibits hunting of animals or

birds; construction of any house, hut, or other structure; clearing or cultivation of any part of the land; harvesting of crops; cutting, burning, or damaging any tree, bush, or other forest product; and mining within national parks or protected areas. The Act provides complete protection to 27 species of mammals, nine species of birds, and three species of reptiles. Since its promulgation in 1973, five amendments have been made to this Act. The Fifth Amendment in 2005 accommodated the provision handing over management responsibility over protected areas to organisations established under the Act. The three regulations formulated after 1996 primarily reflect upon government policy involving local communities in the management of protected areas.

There are two other Acts pertaining to conservation of biodiversity: the Aquatic Animals Protection Act (AAP Act) 1961, and National Trust for Nature Conservation (NTNC) Act 1982 (previously KMTNC Act). The Aquatic Animals Protection Act 1961 provides legislative protection for habitats of aquatic species. This law was

Box 1. Acts and Regulations Related to Protected Areas and Wildlife

- National Parks and Wildlife Conservation Act 1973 (First Amendment 1974, Second Amendment 1983, Third Amendment 1990, Fourth Amendment 1993, and Fifth Amendment 2005)
- Elephant Management Regulations 1966
- National Parks and Wildlife Conservation Regulations 1974 (First Amendment 1975, Second Amendment 1978, and Third Amendment 1985)
- Chitwan National Park Regulations 1974 (First Amendment 1990)
- Wildlife Reserves Regulations 1978 (First Amendment 1985)
- Himalayan National Parks Regulations 1980
- Khaptad National Park Regulations 1988
- Buffer Zone Regulations 1996
- Bardia National Park Regulations 1997
- Conservation Area Regulations 1997
- Conservation Area Government Regulations 1997

amended for the first time in 1998. Section 5a included by the recent amendment permits the use of only safe pesticides should poisonous materials be used to catch aquatic life. Established under the NTNC Act 1982, the Nature Trust for Nature Conservation manages two protected areas, the Annapurna Conservation Area (ACA) and Manaslu Conservation Area (MCA), and the Central Zoo. NTNC also carries out research, training, and education activities in Chitwan National Park, Bardia National Park, and Shuklaphanta Wildlife Reserve.

Under the umbrella of these Acts, regulations provide special provisions for communities living in the park enclaves to collect natural resources for their daily necessities, such as firewood, leaf litter, and small pieces of timber and fodder. These laws allow people to continue to graze domestic cattle on park rangelands. Park people can also help limit the number of 'outsiders' from harvesting forest resources, and can prohibit entry of outsiders into the park/reserve areas altogether. These provisions help reduce the exploitation and pressure on the reserves. Specific regulations for protected areas highlight site-specific needs in these areas, such as provisions to allow for the transhumance system of grazing in the 'Patans' (grazing meadows) of the Khaptad National Park.

Other relevant regulations

Acts and regulations applicable to forests, watersheds, the environment, livestock, self-governance, and tourism (**Box 2**) hold equal significance for the conservation of flora and fauna in Nepal. According to the Forest Act 1993 (amended 1999), forest products also include birds, wildlife, and trophies thereof. Provisions made in the Forest Act 1993 as amended, and Forest Regulations 1995 relating both to national forests including government managed forests, protected forests, community forests, leasehold forests, and religious forests, and private forests will have long-term impacts on the conservation and sustainable use of various components of biodiversity. Section 23 empowers the government to delineate any part of a national forest that has a 'special environmental, scientific, or cultural importance,' as a protected forest.

The Soil and Watershed Conservation Act 1982 (Section 3) outlines the parameters for proper watershed management including

management of rivers and lakes. The Act also empowers the government to proclaim certain areas as protected watershed areas. The Environment Protection Act of 1996 and Environment Protection Regulations 1997 have made initial environmental examination (IEE), or environmental impact assessment (EIA) mandatory in forests, agriculture, hydropower development, and other environment related fields.

Box 2. Acts and Regulations Relevant to Forests and the Environment

- Aquatic Animals Protection Act 1961
- Environment Protection Act 1996, and Environment Protection Regulations 1997
- Forest Act 1993 (amended 1999) and Forest Regulations 1995
- Forest Act 1992
- Local Self-Governance Act 1998
- National Trust for Nature Conservation Act 1982
- Pesticides Act 1991
- Plant Protection Act 1964
- Soil and Watershed Conservation Act 1982

According to the Local Self-Governance (LSG) Act 1998, local district development committees (DDCs) and village development committees (VDCs)⁵ are responsible for the formulation and implementation of programmes for the conservation of forests, vegetation, biological diversity, and soil.

Site-specific Acts and regulations also play a vital role in safeguarding the biodiversity of localities. Examples are the Lumbini Development Trust Act 1985 and the Pashupati Area Development Trust Act 1987.

Laws and regulations in the 'nongreen' sectors also have provisions to help ultimately conserve biodiversity. For example, Municipality Act 1992, the Pesticide Act 1991, Solid Waste (Management and Resource Mobilisation) Act 1986, and Tourism Act 1978 have provisions for environment and heritage conservation, sanitation services, pollution control, and solid waste management. These legislations, in most cases, complement each other with respect to the management, utilisation, and ownership of natural resources particularly forests.

⁵ The VDC is the lowest local level of governance. Each of the 75 districts of Nepal is composed of several VDCs, each VDC consisting of 9 Wards. There are altogether 3,912 VDCs in the whole of Nepal. The DDC, on the other hand, is a body of local representatives formed under the 1999 Local Self-Governance Act.

Policy

Handover of the management of protected areas

The 'Working Procedure for the Implementation of the Policy with Regard to the Handover of the Management of National Parks, Wildlife Reserves and Conservation Areas for Non-governmental Organizations (NGO) or Other Organisations' was approved by the government on 15 August 2003. The objective of the guideline was to enable NGOs and other organisations to manage national parks, wildlife reserves, and protected areas. Among the unchangeable conditions was that the fundamental principles of protected areas would be ensured.

The Domesticated Elephant Management Policy 2003, approved by the government on 16 September 2003, aimed to maximise economic and environmental benefits through proper management of domesticated elephants. The policy highlights the need for elephant breeding, domestication of wild elephants, and appropriate integration with ecotourism activities.

Working Policy on Wildlife Farming

The 'Working Policy on Wildlife Farming, Breeding and Research 2003', approved by the government on 28 August 2003, was designed to implement policies that improve the living conditions of women, the poor, and disadvantaged sections of the society through

conservation of biodiversity. The policy permits commercial farming of wild animal species including those protected under the law (Table 3).

Apart from wildlife farming, Nepal has recognised that both domesticated and cultivated livestock species are an important component of biological diversity. With the assistance of FAO (GCP/RAS/144/JPN), the Government of Nepal (HMG 1998) has prepared a national policy document on management and utilisation of farms as genetic resources of animals. Although there is no legislation related to animal breeding policies, the conservation of animal genetic resources in farms has been considered in the proposed Veterinary Act currently awaiting approval.

2003 National Wetland Policy of Nepal

The primary goal of the National Wetland Policy of Nepal 2003 is to conserve and manage wetland resources with local community participation in a judicious and sustainable manner. It also aims to place wetland conservation and management within the broader framework of environmental management. The policy addresses various aspects of wetlands, including identification and classification of wetlands; prevention and control of invasive plant species; identification and promotion of local indigenous knowledge; and mobilisation of local communities including women.

Table 3. List of Wild Animal Species Permitted for Commercial Farming, Fees and Farming Permit and Seed Animals

| Species | Scientific Name | Fees for Seed Animal (NRs per head) | Fees for Farming (NRs) |
|---|------------------------------|--|---------------------------|
| Protected wild animal species | | | |
| 1. Black buck* | <i>Antelope cervicapra</i> | 25,000 | 25,000 |
| 2. Gharial crocodile* | <i>Gavialis gangeticus</i> | 40,000 | 40,000 |
| 3. Danphe (Impeyan pheasant)* | <i>Lophophorus impejanus</i> | 5,000 | 10,000 |
| 4. Monal (Satyr tragopan)* | <i>Tragopan satyra</i> | 5,000 | 5,000 |
| 5. Cheer pheasant* | <i>Catreus wallichii</i> | 5,000 | 5,000 |
| Other wild animal species | | | |
| 1. Barking deer | <i>Muntiacus muntjak</i> | 15,000 | 15,000 |
| 2. Spotted deer | <i>Axis axis</i> | 15,000 | 15,000 |
| 3. Samber deer | <i>Cervus unicolor</i> | 20,000 | 20,000 |
| 4. Hog deer | <i>Axis porcinus</i> | 15,000 | 15,000 |
| 5. Wild boar | <i>Sus scrofa</i> | 10,000 | 10,000 |
| 6. Monkey (Rhesus monkey) | <i>Macaca mulatta</i> | 25,000 | 15,000 |
| 7. Snakes | Order <i>Serpentes</i> | 5,000 | 10,000 |
| 8. All other kinds of birds | <i>Aves</i> | 5,000 | 5,000 |
| Source: GoN/MFSC, 2003 * Protected species Average of NRS74.75=US\$ in 2003 | | | |

Table 4. Nepal Commitments to Major International Conventions

| Name of Convention | Entry into force in Nepal | Major obligations |
|---|---------------------------|--|
| United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, 1994. | 13 January 1997 | <ul style="list-style-type: none"> Combating desertification and mitigation of the effects of drought by adopting an integrated approach to address the physical, biological, and socioeconomic aspects of the processes of desertification and drought Integration of strategies for poverty eradication, and preparation and implementation of the National Action Programme |
| Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989 | 13 January 1997 | <ul style="list-style-type: none"> Protection of the environment and adoption of measures to safely transport, dispose, and manage hazardous wastes Controlling illegal traffic in hazardous wastes |
| Vienna Convention for the Protection of the Ozone Layer, 1985 | 4 October 1994 | <ul style="list-style-type: none"> Adoption of appropriate measures for the protection of human health and the environment resulting from modifications in the ozone layer Adoption of measures, procedures, and standards to minimise use of ozone depleting substances Initiation and cooperation to carry out research and scientific assessment on processes that may affect the ozone layer |
| United Nations Framework Convention on Climate Change, 1992 | 31 July 1994 | <ul style="list-style-type: none"> Stabilisation of greenhouse gas concentrations in the atmosphere and protection of the climate system Precautionary measures to anticipate, prevent, or minimise the causes of climate change Formulation of national policies and corresponding measures Promotion, cooperation, and facilitation in research and public awareness on climate change and its effects |
| Convention on Biological Diversity, 1992 | 21 February 1994 | <ul style="list-style-type: none"> Conservation and sustainable use of biological diversity, and equitable sharing of its benefits Preparation and implementation of national strategies, plans or programmes for the conservation and sustainable use of biodiversity Conservation in in- and ex-situ conditions, and promotion of biotechnology and genetic research |
| Agreement on the Network of Aquaculture Centers in Asia and the Pacific, 1988 | 4 January 1990 | <ul style="list-style-type: none"> Expansion of aquaculture development through multidisciplinary research on selected aqua-farming system and transfer of technologies Establishment of a regional information system, and training and upgrade of core personnel for national aquaculture planning, research, training, extension, and development |
| Convention on Wetlands of International Importance Especially as Waterfowl Habitat, 1971 | 17 April 1988 | <ul style="list-style-type: none"> Designation of wetlands of national and international importance and conservation, management, and wise use of migratory stock of waterfowl and their habitats |
| Convention for the Protection of the World Cultural and Natural Heritage, 1972 | 20 September 1978 | <ul style="list-style-type: none"> Adoption of effective measures for the protection of cultural and natural heritage through national and international cooperation |
| Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973 | 16 September 1975 | <ul style="list-style-type: none"> Protection of natural ecosystems including wild fauna and flora Regulation on trade, import, and export of species listed in the Appendices |
| Plant Protection Agreement for Southeast Asia and the Pacific (as amended), 1956 | 12 August 1965 | <ul style="list-style-type: none"> Prevention of the spread and introduction of pests of plants and plant products, and promotion of measures for their control during import and export |

International conventions and treaties

Based on commitment as a signatory to the **Convention on Biological Diversity** at the Earth Summit (1992) in Rio, Nepal developed a **Nepal Biodiversity Strategy** in 2002. This strategy links the diverse obligations of the Convention together, and serves as an overall framework for the conservation and sustainable use of national biodiversity and biological resources. Nepal is a party to ten major international agreements and conventions on biodiversity conservation (**Table 4**). Methods for transforming international treaty norms into domestic law in Nepal are currently in progress.

In addition to these international conventions and treaties, Nepal is committed to other global affiliations pertinent to biodiversity conservation and sustainable development, including the World Trade Organization (WTO), the World Conservation Union - IUCN, and the Global Tiger Forum. Nepal is also dedicated to the spirit of the World Conservation Strategy 1980, and the World Charter for Nature 1982. Government officials and representatives of NGOs have participated in global forums such as the World Park Congress, the World Forestry Congress, and the International Technical Conference on Plant Genetic Resources: Global Action Plan on Plant Genetic Resources 1996, among others.

Protected sites

As authorised by the National Parks and Wildlife Conservation Act, and in response to international conventions and treaties, the Government of Nepal has established a network of 16 protected areas (nine national parks, three wildlife reserves, three conservation areas, and one hunting reserve). Buffer zones have been established in eight national parks except Shivapuri National Park, and in three wildlife reserves.

Four properties in Nepal have also been inscribed in UNESCO's List of World Heritage Sites. They include two natural properties namely, Sagarmatha and Chitwan national parks; and two cultural properties namely Lumbini and the Kathmandu Valley. Of the seven monumental zones of the Kathmandu Valley, three properties

of particular ecological significance are Swayambhu, Pashupati, and Changunarayan.

There are four Ramsar sites, of which Koshitappu is a wildlife reserve, and Beeshazar and Associated Lakes fall within the buffer zone of Chitwan National Park (CNP). The Jagdishpur Reservoir is an artificial water body, whereas Ghodaghodi 'Tal' (lake) is a natural lake.

Global change factors

This network of protected areas covers 19.67% of Nepal's land area – the equivalent of 11% of the earth's land surface. Protected areas of the world face a growing set of global changes that threaten existing capacity to protect and maintain the valuable diversity of life and the sources of ecosystem services for human communities (WCPA 2003).

With respect to biophysical changes, analysis of maximum temperature data from 49 stations in Nepal from 1971 to 1994 reveals warming trends. Records show a steady increase in temperature from 0.06° to 0.12° C per year since 1977 in most of the middle mountains and the Himalayan region, and a rise in temperature is less than 0.03° C per year in the Siwalik and Terai regions (Shrestha et al. 1999).

In addition to changes in the ecosystem as a result of climate change, other aspects of the modern world pose challenges on indigenous biodiversity. The visible examples of habitat fragmentation in the Terai Arc Landscape-Nepal protected areas include highways, irrigation canals, barrage, and high-tension electrical lines. The east-west highway intersects the north-south Barandabhar forest corridor linking CNP and the Mahabharat foothills, and separates the Babai Valley from the Karnali flood plain of BNP (Bhujju et al. 2006).

Such interventions, human-induced and otherwise, have resulted in movement of species beyond their areas of origin. The major alien species currently prolific in the lowland protected areas of Nepal are weed species *Eupatorium odoratum*, *Mikania micrantha*, *Eichhornea crassipis*, and *Lantana camara* (Bhujju, UR; Shakya, PR; and Shrestha, S. 2006).



Meconopsis horridula Hook F. & Thoms. Jaljale area, Taplejung 4500m
(P R Shakya)