









Nepal Biodiversity Resource Book

Protected Areas, Ramsar Sites,
and World Heritage Sites

Ukesh Raj Bhuju
Puspa Ratna Shakya
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The Ministry can be reached through its website-www.moest.gov.np and email-info@moest.gov.np.

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International Centre for Integrated
Mountain Development
ICIMOD



Government of Nepal,
Ministry of Environment,
Science and Technology
MOEST



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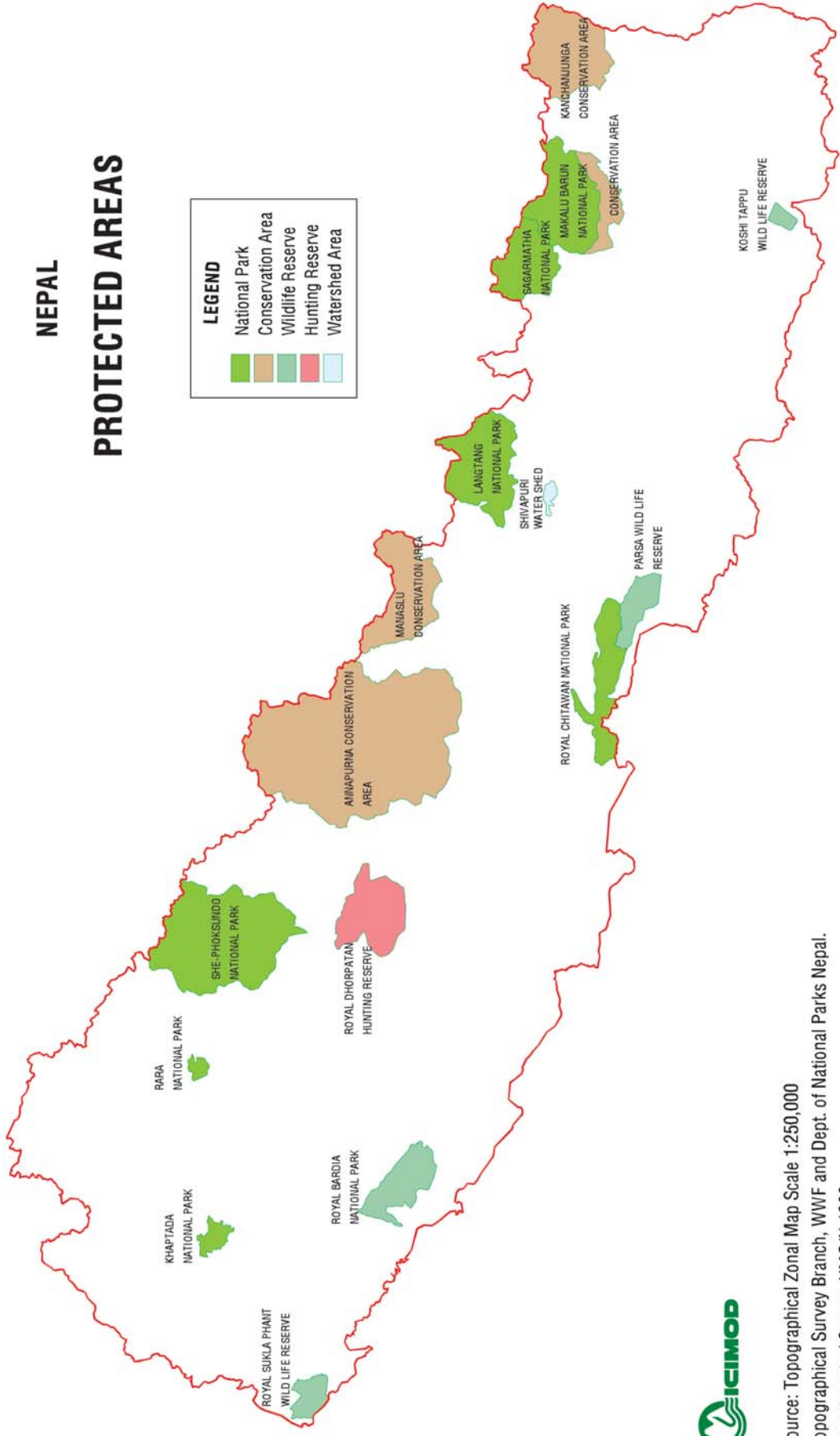
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Ministry of Environment, Science and Technology, Government of Nepal
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June 2007

NEPAL PROTECTED AREAS

LEGEND	
	National Park
	Conservation Area
	Wildlife Reserve
	Hunting Reserve
	Watershed Area



Source: Topographical Zonal Map Scale 1:250,000
 Topographical Survey Branch, WWF and Dept. of National Parks Nepal.
 Department of Survey, HMG/N 1988.

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Message

State Minister

Ministry of Environment, Science and Technology

Biological resources and associated traditional knowledge play important roles in the livelihoods of Nepalese society. Food security, human health, and environmental balance are interlinked with the state of these resources. Some flora and fauna have religious importance in Nepalese society.

Nepal faces ongoing and emerging challenges in conserving biodiversity due to, inter alia, growing population, poverty, habitat loss, erosion of crop genetic diversity, and climate change. Although emission of greenhouse gases from Nepal is negligible, the impact of climate change is being felt in the changes in biodiversity distribution and its production timings including additional threats to and extinction of important species.

Realising the importance of biological resources, the people and the Government of Nepal are actively involved in conserving these resources since time immemorial. By adhering to conservation-friendly policies and laws, it has extended its support to empower community users and to share benefits accrued from the conservation of biodiversity. Nepal has also joined the international community in conserving biodiversity by ratifying environment-related international legal instruments including the Convention on Biological Diversity. As a Party to this Convention in February 1994, Nepal has made significant progress to further mainstream biodiversity conservation in development planning and implementation. With a view to protect flora and fauna including endangered species, over 19 percent of the total area of the country has been managed in the form of protected areas which also includes two World Heritage Sites and one Ramsar site and their buffer zones. Forests outside the protected areas, and a community-based natural resource management regime such as community forests have been exemplary.

The Government of Nepal is implementing the biodiversity strategy and its implementation plan in collaboration with its development partners through widened institutional networks, capacity building, and people's active participation. The changing political scenario has given additional impetus for meaningful participation of and benefit to local communities from biodiversity conservation.

I believe that this Nepal Biodiversity Resource Book will provide updated information on floral and faunal diversity and encourage further our development partners in assisting our local communities in their continued efforts at biodiversity conservation. We look forward to moving ahead with local and international development partners in the auspicious task of preserving flora and fauna. I also believe that the publication of this book on the occasion of the World Environment Day will encourage all of us to further understand the role of biodiversity in conserving the environment. Finally, I would like to thank all those involved in preparing this

Mr Mahantha Thakur

Minister, Ministry of Environment, Science and Technology

Singh Durbar, Kathmandu, Nepal

June 2007



Foreword

Director General

International Centre for Integrated Mountain Development

Now at the turn of the 21st Century, a large part of Nepal's efforts towards biodiversity conservation has been institutionalised in the form of protected areas, Ramsar sites, and World Heritage Sites. Backed by powerful legislative tools like the 1973 National Parks and Wildlife Conservation Act, and progressive policies that aim to include local communities in every conservation programme, Nepal's protected areas covers nearly 20 per cent of the country's land, compared to a global figure of 11 per cent. The main challenge for the last few decades has been the continuous struggle of reconciling and saving threatened species and managing their habitats while still fulfilling the basic needs of the people who depend on these natural resources, and as in all countries the challenges remain.

This publication provides a compilation of the rich flora and fauna found in Nepal's protected areas, Ramsar sites, and World Heritages Sites. The resource book is another landmark in the conservation history of the country, following in wake of the 1996 'Biodiversity Profiles of Nepal' and provides a great opportunity for sharing and exchanging of information among conservation partners.

ICIMOD, as a knowledge and learning organisation focusing on the improved well-being of the people of the greater Himalayas allied to conservation of the natural environment, is concerned with making the information available that is needed for planning related to these goals. The Centre is delighted to join with the Government of Nepal and the United Nations Environment Programme in publishing this document, which will provide a backbone for awareness-raising efforts on the need for biodiversity conservation in the region, as well as a useful planning tool for years to come.

The further steps described in this document will provide a useful road map for the way forward. We believe that documents like this will help the rich biodiversity of the region to receive better attention from the global community. The companion CD along with the publication will provide a useful source of rich sources of data and information for the many people concerned with biodiversity conservation in Nepal and the Himalayas.

A handwritten signature in black ink, appearing to read 'Andreas Schild'.

Dr. Andreas Schild

Director General

International Centre for Integrated Mountain Development



Foreword

Executive Director
United Nations Environment Programme

The protected areas of the world—from World Heritage to Ramsar sites-- are facing a growing set of challenges as a result of human activities. These threaten their existing capacity to protect and maintain not only valuable biodiversity but the ecosystem services upon which all of us ultimately depend. A detailed inventory and assessment of the status of the floral and faunal species in protected areas is among the pre-requisites towards sustainable management of their biodiversity and gene pools.

The Nepal Biodiversity Resource Book is a timely contribution to these needs in a period when the United Nations network has urged the governments, organisations and the people to join hands to achieve the Millennium Development Goals and the 2010 Targets and Indicators. Nepal has made its road map clear through this Resource Book, which has opened up a new avenue of looking into the opportunities for us to identify specific conservation actions.

Nepal's conservation endeavors have been carefully watched by the international community. Its conservation policies of trusting the local people in biodiversity conservation and sharing the revenue of the protected areas with the community have added new dimensions to its conservation strategies. We believe that the emerging concept of establishing community-conserved areas will be well rooted in a country like Nepal where community forests and buffer zones have already been part of the country's response to the global biodiversity challenge.

On behalf of the United Nations Environment Programme, I would like to thank the Ministry of Environment, Science and Technology (MOEST) and the International Centre for Integrated Mountain Development (ICIMOD) for bringing out this publication and the Nepalese conservationists, biologists, scientists, and managers for conserving the unique biodiversity of Nepal that has global significance. We take pride in having had an opportunity to support the work documented in the Nepal Biodiversity Resource Book.

A handwritten signature in black ink, reading "Achim Steiner". The signature is fluid and cursive, with a large initial 'A' and 'S'.

Dr. Achim Steiner

United Nations Under-Secretary General and Executive Director
United Nations Environment Programme
Nairobi, Kenya
June 2007

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ICIMOD staff who have spent considerable energy and time to edit, format, and produce the document are to be commended as well, especially Ms. Joyce M. Mendez and Ms. Mona Sharma for editing, Ms. Punam Pradhan for layout design and execution, Mr. Anjesh Tuladhar who uploaded the report in Wiki form, and Mr. Asha Kaji Thaku for editorial assistance.

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Executive Summary

Introduction

Biodiversity Profiles of Nepal 1996 (BPN) is a landmark endeavour to document all the information available and also recorded in the field on Nepal's biodiversity. In 16 volumes of documents, the profiles recorded 181 mammal species, 844 bird species, 100 reptile species, 43 amphibian species, 185 freshwater fish species, and 635 butterfly species. In the context of flora, BPN recorded 5,160 species of flowering plants and 1,120 non-flowering plants. According to BPN, Nepal ranks 10th in terms of richest flowering plant diversity in Asia, and 31st in the world.

Since 1996 when the BPN documents were published, Nepal has advanced further in biodiversity conservation and protected areas management. A total of 8,778 sq km of protected areas has been added to the country's protected areas between 1996 and 2004, including Shivapuri National Park, Kangchenjunga and Manaslu conservation areas, and 11 buffer zones.

In 1996, IUCN-Nepal prepared a detailed wetlands inventory of 163 sites from the Terai and 79 sites from the hills and mountains; three sites, Bishazari Tal, Jagdishpur reservoir, and Ghodaghodi Tal, have been designated as Ramsar sites in 2003.

Since 1996, at least seven species of birds have been newly recorded in Nepal, and the number of bird species recorded in the protected areas has increased significantly. In Shivapuri National Park, for example, the number of bird species recorded in 1996 was 151; in 2002 it was 177, and 311 in 2005. The number of species of flowering plants on record to date is about 5,900 compared to 5,160 recorded by BPN in 1996. A new chapter on entomology has been opened following the publication of the inventory of insects of Nepal in 1997 and 1998.

The overall goal of the Nepal Biodiversity Yearbook Project (NBYP) was to establish a system for updating Nepal's biodiversity resources every year into a Nepal Biodiversity Resource Book 2006, 2007, 2008, and so on, based on scientific studies.

The main objective of NBYP was to prepare a resource book 2006 on Nepal's biodiversity by updating the 1996 Biodiversity Profiles of Nepal using published information between 1996 and 2005 and field verification.

The NBYP was implemented in five stages preparatory to publication. Upon completion of the preparatory stage, Nepal Nature dot Com formed a working team to implement the Project. Team formation approach followed the steps taken by BPP in 1996, with essential modifications.

The checklists of fauna and flora compiled for the resource book have been derived primarily from the BPP documents. To update the checklists, references were made to publications made by various conservation organisations.

The first draft of the resource book was reviewed by six experts. A consultative meeting of 26 other experts representing 13 organisations was also held in Kathmandu on November 28, 2006 to discuss the draft. Conservation organisations were provided access to the digital version of the draft to facilitate review and feedback.

The major outputs of NBYP were the two resource book documents, one in English, one in Nepali, and a digital version of both. NBYP 2006 focuses on flora and fauna diversity in protected areas, Ramsar sites, and World Heritage Sites of Nepal.

Country Background

Nepal, with area 147,181 sq km, occupies the central part of the Himalayas standing between the Palaearctic (Holartic) and Plaeotropical (Indo-Malayan) regions. The country is located between latitudes 26°22' and 30°27' N and longitudes 80°40' and 88°12' E. Altitude varies from 67m above sea level at Kechana Kalan, Jhapa in the south-eastern Terai to 8848m at Mt. Sagarmatha, the highest point in the world. Nepal's biodiversity is a reflection of its unique geographic position and variations in altitude and climate.

The extreme altitudinal gradient has resulted in 11 bio-climatic zones ranging from tropical to Nival within a short horizontal span. The Terai belt (67-300m) is a flat stretch of fertile agricultural land in southern Nepal, which forms part of the alluvial Gangetic plain. The Siwalik Hills Zone (700-1500m) rises abruptly from the Terai plains and is mainly composed of sedimentary rock and big boulders. The Mahabharat Lek (1500m to 2700m) lies between the Siwalik Hills to the south and the midlands to the north. The Midlands (average altitude 2000m) occupy the central region of the country. The Himalayan zone (above 4000m) lies in the north and stretches from east to west of the country. It consists of sub-alpine and alpine climates where summer grazing pastures are found in the lower elevations and high altitude plant species adapted to extremes of cold and desiccation grow in higher elevations. There are several inner Himalayan valleys with desert conditions such as the upper Kaligandaki and Bheri valleys located at altitudes above 3600m.

A wide range of climatic conditions exists in Nepal, mainly as a result of variations in altitude. This is reflected in contrasting habitats, vegetation, and fauna. Other important climatic factors influencing biodiversity and the composition of flora and fauna in Nepal include rainfall, winter snowfall, temperature, and aspect.

Soil formation is related to the physiographic zone. In the Terai, the soil is alluvial and fine to medium-textured. In the Siwalik Hills, it is made up of sedimentary rocks with a sandy texture, while in the Mid-Hills soil 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.

The country's major perennial river systems are the Mahakali, Karnali, Narayani, and Koshi rivers, all of which originate in the Himalayas. These rivers contain water resources that hold tremendous potential for large-scale hydropower and irrigation development. Medium-sized rivers include the Babai, West Rapti, Bagmati, Kamla, Kankai, and Mechi rivers that generally originate in the Mid-hills or in the Mahabharat range. The Terai region contains many small and usually seasonal rivers most of which originate in the Siwalik Hills.

The latest physiographic data show that Nepal comprises around 4.27 million hectares (29% of total land area) of forest, 1.56 million hectares (10.6%) of scrubland and degraded forest, 1.7 million hectares (12%) of grassland, 3.0 million hectares (21%) of farmland, and about 1.0 million hectares (7%) of uncultivated lands. Forest cover in the Terai and Hill areas is reported to have decreased at an annual rate of 1.3% and 2.3%, respectively between 1978/79 and 1990/91.

Nepal has a population of 23.2 million (2001 census). Some 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 (330.78/km²) in the Terai, medium density in the Hills (167.44/km²), and lowest in the Mountains (32.62/km²). In relation to Nepal's five development regions, 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 the Far-Western Development Region, 9.5%.

Nepal ranks 138th out of 177 countries in the 2006 Human Development Index, with 62.1 years life expectancy at birth, 48.6% adult literacy rate, and 147th ranking in purchasing power parity of US\$1,490. The country ranks 68th among 102 developing countries in Human Poverty Index.

The economic well being of Nepal is closely bound to its natural resources – agricultural land, wetlands, forests, and protected areas. Although only 20% of land area is agricultural, agriculture is the major determinant of economic activities and the nation's socio-political identity. Forests cover some 29% of the land area. The high demand for agricultural land has led to considerable deforestation and loss of land cover. Natural phenomena such as floods and landslides contribute to an annual soil loss of 20-25 tonnes/ha. The majority of protected areas including the major national parks comprise forested land. Their contribution to the national economy through foreign exchange earnings is of major importance.

Nepal's bioresources in the international trade are mostly wild in origin. The 188 biomaterials commonly found in international trade consists of various plant parts such as roots and tubers (39 plants), barks (seven plants), leaves (26 plants), flowers (14 plants), fruits and seeds (61 plants), whole plants (12 plants), gums and resins (eight plants), and miscellaneous other plants (11).

Tourism is the second most important source of foreign exchange for Nepal. During the period 1996-2005, over 45% of total visitors to Nepal, on average, visited the protected areas. Tourist arrivals in Nepal, as well as in its protected areas, are expected to grow by 8-10% annually.

The National Parks and Wildlife Conservation Act (NPWCA) 1973 and its seven associated regulations are the principal legal instruments that govern the management of Nepal's protected areas. Section 3 of the NPWCA prohibits hunting of animals or birds, building any house, hut, or structure, clearing or cultivation on any part of the land, or harvesting any 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. Four amendments were made effective 1993. The Fifth Amendment in 2005 accommodated the provision handing over management responsibility for the protected areas to organisations established under the Act. Three regulations formulated after 1996 mainly reflect upon government policy involving local communities in the management of protected areas.

Acts and regulations pertinent to forests, watersheds, the environment, livestock, self- governance, and tourism are equally significant for the conservation of flora and fauna.

The government recently formulated four main policies pertaining to biodiversity conservation. They are, 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 to Non-governmental Organisations or Other Organisations; the Domesticated Elephant Management Policy 2003; the Working Policy on Wildlife Farming, Breeding and Research 2003; and the National Wetland Policy of Nepal 2003.

As a signatory to the Convention on Biological Diversity at the Earth Summit (1992), Nepal has fulfilled its commitment and has developed a Nepal Biodiversity Strategy in 2002 to meet the obligations of the Convention and to serve as an overall framework for the conservation and sustainable use of its rich biodiversity and biological resources. Nepal is a party to eight major international agreements and conventions on biodiversity conservation (**Table 4**). Methods for transforming international treaty norms into internal law are in progress in Nepal.

Apart from international conventions and treaties, global affiliations pertinent to biodiversity conservation and sustainable development that Nepal has been affiliated with include the World Trade Organization (WTO), the World Conservation Union - IUCN, and the Global Tiger Forum. Nepal has also followed the spirit of the World Conservation Strategy 1980 and the World Charter for Nature 1982.

Using the authority empowered by the 1973 NPWC 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 of the nine national parks (except for Shivapuri National Park), and three wildlife reserves.

Four properties have been inscribed in the UNESCO 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 monument zones of the Kathmandu Valley, three properties of national 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. The Jagdishpur reservoir is an artificial water body, whereas Ghodaghodi Tal is a natural lake.

The network of protected areas cover almost 20% of the country's land compared to the global figure of 11% of the earth's land surface under the protected area system. The protected areas of the world face a growing set of global challenges that threaten the existing capacity to protect and maintain the valuable diversity of life and the sources of ecosystem services for people.

Biodiversity Assessment

Nepal has a complex biogeography due to its past geological history and its presence at the crossroads of two bio-geographic realms, Palaeartic and the Palaeotropic (Udvardy 1975), and two major zoogeographical Kingdoms: Palaeartic in the north and Indo-Malayan in the south.

Furthermore, Nepal lies at the crossroad of six floristic regions namely Central Asiatic in the north, Sino-Japanese in the east, South East Asia-Malaysia in the south east, Indian in the south, Sudano-Zambian south west, and Irano-Turanian in the west.

Adam Stainton (1972) used six climatic and vegetation divisions in his classification of forest types of Nepal, and recognised 35 forest types classified into ten major groups which have been widely adopted in later work. Jean-François Dobremez (1972, 1976) recognised four domains (western; northwestern; central; and eastern); six levels and 11 sublevels of bioclimatic zones, and 75 vegetation types.

According to the ecoregional classifications made by the Conservation Science Program of WWF US, Nepal's landmass includes nine land-based ecoregions defined by ecological features, climate, and plant and animal communities. Of them, three each are in three different conservation statuses such as Critical/Endangered, Vulnerable, and Stable/Intact.

The vegetation types described by Dobremez and his Nepalese colleagues totaled 198 categories. The Biodiversity Profiles Project 1995 attempted to synthesise them into 118 categories. During 1998-99, IUCN revised the vegetation types and devised 59 vegetation types for the use of the Tree Improvement and Silvicultural Component/Natural Resource Management Sector Assistance Programme (TISC/NARMSAP). The 59 types have been further reduced to 36 in order to give a simplified ecological picture of Nepal's vegetation based upon climax or near-climax vegetation type spread over potential areas of ecological homogeneity.

The monsoon climate and huge altitudinal range found in Nepal create a wide array of habitats, from the lowland (as low as 67m above mean sea level) evergreen tropical forests in the Terai and low hills (below 1000m) through temperate broadleaved and coniferous forests to the tree line. Above this, Rhododendron scrubland extends up to the high alpine meadows before plant life gives way to the frozen and biologically barren snow capped peaks including Mount Sagarmatha (8848m). The highest recorded flowering plants like *Ermania himalayensis* of the Brassicaceae family are found at around 6000m. The deep river valleys and gorges create their own microclimates. Dramatic vegetation changes can be seen in relatively small areas with differing aspects and altitudes.

Nepal comprises only 0.1% of land area on a global scale, but it possesses a disproportionately rich diversity of flora and fauna at genetic, species and ecosystem levels. These species are found in the dense tropical monsoon forests of the Terai, in the deciduous and coniferous forests of the subtropical and

temperate regions, and in the sub-alpine and alpine pastures and snow-covered Himalayan peaks. Nepal falls within two biogeographical realms - the Indo- Malayan and the Palearctic realms – which add to the high biodiversity level.

There has been comparatively much work carried out on the higher groups of plants (angiosperms and gymnosperms), but research on the lower groups has not been extensive or systematic.

Lichenologists estimate about 2,000 lichen species in Nepal of which 48 species are reported to be endemic to Nepal. There are 1,822 species of fungi, 687 species of algae, 853 species of bryophytes, and 534 species of ferns and fern allies in Nepal. Similarly, there are 6,391 angiosperm flora of which 25 species of gymnosperms have been listed in Nepal.

Nepal has a relatively high number of fauna species. Higher fauna groups have been relatively well studied; however, the taxonomy and distribution of lower fauna groups except for butterflies, and to some extent spiders, have yet to be studied. A comprehensive Fauna of Nepal guide is essential to understand the status of species for their conservation.

A checklist of 168 species of helminth parasites, 33 species of trematodes, 67 species of nematodes, 36 species of cestodes, and 32 species of plant nematodes has been recorded. There are 144 species of spiders, and approximately 5,052 species of insects.

So far, 2,253 species of moths (excluding Microlepidoptera) have been recorded in Nepal. The current list includes 651 species of butterflies and 785 species of moths.

There are 187 species of fish and 195 species of herpeto fauna (117 amphibians and 78 reptiles) in Nepal. The number of bird species is 874, and mammals, 185.

Of the total 874 species of birds, 62% are resident birds, 14% winter visitors, 12% passage migrants, 6% summer visitors, 5% residents and migrants, and 1% summer and winter visitors. The four new additions in the mammal checklist are the Binturong (*Arctictis binturong*), Indian Mongoose (*Herpestes nyula*), Himalayan marmot (*Marmota himalayana*) and Tibetan gazelle (*Procapra picticaudata*). Mammals are well represented in the protected areas of Nepal.

Species distributions are viewed from two perspectives: confinement, and richness.

Of the total number of mammal species, the Terai-Siwaliks region harbours the highest number of confined species (35 mammal species, 111 bird species, 46 Herpeto species, and 106 fish species). The central phytogeographical region harbours the highest number of confined species (28 mammal species, 24 bird species, 40 Herpeto species, and 31 fish species). Both the regions combined, the central Terai-Siwaliks region, holds the highest number of species.

Based on phytogeographical and altitudinal zoning, Nepal's landmass can be divided into nine blocks. The Mid Hills Centre block harbors the highest number of mammals (55%) and birds species (77%), whereas Terai-Siwaliks Centre harbours the highest number of herpeto (45%) and Fish species (74%). Overall, the Mid Hills Centre has the highest species richness followed by the Terai Siwaliks Centre.

There are 399 endemic flowering plants in Nepal of which about 63% are from the High Mountains, 38% from the Mid Hills, and only 5% from the Terai and Siwaliks. Similarly, the central region contains 66% of the total endemic species followed by western (32%) and eastern regions (29%).

The Himalayan field mouse (*Apodemus gurkha*) which is found in central Nepal between 2200-3600m, is the endemic mammal species of Nepal. The Spiny Babbler (*Turdoides nipalensis*) and the Nepal Kalij (*Lophura leucomelanos leucomelanos*) are endemic to Nepal. There are 14 species of herpetofauna and six species of fish that are endemic to Nepal. Similarly, one hundred and eight species of spiders are reported to be endemic to Nepal.

The updated version of the **National Red Data Book of Nepal** includes 59 mammal species, 279 bird species, 35 Herpeto species and 34 fish species. Of these, two species namely the Cheetah (*Acinonyx jubatus*) and Black musk deer (*Moschus fuscus*) have not probably been recorded in Nepal, and the pigmy hog (*Sus salvanius*) and the Indian Chevrotain (*Moschiola meminna*), have probably become extinct in Nepal.

Of the 11 bird species that were listed as Extinct in Nepal in the BPN, the presence of three species has been recently reported.

Thirty-four species of plants have been included in the IUCN Red List. Of them, two species (*Andrewsianthus ferrugineus* and *Diplocolea sikkimensis*) are considered Endangered, five Vulnerable (*Cycas pectinata*, *Dalbergia latifolia*, *Scaphophyllum speciosum*, *Takakia ceratophylla* and *Ulmus wallichiana*), two Near Threatened (*Aglaia cucullata* and *Cupressus torulosa*), 24 of Least Concern, and one Data deficient (*Taxus wallichiana*).

Altogether, 173 mammal species are listed as Threatened by IUCN: one as Critically Endangered (pigmy hog, *Sus salvanius*), eleven as Endangered, 21 as Vulnerable, 19 as Near Threatened, 120 of Least Concern, and one Data deficient (Csorba's Mouse-Eared Bat *Myotis csorbai*).

Of the total number of bird species (874), three species are critically endangered (Slender-Billed Vulture *Gyps tenuirostris*, Pink-Headed Duck *Rhodonessa caryophyllacea*, and White-Rumped Vulture *Gyps bengalensis*), six Endangered, 23 Vulnerable, 25 Near Threatened and 813 are of Least Concern.

Under the Forest Act 1993, the Government of Nepal has banned the collection use, sale, distribution, transportation, and export of three species effective from February 12, 2001. They are the Pancha ounle (*Dactylorhiza hatagirea*), Okhar ko bokara (*Juglans regia* bark) and 'Kutki' (*Neopicrorhiza scrophulariflora*). The government has also banned the export of eight species of plants and rock exudes (*shilajit*), except for their processed product, and upon the permission of the Department of Forests. Likewise, the government has banned transportation, export, and felling of seven tree species for commercial purposes.

In addition, 26 mammal species, nine bird species, and three reptile species have been listed as protected under the 1973 NPWC Act. However, 10 species of fish and 12 species of butterflies are in need of protection.

In 2003, the Government of Nepal approved the Working Policy on Wild Animal Farming, Breeding and Research. Under its provision, seven species of mammals, one species of amphibian (Gharial crocodile *Gavialis gangeticus*), all snakes (77 species in total), and all species birds (874 species) including three protected ones.

Nepal is a signatory of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) since 1975; a number of Nepali species are listed under various CITES Appendices, such as 139 species of plants, 66 species of mammals, 128 species of birds and 26 species of fish.

Of the total 181 mammal species excluding four extinct species, 28 species are found only outside the protected sites. Fifteen of these species are bats, 10 species are rats, shrew, and Pikas, and three others are Large-toothed ferret badgers (*Melogale personata*), Malayan porcupines (*Hystrix brachyura*), and Tibetan antelopes (*Pantholops hodgsoni*).

Of the total 867 bird species found in Nepal excluding seven extinct species, only 37 species (5%) are found outside protected sites. Of them, 14 species are migrants, four species are summer/winter visitors, and 19 species are resident birds.

One-third of the total number of Herpeto species (65) and only 25 species of fish are found outside protected sites.

Protected Areas

Khaptad National Park (225 km²) and buffer zone (216 km²)

Site code: 7953

A unique landscape of rolling plateau with grasslands harbouring four species of endemic flowering plants, and many religious sites and temples constitute the Park's major significance. The Khaptad Lake is a major feature.

Of the total number of faunal species found in the area, 23 are mammals, 287 birds, and 23 herpeto species. The area harbours 295 recorded vascular plants.

Bardia National Park (968 km²) and buffer zone (328 km²)

Site codes: 1308 (Park) and 303303 (buffer zone)

The Park provides habitat for many threatened species including the tiger, sloth bear, swamp deer, hispid hare, elephant, dolphin, black buck, mugger, gharial, and a second-generation of rhinos.

The Park is indirectly linked with the Katarniaghat Wildlife Sanctuary in India and features the Karnali and Babai rivers, and the Thakurdwara shrine. It harbours 59 faunal species of mammals, 407 birds, 42 herpeto and 124 fish species. Recorded number of vascular plants from the area is 173.

Rara National Park (106 km²) and buffer zone (198 km²)

Site code: 806

The smallest national park in Nepal, Rara National Park provides habitat for leopards, the Red panda, Danphe pheasants, and musk deer, as well as harbours 16 species of endemic flowering plants. Established to maintain the natural beauty of Rara Lake and protect it from sedimentation and other adverse impacts of human activities, the Park had to completely evacuate local people, however. The numbers of faunal species found in the Park include 51 mammals, 241 birds, two herpeto and three fish species. The number of vascular plants recorded in the area is 88.

Shey-Phoksundo National Park (3,555 km²) and buffer zone (1,349 km²)

Site codes: 7952 (Park) and 313457 (buffer zone)

This is the largest national park in Nepal and represents the Trans-Himalayan ecosystem. Home to the Snow leopard and musk deer, the Park's prominent feature is Phoksundo Lake, and the area is a proposed World Heritage Site for its cultural significance. Local people inhabit the Park, as well as 30 species of endemic flowering plants and faunal species that include 35 mammals, 208 birds, and three Herpeto species. The number of vascular plants recorded from the area is 174.

Chitwan National Park (932 sq km²) buffer zone (750 sq km²)

Site codes: 805 (Park) and 303694 (buffer zone)

The first national park in Nepal, Chitwan National Park is also a World Heritage Site, a tourist destination famous for exotic fauna such as the Greater one-horned rhino, tiger, bison, gharial, migratory birds and elephant and crocodile breeding centres. The Ranital and Bishazari Tal (Lakes), Narayani and Rapti rivers, and other wetlands, and Bikram Baba's temple, the Valmiki Ashram and other cultural sites are also found here. The Park is connected to Valmiki Tiger Reserve in India. The numbers of faunal species found in the Park include 58 mammals, 539 birds, 56 herpeto, and 124 fish species. There are 234 recorded vascular plants in the area.

Langtang National Park (1,710 km²) and buffer zone (420 km²)

WDPA Site code 803 and Site code: 313458

Of Nepal's protected areas, Langtang National Park (over 6450m) is distinguished as having one of the greatest altitudinal ranges within its boundaries. The Park is linked with Qomolangma Nature

Preserve in the Tibet Autonomous Region of China, and is famous for the Red panda, religious shrines like Gosainkund, and 15 species of endemic flowering plants. Local people inhabit the Park. The numbers of faunal species found in the area include 45 mammals, 345 birds, four herpeto, and two fish species. The number of vascular plants recorded in the Park is 1,043.

Shivapuri National Park (144 km²)

Site code: 10910

This national park is the nearest to the capital city, Kathmandu, and is a major watershed providing drinking water to Kathmandu's burgeoning urban population. The Park is rich in bird species and plants, and is the only walled protected area in Nepal. It serves as habitat for the relict Himalayan dragonfly, and harbours 16 species of endemic flowering plants. The numbers of other faunal species found in the Park include 19 mammals, 311 birds, and three herpeto species. Some 449 species of vascular plants are recorded present in the Park.

Sagarmatha National Park (1,148 km²) and buffer zone (275 km²)

Site codes: 804 (Park), 313459 (buffer zone)

Sagarmatha National Park is the 120th World Heritage Site. The Park is characterised by a rugged terrain, features Mount Everest (the world's highest peak at 8848m), and other peaks and glaciers, Sherpa settlements below, and is linked with Qomolongma Nature Preserve in the Tibet Autonomous Region of China. Twenty-one species of endemic flowering plants and 10 species of rhododendron grow in the area. The numbers of faunal species include 33 mammals, 208 birds, five herpeto and one fish species. The Park records 160 vascular plants.

Makalu Barun National Park (1,500 km²) and buffer zone (830 km²)

Site codes: 26606 (Park) 26605 (buffer zone)

Makalu Barun National Park provides ecological support to the Mt. Everest Ecosystem, and habitat for threatened species of the Black bear, Red panda, and Musk deer. The Park is linked with Qomolongma Nature Preserve in the Tibet Autonomous Region of China. Twenty-five species of rhododendrons thrive in the area, and eight species of endemic flowering plants; the presence of archive species (*Tetracentron chinense*) has also been noted. The numbers of faunal species found in the Park area include 81 mammals, 421 birds, 14 herpeto and 13 fish species. The area has 284 recorded vascular plants.

Shuklaphanta Wildlife Reserve (305 km²) and buffer zone (243.5 km²)

Site code: 1309

Characterised by extensive grasslands (*phanta*) and forests, and featuring the Mahakali River, the largest pool of swamp deers, tiger, rhino, elephant, python, monitor lizard, cobra. The numbers of faunal species are 46 Mammals, 351 birds, 7 herpeto, and 28 fish. The number of vascular plants as recorded from the available records is 553.

Parsa Wildlife Reserve and (499 km²) and buffer zone (298.2 km²)

Site code: 10089

The numbers of faunal species are 37 mammals, 503 birds, eight herpeto and eight fish
The number of vascular plants as recorded from the available records is 298.

The major protected area related significances are eastern extension of CNP, Representative Churia ecosystem, portion of *char-kose jhadi*, home to species like wild elephant, gaur and tiger; and Shiva temple.

Koshitappu Wildlife Reserve (175 km²) and buffer zone (173 km²)

Site code: 1310

Refuge for the last remaining population of wild buffalos (below 150 in number), Koshitappu Wildlife Reserve is rich in water fowl and other birds, features the Koshi River, and is the first Ramsar site of Nepal. The numbers of faunal species found in the Reserve include 23 mammals, 485 birds, 17 herpeto and 105 fish species. Some 158 vascular plants are recorded in the area.

Dhorpatan Hunting Reserve (1,325 km²)

Site code: 10087

The only hunting reserve in the country, Dhorpatan is renowned for the Blue sheep (*Pseudois nayaur*), and 36 species of endemic flowering plants. The numbers of faunal species found in the area include 18 mammals, 137 birds, and two herpeto species. Fifty-eight vascular plants have been recorded as present in the reserve.

Annapurna Conservation Area (7,629 km²)

Site code: 10091

The largest protected area in Nepal, the Annapurna Conservation Area's habitat represents the Trans-Himalayan and mountain ecosystems, contains the deepest gorge of the Kali Gandaki River, and is both the highest and lowest rainfall area in Nepal. The Annapurna is home to the Snow leopard, Musk deer, pheasants, and records the presence of 97 mammal species, 476 birds, 56 herpeto and two fish species. The Muktinath, the famous Hindu and Buddhist pilgrimage site, is located here, as well as other shrines and ancient monasteries. Fifty-five species of endemic flowering plants have been recorded present in the area, as are 456 vascular plants.

Manaslu Conservation Area (1,663 km²)

Site code: 143002

Habitat for the Snow leopard, Grey wolf, musk deer, blue sheep and the Himalayan tahr, Manaslu has on record 21 mammals and 193 bird species, and 587 species of vascular plants.

Kangchenjunga Conservation Area (2,035 km²)

Site code: 143001

Habitat for the Snow leopard, Musk deer; rhododendrons, Himalayan larch, and some of the world's largest glaciers, Kangchenjunga also presents an opportunity for realising a tri-nation peace park linking it with Qomolongma Nature Preserve in the Tibet Autonomous Region of China and Kangchenjunga Biosphere Reserve in Sikkim, India. This conservation area has on record faunal species of 13 mammals, and 280 birds and 77 species of vascular plants.

Apart from the 16 protected areas, there are nine additional sites (five conservation areas covering in total 50,600 ha, four hunting reserves with a cumulative area of 98,500 ha, and one national park extension of 96,200 ha (WDPA).

Ramsar Sites

Ghodaghodi Tal (area: 2,563 ha)

Ramsar site number 1314 Site code: 901298

A large and shallow oxbow lake with associated marshes and meadows surrounded by tropical deciduous forest, 98% of which is dense forest and 2% pasture, this Ramsar site is a wildlife corridor between the lowland and the Siwalik fed by direct precipitation during the monsoon season. The area is intensively used for traditional fishing and agriculture while at the same time serves as an important religious landmark. The Department of Forest has management authority over 16 local community-based organisations involved in managing the site. A management plan for the site has been prepared, and community-based anti-poaching operations are in practice. The site has 34 mammals, 96 birds, nine herpeto, and 23 fish species on record and 388 species of vascular plants.

Jagdishpur Reservoir (area: 255 ha)

Ramsar site number 1315 Site code: 901299

The reservoir has been constructed for irrigation purposes for 6,200 ha; water is fed from the Banganga River. The reservoir is surrounded by cultivated land, and serves as shelter for some rare and endangered species. Management responsibility for the area is shared by the Department of Irrigation, the District Forest Office, and the local community. The area has green belt plantations, and land uses include fishing, grazing, fuel wood and fodder collection, household consumption, with potential for commercial stock fish production, and a proposed for bird sanctuary. The reservoir has on record faunal species of six mammals, 45 birds, nine herpeto, and 18 fish species and floral species of 16 vascular plants.

Beeshazar and Associated Lakes (3,200 ha)

Ramsar site number 1313 Site code: 901297

An extensive typical oxbow lake system inside the buffer zone of Chitwan National Park, Beeshazar and its Associated Lakes is a World Heritage site that consists of 30% open forest, 40% dense forest, 15% grassland, and 15% pasture. Water is fed from direct precipitation and the Khageri irrigation canal and is supplied to the canal during the dry season. The site helps control flooding in the Khageri River and recharges the ground water, and provides excellent habitat as a watering hole and corridor for endangered wildlife species. The numbers of faunal species on record in the site are 26 mammals, 271 birds, 18 herpeto, and 25 fish species and floral records of seven vascular plants. Nearly 100,000 people practice farming and fishing in the lake and its environs. A buffer zone management committee has been constituted for the area, and invasive weeds have been manually removed from the site and associated lakes.

Koshitappu Wildlife Reserve

Ramsar site number 380 Site code: 14196

A section of the Sapta Kosi River and its floodplains which consists of extensive mudflats, reed beds, and freshwater marshes, this reserve is an important staging area for water birds. The area is subjected to livestock grazing and attempts by local people to re-establish themselves in the reserve. Subsistence fishing and rice cultivation are the major sources of livelihood of people living near the reserve.

World Heritage Sites

Lumbini, the Birth Place of the Lord Buddha (area 64.5 km²)

Site code: 900334

This is the 666th World Heritage Site and is the birth place of Lord Buddha (Siddhartha Gautama, born in 623 BC in the famous gardens of Lumbini). Also famous for the Ashok pillar and as a Buddhist pilgrimage centre, the site features the Harhawa river catchment (21 km²), the Telar mentioned by Chinese travelers as flowing close to the birthplace of Buddha. The area consists of grassland (400 ha) 58.8%, forest plantation (270 ha) 40%, and open bodies of water (10 ha) 1.5%, and a plantation of over 65 species of more than 370,000 saplings, and a nesting place in 2005 of the 25 Sarus crane and 50 Blue bulls. The numbers of faunal species recorded in Lumbini includes 26 mammals, 207 birds, 39 herpeto, and 44 fish species and records of 72 vascular plants.

Chitwan National Park

Site Code: 10905

The 284th World Heritage Site, Chitwan National Park contains the largest and least disturbed example of natural Sal hill forest and associated communities of the Terai. The site is rich in flora and fauna, with populations of the Single-horned Asiatic rhinoceros, the Bengal tiger, and other endangered species. A system of controls has been established in the Park on the use of the Kasara

Bridge and associated roads. There are threats of invasive plants and a paper mill, however. (Also see Chitwan National Park and Buffer Zone)

Kathmandu Valley

Site Code: 900068

The Kathmandu Valley, the 121st World Heritage Site, is a bowl shaped valley with average 25km diameter and features four of the seven monument zones namely Swayambhu, Pashupati, and Changunarayan located in their natural settings. Biological explorations of the Valley was initiated as early as 1793. It contains six major forest types and is home to about 550 species of birds. Management of the site is community based, with legally-formed management bodies.

Swayambhu Monument Zone (0.6 km²)

Swayambhu monument zone is the type locality for 27 species of flowering plants discovered by Francis Buchanan, later Hamilton, in 1802-03. The zone contains a plantation and natural forests, 64 species of birds, and is colonised by about 300 Rhesus macaques. The Natural History Museum of Nepal, with over 55,000 biological specimens managed under a master plan, is located in the zone. The numbers of faunal species recorded in the zone include six mammals and 64 birds, and the number of vascular plant records is 109. Lively festivals are celebrated here throughout the year.

Pashupati Monument Zone (2.64 km²)

Lying on both banks of the Bagmati River, Pashupati monument zone harbours forests (50.27 ha) in three main plots and is home to 63 species of birds, populated by over 200 Rhesus macaques, 32 ungulate species including the Barking deer, Spotted deer, and Blackbuck translocated from the Central Zoo. The Guheshwori wastewater treatment plant (5ha) is also in the area and the zone is managed under the Pashupati Area Development Trust Act. The numbers of faunal species recorded in the zone include nine mammals and 63 birds. The number of recorded vascular plants is 74.

Changunarayan Monument Zone (0.5 km²)

One of the oldest Hindu temples of the Valley (3rd century), the oldest stone inscription discovered in Nepal (5th century) can be found in the zone. It contains community forests (47 ha), natural forests (21.25 ha) dominated by a *Schima wallichii*, plantation forest (15 ha) mainly of pines (*Pinus roxburghii*), and is home to over 51 species of birds, seven recorded mammals, and 21 recorded vascular plants. Soil conservation with bioengineering work in the zone is ongoing.

Sagarmatha National Park (120th World Heritage Site)

Site Code: 2007

An exceptional area with dramatic mountains, glaciers, and deep valleys dominated by Mount Everest, the highest peak in the world (8848m), Sagarmatha National Park is home to several rare species (the Snow leopard, Musk deer and Red panda), and is noted for the presence of the Sherpas, plantation and natural forest management, waste management involving community participation. (Also see Sagarmatha National Park and Buffer Zone)

Conclusion

Based on the biodiversity assessment the following conclusions have been made:

Vegetation

Of the 36 types of vegetation as simplified from the previous classifications, 31 types are represented in the 16 protected areas. Annapurna Conservation Area represents 16 vegetation types. The five types of vegetation that are not represented in the 16 protected areas are forests of Fir (*Abies lasiocarpa*), Hemlock (*Tsuga* spp. *Viburnum*, *Viburnum* spp) –Oak (*Quercus laurifolia*), Lithocarpus, Rhododendron, *Olea* (Olives), and *Eugenia* (myrtle family Myrtaceae) and *Ostodes* (family Euphorbiaceae).

Flora

By 2006, total number of flowering plant species recorded from Nepal is 6,391 representing 1,590 genera and 231 families compared to 4,259 species representing 1,447 genera and 194 families in 1995. Nepal's share of flowering plants species is 2.76% of global totals compared to earlier records of 2.36%. Nepal's share of pteridophytes is 5.15% compared to earlier records of 4.45%.

The present number of flowering plant species endemic to Nepal is 399 compared to earlier records of 246, which has been reduced by 40 due to possible extinction (eight species) and new reporting elsewhere (32). The number of species included in the IUCN Red List is 34, which is approximately 0.5% of the total number of species in the IUCN Red List. There are 72 plant species regarded as having high commercial value. The Government of Nepal has banned commercial exploitation of 18 species of plants, and the CITES appendices include 139 species.

There are 2,532 species of vascular plants represented by 1,034 genera and 199 families in the protected sites. Some 130 endemic species are found in the protected sites. On average, the NBY records of flowering plant species are 40% more compared to the BPN estimates for protected areas.

Fauna

The current checklist includes 185 species of mammals of which four species are believed to be extinct from Nepal, and four new additions. In general, the total number of reported fauna species has increased since 1996. The number of bird species is 874 compared to 843 in 1995, and herpeto species 195 compared to 143 in 1995.

A new field of entomology has been opened with the publication of the IUCN Red List, among others, which has recorded 536 species under 17 orders from Protura to Odonata, 789 species of moths, and 656 species of butterflies. Remarkably, of the known 5,052 species of insects recorded from Nepal, 1,131 species, which is over 22% of the world list, are species that have been first discovered and described from Nepalese specimens.

Nepal's share of the mammal species is 3.96% of global totals, and bird species 8.9%.

The Terai-Sivaliks region harbors the highest number of confined species (35 mammal species, 111 bird species, 46 herpeto species, and 106 fish species) compared to other physiographical regions. Similarly, the central phytogeographical region harbors the highest number of confined species (28 mammal species, 24 bird species, 40 herpeto species, and 31 fish species) compared to the eastern and western regions. For both combined regions combined, the central Terai-Sivaliks region has the highest recorded number of confined species.

There are 11 mammal species found in all nine regions, but there are 11 other mammal species that are not reported in any of these regions. In case of the birds, 104 species are found in all nine regions, but 41 species are not reported in any of the regions.

Among the nine regions, the Mid Hills Center harbors the highest number of mammals (55%) and birds species (77%), whereas Terai-Sivaliks Center harbors the highest number of herpeto species (45%). The eastern Terai-Sivaliks houses 74% of all fish species found in Nepal. Overall, the Mid Hills Centre has the highest species richness, followed by the Terai Sivalik Center, the Terai Sivalik East, the Terai Sivalik West, the Mid Hills East, the Highlands Center, Mid Hills West, Highlands East, and Highlands West.

Annapurna Conservation Area (ACA) harbors 97 mammal species (52%), and Chitwan National Park (CNP) harbors 539 species (62%). The CNP and ACA combined are home to 29% herpeto species, and 66% fish species found in Nepal.

The only endemic mammal in Nepal, the Himalayan field mouse (*Apodemus gurkha*), is found in the Central Mid Hills and High Mountain regions. In the case of birds, the endemic Spiny Babbler (*Turdoides nipalensis*), is found in the Terai-Sivaliks and Mid Hills regions. The subspecies, Nepal Kalij (*Lophura*

leucomelanos leucomelanos) is also endemic to Nepal and is found in the western regions. Fourteen species of herpetofauna and six species fish are endemic to Nepal.

The NRDB includes 59 mammal species, 279 bird species, 35 Herpeto species, and 34 fish species, of which four species of mammals and seven species birds are believed to be extinct, according to the updated checklists. Altogether, 173 mammal species (nearly 94% of total 185 mammal species) are listed as threatened by IUCN. Of the total number of bird species (874), three species are critically endangered (the Slender-billed vulture *Gyps tenuirostris*, the Pink-headed duck *Rhodonessa caryophyllacea* and the White-rumped vulture *Gyps bengalensis*). Sixty-four species of herpeto (34% of total herpeto species) are listed in the IUCN Red List.

Twenty-seven mammal species, nine bird species, and three reptile species are listed as protected species under the NPWC Act 1973. Ten species of fish and 12 species of butterflies are in need of protection. Sixty-six species of mammals are listed in the CITES Appendices.

In case of fauna, the number of birds reported from the protected areas has increased considerably since 1996. For example, the number of birds listed for Chitwan National Park was 483 in 1996 compared to 539 in 2006, and for Koshitappu 199 in 2006 compared to 485 in 1996. However, the number of mammal species has decreased by one in Sagarmatha National Park, due to non-reporting of the Black musk deer.

Of the total 181 mammal species excluding four extinct species, 28 species are found outside protected sites. Of them, 15 species are bats (out of a total 37 species), 10 species are the shrew, rats, and Pikas, and three other species. Three species namely, the Golden jackal (*Canis aureus*), Rhesus macaque (*Macaca mulatta*) and Common leopard (*Panthera pardus*) are found in the 20 protected sites.

Of the total 867 bird species excluding seven extinct species found in Nepal, 37 species (5%) are found outside protected sites. One-third of the total number (65) of Herpeto species are found outside protected sites, and 25 species of fish are also outside protected sites. In case of herpetofauna, the number of reported species has increased in all protected areas. Similarly, the number of fish species in Chitwan National Park was recorded to be 125 in 1996, and only 124 in 2006.

Separate lists of fauna species have been prepared for globally significant areas such as Ramsar sites and World Heritage Sites. Compared to protected areas, these areas have been studied less and limited data are available.

According to the mammal checklists (185), based on the available records by 2006, the Annapurna Conservation Area records the highest number of species (97), followed by Makalu-Barun National Park (81), compared to 13 in the Kanchenjunga Conservation Area. Similarly, the number of mammal species in Ghodaghodi Tal Ramsar site is 34 compared to six in Jagdishpur Reservoir Ramsar site, nine in Pashupati, and six in Swayambhu.

According to the bird checklists (874) based on available records by 2006, the Chitwan National Park records the highest number of species (539) followed by Parsa Wildlife Reserve (503), and 137 in Dhorpatan Hunting Reserve. Similarly, the number of species in Bishazari Tal Ramsar site is 271 compared to 45 in Jagdishpur Reservoir Ramsar site, and 64 bird species in Swayambhu compared to 51 in Changunarayan.

These variations in recorded number of faunal species in protected sites are primarily due to differing intensities of biological explorations in these sites.

Ex-Situ Conservation

Apart from conservation of species in the wild, some efforts have been made towards ex-situ conservation and specimen preservation. There is a network of 11 botanical gardens across the country. The central botanical garden of Godavari houses nearly 300 species of plants.

The National Herbarium (KATH) houses over 161,800 specimens, and the Central Department of Botany of the Tribhuvan University (TUCH) houses 20,000 specimens.

The Central Zoo houses 119 species of 970 animals of which there are 33 species of 206 mammals, 60 species of 321 birds, 17 species of 424 fish species, and nine species of 19 reptiles. The Hetauda Municipality Zoo houses species of the Spotted deer, Barking deer, hares, birds, and tortoises, amongst others.

Captive breeding of crocodiles has been carried out successfully in the Gharial farm in Chitwan. Between 1978 and 2005, 661 captive bred Gharials were released into the rivers of Nepal.

There are 171 domesticated elephants in Nepal, of which 77 belong to the government, nine to Nepal Trust for Nature Conservation, and 85 to the private sector.

Since 1986, translocation of rhinos has been carried out successfully using Chitwan National Park as a gene pool. Between 1986 and 2003, a total of 87 rhinos (39 males, and 48 females) have been translocated to Bardia National Park (83), and Shuklaphanta Wildlife Reserve (4). Blackbuck translocation was initiated in 1992 from the Central Zoo to Bardia National Park, and recently to Pashupati World Heritage Site.

The Natural History Museum houses over 40,000 zoological specimens and over 9,000 botanical specimens. The wildlife museums in the protected areas have preserved a number of specimens of wildlife and plants mostly found locally.

Recommendations

Thirteen recommendations have been made to further biodiversity exploration and protection of species outside protected sites, prepare and update the checklists of flora and fauna, verify doubtful species, link the NBY data with other available databases, and review the NRDB, as well as on policies relevant to biodiversity conservation.

Acronyms and Abbreviations

ACA	Annapurna Conservation Area
BNP	Bardia National Park
BPN	Biodiversity Profiles of Nepal 1996
BPP	Biodiversity Profiles Project
BTRS	Bishazari Tal Ramsar Site, also called Beeshazar and Associated Lakes
BZ	buffer zone
CAMC	conservation area management committee
CBO	community-based organisation
CDR	Central Development Region
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CNP	Chitwan National Park
CP	Central Phytogeographical Region
CR	critically endangered
CWHS	Changunarayan World Heritage Site
DD	data deficient
DDC	district development committee
DFID	Department for International Development
DHR	Dhorpatan Hunting Reserve
DNPWC	Department of National Parks and Wildlife Conservation
EDR	Eastern Development Region
EIA	environmental impact assessment
EN	endangered
EP	Eastern Phytogeographical Region
E-W	east-west
EW	extinct from the wild
EX	globally extinct
FAO	Food and Agriculture Organization
FDR	Far-Western Development Region
GDI	Gender-related Development Index
GO	gazetted officers
GoN	Government of Nepal
GTF	Global Tiger Forum
GTRS	Ghodaghodi Tal Ramsar Site
ha	hectare
HDI	Human Development Index
HH	household
HL	Highlands
HL CP	Highlands Central Phytogeographical Region
HL EP	Highlands Eastern Phytogeographical Region
HL WP	Highlands Western Phytogeographical Region
HPI	Human Poverty Index for developing countries
IEE	initial environmental examination
IUCN	The World Conservation Union
JRRS	Jagdishpur Reservoir Ramsar Site
KCA	Kangchenjunga Conservation Area
km	kilometre
km ²	square kilometre
KNP	Khaptad National Park
kW	kilowatt

KWR	Koshitappu Wildlife Reserve
LC	least concern
LCCC	Lumbini Crane Conservation Centre
LDA	Lumbini Development Area
LDT	Lumbini Development Trust
LNP	Langtang National Park
LRMP	Land Resource Mapping Project
LSG	local self-governance
LWHS	Lumbini World Heritage Site
m	metre
MBNP	Makalu-Barun National Park
MCA	Manaslu Conservation Area
MDR	Mid-Western Development Region
MFSC	Ministry of Forests and Soil Conservation
mg/l	milligram per litre
MH	Mid Hills
MH CP	Mid Hills Central Phytogeographical Region
MH EP	Mid Hills Eastern Phytogeographical Region
MH WP	Mid Hills Western Phytogeographical Region
mm	millimetre
MOCTCA	Ministry of Culture, Tourism and Civil Aviation
MOEST	Ministry of Environment, Science and Technology
NA	Nepal Army
NARMSAP	Natural Resource Management Sector Assistance Program
NBS	Nepal Biodiversity Strategy
NBYP	Nepal Biodiversity Yearbook Project
NE	not evaluated
NG	non-gazetted staff
NGO	nongovernment organisation
NNC	Nepal Nature dot Com
NP	National Park
NPWC	National Parks and Wildlife Conservation
NRDB	National Red Data Book
NRs	Nepalese rupees
NT	near threatened
NTNC	National Trust for Nature Conservation
PA	protected area
PADT	Pashupati Area Development Trust
PALNet	Protected Areas Learning Network
PWHS	Pashupati World Heritage Site
PWR	Parsa Wildlife Reserve
RNP	Rara National Park
RS	Ramsar sites
Rs	Rupees
SAARC	South Asian Association for Regional Cooperation
ShNP	Shivapuri National Park
SNP	Sagarmatha National Park
SPNP	Shey-Phoksundo National Park
SSC	Species Survival Commission
SWHS	Swayambhu World Heritage Site
SWR	Shuklaphanta Wildlife Reserve
TAL-N	Terai Arc Landscape - Nepal
TCM	traditional Chinese medicine
TISC	Tree Improvement and Silvicultural Component
TRAFFIC	Trade Records Analysis of Flora and Fauna in Commerce

TRPAP	Tourism for Rural Poverty Alleviation Project
TS	Terai and Siwalik
TS CP	Terai and Siwalik Central Phytogeographical Region
TS EP	Terai and Siwalik Eastern Phytogeographical Region
TS WP	Western Phytogeographical Region Terai and Siwalik
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
v2.3	IUCN Red List of Threatened Species version 2.3 (1994)
v3.1	IUCN Red List of Threatened Species version 3.1 (2001)
VDC	village development committee
VU	vulnerable
WCMC	World Conservation Monitoring Center
WCPA	World Commission on Protected Areas
WDPA	World Database on Protected Areas
WDR	Western Development Region
WG	women's group
WHC	World Heritage Committee
WHS	World Heritage Sites
WP	Western Phytogeographical Region
WR	wildlife reserve
WS	wetland site
WTO	World Trade Organization
WWF	World Wildlife Fund



Pine, rhododendron, and barren snowcapped mountains characterise the landscape of Sagarmatha National Park
(Govinda Joshi)

The Nepal Biodiversity Resource Book Project

Background

Biodiversity Profiles of Nepal (BPN) 1996 is a scientific milestone in the methodical documentation and presentation of then available information, published as well as field observations, about biodiversity in Nepal. BPN systematically distinguished, compiled, and presented findings pertinent to a biodiversity inventory of Nepal in 16 volumes spread over 1,500 pages (Table 1). In the profiles, Nepal's flora and fauna are categorised by physiographic zones and protected areas. The documents recorded in total 181 mammal species belonging to 12 orders and 39 families (Suwal and Verheugt 1995). BPN 1996 recorded numerous other fauna of various orders including 844 species of birds, 100 species of reptiles, 43 species of amphibians, 185 species of freshwater fish, and 635 butterfly species. Of the 635 butterfly species, four species and 25 subspecies are possibly endemic. In the context of flora, BPN recorded 5,160 species of flowering plants and 1,120 species of non-flowering plants (bryophytes and pteridophytes) (BPP 1995).

Meticulous documentation in this publication has highlighted and promoted Nepal's magnitude of wealth of biodiversity in the world conservation arena. BPN ranks Nepal as a country harbouring the 10th richest flowering plant diversity in Asia, and the 31st in the world.

From October 1994 to January 1996, over 70 Nepalese and 30 foreign experts representing 28 institutions and eight projects worked to complete the **Biodiversity Profiles Project (BPP)**, generously contributing data and assistance in the preparation of all 16 volumes. Twenty-one experts contributed information for the texts. The

BPP was a major undertaking of the Government of Nepal, Ministry of Forests and Soil Conservation (MFSC) and the Department of National Parks and Wildlife Conservation (DNPWC) and was carried out with financial support of the Government of the Netherlands.

BPN documents have subsequently become a foundation for the Nepal Biodiversity Strategy 2002 (NBS), and its Implementation Plan 2003. They were also instrumental in enhancing the implementation of the Master Plan for the Forestry sector, the National Conservation Strategy for Nepal, numerous national development plans, and various conservation projects in and around Nepal's protected areas. The document has become a major source of information and reference on biodiversity for researchers, protected area managers, policy makers, and others.

Rationale

Nepal has made further progress in biodiversity conservation and management of protected areas since 1996, when the BPN documents were first published. An additional 8,778 km² of protected areas have been added to Nepal's protected areas from 1996 to 2004. The areas gazette-notified as 'protected' since 1996 include Shivapuri National Park, Kangchenjunga and Manaslu conservation areas, and 11 buffer zones.

Wetlands in Nepal are rich in biological diversity and are known to support more than 20,000 waterfowls during peak migratory periods between December to February. In 1996, IUCN-Nepal prepared a detailed wetlands inventory of 163 sites from the Terai, and 79 sites

Table 1. Bibliographical List of BPN documents

TPN*	Title	Contributors	Date	Pages
1	Biodiversity Assessment of Terai Wetlands	WJM Verheugt	December 1995	xi+80
2	Enumeration of Amphibians and Reptiles of Nepal	K Shah	December 1995	vii+60
3	Enumeration of Lichens of Nepal	Dr LR Sharma	December 1995	vi+111
4	Red Data Book of the Fauna of Nepal	RN Suwal and WJM Verheugt with contribution from HS Nepali "Kazi" and C Smith	December 1995	xi+58
5	Enumeration of Spiders of Nepal	Dr VK Thapa	December 1995	v+43
6	Enumeration of the Mammals of Nepal	RN Suwal and WJM Verheugt	December 1995	x+86
7	Biodiversity Assessment of Forest Ecosystems of the Westerns Mid Hills of Nepal	P Bista, K Shah, P Shrestha, WJM Verheugt	December 1995	x+65
8	Biodiversity Assessment of Forest Ecosystems of the Central Mid Hills of Nepal	K Shrestha, P Budhathoki, HS Nepali "Kazi" and WJM Verheugt	December 1995	x+49
9	Biodiversity Forest Ecosystems of the Eastern Mid Hills of Nepal	PM Acharya, HR Bhandary, NK Khadka and WJM Verheugt	December 1995	x+47
10	Enumeration of Fishes of Nepal	J Shrestha	December 1995	vii+64
11	Enumeration of Algae of Nepal	Dr Sushim R Baral	December 1995	iv+153
12	Biodiversity Profiles of the Terai and Siwaliks Physiographic Zones	SJ Keeling, RN Suwal and WJM Verheugt; with contribution from HS Nepali "Kazi", Dr PR Shakya, C Smith and B Upreti.	December 1995	xix+136
13	Biodiversity Profiles of the Mid Hills Physiographic Zones	SJ Keeling, RN Suwal and WJM Verheugt; with contribution from HS Nepali "Kazi", Dr PR Shakya, C Smith and B Upreti.	December 1995	xviii + 151
14	Biodiversity Profiles of the High Himal /High Mountains Physiographic Zones	SJ Keeling, RN Suwal and WJM Verheugt; with contribution from HS Nepali "Kazi", Dr PR Shakya, C Smith and B Upreti.	December 1995	xvii+178
15	An Assessment of the Representation of the Terrestrial Ecosystems in the Protected Area system of Nepal	WJM Verheugt; with contribution from Dr PR Shakya and SJ Keeling	January 1996	viii+23
16	Opportunities for Investment in Biodiversity Conservation Nepal	P Budhathoki, with contributions from LP van Lavieren and WJM Verheugt	December 1995	x+29

*TPN = Technical Publication Number

Source: Nepalnature.com based on BPN 1996 documents

from the hills and mountains (IUCN-Nepal 1996). In consideration of BPP's emphasis on conservation, 10 wetland sites were recommended for legal protection (HMG/N/MFSC 2002). Three sites, Beeshazar Tal, Jagdishpur Reservoir, and Ghodaghodi Tal, were designated as Ramsar sites in 2003 (DNPWC 2004).

BPN documents 844 species of birds recorded by 1996; current records document 852 (Grimmet et al. 2000). At least seven additional species of birds have been recorded in Nepal recently, including the Asian glossy starling, Loon, and White fronted goose in the Koshitappu Wildlife Reserve (KWR); the Moustache fly-

catcher, and Finn's baya in the Shuklaphanta Wildlife Reserve; and the Tibetan sandgrouse in the Annapurna Conservation Area (Kazi 2005, Choudhary, B. 2003, and Shah et al. 2002). Similarly, 151 species of birds were recorded in Shivapuri National Park – then referred to as the Shivapuri Watershed and Wildlife Reserve – in 1996 (BPP 1996); 177 were recorded in 2002 (DNPWC 2002). More recent studies in 2005 document 311 species (Kazi and Suwal 2005). In February 2005, Nepal Nature dot Com handed over the newly updated checklists of birds and flowering plants to the Government of Nepal (Shakya, PR 2005).

Much progress has also been made in documenting species of flowering plants since the BPN was released. Current records indicate existence of about 6,391 such species; BPP records in 1996 documented only 5,160. In 1998, research by Akiyama et al. (1998) added a further 50 species of flowering plants from Nepal to the BPN list. In 2003, Rajbhandari incorporated new records of Gramineae and Orchidaceae families, and 104 additional species of 35 families of flowering plants from Nepal (Rajbhandari, KR 2003). Similarly, a species of orchid, *Oberonia nepalensis*, has been reported recently as endemic to Nepal and is another addition to Nepal species of angiosperm (Shakya and Chaudhary 1999).

A new chapter on the science of entomology in Nepal has been introduced following the publication of the inventory of insects of Nepal in 1997 and 1998. Prior to those years, BPN documented only 635 butterflies representing the entire field of entomology (BPP 1996). The entomological inventory in 1997 recorded 536 species under 17 orders from Protura to Odonata (Thapa 1997); 789 species of moths and 656 species of butterflies were subsequently recorded in 1998 (Thapa 1998). Of the recorded 5,052 known species of insects, 1,131 species (over 22%) were first discovered and described from Nepali specimens (Thapa 1998).

Goal and objective

The goal of the **Nepal Biodiversity Resource Book Project** (NBRBP) is to establish a system of updating Nepal's biodiversity annually in order to pave the way for Nepal Biodiversity Resource Books 2006, 2007, 2008, and so on, based on scientific studies.

The primary objective of NBRBP is to prepare a yearbook on Nepal's biodiversity for 2006 by updating the 1996 Biodiversity Profiles of Nepal based on information published between 1996 and 2005, as well as field verification.

Methodology

Compilation of the resource book was carried out in five stages from preparatory planning to publication. Each stage consisted of a complete task of activities that were prerequisite for the successive stages. A timeline was drawn with the

assumption that activities would continue according to the plan.

Preparatory stage

Nepal Nature dot Com (NNC) developed the concept of updating BPP 1996 upon consultation with relevant authorities and experts. The major steps in this process were the following.

- Conceptualisation of the project (NBRBP) and Biodiversity Resource Book publications from 2006 onwards
- Consultation with the Government of Nepal (GoN) for endorsement and advice on the concept of the NBRB
- Approval from the GoN for initiating the resource book project activities
- Resource mobilisation to implement the NBRB project

Working team formation stage

Upon completion of the preparatory stage, NNC formed a working team to implement the NBRB Project. Team formation was based on the BPP approach in 1996 with certain modifications. Resource persons and contributors to the BPP continuing their inventory research under various capacities were contacted for updated data and information.

The major steps were as follows.

- Preparation of the terms of reference for experts and job descriptions for staff
- Identification and contracting out to relevant experts
- Appointment of support staff
- Establishment of the NBRBP office
- Establishment of the NBRBP reference library

Scoping stage

The scope of the proposed publication was initiated following establishment of the NBRBP office and team.

- Literature surveys were carried out of:
 - BPP documents
 - Contemporary documents published since 1996
 - Unpublished information
 - Relevant websites
- Selection of tools for consultation and field verification
- Preparation of a Nepal Biodiversity Resource Book (NBRB) format including the table of contents, presentation, and language with the NBS document as a reference point

- Preparation for production of print and digital copies of NBRB 2006, including texts, graphics, and illustrations

The check lists of fauna and flora compiled for the resource book were derived primarily from the BPP documents. The checklists were updated referring to recent publications of Bird Conservation Nepal (BCN), the departments of Plant Resources (DPR), and National Parks and Wildlife Conservation (DNPWC), the World Conservation Union (IUCN), National Trust for Nature Conservation (NTNC), World Wildlife Fund Nepal Program (WWF), UNESCO, and Nepal Nature dot Com (NNC). Reference to the personal collections of Dr Puspa Ratna Shakya were also made in order to update the plants checklist, as well as to those of Mr Hari Sharan Nepali 'Kazi' for the birds checklist.

In general, the **Nepal Biodiversity Resource Book** follows the practices adopted in the IUCN Red List, CITES Appendices, and the BPP checklist in identifying plant and animal species by a binomial nomenclature (genus and species in Latin) without authorships (See www.iucnredlist.org and www.cites.org/eng/appendices.shtml).

However, in the case of phanerogams (plants that reproduce by means of seeds not spores) the authors' names have been attached to the binomial nomenclature to avoid possible confusion where there are multiple authors to the same species and infraspecific levels of biological diversity.¹ (See **Annexes 1.4** and **1.5**).

Nepali names (enclosed in single quotation marks ' ') for various plant and animal species are only partially available at present and standards need to be set for their spelling. The same Nepali names sometimes denote more than one species, and the names also vary from place to place. Efforts made to coin new Nepali names for some species have found dissenters among the general public and consensus has not been reached. There are also non-Nepali vernacular names specific to each species in other languages such as Maithili, Newari, Sherpa, Tamang, Tharu, among others. A separate work needs to be undertaken to document as well as coin local nomenclature for

plant and animal species in the various Nepal languages.

Where possible, the English common names of the birds and mammals are provided in this book. But in the case of flora and some species of herpeto and fish mostly found only in the Himalayan region and with no English equivalent common names only their scientific names are given. Again, separate work needs to be undertaken to find out or coin English common names for these species. Scientific names are also no longer repeated after second or third mention.

The literature survey was an ongoing process that continued until the final version of the resource book was ready for printing.

Verification stage

The information collected was cross-checked, verified, authenticated, approved, and finalised through:

- Participatory workshop with experts for technical cross-checking, verification and authentication;
- Field verification and consultation with field staff;
- Consultative workshop with policy makers for authentication;
- Preparation of the comprehensive English version of NBRB 2006, as well as the summarised version in Nepali;
- Language editing for both versions;
- Preparation of the final rendering of NBRB 2006 following necessary amendments and improvements.

The first draft of the resource book was reviewed by several specialists in their respective fields: Mr Shyam Bajimaya for fauna and protected areas, Dr Tirtha Bahadur Shrestha for flora. Mr Rajendra Suwal and Mr Hari Sharan Nepali 'Kazi' also reviewed the documents over the entire preparation process. A team of experts from the International Centre for Integrated Mountain Development (ICIMOD) also reviewed the first draft for overall perspective on biodiversity in the publication.

A consultative meeting was held in Kathmandu on 28 November 2006 to discuss the

¹ Infraspecific levels mean taxa below species such as subspecies, variety and forma

draft report and seek suggestions and inputs from experts representing various conservation organisations. Along with access to the digital version of the resource book, the Ministry of Environment, Science and Technology (MOEST) sent out invitation letters to 16 organisations for their participation and feedback on the draft book. Twenty-six experts including reviewers representing 13 organisations² participated in the book consultation meeting.

Production and dissemination stage

- The final versions of NBRB 2006 (both in Nepali and English) were prepared for printing and digital production.

Outputs

The major outputs were the two documents in English and Nepali, as well as the digital versions of both.

- a. Nepal Biodiversity Resource Book 2006 (English): over 150 pages including illustrations, pictures, and maps
- b. Nepal Biodiversity Resource Book 2006 (Nepali): a summary of the English version, is forthcoming

Limitations

NBRB 2006 focused on the diversity of flora and fauna in protected areas, Ramsar sites, and World Heritage sites of Nepal with primary focus on higher plants and animals, along with general checklists of flowering plants and animals of Nepal.

How the document is organised

This document is organised in seven chapters. Chapter One presents the study background, objectives, and methodology. Chapter Two presents the country background including location, physiographic, climate, soil, river

systems, land use, population and human development, and natural resources of economic significance. The chapter also includes brief notes on relevant national acts, regulations and policies, international conventions and treaties, and protected areas.

The third chapter evaluates the biogeographical assessment of Nepal focusing on biogeography, vegetation types, diversity at different altitudes (Terai-Sivaliks below 1000m, Mid-Hills between 1000m and 3000m, Highlands above 3000m), and species diversity (flora, fauna, distribution, endemism, threatened and protected species, and species in protected sites).

The document includes two sets of data, one pertaining to flora (Annex 1), and another to fauna (Annex 2). Biodiversity Profile Nepal (BPN) data have been used as benchmarks. The Nepal Biodiversity Resource Book followed the BPN system to prepare lists of floral and faunal species found in the protected areas. Two additional classifications of global significance, the Ramsar and World Heritage sites, have also been added.

Reviews of the protected areas are presented in Chapter Four. The fifth and sixth chapters highlight the Ramsar sites (RS) and the World Heritage sites (WHS). Documentation of all three areas includes basic observations and are arranged to reflect the background, significance, and achievements pertinent to biodiversity of individual sites. A conclusion of the findings of the earlier chapters is presented in the seventh chapter. Recommendations for consideration as indicated by the study complete the document and are presented in Chapter Eight.

A total of three annexes with 65 sub-annexes supplement this report. They are included on a CD-ROM in a pocket at the back of the report.

² BCN, Central Department of Zoology-Tribhuvan University, DNPWC, DPR, IUCN, ICIMOD, MoEST, NNC, NTNC, Natural History Society of Nepal, Nepal Botanical Society, Nepal Foresters' Association, and WWF.



Bhaktapur, the most medieval of the three cities of Kathmandu Valley World Heritage Site
(Sharad Joshi)

2

Country Background

Location

Nepal, with an area of 147,181 km², occupies the central Himalayas between the Palaearctic (Holartic) 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 Himal 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 (HMGN/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 (HMGN/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 (HMGN-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>Antilope 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, amongst 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 micarantha*, *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)

Biodiversity Assessment

Biogeography

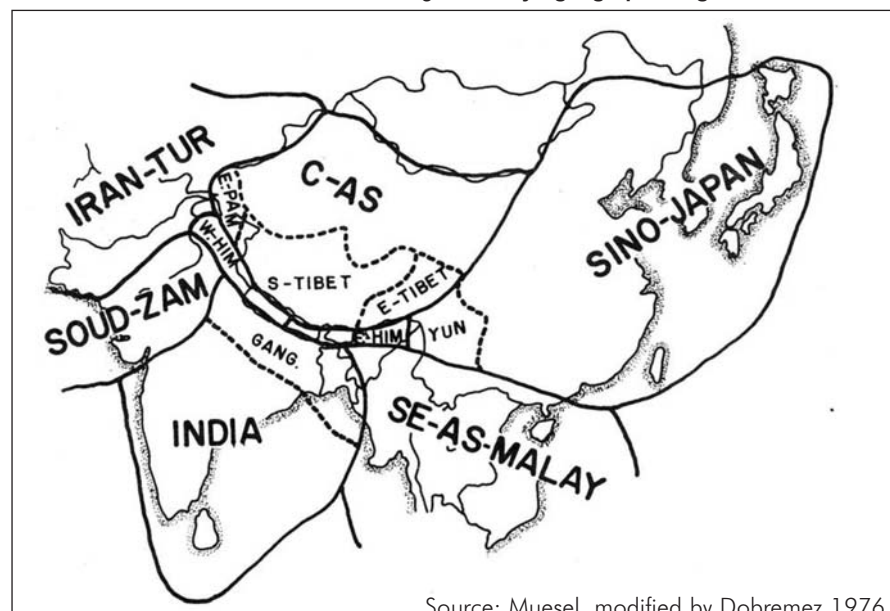
Nepal's geological history has given rise to the country's complex biogeography reinforced by its presence at the crossroads of two biogeographic realms: Palearctic in the north, and Palaeotropical in the south (Udvardy 1975). Zoo-geographically, Nepal falls within two biogeographical realms: Indo-Malayan and Palearctic. Phyto-geographically, Nepal lies at the crossroads of six floristic regions: Central Asiatic in the north, Sino-Japanese in the east, Southeast Asia-Malaysia in the south-east, Indian in the south, Sudano-Zambian in the south-west, and Irano-Turanian in the west (Figure 1).

Phyto-geographical studies of Nepali flowering plants indicate that the lower subtropical and tropical bioclimatic belts below 1500m altitude are floristically related to the south-east Asia-Malaysian and Indian floristic regions. The central belt, composed of upper subtropical and temperate bioclimatic zones at altitudes ranging from 1500m to 3000m, are floristically related to the Sino-Japanese floristic region. The sub-alpine and alpine zones above this belt are floristically related to the central Asiatic floristic region. The floristic relations of Nepal with the Sudano-Zambian and Irano-Turanian floristic regions

are feeble in magnitude in the western parts of Nepal (Shakya 1983).

Adding variety to this diverse mix are plants from the arid highlands of the Tibetan Plateau (central Asian elements) in the north and plants from Indo-Gangetic elements (Indo-Chinese and Indo-Malayan regions) found in the southern lowland plains or Terai, representing widespread species from the humid tropics that extend deep into Southeast Asia. Understanding the distribution of plants within the Himalayas requires an examination of both the floristic regions found in the area and its geological history. Indicator species such as the Indian horsechestnut (*Aesculus indica*) and Deodar cedar (*Cedrus deodara*) are predominantly found in the west, while Evergreen broadleaf (*Castanopsis hystrix*) and the Sikkim larch (*Larix griffithiana*) are predominant in eastern and central Nepal.

Figure 1. Phytogeographic regions of South Asia



Vegetation types

Climatic and vegetation classifications

Adam Stainton (1972) used the following climatic and vegetation divisions in his classification of forest types in Nepal.

1. Terai and outer foothills, including the Siwalik Hills and valleys
2. Midlands and southern slopes of the main Himalayan ranges
 - a. Western Midlands
 - b. Central Midlands
 - c. Eastern Midlands
 - d. South of Annapurna and Himalchuli
3. Jumla-Humla region
4. Dry river valleys
5. Inner valleys
6. Arid zone

Stainton recognised 35 forest types classified into 10 major groups. This categorisation has been widely adopted in later work.

Jean-François Dobremez (1972, 1976) recognised four domains (western, northwestern, central, and eastern); six levels, and 11 sublevels of bioclimatic zones. Under these bioclimatic zones, Dobremez et al. (1970-1985) in their eight ecological maps of Nepal identified 136 ecosystems. These were later reduced to 118 by ICIMOD/MENRIS in 1995, by grouping closely allied types together during the process of map digitisation (BPP 1996). In 1998/1999, IUCN revised the classification of vegetation types and

devised a list of 59 kinds of vegetation for use by the Tree Improvement and Silvicultural Component (TISC/NRMSAP) /Natural Resource Management Sector Assistance Programme. The 59 kinds of vegetation have been further reduced to 36 in order to present a simplified ecological picture of Nepal's vegetation, based upon climax or near-climax vegetation type spread over potential areas of ecological homogeneity (Annex 1.1) (TISC/NRMSAP/MFSC 2002).

Ecoregional classification

The ecoregional classification made by WWF's US Conservation Science Program categorises Nepal's landmass into nine land-based ecoregions defined by ecological feature, climate, as well as by their plant and animal communities. Of these, three are considered in the 'Critical/Endangered' conservation status; three are considered 'Vulnerable'; and three 'Stable/Intact'. (Table 5) (NGS and WWF 2001).

Vegetation maps

Schweinfurth (1957) developed the first vegetation map of the Himalayas and laid the foundations for more detailed work in Nepal by later authors. Dobremez and his co-authors, including three Nepali scientists, TB Shrestha, PR Shakya, and DP Joshi, prepared a series of ecological maps of Nepal. Stearn (1960), using climatological, floristic, and ecological data, proposed a broad categorisation of Nepal into three geographic regions: Western Nepal (corresponding to the Karnali River system from the western boundary of Nepal to 83°E

longitude), dominated by western Himalayan flora; Eastern Nepal (corresponding to the Koshi River system from the eastern boundary of Nepal to 86°30'E longitude), dominated by an eastern Himalayan flora; and Central Nepal (between 83° and 86°30'E), comprising an inter-mediate zone between these two floras (Table 6). This classification was used to indicate distribution of plant species in Nepal (*Enumeration of the Flowering Plants of Nepal*, Hara et al. 1978, 1979, and 1981).



P. R. Shakya

Steppe-Caragana, Berberies, among others, at Lower Mustang 2780m

Table 5. Ecoregions, Distribution and Conservation Status			
Symbol	Ecoregion Type	Distribution	Conservation Status
IM0115	Himalayan subtropical broadleaf forests	Bhutan, India, Nepal	Critical/ Endangered
IM0301	Himalayan subtropical pine forests	Bhutan, India, Nepal, Pakistan	Vulnerable
IM0401	Eastern Himalayan broadleaf forests	Bhutan, India, Nepal	Stable/Intact
IM0403	Western Himalayan broadleaf forests	India, Nepal, Pakistan	Critical/Endangered
IM0501	Eastern Himalayan sub-alpine conifer forests	Bhutan, India, Nepal	Vulnerable
IM0502	Western Himalayan sub-alpine conifer forests	India, Nepal, Pakistan	Vulnerable
IM0701	Terai-Duar savannah and grasslands	Bhutan, India, Nepal	Critical/Endangered
PA1003	Eastern Himalayan alpine shrub and meadows	Bhutan, China, India, Myanmar, Nepal	Relatively Stable/ Intact
PA1021	Western Himalayan alpine shrub and meadows	India, Nepal	Relatively Stable/Intact
Note: IM = Indo-Malayan, PA = Palearctic			
Source: NGS and WWF, 2001 Available at http://www.nationalgeographic.com/wildworld/			

Zoologists Swan and Leviton (1962) used a system of seven ecological zones based on altitude, but did not differentiate between east-west patterns.

Two landmark publications in 1972, both the result of many years of fieldwork by their respective authors, combined climatic and phytogeographic regions (Stainton 1972; and Dobremez 1972, 1976). These two systems of vegetation classification are widely used today and are outlined in tables below. Other notable contributions to plant ecology and vegetation studies in Nepal have been made by George Meihe and co-workers from 1990 onwards. In all these systems, generalisations need to be made as vegetation zones are greatly affected by local conditions, particularly rainfall and aspect. Sometimes the boundaries are abrupt and clear; but often they are gradual and intergraded over quite large areas. The vegetation pattern for the whole country is a complex mosaic and the categorisation is open to debate.

Diversity at different altitudes

The monsoon climate and vast altitudinal range in Nepal create a wide array of habitats, from lowland (as low as 67m above mean sea

level), evergreen tropical forests in the Terai and low hills (below 1000m), through temperate sub-alpine broadleaved and coniferous forests to the tree line (Table 7). Above this, rhododendron scrublands extend up to the high alpine meadows before plant life gives way to frozen and biologically barren snow-capped peaks including Mount Sagarmatha (8848m). The highest recorded flowering plants such as the Scree plant (*Ermania himalayensis*) of the Brassicaceae family are found at around 6000m. The deep river valleys and gorges create their own microclimates. Dramatic vegetation changes can be seen over relatively small areas with differing aspects and altitudes.

Terai-Siwaliks (below 1000m)

The biological diversity contained in the Terai and Siwalik Hill (lowlands) ecosystems are of international significance, both in view of the numerous globally threatened species of fauna and flora they harbour, as well as because of the diversity of ecosystems contained within the area (BPP 1995). The Terai is densely populated resulting in incalculable encroachment and pressure on forest resources. The lowlands are mostly dominated by Sal (*Shorea robusta*), tropical deciduous riverine forests and tropical evergreen forests. Sparse cover of Sal forests remain in eastern and central Nepal, the bulk having succumbed to widespread lopping and deforestation, but they still form some magnificent stands of tall trees in western Nepal.

In recognition of the magnitude of biodiversity of the lowlands, the Government of Nepal has established five protected areas in the Terai and

Table 6. Phytogeographical Divisions			
Divisions	West	Centre	East
Boundary	Western frontier to 83° 00' East longitude	83° 00' East longitude to 86° 30' East longitude	86° 30' East longitude to Eastern frontier

Table 7. Bioclimatic and Equivalent Physiographic Zones			
Altitude (m)	Bioclimatic Zones	Physiographic Zones	BPP/NBY
Above 5000	Nival	High Himal	Highlands
4501 to 5000	Upper Alpine	High Mountains	
4001 to 4500	Lower Alpine		
3501 to 4000	Upper Sub-Alpine		
3001 to 3500	Lower Sub-Alpine		
2501 to 3000	Upper Temperate	Mid-Hills	Mid-Hills
2001 to 2500	Lower Temperate		
1501 to 2000	Upper Sub-Tropical		
1001 to 1500	Lower Sub-Tropical		
501 to 1000	Upper Tropical	Siwaliks	Terai-Siwaliks
Below 500	Lower Tropical	Terai	

Domain north-west, Dobremez (1976) localised in the trans-Himalaya
Sources: Dobremez 1972, LRMP 1986

Siwalik Hills. These are the Koshitappu Wildlife Reserve, Parsa Wildlife Reserve, Chitwan National Park, Bardia National Park, and Shuklaphanta Wildlife Reserve. While the Terai ecosystems are well represented within these protected areas, coverage of the Siwalik Hill ecosystems is less comprehensive (Maskey 1996).

Out of the 23 ecosystems described by Dobremez in the lowlands, 15 are included in the current protected areas of Nepal. The Biodiversity

Profiles Project (BPP 1995) lists 1,885 species of angiosperms, 61 species of bryophytes, and 81 species of pteridophytes from the Terai and Siwalik Hills. To date, most of the exploratory work on the flora of Nepal has been done in the mid-hills mountains. Recent studies and surveys of floral species in the Terai and Siwalik Hills are expected to alter this count significantly. Faunal diversity in the different ecological zones is not well categorised but is, reported to be high in the Terai and Siwalik Hills (BPP 1995).



R N Suwal

Black scorpion, Lumbini



P R Shakya

Bombax cieba L., Kaski 1300m



R Suwal

Red Jungle fowls (*Gallus gallus murgae*)



U R Bhujju

Sal (*Shorea robusta* Gaertn, 2005) Shankarnagar Forest, (Rupandehi)

Out of the 833 bird species found in Nepal, the Biodiversity Profiles Project lists 648 species in the Terai and Siwalik Hills. Some 111 of them are species confined to this area alone. The lowland fauna is seen to be more endangered than mid-hills or mountain fauna because of greater human activity in the lowlands of the Terai and Siwalik Hills (HMGN/MFSC 2002).

Studies indicate evidence of an estimated 1,499 species of flowering plants found at altitudes of 1000m and below.

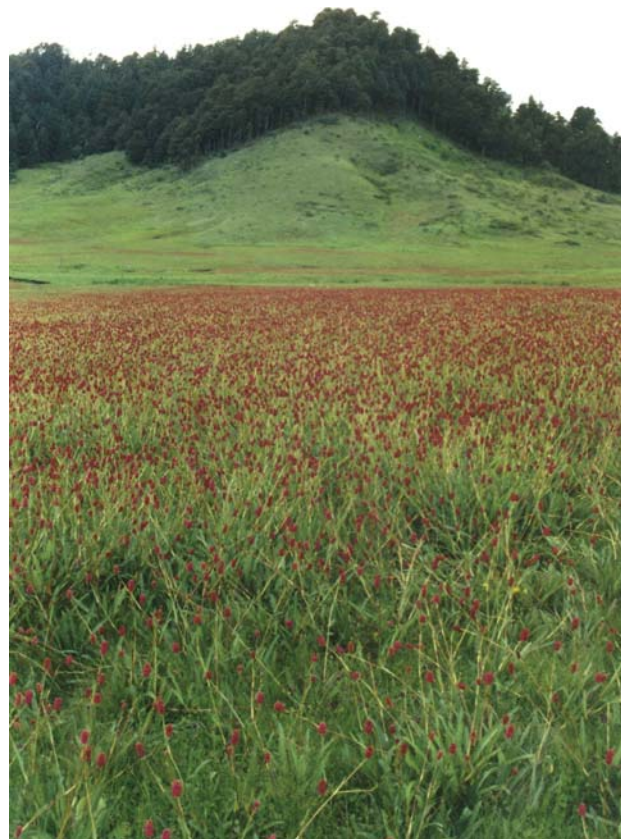
Mid-Hills (1000-3000m)

The Mid-Hills constitute the greatest ecosystem and species diversities in Nepal. The great diversity of terrain and the occurrence of subtropical to temperate flora and fauna in this zone account for this. Nearly 32% of the forests in Nepal are found in the Mid-Hills, and the zone includes 52 types of ecosystems. Dobremez (1996) presented the origin of flora in central Nepal and their distribution in 11 sublevels under five main levels (from Tropical to Nival types) of vegetation, and 15 Himalayan biogeographical domains. He pointed out the occurrence of the highest number of angiosperms in the Mid-Hills, particularly between the altitudes of 2000-2500m. The Biodiversity Profiles Project (BPP 1995) lists 3,364 species of angiosperms, 493 species of bryophytes, 272 species of pteridophytes, and 16 species of gymnosperms in the Mid-Hills. Furthermore, 557 species of butterflies, 76 species of fish, 29 species of amphibians, 56 species of reptiles, 691 species of birds, and 110 species of mammals are listed in the mid-hills (HMGN/MFSC 2002).

Studies indicate evidence of an estimated 2,028 species of flowering plants found at between 1000m to 2000m altitude, and 1,989 species growing at between 2000m to 3000m.

Highlands (above 3000m)

The Nepal Highlands are a point of convergence of two major geographical regions of the world: the Palaeartic region to the north, and the Palaeotropical or Indo-Malayan region to the south. Thirty-eight major ecosystems are found in the Highlands. In recognition of the significance of these ecosystems, the Government of Nepal has established seven protected areas in the Highland mountains (and three protected areas spanning the Mid-Hills and



Bistorta millitii field, Chhedi Patan, Khaptad National Park

U R Bhuju

Highlands), covering 78.52% (20,939km²) of the total protected areas. These protected areas represent 30 of the 38 highland ecosystems (HMGN/MFSC 2002).

The Highlands are relatively less diverse in both flora and fauna than the Mid-Hills and lowlands due to adverse environmental conditions. They are, however, characterised by large numbers of endemic species. The highlands host around one-third of the total forest cover of Nepal representing birch oak, rhododendron, juniper, fir, cedar, larch, and spruce forests. About 420 phanerogamic species have been recorded above 5000m on both sides of the Himalayan range in the Everest region (Miehe 1989).

Studies indicate evidence of an estimated 1,645 species of flowering plants found between 3000m to 4000m; and 1,071 species above 4000m

Species diversity

Global comparison

Nepal comprises only 0.1% of land area on a global scale but possesses a disproportionately rich diversity of flora and fauna at genetic,

species, and ecosystem levels. The species are found in the dense tropical monsoon forests of the Terai, in the deciduous and coniferous forests of the country's subtropical and temperate regions, and in the sub-alpine and alpine pastures and snow-covered Himalayan peaks. Comprehensive summaries of species diversity are presented in **Tables 8** and **9**.

Diversity of flora

There has been comparatively more research on higher groups of plants (angiosperms and gymnosperms); research on the lower groups has not been as extensive or systematic. Collection of Nepali specimens was initiated in 1802 by Buchanan Hamilton, and was continued by N Wallich in 1820-21. Since then, many parts of Nepal have been well explored. Major herbaria that house Nepali specimens are found in the National Herbarium and Plant Laboratories, Kathmandu; the Natural History Museum, London; Herbaria of the Royal Botanic Garden, Kew; the University of Tokyo, Japan; the Smithsonian Institution, Washington DC; the University of Grenoble, France; and the Royal Botanic Garden, Edinburgh. It is estimated that

the British Museum has over 40,000 specimens, the University of Tokyo about 100,000 specimens, and the National Herbarium and Plant Laboratories of Kathmandu, 150,000 specimens. Moreover, approximately 10,000 specimens are housed in various institutions in Tribhuvan University (TU). Nepali herbarium specimens are also housed in 38 herberia throughout the world (Shakya 2002).

The Flora of Nepal programme was initiated by the National Herbarium and Plant Laboratories of Godavari under the Department of Plant Resources (DPR-MFSC 1997). The Department of Plant Resources was established in 1960-61, and has established seven district offices for the development of plant resources activities at the district level. The Ministry of Forests and Soil Conservation (MFSC), TU, and the Nepal Academy of Science and Technology (NAST) have signed an agreement to produce a comprehensive list of flora of Nepal. The Department of Plant Resources has published 32 books and booklets about local and regional flora, and TU has published several papers on the subject. Several Master of Science dissertations from TU have studied local flora, ecology, and biological diversity. Foreign institutions actively involved in the Flora of Nepal Programme include the Natural History Museum in London, the University of Tokyo, and the Royal Botanic Garden of Edinburgh.

Bacteria. Between 3,000 and 4,000 bacteria species have been identified around the world. Enormous numbers of uncultured bacteria are yet to be identified from soils, deep sea sediments, and the digestive tracts and pockets of a wide variety of animals and insects (WCMC 1992). This important group of organisms has not received adequate attention in Nepal yet, and the study of bacteria in diverse habitats is needed.

Lichens. During the International Workshop on Lichen Taxonomy held in Kathmandu in 1994, lichenologists estimated about 2,000 lichen species in Nepal. Lichens are found in all climatic zones. Forty-eight lichen species are reported to be endemic to Nepal. Sharma (1995) identified 471 species from 79 genera and 30 families. Studies on lichens have been carried out mainly in eastern and central Nepal. Lichens from the lowland Terai and Siwalik Hills are much less known, and those of western Nepal remain largely unexplored.

Table 8. Comparative Totals of Plant Species of the World and Nepal

Group (Life Form)	World Number	Nepal	
		Number#	%
Flowering Plants	231,638*	6,391	2.76
Pteridophytes	10,369*	534	5.15
Lichens	>17,000**	471	2.77
Bryophytes	>14,000**	668	4.77
Fungi	>70,000**	1,882	2.69
Algae	>40,000**	687	1.72
Total	>403,000	10,633	2.80

Sources: * UNEP-WCMC 2006; ** WCMC 1992; # Modified after Malla and Shakya 1998

Table 9. Comparative Total of Animal Species in the World and in Nepal

Group (Life Form)	World Number	Nepal ¹	
		Number	%
Mammals	4,675 ⁺	185	3.96
Birds	9,799 [@]	874	8.90
Herpeto	12,650	195	1.54
Amphibians	4,780 ⁺	118	2.47
Reptiles	7,870 ⁺	78	0.99
Fish	10,000 [@]	187	1.87
Butterflies	17,500 [#]	651	3.72
Moths	160,000 [#]	785	0.49
Spiders	39,490 [*]	175	0.44

Sources: ⁺Uetz, P. 2000, [@]BirdLife International 2006, [®]IUCN. 2003, [#]Smithsonian Institution 2007, ^{*}Platnick, NI. 2006, ¹Annexes to this document

Fungi. Adhikari (1999) listed 1,822 species of fungi belonging to 585 genera and 80 families. However, studies on fungi have mainly focused in the Mid-Hills and high altitude regions and in the Kathmandu Valley, and exploration in the lowlands has been inadequate. Little is known about the distribution of fungi in Nepal.

Algae. Baral (1995) identified 687 species of algae belonging to 150 genera and 50 families in Nepal, with 12 species presumed to be endemic. Most work on algae has been concentrated in the High Mountain and Mid-Hills regions. The Terai belt, which supports luxuriant growths of algae owing to its hot and humid climate, has not been extensively investigated yet.

Bryophytes. A total of 853 species of bryophytes (mosses and liverworts) has been recorded (Kattel and Adhikari 1992) and 668 species of bryophytes listed, of which 627 species are found in eastern Nepal, and 283 species in central Nepal (BPP 1995) (**Annex 1.2**). The largest number of bryophyte species, 493, has been recorded in the Mid-Hills (subtropical and temperate zones); 347 in the High Mountains (alpine and sub-alpine zones); and 61 in the Siwalik Hills and Terai (tropical zone). The bryophytes of eastern and central Nepal have been reasonably well studied, but work is still required on the bryophytes of western Nepal.

Pteridophytes. An enumeration of pteridophytes (ferns and fern allies) was compiled by Iwatsuki (1988). Iwatsuki recorded 380 species, with 258 distributed in the eastern region, and 97 in the central region of Nepal. No collections have been made from western Nepal. The greatest number of pteridophyte species was recorded in the Mid-Hills: 272 species in subtropical and temperate zones. The Siwalik Hills and the Terai tropical zones hold 81 species, the High Mountains (alpine and sub-alpine zones) 78 species, and the high Himalayas (Nival zone) just one species. **Pteridophytes of Nepal**, published in 2002 by the Department of Plant Resources, enumerated 534 species of ferns and fern allies representing 35 families and 102 genera (**Annex 1.3**) (DPR-MFSC 2002).

Gymnosperms. Gymnosperms have been the best studied topic amongst the vascular plants of Nepal. Altogether, 27 species of gymnosperms have been listed (Koba et al. 1994). These

include 20 indigenous species belonging to 13 genera and 10 families (Shrestha 1984-85).

Angiosperms. The angiosperm flora of Nepal is impressively high on a global scale in view of the limited area of the country. Koba et al. (1994) extended the lists of flowering plant species prepared by Hara and Williams (1979); Hara et al. (1978;1982), enumerating 5,806 species belonging to 203 families. To this number, a list of 50 species has been added by Akiyama et al. (1998) bringing the total angiosperm species count in Nepal to 5,856. The introduction of additional species new to Nepal has raised this number to 5,891 (Malla and Shakya 1998). However, Hara et al. (1978) and the World Conservation Monitoring Centre (Caldecot et al. 1994) estimate a total of 6,500 species. This figure is corroborated by the Biodiversity Profiles Project (1995) ranking Nepal as having the tenth richest flowering plant diversity in Asia. On a world scale, Nepal ranks 31st (Caldecot et al. 1994).

Calculations for the Nepal Biodiversity Resource Book 2006 was based on the checklists including BPP (1995), eflora of Nepal (Press, JR, Shrestha, KK, and Sutton, DA. 2000), and the Flora Himalaya Database (Dobremez et al. 1967-2005). The findings indicate evidence of 6,391 phanerogamic species in Nepal representing 1,590 genera, and 231 families (**Annex 1.4**). The species number also includes infraspecific taxa (subspecies, varieties, and forma).

Table 10. Families Represented by Higher Numbers of Genera and Species

Family	Species*	Genus
1. Poaceae (Gramineae)	454	126
2. Asteraceae (Compositae)	450	110
3. Orchidaceae	423	98
4. Fabaceae (Leguminosae)	362	94
5. Rosaceae	236	29
6. Cyperaceae	213	19
7. Ranunculaceae	208	21
8. Scrophulariaceae	190	41
9. Lamiaceae (Labiatae)	162	46
10. Apiaceae (Umbelliferae)	144	48
11. Gentianaceae	134	15
12. Brassicaceae (Cruciferae)	124	42
13. Rubiaceae	121	37
14. Saxifragaceae	108	6
15. Primulaceae	107	6
16. Caryophyllaceae	105	16
17. Euphorbiaceae	102	30

including infraspecific levels

Source: BPP 1995, Flora Himalayan Database 1967-2005

The top ranking families in terms of the highest numbers of genera (over 90), and species (362 and above), are **Poaceae**, **Asteraceae**, **Orchidaceae**, and **Fabaceae** (Table 10).

Diversity of fauna

The number of fauna species in Nepal is relatively high. Higher fauna groups have been relatively well studied. The taxonomy and distribution of lower fauna groups, with the exception of butterflies and to some extent spiders, are yet to be studied. A comprehensive **Fauna of Nepal** guide is essential in order to understand the status of such species for their effective conservation.

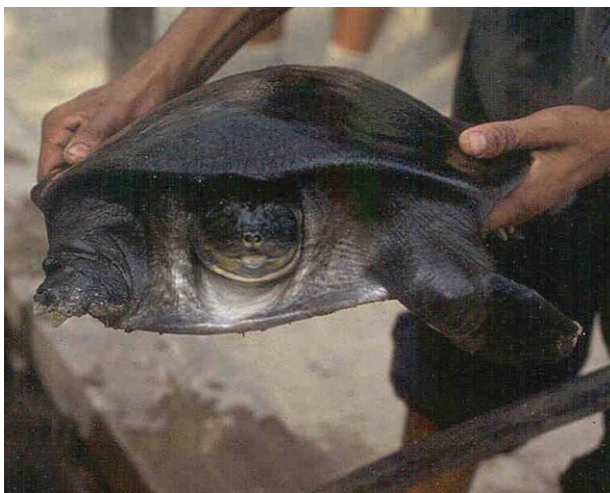
Platyhelminthes. Helminths are invertebrate animals with bilateral symmetry and without appendages. Most of these species are parasitic and are found in the wild as well as within domestic plants and animals. In Nepal, helminths are not well studied and helminthological work is confined to the Kathmandu Valley. A checklist of 168 species of helminth parasites has been compiled: 33 species belong to trematodes, 67 to nematodes, 36 to cestodes, and 32 species are plant Nematodes (Gupta 1997). Some common plant helminth parasites include the *Meliodygyn incognita*, *M. arenaria*, and *M. javanica*, all of which cause damage to vegetables. *Ascaris lumbricoides*, *Ancylostoma duodenale*, and *Taenia* species are common human parasites.

Spiders. Thapa (1995) reported 144 species of spiders belonging to 17 families. Some 109 species were new to science at the time of their

identification in Nepal. Most have been collected from the High Mountains and Mid-Hills. The far-western region and the entire lowland Terai and Siwalik Hills need further study. With the additional contributions of Thapa and Rana (2001), 175 species of spiders have been identified (**Annex 2.1**).

Insects. An inventory by Thapa (1997) enumerates 5,052 species of insects; 1,131 species were discovered for the first time and described from Nepali specimens. *Apis laboriosa*, the world's largest honeybee; *Attacus atlas*, the world's largest Atlas moth; and *Epiophlebia laidlawi*, a relict dragonfly species, are three insect species unique to Nepal. A list of 564 species of insects representing 17 orders, with the exception of Lepidoptera, is presented in **Annex 2.2**.

Butterflies and Moths. Among Nepal's fauna, butterflies are the best studied group throughout the country (Smith 1994; 1997). In 1995, 640 species of butterflies were recorded in different ecological zones. The Red Data Book of the Fauna of Nepal (BPP 1995) listed 142 species of which 12 were endangered, 43 vulnerable, and the remaining 87 species susceptible to becoming threatened in the future. Four species and 25 subspecies are possibly endemic. There are 557 species found in the Mid-Hills, 325 in the Terai, and 82 in the highlands (BPP 1995). Some 2,253 species of moths excluding *Microlepidoptera* have been recorded in Nepal (HMG/MFSC 2002). The current list includes 651 species of butterflies (**Annex 2.3**) and 785 species of moths (**Annex 2.4**) (Thapa, 1998; and Khanal, B. 2006).



U R Bhujju

Black Soft-shelled turtle (*Melanochelys trijuga indopeninsularis*), Karnali River

Fish. The fishes of Nepal have been fairly well documented. There are 187 species. (**Annex 2.5**) (Shrestha, J. 1995; and DNPWC 2001). Many taxonomic changes have been made in the genera and species of fish by Shrestha, J. (2001) who listed a total of 182 species belonging to 11 orders, 31 families, and 93 genera. Altogether, 34 species are known to be threatened and eight species are endemic to Nepal.

Amphibians and Reptiles. Shah (1995) listed 143 species of amphibians and reptiles in Nepal. Forty-three species include one salamander; four toads, and 38 frogs. The 100 species of reptiles include 24 lizards, 14 turtles, two crocodiles, and 60 snakes. Studies of amphibians and reptiles have been carried out in a number of areas



R N Suwal

Bar headed Geese (*Anser indicus*) flying over the skies of Chitwan National Park

including the Arun Valley in eastern Nepal, Chitwan National Park in central Nepal, and the Annapurna-Dhaulagiri region in western Nepal. There are 195 species of herpetofauna, including 77 amphibians and 118 species of reptiles in Nepal (**Annex 2.6**) (Shah, K. 1995; and Shah and Tiwari 2004).

Birds. The birds of Nepal have been well studied. A total of 874 bird species have been recorded by 2006 (BCN. 2006, Inski 1991; Fleming 1976; and Baral 2005). BPP records included 854 species of birds including 11 species listed as extinct. The DNPWC/BCN checklist included 862 species of birds; other sources reported 12 additional species.

An additional 20 species of birds have been added to the BPN list since 1996 (**Table 11**).

Of the total 874 species of birds, 62% are resident birds, 14% are winter visitors, 12% are passage migrants, 6% summer visitors, 5% residents and migrants, and 1% summer and winter visitors (**Annex 2.7**).

Mammals. A comprehensive account of Nepal's mammalian fauna has been produced by Suwal and Verheugt (1995) who listed 181 mammal species belonging to 12 orders and 39 families.

Table 11. Bird Species Added to the BPN Checklist

SN	Scientific name	Common name
1.	<i>Acrocephalus melanopogon</i>	Moustached Warbler
2.	<i>Anser albifrons</i>	Greater White-fronted Goose
3.	<i>Aplonis panayensis</i>	Asian Glossy Starling
4.	<i>Calidris canutus</i>	Red Knot
5.	<i>Carpodacus rodopeplus</i>	Spot-winged Rosefinch
6.	<i>Emberiza pallasi</i>	Pallas's Bunting
7.	<i>Gavia stellata</i>	Red-throated Loon
8.	<i>Mycerobas icteroides</i>	Black-and-yellow Grosbeak
9.	<i>Oenanthe picata</i>	Variable Wheatear
10.	<i>Oenanthe xanthopyrmyna</i>	Rufous-tailed Wheatear
11.	<i>Pericrocotus erythropygus</i>	White-bellied Minivet
12.	<i>Ploceus megarhynchus</i>	Finn's Weaver
13.	<i>Porzana bicolor</i>	Black-tailed Crane Sp
14.	<i>Prinia burnesii</i>	Rufous-vented Prinia
15.	<i>Pyrrhula erythaca</i>	Grey-headed Bullfinch
16.	<i>Riparia diluta</i>	Pale Martin
17.	<i>Seicercus whistleri</i>	Whistler's Warbler
18.	<i>Sphenocichla humei</i>	Wedge-bellied Wren Babbler
19.	<i>Sturnus sturninus</i>	Purple-backed Starling
20.	<i>Syrrhaptes tibetanus</i>	Tibetan Sandgrouse

Sources: BCN 2006, Baral H. 2005, Inskipp C. 2000

The current list includes 185 species of mammals (Annex 2.8). The four new additions are the binturong (*Arctictis binturong*), Indian mongoose (*Herpestes nyula*), Himalayan marmot (*Marmota himalayana*) and Tibetan gazelle (*Procapra picticaudata*) (Table 12). The Indian mongoose (*Herpestes nyula*) is not included in the general mammal checklist although it is mentioned in the BPP document (BPP, 1995). Mammals are well represented in the protected areas of Nepal.

Species distribution

Species distribution is examined from two perspectives: confinement, and richness. Confinement analyses the number of species distributed in a given region; richness assesses the total number of species found.

Species confinement

Of the total number of mammal species identified, the Terai-Siwaliks region harbours the highest number of confined species, including 35 mammal species, 111 bird species, 46 herpeto species, and 106 fish species (Table 13). The central phytogeographical region harbours the highest number of confined species including 28 mammal species, 24 bird species, 40 herpeto species, and 31 fish species (Table 14). Collectively, the central Terai-Siwaliks region contains the highest number of species confined to a region. The number of species spatially confined to the specific regions such as the Central Highlands, Eastern Mid Hills, and Western Terai-Siwaliks are presented in Table 15.

Table 12. New Additions to the Mammals Checklist

SN	Common name	Scientific Name	Location	Source
1	Binturong	<i>Arctictis binturong</i>	CNP	CNP Plan 2000
2	Indian Mongoose	<i>Herpestes nyula</i>	ACA	BPP 1995g
3	Himalayan Marmot	<i>Marmota himalayana</i>	ACA	KMTNC 2005
4	Tibetan Gazelle	<i>Procapra picticaudata</i>	ACA	KMTNC 2005

Source: Nepalnature.com

Table 13. Fauna Species Confined to Physio-graphical Regions

Altitudinal Zones	Mammals	Birds	Herpeto	Fish
Highlands	30	21	6	3
Mid Hills	32	24	32	14
Terai-Siwaliks	35	111	46	106

Sources: Annexes 2.5 to 2.8

Table 14. Fauna Species Confined to Phytogeographical Regions

Divisions	West	Center	East
Mammals	10	28	7
Birds	4	24	19
Herpeto	13	40	30
Fish	5	31	12

Sources: Annexes 2.5 to 2.8

Species richness

Based on phytogeographical and altitudinal zoning, Nepal’s landmass can be divided into nine blocks. Among them the central Mid-Hills harbour the highest number of mammals (55%) and birds species (77%); the central Terai-Siwaliks harbour the highest number of herpeto (45%), and the eastern Terai-Siwaliks houses 74% of fish species. Overall, richness in species is highest in the central Mid-Hills, followed by the central Terai Siwaliks, the eastern Terai Siwaliks, the western Terai Siwaliks, the eastern mid-hills, the central Highlands, the western Mid-Hills, the eastern Highlands, and finally the western Highlands (Table 16 and Figure 2).



Tiger (*Panthera tigris*) pugmarks found at Chitwan National Park

Table 15. Fauna Species Confined to Physiological-Phytogeographical Regions

Region (Spatial confinement)	Mammals	Birds	Herpeto	Fish
Highlands	15	15	1	-
Central Highlands	10	5	3	-
Eastern Highlands	3	-	-	-
Western Highlands	2	1	2	3
Mid-Hills	14	10	10	4
Central Mid-Hills	13	10	11	9
Eastern Mid-Hills	3	4	8	1
Western Mid-Hills	2	0	3	0
Terai and Siwalik	23	83	20	71
Central Terai and Siwalik	5	10	17	22
Eastern Terai and Siwalik	1	15	6	11
Western Terai and Siwalik	6	3	3	2
Central Region	0	0	9	0
Eastern Region	0	0	16	0
Western Region	0	0	5	0

Sources: Annexes 2.5 to 2.8

Endemism

Of the 246 endemic plants recorded, eight species were presumed extinct from Nepal (Shrestha and Joshi 1996). Thirty-two species from this list have been reported to have originated elsewhere. In spite of these deductions, 185 species including infraspecific taxa have been added to the checklist of endemic plants, bringing the total count of endemic plants to 399. These calculations are based on various sources including Dobremez et al. (1967-2006) and Press et al. (2000).

Of 399 endemic flowering plants in Nepal, about 63% are from the high mountains, 38% are from the Mid-Hills. Only 6% are from the Terai and Siwaliks. The central region contains 66% of total endemic species followed by the western (32%), and eastern regions (29%) (Annex 1.5).

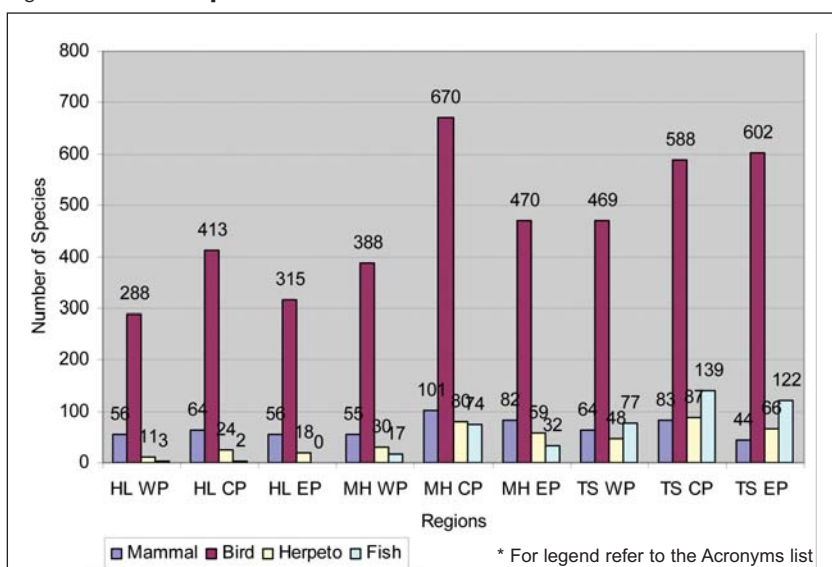
Table 16. Faunal Species Richness by Region

Region	Mammal		Bird		Herpeto		Fish	
	#	%	#	%	#	%	#	%
Western Highlands	56	30	288	33	11	6	3	0
Central Highlands	64	35	413	47	24	12	2	0
Eastern Highlands	56	30	315	36	18	9	0	1
Western Mid-Hills	55	30	388	44	30	15	17	17
Central Mid-Hills	101	55	670	77	80	41	74	2
Eastern Mid-Hills	82	44	470	54	59	30	32	40
Western Terai/Siwalik	64	35	469	54	48	25	77	41
Central Terai/ Siwalik	83	45	588	67	87	45	139	9
Eastern Terai/Siwalik	44	24	602	69	66	34	122	74
Endemic to Nepal	1	1	2	0	14	7	6	3

Sources: Annexes 2.5 to 2.8

One mammal and one bird species each may be considered endemic in Nepal. From the mammals species, the Himalayan fieldmouse (*Apodemus gurkha*) (Thomas 1924) found in central Nepal between the altitudes of 2200-3600m is an endemic mammal species in Nepal. It was classified as 'Lower Risk-Least Concern' in 1994, and assessed in 1996 by the IUCN Red List of Threatened Species (Baillie, J. 1996; and Wilson, D.E. and Reeder, D. M (eds.). 2005). The Spiny Babbler (*Turdoides nipalensis*) is Nepal's endemic bird species. It is found in the six mountain protected areas: Khaptad National Park, Bardia National Park, Shivapuri National Park, Makalu-Barun National Park, Annapurna Conservation Area, Manaslu Conservation Area, and Kangchenjunga Conservation Area. It is classified as the species of 'Least Concern' in the IUCN Red List in 2001 (BirdLife International. 2004). The Nepal Kaliij (*Lophura leucomelanos leucomelanos*) is

Figure 2. Faunal Species Distribution





R. N. Suwal

Blood pheasant (*Ithaginis cruentus*), Sagarmatha National Park

another species endemic to Nepal (Inskipp, C. 2000).

Fourteen species of herpetofauna are endemic to Nepal. Of these, four species (*Paa ercepeae*, *Melanochelys trijuga indopeninsularis*, *Python molurus bivittatus* and *Rana chitwanensis*) are listed as 'Near Threatened' in the IUCN Red List, and three species, *Rana humeralis*, *Megophrys parva* and *Polypedates maculatus* as of 'Least Concern'. Similarly, the Burmese rock python (*Python molurus bivittatus*) is protected under the NPWC Act of Nepal, and also listed in the CITES Appendix I. The Che-quered keelback (*Xeno-chrophis piscator piscator*) is listed in the CITES Appendix III (**Annex 2.6**).

Six species of fish are endemic in Nepal. Among them, three species of Asala (*Schizothorax macro-phthal-mus*, *Schizothorax nepalensis* and *Schizothorax raraensis*) are recorded only in Rara National Park. The Chuche Asala (*Schizo-tharaichthys annandalei*) is recorded in BNP, the 'Jalkapur Totiyara' (*Barilius jalkapooei*) is recorded in Bardia National Park, and Koshitappu Wildlife Reserve, and the 'Tite machha' or bitter fish (*Psilorhynchus pseudocheneis*) is recorded in Sagarmatha National Park, and Makalu-Barun National Park.

In 1995, 108 species of spiders were recorded as endemic in Nepal. This included 33 species that were rare in distribution, and three threatened species (**Annex 2.1**) (Thapa. 1995).

Threatened species

A system for version numbering has been adopted for the IUCN Red List of Threatened Species. The system was developed to clarify the process of classification and to open the way for modifications as and when necessary (**Boxes 3 and 4**). From the Red List, it is clear that no species recorded in Nepal are classified in the categories of 'Globally Extinct (EX)', 'Extinct from the Wild (EW)', and 'Not Evaluated (NE)'.

Thirty-four species of plants are included in the IUCN Red List (**Annex 1.6**). Of them, two species (*Andrewsianthus ferrugineus*, Grolle family and *Diplocolea sikkimensis*) Amakawa family are considered 'Endangered'; five are considered 'Vulnerable' (*Cycas pectinata*, a wild palm; *Dalbergia latifolia*, Indian rosewood; *Scaphophyllum*, Horik; *speciosum*, *Takakia ceratophylla*, sporophyte; and *Ulmus wallichiana*), Himalayan elm; two are 'Near Threatened' (*Aglaia cucullata* English common maple and *Cupressus torulosa* Bhutan cypress), 24 of 'Least Concern', and one (*Taxus wallichiana*) 'Data Deficient' (IUCN. 2006).

As a part of the BPP report series, the National Red Data Book (NRDB) of the Fauna of Nepal has been prepared to review the conservation status of wildlife species in Nepal. This document also identified faunal elements which require urgent legal protection. The NRDB includes 59 mammal species, 279 bird species, 35 herpeto species, and 34 fish species (**Table**

Box 3. Versions and Categories of the IUCN Red List of Threatened Species

The proposals presented in this document result from a continuing process of drafting, consultation and validation. The production of a large number of draft proposals has led to some confusion, especially as each draft has been used for classifying some set of species for conservation purposes. To clarify matters, and to open the way for modifications as and when they become necessary, a system for version numbering has been adopted as follows:

Version 1.0: Mace and Lande (1991)

The first paper discussing a new basis for the categories, and presenting numerical criteria especially relevant for large vertebrates.

Version 2.0: Mace et al. (1992)

A major revision of Version 1.0, including numerical criteria appropriate to all organisms and introducing the non-threatened categories.

Version 2.1: IUCN (1993)

Following an extensive consultation process within SSC, a number of changes were made to the details of the criteria, and fuller explanation of basic principles was included. A more explicit structure clarified the significance of the non-threatened categories.

Version 2.2: Mace and Stuart (1994)

Following further comments received and additional validation exercises, some minor changes to the criteria were made. In addition, the Susceptible category present in Versions 2.0 and 2.1 was subsumed into the Vulnerable category. A precautionary application of the system was emphasised.

Version 2.3: IUCN (1994)

IUCN Council adopted this version, which incorporated changes as a result of comments from IUCN members, in December 1994. The initial version of this document was published without the necessary bibliographic details, such as date of publication and ISBN number, but these were included in the subsequent reprints in 1998 and 1999. This version was used for the 1996 IUCN Red List of Threatened Animals (Baillie and Groombridge 1996), The World List of Threatened Trees (Oldfield et al 1998) and the 2000 IUCN Red List of Threatened Species (Hilton-Taylor 2000).

Version 3.0: IUCN/SSC Criteria Review Working Group (1999)

Following comments received, a series of workshops were convened to look at the IUCN Red List Criteria following which, changes were proposed affecting the criteria, the definitions of some key terms and the handling of uncertainty.

Version 3.1: IUCN (2001)

The IUCN Council adopted this latest version, which incorporated changes as a result of comments from the IUCN and SSC memberships and from a final meeting of the Criteria Review Working Group, in February 2000.

All new assessments from January 2001 should use the latest adopted version and cite the year of publication and version number.

Source: IUCN 2001



P. R. Shakya

Lithocarpus pachyphylla (Curz) Rehder forest, Panchthar, 2500m

Box 4. 2001 Categories of the IUCN Red List of Threatened Species

EXTINCT (EX) : A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

EXTINCT IN THE WILD (EW) : A taxon is Extinct in the Wild when it is known only to survive in cultivation, in captivity or as a naturalized population (or populations) well outside the past range. A taxon is presumed Extinct in the Wild when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR) : A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.

ENDANGERED (EN) : A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section V), and it is therefore considered to be facing a very high risk of extinction in the wild.

VULNERABLE (VU) : A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.

NEAR THREATENED (NT) : A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.

LEAST CONCERN (LC) : A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable, or Near Threatened. Widespread and abundant taxa are included in this category.

DATA DEFICIENT (DD) : A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

NOT EVALUATED (NE) : A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

Note: As in previous IUCN categories, the abbreviation of each category (in parenthesis) follows the English denominations when translated into other languages.

Source: IUCN 2001

17). Updated checklists suggest that four species of mammals and seven species birds from this list are now extinct. Of the mammals, two species, namely the Cheetah (*Acinonyx jubatus*) and the Black musk deer (*Moschus fuscus*) have probably never been recorded in Nepal; the remaining two, the pigmy hog (*Sus salvanius*) and the Indian

chevrotain (*Moschiola meminna*) are likely to have become extinct in Nepal (IUCN-Nepal 1995).

The National Red Data Book (NRDB) of Nepal

Of the 11 bird species listed in the BPN (BPP 1995), as 'Extinct' in Nepal, sightings of three species have recently been reported. The

Hodgson's hawk cuckoo (*Hierococcyx fugax*) was sighted in Koshitappu Wildlife Reserve (Baral, HS 2005), the black-breasted parrotbill (*Paradoxornis flavirostris*) in the Annapurna Conservation Area (Suwal, RN. 2003), and the long-tailed sibia (*Heterophasia picaoides*) in Chitwan National Park (BES 2006). The fourth species, the green cochoa (*Cochoa viridis*) was already listed in

Table 17. List of Faunal Species in the NRDB

NRDB Status	Mammals	Birds	Herpeto	Fish
EXN = Extinct Nepal	4	7	0	0
C = Critically endangered	5	6	0	0
E = Endangered	11	53	1	1
V = Vulnerable	16	112	6	10
S = Susceptible	23	101	28	23
Subtotal	59	279	35	34
% of Total	32	32	18	18
Total number of species	185	874	195	187
Sources: Annexes 2.5 to 2.8				

the bird checklist of the Makalu-Barun National Park - BPN Technical Report Number 14 (BPP 1995, and Jackson et al. 1990) (Table 18).

Altogether, 173 mammal species are listed as Threatened by IUCN, one as Critically Endangered (Pigmy hog *Sus salvanius*), 11 as Endangered (EN), 21 as Vulnerable, 19 as Near Threatened, 120 as of Least Concern, and one Data Deficient (Csorba's mouse-eared bat *Myotis csorbai*).

Of the total 874 species of birds, three species are classified as Critically Endangered (the Slender-billed vulture *Gyps tenuirostris*, the Pink-headed duck *Rhodonessa caryophyllacea*, and White-rumped vulture *Gyps bengalensis*). Six are classified Endangered, 23 as Vulnerable, 25 as Near Threatened, and 813 as of Least Concern (Table 19) (IUCN 2006).

Protected species

Under the Forest Act 1993, the Government of Nepal has banned the collection, use, sale, distribution, transportation, and export of three species: 'Pancha ounle' (*Dactyloctenium aegyptium*), 'Okhar ko bokara' (*Juglans regia* bark), and 'Kutaki' (*Picro-rhiza scrophu lariflora*) effective 12 February 2001. The government has also banned the export of eight species of plants and rock exudes (*shilajit*) except for their processed product, and upon the permission of the Department of Forests, and transportation, export, and felling of seven tree species for commercial purposes (Annex 1.7) (MFSC 2007).

Seventy-two species of plants have been inventoried for their commercially important biomaterials. The five major species with the highest export value of biomaterials are the Soap nut tree (*Sapindus mukorossi*), Nepal pepper (*Zanthoxylum armatum*), lichens (*Parmelia*) spp, Cotton paper (*Persia bombycina*) and a medicinal indigenous plant called 'Anaryatikta' and other

Table 18. List of Bird Species Classified as Extinct from Nepal in BPN

Common name	Scientific name	Status	Remarks
Black-breasted parrotbill	<i>Paradoxornis flavirostris</i>	VU	Sighted in ACA (Suwal, RN 2003)
Green cochoa	<i>Cochoa viridis</i>	LC	Sighted in MBNP (BPP 1995h, and Jackson et al. 1990)
Hodgson's hawk-cuckoo	<i>Hierococcyx fugax</i>	LC	Sighted in KWR (Baral, HS 2005)
Jungle bush quail	<i>Perdica asiatica</i>	LC	
Long-tailed sibia	<i>Heterophasia picaoides</i>	LC	Sighted in CNP (BES 2006)
Pink-headed duck	<i>Rhodonessa caryophyllacea</i>	CR	
Red-faced liocichla	<i>Liocichla phoenicea</i>	LC	
Rufous-necked hornbill	<i>Aceros nipalensis</i>	VU	
Rusty-bellied shortwing	<i>Brachypteryx hyperythra</i>	VU	
Silver-breasted broadbill	<i>Serilophus lunatus</i>	LC	
White-bellied heron	<i>Ardea insignis</i>	EN	

Source: BPP 1995
VU = vulnerable; LC – least concern; CR = critical; EN = endangered

Table 19. Number of Species in the IUCN Red List

Category	Symbol	Plants	Mammals	Birds	Herpeto
Critically Endangered	CR	-	1	3	1
Endangered	EN	2	11	6	3
Vulnerable	VU	5	21	26	7
Near Threatened	NT	2	21	26	4
Least Concern	LC	24	130	813	39
Data Deficient	DD	1	1	-	10
Total		34	185	874	64

Sources: Annexes 1.6, 2.6 to 2.8

names (*Swertia chirayita*) (Annex 1.7) (Nepal Nature dot Com 2005).

Twenty-seven species of mammals, nine bird species, and three reptile species are listed as protected under NPWC Act 1973 (Annexes 2.6 to 2.8, and Annex 2.34). An additional 10 species of fish and 12 species of butterflies have since been identified as needing protection (HMG/N/MFSC 2002).

In 2003, the Government of Nepal approved the Working Policy on Wild Animal Farming, Breeding, and Research. Under this provision, activities related to seven species of mammals, one species of amphibian (the gharial crocodile *Gavialis gangeticus*), all of 77 species of snakes, and the total 874 species of birds including the three protected ones are restricted (Annex 2.9) (GoN/MFSC 2003).

CITES

Nepal is a signatory of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) since 1975. A number of Nepali species are listed under various CITES appendices as follows (Table 20 and Box 5):

- Vascular plants – One hundred thirty-nine species of plants (two species of orchids namely, *Paphiopedilum insigne* and *Paphiopedilum venustum* in Appendix I; 132 in Appendix II; five species namely, *Cycas pectinata*, *Gnetum montanum*, *Meconopsis regia*, *Podocarpus neriifolius*, and *Tetracentron sinense* in Appendix III (Annex 1.8)
- Mammals - Sixty-six species (28 species in Appendix I; 14 species in Appendix II; 24 species in Appendix III (Annex 2.8)
- Birds - One hundred and twenty-eight species (16 species in Appendix I; 95 species in Appendix II; 17 species in Appendix III (Annex 2.7)
- Reptiles - Eleven species in total. Four species, the Bengal monitor (*Varanus bengalensis bengalensis*); Yellow monitor (*Varanus*



P R Shakya

Aconitum spicatum (Bhrtl.) Stapf., Ghurchi Lekh, found in Jumla at 3140m

Table 20. Number of Species in the CITES Appendices

Appendices	Plants	Mammals	Birds	Herpeto
I	2	28	16	8
II	132	14	95	13
III	5	24	17	3
Total	139	66	128	24

Source: <http://www.cites.org/eng/resources/species.html>
Sources: Annexes 1.8, 2.6 to 2.8

flavescens); Burmese rock python (*Python molurus bivittatus*); and Asiatic rock python (*Python molurus molurus*) are in Appendix I. Four species, the Indian egg-eating snake (*Elachistodon westermanni*), Asiatic rat snake (*Ptyas mucosus mucosus*); Monocellate cobra (*Naja kaouthia*); and King cobra (*Ophiophagus Hannah*) are in Appendix II. Three species, the chequered keelback (*Xenochrophis piscator piscator*), common cobra (*Naja naja*), and Russell's viper (*Daboia russelli russelii*) are in Appendix III (Annex 2.6);

Box 5. CITES Appendices

Article II Fundamental Principles

1. Appendix I shall include all species threatened with extinction, which are or may be affected by trade. Trade in specimens of these species must be subject to particularly strict regulation in order not to endanger further their survival and must only be authorized in exceptional circumstances.
2. Appendix II shall include:
 - (a) All species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival; and
 - (b) Other species which must be subject to regulation in order that trade in specimens of certain species referred to in sub-paragraph (a) of this paragraph may be brought under effective control.
3. Appendix III shall include all species which any Party identifies as being subject to regulation within its jurisdiction for the purpose of preventing or restricting exploitation, and as needing the co-operation of other Parties in the control of trade.
4. The Parties shall not allow trade in specimens of species included in Appendices I, II and III except in accordance with the provisions of the present Convention.

Note: When both Appendix I and Appendix II are mentioned to a particular taxon on one date, Appendix I takes precedence in the list, according to the Explanatory Note for the CITES Appendices.

Source: CITES 1979

- Amphibians – Five species: the mugger crocodile (*Crocodylus palustris*), gharial (*Gavialis gangeticus*), Indian roofed-turtle (*Pangshura tectum*), three-keeled land tortoise (*Melanochelys tricarinata*), and Indian softshell turtle (*Aspideretes gangeticus*) are in Appendix I; another 10 species are in Appendix II (**Annex 2.6**);
- Insects – Three species of butterflies, the Kaiser-I-hind (*Teinopalpus imperialis*), golden birdwing (*Troides aeacus*), and common birdwing (*Troides Helena*) are in Appendix II.

Species in protected sites

Protected sites

The 23 protected sites in the country consist of 16 protected areas: nine national parks, three wildlife reserves, three conservation areas, and one hunting reserve. Four Ramsar sites include Koshitappu Wildlife Reserve; and the four World Heritage sites include Sagarmatha National Park and Chitwan National Park. The Kathmandu Valley World Heritage site includes three monumental zones with particular significance to biodiversity: Swayambhu, Pashupati, and Changunarayan (**Table 21**).

With the exception of the eastern Mid-Hills (MH-E), these protected areas represent the remaining altitudinal zones (Highlands, Mid-Hills, and Terai-Siwaliks), and phyto-geographical regions (West, Center, and East). The Ramsar sites are confined only to the Terai-Siwalik regions. Most of the World Heritage sites are located in the central region (**Table 22**).

The protected sites are managed under the legal system. The protected areas are all managed under the National Parks and Wildlife

Conservation Act 1973 (as amended in 1974, 1983, 1990, 1993, and 2005), and other pertinent regulations. Thus, all the species found in these areas are legally protected in-situ.

Of the Ramsar sites, two (Bishazari Tal Ramsar Site and Koshitappu Wildlife Reserve) are already within the Protected Areas system. The two other Ramsar sites (Ghodaghodi Tal Ramsar Site and Jagdishpur Reservoir Ramsar Site) are protected under the Forest Act 1993 (as amended 1999) and Forest Regulations 1995. Similarly, two World Heritage sites, Chitwan National Park and Sagarmatha National Park, are managed under the National Parks and Wildlife Conservation Act. The other two heritage sites, Lumbini and Pashupati, are managed under special Acts: the Lumbini Area Development Trust Act 1985, and the Pashupati Area Development Act 1987. The remaining heritage sites, Swayambhu and Changunarayan, are managed under the Forest Act 1993 (amended 1999) and Forest Regulations 1995.

Flora

The flowering plant checklists based on records available in 2006 specify 2,532 species of vascular plants represented by 1,034 genera and 199 families in the protected sites (**Annex 1.9**). Of 399 endemic species, 130 species are found in protected sites (**Annex 1.5.1**). Variations in records are primarily due to variances in intensity of floral explorations in given sites.

Biodiversity Profiles Nepal was based upon estimation of the potential number of floral species

Table 21. Number of Protected Sites

Names	Protected sites	Number
National parks	Khaptad National Park, Bardia National Park, Rara National Park, Sshey-Phoksundo National Park, Chitwan National Park, Sshivapuri National Park, Langtang National Park, Sagarmatha National Park, Makalu-Barun National Park	9
Wildlife reserves	Shuklaphanta Wildlife Reserve, Palsa Wildlife Reserve, Koshitappu Wildlife Reserve	3
Conservation areas	Annapurna Conservation Area, Manaslu Conservation Area, Kangchenjunga Conservation Area	3
Hunting reserve	Dhorpatan Hunting Reserve	1
Ramsar sites	Ghodaghodi Tal Ramsar Site, TRS, Jagdishpur Reservoir Ramsar Site, Bishazari Tal Ramsar Site (Koshitappu Wildlife Reserve is listed in Protected Areas)	3
World Heritage sites	Lumbini World Heritage Site, Kathmandu Valley: Swayambhu World Heritage Site, Pashupatinath World Heritage Site, Changunarayan World Heritage Site (Chitwan National Park and Sagarmatha National Park are listed in Protected Areas)	4

Source: TISC/NARMSAP/MFSC 2002

Table 22. Protected Sites in the Altitudinal and the Phytogeographical Regions		
Highlands - West <i>Protected Area</i> Shey-Phoksundo National Park	Highlands - Center <i>Protected Areas</i> Annapurna Conservation Area Manaslu Conservation Area Langtang National Park	Highlands - East <i>Protected Areas</i> Sagarmatha National Park Makalu Barun National Park Kangchenjunga Conservation Area World Heritage site Sagarmatha National Park (also listed in Protected Areas)
Mid Hills - West <i>Protected Areas</i> Khaptad National Park Rara National Park Dhorpatan Hunting Reserve	Mid Hills - Center <i>Protected Area</i> Shivapuri National Park <i>World Heritage sites</i> Swayambhu World Heritage site Pashupati World Heritage site Changu Narayan World Heritage site	Mid Hills - East
Terai and Siwalik - West <i>Protected Areas</i> Bardia National Park Shuklaphanta Wildlife Reserve <i>Ramsar sites</i> Ghodaghodi Tal Ramsar Site Jagdishpur Reservoir Ramsar Site	Terai and Siwalik - Center <i>Protected Areas</i> Chitwan National Park Parsa Wildlife Reserve <i>Ramsar site</i> Bishazari Tal Ramsar Site World Heritage site Lumbini World Heritage Site Chitwan National Park (also listed in Protected Areas)	Terai and Siwalik - East <i>Protected Area</i> Koshitappu Wildlife Reserve <i>Ramsar Site</i> Koshitappu Wildlife Reserve (also listed in Protected Areas)

Source: TISC/NARMSAP/MFSC 2002

Table 23. Floral Data of Protected Sites				
SN	Protected Sites	BPN Estimate of Flowering Plants	Flowering Plants	Pteriodophytes
1	Khaptad National Park	567	289	6
2	Bardia National Park	839	167	6
3	Rara National Park	1,070	88	0
4	Shey-Phoksundo National Park	1,579	174	0
5	Chitwan National Park	919	227	7
6	Langtang National Park	3,689	976	67
7	Shivapuri National Park	2,122	449	0
8	Sagarmatha National Park	1,074	160	0
9	Makalu-Barun National Park	3,073	280	4
10	Shuklaphanta Wildlife Reserve	202	535	18
11	Parsa Wildlife Reserve	919	293	5
12	Koshitappu Wildlife Reserve	237	154	4
13	Dhorpatan Hunting Reserve	1,150	58	0
14	Annapurna Conservation Area	3,430	451	5
15	Manaslu Conservation Area	NA	587	0
16	Kangchenjunga Conservation Area	NA	77	0
17	Ghodaghodi Tal Ramsar Site	NA	383	5
18	Jagdishpur reservoir Ramsar Site	NA	15	1
19	Beeshazar Tal Ramsar Site	NA	36	1
20	Lumbini World Heritage Site	NA	72	0
21	Swayambhu World Heritage Site	NA	109	0
22	Pashupati World Heritage Site	NA	74	0
23	Changunarayan World Heritage Site	NA	21	0

Sources: BPP 1995f, 1995g and 1995h., and Annexes 1.9.1-1.9.23
 SN = Site Number

using the coordinates of latitudes and longitudes and altitudinal variations for each protected area. **The Nepal Biodiversity Resource Book** presents currently reported data, which tends to be much

less than projections (**Table 23**). For example, 3,689 species of flowering plants were expected in Langtang National Park; the reported number is much less: 976. In the Dhorpatan Hunting Reserve

the figures are 1,150, and 58, respectively. However, in Shuklaphanta Wildlife Reserve, the reported number is 535, twice the 202 species previously estimated.

Among protected areas, Langtang National Park recorded 1,043 species of flora in the area; this is the highest number of species in any given area. Dhorpatan Hunting Reserve recorded 58: the lowest. Similarly, there are 388 species in Ghodaghodi Tal Ramsar Site compared to 16 in Jagdishpur Reservoir Ramsar Site, 109 in Swayambhu, and 21 in Changunarayan (Annexes 1.9.1 to 1.9.23 and Figure 3). The variations in count are primarily due to varied intensity of floral explorations in the given sites.

Fauna

Of the total 181 mammal species, 28 are found only outside the protected sites (Table 24). This count does not include the four extinct species.

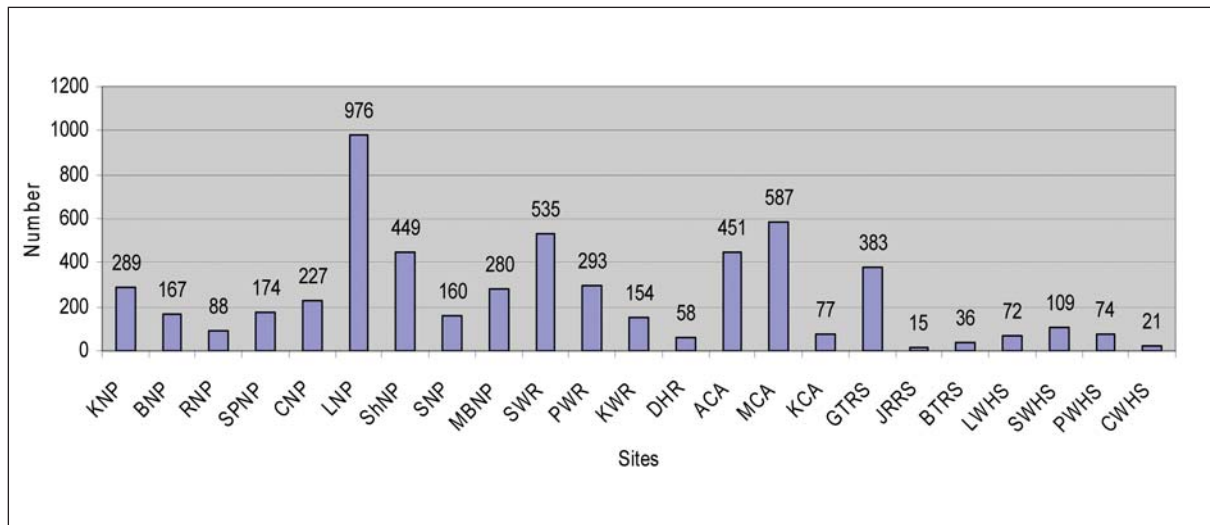
Of the species found outside protected areas, 15 are species of bats; 10 are species of shrew, rats and Pikas; and three species of the Large-toothed ferret badger (*Melogale personata*); the Malayan porcupine (*Hystrix brachyura*); and the Tibetan antelope (*Pantholops hodgsoni*).

Species	Total Number	Number	%
Mammals*	181	28	15
Birds*	867	44	5
Herpeto	195	65	33
Fish	187	25	13
* Excluding extinct species four mammals and seven birds			
Sources: Annexes 2.5 to 2.8			

Of the 867 species of birds found in the country, only 37 species (5%) are found outside protected sites (Table 24). This count does not include the seven extinct species. Of them, 14 species are migrants, four species are summer/winter visitors, and 19 species are residents.

One-third of the total 65 herpeto species are, however, found outside protected sites. Only 25 species of fish are found outside protected sites (Table 24). There are 56 species of herpeto fauna in the Annapurna Conservation Area and Chitwan National Park. There are no herpeto species at all in the Manaslu and Kanchengjunga conservation areas. Similarly, there are 124 species of fish in Bardia and Chitwan national parks, 105 in Koshitappu Wildlife Reserve, and none at all in the five other protected areas.

Figure 3. Number of Flowering Plants by Protected Site



KNP=Kangchenjunga National Park; BNP=Bardia National Park; RNP=Rara National Park; SPNP=Shey-Phoksundo National Park; CNP=Chitwan National Park; LNP=Langtang National Park; ShNP=Shivapuri National Park; MBNP=Makalu-Barun National Park; SWR=Shuklaphanta Wildlife Reserve; PWR=Parsa Wildlife Reserve; KWR=Koshitappu Wildlife Reserve; DHR=Dhorpatan Hunting Reserve; ACA=Annapurna Conservation Area; MCA=Manaslu Conservation Area; KCA=Kangchenjunga Conservation Area; GTRS=Ghodaghodi Tal Ramsar Site; JRRS=Jagdishpur Reservoir Ramsar Site; BTRS= Bishazari Tal Ramsar Site; LWHS=Lumbini World Heritage Site; SWHS=Swayambhu World Heritage Site; PWHS=Pashupati World Heritage Site; CWHHS=Changunarayan World Heritage Site

Ex-Situ conservation and specimens preservation

Apart from conservation of species in the wild, efforts have been made towards ex-situ conservation and specimen preservation.

Botanical gardens and herbarium

Botanical gardens are established and managed under the Department of Plant Resources in various ecological locations of the country. The botanical gardens conduct landscape development, ex-situ and in-situ conservation, as well as conservation with educational programmes and pilot productions.

The Central Botanical Garden (82 ha) is located at Godavari (1515m) in the south-east corner of Kathmandu Valley, at the base of the Phulchoki Hill (2715m). It is surrounded by evergreen natural forests of mainly *Schima wallichii* and *Castanopsis indica*. *Alnus nepalensis* are concentrated along the watercourses. Some common trees and shrubs of this garden are the Lapsi tree (*Choerospondias axillaris*), Box myrtle (*Myrica esculenta*), an evergreen shrub, *Mohonia*, (*Mahonia napaulensis*), Nepalese firethorn (*Pyracantha crenulata*), *Brambling raspberry* (*Rubus ellipticus*), *Zizyphus lotus*, *Stranvaesia nussia*, *Prunus cerasoides* (cherry family), and *Pyrus pashia*. The temperature ranges between 20°C and 30°C during summer, and -5°C to 20°C during winter.

Since their establishment in October 1962, much of the activities in the botanical gardens have centred around enriching the gardens with indigenous plants so as to integrate the collection with scientific investigation, conservation, education, and demonstration.

Eighty-nine species of trees, 26 species of shrubs, 50 species of herbs, and 12 species of climbers are conserved in the central garden. Special features of the garden include the Japanese cherry garden, flowering peaches, plantations made by very important persons (VIPs), usually prominent visitors to the gardens, and representation of the Fagaceae and Magnoliaceae gardens. A number of exotic species such as 31 trees and shrubs including *Sequoia sempervirens*, *Metasequoia glyptostroboides*, *Platanus orientalis*, *Liriodendron tulipifera*, *Ginkgo biloba*, and *Acer truncatum* have also been recorded.

A number of medicinal plants are cultivated in the botanical gardens. They include *Ephedra gerardiana*, *Mentha spicata*, *Aceorus calamus*, *Podophyllum hexandrum*, *Asperagus racemosus*, *Houttuynia cordata*, and *Costus speciosus* as ex-situ germplasm conservation. Some exotic medicinal plants such as *Coptis suaveolens*, *Solanum surattense*, *Mentha piperata*, *Aloe vera*, and *Nepeta* sp. are also conserved here.

Major landmarks of the garden include the orchid, cactus, and tropical species greenhouses; and fern, lily, bulb, and rose gardens. The Nepali terrace and the Japanese style rock and water gardens are also focal pieces. The orchid house alone contains about 90 orchid species including the *Dendrobium densiflorum*, *Ceologyne cristata*, *Calanthe masuca*, and *Pleione hookeriana*.

Other botanical gardens in the country by location, altitude, and year of establishment are:

1. Maipokhari Botanical Garden, Ilam, 2200m (1992)
2. Dhanusha Botanical Garden, Dhanushadham, Dhanusha, 100m (1998)
3. Vrindaban Botanical Garden, Hetauda, Makawanpur, 500m (1962)
4. Daman Botanical Garden, Daman Makawanpur, 2140m (1962)
5. Tistung Botanical Garden, Tistung, Makawanpur, 1700m (1962)
6. Dhakeri Botanical Garden, Banke, 130m (1962)
7. Mulpani Botanical Garden, Kapurkot, Salyan, 2000m (1990)
8. Dhitachor Botanical Garden, Jumla, 2500m (1990)
9. Godavari Botanical Garden, Godavari, Kailali (1998)
10. Deoria Botanical Garden, Dhangadhi, Kailali, 100m (1998)

The National Herbarium (KATH⁶), a part of the National Herbarium and Plant Laboratories under the Department of Plant Resources at Godavari, houses over 161,800 specimens of plants, and is the largest herbarium in Nepal. It was established in 1960 with the objective of exploring and providing knowledge by conducting research on plant resources of Nepal. It has 12 departments in the specific fields of Phanerogams, Cryptogams, Economic Botany, Cytology, Anatomy, Tissue Culture, Plant Breeding, Plant Genetic Resources, Floriculture, Plant Protection, Ecology and Environment, and Medicinal Herbs.

⁶Herbarium Code for the National Herbarium as per the Index Herbariorum

The Department of Plant Resources, together with the herbarium and botanical gardens, is the scientific authority on flora for the implementation of CITES in Nepal.

The Central Department of Botany of Tribhuvan University was established in 1965, and manages a herbarium (TUCH⁷) that houses 20,000 specimens.

Central Zoo – National Trust for Nature Conservation

The Central Zoo (6.5 ha) houses 119 species of 970 animals including 206 mammals of 33 species, 321 birds of 60 species, 424 fish of 17 species, and 19 reptiles of nine species (**Annex 2.10**).

Of the mammals, five exotic species are the Buinea pig (*Cavia aperea*), hippopotamus (*Hippopotamus amphibius*), Lion-tailed macaque (*Macaca silenus*), Siamang (*Symphalangus syndactylus*), and White mice (*Mus musculus*). Similarly, there are three exotic reptile species: the Chinese alligator (*Alligator sinensis*), Giant land tortoise (*Testudo gigantea*), and Red-eared slider turtle (*Trachemys scripta elegans*). All the fish species in the zoo are exotic whereas only 15 of the 60 species of birds are exotic.

Some species are better represented in the zoo: the Blackbuck has a population of 43 animals, the highest number of animals within the mammal species. The Spotted deer and guinea pigs have 25 animals each. There are also 22 rabbits and 14 white mice and Barking deer each. The 74 Greylag geese constitute the highest bird population within the species followed by 42 budgerigars, 21 Scaly-breasted munias, 15 Golden pheasants, and 10 Rose-ringed parakeets.

Successful results of captive breeding of species such as tigers, leopards, and other animals has distinguished the zoo as a source of gene pool for some ungulate species such as the Blackbuck, Barking deer, and Spotted deer. Several translocations of these animals have been carried out to initiate establishment of new populations in Bardia National Park and Pashupati areas.

Hetauda municipality maintains a mini zoo (0.3ha) integrated with a public park and a picnic spot. The zoo was established in 1991 and includes animals such as the Spotted deer, Barking deer, hares, birds, and tortoises.

Captive breeding and translocation

Captive breeding of crocodiles has been carried out successfully in the Gharial Farm in Chitwan. Although the population of gharial crocodiles was close to extinction, the breeding effort has revived its population. The Gharial Breeding Centre was established in 1978 at Kasara in Chitwan. By 2005, 661 captive bred gharials have been released into the various rivers of Nepal. Crocodile breeding has also been initiated in Bardia National Park (**Table 25**).

The Elongated tortoise (*Indotestudo elongata*) has also been successfully hatched at the Gharial Breeding Centre from seed animals brought from the Hetauda Mini Zoo. At present there are six adult male, ten adult female, and three adolescent tortoises at the Centre. Altogether there are 60 tortoises of eight species in the breeding centre (DNPWC 2005).

The Elephant Breeding Centre at Khorsor, Chitwan, and the elephant stables in Shuklaphanta, Bardia, Chitwan, Parsa, and Koshitappu are noteworthy for elephant breeding. There are 171 domesticated elephants in Nepal. Seventy-seven are under government ownership, and are spread out over the five lowland protected areas (Shuklaphanta Wildlife Reserve, Bardia National Park, Chitwan National Park, Parsa Wildlife Reserve and Koshitappu Wildlife Reserve); as well as the breeding centre at Khorsor, Chitwan. The National Trust for Nature Conservation has maintained nine domesticated elephants (three in Bardia National Park, five in Chitwan National Park and one in the Central Zoo). Ten hotels inside and outside Chitwan National Park (CNP) and outside Bardia National Park (BNP) also maintain 85 domesticated elephants for tourism

Table 25. Gharial Crocodile Release to their Natural Environment

Year	Narayani	Kali	Rapti/ Tamor Tal	Kosi	Karnali	Babai	Total
1981-1989	183	35	5	85			308
1990-1999	139		12		23		224
2000-2005	63	10	56	-	-	-	129
Total	385	45	73	85	23	50	661

Source: DNPWC annual Report 2004-2005

⁷ Herbarium Code for the Tribhuvan University herbarium as per the Index Herbariorum

Table 26. Domesticated Elephants in Government Camps				
Names of Camps	Government	NTNC	Private Camps	Total
Shuklaphanta Wildlife Reserve	7	-	-	7
Bardia National Park	10	3	5	18
Chitwan National Park	42	5	80	127
Parsa Wildlife Reserve	8	-	-	8
Koshitappu Wildlife Reserve	10	-	-	10
Central zoo	-	1	-	1
Total	77	9	85	171

Sources: Kharel, FR 2006, and Suwal, RN 2003

and research (Table 26) (Kharel, FR 2006, and Suwal, RN 2003).

Following government formulation of the 'Working Policy on Wildlife Farming, Breeding and Research' in August 2003, eight parties have

taken initiatives towards farming the Spotted deer, monkeys, birds, and snakes as of 2005 (DNPWC 2005).

Research related to wildlife has been continued since the enactment of the working policy, with added focus on mechanisms to facilitate both in-situ, and ex-situ measures. Translocation of rhinoceros has been successfully carried out with the objectives of establishing a viable rhino population in the BNP, a breeding population in Shuklaphanta Wildlife Reserve, and to safeguard this endangered species from poaching and natural calamities such as floods, fire, and epidemics. Founder



MENRIS

A shrine around Sagarmatha National Park

populations of 13 rhinos were reintroduced to BNP from CNP in 1986. Most of the translocated females conceived shortly after they were released, indicating their acceptance of the new habitat. In 1991, 25 rhinos were translocated to the Babai Valley in the northeastern part of BNP. The rhino population in BNP had increased to 45 by 1995, but the population density of rhinos in the park remains low (0.3 animals/km²) compared to that of RCNP (8-10 animals/km²). The trans-location of rhinos to BNP is expected to bolster the creation of a viable rhino population (Jnawali 1995).

Since 1986, a total of 87 rhinos have been translocated to BNP from CNP, and four have been translocated to Shuklaphanta Wildlife Reserve. During the translocation in April 2003, 10 rhinos, seven of which were radio collared, were released across Babai Valley in the eastern Chisapani sector of BNP (Table 27).

Translocation of 25 blackbucks was also carried out in 1992. The animals were collected from the Central Zoo and released into semi-wild conditions in Bardia National Park (Bhandari et al. 1992). Similarly, 32 ungulates were translocated from the zoo into the Pashupati area.

Natural History Museum - Tribhuvan University

The main objective of the Museum is to nurture Nepal's natural history and serve as a research and educational facility in Nepal for scientists, teachers, students, and other scholars. The Museum maintains a well managed scientific record of Nepalese flora and fauna. A large number of floral and faunal specimens are exhibited at the Museum's exhibition hall.

Table 27. Rhino Translocations				
Year	Male	Female	Total	Translocations
1986	8	5	13	Chitwan to Bardia
1991	8	17	25	Chitwan to Bardia
1999	2	0	2	Chitwan to Bardia
1999	2	0	2	Sarlahi to Bardia
2000	8	8	16	Chitwan to Bardia
2000	1	3	4	Chitwan to Shuklaphanta
2001	2	3	5	Chitwan to Bardia
2002	5	5	10	Chitwan to Bardia
2003	3	7	10	Chitwan to Bardia
Total	39	48	87	

Source: DNPWC Annual Report 2002-2003

The Museum manages the Swayambhu Environment Garden (1 ha) representing the medicinal plants of Nepal. The garden consists of three primary components: the public park, an experimental park, and a nursery. The Museum serves as the scientific authority of fauna for CITES implementation in Nepal.

Wildlife museums in the protected areas

The protected areas maintain local museums for research as well as for educational purposes. They mainly house wildlife parts collected from within specific protected areas. They also put on display materials confiscated from poachers and smugglers. Among these, the collections at the museums of Khaptad, Bardia, Chitwan, Sagarmatha, Makalu-Barun, Koshitappu national parks, and Annapurna Conservation Area are significant. Similar items are housed in the forest guard training center storerooms at Tikauli under the Department of Forests.



Some rare birds, Koshitappu Wildlife Reserve
(Govind Joshi)

Protected Areas of Nepal

Nepal crossed the threshold into the modern history of biodiversity conservation with the enactment of the National Parks and Wildlife Conservation Act 1973. Clause 3 of this Act empowers the Government of Nepal to establish protected areas such as strict nature reserves, national parks, wildlife reserves, hunting reserves, conservation areas, and buffer zones within four boundaries in any part of the country through gazette notification. The Act also allows the government to withdraw from the protected areas and to hand over ownership or modify the boundaries through similar notifications. At present, the protected areas in Nepal include nine national parks, three wildlife reserves, one heritage reserve, three conservation areas, and 11 buffer zones covering a total area of 28,959.67 km². Altogether these areas constitute 19.67% of the country's land area. Following are the profiles of these protected areas.

Khaptad National Park Background

Area

Khaptad National Park (225 km²) and buffer zone (216 km²)

Site code: 7953

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
	°	'	°	'		
NP	29°	29'	80°	81'	1,400	3,300
	16'	27'	59'	13'		
	12''	36''	24''	48''		
BZ	-	-	-	-	900	2,700

NP= national park; BZ= buffer zone

History

Established in 1984 on the advice of the region's remarkable holy man, Khaptad Baba; declared a buffer zone in 2006

Relevant legislation

National Parks and Wildlife Conservation Act 1973

National Parks and Wildlife Conservation Regulations 1974

Khaptad National Park Regulations 1988
Buffer Zone Regulations 1996

IUCN management category

National Park II, and buffer zone VI

Significance

The physiographic aspects of the protected area are as follows.

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Lower Sub-Alpine	3001 to 3500	High Mountains
Upper Temperate	2501 to 3000	Mid-hills
Lower Temperate	2001 to 2500	
Upper Sub-Tropical	1501 to 2000	
Lower Sub-Tropical	1001 to 1500	

Sources: Dobremez 1972, LRMP 1986

The forest ecosystems and vegetation types are as follows (**Annex 1.1**).

Biological aspects cover species and habitat including ecosystem description, conservation and management.

- The landscape consists of 22 'Patans' (moorland), steep slopes, and streams
- In the north-eastern part of the park is a lake called Khaptad Daha
- Five hundred and sixty-seven species of flora have been recorded from the Park (BPP 1995)
- Two hundred and ninety-five vascular plants, six pteridophytes, eight gymnosperms, 238 dicots, and 43 monocots have also been recorded (**Annex 1.9.1**), and four flowering

Ecosystem Type	NBRB 2006
<p>Eight types of ecosystems</p> <p>3201 Lower sub-alpine mesophytic Fir forest 4001 Mesophytic montane oak-rhododendron 4003 Mixed hygrophytic oak-hemlock-fir 5002 Collinean pak forest 5004 Mixed oaks-laurel forest 6101 Mixed Chir Pine-oak forest 6201 Chir Pine forest with grasses and <i>Engelhardtia</i> 6203 <i>Alnus nepalensis</i> riverine* forest</p>	<p>Six types of vegetation</p> <p>3221 Fir - Oak-Rhododendron 4122 West Himalayan Fir-Hemlock-Oak forest 4134 Mountain Oak-Rhododendron forest 4231 Lower Temperate Oak forest 5011 Chir Pine forest 5021 Chir Pine Rhododendron Forest</p>
<p>*listed as riverain forest in the original BPP document Sources: BPP 1995, TISC MAPs for NBRB</p>	

endemic plant species (Shrestha and Joshi 1996)

- Twenty-one species of mammals and 266 species of birds have been recorded from the Park (CEDA 2003); current checklists include 23 mammals, 287 birds, and 23 herpeto species (**Annex 2.11**)
- Eleven species of mammals found in the park are protected by CITES
- Two species of mammals and two bird species are protected under Appendix I of the National Parks and Wildlife Conservation Act 1973
- The mammal species symbolic of the park are the common leopard (*Panthera pardus*), Himalayan black bear (*Selenarctos thibetanus*), wild dog (*Cuon alpinus*), and musk deer (*Moschus chrysogaster*)
- Bird species symbolic of the park include the Impeyan pheasant, Peregrine falcon, and White rumped vulture
- The renowned Khaptad Baba Ashram, a religious site where Hindu pilgrims come to worship Shiva on the full moon of July-August each year, is located near the Park



U R Bhujju

A musk deer (*Moschus chrysogaster*) found at Khaptad National Park

headquarters; many pilgrims also visit the Park during the Ganga Dashahara festival on Jestha Purnima (the full moon of mid-June or July)

- Sahashra Linga is another religious site situated at the highest point (3200m) of the Park
- The Tribeni confluence of three rivers and a Shiva temple are near the Park
- Other religious places in the Park include a Ganesh temple, 'Nagdhunga' (cobra-like stone), and Kedardhunga; these areas are revered for meditation and tranquility, and prohibit intrusions on nature, and sale or use of tobacco products, alcohol, and animal sacrifice
- Checklists of the fauna are presented in **Annex 2.11**

Achievements

The major achievements of Khaptad National Park (KNP) are:

- A separate KNP regulation formulated in 1987
- Declaration of a KNP buffer zone in 2006, and activation of a buffer zone management committee, user committee, and user group
- Consolidation of the Park People Programme (PPP) through immediate initiation of the Participatory Conservation Programme following the PPP Project phase-out (DNPWC/PCP, 2002)
- Commitment to park ethics: five people involved in illegal activities have been arrested in 2000-2001 (DNPWC, 2003a)
- Preparation of a park management strategy framework and management plan
- Inclusion in Nepal Tourism Board's national tourism destination list

Bardia National Park

Background

Area

Bardia National Park (968 km²) and buffer zone (328 km²)

Site codes: 1308 (Park) 303303 (buffer zone) (DNPWC 2001)

Location

Co ordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
NP	28° 16' 12"	28° 40' 12"	81° 13' 12"	81° 42' 36"	152	1441
BZ	-	-	-	-	-	-

NP= national park; BZ= buffer zone

The districts of Bardia and Banke encompassing 17 VDCs in the buffer zone (DNPWC, 2001), and a proposed buffer zone extension in Surkhet (**Annex 3**)

History

Established in 1976 as a wildlife reserve, later extended and declared a national park in 1988 (DNPWC 2001)

Relevant legislation

National Parks and Wildlife Conservation Act 1973

National Parks and Wildlife Conservation Regulations 1974

National Trust for Nature Conservation Act 1982

Buffer Zone Regulations 1996

Royal Bardia National Park Regulations 1997

Elephant Management Regulations 1966

IUCN management category

National Park II and Buffer Zone VI

Significance

The physiographic aspects of the protected area are as follows.

Bioclimatic Zone	Altitude (metre)	Physio-graphic Zone
Upper Tropical	501 to 1000 (~1441)	Siwaliks
Lower Tropical	Below 500	Terai

Sources: Dobremez 1972, LRMP 1986

The area's forest ecosystems and vegetation types are as follows (**Annex 1.1**).

Biological aspects cover species and habitat including ecosystem description, conservation and management.

- Landscape consists of the Karnali floodplain, the Babai River Valley, and Siwaliks, with the highest peak of Sukarmala (1441m)
- Eight hundred and thirty-nine species of flora are estimated in the Park (BPP 1995)
- One hundred and seventy-three vascular plants recorded in the Park: six pteridophytes, one gymnosperms, 140 dicots, and 26 monocots (**Annex 1.9.2**)
- Fifty three species of mammals, 400 species of birds, 25 species of reptiles/amphibians, and 125 species of fish have been recorded from the Park (DNPWC, 2001)
- Current checklists include species of 59 mammals, 407 birds, 52 herpeto, and 124 fish (**Annex 2.12**)
- Twenty-two species of mammals found in BNP are protected by CITES
- Thirteen species of mammals, five species of birds, and three species of reptiles are endangered and protected under Appendix I of NPWC Act 1973
- Mammal species symbolic of BNP are the Royal Bengal tiger (*Panthera tigris*), Asian elephant (*Elephas maximus*), and Black buck (*Antelope cervicapra*)
- Bird species symbolic of BNP include the Bengal florican (*Houbaropsis bengalensis*), white sumped vulture (*Gyps africans*), peacock (*Pavo cristatus*, *Pavo muticus*), and the bar-headed geese (*Anser indicus*)



A cub leopard (*Panthera pardus*) found in Bardia National Park

Ecosystem Type	NBRB 2006
<p>Seven types of ecosystems</p> <p>6104 Upper Siwaliks Chir Pine-Oak forest</p> <p>6205 Siwaliks Chir Pine-Oak forest</p> <p>7101 Tropical hill Sal forest in inner valleys</p> <p>7201 Terai tropical Sal forest</p> <p>7202 Khair-Sissoo scrub and riverine forest</p> <p>7205 Bhabar light Sal forest</p> <p>9002 Terai cultivated land</p>	<p>Three types of vegetation</p> <p>5011 Chir Pine forest</p> <p>6131 Hill Sal forest</p> <p>6231 Lower Tropical Sal and Mixed broad-leaved forest</p>
Sources: BPP 1995, TISC maps 2002	

Achievements

The major achievements of Bardia National Park include the following.

- A buffer zone area of 327 km² was declared in 1996 (DNPWC 2001f)
- Extension of the park by an additional area of 893 km² has been proposed in line with 'Gift to the Earth' project
- Habitat management activities such as uprooting of inedible vegetation, seasonal cutting and burning of tall grasses, and construction of and traffic control mechanism at water holes have been adopted
- The Park has the second largest recorded population of rhinos in Nepal (DNPWC 2001)
- Anti-poaching activities have been conducted successfully
- Remarkable increase in the Black buck population at Khairapur to 177 during the early 1990s; currently, there are over 100 animals
- Fifty-eight rhinos were released in two separate sites (the Karnali floodplains and Babai Valley); the rhino population in the Park has multiplied to 73 and has established permanent residency (DNPWC 2001)
- Implementation of separate action plans for the rhino, tiger, and domestic elephant
- Enactment of a separate regulation for Bardia National Park
- Preparation of a park management strategy framework and tourism plan and buffer zone management plan (DNPWC 2001)
- Successful coordination with various donors such as WWF, CARE, NORAD, and UNDP for the implementation of several park and conservation projects
- Park researches since 1999 included studies on the nilgai (*Boselaphus tragocamelus*), gharial (*Gavialis gangeticus*), dolphin disambiguation, black buck ecology, fisheries, ethnobotany, forest resources sustainability, agroforestry, corridor mapping, corridor socioeconomy, and Parks and People Project impact (DNPWC/PCP 2002)
- 2,137 households over an area of 1,581.6 ha have benefited from seven agroforestry plots in the Park over a period of three years from May 2000 to April 2003
- Establishment of a park community health center at Thakurdwara



P.R. Shakya

Yarcha gumbu (*Cordyceps sinensis*), a plant-animal combination unique to the Himalayan region and reputed to possess remarkable medicinal qualities (Photo taken from Dolpa, 428m)

- 14% per annum increase in the number of tourists visiting the Park
- Commitment to wildlife and park ethics: action has been taken against 23 poachers and illegal dealers between 2002 and 2003 (DNPWC 2002a)
- Establishment of endowment funds including the 'Rahat Kosh' (Relief Fund), 'Apatkalin Kosh' (Emergency Fund), and 'Chetipurti Kosh' (Compensation Fund) to compensate for injuries and loss of life, livestock depredation, and damage to property by wild animals (DNPWC 2001f)
- Proposal to extend the Park area in order to meet the 'Gift to the Earth' criteria
- Recognition of the Park as a major player in the Tiger Conservation Landscape given by the Global Tiger Forum

Rara National Park

Background

Area

Rara National Park (106 km²) and buffer zone (198 km²)

Site code: 806 (HMGN/MFSC, 2002)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
NP	29° 25' 48''	29° 33' 00''	81° 00' 00''	82° 09' 00''	1800	4039
BZ	-	-	-	-	-	-

NP= national park; BZ= buffer zone

Districts of Mugu and Jumla encompassing nine VDCs (DNPWC 2001) (**Annex 3**)

History

Established in 1976; the smallest national park in Nepal (DNPWC 2001); Declaration of a buffer zone in the Park in 2006

Relevant legislation

National Parks and Wildlife Conservation Act 1973

National Parks and Wildlife Conservation Regulations 1974

Himalayan National Parks Regulations 1980
Buffer Zone Regulations 1996

IUCN management category

National Park II, and Buffer zone VI

Significance

The physiographic aspects of the protected area are as follows.

Bioclimatic Zone	Altitude (metre)	Physio-graphic Zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-alpine	3501 to 4000	
Lower Sub-alpine	3001 to 3500	
Upper Temperate	2501 to 3000	Mid-hills
Lower Temperate	2001 to 2500	
Upper Sub-tropical	1501 to 2000	

Sources: Dobremez 1972, LRMP 1986

The forest ecosystems and vegetation types are as follows (**Annex 1.1**).

Biological aspects cover species and habitat, including ecosystem description, conservation and management:

- Rara Lake (2990m), Nepal's biggest lake (167m deep, 10.8km² long) is the main feature of the Park; the lake is oval-shaped with an east-west axis; maximum length 5 km, and width 3 km; drains into the Mugu-Karnali River via Nijar Khola
- Chuchemara peak (4039m), the highest point in the park, is located on the southern side of the lake and provides an excellent backdrop to Lake Rara
- Two other major peaks, Ruma Kand (3731m), and Malika Kand (3444m), are located on the northern side of the lake and provide added view
- Mammal species symbolic of the Park are the Snow leopard (*Uncia uncia*); musk deer (*Moschus chrysogaster*) and Red panda (*Ailurus fulgens*)
- Rhododendron, fir, oak, and birch species are found in the sub-alpine region
- One thousand and seventy species of flora are estimated from the Park (BPP 1995), 16 are endemic flowering plants (HMGN/MFSC 2002), 88 vascular plants: 10 gymnosperms, 64 dicots, and 14 monocots (**Annex 1.9.3**)
- Fifty-one species of mammals, 214 species of birds, two species of reptiles/amphibians, and three species of fish have been recorded from the Park (BPP 1995)
- Current checklists include species of 51 mammals, 241 birds, two herpeto (reptile amphibians), and three fish species (**Annex 2.13**)
- Twenty-six species of mammals found in the Park are protected by CITES (**Annex 2.13**)

Ecosystem Type	NBRB 2006
11 types of ecosystems 2104 Mesophytic & hydrophytic mat patches and vegetation on rocks* 3102 Upper sub-alpine Rhododendron-Birch forest 3203 Lower sub-alpine Fir (<i>Abies spectabilis</i>) forest 4002 Mixed Blue Pine-Oak 4004 Open and dry montane Blue Pine 4005 Blue Pine-Spruce forest 4006 Juniper forest 4009 Mountain Oak (<i>Q. semecarpifolia</i>) 5010 Deciduous broadleaved forest (<i>Alnus, Juglans</i>) 6203 <i>Alnus nepalensis</i> riverain forest 9900 Water bodies	10 types of vegetation 2231 Moist Alpine Scrub 3131 Birch-Rhododendron forest 3211 Fir forest 3231 Sub-alpine Mountain Oak forest 4111 Upper Temperate Blue Pine forest 4114 Spruce forest 4213 Cypress forest 4231 Lower Temperate Oak forest 4234 Deciduous Walnut-Maple-Alder forest 5021 Chir Pine – Broadleaved Forest
*veg. rocks in the original BPP document Sources: BPP 1995, TISC maps 2001	

- Eight species of mammals and two species of birds are protected under Appendix I of NPWC Act 1973
- Mammal species symbolic of RNP are the snow leopard (*Uncia uncia*), musk deer (*Moschus chrysogaster*), red panda (*Ailurus fulgens*), and Himalayan black bear (*Ursus selenarctos thibetanus*)
- Bird species symbolic of RNP are the Impeyan pheasant (*Lophophorus impejanus*), Cheer pheasant, Koklas pheasant, White crested kalij pheasant (*Lophura leucomelanos*) and Chukor partridge (*Alectoris chukar*)
- Of the six endemic fish species found in Nepal, three species of 'Asala' (snow trout) are recorded only in Rara National Park; they are *Schizothorax macrophthalmus*, *Schizothorax nepalensis* and *Schizothorax raraensis*

Achievements

The major achievements of RNP are:

- Declaration of 158 km² buffer zone in 2006
- Consolidation of successful programmes: Parks and People Project has continued activities through the Participatory Conservation Programme in the buffer zone and in the Park
- Operation of the airport at Talcha
- Reduction in crop damage by wild boars through construction of 5 km stonewall
- RNP has been selected as an eco-tourism destination
- Development of a trail along Rara Lake for tourism promotion and patrolling
- Significant increase in the population of symbolic species
- Introduction of boating facilities in the lake
- Preparation of the park management strategy framework

Shey Phoksundo National Park Background

Area

Shey-Phoksundo National Park (3,555 km²) and buffer zone (1,349 km²)
 Site code: 7952 Site code: 313457
 (DNPWC, 2002a)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
NP	28° 58' 12''	29° 46' 12''	82° 29' 24''	83° 08' 24''	2,130	6,883
BZ	-	-	-	-	-	-

NP= national park; BZ= buffer zone

Districts of Mugu and Dolpa encompassing 11 VDCs, with a few VDCs inside the Park area (DNPWC 2003) (**Annex 3**).

History

Established in 1984; the biggest national park representing the Trans-Himalayan ecosystem; declaration of a buffer zone in the Park in 1998 (DNPWC 2003a).

Relevant legislation

National Parks and Wildlife Conservation Act 1973
 National Parks and Wildlife Conservation Regulations 1974
 Mountaineering Expedition Regulations 1979
 Himalayan National Parks Regulations 1980
 Buffer Zone Regulations 1996

IUCN management category

National Park II, and Buffer zone VI

Significance

The physiographic aspects of the protected area are as follows:

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-Alpine	3501 to 4000	
Lower Sub-Alpine	3001 to 3500	
Upper Temperate	2501 to 3000	Mid-Hills
Lower Temperate	2001 to 2500	
Sources: Dobremez 1972, LRMP 1986		

The forest ecosystems and vegetation types are as follows (Annex 1.1):

Ecosystem Type	NBRB 2006
<p>21 types of ecosystems</p> <p>1000 glaciers, snow and rock</p> <p>2102 Xerophytic mat patches vegetation on rocks</p> <p>2201 Rhododendron mesohygrophytic scrublands</p> <p>2204 Xerophytic closed alpine mat and scrub</p> <p>3102 Upper sub-alpine Rododendron-Birch forest</p> <p>3103 Upper sub-alpine Birch Blue-Pine open forest</p> <p>3203 Lower sub-alpine Fir (<i>Abies spectabilis</i>) Forest</p> <p>4004 Open and dry montane Blue Pine</p> <p>4006 Juniper forest</p> <p>4009 Mountain Oak (<i>Q. semecarpifolia</i>)</p> <p>5001 Cypress forest with Dwarf Barberry</p> <p>5006 Cedar forest</p> <p>5009 <i>Aesculus, Juglans</i> riverain forest</p> <p>6201 Chir Pine forest with grass and <i>Engelhardtia</i></p> <p>6207 Grasses-<i>Artemisia</i> steppe</p> <p>8001 High altitude cushion plant formation</p> <p>8003 <i>Caragana gerardiana, Lonicera spinosa</i> steppe</p> <p>8004 <i>Caragana brevispina, Artemisia</i> steppe</p> <p>8005 <i>Caragana pygmaea, Lonicera spinosa</i> xerophile steppe</p> <p>8006 <i>Myricaria-Hippophae-Salix</i> riverain thickets</p> <p>9900 Water bodies</p> <p>Sources: BPP 1995, TISC maps 2001</p>	<p>10 types of vegetation</p> <p>2211 Dry Alpine Scrub</p> <p>2231 Moist Alpine Scrub</p> <p>3001 Trans-Himalayan Steppe</p> <p>3002 Trans Himalayan Lower <i>Caragana</i> Steppe</p> <p>3003 Trans Himalayan High Alpine vegetation</p> <p>3231 Sub-alpine Mountain Oak forest</p> <p>4111 Upper Temperate Blue Pine forest</p> <p>4114 Spruce forest</p> <p>4212 Cedar forest</p> <p>4213 Cypress forest</p>

Biological aspects cover species and habitat, including ecosystem description, conservation, and management:

- The landscape of this largest park in Nepal consists of the Trans-Himalayan landscape, Phoksundo high altitude lake, alpine meadows, forests and rivers
- Elevation in the Park ranges from 2130m in Ankhe to 6883m at the summit of Kanjiroba Himal
- Much of the Park lies to the north of the Himalayan crest, Nepal's deepest and second largest lake, Phoksundo Lake, famous for its magnificent turquoise color and spectacular scenery, lies in the upper regions of Suligad and makes the Park among the most scenic mountain parks in the world; Ringmo village,

a typical Tibetan village, is also scenically nestled in the area

- Many beautiful glaciers can be found near and above the lake area
- The country's highest waterfall is near the lake outlet
- The Park's major rivers include the Khung, Nmajung, and Panjang rivers; the Suligad and Jugdual rivers which are the major tributaries of Thuli Bheri and Langu rivers, drains the high Dolpo Plateau to the east and flows westward
- One thousand five hundred and seventy-nine species of flora are estimated present in the Park (BPP 1995)

- One hundred and seventy-four vascular plants have also been recorded: seven gymnosperms, 150 dicots, and 17 monocots (Annex 1.9.4)
- Thirty-two species of mammals, 200 species of birds, and six species of reptile/amphibians have been recorded from the Park (Regmi 2003)
- Current checklists include species of 35 mammals, 208 birds, and three herpeto reptile amphibians (Annex 2.14)
- Nineteen species of mammals found in the Park are protected by CITES
- Ten species of mammals, and two species of birds are classified as endangered and protected under Appendix I of NPWC Act 1973



U R Bhuju

Phoksundo Lake, Dolpa

- Thirty endemic species of flowering plants have been recorded from the Park (Shrestha and Joshi 1996)
- The Park supports prime habitat for the highest number of Snow leopard (*Uncia uncia*), Tibetan wolf (*Canis lupus*), Musk deer (*Moschus chrysogaster*), and Blue sheep (Regmi, 2003)
- The Park harbours one of the highest number of rare, endangered, endemic, and medicinal plants in Nepal (Regmi 2003)
- Mammal species symbolic of SPNP are the Snow leopard (*Uncia uncia*), Blue sheep (*Pseudois schaeferi*), Musk deer (*Moschus chrysogaster*), wild dog (*Lycaon pictus*), and Tibetan wolf (*Canis lupus*)
- Bird species symbolic of the Park are the Himalayan griffon, White breasted deeper, Monal pheasant, and Cheer pheasant
- The park contains many 'gombas' (monasteries) and religious sites. The famous Shey Gompa was established in the 11th Century. Thashung Gomba located near Phoksundo Lake was built 900 years before to conserve wildlife

Achievements

The major achievements of the Shey Phoksundo National Park (SPNP) include:

- Preparation of the Park tourism plan
- Preparation of a park management plan
- Declaration of a buffer zone in the area
- Development of the Snow Leopard Action Plan
- Formation of Snow Leopard Management Committee, and Rangeland Management Committee
- SPNP was proposed as a World Heritage site for its unique flora, fauna, and traditional culture

- Second Phase of the Northern Mountain Conservation Project is currently under implementation
- Commitment to wildlife and park ethics: six people were arrested by Park authorities between 1999 and 2000 for conducting illegal activities inside the park
- Successful completion of WWF's People Plant Initiative Project
- Renovation of several gombas in the Park
- Mobilisation of 16 eco-clubs in the area
- Formation of 17 Park forest user committees
- Conduct of several researches at both institutional and individual capacity levels (DNPWC Annual Report 1999-2003):
 - Three research initiatives on plants were conducted between 1999 and 2000, one study focused on management of medicinal plants in SPNP
 - Two research initiatives were conducted between 2001 and 2002: one related to the management of Tripurakot buffer zone, the other studied 'Amchi' (traditional faith healers) knowledge of medicinal plants
 - One research initiative conducted between 2002 and 2003 related to Dolpha's flora
- Perceptible increase in development of skills, human resource, and capacity of local communities of the Park (WWF 2003)
- Perceptible positive transformation in local attitudes towards education, basic health care, hygienic living, and conservation (WWF 2003) in the Park.

Chitwan National Park

Background

Area

Chitwan National Park (932 km²)
buffer zone (750km²)

Site codes: 805 (Park) and 303694 (buffer zone) (DNPWC 2002)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
NP	27° 24' 00"	27° 40' 48"	83° 52' 48"	84° 49' 48"	110	850
BZ	27° 16' 56"	27° 42' 14"	83° 50' 23"	84° 46' 26"	-	-

NP= national park; BZ= buffer zone

Districts of Chitwan, Nawalparasi, Parsa, and Makwanpur encompassing 35 VDCs, and two municipalities (Bharatpur and Ratnanagar) (DNPWC 2001) (**Annex 3**)

History

Established in 1973 as the first national park; royal approval granted in 1970/71; extended from 544 to 932 km² in 1977; declared the 284th World Heritage Site in 1984; declaration of a buffer zone in the Park in 1997 (DNPWC 2002).

Relevant legislation

- National Parks and Wildlife Conservation Act 1973
- National Parks and Wildlife Conservation Regulations 1974
- Royal Chitwan National Park Regulations 1974
- NTNC Act 1982
- Buffer Zone Regulations 1996
- Elephant Management Regulations 1966

IUCN management category

National Park II, and Buffer zone VI

Significance

The physiographic aspects of the protected area are as follows:

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Upper Tropical	501 to 1000	Siwaliks
Lower Tropical	Below 500	Terai
Sources: Dobremez 1972, LRMP 1986		

The forest ecosystems and vegetation types are as follows (**Annex 1.1**):

Ecosystem Type	NBRB 2006
Seven types of ecosystems	Two types of vegetation
7101 Tropical hill Sal forest in inner valleys	6131 Hill Sal forest
7103 Sal forest in inner valleys	6231 Lower Tropical Sal and Mixed Broadleafed forest
7121 Tropical riverain forest	
7202 Khair-Sissoo riverain forest	
7206 Pseudo steppe with Graminae	
7220 Terai tropical Sal forest	
9002 Terai cultivated land	
Sources: BPP 1995, TISC maps 2001	

Biological aspects cover species and habitat, including ecosystem description, conservation and management:

- The Park consists of a diversity of ecosystems, including the Churia hills, ox-bow lakes, and the flood plains of the Rapti, Reu, and Narayani rivers

- The Churia hills rise progressively towards the east from 150m to over 800m
- The western portion of the Park consists of the lower but more rugged Someshwor hill;
- The Park shares eastern boundary with Parsa Wildlife Reserve
- The landscape includes the Dun valley, Churia and Someswor range, and the water bodies of Narayani and Rapti rivers, Lamital, Devital, Beeshazar Tal Ramsar site, and other wetlands
- Nine hundred and nineteen species of flora are estimated present in the Park, including endangered species such as the Tree fern (*Cyathea spinosa*), Cycas (*Cycas pectinata*), Screw pine (*Pandanus nepalensis*), and several other orchids (BPP 1995)
- Two hundred and thirty-four vascular plants have been listed from the available records: seven pteridophytes, three gymnosperms, 161 dicots, and 63 monocots (**Annex 1.9.5**)
- Fourty-three species of mammals (CEDA 2003), 450 species of birds, and 100 species of reptile/amphibians have been recorded from the Park (BPP 1995)
- Current checklists include 58 mammals, 539 birds, 56 herpeto, and 124 fish species (**Annex 2.15**)
- Twenty-three species of mammals found in CNP are protected by CITES
- Thirteen species of mammals, six species of birds, and three species of reptiles are considered endangered and protected under Appendix I of NPWC Act 1973
- The mammal species symbolic of CNP are the Greater one-horned rhinoceros (*Rhinoceros unicornis*), Royal Bengal tiger (*Panthera tigris tigris*), and Asiatic elephant (*Elephas maximus*)
 - The species endemic to the park is the Maskey frog (*Tomopterna maskeyi*) (DNPWC 2001a)
 - The bird species symbolic of the park are the Black-necked stork, Lesser-adjutant stork, Grey-headed fishing eagle, and the Brahmini duck

Achievements

The primary biological achievements of CNP are:

- Subsequent to complete evacuation of 11,208 human inhabitants of Old Padampur VDC in 2004, this 17.82 km² area has excellent potential for tourism development and is prime habitat for about 100 rhinos (CNP Management Plan 2000)

- Continual rehabilitation of an estimated 50 ha of grassland, and two wetlands every year since 1996
- Restoration of Devital and Lamital wetlands in CNP
- Considerable extension of the Park area from 544 km² to 932 km² in 1977 (DNPWC 2001)
- Significant 3.38% increase in rhino population from 446 to 466 in 1994, to 544 in 2000; the rhino count was initiated in 1994 by a team of Nepal experts
- Successful translocation of rhinos from 1986 to 2003: 83 rhinos from CNP were translocated to BNP, and four were translocated to Shuklaphanta Wildlife Reserve, as tabulated in the DNPWC's Annual Report 2002-2003
- Symbolic presentation of rhinos as gifts to various countries, including two to Japan in 2001 (DNPWC 2001c)
- Notable increase in tiger population from 46 in 1977, to 110 in 1995 (DNPWC 2001)
- Initiation of radio collaring of tigers, rhinos, sloth bears, and some ungulates in the early period of park management; radio collaring of the tiger was initiated under the tiger research work supported by the Smithsonian Institution; the camera trap and pug marks method of tiger monitoring are also being implemented
- Significant increase in gharial (>500), and sloth bear (about 250) populations (DNPWC 2001c).
- CNP was recognised as a World Heritage Site in 1984 for its high biodiversity and for maintaining ecological process ecosystems of international significance (DNPWC 2001)
- The Park is recognised as a major element in the Tiger Conservation Landscape by the Global Tiger Forum
- Designation of Beeshazari Tal as a Ramsar site within the Park buffer zone (DNPWC 2001c)
- Internationally acclaimed as the Best Managed Park at the 5th World Park Congress held in Durban, South Africa in September 2003

Langtang National Park

Background

Area

Langtang National Park (1,710 km²) and buffer zone (420 km²) (WDPA Site codes 803 (Park) 313458 (buffer zone) (DNPWC, 2001)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
NP	27° 57' 36''	28° 22' 48''	85° 12' 36''	85° 52' 48''	-	7245
BZ	-	-	-	-	845	-

NP= national park; BZ= buffer zone

Districts of Rasuwa, Nuwakot and Sindhupalchowk encompassing 26 VDCs (DNPWC, 2001) (**Annex 3**).

History

Established in 1976; royal approval granted as the first Himalayan national park in 1970/71. Declaration of buffer zone in 1998 (DNPWC 2001, DNPWC 2002).

Relevant legislation

National Parks and Wildlife Conservation Act 1973
 National Parks and Wildlife Conservation Regulations 1974
 Mountaineering Expedition Regulations 1979
 Himalayan National Parks Regulations 1980
 Buffer Zone Regulations 1996

IUCN management category

National Park II, and Buffer zone VI

Significance

The physiographic aspects of CNP and BZ are as follows:

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-Alpine	3501 to 4000	
Lower Sub-Alpine	3001 to 3500	
Upper Temperate	2501 to 3000	Mid-Hills
Lower Temperate	2001 to 2500	
Upper Sub-Tropical	1501 to 2000	
Lower Sub-Tropical	1001 to 1500	
Upper Tropical	501 to 1000	

Source: Dobremez 1972, LRMP 1986

The forest ecosystems and vegetation types are as follows (Annex 1.1)

Ecosystem type	NBRB 2006
18 ecosystems included	14 types of vegetation
1000 Glaciers, snow, rock	2101 Upper Alpine Meadow
2108 Meadows (mat patches)	2211 Dry Alpine Scrub
2110 Meadows (mat patches) and common land	2231 Moist Alpine Scrub
2202 Mesohygrophile rhododendron (<i>R. anthopogen</i> , <i>R. nivale</i>)	3001 Trans-Himalayan Steppe
2203 Mesohygrophytic juniper scrublands	3131 Birch-Rhododendron forest
3102 Upper sub-alpine Rhododendron-Birch forest	3211 Fir forest
3121 Upper sub-alpine Rhododendron scrubland	3212 Larch forest
3203 Lower sub-alpine Fir (<i>Abies spectabilis</i>) Forest	4131 Temperate Mountain Oak forest
3222 Lower sub-alpine <i>Larix griffithiana</i> , <i>L. potanini</i> forest	4221 Mixed Blue Pine-Oak forest
4004 Open and dry montane Blue Pine	4231 Lower Temperate Oak forest
4009 Mountain Oak (<i>Q. semecarpifolia</i>)	4235 East Himalayan Oak-Laurel forest
4021 <i>Rhododendron cinnamomeum</i> forest	5021 Chir Pine and Broadleaved forest
5008 Collinear oak-mixed Broadleaved forest	5033 <i>Schima-Castanopsis</i> forest
5010 Deciduous Broadleaved forest (<i>Alnus</i> , <i>Juglans</i>)	6131 Hill Sal forest
5013 Mesohygrophile forest with <i>Q. lanata</i> , <i>P. excelsa</i>	
6220 <i>Schima wallichii</i> , <i>Castanopsis indica</i> hygrophile	
6221 <i>Schima wallichii</i> , <i>Pinus roxburghii</i> mesohygrophile	
6222 <i>Pinus roxburghii</i> xerophile forest	
Sources: BPP 1995, TISC maps 2001	

Biological aspects cover species and habitat, including ecosystem description, conservation and management:

- Park landscape consists of mountain peaks, glaciers, high altitude lakes, rivers, pastures, and forests
- Encompassed by an altitudinal range exceeding 6450m
- Estimated 3,689 species of flora are native to the Park (BPP 1995)
- One thousand and forty-three species of vascular plants recorded: 67 pteridophytes, 10 gymnosperms, 818 dicots, and 148 monocots (Annex 1.9.6)
- Forty-six species of mammals, 345 species of birds, 11 species of herpeto fauna, and 30 species of fish recorded from the Park (DNPWC 2003)
- Current checklists include 45 mammals, 345 birds, four herpeto, and two fish species (Annex 2.16)
- Nineteen species of mammals found in LNP are protected by CITES
- Twelve species of mammals, and two species of birds are considered endangered and protected under Appendix I of NPWC Act 1973
- Fifteen endemic species of flowering plants such as the *Rhododendron cownianum*, *R. lowndesii*, and *Larix nepalensis* (Shrestha and Joshi, 1996) have been recorded from the Park
- Mammal species symbolic to the Park include the Snow leopard (*Uncia uncia*), Clouded leopard (*Pardofelis nebulosa*), Musk deer (*Moschus chrysogaster*), and Red panda (*Ailurus fulgens*)

- Bird species symbolic to the Park are the Impeyan pheasant, Ibis bill, White-winged redstart, and Snow partridge

Achievements

The major achievements of Langtang National Park (LNP) are:

- Formulation of a Species Action Plan for the Snow Leopard
- Research on the Red Panda
- Survey of ethnobotany
- Research on the Assamese monkey
- Preparation and endorsement of a management plan for the Park buffer zone in 2003
- Restoration of Rasuwa Gadi, Gosainkunda, and Panch Pokhari
- Mobilisation of Tourism for the Rural Poverty Alleviation Project (TRPAP) in the buffer zone for park conservation
- Participation of an estimated 2000 locals in various TRPAP activities
- Successful transfer of 78 forest patches over 11,132.61 ha to local users as community forest benefitting about 9,105 households (DNPWC 2001)
- Successful handover of three forest patches of religious significance, benefitting about 199 households (DNPWC 2001)
- Development of a park management plan (1977-82) by Durham University Himalayan Expedition, in conjunction with HMG/UNDP/Food and Agriculture Organization (FAO) Project Nep/72/002

Shivapuri National Park

Background

Area

Shivapuri National Park (144 km²)
Site code: 10910 and buffer zone
(conceived) (FAO/HMG 1995)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
	NP	27° 45' 36''	27° 49' 48''	85° 17' 24''	85° 29' 24''	1000

NP= national park

Kathmandu, Nuwakot, and Sindhupalchowk districts with 23 VDCs adjoining the Park zone (**Annex 3**)

History

Established in 1976 as a watershed and wildlife reserve; gazetted as a national park in 2002

Relevant legislation

National Parks and Wildlife Conservation Act 1973
National Parks and Wildlife Conservation Regulations 1974

IUCN management category

National Park II

Significance

The physiographic aspects of the protected area are as follows:

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-Alpine	3501 to 4000	
Lower Sub-Alpine	3001 to 3500	
Upper Temperate	2501 to 3000	Mid-Hills
Lower Temperate	2001 to 2500	
Upper Sub-Tropical	1501 to 2000	
Lower Sub-Tropical	1001 to 1500	

Sources: Dobremez 1972, LRMP 1986

The forest ecosystems and vegetation types are as follows (**Annex 1.1**):

Biological aspects cover species and habitat including, ecosystem description, conservation and management:

- Mountain slopes, forests, and streams in the northern rim of Kathmandu Valley comprise the landscape
- An estimated 2,122 species of flora in the Park (BPP 1995)
- Sixteen species of endemic flowering plants recorded in the area (HMGN/MFSC 2002)
- Four hundred and forty-nine vascular plants listed from available records: four gymnosperms, 313 dicots, and 132 monocots (**Annex 1.9.7**)
- Nineteen species of mammals and 177 species of birds recorded from the Park (DNPWC 2002)
- Current checklists include 19 mammals, 311 bird and 3 herpeto species (**Annex 2.17**)
- Of the total 311 species of birds recorded in ShNP, nearly 73%, or 227 species are resident species, 48 are migrants, and 36 are both resident and migrant
- Eleven species of mammals, found in ShNP are protected by CITES
- Four species of mammals, and one bird species are protected under Appendix I of NPWC Act 1973
- Mammal species symbolic of ShNP are the common Leopard (*Panthera pardus*), Wild boar, (*Sus scrofa*) and Himalayan black bear (*ursus thibetanus*)
- Bird species symbolic to the area are the Slender billed scimitar babbler, White-gorgetted flycatcher, barred cuckoo dove, and golden-throated barbet,

Achievements

The major achievements at Shivapuri National Park (ShNP) are the following.

- The Park was upgraded from the status of a wildlife reserve to a national park in 2002 (Falgun 2001)
- Tremendous increase noted in the population of Park wild boars in the late 1990s
- Commitment to wildlife and park ethics: over 115 illegal collectors and poachers arrested in 2002-2003 (DNPWC 2002, DNPWC 2003)
- Construction of 111 km stonewall boundary around the Park effectively limited access to and from the Park
- Re-vegetation by natural regeneration and plantation
- Increase in capacity of water discharge from the catchment area generates one million cubic liter of water per day

Ecosystem type	NBRB 2006
Five types of ecosystems 4009 Mountain Oak (<i>Q. semecarpifolia</i>) 5008 Collinean Oak-mixed Broadleaved forest 6220 <i>Schima wallichii</i> , <i>Castanopsis indica</i> hygrophytic 6221 <i>Schima wallichii</i> , <i>Pinus roxburghii</i> mesohygrophile 6222 <i>Pinus roxburghii</i> xerophile forest	Four types of vegetation 4131 Temperate Mountain Oak Forest 4235 East Himalayan Oak-Laurel forest 5021 Chir Pine and Broadleaved forest 5033 <i>Schima-Castanopsis</i> forest

- Construction and management of a 90 km road
- Completion of research initiatives on mammal diversity, wildlife-human interface, the Sundarijal reservoir, and pre- and post Park situation from 1999 to 2003 (DNPWC 2000, DNPWC 2001, DNPWC 2002, DNPWC, 2003)

Sagarmatha National Park Background

Area

Sagarmatha National Park (1,148 km²) and buffer zone (275 km²)

Site code: 804 (Park) Site code: 313459 (buffer zone)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitudes (metre)	
NP	27° 45' 00"	28° 06' 36"	86° 30' 36"	85° 58' 48"	2,845	8848
BZ	27° 38' 46"	27° 48' 07"	86° 33' 21"	85° 49' 30"	2,800	-

NP= national park, BZ= buffer zone

District of Solukhumbu encompassing three VDCs, two in the Park, and one adjoining the Park (**Annex 3**)

History

Established in 1976; declared a World Heritage site in 1979; declaration of a buffer zone in 2002

Relevant legislation

National Parks and Wildlife Conservation Act 1973
 National Parks and Wildlife Conservation Regulations 1974
 Mountaineering Expedition Regulations 1979
 Himalayan National Parks Regulations 1980
 Buffer Zone Regulations 1996

IUCN management category

National Park II and Buffer zone VI

Significance

The physiographic aspects of the protected area are as follows:

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-Alpine	3501 to 4000	
Lower Sub-Alpine	3001 to 3500	Mid-Hills
Upper Temperate	2501 to 3000	

Sources: Dobremez 1972, LRMP 1986

The forest ecosystems and vegetation types are as follows (**Annex 1.1**):

Biological aspects cover species and habitat including ecosystem description, conservation and management:

- Landscape comprises the highest mountain peaks, rugged terrain, high altitude wetlands, glaciers, rivers, forests and pastures
- An estimated 1,074 species of flora found in the Park (BPP 1995)
- Records of 160 vascular plants, six gymnosperms, 109 dicots, and 45 monocots (**Annex 1.9.8**)



The Yellow-billed chough (*Pyrrhocorax graculus*), Sagarmatha National Park

Ecosystem type	NBRB 2006
8 types of ecosystems	8 types of vegetation
1000 Glaciers, snow, rock	2101 Upper Alpine Meadow
2101 Alpine meadows with Graminae and Cyperaceae	2211 Dry Alpine Scrub
2108 Meadows (mat patches)	2231 Moist Alpine Scrub
2109 Sparsely vegetated rocks and screes	3131 Birch – Rhododendron forest
2110 Meadows and common land	3211 Fir forest
2203 Mesohygrophytic juniper scrublands	4111 Upper Temperate Blue Pine forest
3120 Upper sub-alpine <i>Betula utilis</i> with Rhododendron and Fir	4131 Temperate Mountain Oak Forest
4004 Open & dry montane Blue Pine	4231 Lower Temperate Oak forest
4006 Juniper forest	
Sources: BPP 1995, TISC maps 2001	

- Records of 26 species of mammals, 162 species of birds, and 13 species of reptiles/amphibians from the Park (DNPWC 2003)
- Current checklists include 33 mammals, 208 birds, five herpeto, and one fish species (**Annex 2.18**)
- Twenty-one endemic species of flowering plants were recorded from the Park (HMGN/MFSC 2002)
- Thirteen species of mammals found in SNP are protected by CITES
- Six species of mammals, and two bird species are considered endangered and protected under Appendix I of NPWC Act 1973
- Mammal species symbolic of the park include the Snow leopard (*Uncia uncia*), Musk deer (*Moschus chrysogaster*), and Red Panda (*Ailurus fulgens*)
- Bird species symbolic of the Park are the Impeyan pheasant, Lammergeyer, Bearded vulture, Snow cock, and the Yellow-billed chough
- The Park is home to Gokyo and other high altitude lakes



S.Ale

Snow leopard (*Panthera uncia*), Sagarmatha National Park

Achievements

The major achievements at Sagarmatha National Park (SNP) are the following.

- First national park in Nepal to become accredited as a UNESCO World Heritage Site (WHS) in 1979 for its exceptional area with dramatic mountains, glaciers, and deep valleys dominated by Mount Everest (popularly known as 'Sagarmatha' in Nepal), the highest peak in the world
- Commitment to wildlife and park ethics: 23 violators have been arrested for conducting illegal activities inside SNP in 2001-2002 (DNPWC 2001, DNPWC 2002)
- Increase in the population of the Himalayan tahr, Red panda, Musk deer, wolf, and Snow leopard (DNPWC 2003)
- Declaration of a Park buffer zone in January 2002 (DNPWC 2003)
- Completion of a draft management plan
- Completion of training needs assessment for Park authorities
- Revision of park management modality currently underway (DNPWC 2003c)
- Considered a focal park for the eco-regional complex connecting Langtang National Park via the proposed Gaurisankar area⁸, Makalu Barun National Park, and the Tinjure-Milke-Jaljala community-managed rhododendron conservation project area, and the Qomolongma Nature Preserve in Tibet
- Effective implementation of a pollution free policy
- High levels of community awareness in maintaining WHS standards as indicated by Park protests against the proposed expansion of Syangboche airstrip, renovation of major monasteries, and proposal for an electrical incinerator for cremation
- Increased social facilities such as trail improvement, drinking water, garbage management, and provision of electricity

⁸ In support of the Dolkha DDC's proposal, the Dolkha Chamber of Commerce and Industries in April 2006 has requested the Government of Nepal and the Nepal Tourism Board in April 2006 to declare the Rolwaling area as a Gaurisankar National Park.

- Completion of potential micro hydro sites in the buffer zone survey
- Introduction of appropriate alternative sources of energy such as hydroelectricity, solar heating system, kerosene oil, and improved cooking stoves for energy efficiency and reduced fuel wood collection (WWF 2003)
- Establishment of kerosene depots at Namche and Lukla to reduce the pressure on the ecosystem
- Evacuation of goats from the Park a decade ago in consideration of their negative impact on conservation
- Minimal poaching and illegal slaughter of animals by local Sherpas due to cultural and religious significance of non-violence
- Involvement of 46% of total households in trekking and related businesses (DNPWC 2003)
- Initiation of habitat management and improvement in the Park through establishment of a plant nursery, and reforestation of the barren lands in the vicinity of Namche Bazaar
- Significant research conducted at SNP during the last three years on community land management, crop damage by the Himalayan tahr, forest management outside the park, environment impact analysis (EIA) study of herpetofauna, landscape management, and conservation governance
- Plantation of over 151 ha forest cover with the help of the Himalayan Trust
- Some 230,731 kg of garbage cleaned from the region in 2001/2002 (DNPWC 2003)
- Formation of buffer zone user groups, and three buffer zone user committees
- Major projects and programs currently in operation in SNP include:
 - Tourism for Rural Poverty Alleviation Project supported by DFID, SNV, and UNDP
 - Sagarmatha Community Agroforestry Project (1996-2002) jointly implemented by DNPWC and WWF Nepal Program; the project focuses on community participation in sustainable natural resource management and primary activities include the establishment of a forest nursery, plantation, local capacity enhancement, and conservation awareness (WWF 2003)
- Sagarmatha Pollution Control Committee with support from WWF, Himalayan Adventure Trust of Japan (HAT-J), and the Nepal Tourism Board coordinate solid waste management in SNP (WWF, 2003)

Makalu Barun National Park Background

Area

Makalu Barun National Park (1,500 km²) and buffer zone (830 km²)

Site code: 26606 Site code: 26605 (HMGN/MFSC 2002)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
NP	27° 33' 00"	27° 57' 00"	85° 46' 12"	87° 26' 24"	435	8463
BZ	27° 25' 48"	27° 40' 48"	86° 46' 48"	87° 21' 36"	-	-

NP= national park, BZ = Buffer zone

Districts of Solukhumbu and Sankuwasabha, encompassing 12 VDCs in the buffer zone (DNPWC 2001) (**Annex 3**)

History

Established in 1991; conservation area was converted into a buffer zone in 1999; The first park adjacent to an inhabited conservation area (HMGN/MFSC 2002)

Relevant legislation

National Parks and Wildlife Conservation Act 1973
 National Parks and Wildlife Conservation Regulations 1974
 Mountaineering Expedition Regulations 1979
 Himalayan National Parks Regulations 1980
 Buffer Zone Regulations 1996

IUCN management category

Core area I, National Park II, and Buffer zone VI



Mixed broad-leaved deciduous forest, Arun Valley (2700m)

Significance

The physiographic aspects of the protected area are as follows.

Bioclimatic zone	Altitude (metre)	Physio-Graphic zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-Alpine	3501 to 4000	
Lower Sub-Alpine	3001 to 3500	
Upper Temperate	2501 to 3000	
Lower Temperate	2001 to 2500	Mid-Hills
Upper Sub-Tropical	1501 to 2000	
Lower Sub-Tropical	1001 to 1500	
Upper Tropical	501 to 1000	

Source: Dobremez 1976, LRMP 1986

The forest ecosystems and vegetation types are as follows (Annex 1.1):

Ecosystem type	NBRB 2006
20 types of ecosystems	12 types of vegetation
1000 Glaciers, snow, rock	2101 Upper Alpine Meadow
2101 Alpine meadows with <i>Graminae</i> and <i>Cyperaceae</i>	2231 Moist Alpine Scrub
2201 Rhododendron mesohygrophytic scrublands	3131 Birch-Rhododendron forest
2202 Mesohygrophyte Rhododendrons (<i>R. anthopogen</i> , <i>R. nivale</i> ..)	3211 Fir forest
2206 Shrublands with Rhododendrons	4131 Temperate Mountain Oak forest
3102 Upper sub-alpine Rhododendron-Birch forest	4135 Deciduous Maple-Magnolia-Sorbus forest
3120 Upper sub-alpine <i>Betula utilis</i> with Rhododendron and Fir	4136 Mixed Rhododendron-Maple forest
3121 Upper-sub-alpine Rhododendron scrublands	4231 Lower Temperate Oak forest
3122 Upper-sub-alpine Rhododendron-Juniper scrublands	4235 East Himalayan Oak-Laurel forest
3203 Lower sub-alpine Fir (<i>Abies spectabilis</i>) Forest	5021 Chir Pine and Broadleaved forest
3220 Lower sub-alpine <i>Abies spectabilis</i> Forest	5033 <i>Schima-Castanopsis</i> forest
4009 Mountain Oak (<i>Q. semecarpifolia</i>)	6131 Hill Sal forest
4022 Deciduous mixed Broadleaved forest	
4023 Mixed Broadleaved forest	
4024 <i>Daphniphyllum himalayense</i>	
5008 Collinear oak-mixed Broadleaved forest	
5010 Deciduous Broadleaved forest (<i>Alnus</i> , <i>Juglans</i>)	
6110 Hygrophylic <i>Schima wallichii</i>	
6220 <i>Schima wallichii</i> , <i>Castanopsis indica</i> hygrophile	
6221 <i>Schima wallichii</i> , <i>Pinus roxburghii</i> mesohygrophyte	
7101 Tropical hill Sal forest in inner valleys	

Source: BPP 1995, TISC maps 2001

Biological aspects of the Park cover species and their habitat including ecosystem, description, conservation, and management.

- From tropical forests along the Arun River to icy mountain summits, Nepal's Makalu-Barun National Park and buffer zone is the only protected area on earth with an elevation gain of 8000m
- The landscape consists of mountain peaks, glaciers, high altitude lakes, pastures, forests and rivers
- The skyline is a panorama of rugged Himalayan peaks including Mt. Makalu (8463m), the fifth highest mountain in the

world and fourth highest in Nepal; Mt. Chamlang (7319m), Mt. Baruntse (7129m), and Mera Peak (6654m); Mt Makalu is the Park's major landmark; Makalu base camp and Mera peak are popular trekking routes

- An estimated 3073 species of flora are found in the Park (BPP 1995) and include records of 284 vascular plants: four pteridophytes, seven gymnosperms, 245 dicots, and 28 monocots (**Annex 1.9.9**); eight species are endemic flowering plants (HMGN/MFSC 2002)
- The Park has records of 88 species of mammals, 440 species of birds, 59 species of reptiles/amphibians, and 78 species of fish (TMI/IUCN 1995)
- Current checklists include 81 species of mammals, 421 species of birds, 14 species of herpeto, and 13 species of fish (**Annex 2.19**)

- Twenty-four species of mammals found in Makalu Barun National Park (MBNP) are protected by CITES
- Eleven species of mammals and three species of birds are protected under Appendix I of NPWC Act 1973
- The mammal species symbolic of MBNP are the Snow leopard (*Uncia uncia*), Musk deer (*Moschus chrysogaster*), and Himalayan black bear (*Ursus thibetarus*)
- Bird species symbolic to the Park are the Spiny babbler, Impeyan pheasant, Rufous throated wren babbler, and Slety-bellied tesia

Achievements

The major achievements in Makalu Barun National Park are the following.

- Completion of a meticulous Park survey and research including environmental relations aspects, temporal dynamics, and spatial diversity of habitats, communities, and species along mountain transects; specific research initiatives include the following:
 - Biodiversity conservation, a buffer zone community forest, and small-scale enterprise, carried out in 2000-2001 (DNPWC 2001)
 - Biodiversity conservation and rituals, carried out in 2001-2002 (DNPWC 2002)
- Successful management and protection of the Park without involving the Nepal Army
- Successful cultivation and marketing of non-timber forest products
- Declaration of the Park as a conservation area and buffer zone in 1999
- Incorporation and strengthening of traditional resource management systems such as community control-led grazing and forest guardianship, and introduction of low level technologies where appropriate
- Establishment of Nepal's first grazing user group at Lamaden in 1996 laid the

groundwork for the proposed establishment of up to a dozen grazing user groups in the Park

- Construction and installation of emergency safety shelters, trail markers, and improvements of hazardous trails and bridges to minimise accidents and death among tourists, support staff, and local users
- Successful anti-pollution measures: "Pack It In and Pack It Out" policy has been effective in reducing garbage along the Park's trekking routes

Shuklaphanta Wildlife Reserve Background

Area

Shuklaphanta Wildlife Reserve (305 km²) and buffer zone (243.5 km²)

Site code: 1309 (HMGN/MFSC 2002)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
NP	28° 42' 29"	29° 03' 27"	80° 03' 08"	80° 25' 53"	174	1,386
BZ	-	-	-	-	-	-

NP= national park ; BZ = buffer zone

District of Kanchanpur, with 11 VDCs (HMGN/MFSC 2002) (**Annex 3**)

History

Established in 1976 (DNPWC 2000); declaration of Park buffer zone in 2004

Relevant legislation

National Parks and Wildlife Conservation Act 1973

National Parks and Wildlife Conservation Regulations 1974

Wildlife Reserves Regulations 1978

NTNC Act 1982

Buffer Zone Regulations 1996

Elephant Management Regulations 1966

IUCN management category

Wildlife Reserve IV and buffer zone VI

Significance

The physiographic aspects of the protected area are as follows.



P. R. Shakyia

Tetracentron sinense Oliver, Khiraunle, Sankhuwasabha, 2740m

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Lower Sub-Tropical	1001+	Siwaliks
Upper Tropical	501 to 1000	
Lower Tropical	Below 500	Terai
Source: Dobremez 1972, LRMP 1986		

The forest ecosystems and vegetation types are as follows (**Annex 1.1**).

Ecosystem types	NBRB 2006
Three types of ecosystems	Three types of vegetation
7201 Terai tropical Sal forest	5011 Chir Pine forest
7202 Khair-Sissoo riverain forest	6131 Hill Sal forest
9002 Terai cultivated land	6231 Lower Tropical Sal and Mixed Broadleafed forest

Biological aspects of the Park cover species and their habitat including ecosystem description, conservation, and management.

- The landscape consists of open grassland, forests, riverbed and tropical wetlands
- Some 700 species of flora are estimated in the Reserve (BPP 1995), with records of 553 vascular plants, 18 pteridophytes, 410 dicots, and 125 monocots (**Annex 1.9.10**)
- Records also of 43 species of mammals, 349 species of birds, 12 species of reptiles/amphibians, and 24 species of fish in the reserve (DNPWC 2003a); current checklists include species of 46 mammals, 351 birds, seven herpeto, and 28 fish (**Annex 2.20**)
- Eighteen species of mammals found in Shuklaphanta Wildlife Reserve (SWR) are protected under CITES
- The mammal species symbolic of the Reserve include the Swamp deer (*Cervus duvaucelli*), Bengal tiger (*Panthera tigris*), Asiatic elephant (*Elephas maximus*), and Hispid hare (*Caprolagus hispidus*)
- Bird species symbolic of the Park include the Bengal florican, Back-capped kingfisher, and Finn's weaver

Achievements

The major achievements of Shuklaphanta Wildlife Reserve are the following.

- Declaration of an area of 155 km² as a wildlife reserve in 1976
- Extension of the Reserve area to 305 km² in the late 1980s
- Effective protection and management of the last remaining herd of swamp deers (*Cervus duvaucelli*)

- Declaration of an area of about 152 km² adjacent to the reserve as a buffer zone
- Adequate management of 95 ha of grassland
- Maintenance of six water holes, 22 km trench, and 10 km of barbed wire fence
- Construction of three 'machans' (Tree-top lookout/house), and 22 km of fire lines (DNPWC 2003)
- Rehabilitation of two 'tals' (wetlands) (DNPWC 2003d)
- Implementation of various activities for the management of grasslands within the Reserve, including construction and clearing of access roads, regular burning and ploughing of grasslands, and construction of water holes (DNPWC 2003)
- Preparation of a management strategy framework in 2000 (DNPWC 2003)
- Development of a strategy to translocate 10 additional rhinos from Chitwan to enable Nepal to establish a third viable population of the one-horned rhinos in SWR (DNPWC 2002)
- A high density tiger population, completed research on tigers and small mammals, and regular monitoring of tigers using the camera trap method
- Commitment to wildlife: two poaching units established in order to control the poaching and illegal slaughter of wild animals (DNPWC 2003)
- Nominated by CITES as A site for Monitoring of Illegally killed elephants (MIKE)
- Formulation of a Tiger Conservation Action Plan to increase the number of breeding tigers
- Establishment of 422 user groups (DNPWC/PCP 2002)
- Development of databases and annual and five-year plans of 40 user groups with the technical and financial support of the Shuklaphanta Wildlife Reserve Participatory Community Programme (DNPWC/PCP 2002)
- Research undertaken at SWR during the last three years include:
 - A study of the effect of wild elephants on woody vegetation in 1999-2000 (DNPWC 2000, DNPWC 2001, DNPWC 2002)
 - Specific researches in 2000-2001 on the effectiveness of community-based programmes, wetland vegetation dynamics, population ecology of the nilgai and swamp deer (DNPWC 2000, DNPWC 2001, DNPWC 2002)
 - Researches undertaken in 2002-2003 include a study of habitat structure, the

swamp deer, wildlife damage, small mammals, and rhinos (DNPWC 2000, DNPWC 2001, DNPWC 2002)

- The final draft of the SWR management plan has been submitted to the Department of National Parks and Wildlife Conservation
- Development of a park management strategy framework
- Ongoing projects and programme in the SWR area:
 - Participatory Conservation Programme (May 2002-April 2004) in continuation of the - Park and People Programme supported by UNDP (DNPWC/PCP 2002)
 - National Trust for Nature Conservation's recently established Shuklphanta Conservation Programme

Parsa Wildlife Reserve Background

Area

Parsa Wildlife Reserve and (499 km²) and buffer zone (298.2 km²)
Site code: 10089 (HMGN/MFSC 2002)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitudes (metre)	
NP	27° 13' 48''	27° 27' 36''	84° 31' 48''	84° 58' 12''	435	950
BZ	-	-	-	-	-	-

NP= national park, BZ = buffer zone

Districts of Bara, Parsa, and Makwanpur, with 22 VDCs in the Reserve's buffer zone (**Annex 3**)

History

Established in 1984 as a wildlife reserve by converting the hunting grounds of the royal family; declaration of reserve buffer zone in 2005

Relevant legislation

National Parks and Wildlife Conservation Act 1973
National Parks and Wildlife Conservation Regulations 1974
Wildlife Reserves Regulations 1978
Buffer Zone Regulations 1996
Elephant Management Regulations 1966

IUCN management category

Wildlife Reserve IV, and buffer zone VI

Significance

The physiographic aspects of the protected area are as follows.

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Upper Tropical	501 to 1000	Siwaliks
Lower Tropical	Below 500	Terai

Sources: Dobremez 1972, LRMP 1986

The Reserve's forest ecosystems and vegetation types are as follows (**Annex 1.1**).

Biological aspects of the Reserve cover species and their habitat including ecosystem description, conservation, and management.

- The Reserve's landscape consists of Siwalik Hills (750m to 950m east to west), and forests contiguous with Chitwan National Park
- The soil is primarily composed of gravel and conglomerates susceptible to erosion
- The hills present a rugged face with numerous gullies and dry streambeds
- As the foothills are very porous, water flows underground and surfaces at a distance of about 15 km from the Reserve's hill base
- An estimated 919 species of flora recorded at the Reserve (BPP 1995); these include records of 298 vascular plants, five pteridophytes, one gymnosperm, 234 dicots, and 58 monocots (**Annex 1.9.11**)
- Thirty species of mammals, 500 species of birds, 13 species of reptiles/amphibians, and eight species of fish are recorded from the Reserve (DNPWC 2002), but current checklists include 37 species of mammals, 503 species of birds, eight species of herpeto, and eight species of fish (**Annex 2.21**)
- Sixteen species of mammals found in the Reserve are protected under CITES
- Eleven species of mammals, six species of birds, and two species of reptiles are protected under Appendix I of the National Parks and Wildlife Conservation Act 1973
- Mammal species symbolic of PWR are the Royal Bengal Tiger (*Panthera tigris*), Gaur (*Bos gaurus*), wild elephant (*Elephus maximus*), and Hyena (*Hyaena hyaena*);
- Bird species symbolic of Parsa Wildlife Reserve include the Crow-billed drongo, Thick-billed green pigeon, Long-tailed broadbill, and Red jungle fowl

Ecosystem type	NBRB 2006
Eight types of ecosystems 7101 Tropical hill Sal forest in inner valleys 7103 Sal forest in inner valleys 7105 Hygrophytic tropical forest on northern slopes 7121 Tropical riverain forest 7202 Khair-Sissoo riverain forest 7206 Pseudo steppe with Graminae 7220 Terai tropical Sal forest 7222 Tropical dense forest with <i>Terminalia</i>	Two types of vegetation 6131 Hill Sal forest 6231 Lower Tropical Sal and Mixed Broad leafed forest
Sources: BPP 1995, TISC maps 2001	

Achievements

The major achievements of Parsa Wildlife Reserve include the following.

- Creation of a water hole near the Adhabar grassland, and renovation of Kamini 'Daha' (pond)
- Development of a draft management plan of the area
- Establishment of an anti-poaching unit
- Creation of a 110 km fire line network in the Reserve to prevent spread of fire from one area to another (DNPWC 2002)
- Commitment to park ethics: confiscation of a large volume of illegally collected NTFPs (DNPWC 2003)
- Established Hattisar in Amlekhgunj, about 5 km north of the reserve headquarters for patrolling, tourism activities, research programmes, rescue and search operations
- Maintenance of an orphanage centre to care for abandoned wildlife until they recover and are ready for release back into the Reserve; 12 wild animals have been released in the Reserve between 2000-2002
- Commitment to wildlife: action has been taken against 91 poachers and illegal dealers between 2002-2003 (DNPWC 2003)
- Community plantations have been carried out over a 5,491 ha area benefitting 8,765 beneficiary households (DNPWC 2003)
- Reforestation over an area of 97 ha of private lands carried out by 804 households
- Minimal human injuries by wildlife: one person injured by wildlife in 2002/03; two in 2001/02
- Ongoing project: Parks Conservation Programme (May 2002 – April 2004) in continuation of the People and Parks Programme supported by UNDP

Koshitappu Wildlife Reserve

Background

Area

Koshitappu Wildlife Reserve (175 km²) and buffer zone (173 km²)

Site code: 1310

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
NP	26° 33' 00"	26° 42' 00"	86° 54' 36"	87° 03' 36"	80	100
BZ	26° 33' 58"	26° 43' 42"	86° 53' 41"	87° 06' 32"	-	-
NP= national park ; BZ = buffer zone						

The districts of Sunsari, Saptari, and Udaypur with 16 VDCs in the buffer zone (DNPWC, 2002) (**Annex 3**)

History

Established in 1976 over 65 km²; extended to its present size in 1980 by including the flood plains of the Koshi River to protect the last remnant population of wild water-buffaloes. Declared a Ramsar site on 17 December 1987 (IUCN 1998); and buffer zone in 2004 (DNPWC 2004)

Relevant legislation

National Parks and Wildlife Conservation Act 1973

National Parks and Wildlife Conservation Regulations 1974

Wildlife Reserves Regulations 1978

Buffer Zone Regulations 1996

Elephant Management Regulations 1966

IUCN management category

Wildlife Reserve IV, and Buffer Zone VI

Significance

The physiographic aspects of the protected area are as follows.

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Lower Tropical	Below 500	Terai
Sources: Dobremez 1972, LRMP 1986		

The forest ecosystems and vegetation types are as follows (Annex 1.1).

Ecosystem types	NBRB 2006
Five types of ecosystems	One vegetation type
7202 Khair-Sissoo riverain forest	6231 Lower Tropical Sal and Mixed Broad leafed forest
7206 Pseudo steppe with Graminae	
9000 Cultivated land	
9002 Terai cultivated land	
9900 Water bodies	
Sources: BPP 1995, TISC maps 2001	

The wildlife reserve’s biological aspects cover species and habitat, including ecosystem description, conservation, and management.

- The landscape consists of riverbeds, floodplains, grasslands, and forests
- Sapta Koshi is one of three main tributaries of the Ganges; there is rapid and intense flooding in the Reserve during the rainy season; embankments constructed parallel to the river control flooding
- Records of 514 species of flora from the Reserve (DNPWC 2002b)
- Some 514 species of plants found in the wetlands common species include the Sisso tree (*Dalbergia sissoo*), Kapok (*Bombyx ceiba*), Sugarcane (*Saccharum* sp), reed beds (*Phragmites* sp.), Cattail (*Typha* sp.), Cassava (*Imperata* sp.), eel grass (*Vallisneria* sp.), *Eichornia* sp., *Hydrilla* sp., *Azolla* sp., and

Lotus sp.

- Six species of plants found in this area, the Indian snakeroot (*Rauwolfia serpentina*), Saptaparna (*Alstonia scholaris*), Indian trumpet flower (*Oroxylum indicum*), Acacia (*Acacia catechu*), Palash (*Butea monosperma*) and Indian rosewood (*Dalbergia latifolia*), are listed in the specific threat categories and appendices of IUCN and CITES; with the exception of *Acacia catechu*, the five plant species are sparse in the area
- Lacustrine habitats such as the Kamal Daha oxbow lake, harbour 28 species of plants; four species of flowering plants from the reserve are recorded as endemic (HMGN/MFSC 2002)
- Records of 158 vascular plants, four pteridophytes, 112 dicots, and 42 monocots (Annex 1.9.12) in the Reserve; current checklists include 23 species of mammals, 485 birds, 17 species of herpeto, and 105 species of fish (Annex 2.22)
- Notable among the 485 species of birds are the Watercock (*Gallicrex cinerea*), Indian nightjar (*Caprimulgus asiaticus*), Dusky eagle owl (*Bubo coromandus*), Black-headed cuckooshrike (*Coracina melanoptera*), White-tailed stonechat (*Saxicola leucura*) Striated grassbird (*Megalurus palustris*), Large adjutant stork (*Leptoptilos dubius*), Pallas’s fish eagle (*Haliaeetus leucoryphus*), Common golden-eye (*Bucephala clangula*), and Gull-billed tern (*Gelochelidon nilotica*)
- Out of the 485 species of birds, 12 species are globally threatened and 101 species endangered within Nepal; 114 species are water birds, 176 species bred in the reserve, and 180 species are passage migrants or winter visitors; Koshitappu is the only area in Nepal where the Water cock (*Gallicrex*



P. R. Shakya

Nelumbo nucifera Gaertn. Kamalpur lake



R. N. Suwal

Arna (*Bubalus anree*), Koshitappu Wildlife Reserve

- cinerea*) and Abbott's babbler (*Malacocincla abbotti*) can be found
- Of the 31 species of mammals recorded, Nepal's last remaining population of wild water-buffalo (*Bubalus arnee*) inhabit the area; the Gangetic dolphin (*Platanista gangetica*) has also been recorded in the Koshi River
 - A steady decline in the numbers of large mammals such as the Gaur (*Bos gaurus*), and Blue bull (*Boselaphus tragocamelus*) has been noted in the Reserve; other mammals from the area include the Wild elephant (*Elephas maximus*), Wildboar (*Sus scrofa*), Hog deer (*Axis porcinus*), Spotted deer (*Axis axis*), Smooth-coated otter (*Lutra perspicillata*), and the jackal (*Canis aureus*)
 - Of 200 species of fish, 91 species are resident, 21 species are local migratory, and five species migratory; of these, nine species are listed in various threatened categories, eight species are vulnerable, and one species considered endangered
 - Eleven amphibians (two toads and nine frogs) and 24 reptile species (two crocodiles, 11 turtles, six lizards and five snakes) are recorded in the Park
 - Seventeen of the species of herpetofauna are nationally threatened, of which six species are globally threatened
 - There is a record of 77 butterfly species in the area
 - A total of 13 species of mammals found in Koshitappu are protected by CITES
 - Six species of mammals, five species of birds, and three species of reptiles are protected under Appendix I of NPWC Act 1973
 - Mammal species symbolic of KWR are the wild water-buffalo (*Bubalus arnee*) and the Gangetic dolphin (*Platanista gangetica*)

Achievements

The major achievements at Koshitappu Wildlife Reserve (KWR) are the following.

- Declared the first Ramsar site of Nepal on 17 December 1987, when Nepal became party to the Convention on Wetlands of International Importance, with a reinforced commitment to conservation as a Waterfowl Habitat in particular (DNPWC 2002)
- Preservation of the last remnant population of the critically endangered wild water buffaloes and their habitats; a comprehensive management strategy framework and plan has been prepared involving key KWR stakeholders (DNPWC 2002b)

- Increase in bird sightings as well as number and frequency of visiting migratory birds (DNPWC 2002b)
- The Reserve supports over 20,000 waterfowls and is a hotspot for 200 species of fish (DNPWC 2002b)
- Developed a proposal for the translocation of the wild water-buffalo within Nepal (DNPWC 2002b)
- About 500 domestic buffaloes have been evacuated from the reserve
- Improved conditions for wildlife: only three reported wildlife deaths due to natural causes recorded in 2002/03 compared to seven in 2001/02
- Effective protection from wildlife: only one human casualty from encounter with wildlife in 2001/02
- Various kinds of research have been done at KWR under DNPWC:
 - Research carried out from 1999-2000 included studies on crop damage and livestock depredation, riverine forests, the Arna habitat, and the swamp partridge
 - Three studies conducted from 2000-2001 assessed the economics of the wild buffalo, prospective challenges in the the Reserve buffer zone, and a 'nilgai' (bluebull) survey
 - Research initiatives undertaken in 2001-2002 studied wetland sites, fish, and the elephant-human interface

Dhorpatan Hunting Reserve Background

Area

Dhorpatan Hunting Reserve (1,325 km²)
Site code: 10087 (HMG/N/MFSC 2002)

Location

Coordinates

Latitude (North)		Longitude (East)		Altitude (metre)	
28°	28°	82°	83°	2,850	5,500
28'	49'	45'	16'		
12''	48''	00''	48''		

Rukum, Myagdi and Baglung districts (**Annex 3**).

History

Established in 1987 as the only hunting reserve meeting the demands for controlled wildlife hunting of blue sheep and other game animals by Nepali and foreign hunters

Relevant legislation

- National Parks and Wildlife Conservation Act 1973
- National Parks and Wildlife Conservation Regulations 1974
- Wildlife Reserves Regulations 1978
- Mountaineering Expedition Regulations 1979
- Himalayan National Parks Regulations 1980

IUCN management category

Hunting reserve VIII (Multiple Use management)

Significance

The physiographic aspects of the protected area are as follows.

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-Alpine	3501 to 4000	
Lower Sub-Alpine	3001 to 3500	
Upper Temperate	2501 to 3000	Mid-Hills
Lower Temperate	2001 to 2500	
Upper Sub-Tropical	1501 to 2000	
Lower Sub-Tropical	1001 to 1500	

Sources: Dobremez 1972, LRMP 1986

The forest ecosystems and vegetation types are as follows (Annex 1.1).

Ecosystem type	NBRB 2006
<p>14 types of ecosystems</p> <ul style="list-style-type: none"> 1000 Glaciers, snow, rock 2103 Mesophytic mat patches and vegetation on rocks* 2201 Rhododendron mesohygrophytic scrublands 3102 Upper sub-alpine Rhododendron-Birch forest 3203 Lower sub-alpine Fir (<i>Abies spectabilis</i>) Forest 4002 Mixed Blue Pine-Oak 4006 Juniper forest 4009 Mountain Oak (<i>Q. semecarpifolia</i>) 5002 Collinean pak forest 5009 <i>Aesculus, Juglans</i> riverain forest 5011 Hygrophytic <i>Quercus lamellosa</i> forest 6101 Mixed Chir Pine-Oak forest 6204 <i>Euphorbia royleana</i> steppe in inner valleys 8001 High altitude cushion plant formation 	<p>10 types of vegetation</p> <ul style="list-style-type: none"> 2101 Upper Alpine Meadow 2231 Moist Alpine Scrub 3003 Trans Himalayan High Alpine vegetation 3131 Birch-Rhododendron forest 3211 Fir forest 4112 Temperate Juniper forest 4131 Temperate Mountain Oak forest 4231 Lower Temperate Oak forest 4234 Deciduous Walnut-Maple-Alder forest 5021 Chir Pine and Broadleafed forest
<p>*veg rocks in the original BPP document Sources: BPP 1995, TISC maps 2001</p>	

The Reserve’s biological aspects cover species and their habitat including ecosystem description, conservation, and management.

- ‘Dhor’ (marshland) and forests comprise the landscape; the Reserve’s higher elevations remain snow-capped throughout the year
- Locally known as ‘Patans’, flat meadows above the tree line (4000m), are renowned

for animals such as the Blue sheep and other herbivores

- An estimated 1150 species of flora have been recorded in the Reserve (BPP 1995);
- Thirty-six species of flowering plants are endemic (HMGN/MFSC 2002)
- Fifty-eight vascular plants are recorded in the Reserve; seven gymnosperms, 43 dicots, and eight monocots (Annex 1.9.13)
- Current checklists include 18 mammal species, 137 birds, and two herpeto species (Annex 2.23)
- Sixteen species of mammals found in the Reserve are protected by CITES
- Seven species of mammals and three species of birds are protected under Appendix I of NPWC Act 1973
- Mammal species symbolic to Dhorpatan Hunting Reserve (DHR) include the Blue sheep (*Pseudois nayaur*), snow leopard, and musk deer (*Moschus chrysogaster*)
- Bird species symbolic to DHR are the cheer pheasant, koklas pheasant, and Impeyan pheasant.

Achievements

The major achievements of Dhorpatan Hunting Reserve include the following.

- The only designated hunting reserve in the country; well designated hunting safaris has attracted visitors from abroad to the Reserve

- DNPWC annual reports (1999, 2001, 2002) report two researches conducted in this hunting reserve on institutional as well as individual levels:
 - Problems and prospects of the hunting reserve (2001)
 - Status and distribution of cheer pheasant (2003)

Annapurna Conservation Area Background

Area

Annapurna Conservation Area (7,629 km²)
Site code: 10091 (HMGN/MFSC, 2002)

Location

Coordinates

Latitude (North)		Longitude (East)		Altitude (metre)	
28°	29°	83°	84°	790	8,090
13'	19'	28'	26'		
48''	48''	48''	24''		

Manang, Mustang, Kaski, Myagdi, and Lamjung districts, with 55 VDCs inhabited by various ethnic groups (KMTNC 2002a) (**Annex 3**)

History

Established in 1985 and gazetted in 1992 as the largest conservation area in Nepal; managed by National Trust for Nature Conservation, a national NGO (KMTNC 1997)

Relevant legislation

National Parks and Wildlife Conservation Act 1973
National Parks and Wildlife Conservation Regulations 1974
Mountaineering Expedition Regulations 1979
NTNC Act 1982
Conservation Area Regulations 1997

IUCN management category

Conservation VI

Significance

The physiographic aspects of the protected area are as follows.

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-Alpine	3501 to 4000	
Lower Sub-Alpine	3001 to 3500	
Upper Temperate	2501 to 3000	Mid-Hills
Lower Temperate	2001 to 2500	
Upper Sub-Tropical	1501 to 2000	
Lower Sub-Tropical	1001 to 1500	
Upper Tropical	501 to 1000	

Sources: Dobremez 1972, LRMP 1986

The forest ecosystems and vegetation types are as follows (**Annex 1.1**).

The Conservation Area's biological aspects cover species and habitat including ecosystem description, conservation, and management.

- Mountain peaks, high altitude pastures, trans-Himalayan valleys, forests, lakes, glaciers, rivers, and cultivated lands comprise the landscape; some of the highest peaks in the world (Annapurna I: 8091m, Machhapuchhere: 6993m) are contained in this conservation area, also the world's deepest gorge, Kali Gandaki, and highest altitude lake, Tilicho Lake
- Two distinct climatic regions within a span of 120 km and altitude of 1000-8000m: 3000 mm annual rainfall in the south (cis Himalayas); and <500 mm annual rainfall in the north (trans-Himalayas)
- Home to 101 species of mammals including the Snow leopard, Musk deer, Tibetan Argali, Tibetan wolf, and Tibetan fox
- Home to 474 species of birds including 38 species of birds at risk in Nepal, and six species of Himalayan pheasants found in Nepal
- Also hosts 39 species of reptiles and 22 species of amphibians
- Nepal's most extensive protected area and the first conservation area consisting of the entire habitat gradient from subtropical sal forest to perennial snow
- Home to over 100,000 inhabitants from over 10 ethnic groups (Tibeto-Burmese: Gurung, Thakali, Bhotia, Ethnic Tibetan, and Magar; and Indo Aryan: Brahmin, Kshetri, Kami, Damai and Sarki)
- An estimated 3,430 species of flora have been recorded in the conservation area (BPP 1995)
- Fifty-six species of flowering plants are endemic to the area (Shrestha and Joshi 1996);
- Records of 456 vascular plants: five pteridophytes, 11 gymnosperms, 392 dicots, and 48 monocots (**Annex 1.9.14**)
- Current checklists include species of 97 mammals, 476 birds, 56 herpeto, and two fish species (**Annex 2.24**)
- Records of 101 species of mammals, 478 species of birds, 41 species of reptiles, and 23 species of amphibians in the conservation area (KMTNC 2002a)
- Twenty-seven species of mammals found in the Annapurna Conservation Area (ACA) are protected under CITES
- Thirteen species of mammals and three bird species are protected under Appendix I of NPWC Act 1973

Ecosystem Type	NBRB 2006
<p>28 types of ecosystems</p> <p>1000 Glaciers, snow, rock</p> <p>2103 Mesophytic mat patches and vegetation on rocks*</p> <p>2104 Mesophytic and hydrophytic mat patches and vegetation on rocks*</p> <p>2201 Rhododendron mesohydrophytic scrublands</p> <p>3102 Upper sub-alpine Rhododendron-Birch forest</p> <p>3103 Upper sub-alpine Birch Blue-Pine open forest</p> <p>3110 Upper sub-alpine north Himalayan alpine veg.</p> <p>3203 Lower sub-alpine Fir (<i>Abies spectabilis</i>) Forest</p> <p>8001 High altitude cushion plant formation</p> <p>8002 <i>Caragana versicolor</i>, <i>Lonicera spinosa</i> steppe</p> <p>8003 <i>Caragana gerardiana</i>, <i>Lonicera spinosa</i> steppe</p> <p>8004 <i>Caragana brevispina</i>, <i>Artemesia</i> steppe</p> <p>8006 <i>Myricaria-Hippophae-Salix</i> riverain thickets</p> <p>8007 <i>Sophora moorcroftiana</i>, <i>Oxtropis mollis</i> steppe</p> <p>4003 Mixed hydrophytic Oak-Hemlock-Fir</p> <p>4004 Open and dry montane Blue Pine</p> <p>4006 Juniper forest</p> <p>4009 Mountain Oak (<i>Q. semecarpifolia</i>)</p> <p>4010 Blue Pine-spruce forest</p> <p>4011 Spruce mountain forest</p> <p>5000 Blue Pine-cypress forest</p> <p>5001 Cypress forest with Dwarf Barberry</p> <p>5007 Open Blue Pine forest</p> <p>5008 Collinean Oak-mixed Broadleaved forest</p> <p>5009 <i>Aesculus</i>, <i>Juglans</i> riverain forest</p> <p>5011 Hygrophytic <i>Quercus lamellosa</i> forest</p> <p>6110 Hygrophytic <i>Schima wallichii</i></p> <p>6220 <i>Schima wallichii</i>, <i>Castanopsis indica</i> hygrophytic</p> <p>9003 Pokhora cultivated areas</p>	<p>15 types of vegetation</p> <p>2101 Upper Alpine Meadow</p> <p>2231 Moist Alpine Scrub</p> <p>3001 Trans-Himalayan Steppe</p> <p>3002 Trans Himalayan Lower <i>Caragana</i> Steppe</p> <p>3003 Trans Himalayan High Alpine vegetation</p> <p>3111 Fir-Blue Pine forest</p> <p>3211 Fir forest</p> <p>4111 Upper Temperate Blue Pine forest</p> <p>4114 Spruce forest</p> <p>4213 Cypress forest</p> <p>4221 Mixed Blue Pine-Oak forest</p> <p>4231 Lower Temperate Oak forest</p> <p>4235 East Himalayan Oak-Laurel forest</p> <p>5033 <i>Schima-Castanopsis</i> forest</p> <p>6131 Hill Sal forest</p>
<p>*written as 'veg rocks' in original BPP document Sources: BPP 1995, TISC maps 2001</p>	

- Mammal species symbolic of ACA are the Snow leopard, Musk deer, Tibetan argali, and Tibetan wolf
- Bird species symbolic of the area are the Golden eagle, Demoiselle crane, and various pheasants

Achievements

The major achievements of the Annapurna Conservation Area (ACA) include the following.

- The Annapurna Conservation Area Project (ACAP) is considered a model for conservation projects both within Nepal and throughout the world
- The Project began in a single VDC, Ghandru, in 1986 as a pilot phase and was extended to Lwang and Sikles in 1990 under the first phase of expansion; the second expansion phase in 1992 and 1993 further extended the project to Lomanthang, Jomsom, Manang (a field site), and Bhujung, covering a total of 55 VDCs in five districts (KMTNC 1997)
- Development and implementation of ACAP management plan for 1997 – 2002

- Development of the Conservation Area Management Regulation 1997 and enforcement of Conservation Area Directives (KMTNC 2002)
- The National Trust for Nature Conservation (NTNC) submitted a phase-out strategy for ACAP to the government in 2001; in consideration of ACAP's commendable



Satin Poppy (*Meconopsis napaulensis*) DC., found at the base of Machhapuchre, 3490m

P. R. Shakyia

undertakings during the first 10-year phase, 1991-2001, the government has extended management responsibility by NTNC for another 10 years until 2012

- Intensive capacity-building of all 55 conservation area management committees to enable handover of management responsibility by ACAP to local community-based organisations was the primary strategy for ACAP's phase-out from the Annapurna Conservation Area (KMTNC 2002)
- The Upper Mustang Biodiversity Conservation Project collectively funded by GEF, UNDP, the American Himalayan Foundation, ICIMOD, and NTNC, has been ongoing for five years since 2000 in the Lomanthang sector of ACAP and covers seven VDCs
- ACAP has proved that the principle of participatory integrated conservation and development in conservation area management is a successful Nepal model; this as well as a people-centred buffer zone management strategy in national parks have been replicated in Manaslu and Kangchenjunga conservation areas (KMTNC 2001a)
- Conservation education has been the backbone of all programmes and is an essential backdrop in most schools in the area
- The conservation of local culture is accorded utmost priority as conservation of nature; the first phase of the cultural conservation programme of Upper Mustang has been completed and will be expanded to other monasteries in the second phase (KMTNC 2002)
- ACAP's Natural Resource Conservation Programme conducted a variety of activities, prepared 55 conservation area management committee (CAMC) operational plans, established 27 project and private nurseries, planted 1,662,014 tree seedlings, and established a CAMC fund raising NRs 2,366,000 (US\$36,400) as a form of economic empowerment; it also established 10 musk deer and snow leopard conservation committees, conducted various training programmes and study tour activities on various aspects of conservation
- An Alternative Energy Programme conducted and completed various activities, set up 13 micro-hydro schemes benefiting 1,989,000 households and serving as hotels, installed 589 back boiler systems, established 36 kerosene depots and conducted training programmes and study tours
- The Conservation Education Programme conducted various activities including 74 conservation education classes in local schools, and 72 study tours for local students
- The Community Development Programme conducted a variety of programme activities including construction of 62 suspension bridges, construction and repair of a 60,191m trail, construction of 194 school buildings, 141 drinking water schemes, and eight river training sites
- The Agriculture Development Programme conducted various activities and training programmes, set up 10 agricultural demonstration sites, distributed 10,143,157 vegetable seedlings, trained 524 people trained in kitchen gardening, and provided soft loans to 45 households for agricultural development and other activities
- The Livestock Development Programme conducted various activities including training for 36 farmers on poultry farming for nine village animal health workers, and provided support to 11 veterinary clinics and 124 shed improvement activities
- The Women Development Programme conducted self-help activities among 290 mothers groups, provided group management training to 36 mother's groups, and operated seven day care centers, 139 adult literacy classes, 27 school endowments for girls; it also formed 18 savings and credit group cooperatives and provided training on their various aspects

Achievements

The major achievements of the Annapurna Conservation Area Project (ACAP) up to year 2000 include the following.



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Pinus wallichiana A.B Jackson Blue pine forest, Lower Mustang 2750m

- The Tourism Development Programme conducted a variety of activities including forming 27 tourism management sub-committees that benefitted 5,120 participants through 89 tourism awareness camps; 656 people participated in 22 lodge management training programmes, 117 rubbish pit and 12 dumping sites were constructed, 29 visitor information centers established; two micro-enterprise training courses conducted; various other training programmes and visits were carried out
- The Cultural Heritage Conservation Programme conducted 15 different activities, renovated 52 monasteries, formed 13 monastery management committees, and constructed 19 temples
- Research and documentation: 13 diverse activities were conducted including two wildlife surveys, seven medicinal plant surveys, and 16 VDC socioeconomic surveys
- Community Health Programme: some 7,117 people have benefited from the Programme's improved health services; conducted 30 mobile health camps benefiting 2,953; conducted 23 health awareness camps with 611 participants
- Recipient of the Deutscher Rieseuro-Verband Award for Tourism and Environment; Tourism for Tomorrow – Worldwide; Tourism for Tomorrow – Asia Pacific
- Recipient of numerous awards including the J. Paul Getty Conservation Award, Global 500 Award, the Abraham Conservation Award 2001 and 2002 from WWF/Nepal, for the Mothers' Group of Jomsom village and for the Tourism Management Sub-Committee of Chhomrong village
- ACAP has brought positive impacts in the lives of people from 55 VDCs; communities that did not have basic clean drinking water at the onset now have this supply; community-owned and managed drinking water supply, health posts, and health services that provide adequate health care
- Alternative means of energy through community-owned and managed systems such as micro-hydro and kerosene depots
- Improved access to and mobility through regular repair and maintenance of trails, and construction of bridges

Manaslu Conservation Area Background

Area

Manaslu Conservation Area (1,663 km²)
Site code: 143002 (HMGN/MFSC, 2002)

Location

Coordinates

	Latitude (North)		Longitude (East)		Altitude (metre)	
NP	28° 20'	28° 45'	84° 28'	85° 11'	-	-
	24''	00''	48''	24''		
NP= national park						

Gorkha district, with seven VDCs inhabited by various ethnic groups (KMTNC 2002) (Annex 3)

History

Established in 1998 as a conservation area, the second conservation area managed by the National Trust for Nature Conservation (NTNC)

Relevant legislation

National Parks and Wildlife Conservation Act 1973
National Parks and Wildlife Conservation Regulations 1974
Mountaineering Expedition Regulations 1979
NTNC Act 1982
Conservation Area Regulations 1997

IUCN management category

Conservation VI

Significance

The physiographic aspects of the protected area are as follows.

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-Alpine	3501 to 4000	
Lower Sub-Alpine	3001 to 3500	
Upper Temperate	2501 to 3000	Mid-Hills
Lower Temperate	2001 to 2500	
Upper Sub-Tropical	1501 to 2000	
Lower Sub-Tropical	1001 to 1500	

The forest ecosystems and vegetation types are as follows (Annex 1.1).

Ecosystem type	NBRB 2006
19 types of ecosystems	11 types of vegetation
1000 Glaciers, snow, rock	2101 Upper Alpine Meadow
2101 Alpine meadows with <i>Graminae</i> and <i>Cyperaceae</i>	2231 Moist Alpine Scrub
2103 Mesophytic mat patches and vegetation on rocks	3001 Trans Himalayan Steppe
2105 Alpine meadows on the southern side of the Himalayas	3003 Trans Himalayan High Alpine vegetation
2201 Rhododendron mesohygrophytic scrublands	3131 Birch-Rhododendron forest
3102 Upper sub-alpine Rhododendron-Birch forest	3211 Fir forest
3103 Upper sub-alpine Birch Blue-Pine open forest	3212 Larch forest
3110 Upper sub-alpine north Himalayan alpine vegetation	4111 Upper Temperate Blue Pine forest
3203 Lower sub-alpine Fir (<i>Abies spectabilis</i>) Forest	4131 Temperate Mountain Oak Forest
4004 Open & dry montane Blue Pine	4231 Lower Temperate Oak forest
4006 Juniper forest	5021 Chir Pine and Broad-leaved forest
4007 Rhododendron-Hemlock-Oak forests	
4009 Mountain Oak (<i>Q. semecarpifolia</i>)	
4010 Blue Pine-spruce forest	
4011 Spruce mountain forest	
5011 Hygrophytic <i>Quercus lamellosa</i> forest	
6109 Hygrophytic <i>Schima-Castanopsis-Englehardtia</i> forest upper subtropical	
6210 Hygrophytic <i>Schima-Castanopsis-Englehardtia</i> forest lower subtropical	
8001 High altitude cushion plant formation	
Sources: BPP 1995, TISC maps 2001	

The biological aspects cover species and habitat including ecosystem description, conservation, and management:

- Mountain peaks, glaciers, high latitude lakes, rivers, pastures, forests and cultivated lands comprise the landscape of Manaslu Conservation Area
- An estimated 2,500 species of flora recorded in the area (BPP 1995), including 587 vascular plants: 10 gymnosperms, 491 dicots, and 86 monocots (**Annex 1.9.15**)
- Records of 33 species of mammals, 110 species of birds, and three species of reptiles and amphibians in Manaslu (KMTNC 2002); current checklists include nine species of mammals protected under CITES
- Six species of mammals and one bird species are protected under Appendix I of NPWC Act 1973
- Mammal species symbolic of Manaslu Conservation Area (MCA) include the Snow leopard (*Panthera uncia*, *Uncia uncia*), Musk deer (*Moschus chrysogaster*), Himalayan Tahr (*Hemitragus jemalhicus*), and ground squirrel (family Sciuridae)
- Bird species symbolic of MCA are the Variegated laughing-thrush (*Garrulax variegatus*), Grandala (*Grandala coelicolor*), and Northern Goshawk (*Accipiter gentiles*)

Achievements

The major achievements of Manaslu Conservation Area are as follows.

- Conservation area management committees (CAMCs) have been established in each of the seven VDCs in Manaslu; the major community-based organisations in the area are 12 forest management committees at the ward level, 25 women's groups (WGs), four micro-hydro management committees, and two tourism management committees
- Material distribution centre and check post and tourist information centre established at MCA Project headquarters in Phidim
- Improved access to the area (as the nearest roadhead is a three-day walk); a 10.8 km trail was improved by stone paving and widening; sign posts were placed along the entire Larkye trail with tourism management committees taking responsibility for road maintenance; construction of 16 new wooden bridges and restoration of two old ones; construction of two helipads; survey of short take off and landing airport at Prok village; establishment of six wireless radio communication sets
- Alternative energy: four micro-hydro electricity projects are underway, the Samagaon 33 kW, Lho 30 kW, Prok 23 kW, and Namrung 15 kW projects, benefiting 351 households; seven kerosene depots have been established under a loan agreement; eight gombas were supported with 40-50 watt solar energy systems
- Nature conservation: development of a strategy to seek alternatives to natural resources; formation and strengthening of CAMCs through training programmes, workshops, and exposure visits; and deposit of NRs 24,000 (US\$370) in each CAMC account since 2000 (the CAMCs employ a forest guard in each ward); formation of 11

- forest management committees in each ward in three VDCs; establishment of a forest nursery and production of 7000 seedlings for the plantation; conduct of various village conservation education and extension activities; a workshop held as a first step in developing operational plans for each CAMC
- Sustainable tourism development and management: built five community-owned camp grounds; supported the construction of toilets in five private campsites; provided financial support to three local lodge owners; organised various training programmes to build local capacity; 20 campsites now have piped drinking water, 10 have dumping pits, 15 have toilets; organised tourism awareness camps and formed tourism management committees in two VDCs; provided training on various aspects of hospitality
 - Sustainable community development: established drinking water supply schemes in 11 villages, with 55 tap water supply systems benefiting 525 households; built 14 community toilets; various kinds of support to schools such as for the construction of roofs and inclusion of conservation education in the curriculum; launched health improvement and sanitation programmes through various training and extension programmes and through infrastructure support; provided support for the continuation of traditional 'Amchi' (Tibetan healing) practices
 - Heritage conservation: renovated 120 gombas through financial and technical support; provided support for the installation of solar photovoltaic electricity
 - Women in conservation and development: formed 25 women's groups (WGs) in seven VDCs; launched adult literacy classes in 10 villages in four VDCs: WGs are among the most active institutions, playing significant roles in conservation and development
 - Agriculture and livestock development: promoted vegetable production, established demonstration plots in four sites; provided training on kitchen gardening, as a result of which local people have started their own kitchen gardens
 - Capacity building: strengthened technical, analytical and decision-making skills for local people; conducted five exposure tours of VDCs, WGs, CAMCs; organised micro hydro-electricity management committee representatives and provided training on various aspects

- Research, promotion and publicity: conducted biodiversity survey in 1998/99; prepared a promotional documentary film

Kangchenjunga Conservation Area

Background

Area

Kangchenjunga Conservation Area (2,035 km²)

Site code: 143001 (HMGN/MFSC 2002)

Location

Coordinates

Latitude (North)		Longitude (East)		Altitude (metre)	
27°	27°	87°	88°	-	8586
28'	56'	39'	12'		
48''	24''	00''	00''		

Taplejung district, with four VDCs inhabited by various ethnic groups (WWF 2003) (**Annex 3**)

History

Established in 1997 as a conservation area adjoining the Qomolongma Nature Preserve in Tibet, and Kanchenjunga Biosphere Reserve in Sikkim, India; Declared as a 'Gift to the Earth' (WWF 2003) in 1997

Relevant legislation

National Parks and Wildlife Conservation Act 1973
 National Parks and Wildlife Conservation Regulations 1974
 Mountaineering Expedition Regulations 1979
 Conservation Area Government Regulations 1997

IUCN management category

Conservation VI

Significance

The physiographic aspects of the protected area are as follows.

The forest ecosystems and vegetation types are as follows (**Annex 1.1**).

Bioclimatic zone	Altitude (metre)	Physio-graphic zone
Nival	Above 5000	High Himal
Upper Alpine	4501 to 5000	High Mountains
Lower Alpine	4001 to 4500	
Upper Sub-Alpine	3501 to 4000	
Lower Sub-Alpine	3001 to 3500	
Upper Temperate	2501 to 3000	Mid-Hills
Lower Temperate	2001 to 2500	
Upper Sub-Tropical	1501 to 2000	
Lower Sub-Tropical	1001 to 1500	
Upper Tropical	501 to 1000	

Sources: Dobremez 1972, LRMP 1986

Biological aspects cover species and habitat, including ecosystem description, conservation and management.

- Mountain peaks, glaciers, high latitude lakes, rivers, pastures, forests and cultivated lands comprise the landscape
- An estimated 3,000 species of flora can be found in the conservation area (BPP 1995)
- Twenty-three species of flowering plants are endemic to the area (Shrestha and Joshi 1996)
- Records of 77 vascular plants: three gymnosperms, 70 dicots, and four monocots in the area (**Annex 1.9.16**)

Ecosystem type	NBRB 2006
<p>12 types of ecosystems</p> <p>1000 Glaciers, snow, rock 2101 Alpine meadows with <i>Graminae</i> and <i>Cyperaceae</i> 2202 Mesohygrophile Rhododendrons (<i>R. anthopogen</i>, <i>R. nivale</i>..) 2206 Shrublands with Rhododendrons 3121 Upper-sub-alpine Rhododendron shrublands 3220 Lower sub-alpine <i>Abies spectabilis</i> Forest 3221 <i>Larix griffithiana</i> forest 4008 Hemlock forest (<i>Tsuga dumosa</i>) 4023 Mixed Broadleafed forest 5012 Hygrophytic forest with <i>Quercus lamellosa</i> 6110 Hygrophylic <i>Schima wallichii</i> 6220 <i>Schima wallichii</i>, <i>Castanopsis indica</i> hygrophytic</p> <p>Sources: BPP 1995, TISC maps 2001</p>	<p>Eight types of vegetation</p> <p>2101- Upper Alpine Meadow 2231- Moist Alpine Scrub 3211- Fir forest 3212- Larch forest 4136- Mixed Rhododendron-Maple forest 4235- East Himalayan Oak-Laurel forest 5033- <i>Schima-Castanopsis</i> forest 6131- Hill Sal forest</p>



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Rhododendron falconeri Hook.f., Taplejung

- Current checklists include 13 mammal, and 280 bird species (**Annex 2.26**)
- Fifteen species of mammals found in the Kangchenjunga Conservation Area (KCA) are protected under CITES
- Seven species of mammals and one bird species are protected under Appendix I of NPWC Act 1973
- Mammal species symbolic of KCA include the Snow leopard, musk deer and Red panda (*Ailurus fulgens*)
- Bird species symbolic of the area include the Golden-breasted fulvetta, snow cock, blood pheasant, and red-billed chough
- Declared as a 'Gift to the Earth' in April 1997 by HMG of Nepal in support of WWF's Living Planet Campaign in recognition of the area's rich natural and cultural resources (WWF 2003)

Achievements

The major achievements of Kangchenjunga Conservation Area are as follows.

- Research endeavours conducted in and around KCA have studied ecotourism, transhumance grazing, and the red panda

- Development of the Kanchenjunga Management Plan is currently underway
- Successful development of user committee operational plan
- Successful development and monitoring of the Snow Leopard Action Plan
- Completion of Red Panda status survey
- Development of a Tourism Plan by the DNPWC designed to introduce and regulate efficient tourism management practices
- Effective formation of Conservation Area Management Council
- Extension of KCA area from 1,650 km² to 2,035 km²
- WWF is promoting a long-term concept of a 'Tri-Nation Peace Park' in collaboration with



High altitude Topke Lake 3680m, Taplejung

P. R. Shakyia

several international organisations to connect KCA to neighbouring protected areas in India and China (WWF, 2003)

Proposed protected areas

Along with the gazette notified protected areas described in the preceding table on Protected Areas, eight are recommended sites: five conservation areas and three hunting

reserves; and one is a proposed extension to the national park as mentioned in the World Database on Protected Areas (<http://www.unep-wcmc.org/wdpa/>).

Site code	Name	Latitude (North)	Longitude (East)	Area (ha)
Conservation Areas				
10085	Bara	27° 0' (27.000°)	84° 59' 59" (85.000°)	20,000
33551	Ghodaghodi Tal	28° 40' 59" (28.683°)	80° 55' 59" (80.933°)	10,000
33552	Phulchoki	27° 37' (27.617°)	85° 16' (85.267°)	15,000
143004	Tambedanda	27° 30' (27.500°)	86° 15' (86.250°)	200
143003	Thodung	27° 10' 13" (27.170°)	88° 7' 18" (88.122°)	5,400
			Total	50,600
Hunting Reserves				
10086	Banke	-	-	51,800
10088	Rasuwa	-	-	10,400
10090	Trijuga	-	-	36,300
			Total	98,500
National Park Extension				
303304	Bardia National Park (altitude 141m-1,156m)	28° 9' 22" (28.156°)	81° 54' 45" (81.913°)	96,200
Source: IUCN World Commission on Protected Areas and the World Database on Protected Areas Consortium				



A wetland area around Koshitappu Wildlife Reserve
(Govinda Joshi)

5

Ramsar Sites

Popularly known as the 'Ramsar Convention', the Convention on Wetlands of International Importance, especially as habitats for waterfowl, is an intergovernmental treaty adopted on 2 February 1971 in the Iranian city of Ramsar on the southern shore of the Caspian Sea. In December 1987, Nepal became the 46th Contracting Party to the treaty by depositing Koshitappu Wetland Wildlife Reserve as the 384th wetland in the Convention List. The Convention on Wetlands came into force in Nepal on April 17, 1988. The three sites in Nepal designated as Wetlands of International Importance on 13 August 2003 are Beeshazar and Associated Lakes in the buffer zone of Chitwan National Park, the World Heritage site Ghodaghodi Lake area in Kailali district, and Jagadishpur Reservoir in Kapilvastu district. These sites are among the 10 wetland sites in the Terai highlighted in the 2002 Nepal Biodiversity Strategy, and recommended as meriting legal protection.

Ghodaghodi Tal Ramsar site

Background

Area: 2,563 ha
Ramsar Site Number 1314, and WDPA
Site code: 901298

Location

Main access is 100m north of the east-west highway in ward 5 of Darakhnidi VDC, Kailali district (**Annex 3**)

Kailali district, encompassing three VDCs: Darakhnidi, Ramsikharjhala, and Sandepani

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
28° 41' 03"	80° 56' 43"	205

Description

The Ghodaghodi Lake area in Western Nepal was declared a Ramsar site in 2003. It consists of a large and shallow oxbow lake system with associated marshes and meadows surrounded by tropical deciduous forest on the lower slopes of the Siwaliks, the youngest mountain range of the Himalayas. There are around 13 associated lakes and ponds, and some streams separated by hillocks situated along the site's periphery.

The forest and wetlands serve as a wildlife corridor between the lowlands and the Siwalik Hills. They support critically endangered species including the Red-crowned roofed turtle (*Kachuga kachuga*), Bengal tiger (*Panthera tigris*), and Three-striped toofed turtle (*Kachuga dhongka*). Vulnerable species include the Smooth-coated otter (*Lutra perspicillata*), common otter (*Lutra lutra*), Swamp deer (*Cervus duvaucelli*), Lesser adjutant stork (*Leptotilos javanicus*), and Marsh crocodile (*Crocodylus palustris*). Endangered plant species include the Orchid (*Aerides odorata*), the religiously important and threatened Lotus (*Nelumbo nucifera*), and rare wild rice (*Hygrohiza aristata*).

The lake is fed by direct precipitation during the monsoon season, and by surface flows from the watershed area, ground water springs, and small streams. Water depth varies from 1-4m. Secchi depth transparency and high phosphor levels indicate that the lake is hypertrophic, nitrogen level eutrophic, and Chlorophyll 'A' level low (due to rich growth of macrophytes) as oligo to mesotrophic. Dissolved oxygen is low with a minimum of 3 to 5 mg/l.

The Lake is an important religious shrine dedicated to the Ghodaghodi deity. The indigenous Tharu community celebrates a traditional festival, 'Agan Panchami', in December with a cleansing dip in this holy lake. The 6,700-strong population within the site, of which 50% are migrants from adjoining hilly areas, are dependent on the lake for traditional fishing and agriculture.

The factors exerting undue pressure on the site's ecology include highway traffic at the southern edge, construction of new unplanned temples in the vicinity, over grazing, poaching and hunting, as well as illegal tree felling and smuggling of Sal (*Shorea robusta*) and Khair (*Acacia catechu*) timber, and natural eutrophication accelerated by human religious and agricultural activities.

The Department of Forests is the principal management authority of the area, and the Kailali District Forest Office manages the area. Local communities and NGOs support the conservation process by forming themselves into and operating user groups. A participatory community-centered management plan has been prepared for the conservation of the Lake area. Community-based anti-poaching operations help reduce poaching in the Lake area.

Significance

The biological aspects of Ghodaghodi Tal Ramsar site cover species and habitat including ecosystem description, conservation, and management.

Flora

- Ninety-eight percent (98%) of the area is dense forest and 2% pastureland
- Native aquatic plants adaptable to the unique physiological conditions of the area include the Water primrose (*Ludwigia adscendens*) and Bladderwort (*Utricularia australis*)
- The floating vegetation in the Lake provides an excellent habitat for waterhens and jacanas; the surrounding dense forest for birds of prey including the rare osprey (*Pandion haliaetus*), and kingfisher
- Biogeographically significant as representatives of the Indo Malayan realm are Sal (*Shorea robusta*) and Myrobalan trees (*Terminalia alata*)

- Threatened plant species include the endangered Orchid (*Aerides odorata*), the religiously important and threatened Lotus (*Nelumbo nucifera*), and rare wild rice (*Hydrochiza aristata*)
- The Lake has records of 388 vascular plants: five pteridophytes, 253 dicots, and 130 monocots (**Annex 1.9.17**)

Fauna

- The fauna consists of lower risk species on the **IUCN Red List** such as the Ferruginous duck (*Aythya nyroca*), Grey-headed fish eagle (*Ichthyophaga ichthyaetus*), and Asiatic rock python (*Python molurus*); other rare species include the lizard (*Varanus flavescens*)
- Records reflect 29 fish species in the area, including the threatened *Puntius chola*, and the locally endemic Asian knifefish (*Notopterus notopterus*), and cold water fish (*Oxygaster bacaila*)
- Around 140 partly migrating bird species representing over 16% of the national avifauna inhabit the area
- Also home to an estimated 1% of the South Asian cotton teal (*Nettapus coromandelianus*) population in Nepal and supports a large population of Marsh mugger crocodiles (*Crocodylus palustris*)
- Bird species symbolic of the area include the Grey hornbill (*Ocyrceros birostris*), Eurasian eagle owl (*Bubo bubo*), Brown fish owl (*Ketupa zeylonensis*), and Osprey (*Pandion haliaetus*)
- The area supports numerous globally threatened species (IUCN 2002) including the critically endangered Red-crowned roofed turtle (*Kachuga kachuga*), Bengal tiger (*Panthera tigris*), leopard (*Panthera pardus*), Three-striped and roof turtle (*Kachuga dhongka*), the vulnerable Smooth-coated otter (*Lutra periscillata*), Common otter (*Lutra lutra*), Lesser adjutant stork (*Leptotilos javanicus*), and Marsh crocodile (*Crocodylus palustris*)
- A crucial point in the ecosystem as a waterhole for all kinds of wild life
- Evidence of gharials (*Gavialis gangeticus*) reported in the area (BPP 1995)
- Current checklists include species of 34 mammals, 96 birds, nine herpeto, and 23 fish (**Annex 2.27**)

Achievements

- Preparation of a participatory community-centered conservation management plan with the joint efforts of IUCN and 'Ghodaghodi Kshetra Samrakshan Tatha Bikas Samiti' (Ghodaghodi Area Conservation and Development Committee)
- Selected as a demonstration site by IUCN-Nepal for research and monitoring
- Proposed as a conservation or bird sanctuary and wildlife reserve
- User groups have been formed through the initiative of local NGOs
- Over 16 community-based organisations are active in area
- Three wetland clubs have been formed in three local schools around Ghodaghodi Lake in 2007: Dasarath Secondary School, Sitakunda Secondary School, and Rastriya School; each club consists of 15 committee members from Grades 5 to 9

Jagdishpur Reservoir Ramsar site

Background

Area 225 ha
Ramsar site number 1315, and WDPA
Site code: 901299

Location

10 km south of east-west highway in Ward 9 of Jagdishpur VDC, Kapilvastu district (Annex 3)
Kapilavastu district encompassing one VDC (Jagdishpur VDC)

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 35' 00"	83° 05' 00"	197

Description

Jagdishpur Reservoir was declared a Ramsar site on 13 August 2003, and is also highlighted in the Directory of Asian Wetlands. The reservoir was constructed in the early 1970s over Jakhira Lake and agricultural land for irrigation, and is fed by the Banganga River in the Churia hills catchment area. It is surrounded by cultivated land and a few smaller lakes serving as a buffer zone for bird movement. Reservoir depth varies between 2 and 7m during the summer and winter crop plantation periods, respectively. Silt and nutrients from the inlet are deposited in the reservoir delta; the resulting reed

growth provides a secure habitat for water birds. Secchi disc and phosphorus content indicate that the water is hypertrophic, and the nitrogen concentration eutrophic. Chlorophyll 'A' content of the surface water is low (3-5 mg/l) indicating oligotrophy due to a rich macrophytes growth.

The site provides shelter for an assembly of rare and endangered species of conservation importance, including plants such as the endangered *Serpentina* (*Rauvolfia serpentina*), rare Pondweed (*Potamogeton lucens*), threatened Lotus (*Nelumbo nucifera*), and the endangered tallest flying bird species, the Sarus crane (*Grus antigone*).

Authorities in the Department of Irrigation, Kapilvastu District Office are responsible for the management of the irrigation system. The external forest area is managed by the District Forest Office with the help of the local community. Conservation measures include green belt plantations around the reservoir, maintenance of the water level by a dike and a sluice, as well as construction of an irrigation canal.

Current uses of the reservoir and adjacent areas include fishing, grazing, fuel wood and fodder collection, domestic use of the Reservoir such as for laundry, and harvesting of wetland products. The area is also popular for picnics, swimming, boating, bathing, and other forms of recreation and supplies water for irrigation in 6,200 ha of surrounding cultivated land. The water body has great potential for commercial stocking and production of fish. Surrounding areas are primarily used for farming. The site has been proposed as a designated bird sanctuary.

Significance

Biological aspects of the Reservoir cover species and habitat, including ecosystem conservation and management.

Flora

- The vegetation is primarily in a submerged succession stage, with patches of floating species and reed swamp formations; marsh meadows and extensive mudflats constitute the northern part the Lake
- The terrestrial vegetation along the dike is dominated by Sisoo (*Dalbergia sisoo*) and khair (*Acacia catechu*)
- Wetland vegetation consists of Morning glory (*Ipomea carnea* ssp. *fistulosa*), and cattail (*Typha angustifolia*)

- The Reservoir's aquatic vegetation is represented by extensive coverage of floating leaf species, mainly lotus (*Nelumbo nucifera*), followed by wild rice (*Hygrorhiza aristata*), and pondweed (*Potamogeton nodosus*); free floating species include Water velvet (*Azolla imbricata*) and Duckweed (*Lemna* spp.)
- Abundant submerged species include the water nymph (*Naja minor*), hydrilla (*Hydrilla verticillata*), and hornwort (*Ceratophyllum demersum*)
- Records of 16 vascular plants in the area: one pteridophyte, seven dicots, and eight monocots (**Annex 1.9.18**)

Fauna

- Twenty-five fish species belonging to 12 families and seven orders including the lowland Terai endemics such as *Notopterus notopterus* and *Oxygaster bacaila*, threatened species such as the *Puntius chola* as well as common species are recorded, and are prey to waders and waterbirds
- Records of 45 species of birds from the Reservoir and surroundings, including from the smaller lakes, such as Sagarhawa and Niglihawa, that serve as a buffer zone for bird movements
- The site provides vital resident, wintering, and stopover habitats for waders, other waterbirds, and small passerines; noteworthy species are Grebes (*Podiceps cristatus*, *Tachybaptus ruficollis*), cormorants (*Phalacrocorax carbo*, *Phalacrocorax niger*), herons (*Ardea* species), and egrets including the rare bittern *Ixobrychus cinensis*, storks (*Ciconia* species), ducks (*Aythya* species), and geese, terns and gulls, birds of prey; rails, coot and waterhens, Jacanas, as well as cranes and kingfishers
- Resident stork species (*Anastomus oscitans* and *Ciconia episcopus*) are recommended for protection because of their susceptibility to endangerment through impacts of human activities
- Because of its position surrounded by cultivated land and its moderate size, the site is not suitable for large mammal conservation; the area does, however have immense potential to support a small population of Smooth-coated otter (*Lutrogale perspicillata*,) and other common species such as the Jungle cat (*Felis chaus*), Golden jackal (*Canis aureus*), and Indian fox (*Vulpes bengalensis*)

- Nine species of reptiles are presumed to be residents in the area; the Marsh mugger (*Crocodylus palustris*) is nonresident, entering the reservoir only during the monsoon
- The site is visited by a large number of wintering and staging waterfowls and provides excellent foraging habitat for both resident and migratory bird species
- Bird species symbolic of the area are the Falcated duck, Mallard, Tufted duck, and Red-crested pochard
- Current checklists include six mammal, 45 bird, nine herpeto and 18 fish species (**Annex 2.28**)

Achievements

- Sustainable wetland management strategy for wildlife and humans evaluated and approved by the Ramsar Small Grants Fund for Wetland Conservation and Wise Use in 2006 (http://www.ramsar.org/sgf/key_sgf06.htm)

Beeshazar and Associated Lakes Ramsar site

Background

Area: 3200 ha

Ramsar site number 1313, and WDPA

Site code: 901297

Location

8 km south from Tikauli on the east-west highway in Gitanagar VDC (**Annex 3**)

Chitwan district encompassing two municipalities, Bharatpur and Ratnanagar, and two VDCs, Gitanagar and Bachhauli

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 37' 05"	84° 26' 11"	286

Description

Beeshazar and Associated Lakes, also known as Bishazari Tal, was declared a Ramsar site on 13 August 2003. It forms an extensive, typical oxbow lake system of the tropical Inner Terai area in Central Nepal within the buffer zone of the Chitwan National Park, a World Heritage site. Water is received from direct precipitation during the monsoon and through inflow from the Khageri irrigation canal. Lake water is supplied through the canal and the stream during the dry season. The catchment area of the Lake helps control flooding in the Khageri River, and recharges the ground water and streams.

Situated between the Mahabharat mountain range to the north and the Siwalik range to the south, this forested wetland provides excellent habitat as a waterhole and corridor for numerous endangered wildlife species that include the critically endangered White-rumped vulture (*Gyps bengalensis*), Bengal tiger (*Panthera tigris*), one-horned rhinoceros (*Rhinoceros unicornis*), and gharial (*Gavialis gangeticus*); and the vulnerable Smooth-coated otter (*Lutra perspicillata*), Sloth bear (*Melalurus ursinus*), Marsh crocodile (*Crocodylus palustris*), Lesser adjutant stork (*Leptotilos javanicus*), Ferruginous duck (*Aythya nyroca*), and Band-tailed fish eagle (*Haileetus leucoryphus*).

The lake bed is situated on laterite soil. Its oligotrophic state is indicated by the low content of Chlorophyll 'A' due to the rich growth of macrophytes; this prevents the penetration of sunlight needed for photosynthesis. However, with respect to nutrient content and Sechi depth, and based on a one-time analysis during the summer season the Lake is considered to be eutrophic to hypertrophic.

The surrounding forest area is home to an estimated 100,000 people who farm and fish in the lake and surrounding areas through a grant of annual fishing contracts. A buffer zone management committee has been formed for participatory management of the area. Local NGOs, the Nepal Army, and volunteers have periodically removed invasive weeds such as water hyacinth and water chestnut manually from the water body.

Significance

Biological aspects cover species and habitat, including ecosystem description, conservation, and management.

Flora

- Land use patterns in the total wetlands site area include 30% open forests, 40% dense forests, 15% grass lands, and 15% pasturelands
- Sal dominated forests exist in the surrounding areas of the lake; prominent associated species include the Myrobalan (*Terminalia alata*), Silk cotton (*Bombax ceiba*), and Bot dhainyaro (*Lagerstroemia parviflora*)

- Wetland vegetation of the area includes sedge (*Cyperus* spp.), Common reed (*Phragmites karka*), and Morning glory (*Ipomea carnea* ssp. *fistulosa*)
- The aquatic vegetation is represented by extensive coverage of floating leafed species, primarily water hyacinth (*Eichhornia crassipes*), water chestnut (*Trapa quadrispinosa*), and Evening primrose (*Ludwigia adscendens*)
- Free floating species include the Water velvet (*Azolla imbricate*) and duckweed (*Lemna* spp.)
- Abundant submerged species include the Hornwort (*Ceratophyllum demersum*), Hydrilla (*Hydrilla verticillata*), and water nymph (*Najas minor*)
- The area records 37 vascular plants: one pteridophyte, 26 dicots, and 10 monocots (**Annex 1.9.19**)

Fauna

- The area records 21 species of mammals, of which four are considered threatened, and one is protected
- An important waterhole for wildlife species such as the tiger, rhinoceros (*Rhinoceros unicornis*), among others
- Thirteen species of reptiles are assumed to be in the area, including two endangered species
- Records of 273 bird species of 61 families, of which 60 are wetland species
- Bird species include the Grey heron (*Ardea cinerea*), Large cormorant (*Phalacrocorax carbo*), Darter (*Anhinga melanogaster*), Stork-billed kingfisher (*Halcyon capensis*), Ferruginous duck (*Aythya nyroca*), Painted



Beeshazar Tal, Chitwan

stork (*Mycteria leucocephala*), Black-necked stork (*Ephippiorhynchus asiaticus*), Indian black vulture (*Sarcogyps calvus*), Black vulture (*Aegypius monachus*), Grey-headed fishing eagle (*Ichthyophaga ichthyaetus*), Black-bellied tern (*Sterna acuticauda*), and Great hornbill (*Buceros bicornis*)

- Records of 17 fish species in Beeshazar include the threatened *Puntius chola*, and the endemic Asian knifefish, and Common water fish (*Oxygaster bacaila*)
- The site supports an estimated 20 Marsh crocodiles (*Crocodylus palustris*), the largest number of these animals in a single group in Nepal
- Tikauli forest serves as a critical corridor and refuge for wildlife migrations from the Churia to the Mahabharat foothills
- Current checklists include 26 mammal, 271 bird, 18 herpeto and 25 fish species (**Annex 2.29**)

Achievements

- Included in the buffer zone of Chitwan National Park in 1996
- Selected as a priority learning site for the Protected Areas Learning Network (PALNet) promoted by DNPWC, IUCN, WWF and other conservation organisations
- Local conservation organisations have mobilised significant numbers of the labour force in the area to remove aquatic weeds such as *Eichhornia crassipes*, *Trapa quadrispinosa*, and *Cyperus* species in 2004 and 2005
- Highlighted in the current Management Plan of Chitwan National Park and Buffer Zone (2006-2010)

Koshitappu Wildlife Reserve Ramsar site

Background

Area 17,500 ha

Ramsar site number 380 WDPA

Site code: 14196

Location

2.5 km north from Jamuha on the east-west highway (east of the Sapta Koshi barrage); the headquarters of the Ramsar site is located at at Kusaha of Sunsari district (**Annex 3**)

Sunsari, Saptari, and Udaypur districts, with 16 VDCs in the buffer zone (DNPWC 2002b)

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
26° 33' 00" – 26° 42' 00"	86° 54' 36" – 87° 03' 36"	75-81

Description

The Koshitappu Wildlife Reserve was designated as a Ramsar site on 17 December 1987. The Reserve is a section of the Sapta Kosi River and floodplain, of extensive mudflats, reed beds, and freshwater marshes. It is rectangular and formed by the Koshi barrage near Nepal-India border on the east-west highway.

An important staging area for water birds, the site supports several species of notable birds including the Large adjutant stork (*Leptoptilos dubius*), Pallas's fish eagle (*Haliaeetus leucoryphus*), Common golden-eye (*Bucephala clangula*) and Gull-billed tern (*Gelochelidon nilotica*). Notable mammals such as the wild water buffalo (*Bubalus arnee*), and the Gangetic dolphin (*Platanista gangetica*) inhabit the Reserve. Located in a densely populated area, the site is subjected to severe livestock grazing, and attempts by local communities to re-establish their roots in the reserve. Land use in the surrounding areas includes subsistence fishing and rice cultivation.

A buffer zone management committee has been formed with user committees and user groups from 10,693 households following the designation of buffer zone areas in 2004. A management plan has been prepared for Koshitappu Wildlife Reserve, and the buffer zone authorisation process is underway.



Rat snakes (*Elaphe obsoleta*) mating, Koshitappu Wildlife Reserve

Other priority wetland sites

Wetland sites account for only 5% of Nepal's total surface area, but contain biodiversity of immense global significance. In 1998, IUCN Nepal prepared a list of 163 wetlands of Nepal based on surveys conducted between 1993 and 1996 as well as upon secondary sources (Table 28).

Wetland	FDR	MDR	WDR	CDR	EDR	Total
Lakes	40	5	17	13	3	78
Marshes	2	1	3	7	-	13
Swamps	5	-	-	-	-	5
Floodplains	15	6	10	12	10	53
Reservoirs	-	-	3	2	1	6
Canals	-	-	1	3	4	8
Total	62	12	34	37	18	163

Source: National Wetland Database, IUCN Nepal as cited in Bhandari, B. (compiled) 1998

Terai wetlands

The BPP in 1995 recorded that 36 of the 51 wetlands in the Terai are biologically significant, and that 10 specific sites merit legal protection. The **2002 Nepal Biodiversity Strategy** also highlighted the 10 sites meriting legal protection. Of the 10 priority wetland sites, three were designated as Ramsar sites in 2003. The remaining seven sites are Bedkot Tal, Padereni Tal, Deukhuria Tal, Rampur Tal, Nakhrodi Tal, Badhaiya Tal and Gaundahawa Tal. Details of these sites follow.

Bedkot Tal

Area 5 ha

Location

Chhela Bagon Ward 5 of Daiji VDC,
23 km north of Mahendranagar,
Kanchanpur

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
29° 01' 26"	80° 19' 05"	407

Background

Bedkot Tal is a small (approximately 10m deep) freshwater lake. Before the construction of the East-West Highway, Bedkot was an important exit point to India for Nepali hill people. It is a scenic lake of exceptional genetic and ecological diversity and is situated on a hilltop in the middle of a dense Sal forest.

Significance

Flora

Lake vegetation is rich in plant species. The Lake is situated in the Churia/Siwalik mountain range surrounded by dense Sal forests covered by heavy growth of lianas, and dense undergrowth beneath the heavy forest canopy. Lake vegetation includes duck weeds and pond weeds *Lemna minor*, *Wolffia globosa*, and *Spirodela polyrhiza* of the free floating community; aquatic grasses and pond weeds, *Vallisneria natans*, *Zannichellia palustris*, *Hydrilla verticillata*, *Potamogeton* spp. and *Ottelia alismoides* of the submergent community; *Nymphaea stellata* and *Potamogeton* spp. of the rooted floating community; *Typha angustifolia* and *Acorus calamus* of the emergent community and *Colocasia falax*, *Ranunculus* species, *Crinum amoenum* of the surrounding marsh community. A few *Salix tetrasperma* trees are found on the Lake's northern marshy shore.

Fauna

The surrounding forests are renown for their rich mammalian fauna, with 21 species recorded to date, including threatened species such as the Dhole (*Cuon alpinus*), a species of wild dogs; sloth bear (*Ursus ursinus*), the Asiatic black bear (*Ursus thibetanus*), Bengal fox (*Vulpes benghalensis*), and Himalayan ghoral (*Naemorhedus sumatranensis*). Mammals especially dependent on wetlands are the wild ungulates: Axis deer (*Axis axis*), the Indian sambar (*Cervus unicolor*), Barking deer (*Muntias muntjak*), and predators including the tiger. The Lake is of minimal importance as a resident, staging, or wintering area for waterfowl. Of the recorded species, the goose (*Tachybaptus ruficollis*) and Black stork (*Ciconia nigra*) are noteworthy. The Lake is rich in herpetofauna, and is also thought to support a population of marsh crocodiles (*Crocodylus palustris*); two dead specimens have been collected in the past. Three species of fresh-water turtle have also been recorded.

Padereni Tal

Area 15 ha

Location

Bani, Ward 2 of Krishnapur VDC,
Kanchanpur district, 11 km west of Atariya

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
28° 51' 09"	80° 25' 32"	205

Background

Padereni Tal is a large, shallow eutrophic oxbow lake (1-3m deep) formed by the Donda River. It is surrounded with Syzigium forests and supports a small number of resident and migratory waterfowl.

Significance**Flora**

The Lake's vegetation is not rich in species diversity, but is densely covered with free floating *Azolla imbricata* and *Pistia stratioides*, and submerged plants *Hydrilla verticillata* and *Nymphoides indica*. Emergent plants are rich with marsh species such as *Schoenoplectus* spp, *Cyperus diffusus*, *Typha angustifolia*, *Oedogonium cardiacum* and *Spirogyra affinis*. The marsh community is represented by patches of Narrow leaf cattail (*Typha angustifolia*) and water vines, and knot-weed (*Polygonum*) species. The Lake is set in an area of dense Sal and moist Syzigium forest with thick lianas and dense undergrowth. Diversity is maintained by a large reed bed covered island (*Phragmites karka*), tall grasses (*Saccharum spontaneum*), and *Salix tetrasperma* trees.

Fauna

The Lake is a wintering area for sizeable numbers of various species of waterfowl and provides a staging area for many species during migration. Resident bird species include egrets *Bubulcus ibis*, *Egretta alba*, *Pseudibis papillosa*, *Ardea purpurea*, *Nettapus coromandelianus*, and *Francolinus pondicerianus*. Passage migrants and winter visitors include the *Anas penelope*, *A. crecca* and *Vanellus vanellus*. Regular visitors include the *Leptoptilus javanicus* and *Ciconia episcopus*. The wetland has a sizeable 20 ha area of grassland which provides excellent habitat for *Houbaropsis bengalensis*, *Sypheotidus indica* and other grassland birds. The Lake is known to support a population of marsh crocodiles (status unknown), Monitor lizards, and pythons.

Deukhuria Tal

Area 22 ha

Location

Ward 7 of Dhangadi municipality area in Kailali district

Coordinates

Latitude (North)	Longitude (East)	Altitudes (metre)
28° 42' 38"	80° 37' 32"	140

Background

Deukhuria Tal is a large, 1.5m shallow, eutrophic rainfed lake set in a scenic environment, a particularly good example of an oxbow ecosystem supporting an appreciable assemblage of the rare Knob-billed duck (*Sarkidiornis melanotos*), and vulnerable and endangered wildlife species.

Significance**Flora**

Lake vegetation is not particularly rich in plant species, and is surrounded by degraded Sal forests associated with *Mallotus philippensis*, *Terminalia alata*, and *T. bellirica* on its southern side, and moist mixed Syzigium forest (*Syzigium cumini*, *S.jambos*, *Adina cordifolia*) on its eastern side. The Lake has some free floating plant species (*Eichornia crassipes* and *Azolla imbricata*), and submerged species like *Ceratophyllum demersum*, *Chara fragilis*, and *Hydrilla verticillata* at its margins. Emergent and marsh communities are represented by a few species of native plants that thrive in wetlands including the *Schoenoplectus mucronatus* (bog bulrush) and *Ranunculus* (Buttercups, spear worts). The surrounding forest floor and meadows comprise wetland grasses such as *Chrysopogon aciculatus*, *Cynodon dactylon*, and *Vetiveria zizanoides*. Some of the areas are cultivated.

Fauna

The Lake is a wintering area for sizeable numbers of numerous species of waterfowl, and provides a regular staging area for many species during migration. Resident species include the knob-billed duck (*Sarkidiornis melanotos*), Indian pond heron (*Ardeola grayii*), Little egret (*Egretta garzetta*), Bronze-winged Jacana (*Metopidius indicus*) and pheasant-tailed Tacana (*Hydrophasianus chirugus*). Passage migrants and winter visitors include the Sea Kayak (*Anas acuta*) and a number of shorebirds. Seven species of fish have been recorded.

Rampur Tal

Area 22 ha

Location

7 km. south of East-West Highway in Ward 9 of Urma VDC, Kailali District.

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
28° 44' 41"	80° 42' 34"	160

Background

Rampur Tal is a 0-3m shallow, eutrophic oxbow lake. The water level decreases significantly in the Lake during March and April. The site is a medium-sized complex of oxbow lakes set in a scenic environment surrounded by dense Sal forests along most of the lake shoreline.

Significance

Flora

Lake vegetation is medium in species diversity, and is set in an area of dense Sal forests. Associated with Sal are tree species such as the Kamala tree (*Mallotus philippensis*), 'Kadamba' in Hindi (*Adina cordifolia*), Beleric (*Terminalia bellirica*), 'Jamun' (*Syzigium cumini*), and *Terminalia alata* (common timber). The Lake is dominated by the rooted floating lotus varieties such as *Nelumbo nucifera*, *Nymphaea stellata*, *Ludwigia adscendens*; and the free floating *Trapa quadrispinosa*, *Pistia stratioides*, *Azolla imbricate*, and *Spirodela polyrhiza*. It is also rich in submerged plants such as the *Hydrilla verticillata*, *Ceratophyllum demersum* and *Chara fragilis*. The emergent and marsh communities are represented by the *Schoenoplectus mucronatus*, *Ranauculus* species and *Isachne milliacea* species. The surrounding vegetation is rich in reed and other grass species.

Fauna

The Lake is a wintering and staging area for a number of species of waterfowl. Resident species include the Great white egret (*Egretta alba*), *E. intermedia*, Bronze winged Jacana, and pheasant-tailed Tacana. Passage migrants and winter visitors include *Falco severus*. Seven species of fish have been recorded in the area.

Nakhrodi Tal

Area 70 ha

Location

5 km north of the east-west highway, in Ward 8 of Sandepani VDC, Kailali district.

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
28° 42' 06"	80° 57' 33"	205

Background

Nakhrodi Tal is a large, 10m deep, eutrophic oxbow lake with an island in the middle. The Lake is surrounded by dense Sal forests, is fed by precipitation, a few springs, and inflow from Kauwa Khola canal. Average outflow discharge from the lake was estimated to be 50th l/s (3 February 1995). The lake is located some 600 metres north-east of Ghodaghodi Tal and is within the Ghodaghodi lake system cluster.

Significance

Flora

An oxbow lake surrounded by dry Sal forests with spiny shrubs (*Gardenia turgida*, *G. campanulata*, *Zizyphus rugosa*) representing the lower canopy level, lake vegetation is rich and dominated by *Azolla imbricata* and *Pistia stratioides* as the Lake's free floating plant community; *Potamogeton* spp. and *Hydrilla verticillata* as submergent plant community; *Potamogeton nodosus*, *Nymphaea stellata* and *Nymphoides indica* as rooted floating community; and *Oryza rufipogon*, *Phragmites karka*, *Corchorus olitorius*, and *Aechmanthera gossypina* as the marsh community. Patches of *Salix tetrasperma* thickets are found on the northern banks of the Lake.

Fauna

The wetland and surrounding forests are renowned for their rich mammalian fauna. Twenty-one species of mammals have been recorded in the Lake, including threatened species such as the dhole (*Cuon alpinus*), sloth bear (*Ursus ursinus*), otter (*Lutra perspicillata*, *Aonyx cinera*), and Asiatic elephant (*Elephas maximus*). Mammals present in the river especially dependent on the wetland include various wild ungulates and their predators, such as the tiger. The Lake is a wintering area for sizeable numbers of various species of waterfowl and provides a staging area for many species during migration. Resident bird species include the Indian pond heron (*Ardeola grayii*), Great white egret, and heron (*Ardea purpurea*). Passage migrants and winter visitors include swans, ducks, ducks teal (*Anas crecca*).

The Lake is rich in herpetofauna, with 12 recorded species. Incidence of crocodiles (*Crocodylus palustris* and *Gavialis gangeticus*) is presumed but has not been confirmed. Three species of fresh-water turtles have been recorded, as well as the endangered *Python*

molurus and monitor lizard. There is evidence of 20 species of fish including the riverine species, *Glossogobius giurus*.

Badhaiya Tal

Area 105 ha

Location

Wards 1 and 3 of Soraka VDC of Bardia district

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
28° 12' 08"	81° 30' 35"	197

Background

Badhaiya Tal is a shallow, eutrophic rainfed lake that reaches maximum depths of 4m. The Lake is surrounded by rice fields on all sides. It is a large marshy natural depression supporting a large number of resident and wintering populations of several species of waterfowl.

Significance

Flora

Lake vegetation is abundant in diverse rooted floating plants such as the lotus (*Nelumbo*), algae and yellow-green algae (*Spirogyra*, and *Vaucheria*), water primroses (*Ludwigia*), water fern (*Marsilea*), water vine (*Ipomea*), and water lily (*Nymphaea*), and marsh vegetation of weeds (*Persicaris*, *Oryza*, *Ranunculus*, and *Ipomoea*), but have limited free floating plants such as the *Pistia stratiotes* and *Azolla imbricata*; and the submerged *Chara fragilis* and emergent *Colocasia falax*. Adjacent terrestrial vegetation consisting of various meadow species such as the *Lippia nodiflora* (mud grass), *Rumex nepalensis* (broad-leafed dock), and occasional clumps of tall grasses (*Vetiveria zizanioides*, *Saccharum spontaneum*, and *Themeda arundinacea*).

Fauna

The Lake supports a small population of otters and a number of wild ungulates including the Spotted deer, and Indian Sambar or Sambar deer (*Cervus unicolor*) that use the lake as a waterhole. A large variety of waterfowl visit the lake, which offers an excellent foraging habitat for both resident and migratory species. Resident species include the Grey Heron (*Ardea cinerea*), Great white egret, rare birds *E. intermedia*, *E. garzetta*, and the Asian bill stork (*Anastomus*

oscitans). Passage migrants and winter visitors include ducks, geese, swans (*Tadorna ferruginea*), the Eurasian widgeon (*Anas Penelope*), Gadwall (*A. strepera*), a common North American duck; pintail duck (*A. acuta*), Northern shoveler duck (*A. clypeata*), Temminck's Stint (*Calidris temminckii*), a Eurasian-African migratory bird; the Great snipe (*Gallinago gallinago*), pintail snipe (*G. stenura*), Black-tailed Godwit (*Limosa limosa*), the Common redshank (*Tringa tetanus*), marsh sandpiper (*T. stagnatilis*) and wood sandpiper (*T. glareola*). Regular visitors are the Painted stork (*Mycteria leucocephala*), Woolly-necked stork (*Ciconia episcopus*), Common spoon bill (*Platalea leucorodia*), Osprey (*Pandion haliaetus*), and Sarus crane (*Grus antigone*). The Red-necked falcon (*Falco chicquera*) has been sighted and thought to breed in the area. The site is rich in herpetofauna and fish. Eight species of reptile have been reported by the local community, including the protected Monitor lizard. Seven species of fish have also been recorded in the Lake.

Conservation measures required

A concrete dam around the Lake is needed to regulate the outflow from the seven off-takes that irrigate surrounding agricultural land. This embankment should be raised around the Lake to maintain adequate water levels in order to retain water for fisheries, irrigation, and for the enhancement of the habitat for water birds. Afforestation along some banks may reduce the impact of intrusion into this habitat.

Gaindahawa Tal

Area 50 ha

Location

Ward 1 of Bishnupura VDC of Rupandehi district

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 35' 39"	83° 16' 53"	200

Background

Gaindahawa Tal is a shallow (1-4m deep) rain fed ox-bow lake. The Lake's sources of water are an artesian well and surface discharge from the forest. During the rainy season, the Lake's water level is regulated through an irrigation intake structure. Dense forest to the west and

north, private land to the east, and forest areas and settlements to the south surround the Lake.

In 1998/99 IUCN supported the development of a conservation plan for Gaidahawa Lake.

Significance

Flora

A number of free floating weed, grass and plant species (*Eichornia crassipes*, *Azolla imbricata*, *Pistia stratiotes* and *Spirodela polyrhiza*), with submergent species (*Ceratophyllum demersum*, *Alisma plantago-aquatica*, *Ottelia alismoides*), rooted floating species (*Nymphaea*, *Nelumbo*, *Marsilea*, *Ipomoea* and *Ludwigia*), and emergent species (*Ipomoea*, *Carex*, *Schoenoplectus*) comprise the Lake vegetation. The marsh and terrestrial vegetation towards the embankment is dominated by Mother herbs *Vetiveria zizanoides*, *Trema* sp, *Xanthium strumarium*, *Ipomoea carnea*, *Scoparia dulcis*, and *Alternanthera sessilis*.

Fauna

The wetland is an important waterhole for the remnant population of Blue bulls (*Boselaphus tragocamelus*). The ox-bow lake, marshes, adjacent rice fields, and forests support small resident and wintering populations of several species of waterfowl including several egret, heron (*Nettapus coromandelianus*, Sarus crane (*Grus antigone*) and shorebird species. Underwood (1989, p.516) observed 57 *Mycteria leucephala* species (Little blue heron), 20 *Platalea leucorodia* (the Common spoonbill) and 20 *Sarkidiornis melanotos* (Knob-billed duck) in January 1980. The Lake is rich in herpetofauna and fish. Incidence of 10 species of reptile including the endangered Monitor lizard is presumed. Surveillance of the Indian-eyed turtle (*Morenia petersi*) by the BPP team here in January 1995 is the first recorded sighting in Nepal.

Conservation measures required

The local community welcomes the implementation of management schemes to improve the Lake's ecosystem. Local people claim that the hunting of birds is still prevalent. Forest clearance is causing erosion and siltation. Enhancement of the lake area and its environment by improving the regeneration of the forest and limiting the depletion of aquatic vegetation would attract birdwatchers of the Sarus crane (*Grus antigone*)

in particular, to this site. The Lumbini Development Trust has expressed interest in developing the site for conservation and recreation. A study is recommended to assess related potential for tourism.

High-Altitude Wetlands

In 2005, DNPWC and WWF Nepal Program prepared a fact sheet of eight wetland sites including four Ramsar sites. The other four priority sites are from the high altitude region, and located within protected areas. They are the following.

Rara Lake

Area 1061 ha

Location Rara National Park

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
29° 31' 25" – 29° 32' 47"	82° 04' – 82° 07' 30"	2,990

Background

Rara Lake is the largest fresh water lake in Nepal (5.1 km in length, 2.7 km wide, 167m in depth, 140 km in shoreline) and is a unique and rare example of natural wetlands in the high Himalayan biogeographic region. The Lake is rich in nutrient content and transports 1.039km³ of water.

The water has coliforms, which indicates it cannot be used as drinking water without treatment. Suspended solids are higher in the outlet area (263 mg/l) compared to the lake body (<1.0 mg/l), but still substantially lower than the WHO benchmark of 1000 mg/l.

The Thakur Baba Temple is located 500m upwards near the Lake's south-east corner and is linked to a local myth about the Gods shooting an arrow to discharge the Lake's water to reduce potential damage by overflowing. The local community depends minimally on the lake for daily livelihood. The tourism base of the social economy, however, is dependent on the wetlands. Rara has not received more than 200 tourists in any given year and visitors have been on the decline since 1995.

Major threats to the wetland include:

- Overgrazing and erosion
- Unsustainable harvesting of resources including NTFPs
- Pollution due to sedimentation from adjacent hills, discharge of domestic sewage and solid waste, and uncontrolled wallowing of domestic cattle

Rara Lake is situated within the Rara National Park which is managed by the Department of National Parks and Wildlife Conservation. The Lake's buffer zone was declared in 2006. The Nepal Army has been deployed for conservation and protection activities within the Park. The area fulfills the criteria and vision of Ramsar 2006-2008.

Significance

Flora

- Lake margin is surrounded by reeds (*Phragmites*), bushes (*Juncus*), and sedges (*Fimbristylis*)
- Phytoplanktonic algae and aquatic plants are present in the Lake
- Leathery leaves of *Polygonum* form oily floating layers, and sessile plants (*Myriophyllum*) cover the Lake's shallow areas
- Potential endemic species in the catchments are the *Meconopsis regia* (yellow and orange Himalayan poppy), *Primula poluninii* (terrestrial,) and *Cirsium flavisquamatum* (aquatic)
- Based on availability and field assessment, the following Himalayan herbs, *Dactylorhiza hatagirea*, *Nardostachys grandiflora*, and *Neopicrorhiza scrophulariflora* were found to be the most threatened species in the area

Fauna

- Zooplankton is relatively high in Rara Lake (1.62×10^5 ind/m³), which has the potential to support a moderate fish population
- Some groups of zooplankton recorded are the *Chironomid* larvae, aquatic insects (*Diaptomidae*), and mollusks; the Lake has a rich invertebrate aquatic fauna, predaceous water beetle (*Dytiscid*), mayfly (*Ephemeroptera*) and caddis fly larvae. Watershrimp (*Gammarus sp.*), Lumbricolid worms, snail (*Limnea and Planorbis*), and ram's horn (*Planorbis*) are abundant and serve as food for the snow trout and migratory wildfowl

- Of the 235 bird species recorded in the Lake, 49 species are wetland birds; most are migratory
- Of them, the Ruddy shelduck (*Tadorna ferruginea*) is said to breed in Rara Lake
- Coots (*Fulica atra*) are plentiful in the Lake, and several stay throughout the year
- Resident wetland birds such as the Eurasian woodcock (*Scolopax rusticola*), Brown dipper (*Cinclus pallasii*), Little grebe (*Tachybaptus ruficollis*) and Wood snipe (*Gallinago nemoricola*) have been recorded
- The great-crested Grebe (*Podiceps cristatus*) and Black-necked grebe (*Podiceps nigricollis*) are winter visitors presumed to be residing throughout the year round in the Lake
- The common kingfisher (*Alcedo atthis alcedinidae*), crested kingfisher (*Megaceryle lugubris*), Black-crowned night heron (*Nycticorax nycticorax*), and Great cormorant (*Phalacrocorax carbo*) are summer visitors presumed to breed in the Lake
- It is the habitat and resting site of winter visitor water birds such as the Gadwall (*Anis strepera*), Mallard (*Anas platyrhynchos*), Northern shoveler (*Anas clypeata*), common teal (*Anas crecca*), Tufted duck, common Goldeneye (*Bucephala clangula*), common merganser (a large-sized duck), common coot (*Fulica atra*), and Solitary snipe (*Gallinago solitaria solitaria*)
- Fifty Tufted ducks, 200 common coots, 85 great crested grebes, and 15 Black-necked grebes (Scott 1989), 232 representatives of five species of wetland birds were recorded in the Asian waterfowl census 1994
- The globally threatened cheer pheasant (*Catreus wallichii*) is found in the catchment area (Salleri, Lamichur, Bamichur and Rara) in the southern slope of mixed grassland, shrubs, and scattered trees
- Other globally threatened birds such as the Wood snipe (*Gallinago nemoricola*) is thought to be resident in the Lake with status Rare (5% chance-Giri 2005)
- Three endemic species of snow trout (*Schizothorax macrophthalmus*, *S. nepalensis*, *S. raraensis*) are reported in the Lake
- The endemic frog *Paa rarica* is also found in abundance here; the Smooth otter (*Lutra perspicillata*) is the most represented mammal in the Lake
- Other endangered mammals in the catchment area are the Musk deer, Red panda, and Himalayan black bear; Snow

leopards sometimes pass through the upper part of the catchment area through Chuchemara peak

Phoksundo Wetland Series

Area 494 ha

Location

Shey Phoksundo National Park

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
29° 10' 00" – 29° 15' 00"	82° 55' 00" – 83° 00' 00"	3611.5

Background

The Phoksundo Wetland Series is a y-shaped alpine fresh water oligotrophic lake, 5.15 km in length and 800m in breadth. The water volume is 409 million m³, and discharge is 3.715 m³/sec. The Lake drains into Phoksundo River in the south, serving as a freshwater source for the people in the downstream settlements. Sources include several streams including the Sagar, Phoksundo, Chisa, Baulaha, Dekhutaichu, Jagatilumba, and Chollapu.

There are more than 20 'Chortens' (stupas) in the southern belt, and one gomba in the eastern side of the Lake where annual prayers and worship are carried out. Traditional Tibetan culture prevails in upper Dolpo; Buddhism and an ancient Tibetan religion called Bon-Po are prevalent in lower Dolpo, including Ringmo (Tsho) village.

User committees and groups have been formed under the buffer zone program. Amchi groups have been formed to regulate (Tibetan healing) farming, conservation and sustainable use of NTFPs. Local people manage camping sites and home-stay tourism.

Significance

Flora

- About 155 species of flowering plants are found in the catchment
- Threatened species per the IUCN category are the *Neopicrorhiza scrophulariifolia* (VU), *Dactylorhiza hatagirea* *Dioscorea deltoidea* (CT), *Aconitum spicatum* (VU), *Nardostachys grandiflora* (VU), *Podophyllum hexandrum* (VU) and *Megacarpa polyandra* (VU); most of the species are endemic and local only to

Nepal or the Himalayan region and have no equivalent English common names

Fauna

- Wetland birds found in the Lake include the Red-crested pochard (*Rhodonessa rufina*), and Ruddy shelduck (*Tadorna ferruginea*)
- Other wetland birds recorded downstream are the Common moorhen (*Gallinula chloropus*), Common coot (*Fulica atra*), Eurasian wigeon (*Anas Penelope*), and Bar-headed goose (*Anser indicus*)
- Other birds dependent on the Lake's water include the Brown dipper (*Cinclus pallasii*), White-throated dipper (*Cinclus cinclus*), and White-throated redstart (*Phoenicurus schisticeps*)
- The catchment is the winter habitat of the snow leopard and musk deer

Gosainkunda Wetland Series

Area 13.80 ha

Location

Langtang National Park

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
28° 05' 00"	85° 24' 58"	4000 - 4700

Background

Gosainkunda, with its direct reference to saints and wetlands, is an alpine freshwater oligotrophic lake series with alpine meadows, bogs, lakes/ponds, streams, and wet steep slopes creating a unique and representative wetland of high religious significance in the high Himalayan Palearctic biogeographical region. It is one of the world's highest freshwater lake systems, is an important source of water for the Trisuli River that generates 20MW electricity (from two power houses at Trishuli and Devighat). The water volume is 1.472 million m³, and discharge at outlet is 60 l/s; the inlet discharge is 35 l/s.

Hindu mythology attributes Gosainkunda as the abode of Hindu deities Lord Shiva and Goddess Gauri. Hindu scriptures, the Bhagawat and Bishnu Puran, and Hindu epics, Ramayan and Mahabharat, refer to 'Samundra Manthan' (marine exploration) which is directly related to the origin of Gosainkunda. Its holy waters are considered of particular significance during Gangadashahara and 'Janai Purnima' (sacred

thread festival) when thousands of pilgrims from Nepal and India visit the Lake.

The Gosainkunda wetland series falls within Langtang National Park and is managed by the Department of National Parks and Wildlife Conservation, Government of Nepal. The Park management has delineated the Gosainkunda area as a religious site. Animal slaughter, sacrifice, and even grazing in the upper catchment is prohibited. The Gosainkunda Area Management Committee, a registered NGO, oversees overall development and management during festivals, through which sub-committees together with lodge owners are responsible for tourism management. The 'gothalo' (herders) committees are responsible for management of the lower catchment area.

Significance

Flora

- About 100 species of flowering plants have been recorded from the Gosainkunda catchment area
- Also hosts endemic species of plants such as the *Meconopsis dhwojii*, *M.taylorii*, *Heracleum lallii*, *Primula aureata*, *P. sharmae*, *Pedicularis pseudoregeliana*, and *Rhododendron cowanianum*; most of these species are local to Nepal and have no English common name equivalents as yet
- Other threatened species, mostly local to Nepal or the Himalayan region, according to IUCN category are the *Aconitum spicatum* Vulnerable; *Heracleum lallii*, Endangered; *Jurinea dolomiaea*, Near Threatened; *Meconopsis dhwojii*, Near Threatened; *Nardostachys grandiflora*, Vulnerable; *Neopicrorhiza scrophulariifolia*, Vulnerable; *Rheum australe*, Vulnerable; *Rheum moorcroftianum*, Near Threatened; and *Swertia multicaulis*, Data Deficit.
- Gosainkunda is one of the key sites for the collection of type specimens of plants for botanical purposes
- Phytoplankton 1,548 units/ml. (6 m. depth) with higher *Merismopedia* sp. followed by *Chlorobotrys* sp., *Ankistrodsmus* sp., *Dinobryon* sp., *Glenodium* sp., *Aphanotheca* sp., and *Planktosphaeria* sp.

Fauna

- Zooplankton were found 6.4x10⁶ ind./m³ (20m depth) - *Daphnia* sp. 52%, *Cyclops* sp. 35%, and *Napular* larvae of *Cyclops* 11%

- The wetland birds recorded in Gosainkunda include the Brahminy duck (*Tadorna ferruginea*), and common teal (*Anas crecca*)
- Potential wetland birds listed in the area are the Bar-headed goose (*Anser indicus*), Brahminy duck, Common teal (*Anas crecca*), Tufted duck (*Aythya fuligula*), Common merganser (*Mergus merganser*), Northern pintail (*Anas acuta*), and Brown dipper (*Cinclus pallasii*)
- Other birds dependent on water in the catchment area include the Brown dipper (*Cinclus pallasii*), White-capped water redstart (*Chaimarrornis leucocephalus*), and Plumbeous water redstart (*Rhyacornis fuliginosus*);
- The lower section of the catchment is the winter habitat of the red panda and musk deer.

Kyangjing Wetland Series

Area 47,600 ha

Location

Langtang National Park

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
28° 09' 50"	85° 26' 00"	2550

Background

The Kyangjing wetland is an alpine fresh water river and is oligotrophic in nutrient content in its upper part. The Langsisa and Langtang glaciers are the main sources of water; discharge at outlet is 20m³/second. The clean, unpolluted and regular supply of water from the Kyangjing Valley has a high significance for the local communities of Langtang and Syafru VDCs.

The cultural and religious values of wetlands are experienced during the celebration of 'Lhoshar' as well as 'Janai Purnima' festivals. The gomba at Kyangjing is among the sites of religious significance for the Lama and Sherpa communities of Langtang VDC. According to legend, the Langsisa is a symbol of Mila Repa (Guru Padma Sambhava) who had stayed there in the form of a bull. Local people worship the bull shaped stone found in the area. People depend on the wetlands for drinking water, domestic use, grazing, agriculture and other livelihood purposes. Tourism is also dependent on the wetlands.

Major threats to the wetland include:

- Excessive use of timber, fuel wood and non-timber forest products (NTFPs);
- Physical infrastructure development such as hotels, and human induced pollution resulting from tourism;
- Poaching; and
- Overgrazing.

Langtang National Park under the DNPWC/MFSC is the legal authority of the area as governed by the National Parks and Wildlife Conservation Act 1973, and the Himalayan National Parks Regulations 1980. The upper segment of the eastern part of the wetland was identified as a Musk deer (*Moschus chrysogaster*) habitat area; the lower segment as a *Larix (Himalaica)* conservation area. Regulations on the use of timber and firewood have been adopted to control the use of natural resources by the influx of tourists and associated support members (almost 13,000 in 2002), in addition to the residents of the 84 local households. The area is jointly monitored by local communities, park staff and the Nepal Army. The area qualifies in the high altitude wetlands category for its biogeographic criteria as listed by Ramsar Vision 2006-2008.

Significance

Flora

- Most of the lakes have no aquatic vegetation except for phytoplankton and some algae, but ponds near Langtang village support a wide variety of emergent plants
- There are some *Salix* scrubs growing on the riverside in the Langtang 'Khola' (river) valley
- The Park's vegetation is composed of alpine pasture meadows and dwarf rhododendron scrubs associated with a number of medicinal and aromatic plants
- Endemic and threatened species are the *Meconopsis dhwojii*, *Zanthoxylum nepalense*, *Larix potanini* and *Carum carvi*. The *Cordyceps sinensis* (Yarcha gumba) is government protected
- Seventy-eight floral species have been recorded from the catchment

Fauna

- Invertebrates are more numerous in the small ponds near Langtang village and Kyangjing
- Of the 345 bird species recorded in Langtang National Park (Karki and Thapa 2001), seven are wetland birds including wagtails and dippers

- Other birds recorded in the catchment areas are finches, pigeon, monal (*Lophophorus impejanus*), thrush and pipit as well as Himalayan snowcock, Tibetan partridge, and the common quail (*Cortunix cortunix*)
- Mammals found in the catchment include Pika (*Ochotona royle*), Yellow-throated martin (*Martes fluvigula*), Musk deer, and Red panda
- The catchment area is one of the four prime habitats for the Red panda in Langtang National Park (Karki and Zendrovski 2001)
- The endangered Snow leopard has been recorded in the catchment (Chalise and Kyes 2005), along with the Himalayan tahr (*Hemitragus jemlahicus*).

Panch Pokhari Wetlands

Area 4.01 ha

Location

Langtang National Park

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
28° 02' 25" –	85° 24' 58" -	4,039 –
28° 02' 32"	85° 43' 15"	4,069

Background

The 'Panch Pokhari' (Five Lakes) wetlands are a permanent alpine fresh water oligotrophic lake in a small valley surrounded by ridges. They form an important source of water of the Indrawati River, which provides water for the production of electricity at a micro-hydro plant in Tipni Village of Sindhupalchowk district. This area is important for its conservation values related to biodiversity and tourism.

The outlet discharge from Panch Pokhari to Indrawati River is 0.25 m³/second. Hydrological function and values of the wetlands are high for groundwater recharge, flood control, and sediment trapping. It also provides water for wildlife and livestock grazing in the catchment area.

The cultural and religious use of the area is mainly reflected during the Janai Purnima festival in August, when approximately 10,000 pilgrims visit this otherwise deserted site. The temple at Panch Pokhari is revered by all communities and groups. Nomadic groups also depend on the wetlands for drinking water and grazing.

Major threats to the wetland include:

- Over-exploitation of timber, fuel wood and nontimber forest products (NTFPs);

- Poaching of endangered species;
- Water pollution and pollution caused by unmanaged waste;
- Overgrazing leading to changes in floral and faunal composition, and disrupting the natural succession process.

The Langtang National Park under the DNPWC/MFSC is the legal authority of the area as governed by the National Parks and Wildlife Conservation Act 1973, and the 1980 Himalayan National Parks Regulations. Use of NTFPs is permitted for domestic and traditional uses, but banned for commerce. The Park authority is responsible for monitoring the conservation and management of the catchment area. The area fulfills the Ramsar 2006 criteria for inclusion in the list of high altitude wetlands.

Significance

Flora

- Most of the lakes here have no aquatic vegetation except for phytoplankton and some algae
- About 35 plants were recorded in the Panch Pokhari area, with four endemic species
- Catchment vegetation is represented by an alpine pasture meadow and Dwarf rhododendron scrub
- The vegetation is associated with a number of medicinal and aromatic plants; some endemic and threatened species such as the *Meconopsis dhowji*, *Berberis mucrifolia* (barberry), *Carum carvi* (caraway seeds, a Himalayan spice), *Corydalis megacalyx* (Himalayan garden plants), and *Cremanthodium nepalense*, *Dactylorhiza hatagirea* (a perennial Himalayan herb with erect leafy stem) have been recorded in the lakes
- Of these species, *Dactylorhiza hatagirea* is a government-protected species

Fauna

- Invertebrates are more numerous in the small ponds near Panch Pokhari
- Of the 345 bird species recorded in Langtang National Park (Karki and Thapa 2001), seven are wetland-dependent

This site is a good habitat for migratory and residential birds and other wildlife species as it is among the less disturbed remote areas; the main species include the White-winged Redstart (*Phoenicurus erythrogaster*), Ibisbill

(*Ibidorhyncha struthersii*), Yellow-billed Chough (*Pyrrhocorax graculus*), Tibetan snowcock (*Tetraogallus tibetanus*), Brandt's Mountain Finch (*Leucosticte brandti*), amongst others

- The area is home to endangered species such as the Musk deer (*Moschus chrysogaster*), Snow leopard (*Uncia uncia*), and Red panda (*Ailurus fulgens*)

Gokyo Wetland Series

Area 42.69ha

Location Sagarmatha National park

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 57' 12"	86° 41' 35"	4700 - 5000

Background

Gokyo is an oligotrophic lake series in the Khumbu region. Partially fed by Ngozumpa glacier, it lies at the head of the Dudh Koshi River which descends from the world's 7th highest mountain peak, Cho Oyo, creating a unique and representative wetland in the world's highest freshwater lake system. There are six main lakes in the Gokyo series, of which Thonak Lake (4834m) is the largest, followed by Gokyo. Dudh Koshi is a sub-basin of the Koshi River in Nepal, which feeds the Ganges River basin, safeguarding the livelihood of millions of people downstream.

Gokyo Lake is a sacred site for both Hindus and Buddhists. During Janai Purnima, over 500 Hindus take a dip in the holy waters of the Lake. The site is worshipped as the residing place of 'Nag Devata' (Snake God); a temple of the Hindu deities, Lords Vishnu and Shiva, is situated at the western corner of the lake. The belief that birds and wildlife in the area should not be harmed has traditionally protected fauna.

Gokyo is among the most popular tourist destinations leading towards the Sagarmatha base camp and other areas. Over 7,000 visitors on average visit Gokyo every year.

Gokyo wetland series falls within the Sagarmatha National Park area, and is managed by DNPWC. A buffer zone management committee and user committees and groups have been formed under the buffer

zone programme. Local lodge owners and trekking agencies focus on the site for ecotourism activities.

Significance

Flora

- Over 80 species of flowering plants are recorded from the Gokyo catchment
- The catchment also hosts four endemic species: the *Kobresia fissiglumi* K. *gandakienensis*, *Pedicularis poluninii*, and *P. pseudoregelina*, along with rare and endangered plants, *Neopicrorhiza scrophulariifolia*, *Swertia muticaulis*, *Saussurea gossipiphora*, and *Meconopsis horridula*; most of these species are also local to Nepal and the Himalayan region and have no English equivalent common names

Fauna

- Wetland birds found in Gokyo include the Brahminy (*Tadorna ferruginea*), Eurasian wigeon (*Anas Penelope*), Northern pintail (*Anas acuta*), common pochard (*Aythya ferina*), common coot (*Fulica atra*), Wood snipe (*Gallinago nemoricola*), Eurasian woodcock (*Scolopax rusticola*), and Great crested-grebe (*Podiceps cristatus*)
- The area is also a breeding site of at least six pairs of Brahminy ducks; the lower catchment is the winter habitat of the musk deer

Singjema Wetland Series

Area 25.23 ha

Location Kangchenjunga Conservation Area

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 45' 26"	87° 46' 49"	4,671

Background

Singjema Lake, within which believers claim to see a reflection of their own future and fortune, is an alpine fresh water, oligotrophic lake 835m long, with steep slopes creating a unique and representative wetland in the high Eastern Himalayan eco-region complex. It is an important source of freshwater for the Tamor River, one of the tributaries of the Koshi River in Nepal that feeds into the Gangatic River basin.

Local communities and herders from Tibet attribute Singjema Lake with powers to fulfill wishes. Unmarried women offer prayers to the

Lake in the hope of finding a good husband. Local folklore holds that animal slaughter within the vicinity of the lake angers the deity of the Lake. Hunting is therefore traditionally forbidden in the area, and hunting musk deer in particular is believed to result in loss of social status and property. The Lake is also a source of freshwater for cattle herders and communities downstream.

The Lake falls within the Kangchenjunga Conservation Area (KCA). The KCA Management Council and its associated institutions have been empowered to manage their conservation area. The KCA Management Council has also applied to the Government through the Ministry of Forest and Soil Conservation for community management of KCA. Currently, the Management Council together with user groups, mothers' groups, and sub-committees including the Snow Leopard Conservation Committee, are actively managing the conservation area.

Significance

Flora

- About 32 species of flowering plants have been recorded from the Singjema catchment, including three endemic species of rare, endangered and vulnerable plants; potential endemic plants found in the area include the *Aconitum staintonii* Lauener, Klotz, (*Cotoneaster staintonii*), and Kitam (*Cremanthodium nepalense*)
- Other threatened species according to the IUCN category are *Nardostachys grandiflora* (Vulnerable), *Neopicrorhiza scrophulariifolia* (Vulnerable), *Rheum australe* or Himalayan rhubarb (Vulnerable), and *Swertia multicaulis* (Data Deficit); most of the plants are local to Nepal and the Himalayan region and many have no equivalent English common names yet

Fauna

- The Brahminy duck and common Pochard (*Aythya ferina*) have been recorded from the wetlands of Kangchenjunga Conservation Area, but require further observation in Singjema
- Other birds recorded in the catchment area are the Snow pigeon, White-capped redstart, and finches; the catchment is a Snow leopard habitat; the lower section of the catchment is the winter habitat of the Red panda and Musk deer



एतद् स्थलं लुम्बिनी नगरस्य उत्तरदिशि स्थितं
शिवशंकर-संस्कृतस्य अष्टमस्य शतकस्य अन्तर्गतं
संस्कृतस्य अष्टमस्य शतकस्य अन्तर्गतं अस्ति
एतद् स्थलं लुम्बिनी नगरस्य उत्तरदिशि स्थितं

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CRADLE OF THE BUDDH-BODHISATVA THAT THE BUDDH
MORNING PRINCE CONSORTS HIS BIRTH HERE AND THE
WISDOM OF THE INTERNATIONAL YEAR OF BUDDHISM 1988
FOR NOVEMBER 1988

Lumbini World Heritage Site
(Prajna Regmi)

World Heritage Sites

The Convention concerning the Protection of World Cultural and Natural Heritage was adopted by the Conference of UNESCO in Paris in 1972. Nepal ratified the Convention on 20 June 1978. In the spring of 1979, the government requested UNESCO to assist the Department of Archaeology in preparing the nomination of Kathmandu Valley to the World Heritage List. The nomination proposed was for a single World Heritage Site incorporating seven monument-zones identified as: the Durbar Squares of Kathmandu, Patan, Bhaktapur; the two Buddhist sanctuaries of Swayambhu and Boudhanath; the Hindu pilgrimage sites of Pashupati, and the hilltop Hindu sanctuary of Changunarayan.

Lumbini, the birth place of Lord Buddha

Background

WHS number 666 and
WDPA Site code 900334

Location

22 km west of Siddharthanagar (Bhairahawa) in Rupandehi district (**Annex 3**)

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 28' 08"	83° 16' 34"	86

Area: Under the 1978 Master Plan for the development of the Lumbini area, the Government of Nepal acquired an area of 7.7 km² to restore and develop Lumbini Garden as a core area, along with a 64.5 km² additional adjoining area. The

Lumbini World Heritage site is spatially limited within a 130 by 150m area around the chief archaeological remains that testify the location of the birthplace of Lord Buddha.

The Lumbini Development Area (LDA) includes Tilaurakot (ancient Kapilvastu), Gotihawa, Niglihawa, Sagarhawa, Sisiniyakot, Araurakot, Kudan (Kapilvastu), Devadaha (Rupandehi), Ramgrarn (Nawalparasi), and Lumbini, which are directly or indirectly related to the life and birth of Lord Buddha. LDA is authorised to include other areas as specified by the Government of Nepal by a notification in the *Nepal Gazette*, a government publication.

Description

This property was inscribed as the 666th World Heritage site by the World Heritage Committee's (WHC) 21st session on 6 December 1997 on the basis of criteria (iii)⁹ and (vi)¹⁰.

Siddhartha Gautama, the Lord Buddha, was born in 623 BC in the famous gardens of Lumbini, which soon became a place of pilgrimage. Among the pilgrims was the Indian emperor Ashoka, who erected one of his commemorative pillars there. The site is now being developed as a Buddhist pilgrimage centre, where the archaeological remains associated with the birth of the Lord Buddha form a central feature.

The catchment area of Harhawa River is 21 km². Peak flood discharge is estimated at 160 m³/s; the master plan estimation of the maximum rainfall in 24 hours is assumed to be 360 mm.

⁹ bearing a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared

¹⁰ be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance (the Committee considers that this criterion should justify inclusion in the List only in exceptional circumstances and in conjunction with other criteria cultural or natural);

Box 6 World Heritage Selection Criteria

Until the end of 2004, World Heritage sites were selected on the basis of six cultural and four natural criteria. With the adoption of the revised **Operational Guidelines for the Implementation of the World Heritage Convention**, only one set of ten criteria exists.

	Cultural criteria						Natural criteria			
Operational Guidelines 2002	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(i)	(ii)	(iii)	(iv)
Operational Guidelines 2005	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)

Selection criteria

- i. To represent a masterpiece of human creative genius;
- ii. To exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;
- iii. To bear a unique or at least exceptional testimony to a cultural tradition or to a civilization which is living or which has disappeared;
- iv. To be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;
- v. To be an outstanding example of a traditional human settlement, land-use, or sea-use which is representative of a culture (or cultures), or human interaction with the environment especially when it has become vulnerable under the impact of irreversible change;
- vi. To be directly or tangibly associated with events or living traditions, with ideas, or with beliefs, with artistic and literary works of outstanding universal significance. (The Committee considers that this criterion should preferably be used in conjunction with other criteria);
- vii. To contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance;
- viii. To be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological processes in the development of landforms, or significant geomorphic or physiographic features;
- ix. To be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals;
- x. To contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.

Source: <http://whc.unesco.org/en/criteria/> December 22, 2006



R N Suwal

Blue bull antelope (*Boselaphus tragacamelus*), Lumbini

The river basin is flooded several times each year, and each flooding lasts four to five days. The river develops a typical floodplain 100 to 120m in width, 1 to 2m below the surrounding grounds along the course of the River.

The Telar River flows from east of the sacred gardens. Telar is derived from 'tel' (oil) as water from the River is thought to be oily. The River is a landmark referred to by Chinese travelers as flowing close to the birthplace of Lord Buddha. In addition to the two major streams, Harhawa and Telar rivers, a number of open water bodies are in the surrounding lowland plains.

The type of soil is clayish, permeability is very low, sodium level is high and available phosphorus is very low. The soil is firm and alkalinity level is high.

Significance

The WHC's 21st session held in Naples, Italy from 1-6 December 1997 noted the following:

"The Committee decided to inscribe this site on the basis of criteria (iii) and (vi). As the birthplace of the Lord Buddha, the sacred area of Lumbini is one of the holiest places of one of the world's great religions, and its remains contain important evidence about the nature of Buddhist pilgrimage centers from a very early period.

A Delegate of Thailand declared that apart from Lumbini, there are two other sites closely associated with Buddha which are in the process of preparation to be presented as serial nominations and that he hoped that the Committee would consider them in this context."

The biological significance of Lumbini gardens has been enhanced with the recreation of the wetlands.

Flora

- Habitat inside Lumbini Gardens is mainly grasslands 58.8% (400 ha), forest plantation 40% (270 ha), and open water bodies 1.5% (10 ha)
- The dominant grass species include the *Imperata cylindrica*,

Saccharum bengalensis, *Phragmites karka*, and *Vetivera zizanoides*

- Major wetland plants include the *Vallisneria*, *Hydrilla*, *Potamogeton* (submerged), *Nymphaea*, *Trapa*, *Eichornia* (floating species), and *Scirpus*, *Eleocharis*, *Zizania*, *Typha*, *Polygonum*, *Leersia*, *Ipomea*, and *Oryza rufipogon* as emergent species; *Eichornia* is a problem species in the wetlands of Lumbini
- The remaining tree species in the area include groves of mango (*Mangifera indica*), tamarind (*Pithecellobium dulce*), kapok (*Bombax ceiba*), bel (*Aegle marmelos*), Areca nut (*Areca catechu*), and Sissoo.
- About 370,000 saplings of over 65 species were planted in the area, chiefly Sissoo (*Dalbergia sissoo*); patches of Sal trees (*Shorea robusta*) remain in the east and west monastic complex, presenting a fine example of planted Sal trees and avenues of Kadam (*Anthocephalus cadamba*) and bottle brush (*Callistemon* species) trees along the central canal (Suwal, RN 1999)
- Seventy-two vascular plants have been listed from the available records: 62 dicots, and 10 monocots (**Annex 1.9.20**)

Fauna

- There are four nesting sites of the Sarus crane in Lumbini Gardens: swamp areas adjacent to the Vietnam and Tara monasteries; north of the World Peace stupa (Lumbini Crane Sanctuary); east of the World Peace stupa (Lumbini Crane Sanctuary); and the circular pond in between Hokke Hotel and Sri Lankan Pilgrims' House
- Monitoring of the Sarus crane was initiated in



White-rumped vulture (*Gyps bengalensis*) wings, Lumbini

1988; there are about 100 birds in and around 10 km radius of the Gardens; a high count of 88 individual cranes were recorded during the non-breeding season, along with 25 nesting pairs in 2005

- Lumbini Gardens has become a shelter for the Blue bull antelopes (*Boselaphus tragocamelus*) which graze the surrounding fields

The Blue bulls started colonising Lumbini Gardens in the 1990s. By 1995, their numbers had risen to around 200. Local farmers affected by crop depredation are thought to have poisoned some of these animals between 1996 and 1998 and up to 70 dead antelopes were recorded from the Garden between November and December 1997. The 1997 cold wave that hit the Terai was also contributory to the high death toll among cranes. Five antelopes were translocated to Kusum forest area in Banke district in 1998 with the support of the National Trust for Nature Conservation. Recent records in 2005 indicate the presence of around 50 of these animals in the area.

- Bird species symbolic of the area are the Sarus crane, Large grey-babbler, Rufous-tailed lark, Slender-billed vulture, and Red-headed vulture
- Current checklists include 26 mammal, 207 bird, 39 herpeto and 44 fish species (**Annex 2.30**)

Achievements

- The Lumbini Crane Conservation Centre (LCCC) is a leading environmental organisation involved in the Lumbini development area (LDA). Under a lease agreement between Lumbini Development Trust and the International Crane Foundation in December 1994, LCCC is managing the Lumbini Sarus Crane Sanctuary in a 100 ha land leased for 50 years in the northern block of LDA
- The major activities of LCCC are as follows:
 - Annual counting of Sarus cranes using the roadside survey method since 1988; capacity building of local youths in conservation issues
 - Seasonal survey of vultures and storks using roadside bird survey and sample area survey since 1994; capacity building of local youths in conservation issues
 - Establishment of wetlands in five plots of six ha each; construction of an artesian well, introduction of wild rice broadcast sowing (60 kg of seeds, 12 ha), creation of fenced tree plantation of 3,000 saplings of 22 species in a four ha by 2005
 - Construction of an 8m high watch tower of reinforced cement concrete, 3m by 3m in an area on the south-east corner of the Peace stupa
 - Formation of six users groups with an average of 11 members per group; A total of 70 members represent six settlements in Lumbini, Khudabagar, and Tenuhawa VDCs (Sources: Suwal and Joshi 2003, and Hari Sharan Nepali 'Kazi' September 2005)
- A major environmental undertaking of Lumbini Development Trust and its predecessor, Lumbini Development Committee, is the massive reforestation of the area in the 1970s
- At present, over 100 nursery staff maintain the flowerbeds, gardens, tree nursery, and plantation area; sweepers and cleaners clean the office premises
- The other two major organisations involved in the environmental management of LDA are the Tourism for Rural Poverty Alleviation Project (TRPAP), and the IUCN - the World Conservation Union
- The four major activities promoted by TRPAP are school tree plantation, garbage management, biogas promotion, and district-level participatory tourism development and management planning
- During the five years from 1995 to 1999, IUCN launched a series of conservation activities including the following:
 - Construction of a 1m high and 30m long earthen dike along the Harahawa River; this was later replaced by a 1.5m high brick stone and concrete dam 40m in length, 2m in breadth
 - A tree nursery at Parsa for plantation in wetland and grassland areas
 - Plantation of *Sachharum bengalensis* and over 1,200 saplings of native trees
 - Creation of nature trails and resting places
 - Successful tissue culture of the symbolic Maya Devi Temple Peepal tree (*Ficus religiosa*)

In 2006, the World Heritage Committee

- Endorsed the recommendations of the reactive monitoring mission jointly undertaken by the International Council on Monuments and Sites (ICOMOS) and the World Heritage Centre in November 2005
- Commended the State Party (signatory government, the Government of Nepal) for thorough and action-oriented response to the mission recommendations as well as for the consultative measures undertaken
- Requested the State Party to implement the recommendations of the reactive monitoring mission, and particularly to:
 - Develop an effective management plan
 - Refrain from beginning new activities in Lumbini Gardens prior to completion of the management plan
 - Implement corrective measures on the Maya Devi Temple as indicated in the mission report
 - Survey and monitor ground water levels and movements under and adjacent to the Maya Devi Temple as well as the marker stone maintained *in situ* under the temple to ensure the long-term protection of archaeological remains of such significance
 - Develop non-destructive archaeological strategies to ensure long-term conservation of the vast excavated and unexcavated areas of archaeological significance in and around the property through adequate documentation and monitoring
 - Invite the international community to provide technical and financial support to assist the Government of Nepal in these activities

Chitwan National Park Background

WHS Number 284 and
WDPA site code: 10905

Location

Located in the Rapti Dun Valley, central Nepal, and spread over the districts of Nawalparasi, Chitwan, and Makawanpur; boundaries extend 78 km eastward from the Daune Hills on the west bank of the Narayani River to the Hasta and Dhoram rivers; the Park shares natural boundaries with the Narayani and Rapti rivers to the

north and the Panchnad and Reu rivers and a forest road to the south (**Annex 3**)

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 20' 32" to 27° 41' 23"	83° 52' 40" to 84° 44' 34"	110 to 850

Area

The area of Chitwan National Park was initially only 544 km² in 1973; it was later extended to 932 km² in 1977; Recent data indicate that the CNP area encompasses 1,182km², which is larger by 250 km² than the 932 km² stated in previous calculations of the area.

Description

Chitwan National Park was inscribed as the 284th World Heritage Site by the WHC's 8th session on 2 November 1984 on the basis of criteria (vii), (ix) and (x). The decision of the 8th Session highlights a potential challenge to the Park, and a related precondition thereof:

"The Committee noted that there was only a remote possibility that the proposed pulp mills will be constructed on the Narayani River but requested that the Nepalese authorities keep it informed of any developments in this respect which could affect the Park."

Significance

The committee noted:

"At the foot of the Himalayas, Chitwan is one of the few undisturbed areas of the Terai region which formerly extended over the foothills of India and Nepal, with its very rich flora and fauna. One of the last populations of single-horned Asiatic rhinoceros live in the Park, which is also among the last refuges for the Bengal tiger."

The following observations were made at the time of nomination in 1984:

- Chitwan is the largest and least disturbed examples of natural Sal hill forests and associated communities of the Terai
- The Park is managed to a high standard with professional staff and armed guards
- Collection of thatch in the reserve is controlled and not seen as having a negative impact
- The National Park office addresses the issue of crop damage by wildlife through education and awareness programmes

- Tourism provides a significant economic justification for the Park and facilities developed
- The only major threat to the ecosystem is from the proposed paper/pulp mill upstream along the Narayani River
- The Park's western border is recommended to be extended

Achievements

- DNPWC and NTNC, with the cooperation of UNESCO, IUCN, and the Wildlife Institute of India, conducted a planning workshop titled, 'Enhancing Our Heritage for Monitoring and Managing the Success in World Natural Heritage Sites' on 27-29 November 2001
- DNPWC, with the cooperation of IUCN Nepal, submitted a periodic report as required by Article 29 of the World Heritage Convention in December 2002
- Following the decision of WHC's 26th session, and the invitation of the the Government of Nepal, IUCN carried out a monitoring mission to the site on 16-20 December 2002
- In line with the decisions of the WHC's 26th session held in Suzhou in 2004, DNPWC that year devised a system of controls on the use of the Kasara Bridge, and the system of associated roads to minimise the negative impacts
- Nepal Nature dot Com in cooperation with DNPWC, IUCN, and WWF, carried out a series of observations in CNP and its buffer zone to explore practical solutions to control invasive plants in 2004-2006

Kathmandu Valley Background

WHS Number 121 and
WDPA site code 900068

Location

The central region of Nepal, Kathmandu Valley is the political and administrative capital of the country; the valley is divided into the three districts: Bhaktapur, Kathmandu, and Lalitpur (**Annex 3**)

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 32' 13'' - 27° 49' 10''	85° 11' 31'' - 85° 31' 38''	1330-1350

Description

The Kathmandu Valley was inscribed as the 121st World Heritage Site in 1979 by the WHC's 3rd session based on criteria (iii), (iv) and (vi) for World Heritage sites. At the crossroads of the great civilisations of Asia, Kathmandu Valley has seven groups of Hindu and Buddhist monuments as well as three residential and palace areas of the historical cities of Kathmandu, Patan, and Bhaktapur, and illustrates Nepali art in its prime.

The exceptional architectural design of Kathmandu, Patan, and Bhaktapur is gradually disappearing, giving way to uncontrolled urban development. In 2003, upon examination of the World Heritage Centre and Advisory Bodies mission report and assessment of the loss of World Heritage values in the Kathmandu Valley, the WHC at its 28th session in 2004 reflected whether or not to delete the property from the World Heritage list.

Kathmandu Valley is bowl shaped, with rivers flowing towards the centre and merging with the Bagmati River, which drains out through the Chobar Gorge located to the southwest. It is an oval shaped, flat-bottomed 1350m long basin with inadequate ventilation. Valley cross-section is about 20 km from north to south, and 30 km from east to west. The highest hills surrounding the Valley is Phulchoki (2785m) in the southeast, Shivapuri (2713m) in the north, Chandragiri (2250m) in the southwest, and Nagarjun (2100m) in the western corner. The surrounding hills are covered with shrubs at higher altitudes, with slightly to moderately dense forests in some places.

According to the Tree Improvement and Silvicultural Improvement Project map (2001), the Valley and its surroundings contain six major types of forests. The hilltops are covered with Oak and Blue-pine forests; the lower hills and valley bottom are covered with Chir pine, *Schima*, *Castanopsis*, and other broadleaved forests as follows:

- 4131 - Temperate Mountain Oak forest
- 4221 - Mixed Blue Pine-Oak forest
- 4231 - Lower Temperate Oak forest
- 4235 - East Himalayan Oak-Laurel forest
- 5021 - Chir Pine and Broadleaved forest
- 5033 - *Schima*- *Castanopsis* forest

Kathmandu Valley is known for floral and faunal explorations initiated as early as 1793

(Boxes 6 and 7). A total of 9,512 species of birds have been recorded in the Valley including specimens documented by Brian Houghton Hodgson. This is one of the largest single collections of birds in Asia, and consists of 672 species, of which over 124 were previously unknown to science at the time of classification. Most of the specimens were collected from Kathmandu Valley and the encircling hills, since Hodgson's movement was restricted to the 518 km² of the Valley. His collections also included 903 specimens of mammals from 124 species, of which 87 were resident in Nepal and the remaining 37 from Tibet and India; and 84 reptiles, amphibians and fish, of which the great majority were from Nepal (Cocker, M and Inskipp, C. 1988).

Significance

Cultural heritage is illustrated by seven groups of monuments and buildings which display the full range of historic and artistic achievements for which Kathmandu Valley is

Box 7. History of Floral Explorations in Reference to the Kathmandu Valley

Francis Buchanan, later Hamilton (1802-03), and Nathaniel Wallich (1820-21), conducted scientific floral explorations in the valley. They discovered several species here that were then new to science. Similarly, Captain Lal Dhoj, and Khadananda Sharma carried out a botanical survey of east Nepal in the 1930s.

Institutional efforts in floral survey in Nepal were launched in 1960 by establishing the Department of Medicinal Plants under the Ministry of Forests and Soil Conservation. The adjoining areas of Shivapuri were covered in the Langtang-Birgunj cross-sectional vegetation survey conducted with the support of the Department in 1971 (Kanai, Shakya and Shrestha in Ohashi, H. ed. 1975).

There were notable works that resulted in compilation of local floras relevant to this location. They are:

- 1968 Notes on the Flora of Raj Nikunj (Gokarna forest)
- 1969 Flora of Phulchoki and Godawari
- 1974 Flora of Nagarjun
- 1984 Flora of Kathmandu valley

Source: Shakya, PR (compiler) *Flowering Plant Checklist: Shivapuri National Park*. Kathmandu: Nepal Nature dot Com 2005

Box 8. History of Ornithology in Reference to Kathmandu Valley

The history of ornithology in Nepal was initiated by WJ Kirkpatrick in 1793. Documentation of particular significance was first carried out by Brian Houghton Hodgson during his stay in Kathmandu between 1820 and 1843. Nepali artist Raj Man Singh is credited for the paintings of birds and animals for the scientific works of Hodgson. John Scully first described the specific status of birds in the Kathmandu valley in 1876-1877. These works were continued by Frank Bailey during 1935-38, and Dillon Ripley during 1947-49. Biswomany Biswas and Walter Koelz collected bird specimens in the Kathmandu valley in 1947. Desiree Proud published papers on birds from Gandak-Koshi, and the Kathmandu valley including from 1948-1961. HS Nepali 'Kazi' has been continuing focused study of birds since 1945 till today. Both Robert Flemings Senior, and and Robert Flemings Junior continued the research, and first published the Nepali bird book in 1976.

Source: Nepali, HS and Suwal, Rajendra (Compilers) *Bird Checklist: Shivapuri National Park 2005*

renown worldwide. The seven groups include the Durbar Squares of Hanuman Dhoka (Kathmandu), Patan and Bhaktapur; the Buddhist stupas of Swayambhu and Bauddhanath; and the Hindu temples of Pashupati and Changunarayan.

Of the seven monumental zones, Swayambhu, Pashupati, and Changunarayan are located in natural settings with immense biodiversity. Other areas of natural significance in the Valley are Gokarna, Bajrabarahi, Ranibari, Sallaghari, Bansbari on the valley floor, and Suryavinayak, Nagarkot, Telkot, Shivapuri, Kakani, Nagarjun, Chandaragiri, Hatiban, Godavari and Phulchoki along the valley rim.

An estimated 550 species of birds are found inside Kathmandu Valley. Phulchoki, 20 km southeast of the Valley, alone is the home of 265 species; Godavari, at the bottom of Phulchoki hill, has a total of 100 species. Other sites inside the Valley are Nagarjun, Shivapuri and the wetlands along the banks of Bishnumati, Hanumante, Manohara, and Bagmati rivers, as well as lakes and ponds like Taudaha and Nagdaha.

Major wildlife species found in the forests and marginal lands of the Valley include the common leopard (*Panthera pardus*), wild boar (*Sus scrofa*), Himalayan black bear (*Ursus thibetanus*), pangolin (*Manis* species), Barking deer (*Muntiacus muntjak*), Ghoral (*Naemorhedus goral*), Chittal (*Axis axis*), Rhesus monkey (*Macaca mulatto*), Asamese monkey (*Macaca assamensis*), and Langur (*Semnopithecus entellus*).

Some significant bird species found in the Valley are the Slender-billed scimitar babbler (*Xiphirhynchus superciliosus*), White-gorgetted flycatcher (*Ficedula monileger*), Barred cuckoo-dove (*Macropygia unchall*), Oriental turtle dove (*Streptopelia orientalis*), Spotted dove (*Streptopelia chinensis*), Golden-throated barbet (*Megalaima fraklinii*), Peregrine falcon (*Falco peregrinus*), Dark kites (*Milvus migrans*), Dark-throated thrush (*Turdus ruficollis*), Scaly thrush (*Zoothera dauma*), Nepal kalij pheasant (*Lophura leucomelanos*), Golden oriole (*Oriolus oriolus*), Wedge-tailed green pigeon (*Treron sphenura*), Steppe eagle (*Aquila nipalensis*), Long-legged buzzard (*Buteo rufinus*), Speckled wood pigeon (*Columba hodgsonii*), Long-tailed broad billed (*Psarismomus dalhousiae*), Black tailed godwit (*Limosa limosa*), and dunlin (*Calidris alpina*).

Achievements

- The Department of Archeology gazetted the latest amendments to the monument zone boundaries in November 1998 (UNESCO 2004)
- The Pashupati Area Development Trust was established by an Act of Parliament with absolute authority towards the Pashupati Monument Zone. Community-level committees have been set up in most of the monument zones: the Federation of Swayambhu Management and Conservation, Bhouda Area Development and Conservation Committee, 'Bhouda 'Ghyang Guthi' (Trust), and Changunarayan Community Development Committee (UNESCO 2004)
- In 2006, the World Heritage Committee (WHC) approved the proposed modification to the boundaries of the seven monument zones in Kathmandu Valley as a minor modification in consideration that this reflects the remaining outstanding universal values justified for criteria (iii), (iv) and (vi) from the time of its inscription (UNESCO 2006)

- In 2006, WHC resolved to maintain the Kathmandu Valley on the List of World Heritage in Danger upon examination of the state of conservation reports of properties inscribed on the List of World Heritage in Danger (UNESCO 2006)

Swayambhu Monument Zone Background

WHS Number 121 and WDPA
Site code 900068

Location

The western fringe of the capital city of Kathmandu Valley (**Annex 3**)

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 42' 42" – 27° 43' 04"	85° 17' 03" – 85° 17' 43"	86

Description

The monument zone, as gazette notified in 1978, delineates the entire hill sanctuary including the circumambulatory path as protected areas. This hill automatically became the type locality for 27 flowering species introduced to plant science by Francis Buchanan-Hamilton as early on as 1802. The monument zone, as defined in the nomination documents, repeats the delineation of the gazette notified monument zone.

Following earlier discussions about the identification of a buffer zone around the hill sanctuary, the Swayambhu Conservation Master Plan proposes to incorporate the square of Bhuinkhel into the monument zone. This will delineate a buffer zone extending 150m toward the north, and identify a special review zone with special height restrictions and design guidelines for new constructions (Sangachhe, SB 1997).

Significance

- The Swayambhu area is a type locality for 27 flowering plants discovered by Francis Buchanan-Hamilton in 1802-03. Of these species, most have disappeared from the type locality due to forest depletion, reforestation, and regeneration (Shrestha, TB 1992).
- The dominating tree species of the Swayambhu forests are primarily pine (*Pinus roxburghii*), and chilaune (*Schima wallichii*) *Pyrus pashia* (Indian wild pear) forests are also being identified.

- Records of 109 vascular plants: six gymnosperms, 98 dicots, and five monocots (**Annex 1.9.21**)
- Bird species symbolic of the Swayambhu hillock are the Peregrine falcon (*Falco peregrinus*), Dark kites (*Milvus migrans*), Dark-throated thrush (*Turdus ruficollis*), and Spotted dove (*Streptopelia chinensis*)
- Of the total 64 species of birds reported from this area, 49 are resident birds, three migrants, ten visitors (eight summer visitors, and two winter visitors), and one is resident and winter visitor, the (common kestrel, (*Falco tinnunculus*)
- Three species of birds that are under NRDB Susceptible category are the Slaty-headed parakeet (*Psittacula himalayana*), Rose-ring parakeet (*Psittacula krameri*), and Spotted owl (*Athene brama*); the Slaty-headed parakeet (*Psittacula himalayana*) is included in CITES category II, and the Cattle egret (*Bubulcus ibis*) in CITES category III
- Swayambhu Hill is popularly known as 'Monkey Hill' among tourists for the presence of around 300 Rhesus macaques (*Macaca mulatta*) (Johnson et al. 1988). The macaques sampled from Swayambhu area are seropositive for antibodies to the measles virus (Johnes-Engel et al. 2004).
- Current checklists include species of six mammals and 64 birds (**Annex 2.31**). Of them, the Indian palm-squirrel (*Funambulus palmarum*) was introduced in 1990.

Achievements

- The most significant achievement of the area is the establishment of the Natural History Museum of Nepal in 1975.
- Mr Hari Sharan Nepal Kazi presented nearly 900 specimens of over 650 species of birds in Nepal, and a unique specimen of a two-headed rat snake for the establishment of the museum (Nepali HS 'Kazi' 2006). Later, Fleming, RL Jr. and others also presented bird specimens to the museum .
- The Museum houses an estimated 55,000 biological specimens: over 40,000 zoological specimens (invertebrates and vertebrates), over 9,000 botanical specimens (flowering and nonflowering plants), 100 skeletons, some skins, fossils, rocks, and minerals, plastic and clay models, and wildlife trophies (Shah, KB 2005)
- The Museum is linked with Tribhuvan University's Institute of Science and

Technology; it serves as the CITES scientific authority for fauna in Nepal.

- A Swayambhu Environment Garden (1 ha) has been established under the aegis of the Natural History Museum. The garden consists of 31 species of medicinal plants from various parts of Nepal (**Annex**) (CENEED 2005).
- Monoculture plantation of pine was initiated in 1959 on the southwestern slope of the hill, and later also on the south and southeast slopes.
- Soil conservation activities were also initiated in 1977 to safeguard the slopes from landslides.
- Cleaning-up activities have been launched over the past several years by NGOs and volunteers.
- Recent attractions added to the area include recreation facilities

Pashupati Monument Zone Background

WHS Number 121 and
WDPA site code 900068

Location

Eastern fringe of the capital city of Kathmandu Valley beside the international airport (**Annex 3**)

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 42' 15" –	85° 20' 46"-	1300-1337
27° 42' 55"	85° 22' 30"	

Description

The monument zone, as defined in the World Heritage nomination documents, encloses an area which includes the ancient Newar settlement of Pashupati/Deopatan, and Mrigasthali forest, with the sanctuaries of Guhyeswari, Visvarupa, and Gorakhnath. The northern boundary is formed by the Bagmati River towards the west, including the temple of Rajajesvari but excluding the ritual forest of Bhandarkhal. This monument zone has been gazette notified in accordance with the Pashupati Area Development Trust Act. The boundary lines of the Pashupati development area have been redefined and cover the area of the World Heritage nomination document of 1979 (Sangachhe, SB 1997).

Significance

- Stretching across both banks of the Bagmati River, the area consists of 50.27 ha of forests distributed in three main plots, namely, Shleshmantak (Candy fruit *Coerespondias axilaris*) in the eastern part, Bhandarkhal in the western part, and Umakund and Bankali in the central part. These forests are also type locality for early botanical explorations in Nepal.
- Seventy-four vascular plants have been listed from available records: three gymnosperms, 35 dicots, and 36 monocots (**Annex 1.9.22**)
- The area is well known for a sizeable population (200) of Rhesus macaque (*Macaca mulatta*).
- Bird species symbolic of the area are the Steppe eagle, Long-legged buzzard, Speckled wood pigeon, Oriental turtle dove, and Scaly thrush.
- Current checklists include nine mammals and 63 birds (**Annex 2.32**).

Achievements

- Following the memorandum of understanding signed between Nepal Trust for Nature Conservation (NTNC) and the Pashupati Area Development Trust (PADT) in August 2004, 32 ungulate species have been translocated from NTNC Central Zoo to the newly developed Mrigabatika within the Pashupati Development Area. Of the total numbers, 23 are female and nine are male. Translocated species consist of the Barking deer, Spotted deer, and blackbuck. NTNC Central Zoo provided technical assistance for the animal translocation, while the financial cost of the translocation was borne by PADT. Prior to the translocation, a two-week animal care training programme was organised at the Central Zoo for four PADT staff assigned to look after the translocated animals (KMTNC 2005).
- The Guheshwori wastewater treatment plant (5ha) located at the banks of the Bagmati River on the northeastern part of the Pashupati area consists mainly of grit chambers for screening, an aeration tank with activated sludge, and a settling tank. It treats the wastewater generated by households, industries, and other institutions in Gokarna, Chabahil, Bhoudda, and Jorpati (KMC 2002).

Changunarayan Monument Zone

Background

WHS Number 121 and
WHPA site code 900068

Location

The northeastern part of Kathmandu Valley, about 10 km north of Bhaktapur City, and towering over the international airport (**Annex 3**)

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 42' 30''-	85° 25' 14''-	86
27° 43' 10''	85° 25' 50''	

Description

One of the oldest temples in Kathmandu Valley, Changunarayan Temple is located near Changu village. The temple is believed to have been constructed in the 3rd century. Changunarayan is the name of the Hindu deity, Lord Vishnu. A stone slab discovered in the vicinity of the temple dates to the 5th century, and is the oldest such stone inscription discovered in Nepal.

The monument zone, as defined in the World Heritage nomination documents of 1979, delineates an area that covers the entire hilltop of the sanctuary. The monument zone, as gazetted in 1984, is smaller. Recently the Kathmandu Valley Religious and Cultural Sites Development Project identified a boundary which is smaller than the area defined in the World Heritage nomination documents.

This hill sanctuary is of momentous historic and artistic significance and merits particular care and attention. The temple precinct and the adjoining village are still largely untouched by major changes and encroachments, but recent work to improve the approach through repair and maintenance has included plans for a larger parking lot with shopping facilities near the temple vicinity. Drainage remains another major challenge, and measures need to be taken to prevent contamination of the pond at the entrance of the village. Additions to the temple infrastructure have been controlled by conditions that any additional paving in the temple precinct itself must comply with and continue the original design (Sangachhe, SB 1997).

Significance

- Changunarayan hillock is renowned for the native Champ tree (*Michelia champaca*), from which the local name 'Changu' is derived. Some Champ trees found in the area date back to 100 years old.
- The natural forests are composed of *Schima wallichii*, *Engelhardia spicata*, *Castanopsis tribuloides*, *Alnus nepalensis*, *Rhododendron arboretum*, and *Michelia champaca*. The reforested forest is dominated by pine.
- Records of 21 vascular plants: of which one is gymnosperms, 16 are dicots, and four are monocots (**Annex 1.9.23**)
- Bird species symbolic of the area include the Nepal kalij pheasant, Peregrine falcon, Golden oriole, and Wedge-tailed green pigeon.
- Current checklists include seven mammals and 51 birds (**Annex 2.33**).

Achievements

- The Changunarayan Community Forest User Group manages the 47 ha forest area, of which natural forests of *Schima wallichii* cover 21.25 ha, and pine plantations 15 ha. The user group has also introduced cash crops such as Amriso (*Thaysanolaena maxima*), and cardamom (*Amomum subulatum*) (Changu CFUG 2002).
- Major conservation achievements include plantation of pine and other tree species such as bamboo (*Dendrocalmus species*), Champ (*Michelia champaca*), candy fruit (*Choerospondias axillaris*), and Alder (*Alnus nepalensis*).
- A series of 11 check dams were constructed in 2000 through the joint efforts of the Nepal Heritage Society, the Department of Soil Conservation and Watershed Management, the District Development Committee of Bhaktapur, local residents, and others, to safeguard the hillock from landslides (NHS 2000). A follow up enrichment plantation was also launched in 2006.
- Cleaning-up campaigns, tree tagging, other environmental activities were undertaken by volunteers and local residents in 2001 (JUSAN 2001, and CMZ Management Plan 2001).

Sagarmatha National Park Background

WHS Number 120 and WDPA

Site code: 2007

Location

Lies in Solukhumbu district in the north-eastern region of Nepal; the Park encompasses the upper catchments of the Dudh Koshi River system, which is fan-shaped and forms a distinct geographical unit enclosed on all sides by high mountain ranges; the northern boundary is defined by the main divide of the Great Himalayan Range, which follows the international border with the Tibetan Autonomous Region of China. In the south, the boundary extends almost as far as Monjo on the Dudh Koshi. The 63 settlements within the park are technically excluded as enclaves (**Annex 3**)

Districts

Solukhumbu District of the Sagarmatha Zone

Coordinates

Latitude (North)	Longitude (East)	Altitude (metre)
27° 46' 19" – 27° 06' 45"	86° 30' 53" – 86° 99' 08"	2,845-8,848

Significance

Criteria (vii)

Description

When Sagarmatha National Park (SNP) was inscribed as the 120th World Heritage site by the 3rd session of the World Heritage Committee on 22-26 October 1979, the following remarks were made:

The Sagarmatha is an exceptional area with dramatic mountains, glaciers, and deep valleys dominated by Mount Everest, the highest peak in the world (8,848m). Several rare species, such as the snow leopard and the lesser panda, are found in the Park. The presence of the Sherpas, with their unique culture, adds further interest to this site.

The following observations were also made at the time of nomination:

- Without question, Sagarmatha National Park fills the requirements of C(10) iii "superlative natural phenomena of exceptional natural beauty"

- The area is under professional management with a master plan.
- There are approximately 2,500 Sherpas living within the Park.
- There are six altitudinal vegetation classes in the Park, from oak forest at lower elevations, to lichens and mosses at highest elevations
- The Himalayan zone provides an effective barrier between the Palearctic realm and the Indomalayan realm
- The primary challenge at hand is excessive deforestation

Achievements

Upon discussion with the Government of Nepal, IUCN carried out a monitoring mission to the Sagarmatha National Park and World Heritage site on 21-26 December 2002. Along with other observations, the mission supported the Government of Nepal's intention to nominate an extension to the World Heritage site to include the adjacent Makalu Barun National Park. IUCN also noted the potential establishment of a transboundary World Heritage site with the Chinese side of Sagarmatha (Mt Everest).

As informed by Ministry of Culture, Tourism and Civil Aviation (MOCTCA) to the IUCN mission in December 2002, the Syangboche airstrip extension plan had been put on hold,

and MOCTCA agreed not proceed with the development of the airstrip without DNPWC approval.

In 2004, the WHC:

- Commended the GoN for taking the necessary action to delay the construction of the Syangboche airstrip project, and to remove the equipment and construction materials brought into the Park for the project;
- Requested the State Party to reinforce cooperation with local stakeholders;

In 2006, the World Heritage Committee:

- noted with concern the findings of the joint fact-finding mission of the Department of National Parks and Wildlife Conservation, IUCN-Nepal and WWF-Nepal in relation to the development of the Kongde View Resort within the World Heritage property: the potential negative impacts of this development on the integrity of the property, and the lack of adequate consultation; and
- requested the GoN to submit, at the latest before February 1, 2007, to the World Heritage Centre a report on the outcomes of the court case and the steps it plans to take in relation to the Kongde View Resort in the Sagarmatha National Park for examination by the Committee at its 31st session in 2007.



Dependra Tandukar

The Peacock (*Pavo cristatus*)

Conclusion

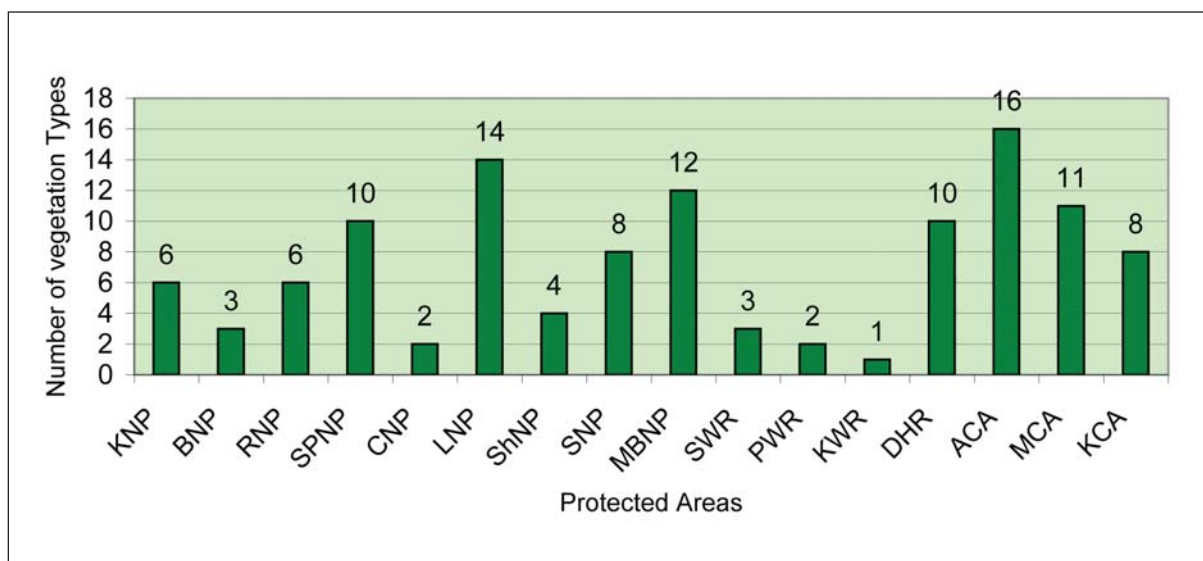
The inventory of Nepal's flora and fauna has been updated using BPN data as benchmarks. Biodiversity assessment has been discussed in **Chapter 3**, supported by relevant references and **Annexes 1 and 2**. Floral and faunal data have been assessed for 23 protected sites which include 16 protected areas, four Ramsar sites, and four World Heritage Sites and monument zones. The assessment focused on higher plants and animals. General checklists of plants and animals of Nepal have been prepared separately (**Annexes 1.2-1.4, 2.1-2.8**).

Vegetation types

Of the 36 types of vegetation as simplified from previous classifications, 31 are represented in 16 protected areas in Nepal: nine national parks, four wildlife/hunting reserves, and three conservation areas. Annapurna Conservation Area contains the highest number of vegetation types found in Nepal (16), followed by Langtang National Park (14), and Makalu-Barun National Park (12) (**Figure 4**).

The five types of vegetation not represented in the 16 protected areas are presented in **Table 29**.

Figure 4: Number of Vegetation Types in Protected Areas

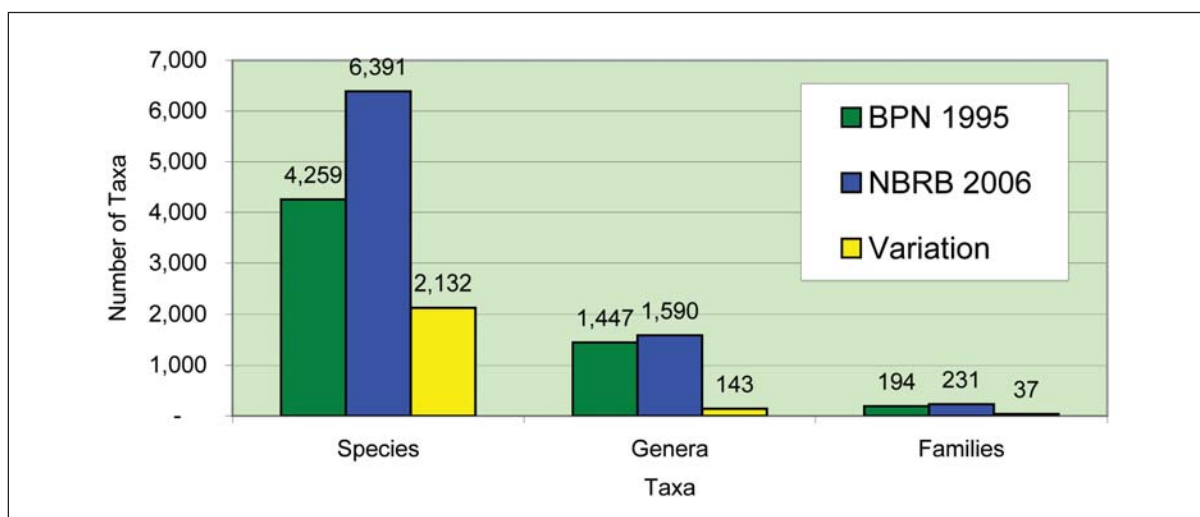


KNP=Kangchenjunga National Park; BNP=Bardia National Park; RNP=Rara National Park; SPNP=Shey-Phoksundo National Park; CNP=Chitwan National Park; LNP=Langtang National Park; ShNP=Shivapuri National Park; MBNP=Makalu-Barun National Park; SWR=Shuklaphanta Wildlife Reserve; PWR=Parsa Wildlife Reserve; KWR=Koshitappu Wildlife Reserve; DHR=Dhorpatan Hunting Reserve; ACA=Annapurna Conservation Area; MCA=Manaslu Conservation Area; KCA=Kangchenjunga Conservation Area; GTRS=Ghodaghodi Tal Ramsar Site; JRRS=Jagdishpur Reservoir Ramsar Site; BTRS= Bishazari Tal Ramsar Site; LWHS=Lumbini World Heritage Site; SWHS=Swayambhu World Heritage Site; PWHS=Pashupati World Heritage Site; CWHW=Changunarayan World Heritage Site

Table 29. Vegetation Types not Represented in the Protected Areas			
Vegetation Types	Altitude	Region	Districts
3222 Fir-Hemlock-Oak Forest	2800m-3300m	West	Sub-alpine mountain areas of Dailekh, Kalikot, Jajarkot, Rukum, Bajhang, Darchula
4132 Lithocarpus forest	2600m-3000m	East	Between Panchthar and Ilam
4133 Rhododendron forest	2600m-3000m	East	Meeting point of Taplejung, Tehrathum and Sankhusabha
4236 Olea forest	1500m-2000m	West	South Dolpa and North Rukum
5034 Eugenia-Ostodes forest	1000m-1700m	East	South-east Ilam

Source: TISC/NARMSAP/MFSC 2002, Annex 1.1

Figure 5. Comparison of Floral Taxa Recorded for BPN and NBY



P. R. Shakya

Cedrus deodara (Roxb. ex D. Don) G. Don, Cedar forest, Tila Valley, 1920m Jumla

Of these, four types grow in the Mid-Hills physiographical region, one can be found in the sub-alpine region, three are local to the eastern phytogeographical region, and two are found in the western region.

Flora Diversity

The total count of flowering plant species recorded from Nepal by 2006 is 6,391, representing 1,590 genera and 231 families. This is a significant increase from the 4,259 species representing 1,447 genera and 194 families recorded in 1995 (Table 30, Figure 5). Detailed checklists are presented in Annex 1.4.

Recent records account that 2.76% of the total number of flowering plant species in the world are found in Nepal. This is an increase

Table 30. Comparison of Number of Taxa Recorded for BPN and NBY			
	BPN 1995	NBY 2006	Variation
Species	4259	6391	2132
Genera	1447	1590	143
Families	194	231	37

Sources: BPP 1995 and Annex 1.4

from the earlier record of 2.36%. Nepal's share of pteridophytes at the global level is 5.15%, an increase from earlier records of 4.45% (Table 8).

Endemic plants

The present number of flowering plant species endemic to Nepal is 399. The 1995 records presented 246, which has been reduced by 40 species possibly due to extinction of eight species and 32 newly reported species elsewhere. In spite of the reduction in recorded numbers, 185 species including infraspecific taxa have been added to the checklist of endemic plants in Nepal, bringing the total to 399. The High Mountain region, with high plant endemism (63%) indicates a more active speciation rate than in the Mid-Hills (38%) and Terai/Siwaliks (6%).

Threatened and protected species

Of the total 6,391 plants in the current Nepal checklist, the 34 species which have been included in the IUCN Red List is approximately only 0.5% of the nation's wealth of flora. This indicates that the plants species found in Nepal appear to be abundant and common.

Seventy-two plant species are commercially important for their biomaterial values. The Government of Nepal has banned the commercial exploitation of 18 plant species including seven species of trees. But the list of plant species in the CITES appendices counts 139 recorded species, of which two are in Appendix I, 132 are in Appendix II, and five in Appendix III.

Species in protected sites

According to the flowering plant checklists records for 2006, there are 2,532 species of vascular plants represented by 1,034 genera and 199 families in the protected sites (Annex 1.9). Of the total 399 endemic species, 130 species are found in the protected sites (Annex 1.5.1). Variations in records may be due primarily to varied intensity of floral explorations in the given sites.

On average, there are 40% more records of flowering plant species in the **Nepal Biodiversity Resource Book** than in **Biodiversity Profile Nepal** (BPN) estimates for the protected areas. The Shuklaphanta Wildlife Reserve records are over two times the BPN estimates; the Dhorpatan Hunting Reserve record is only 5% of the Biodiversity Records Nepal estimates (Table 31).



P. R. Shakya

Cardiocrinum giganteum (Wall.) Makino, Makalu Barun National Park, 2180m



P. R. Shakya

Meconopsis horridula Hook.f. & Thoms, Jaljale area 4500m, Taplejung

From the protected areas, Langtang National Park contains the highest number of vascular plant species (1,043, and the least numbers (58) are in the Dhorpatan Hunting Reserve. From the Ramsar sites, 388 vascular plant species have been recorded in Ghodaghodi Tal compared to



P. R. Shakya

The slipper orchid, *Cypripedium himalaicum* Rolfe, Machhapuchre base camp, 3450m

37 in Beeshazar and Associated Lakes, although both are in similar climatic zones. Among the World Heritage Sites, Swayambhu records 109 vascular plants, Changuarayan records 21, although they are in similar climatic and physiographic zones (Table 31). These differences in recorded numbers illustrate that floral exploration efforts in the protected sites are still inadequate.

Fauna Diversity

A comprehensive account of Nepal's mammalian fauna was produced by Suwal and Verheugt (1995), who listed 181 mammal species belonging to 12 orders and 39 families found in Nepal. Four mammal species believed to be extinct in Nepal are the Cheetah (*Acinonyx jubatus*), Black musk deer (*Moschus fuscus*), Pigmy hog (*Sus salvanius*), and Indian chevrotain (*Moschiola meminna*). There are also four new

Table 31. Comparison of BPN Estimates and Actual NBY Records of Flowering Plants

SN	Protected Areas	BPN Estimates	NBY Records	% of NBY/BPN	Number of Vascular Plant Species
1	Khaptad NP	567	289	51	295
2	Bardia NP	839	167	20	173
3	Rara NP	1,070	88	8	88
4	Shey-Phoksundo NP	1,579	174	11	174
5	Chitwan NP	919	227	25	234
6	Langtang NP	3,689	976	26	1,043
7	Shivapuri NP	2,122	449	21	449
8	Sagarmatha NP	1,074	160	15	160
9	Makalu-Barun NP	3,073	280	9	284
10	Shuklaphanta WR	202	535	265	553
11	Parsa WR	919	293	32	298
12	Kositappu WR	237	154	65	158
13	Dhorpatan HR	1,150	58	5	58
14	Annapurna CA	3,430	451	13	456
				(Average) 40	
15	Manaslu CA				587
16	Kangchenjunga CA				77
	Ramsar Sites				
17	Ghodaghodi Tal				388
18	Jagdishpur Reservoir				16
19	Beeshazar and Associated Lakes				37
	World Heritage Sites				
20	Lumbini				72
21	Swayambhu				109
22	Pashupati				74
23	Changuarayan				21

Sources: BPP 1995 and Annex 1.9; NBY records 2006

additions to the BPN mammals list: the Binturong (*Arctictis binturong*), Indian mongoose (*Herpestes nyula*), Himalayan marmot (*Marmota himalayana*), and Tibetan gazelle (*Procapra picticaudata*) (Table 12). The current checklist includes 185 mammal species.

In general, the number of reported fauna species has increased since 1996. Over 651 butterfly species have been recorded in 2006. This is an increase from the BPN records of 643 in 1996 (Table 32) (BPP 1996).

A new field of entomology has opened with the introduction of the IUCN Red List and others publications on floral and faunal species. The publications, for example, recorded 536 species under 17 orders from **Protura to Odonata** in 1997 (Thapa 1997), and 789 species of moth, and 656 species of butterfly in 1998 (Thapa 1998). Remarkably, 1,131 of the 5,052 known species of insects in Nepal, or over 22%, have been discovered and described first from Nepali specimens (Thapa 1998).

Global comparison

According to NBRB records, 3.96% of the total number of mammal species worldwide are found in Nepal. (Earlier records showed 4.2%.) A similar calculation for bird species indicates that Nepal has 8.9% of the global total of bird species. (BPN calculation place the figure at 8.5%). In terms of fish species, records report that Nepal accounts for just 1.87% of the global total freshwater fish species, a decrease from the BPN calculation of 2.2%. NBRB records 3.72% species of butterflies from Nepal, a decline from 4.2%, which is the BPN calculation. In the case of herpeto fauna, the number of amphibians reported accounts for 2.47% of the total global amphibian species. BPN calculated 1.1% for amphibians. NYRB records of Nepali reptiles constitute 0.99% of the global scale; this is a decrease from the BPN calculation of 1.5% (Table 33).

Distribution

Species distribution may be viewed from two distinct perspectives: confinement, and richness.

Year	Mammals	Birds	Herpeto	Fish	Butterfly	Moth	Spider
BPP1996	181	843	143	185	643	-	144
NBRB 2006	185	874	195	187	651	789	175

Source: BPN 1996, NBY 2006

Life Form	NBY	BPN
Mammals	3.96	4.2
Birds	8.90	8.5
Amphibians	2.47	1.1
Reptiles	0.99	1.5
Fish	1.87	2.2
Butterflies	3.72	4.2

Source: BNP 1996, NBY 2006

Confinement: The Terai-Sivaliks region harbours the highest number of confined species compared to Nepal's other physiographical regions: 35 mammal species, 111 bird species, 46 herpeto species, and 106 fish species (Table 13).

The central phytogeographical region harbours the highest number of confined species compared to the eastern and western regions: 28 mammal species, 24 bird species, 40 Herpeto species, and 31 fish species (Table 14).

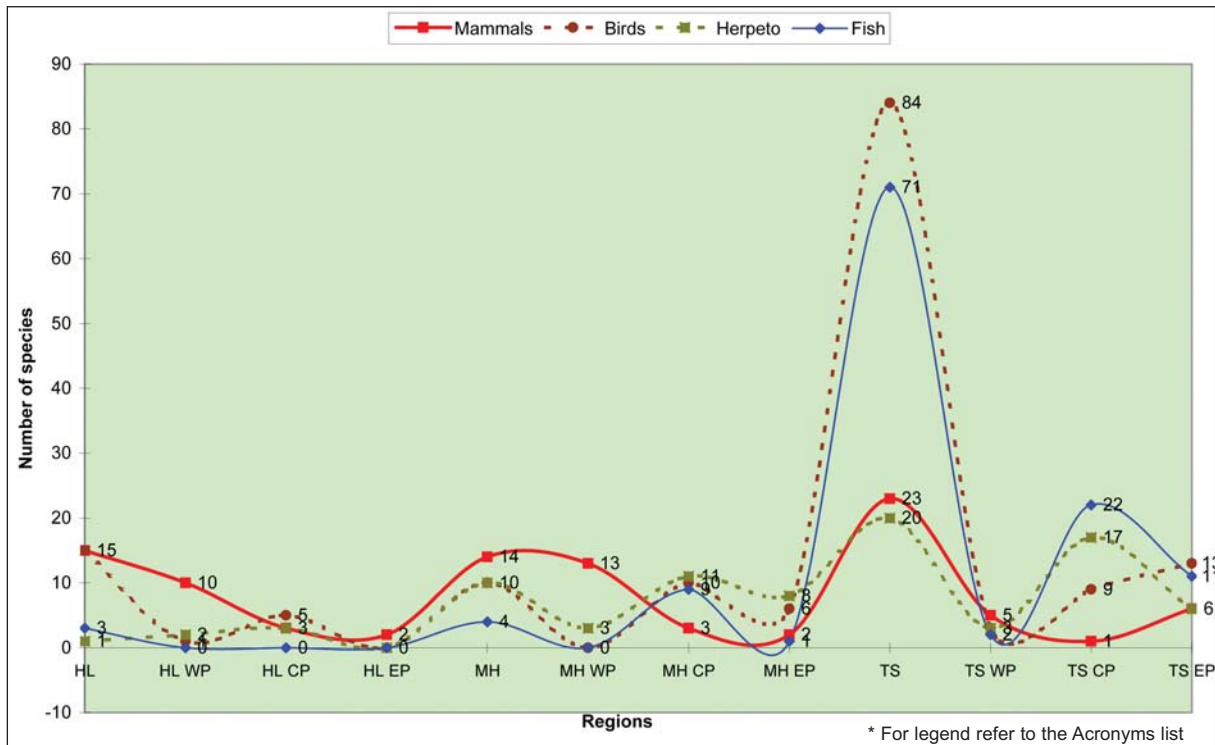
The central Terai-Sivaliks region hosts the highest number of confined species.

There are 11 mammal species, three physiographical and three phyto-geographical, found in all nine regions of the country. Eleven other mammal species are not reported in any of these regions. Of the birds species, 104 species are found in all nine regions, but 41 species are not reported in any of the regions.

Richness: Among the nine regions, the Mid-Hills centre harbours the highest number of mammal (55%) and bird species (77%); the Terai-Sivaliks centre harbours the highest number of herpeto species (45%); and the eastern Terai-Sivaliks houses 74% of fish species. Overall, the Mid-Hills centre is the most abundant in species distribution, followed by the Terai Siwalik centre, Terai Siwalik East, Terai Siwalik West, Mid-Hills East, Highlands Centre, mid-hills West, Highlands East, and Highlands West (Table 16 and Figure 6).

The Annapurna Conservation Area harbours 97 mammal species, or more than half of the total 181 mammal species found in Nepal. Other protected sites rich in mammal species are Makalu-Barun National Park (44%), Bardia National

Figure 6: Regional Faunal Species Confinement



Park (BNP) (32%), Chitwan National Park (CNP) (31%) and Rara National Park (28 %). In terms of bird species, CNP harbours 539 species (62%), followed by Parsa Wildlife Reserve (58%), Koshitappu Wildlife Reserve (55%), Annapurna Conservation Area (54%), and Bardia National Park (47%). CNP and ACA are home to 29% herpeto species, followed by BNP (22%) and Lumbini World Heritage Site (LWHS) (20%). CNP and BNP are home to 66 % of the fish species, followed by Koshitappu Wildlife Reserve (56 %), and LWHS (24 %) (Table 34).

Endemism

The only recorded endemic mammal in Nepal, the Himalayan field mouse (*Apodemus gorkha* Thomas, 1924), is found in the central mid-hills and High Mountain regions. In the case of birds, an endemic Nepal species, the Spiny Babbler (*Turdoides nipalensis*), is found throughout the Terai-Siwaliks and Mid-Hills regions. The subspecies Nepal Kalij (*Lophura leucomelanos leucomelanos*) is also endemic to the country (Inskipp, C 2000), and found in the western regions.

Fourteen species of herpetofauna and six species fish are endemic. Of them, three species of herpeto each are found in eastern and western regions, and four species in the central region. Four species of herpeto are found in the Terai-

Siwaliks, and seven in the Mid-Hills. In case of fish, one species is found in the eastern region, and three in western regions. Similarly, two species of fish are found in the Mid-Hills, and three species in the High Mountains.

Threatened and protected species

Threatened species

The NRDB lists 59 mammal species, 279 bird species, 35 herpeto species, and 34 fish species, of which four species of mammals and seven species of birds are believed to have become extinct, according to the updated checklists. Of these, two species: the Cheetah (*Acinonyx jubatus*) and Black musk deer (*Moschus fuscus*) have probably never been recorded in Nepal; the Pigmy hog (*Sus salvanius*) and the Indian chevrotain (*Moschiola meminna*) have probably now become extinct (Table 33) (IUCN-Nepal 1995).

According to the NRDB, seven species of birds (Table 18) have become extinct, among which four species have been reported again recently. Of the 11 bird species listed as Extinct in Nepal in the BPN (BPP 1995), three species have been reported again recently. The Hodgson's hawk-cuckoo (*Hierococcyx fugax*) was sighted in Koshitappu Wildlife Reserve (Baral, HS 2005); the Black-breasted parrotbill (*Paradoxornis flavirostris*) in the Annapurna Conservation Area

Table 34. Distribution of Faunal Species in the Protected Sites

Sites	Mammal		Bird		Herpeto		Fish	
	#	%	#	%	#	%	#	%
Protected Areas								
Khaptad National Park	23	12	287	33	23	12	-	-
Bardia National Park	59	32	407	47	42	22	124	66
Rara National Park	51	28	241	28	2	1	3	2
Shey Phoksundo National Park	35	19	208	24	3	2	-	-
Chitwan National Park	58	31	539	62	56	29	124	66
Langtang National Park	45	24	345	39	4	2	2	1
Shivapuri National Park	19	10	311	36	3	2	-	-
Sagarmatha National Park	33	18	208	24	5	3	1	1
Makalu Barun National Park	81	44	421	48	14	7	13	7
Shuklaphanta Wildlife Reserve	46	25	351	40	7	4	28	15
Parsa Wildlife Reserve	37	20	503	58	8	4	8	4
Koshiappu Wildlife Reserve	23	12	485	55	17	9	105	56
Dhorpatan Hunting Reserve	18	10	137	16	2	1	0	0
Annapurna Conservation Area	97	52	476	54	56	29	2	1
Manaslu Conservation Area	21	11	193	22	-	-	-	-
Kangchenjunga Conservation Area	13	7	280	32	-	-	-	-
Ramsar Sites								
Ghodaghodi Tal Ramsar Site	34	18	96	11	9	5	23	12
Jagdishpur Reservoir Ramsar Site	6	3	45	5	9	5	18	10
Beeshazar and Associated Lakes Ramsar Site	26	14	271	31	18	9	25	13
World Heritage Sites								
Lumbini World Heritage Site	26	14	207	24	39	20	44	24
Swayambhu	6	3	64	7	-	-	-	-
Pashupati	9	5	63	7	-	-	-	-
Changuarayan	7	4	51	6	-	-	-	-
Sources: Annexes 2.11 to 2.33								
Sources: BPP (1995 No. 6 & 13), KMTNC 2005, and DNPWC 2000								
Available http://www.cites.org/eng/app/appendices.shtml								
Available http://www.iucnredlist.org								

(Suwal, RN. 2003); and Long-tailed sibia (*Heterophasia picaoides*) in Chitwan National Park (BES 2006). The fourth species, the Green cochoa (*Cochoa viridis*), was already listed in the bird checklist of the Makalu-Barun National Park - BPN Technical Report Number 14 (BPP 1995h, and Jackson et al. 1990) (Table 35).

Altogether, IUCN lists 173 species of mammal species. Nearly 94% of the 185 species are threatened; the Pigmy hog (*Sus salvanius*) is critically endangered; 21 are vulnerable; 19 are near threatened; 120 of least concern; and one, Csorba's mouse-eared bat (*Myotis csorbai*) is Data Deficient

Of the total 874 species of birds three species are critically endangered: the Slender-billed vulture (*Gyps tenuirostris*), Pink-headed duck (*Rhodonessa caryophyllacea*), and White-

rumped vulture (*Gyps bengalensis*). Six species are considered endangered; 23 vulnerable; 25 near threatened; and 813 are of least concern (IUCN 2006) (Table 35).

Similarly, 64 species of herpeto or about 34% of the totals are listed in the IUCN Red List. Of them, one is considered critically endangered; three are endangered; seven vulnerable; four near threatened; 39 of least concern; and ten as data deficient (Table 35).

Protected species

Twenty-seven mammal species, nine bird species, and three reptile species are listed as protected under the National Parks and Wildlife Conservation Act 1973 (Annex 2.5 to 2.8). However, 10 species of fish and 12 species of butterflies are still in need of protection (HMG/MFSC 2002).



R N Suwal

The musk deer (*Moschus chrysogaster*), Sagarmatha National Park

In 2003, the Government of Nepal approved a 'Working Policy on Wild Animal Farming, Breeding and Research'. Under this provision, seven species of mammals, one species of amphibian (the Gharial crocodile, *Gavialis*

gangeticus), all 77 species of snakes, and 874 species of birds, including three protected species, are protected (**Annex 2.9**) (GoN/MFSC 2003).

Sixty-six species of mammals are listed in the CITES Appendices. Of these, 28 species are in Appendix I, 14 in Appendix II, and 24 in Appendix III. Similarly, 128 species of birds in the Appendices, of which 16 species are in Appendix I, 95 in Appendix II, and 17 in Appendix III, and 11 species of reptiles are included in the Appendices, of which there are four each in I and II, and three in category III. Five species of amphibians are in Appendix I, and ten in Appendix II. From the insect group, three species of butterflies are included in Appendix II (**Table 35**).

Species in protected areas

With regards to fauna, the number of birds reported in the protected areas had increased since 1996. For example, 483 bird species

Table 35. Number and Status of Faunal Species

Legends and Summary	Mammal		Bird		Herpeto		Fish	
	#	%	#	%	#	%	#	%
Total Number of Species	185	100	874	100	195	100	187	100
GoN = Government of Nepal Protected by NPWC Act 1973	26	14	9	1	4	2	-	-
CITES (Total)	66	36	128	15	24	12	-	-
Appendix I	28	15	16	2	8	4	-	-
Appendix II	14	8	95	11	13	7	-	-
Appendix III	24	13	17	2	3	2	-	-
IUCN = IUCN Red List Category (Total)	185	100	874	100	64	33	-	-
EX = Extinct	-	-	-	-	-	-	-	-
EW = Extinct in the Wild	-	-	-	-	-	-	-	-
CR = Critically Endangered	1	1	3	0	1	1	-	-
EN = Endangered	11	6	6	1	3	2	-	-
VU = Vulnerable	21	11	26	3	7	4	-	-
NT = Near Threatened	21	11	26	3	4	2	-	-
LC = Least Concern	130	70	813	93	39	20	-	-
DD = Data Deficient	1	1	-	-	10	5	-	-
NE = Not Evaluated	-	-	-	-	-	-	-	-
NRDB (Nepal Red Data Book) Status (Total)	59	32	313	36	35	18	35	19
EXN = Extinct Nepal	4	2	7	1	-	-	-	-
C = Critically endangered	5	3	6	1	-	-	-	-
E = Endangered	11	6	53	6	1	1	1	1
V = Vulnerable	16	9	112	13	6	3	10	5
S = Susceptible	23	12	101	12	28	14	23	12
I = Introduced	-	-	-	-	-	-	1	1
UR = Under recorded (BPP)	-	-	34	4	-	-	-	-
Sources: Annexes 2.5 to 2.8								

Table 36. Faunal Data of Protected Areas

SN	Protected Areas	Mammals		Birds		Herpeto		Fish	
		BPP	NBY	BPP	NBY	BPP	NBY	BPP	NBY
1	Khaptad NP	18	23	219	287	2	23	0	0
2	Bardia NP	48	59	260	407	27	42	50	124
3	Rara NP	51	51	212	241	2	2	3	3
4	Shey-Phoksundo NP	26	35	175	208	1	3	0	0
5	Chitwan NP	56	58	483	539	56	56	124	124
6	Langtang NP	45	45	289	345	4	4	2	2
7	Shivapuri NP	19	19	149	311	1	3	0	0
8	Sagarmatha NP	34	33	199	208	5	5	1	1
9	Makalu-Barun NP	81	81	399	421	14	14	13	13
10	Shuklaphanta WR	32	46	267	351	3	7	28	28
11	Parsa WR	25	37	483	503	8	8	8	8
12	Koshitappu WR	23	23	199	485	17	17	105	105
13	Dhorpatan HR	18	18	137	137	2	2	0	0
14	Annapurna CA	92	97	474	476	56	56	2	2
15	Manaslu CA	0	21	0	193	0	0	0	0
16	Kangchenjunga CA	0	13	0	280	0	0	0	0

Sources: Annexes 2.11 to 2.26

were listed in Chitwan National Park in 1996; in 2006 their record numbers had increased to 539. In Koshitappu, the 199 species reported in 1996 had increased to 485 in 2006. An opposite trend appears in the case of mammals. The number of species reported in 2006 has decreased by one in Sagarmatha National Park, due to the inability to report on the Black musk deer (Table 36).

Of 181 total surviving mammal species excluding four extinct species, 28 species are found outside protected sites – protected areas, Ramsar sites and World Heritage sites (Table 24). Fifteen of these species are bats (total 37 species); 10 species are shrew, rats, and Pikas; the remaining three are the Large-toothed ferret badger (*Melogale personata*), Malayan porcupine (*Hystrix brachyura*), and Tibetan antelope (*Pantholops hodgsoni*).

Three species found in all 20 protected sites are the Golden jackal (*Canis aureus*), Rhesus macaque (*Macaca mulatto*), and Common leopard (*Panthera pardus*).

Of 867 bird species excluding the seven extinct species, 37 species (5%) are found outside the protected sites (Table 24). Of these 37 species, 14 are migrant species, four are summer/winter visitors, and 19 are resident birds.

One-third of the total 65 herpeto species are found outside protected sites, as are 25 species of fish (Table 24). There are 56 species of herpeto fauna found in the Annapurna Conservation Area and Chitwan National Park, and none at all in the Manaslu and Kangchenjunga conservation areas. Similarly, there are 124 fish species in Bardia and Chitwan national parks; 105 in Koshitappu Wildlife Reserve; and none in five protected areas.

With regards to herpetofauna, the number of reported species in all protected areas has increased. Similarly, the number of fish species in Chitwan National Park was recorded at 125 in 1996, and only 124 in 2006. The increasing number in fauna indicates substantial biological research and explorations done since 1996.

Separate lists of fauna species have been prepared for globally significant areas such as the Ramsar and World Heritage sites (Table 37). Much less research related to these areas has been conducted compared to studies on protected areas. Data is therefore limited and not conclusive enough to do sufficient analysis.

Based on the 2006 records, Annapurna Conservation Area records the highest number of species (97) of the 185 mammals in the current checklist, followed by Makalu-Barun National Park (81); and least (13) in Kangchenjunga

Table 37. Faunal Data of Nepal Ramsar Sites and World Heritage Sites				
Areas	Mammals	Birds	Herpeto	Fish
Ramsar sites				
Ghodaghodi	34	96	9	23
Jagadishpur	6	45	9	18
Beeshazar	26	271	18	25
World Heritage sites				
Lumbini	26	207	39	44
Swayambhu	6	64	0	0
Pashupati	9	63	0	0
Changunarayan	7	51	0	0

Sources: Annexes 2.27 to 2.33

Conservation Area. Similarly, there are 34 species in GTRS, and only six in JRRS. Nine species have been recorded in Pashupati, and six in Swayambhu (Annex 2.27 to 2.29, and Figure 7).

Based on the 2006 records, Chitwan National Park records the highest number of species (539) of the 874 birds in the current checklist, followed by Parsa Wildlife Reserve (503), and only 137 in Dhorpatan Hunting Reserve. Two hundred seventy-one species are found in Bishazari Tal Ramsar site (also called Beeshazar and Associated Lakes), 45 in the Jadishpur Reservoir Ramsar site, 64 in Swayambhu, and 51 in Changunarayan (Annex 2.30 to 2.33, and Figure 8).

Figure 7: Mammal Species in the Protected Areas

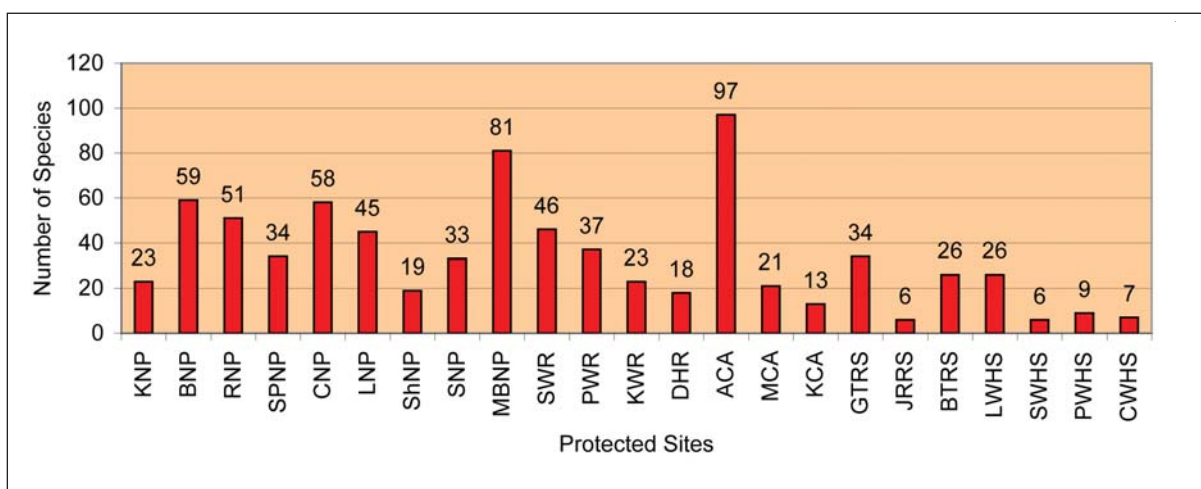
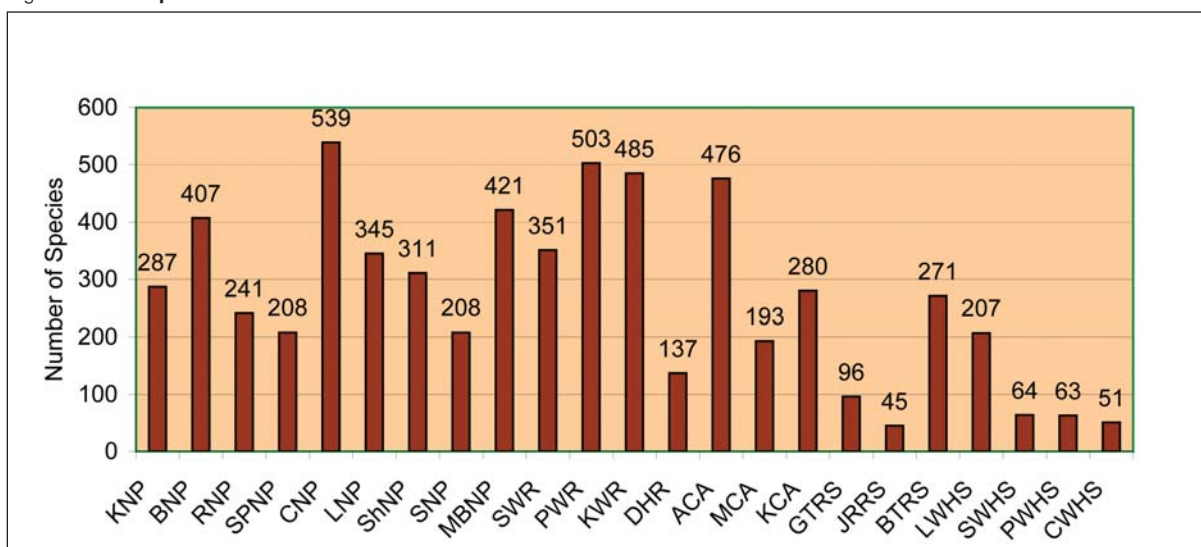


Figure 8: Bird Species in the Protected Areas



KNP=Kangchenjunga National Park; BNP=Bardia National Park; RNP=Rara National Park; SPNP=Shey-Phoksundo National Park; CNP=Chitwan National Park; LNP=Langtang National Park; ShNP=Shivapuri National Park; MBNP=Makalu-Barun National Park; SWR=Shuklaphanta Wildlife Reserve; PWR=Parsa Wildlife Reserve; KWR=Koshitappu Wildlife Reserve; DHR=Dhorpatan Hunting Reserve; ACA=Annapurna Conservation Area; MCA=Manaslu Conservation Area; KCA=Kangchenjunga Conservation Area; GTRS=Ghodaghodi Tal Ramsar Site; JRRS=Jagdishpur Reservoir Ramsar Site; BTRS= Bishazari Tal Ramsar Site; LWHS=Lumbini World Heritage Site; SWHS=Swayambhu World Heritage Site; PWHS=Pashupati World Heritage Site; CWHHS=Changunarayan World Heritage Site

Variations in the recorded number of faunal species in protected sites are primarily on account of differing intensities of biological explorations in the sites.

Ex-Situ conservation and specimens preservation

Botanical gardens and herbaria

Apart from conservation of species in the wild, efforts have been made towards ex-situ conservation and specimen preservation.

There is a network of 11 botanical gardens of Nepal, which represent the central and western mid-hills and Terai-Siwaliks regions, and the eastern mid-hills region. The High Mountain regions and the eastern Terai-Siwaliks region are not represented in this network.

Godavari, Nepal's central botanical garden, contains nearly 300 species of plants including 89 species of trees, 26 species of shrubs, 140 species of herbs including 90 species of orchids, 12 species of climbers, and 31 exotic trees and shrubs.

The National Herbarium (KATH) houses over 161,800 specimens of plants, and the Central Department of Botany of the Tribhuvan University (TUCH) houses 20,000 specimens.

Captive breeding and translocation

The Central Zoo in Lalitpur houses 119 species of 970 animals. It features 33 of the 206 mammal species, 60 of the 321 bird species, 17 of the 424 fish species, and nine of 19 reptiles species found in Nepal (**Annex 2.10**). The Hetauda Municipality Zoo houses some species including the spotted deer, barking deer, hares, birds, and tortoises.

Captive breeding of crocodiles has been carried out successfully in the Gharial Farm in Chitwan. A total of 661 gharials bred in captivity were released into the major rivers of Nepal such as the Narayani, Kali Gandaki, Koshi, Karnali, and Babai between 1978 and 2005. In addition to gharial crocodiles, the breeding centre has also succeeded in hatching elongated tortoise (*Indotestudo eleongata*) and marsh crocodiles.

There are 171 domesticated elephants in Nepal, of which 77 belong to the government, nine to Nepal Trust for Nature Conservation, and 85 to the private sector. The elephant breeding centre at Khorsor in Chitwan, and the elephant stables in Shuklaphanta, Bardia, Chitwan, Parsa, and Koshitappu are noteworthy for successful breeding of elephants.

Since 1986, translocation of rhinos has been successfully carried out with Chitwan National Park providing the gene pool. Between 1986 and 2003, a total of 87 rhinos (39 males, and 48 females) have been translocated to Bardia National Park (83) and Shuklaphanta Wildlife Reserve (4). Translocation of blackbucks from the Central Zoo to Bardia National Park was initiated in 1992, and also to Pashupati World Heritage site quite recently.

Specimen preservation

The Natural History Museum houses about 55,000 biological specimens, including over 40,000 zoological specimens (invertebrates and vertebrates), over 9,000 botanical specimens (flowering and non-flowering plants), 100 skeletons, some skins, fossils, rocks, and minerals; plastic and clay models, and wildlife trophies. The wildlife museums in the protected areas have preserved a number of specimens of wildlife and plants, the majority of which are found locally.



Tengboche, Sagarmatha National Park
(Govinda Joshi)

8

Recommendations

Based on a comprehensive assessment of the status and issues of biodiversity in Nepal, future work must address the following issues and tasks.

1. Biodiversity explorations of ecological 'blank spots', such as the High Mountain regions and the Western region, with focus on lower plants (algae, fungi, etc) and invertebrates (insects, among others)
2. Protection of five vegetation types not represented under the current 16 protected areas by adopting appropriate strategies such as community forestry, and botanical gardens
3. Development and regular updating of flora checklists, including that of lower plants, as 4,134 species and subspecies of flowering plants including 269 endemic species, grow outside the 23 protected sites (16 protected areas, four Ramsar sites, and four World Heritage sites and monuments)
4. Development and regular updating of checklists of fauna, including invertebrates of the protected sites on a regular basis
5. Focused research on particular species such as the Cheetah (*Acinonyx jubatus*), Black musk deer (*Moschus fuscus*), Pigmy hog (*Sus salvanius*), and the Indian chevrotain (*Moschiola meminna*) remains subject to debate in terms of their existence and distribution in the country but is vital
6. The 28 species of fauna found only outside the 23 protected sites (16 PAs, four RSs and four WHS/monuments) merit further scrutiny
7. Protection of bat habitats, caves, and trees, is vital as 15 of the 37 species of bats live outside protected sites
8. Lateral linkages of NBRB information with existing national and global biodiversity databases covering flora, fauna, and protected sites of Nepal, as well as with websites maintained by conservation organisations pertinent to Nepal
9. Studies of the population dynamics and habitats of mammals, birds, herpeto, and fish need to be carried out in relation to the IUCN Red List
10. Review and update of the National Red Data Book of Nepal from the following perspectives:
 - a. Four extinct and four new additions of mammal species
 - b. Reappearance of four species of birds previously believed to be extinct
 - c. Updated checklist of herpeto and fish
11. Implementation of the 2003 Working Policy on Wild Animal Farming, Breeding and Research.
12. Continuous review of current activities and priorities of the botanical gardens and herbaria, as well as the zoos and natural history and wildlife museums
13. Review of existing government policies on banning commercial exploitation of plant species, and the working policy on wild animal farming from the perspectives of the updated NRDB, IUCN Red List, CITES Appendices, and the list of economically important species

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