Biodiversity Conservation in Bhutan

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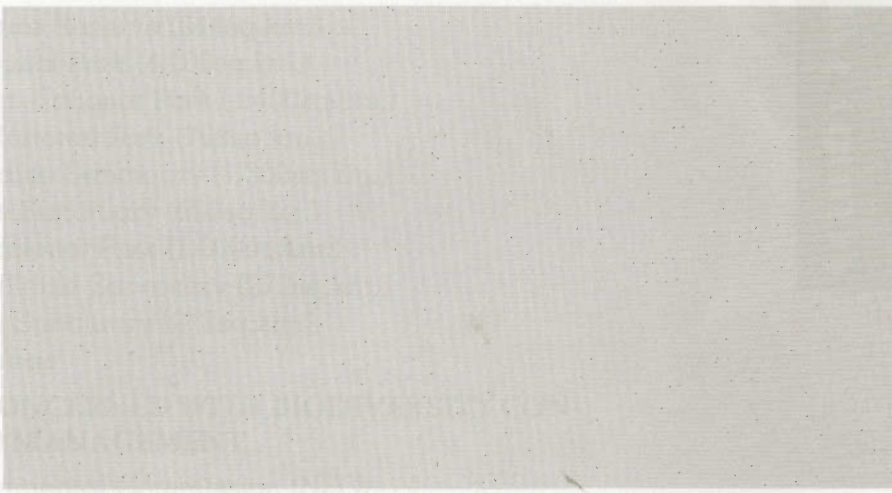

Bhutan

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INTRODUCTION

Slightly larger than Switzerland, Bhutan has a total land area of 46,500 sq.km. and an impressive variety of plant and animal species. Its rich biological diversity is the result of its unique geographical location. Bhutan lies in the eastern Himalayas extending across the Indo-Malayan (Oriental) and the Palaeoarctic biogeographic realms. Bhutan's annual rainfall of 2,000mm is significantly higher than in the central and western Himalayas. In addition, considerable altitudinal variations, from 200 metres in the south to over 7,000 metres in the north, with dramatic climatic changes, add to the biological diversity.

Along Bhutan's southern border, the narrow tropical and subtropical forest ecosystem belt supports the Asian elephant (*Elephas maximus*), greater one-horned rhinoceros (*Rhinoceros unicornis*), gaur (*Bos gaurus*), wild water buffalo (*Bubalus bubalis*), hog deer (*Cervus porcinus*), tiger (*Panthera tigris*), clouded leopard (*Neofelis nebulosa*), great hornbill (*Buceros bicornis*), and other mammals and birds characteristic of Indo-Malayan species. About 150 km to the north, high Himalayan fauna include the blue sheep (*Ovis mahura*), takin (*Budorcas taxicolor*), musk deer (*Moschus chrysogaster*), snow leopard (*Panthera uncia*), wolf (*Canis lupus*), lammergeier (*Gypaetus barbatus*), and other species characteristic of the Palaeoarctic realm. More adaptable species, with habitats extending from tropical to temperate zones, live in between these two extremes. Examples include the Himalayan black bear (*Selenarctos thibetanus*), red panda (*Ailurus fulgens*), leopard (*Panthera pardus*), wild dog (*Cuon alpinus*), sambar (*Cervus unicolor*), barking deer (*Muntiacus muntjak*), serow (*Capricornis sumatraensis*), wild boar (*Sus scrofa*), and langur (*Presbytis entellus*).

Bhutan has a number of threatened mammal species, such as the Asian elephant, greater one-horned rhinoceros, tiger, leopard, snow leopard, wolf, gaur, musk deer, pygmy hog (*Sus salvanius*), hispid hare (*Caprolagus hispidus*), and golden langur (*Presbytis geei*). Among the country's threatened birds are Blyth's tragopan (*Tragopan blythii*), Sclater's monal pheasant (*Lophophorus sclateri*), the black-necked crane (*Grus nigricollis*), and the peregrine falcon (*Falco peregrinus*). Threatened reptiles include the Indian python (*Python molurus*) and the gharial (*Gavialis gangeticus*). Unfortunately, knowledge about the condition of these species is still limited. With the exception of the black-necked crane, the golden langur, and avifauna in some of the parks and reserves, there have been no detailed population surveys or field studies of Bhutanese wildlife.

The Bhutan Himalayas are still in a pristine state, providing a habitat to a variety of flora and fauna. Over 700 bird species and at least 5,000 species of vascular plants have been recorded. About 60 per cent of Bhutan is covered by forest, ranging from moist tropical evergreen and semi-evergreen forests in the south to temperate forests of mixed oak and conifers and sub-alpine forests of fir, spruce, juniper, larch, and birch in the north.

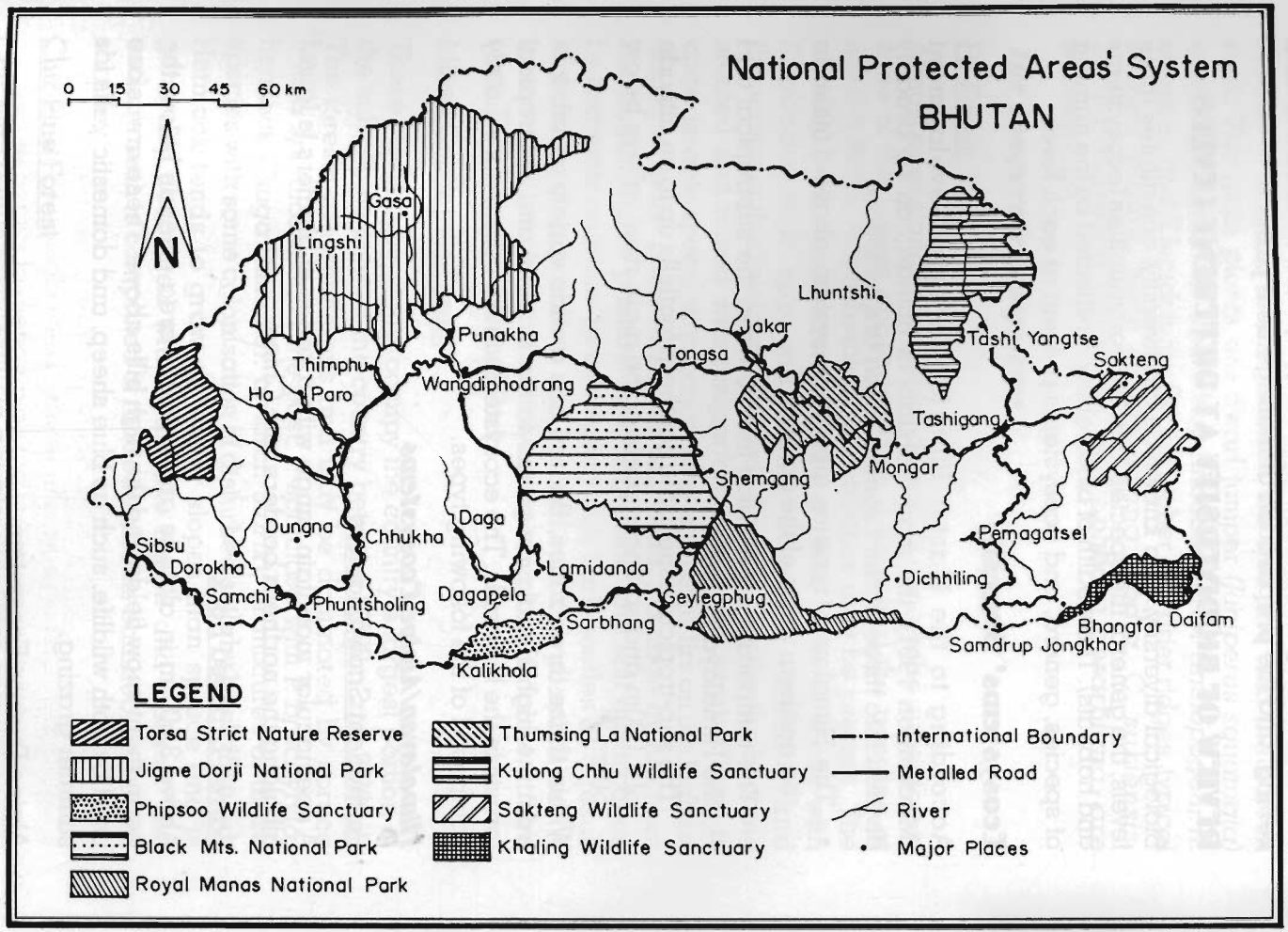
Because of its unique setting and relatively unexploited environment, Bhutan probably possesses the greatest biological diversity of any country of its size in Asia. It contains some of the best remaining representative temperate forests found in the Himalayas.

However, Bhutan's forests and wildlife are increasingly threatened by poor land management. Shifting agriculture, overgrazing, and burning encroach upon forests in certain areas, while serious erosion, a result of overgrazing by domestic livestock, has damaged some alpine grasslands. Organised poaching is depleting wildlife, particularly in the southern areas. Poaching of endangered species, such as tiger and musk deer, has been a problem. Timber theft, especially of valuable agar wood (*Aquilaria agallocha*), which is used in traditional medicines and for the manufacture of incense, is also an issue.

CURRENT STATE OF BIODIVERSITY

Bhutan's history of isolation and policy of slow and sustainable development provides decision-makers with a unique opportunity to conserve the country's natural and cultural heritage. As a first step, Bhutan has established a system of nine protected areas. The system sets aside approximately 26 per cent of the country's total land area in national parks, nature reserves, wildlife sanctuaries, and conservation areas. In 1993, the Royal Government of Bhutan, with technical assistance from WWF, revised the protected areas' network to represent the entire country's major ecosystemic types. The present system (see Map 1) includes subtropical areas in the southern belt, temperate areas in the mid-hills, and alpine areas in the north.

The WWF and the Forestry Services' Division have jointly developed a collaborative programme to provide technical and financial assistance for protected area planning and institutional development. The programme has been designed to help the government develop and manage a system of protected areas. It develops feasibility studies for gazetting of sites, prepares management plans and budgets, and sets priorities for implementation, training, research, and projects. The projects integrate conservation and development of rural communities in the buffer zones which are within or adjacent to reserve boundaries.



Map 1 : National Protected Areas' System of Bhutan

Project activities are focussed on priority protected areas—Jigme Dorji, Royal Manas, and the Black Mountains' national parks. Priority activities include biodiversity surveys, rapid socioeconomic assessments, ground evaluation of proposed boundaries and zoning, and the preparation of management plans.

REVIEW OF BIODIVERSITY AT DIFFERENT LEVELS

Biological diversity, also known as biodiversity, constitutes three levels; the genera, the species, and the communities (ecosystems and habitats). The wealth of biodiversity is reflected by the number of species, genera, and ecosystems present at each level.

Ecosystems' Diversity

According to the Master Plan for Forestry Development (Mackinnon 1991), the main habitats of Bhutan can be broadly divided into three distinct zones. These are as follow.

- The Himalayan zone or alpine ecosystem above 4,500m in the northern parts of the country
- The temperate zone which lies between the subtropical and the Himalayan zones
- The sub-tropical zone in the southern foothills up to an altitude of 1,000m and southern parts of the main river valleys below 500m

Within these three zones, Bhutan has a wide variety of habitats from the high Himalayan peaks to the tropical and subtropical forests in the lowlands. The ecosystems in the country are mainly composed of the following types.

Himalayan/Alpine Ecosystems

Permanent Snow/Glaciers

A spectacular mountain range with a series of glaciers is found all along the northern borders with China.

Barren Exposed Rock

Above 3,500 m in altitude an extensive area extends below the permanent snow fields and the high hills above. These areas are used by both wildlife, such as blue sheep, and domestic yaks for summer grazing.

Alpine Pasture Ecosystem

Alpine pasture consists of open meadows above the tree line and man-made pastures for grazing purposes. The pastures are characterised by a variety of short grasses and a great wealth of alpine plant communities such as *Pedicularis*, *Gentiana*,

Corydalis, Saxifraga, Mecenopsis, Aconitum, and so on. Many of these plants are greatly in demand for traditional medicines.

Alpine Scrub

A zone of scrub is found between the tree line and the barren rock. The main plants are dwarf juniper (*Juniperus squamata*) and rhododendrons (including *Rhododendron anthopogon, R. setosum*, and *R.lepidotum*). On the higher and drier ridges, typical steppe plants, such as *Caragana jubata, C. sukiensis, Spongiacarpella purpurea*, and *Ephedra gerarbiana*, are widespread.

The Temperate Ecosystems

Fir Forest

Almost pure stands of fir (*Abies densa*) dominate the upper forest zone of the higher ridges between 2,700m and the tree line at 3,600-3,800m. A few hemlock and birches may be present. The undergrowth is characterised by a thick layer of moss with *Rhododendron* spp, sub-alpine bamboo, *Primula*, and *Bryocarpum himalaicum*. Towards the tree line, the firs become stunted and mixed with juniper/rhododendron scrub. There is considerable speculation concerning why many firs on the highest ridges in many parts of Bhutan are dead. Damage by fire from burning of alpine pasture, by overgrazing and soil disturbance by domestic animals, by infestation with bark beetles as a result of poor logging practice, and by acid rain are possibilities. A government project is currently examining the fir forest at Ura near Thrumsingla National Park.

Mixed Coniferous Forest

These forest ecosystems occupy the country's largest portion of the sub-alpine zone of the country between 2,000m and 2,700m. The forests are coniferous and may be dominated by spruce (*Picea spinulosa*) or, in the east, *P. spinulosa* with *P. brachytyla*, hemlock (*Tsuga dumosa*), or larch (*Larix*), or mixtures of these species with some colonisation of disturbed soils by birch (*Betula*). Hemlock tends to grow on wetter slopes than spruce and is generally decorated with beard-like lichen and mosses. The undergrowth is comprised of rhododendrons, bamboo, and other shrubs.

Chir Pine Forest

Chir pine (*Pinus roxburghii*) is a subtropical tree growing in dry sandy soils. It predominates in the deep dry valleys of the Sankosh, Kuru, Kulong, and Dangme rivers between 900-1,800m. These forests are characterised by a highly seasonal monsoon climate and annual burning of the grass understorey. Pines are

generally the only tree, but *Bauhinia* and other species grow in the moister streambeds. The pines are tapped extensively for turpentine.

Blue Pine Forest

These forests are found in the temperate valleys between 1,500 m and 3,500m in the Ha, Paro, and Thimphu valleys in the west and in the Bhumthang and Gyetsa valleys in central Bhutan. Blue pine *(Pinus wallichiana)* is dominant and quickly colonises burned and disturbed slopes. It is sometimes mixed with *Quercus griffithii*, *Rhododendron arboretum*, and several types of xerophytic shrubs and annual herbs. This vegetation type is probably a secondary type, and the original forest was most likely a dry oak forest in which Blue Pine was just one component. Blue pine is harvested for timber and is in great demand.

Temperate Scrub

Where temperate forests have been cut or burned and not been used for agriculture or permanent pastures, they have been replaced by scrub of dense bamboo, or xerophytic, often spiny, shrubs.

Broad-leaved/Coniferous Forest

In some parts of Bhutan, the gradation between broad-leaved and coniferous forests is very gradual, and there are extensive areas in which these types are mixed. These forests are generally of oak mixed with Blue Pine (probably the original condition in most areas now dominated by Blue Pine) or upper hill forest with spruce and/or hemlock mixed.

Upper Hardwood Forest

Broad-leaved temperate forests dominate the temperate hillsides between 2,000m and 2,900m. There are two main types—cool broad-leaved forests and evergreen oak forests.

Evergreen oak forests are common in drier areas, especially around Tongsa and above Mongar. *Acer cambellii*, *Castanopsis hystrix*, and *C. tribuloides* dominate at lower altitudes, whilst *Quercus lamellosa* predominates in the higher regions. With increasing dryness, this type grades towards Blue Pine forest with xerophytic oaks such as *Q.lanata*, *Q.griffithii*, and *Q. semecarpifolia* appearing. The shrub layer is generally sparse, and nettles, roses, *Euphorbia*, and bryophytes are common.

Cool broad-leaved forests are richer where the hills are damper. They have less *Fagaceae* trees and are characterised by such species as *Betula alnoides*, *Lindera neesiana*, *L. pulcherrima*, *Chirita lachensis*, *Brassaiopsis alpine*, and many others. The undergrowth has a rich layer of roses and *Rubus* spp.

Tropical and Sub-tropical Ecosystems

Lower Hill Forest

These forests occupy the sub-tropical hills between 1,000m-2,000m. They are rich, mixed forests with a wide variety of both sub-tropical and temperate genera. Characteristic plants include *Castanopsis indica, Schima wallichii, Macaranga pustulata, Dendrocalamus hookerii, Bischofia javanica, Evodia fraxinifolia, Maesa* spp, *Mussaaendra roxburghii*, and many others.

Tropical Lowland Forest

These forests occupy the low hills below 700m. They are broadly classed as semi-evergreen but vary from almost totally deciduous on exposed dry slopes to almost totally evergreen in moist sheltered valleys. Species' diversity is very rich and the forests are multi-storeyed. Sal forests (*Shorea robusta*) formerly predominated in the west as far as the Phipsoo sector but have been extensively cut. In the central and eastern sectors such forests are characterised by plants such as *Bombax ceiba, Duabanga grandiflora, Tetrameles nudiflora, Ailanthus grandis, Schima wallichii, Eugenia* spp, and *Eleocarpus* spp. *Leia asiatica, Musa*, and *Pandanus* are common in the lower canopy.

Forest on Limestone

In eastern Bhutan, particularly in the tropical/sub-tropical zone, there are some dolomitic limestone ridges, falling mainly in the Manas National Park and Phipsoo regions. These limestone areas are quickly drained and consequently have a more seasonal and less lush forest type, including several plants that specialise on limestone soils.

Savannah/Grassland

In the floodplain of the Bramaputra Valley, the *duar*(s)[1], the vegetation is more open with extensive savannah and grassland. This ecosystemic type also colonises low-lying areas artificially cleared of forest. Typical species of this vegetation are *Phragmites karka, Brianthus ravanae, Typha elephantina, Saccharum* spp, and others. This habitat is preferred by rhinos and gaurs.

Farming Ecosystems

Subsistence farming is the traditional system in Bhutan. The total land area available for arable cultivation is only nine per cent. Over 90 per cent of all farm products are for domestic consumption. However, there is growing demand for commercial cultivation of cardamom and citrus production in southern Bhutan and apples in the western and central temperate zones.

1 These are usually defined as flat tracts of land leading to a mountain pass.

Traditional crop varieties are preferred for their grain characteristics and adaptability to the environments in which they are grown (Ghimeray 1993). Indigenous land-use systems continue to integrate crops, animals, and agroforestry in a sustainable manner. Organic manure from animals and forest litter are used to maintain soil fertility.

The climatic conditions caused by altitude and other physical factors have led to development of numerous cropping patterns and farming systems which are locality-specific. A rice-based farming system dominates the irrigated terraced land up to an altitude of 2,500m, while maize and potatoes are grown on dry sloping lands. Buckwheat, wheat, oats, and barley are the traditional crops grown at altitudes from 2,500m to 3,000m.

Rearing livestock is an integral part of the farming systems. There are about 420,000 head of cattle in the country. The principal cash crops include apples, oranges, potatoes, and cardamoms.

Species' Diversity

Flora

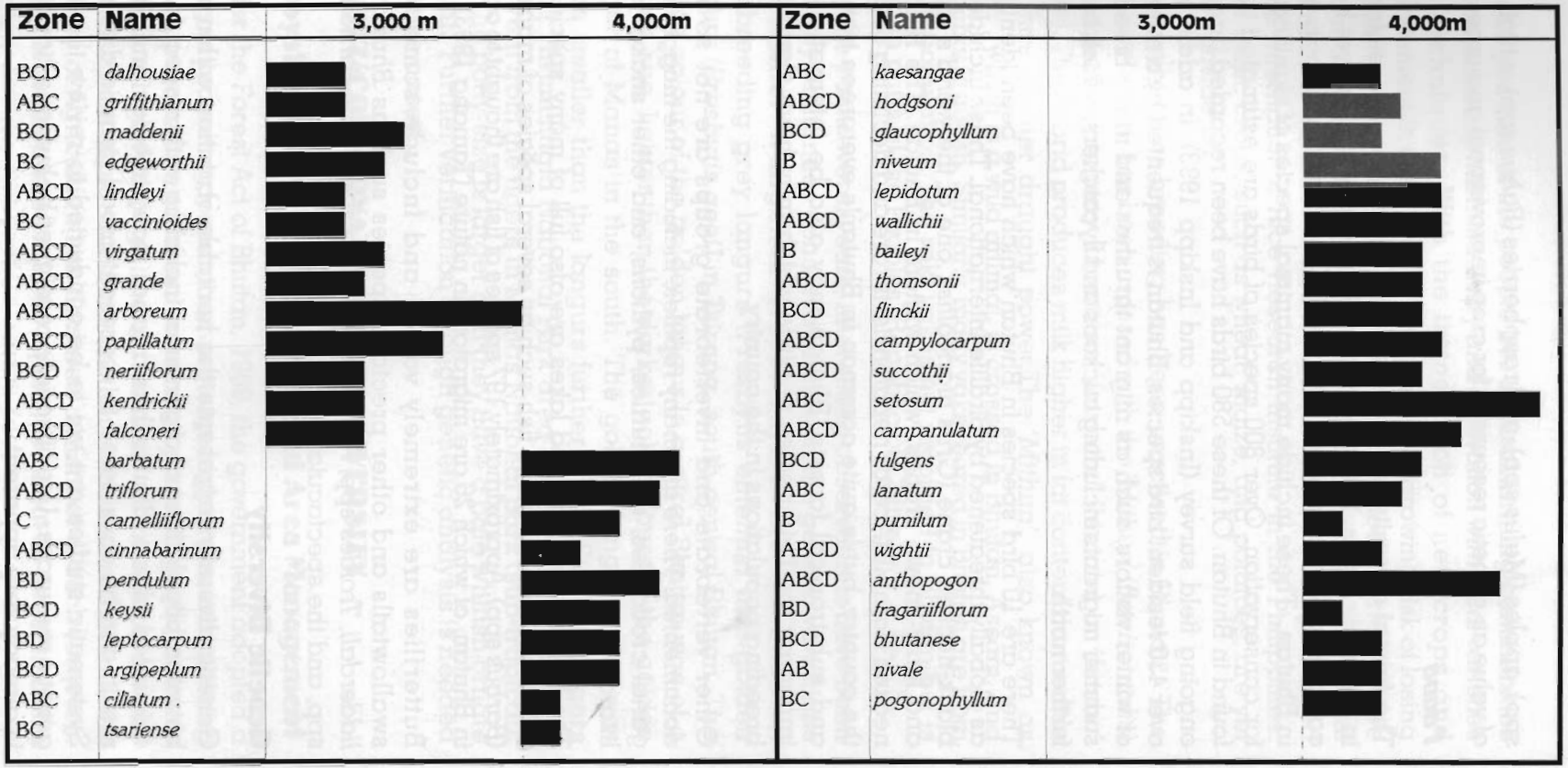
Bhutan's floral diversity is rich, largely due to the great altitudinal range, varied climatic conditions, and the fact that it is a mixing point for several regional flora. The Himalayan flora become richer as the natural environment becomes more humid towards the east. For instance, there are over 55 spp of Rhododendron in Bhutan (Chart 1). Similar patterns of distribution are shown for *Fagaceae* trees.

Over 5,000 species of vascular plants have been recorded so far. The Flora of Bhutan (Grierson and Long 1984) series is being produced by the Botanical Garden of Edinburgh, United Kingdom. The study is yet to be completed but provides valuable information on the floral wealth of Bhutan. Grierson and Long (1984) list 47 species to date that are found in Bhutan.

Many of the tree species are of high timber value, others are tapped for resin and almost all are used for fuelwood and fodder. Over 300 species, largely alpine plants, are used in traditional medicine.

Bhutan's flora also contain a wealth of species highly prized by horticulturists from all over the world. These include rhododendrons, primulas, berberis, lilies, poppies, and so on. Over 168 species of horticultural plants have been introduced into Europe from Bhutan (Grierson and Long 1984). Bhutan's flora also includes many wild relatives of cultivar species, such as strawberries (*Fragaria spp*), currants (*Ribes spp*), cherries (*Prunus*

Chart 1: Distribution of Bhutanese Rhododendrons



Zone : A = West B = West Central C = East Central D = East

Source: Master Plan for Forestry Development (1991)

spp), apples (*Malus spp*), and raspberries (*Rubus spp*), which are of value as genetic resources for crop improvement and crossing.

Fauna

The faunal diversity is also very rich. Field surveys were started in the early 1990s, but the mammal inventory has not yet been completed. It is estimated that over 160 species of mammals exist in Bhutan. These include many mammal species of significance for conservation. Over 800 species of birds are estimated to be found in Bhutan. Of these 580 birds have been recorded through ongoing field survey (Inskipp and Inskipp 1993). In addition to over 450 resident bird species, Bhutan is frequented by a number of winter visitors, such as migrant thrushes and many breeding summer migrants including cuckoos and flycatchers, which breed further north.

There are 10 bird species in Bhutan which have been identified as globally threatened by Birdlife International. These include the black-necked crane (*Grus nigricollis*), one of the world's rarest and least-known cranes, which winters in Bhutan. The Rufous-necked Hornbill (*Aceros nepalensis)* is rare and declining outside the country, but is quite common in Bhutan's evergreen tropical and sub-tropical forests. Bhutan may also be internationally important for 114 species of birds which may have significant breeding populations in the country.

Other vertebrate and invertebrate groups are not so well documented. There are many reptiles, including the mugger and garial crocodiles, river turtles, pythons, and other snakes and lizards.

The Bhutanese rivers and lakes are also full of many species of fish; these include game fish such as several species of *mahseer* (*Barbus* spp). Approximately 197 species of fish are thought to occur in Bhutan, of which 26 are migratory in nature (Tamang 1993).

Butterflies are extremely varied and include some rare swallowtails and other precious species such as *Bhutanitis lidderdali*, *Troides* spp, *Atrophaneura* spp, the alpine *Parnassus* spp, and the spectacular *Teinoppalapus imperialis*.

Genetic Diversity

Genetic diversity represents the heritable variation within and between populations of organisms, including within species. As discussed above, Bhutan has a great many species and, as a result, can be considered to represent broad genetic diversity. Systematic studies are yet to be conducted to review the wild genetic resources. Use of genetic resources by humans, however, is already very apparent.

Over 90 per cent of the people live in rural farming communities and practise animal husbandry and cultivation with local varieties and techniques. With the introduction of new crops and improvement in seed production, there is a growing risk of losing local indigenous varieties. Attempts to protect local varieties have been made in the case of rice. One hundred and fifty traditional high altitude varieties of rice from Bhutan have been preserved at the International Rice Research Institute in the Philippines. Other basic crops, such as wheat, maize, and potatoes, are yet to be considered.

Historically, cross-breeding has been practised in Bhutan. The local cattle 'Siri' has been crossed with the 'Mithun' (*Bos frontalis*) to produce a progeny known as *'Jatsham'* (female) or *'Jatsha'* (male). The hybrid produces milk higher in fat content than cattle and has greater draught power.The *'Mithun'*, also known as *'Gaur'*, which is a wild animal, is crossed in Bhutan, Assam, and Arunchal Pradesh. Similarly, many yaks reared in Bhutan are from a wild population. The wild yak is not recorded in Bhutan but is found in parts of the Peoples' Republic of China.

Over the past several years, interesting observations have been made by Bhutanese conservationists on the genetic variations of wildlife. Wangchuk (1995) raised the question of interbreeding grey langurs (*Presbytis entellus*) and golden langurs (*Presbytis geei*) in Tsirang, south central Bhutan. The pelage colour of the golden langur in central Bhutan was of a golden hue, lighter than the darker gold colours of the golden langur of Manas in the south. The golden langur's size was much smaller than the langurs further north. Similarly, tigers in the Thrumsingla National Park area (temperate forests) are different from the tigers in Manas National park (sub-tropical), i.e., the body-size is larger and they have a pale whitish ornate colour. Further verification through genetic analysis is needed of these cases.

IN SITU CONSERVATION OF BIODIVERSITY

Ecosystems' Approach in Protected Area Management

Under the Forest Act of Bhutan, 1969, the government adopted a policy of protecting forest cover in steep, high areas, maintaining a high percentage of forest cover, and protecting wild animals from hunting. Although the Act makes no provision for the establishment of protected areas other than reserved forests, the Ministry of Agriculture has declared a number of such reserves. The total area covered is 9,505 sq.km., or about 20 per cent of the country.

An examination of the distribution of current protected areas shows that they are not representational of all the ecosystems in the country. Alpine-tundra habitats are over-represented, with almost the entire zone protected, although most of this is bare rock and ice facing little threat to its biodiversity. The tropical-subtropical zone is also over-represented, although this zone and several of the reserves in it have been damaged extensively by agricultural encroachment, logging, and poaching. Representation of the central part of the country is totally inadequate, with almost no protection afforded to the wide range of magnificent broad-leaved forests and temperate coniferous forests.

Reviews by Blower (1989), Mackinnon (1991) and Sherpa et al. (1992) all draw the same conclusions and emphasise the need for large reserves to be established in the central zone of Bhutan. Blower (1989) and Mackinnon (1993) proposed two major reserves —the Black Mountains and Thrumshingla—for Bhutan.

However, in addition to the main north-south zones of Bhutan, there are significant differences in species' distribution from east to west. The country can also be divided into biogeographical sub-divisions, according to the major valley and ridge systems combined with variations in climate. For instance, the distribution of *Fagaceae* trees and rhododendrons in Bhutan demonstrates that quite different species and communities are found in the eastern, central, and western areas of the country. A similar pattern is seen for animal groups. As a result of these observations, the Master Plan for Forestry Development has advocated the need to also protect examples of the easternmost and westernmost variants of the main zones.

Reserves should be large and contain a wide range of altitudes and habitat types. With diverse fauna, species densities are often low, requiring a large area to protect populations of viable size. In addition, a very large proportion of birds and many of the larger mammals are altitudinal migrants with seasonal shifts of about 2,000-3,000m between their summer and winter ranging areas. Therefore, they need both a wide area and a range of altitudinal zones.

Bhutan still has large areas of natural forests from which protected areas can be selected. Pressures to convert forests into agricultural land are still not as evident as in other parts of the Himalayas. It can currently afford the luxury of taking an environmentally cautious approach to development, avoiding disastrous ecological consequences of inadequate conservation of forest resources.

PROTECTED AREA REVISIONS

A revised system of protected areas was proposed for notification consisting of one Strict Nature Reserve (IUCN category I),

four National Parks (IUCN category II), four Wildlife Sanctuaries (IUCN category IV), several small Scenic Areas (IUCN category V), and Conservation Areas (IUCN category VIII). Map 1 shows the distribution of these areas. The proposed notification was subsequently approved by the Royal Government of Bhutan in 1993 and gazettement of four parks took place in 1994. The protected areas are listed in Table 1.

Table 1: Revised System of National Protected Areas

Name	Category	Area (sq.km.)	Buffer (sq. km.)	Dzongkhags (District)
Torsa	SNR	644	0	Ha/Samchi
Jigme Dorji	NP	3,900	300	Paro/Thimphu/ Gasa/Punakha
Black Mountains	NP	1,300	100	Wangdi/Tongsa/ Shemgang/Bumthang
Thrumshingla	NP	748	20	Shemgang/Bumthang/ Mongar
Royal Manas	NP	975	25	Gaylegphug/Shemgang /Samdrup Jongkhar
Sakteng	WS	610	40	Tashigang
Kulong Chu	WS	1,250	50	Lhuntshi/Tashi Yang
Phipsoo	WS	278	0	Gaylegphug
Khaling/Neoli	WS	273	0	Samdrup Jongkhar

SNR Strict Nature Reserve **WS** Wildlife Sanctuary
NP National Park

A short descri-ption of each protected area is given below.

Torsa Strict Nature Reserve (644sq.km.)

This reserve protects the westernmost temperate forests of the country, which range from broad-leaved forests to alpine peaks, and increases the small lakes of Sinchulungpa. The area has no human habitation and is a security area adjacent to the Chinese border. It has been observed that management as a Strict Nature Reserve will have no negative impacts on local people or on other planned developments in the area.

Jigme Dorji National Park (4,200sq.km.)

The park consists of only the western end of the former, enormous wildlife sanctuary, but the border has been brought considerably further south to increase the range of habitats through conifer forests to upper broad-leaved formations. This is necessary because many of the important animals for which the reserve was established move down to these altitudes in the winter, for instance, takin, snow leopard, blue sheep, deer, pheasants, and others. The area protects some of the most spectacular pastoral scenes, including great glaciers, deep alpine lakes, and the highest peaks in the kingdom.

The park area has a heavily populated enclave in the Gaza area up the Mochhu Valley and some high altitude seasonal grazing

areas in the Lingshi, Laya, and Lunana areas. These areas will be zoned as Intensive-use Zones. Thus, creation of a park will not cause any disruption to the lifestyle or land-use rights of the local people. The area has great potential for trekking tourism; but park development will need to tackle a number of problems such as overgrazing, over-harvesting of medicinal plants, minimising tourist impacts on the environment, and protecting religious and cultural sites.

Black Mountains' National Park (1,400sq.km.)

The reserve covers a wide range of habitat types from permanent ice on the peak of Dorsingla at 4,925m, alpine lakes, and pastures to conifers and broad-leaved forests. The reserve is likely to constitute the largest and richest temperate forest nature reserve in the whole of the Himalayas.

Furthermore, the reserve is linked to the Royal Manas National Park by means of a corridor extension to Manas. This constitutes a unique natural heritage reserve spanning the entire gradient from tropical *'duars'* to permanent icefields. The combined park would certainly merit World Heritage Site status under the UNESCO World Heritage Programme. Surveys have already revealed 449 species of birds in this combined area, a greater number than in any other reserve in Asia.

The park contains almost no permanent residents. There are a few small farms along the borders of the park along the River Mangde, in the lower reaches of the River Hara, and along the park's southern border. These areas will be zoned into a buffer zone. A larger human settlement in the Nubi area will be enclaved and left out of the reserve boundaries. The prevalent use of this area is only for grazing large herds of yaks in summer on the northern alpine areas of the park. This area will be zoned as a seasonal grazing area with no loss of rights to local people, except that they will be banned from felling trees to extend the natural grazing area, which is a practice.

Thrumshingla National Park (768sq.km.)

This is the second major temperate reserve in Bhutan with panoramic views and beautiful forests ranging from the alpine to the sub-tropical broad-leaved. The soil of the area is particularly suitable for pine forests, and it is exceedingly fragile, rendering it quite unsuitable for logging or other development purposes. However, it has excellent tourism potential with a good wildlife trail from the Ura down to the Bumthang Valley. The small town of Sengor in the middle of the park is to be enclaved as an Intensive-use Zone.

Kulong Chu Wildlife Sanctuary (1,300sq.km.)

The Alpine-Tundra zone of Bhutan is split by the Kuru Chhu Valley which results in some differentiation in the eastern section. This reserve protects a representative area of the eastern section. *Shou* (*Cervus elephas wallichi*) and *argali* (*Ovis ammon*) were formerly reported from this section. *Shou* is still reported from adjacent parts of Arunachal Pradesh (India) where an adjacent reserve is also planned. The sparsely-populated Khoma Chhu Valley will be enclaved as an Intensive-use Buffer Zone.

Sakteng Wildlife Sanctuary (650sq.km.)

The area is designed to protect a sample of the easternmost temperate systems of Bhutan where some endemic species are found such as the eastern blue pine, black-romped magpie, and other species that are found only in the east. The area is said to contain the legendary Yeti. It is also designed to form part of a trans-frontier reserve with a planned National Park in India.

Royal Manas National Park (1,000sq.km.)

This park is the conservation showpiece of Bhutan and lies adjacent to the Manas Reserve of Assam which contains more endangered species of wildlife than any other Indian Reserve.

The park is formed by combining the existing Manas Wildlife Reserve and the Namgyal Wangchuk Reserve. In addition, a forest corridor northwards, as far as the Gaylephug to Shemgang highway, where the reserve will become adjacent to the Black Mountain National Park, has been proposed. The reason for this is to provide a continuous gradation of protected habitat from tropical duars all the way to permanent ice. This would be a unique conservation achievement in the Himalayas.

Manas is the only reserve in Bhutan to be inhabited by rhinoceri, although poaching in Assam could possibly have exterminated this population. The park contains more significant species than any other in Bhutan, and 362 species of birds have already been confirmed in the park area. When linked with the Black Mountains, the combined area already has a total of 449 species of birds confirmed. This is more than recorded for any other reserve in Asia. The Manas tiger reserve in India, bordering the Royal Manas National Park, which again is linked with the Black Mountains' National Park, can easily qualify to be listed as a biosphere reserve and/or a World Heritage Site (Sherpa 1994).

Small settlements around the park boundary and in a few small enclaves will be zoned as Intensive-use Buffer zones.

Khaling/Neoli Wildlife Sanctuary (273sq.km.)

This reserve is constituted from the existing reserves of Khaling and Neoli. It is planned to combine the two areas and revise the boundaries, retaining the same size.

The reserve is known for elephants, *gaur*, and other tropical wildlife, and could be the only locality in Bhutan where the pygmy hog and hispid hare occur. Both are known from the Khaling reserve on the Assam side of the border, with which this reserve will form a trans-frontier reserve.

Phipsoo Wildlife Sanctuary (278sq.km.)

This reserve is important for tropical fauna such as elephant, gaur, and golden langur. It is the only reserve in Bhutan to have the chital' deer (*Cervus axis*). In addition, it is the only remaining natural sal forest in Bhutan. No revision to the reserve boundaries is necessary.

Conservation Areas

The six areas inside the box are nominated to be Conservation Areas. Such areas are multiple-use areas and do not need to be under the management of the Nature Conservation Division. However, each requires some special regulations to ensure the protection of local species of importance for conservation.

Name	Dzongkhag	Special Values
Bumdeling*	Tashi Yangtse	Black-necked Crane wintering
Gyetsa	Bumthang	Black-necked Crane wintering
Kurjey	Bumthang	Black-necked Crane wintering
Phobjikha	Wangdi Phodrang	Black-necked Crane wintering
Khotokha	Wangdi Phodrang	Black-necked Crane wintering
Doga	Paro	Goral

* Bumdeling was declared a Crane Sanctuary in 1994 by command of His Majesty the King of Bhutan.

Scenic Areas: Four areas which are frequently visited for recreational and religious purposes and have valuable conservation and scenic values that should be preserved have been proposed as Scenic Areas. These include Dochu La, Pele La, Yutong La, and Dhur Tsachu.

INSTITUTIONS CONCERNED WITH BIODIVERSITY CONSERVATION AND MANAGEMENT

National Environmental Commission (NEC)

The National Environmental Commission was initially established under the Planning Commission but has now evolved into a separate autonomous body. The NEC is an advisory body responsible for defining and establishing policies, plans, organisations, and actions to ensure that the national goal of

achieving sustainable use of resources is integrated into every aspect of the five-year plans. In order to achieve this, NEC is developing a national conservation strategy to be implemented in all sectors.

Forestry Services' Division-Ministry of Agriculture

The Forestry Services' Division (FSD) is the main government agency responsible for the execution of conservation projects. Actual day-to-day management and implementation are carried out by the technical section within FSD, i.e., the Nature Conservation Section. FSD exists under the Ministry of Agriculture as the forestry sector is treated as one of the three components of the Renewable Natural Resources' Sector-the other two being agriculture and animal husbandry. The agriculture and livestock division play equally important roles in conserving crop and livestock biodiversity.

A Non-Government Organisation

There is only one conservation-oriented Non-Government Organisation (NGO) in Bhutan, i.e., the Royal Society for the Protection of Nature (RSPN). The main objective of RSPN is to increase awareness among the public, students, and government officials of the importance of nature conservation and wise use of Bhutan's natural resources. RSPN is engaged in successful outreach environmental awareness programmes and has been working closely with the government to integrate environmental education into the national education system at the primary and secondary levels.

Bhutan Trust Fund for Environmental Conservation

In many cases, conservation efforts require long-term investment and commitment of sustained efforts. Despite serious intentions, this often precludes governments of developing nations from undertaking serious commitments to conservation and natural resource management. Hence, for long-term conservation to become effective, a long-term funding mechanism must be available. This guarantees that long-term natural resource management planning can be undertaken and a viable cadre of natural resource managers can be trained and receive further inputs when necessary. Long-term funding also allows effective conservation education to be implemented, updated technology made available to provide effective information systems, and other vital conservation initiatives also to be successfully implemented.

Recognising this, the WWF, in collaboration with the Royal Government of Bhutan and UNDP, established the Bhutan Trust Fund for Environmental Conservation (BTFEC) in 1992.

The Bhutan Trust Fund is set up as a long-term endowment with a target of US $ 20 million, of which US $ 18 million has already been secured (December 1995). It is governed by a five-member Management Board composed of three representatives from the government and a representative each from UNDP and WWF. The Board meets twice a year to decide policy issues, approve the list of projects to be funded by BTF, and carry out other responsibilities as specified in the Trust Fund document.

Interest yielded will be used to fund conservation programmes which, at this stage, include training, development of an ecological information base, development of management plans for identified protected areas, institutional support for relevant institutions, environmental education, and integrated conservation and development projects. The BTF is the first concrete step towards sustainable, long-term conservation in Bhutan and serves as a possible model for global conservation and natural resource management. Trust funds for environmental conservation are being established on an experimental basis in over 15 countries (WWF Country Plan 1992).

WWF Bhutan Programme

Since 1977, WWF has been supporting conservation efforts in Bhutan. Initially, WWF's conservation efforts were in the form of training. It has now evolved to become a major partner in nature conservation in Bhutan. The overall goal of the WWF Bhutan Programme is to conserve the diversity of species, communities, ecosystems, and ecological processes in Bhutan, particularly because the ecological wealth of Bhutan represents the best intact representatives of the ecological systems of the eastern Himalayas. WWF works with the relevant government, non-government, and training institutions on all conservation projects in the Kingdom. Specifically, the key programmes include protected area planning and management and institutional development, including training, conservation education, environmental policy, integrated conservation, and development and research.

LEGISLATION AND POLICIES ON BIODIVERSITY CONSERVATION

The Royal Government of Bhutan places higher priority on the protection of forest resources than on their commercial exploitation. The government has passed laws and regulations restricting grazing in critical watershed areas and in protected forests. It has established an extensive system of protected areas, covering 26 per cent (National Environmental Secretariat

1992) of the total country area, and banned hunting in all protected areas.

The conservation and usage of natural resources in Bhutan are governed, although not exclusively, by the following principle legislation and policies.

Bhutan Forest Act of 1969

Under this act, all unclaimed natural lands were declared government forest reserves. Felling and burning of trees, fishing, and hunting of all large mammals (including golden langurs, tigers, snow leopards, elephants, and red pandas) were banned.

National Forest Policy of 1974

In the past, natural forests were logged indiscriminately, often causing environmental damage. This led the government to nationalise logging. The National Forest Policy of 1974 was instituted. Under this policy all felling of trees was to be carried out by the Department of Forests, which either auctioned off the timber to private sawmills, or exported it to neighbouring Indian states.

National Forest Policy of 1985

This draft policy accorded higher value to conservation than to exploitation of forests.

Forest and Nature Conservation Act of 1995

Under the new Act, the policy for nature conservation is greatly clarified and provisions are made for the gazettement of several new categories of protected areas. Under the approved forest and nature conservation act, social forestry and community forestry roles have been highlighted.

In 1995, Bhutan's national assembly ratified two international conventions, namely, on Biodiversity and Climate Change.

CONCLUSION AND RECOMMENDATIONS

Bhutan is unique in many ways. The socioeconomic situation, and the status of natural resources, with over 60 per cent forest cover, including an intact value system, culture, and traditions make it different from other countries in the Hindu Kush-Himalayas. The opportunity to conserve the country's largely intact natural and cultural heritage presents a challenge to a fast-growing younger generation, especially with a shortage of trained manpower. Equally grave are the environmental problems, such as

overgrazing, extensive shifting cultivation, large-scale development projects, and minimal institutional capacities. Bhutan, however, has provided two important examples to the world community, e.g., planning a network of protected areas to represent all ecological zones in the country and establishment of an endowment through the Trust Fund to finance long-term conservation of biodiversity and sustainable development programmes. Priority areas for investment could include continued field inventories and surveys of flora and fauna; strengthening traditional natural resource management practices; projects that link conservation and development; a national biodiversity database, and conservation education.

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