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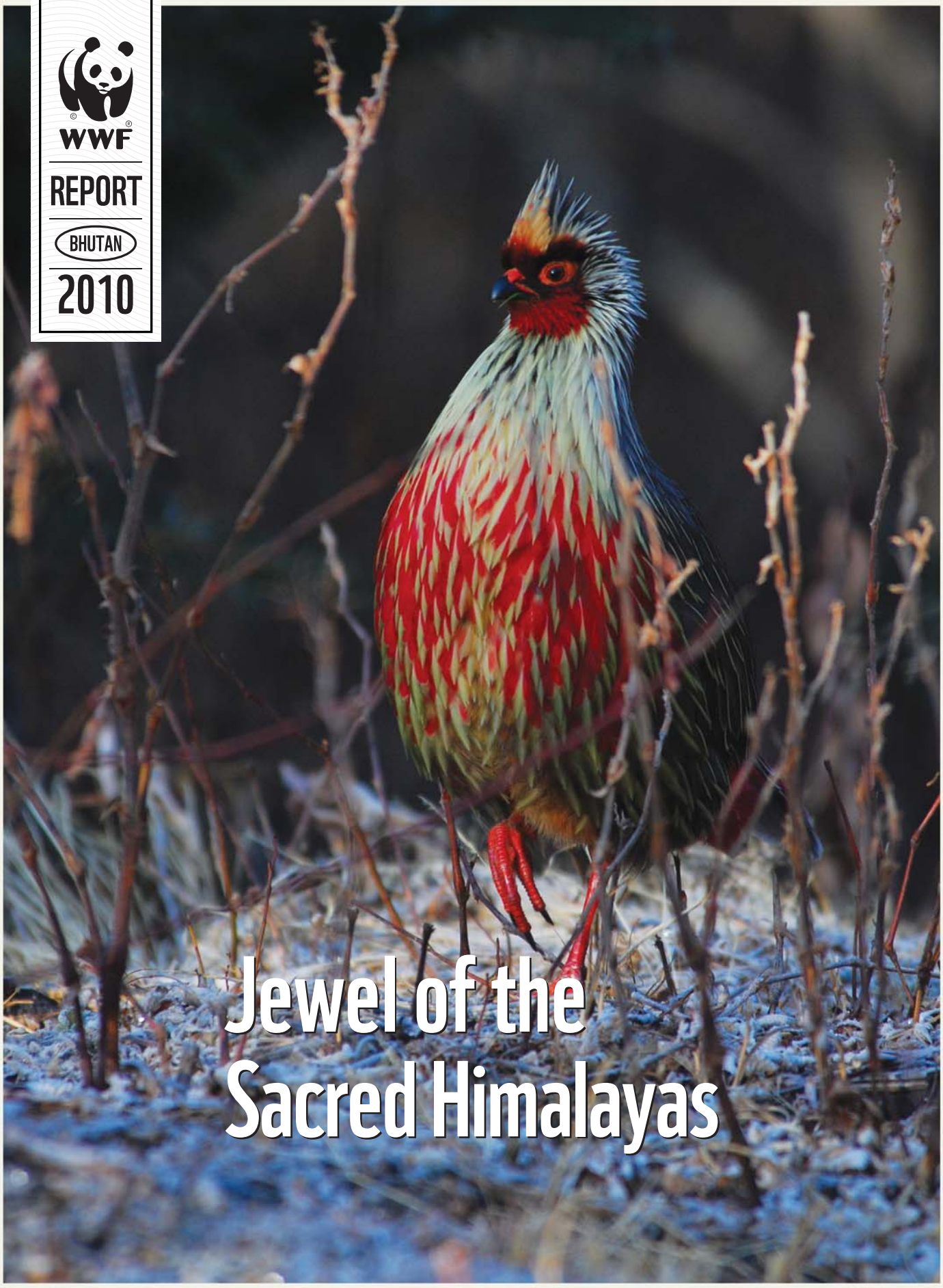

Jewel of the Sacred Himalayas


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ROYAL GOVERNMENT OF BHUTAN
Ministry of Agriculture and Forests
Thimphu:Bhutan

འབྲུག་པ།
MINISTER

FOREWORD

In terms of natural grandeur and magnificence, the Himalayas have no geographical parallel on the earth. The Kingdom of Bhutan, which lies in the eastern Himalayas, gives ample credence to this claim, particularly in terms of the diversity of ecosystems and biological species that it harbours within its small geographical area.

Perhaps no other country could match the efforts that Bhutan has put in to proactively protect its environment and conserve its rich biodiversity, Bhutan has long recognised the link between its fragile environment and the ecological security of the nation as well as the socio-economic well-being of its people and of those living downstream in neighbouring countries. This commitment is manifested in the establishment of a network of parks, protected areas and biological corridors which together cover over 51% of the country's surface area.

Within this conservation complex, the Northern Forest Complex (NFC) covering the three protected areas of Jigme Dorji National Park, Wangchuck Centennial Park and Bumdeling Wildlife Sanctuary, can be justifiably labelled as "the green jewel". The NFC stretches across almost 28% of the kingdom's forest cover– ranging from warm and cool broad-leaf temperate, mixed conifer and sub-alpine to alpine scrubs, meadows and screes that provide space to several keystone animal and bird species like the snow leopard, tiger, Bhutan takin, the Himalayan black bear, pheasants, raven and tragopans. In addition to its rich biodiversity, the NFC provides essential ecosystem services to the region. It also contains the glacial lakes which are the head sources for the country's major rivers that feed the hydropower plants currently generating 40% of the national revenue.

The establishment of the Northern Forest Complex is envisioned as a noble initiative towards securing the ecological integrity of the Bhutan Himalayas and probable intervention to mitigate the impacts of climate change. It is hoped that other nations in the region would initiate similar undertaking to cement the wall and thereby collectively contribute towards sustaining the nature's treasury of the Living Himalayas.

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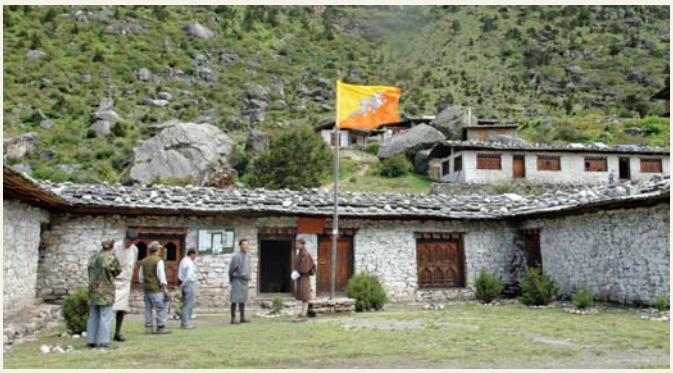


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JEWEL OF THE SACRED HIMALAYAS

Introduction

The Eastern Himalayas encompassing Bhutan, north-east India, Nepal, southern parts of Tibetan Autonomous Region of China and far north of Myanmar is a region where nature's myriad manifestations thrive in original splendor. It is the 'Jewel' of the Himalayas. The bio-geographical setting over millions of years has created a region that has one of the richest biological diversity in the world. Marked by climatic variability and altitudinal gradation, the Eastern Himalayas reflect startling contrasts in its physical profile. It is home to the world's highest mountains and deepest gorges, subtropical jungles, temperate forests, tall grasslands, savannas and alpine meadows. The region harbours over 10,000 plants, 300 mammals, 977 birds, 176 reptiles, 105 amphibians and 269 freshwater fish. The glaciers and ice fields of the Eastern Himalayas feed the large river systems, on which millions of people across the region depend.

With the increasing human-induced activities focused on economic growth and development, much of this biological wealth faces potential threat of being devastated. Unplanned and reckless utilization of natural resources would degrade forest ecosystems and damage their biodiversity and potential to provide essential goods and services. Increasing competition for land and other resources has triggered conflicts between humans and wildlife. Retaliatory killing of tigers and snow leopards and poaching have threatened the survival of flagship species. These impacts could be further amplified by the rising global temperature and climate change that have led to melting of alpine glaciers.

In order to secure the Eastern Himalayan ecosystem from environmental threats and development pressures arising from inadequate economic planning and management, it is essential for the nations in the region to work on a unified strategy. Towards this end, Bhutan has already contributed to the initiative by securing three protected areas across its northern region covering almost 28% of the kingdom's forest cover. The prime objective of this initiative is to protect the keystone species, critical ecosystems, important watersheds and to cushion the impact of climate change on Bhutan's Himalayan rim.


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BHUTAN'S HIMALAYAN ADVANTAGE

Securing the pristine forests in the Northern Forest Complex will go a long way in ensuring the ecological security of a region that provides a host of ecosystem services to the mountain kingdom.

To tourists across the globe, the Land of the Thunder Dragon in the Eastern Himalayas is a cultural destination that offers a unique mystical adventure to the mind, body and spirit. But beyond its spiritual allure, Bhutan is also endowed with a pristine environmental legacy that has been nurtured and conserved by its leaders and people over the centuries.

The strong traditional conservation ethic stems from the deep reverence for nature and life as prescribed by the Buddhist way of life. The mountain kingdom's policies towards the protection of its culture and environment also reflect the Bhutanese philosophy of Gross National Happiness (GNH), a concept—propounded by His Majesty the Fourth King Jigme Singye Wangchuck—which underlines that development can be balanced and sustainable only if it stands on the three pillars of economic growth, emotional and spiritual well-being.

This philosophy has ensured that Bhutan, which has a population of 6,91,141, is one among the few Asian countries that enjoys the rare distinction of having 72.5% of its landmass covered by forests.

One of the world's 25 biodiversity hotspots and 221 Global Endemic Birds Areas, Bhutan has an extraordinary range of animal and plant life found in its forests. The country is home to 190 species of mammals, 5,603 species of vascular plants, 700 birds, two amphibians and 92 reptiles. Of this, 14 bird species and 26 mammal species are globally threatened, according to the Red List of Threatened Species maintained by the World Conservation Union (IUCN).

Interestingly, about 86% of the globally-threatened bird species and 54% of the globally-threatened mammal species found in the country do not have the highest legal protection at present.

To conserve several endangered and threatened ecosystems of the Eastern Himalayas, the Royal Government has assigned Protected Area (PA) status to 42.7 per cent of its territory and declared 8.6 per cent of additional land as biological corridors (which connect the protected areas). The 10 protected areas have been categorized as nature reserves, national parks and wildlife sanctuaries.

These initiatives have put Bhutan on top of the list of countries with the highest proportion of area under protected status. To give conservation efforts a harder push, the Government has also declared a policy that decrees that at a forest cover of at least 60 per cent will be maintained at all times.

The Green Jewel

While much of Bhutan's landscape is criss-crossed by forests and biological corridors, one of its most vital natural assets is the Northern Forest Complex (NFC), comprising of Jigme Dorji National Park (JDNP), Wangchuck Centennial Park (WCP) and Bumdeling Wildlife Sanctuary.

The NFC, which represents the fragile eastern Himalayan ecosystem, spans approximately 10,751 sq Kms—stretching from Gasa district (to the west of JDNP) through WCP to Trashi Yangtse district (to the east of BWS). It links 50% of the country's districts (see chart) and shares almost 28% of the kingdom's forest cover—ranging from warm and cool broadleaf temperate, conifers and sub-alpine to alpine scrubs, meadows and screes.

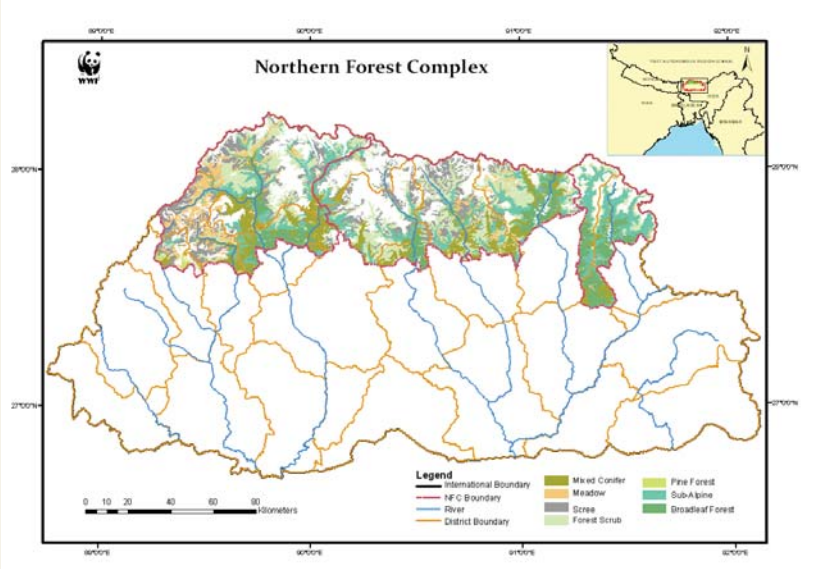
The NFC harbours several keystone animal and bird species like the snow leopard, tiger, Bhutan takin, the Himalayan black bear, pheasants, raven and tragopans. These apart, a rich assortment of plant life is found in the largely mountainous and rugged terrain with altering gradients.

In terms of resources, the NFC generates a host of invaluable ecosystem services. The first in the list is water, on which depend Bhutan's most important economic driver—hydropower. Glacial mountains, glacial lakes and alpine lakes on the northern-most strip of the complex are the head source for the country's major rivers, which cover a large part of the critical watershed in the country.

As much importantly, the region also provides timber and non-timber forest products (like medicinal plants, flowers, food, paper) for both domestic and regional markets.

Trade in forest products, along with tourism, supports the livelihoods of local communities, many of whom prefer to follow traditional occupations like subsistence farming, nomadic semi-pastoralism or yak herding.

The real worth of the Northern Forest Complex is much more than the tangible services and resources that it offers now. By realising its incalculable value and deciding to protect this natural treasure trove, Bhutan has taken a positive stride ahead to strengthen the ecological security of the nation and ensure the well-being of its people and society for the future.

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SECURING NATURAL WATER INFRASTRUCTURE

Climate change could upset the water sufficiency of Bhutan. But NFC's well-preserved watersheds hold out the best hope for ensuring plentiful supply to Bhutan's future generations.

Bhutan's water resources are as bountiful as its biodiversity. Almost the entire freshwater wealth of the country flows down from the highlands of the Northern Forest Complex (NFC) in the form of major rivers to the southern parts of the country. The 'water reservoirs' are sustained by an intricate system of monsoon, glaciers, glacial lakes, high altitude wetlands and streams besides forests and meadows.

A big chunk of this liquid bounty in the NFC rains down from the skies during the monsoon. The climate of the region is dominated by the monsoon, which sweeps in from the Bay of Bengal during June, gains intensity in July and August, and finally moves out in September. The average annual rainfall ranges from nearly 4,000 mm at lower altitudes (below 500 m above sea level) to less than 500 mm at higher altitudes (above 4,000 m above sea level). Nearly 85-90% of the rainfall takes place during April to September.

The waters in the estimated 677 glaciers and 2,674 glacial lakes within the NFC feed into several streams that join up at the watersheds to form major rivers, namely Mo Chhu, Pho Chhu, Wang Chhu, Pa Chhu (Jigme Dorji National Park); Khoma Chhu, Womenang Chhu, Kulong Chhu, Sheri Chhu, Nindari (Bumdeling Wildlife Sanctuary); Punatshang Chhu, Mangde Chhu, Chamkar Chhu and Kuri Chhu (Wangchuck Centennial Park).

These tributaries finally drain into four major river basins: Amo Chhu (also called Toorsa), Wang Chhu, Puna Tsang Chhu (Sunkosh) and Drangme Chhu (Manas). Together, the major river basins have a basin area of about 34,000 square km. Drangme Chhu, which is the largest river basin, drains more than one-third of the country.

Water from the major rivers is primarily used for generation of hydropower, which has a 40% share of the national revenue. More than 90% of that earning came from exports to India *(see chart)*.

In terms of water services, each of the three protected areas in the NFC makes a substantial contribution to the country's revenue kitty. According to a preliminary study, use of water resources from the Jigme Dorji National Park (JDNP) for hydropower contributes nearly US$ 232 million to the nation *(according to draft report 2010, South-South Cooperation for Sustainable Development Among Benin, Bhutan and Costa Rica)*.

Other sectors like agriculture, industry, rural and urban municipalities depend more on tributary streams, springs and sub-surface water for their requirements—many of which have their sources in NFC.

Despite an overall rise in gross consumptive water demand from an estimated 422 million cubic metres in 2002 to nearly 500 million cubic metres at present, Bhutan has a current average per capita water availability of 100,000 cubic metres—one of the highest in the world.

With the long-term mean annual flow of the entire country estimated to be 73,000 million cubic metres, the country seems to be highly water-sufficient for a long time to come. But emerging challenges, in the form of human pressures and climate change, could upset the honeymoon in the future.

For one, rising demand from a growing population could increase the strain on the water towers in the NFC. The most significant spike in usage could come from hydropower projects (installed capacity: 1,488 MW in 2007). In the next 20 years, the Government plans to enhance installed hydropower capacity to 10,000 MW. This could push up the industry demand for water from 6,700 million cubic metres (in 2002) to nearly 30,000 million cubic metres in 2030. Alongside, water requirement from other sectors is also bound to rise due to rapid pace of development and changing lifestyles.

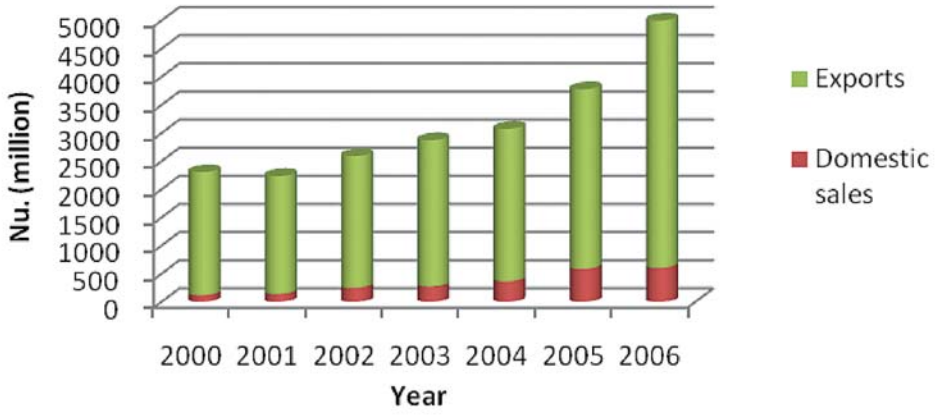
The bigger concern is climate change. A warmer and more variable climate could cause disruptions in the monsoon cycle and trigger rapid glacial melts in the NFC. Consequently, a combination of events like erratic rains, glacial lake outbursts, flash floods and landslides—could lead to decrease in river flows in the long run.

Fall in water levels would seriously impact the revenue potential of the hydropower sector, which is the main driver of socio-economic development in Bhutan. It will also affect downstream communities in neighbouring India and Bangladesh which subsist on agriculture and fisheries.

Also, increase in water temperatures and high intensity rainfalls in the catchment areas could increase outbreaks of micro-organisms, sedimentation and pollution loads in the rivers. Worse, it could increase Government's cost of water treatment and distribution.

Despite the dire threats and alarming repercussions of climate change—along with anticipated costs of restoring the damaged catchments—a protected NFC along with its well-preserved forests and watersheds holds out the best solution for ensuring plentiful

Figure: Sales from Major Hydropower Projects 2000-2006



Still Waters, Deadly Bursts

As in the rest of the Himalayas, Glacial Lake Outburst Floods (GLOFs) in the Northern Forest Complex (NFC) are among the most serious natural threats in Bhutan. Climate change has made these silent water bombs tick faster.

GLOFs are a sudden discharge of large volumes of water contained within a glacial lake due to breach in the perimeter walls.

Seen from the air, glacial lakes are tranquil bodies of water tucked in between rugged alpine slopes. They are held in place by loosely agglomerated rocks and sediments called moraines.
An increase in the level of ice and snow, brought about by melting glaciers, leads to rapid accumulation of water in these lakes bound by weak moraine walls.

GLOFs become highly dangerous once they connect with the surrounding supra glacial ponds and lakes (which get formed on the snow itself).

In October 1994, a partial breaching of Luggye Tsho lake in the NFC caused a catastrophic GLOF that caused loss of 20 lives and property along the Punakha-Wangdue valley and damaged part of Punakha Dzong (fort). It also washed away around 965 acres of pasture land and numerous yaks.

The NFC now has a greater peril in the form of the Thorthormi, a neighbouring lake of Luggye. Reports reveal that the Thorthormi has swelled up to a fearsome size and is in danger of swamping another contiguous glacial lake, the Raphstreng. If the two lakes were to merge, they could push their way out of the unstable moraine walls, and go gushing into the valley.

If the Thorthormi bursts, half of the Punakha-Wangdue valley would be submerged under water, resulting in destruction of lives, property (the Punakha Dzong, for one, would be washed away), biodiversity and livestock.

Of the 25 potentially dangerous glacial lakes in Bhutan, the Thorthormi Lake in the northern Lunana area faces the highest risk of outburst flooding.

During the past decade, the Royal Government of Bhutan has initiated several projects to lower the water levels of the two glacial lakes—Thorthormi and Raphstreng—in Lunana to reduce the likelihood of a GLOF. In 2009, the WWF joined Government of Bhutan and partners in an ambitious effort to minimize the menacing threat from Thorthormi Lake and to keep its water levels from reaching the threshold. The artificial drainage of Thorthormi has shown viable ways to reduce risks in potentially dangerous glacial lakes in Bhutan and elsewhere.

BUILDING CLIMATE RESILIENCE

Securing NFC could be one effective remedy to cushion the impact of climate change on Bhutan's Himalayan rim.

As in the rest of the Himalayas, the glaciers in the upper reaches of the mountains in the Northern Forest Complex (NFC) contribute to Bhutan's major sources of fresh water for majority of Bhutan's population living in the river basins. But today, the water towers are facing the heat of climate change.

A recent report by the Friends of the Earth (FOE) says warming across the greater Himalayas is two-to-four times the global average. As a result, glaciers in the NFC are melting and retreating at an alarming rate each year due to global warming, point out studies.

Accelerated glacier melt, in turn, is leading to the formation of a large number of glacial lakes. At least 24 glacial lakes in the NFC are today classified as potentially dangerous. (See box) Some lakes in the Pho Chu basin in Bhutan have increased in size by as much as 800% in past 40 years, according to the FOE report.

Rapid accumulation of water in these lakes can lead to glacial lake outburst floods (GLOFs), landslides and rock avalanches downstream, bringing unimaginable devastation to wildlife, people, property, lives and livelihoods.

In the longer-term, glacial melts could also reduce the flow and quantity of water in rivers going downstream. This could have profound implications for water security and hydropower, which represents the country's largest source of revenue (more than 80% of power is exported to India). It will also bring down the quantity of water flowing from Bhutanese rivers into bigger rivers in the region such as the Brahmaputra.

Under a warmer and more variable climate, monsoons will turn erratic, causing disruptions in natural and agricultural cycles. Bhutan is already witnessing dry periods interspersed with increasing spells of intense rains, resulting in flash floods, landslides, damage to infrastructure and loss of lives.

But the more tangible impacts on the mountain kingdom's fragile ecology would start showing up as temperatures continue to rise in this region over the next few decades. The possible worst-case scenarios in the long-term are:

- Retreat of snow lines to higher elevations
- Rapid loss of habitats and biodiversity (see box on Snow Leopard).
- Eventual extinction of restricted endemic species.
- South-North migration of animals.
- Conversion of forests into agricultural lands.
- Loss of water resources, and water stress.

Taking heed of these calamitous projections, Bhutan has taken a proactive measure to seal the NFC for posterity. The immediate aim, of course, is to ensure protection of its biodiversity against anthropogenic pressures. But the broader vision is to cushion Bhutan's Eastern Himalayan rim from the surprises and shocks of extreme climate events—and enable the region to recover and revitalize after severe damage. Experts say that by bringing down human pressures to minimal levels in the NFC, nature would be allowed to take its own course in building robustness into the ecosystem to survive extreme climate events.

In the long term, a secure NFC will also replenish Bhutan's wealth of ecosystem services, such as water security and quality (storage and purification of water), air quality (generation of oxygen), prevention of soil erosion and revenues from export of hydro-power. Much of these services will play a critical role in maintaining the climatic balance in countries like India and Bangladesh.

From a global context, the dense forest cover in NFC could provide one of the few remaining buffers in the world that could sequester and store carbon emissions and play a crucial role in stabilising climate by regulating carbon and water cycles.

Ironically, even though Bhutan is one of the world's lowest emitters of greenhouse gases and net sequesters of carbon, it ranks among countries most vulnerable to climate change.

Therefore, any conservation agenda for NFC for the future will have to build in measures to counter or tackle the deleterious effects of climate change. Alongside, it will also have to put in place disaster risk reduction (DRR) strategies to make local communities resilient to climate threats and build adaptive capacities in livelihoods.

Recluse in the Snow

Like sages in the quest of the ultimate truth, they prefer to lead a solitary and secretive life in their snowy habitats in summer. Snow Leopards *(Uncia uncia)*, a globally 'endangered' species, are found above the tree line in mountainous meadows (2,700-6,000 m) of Bhutan's Wangchuck Centennial Park and Jigme Dorji National Park. Surveys estimate their numbers to be in the 150-200 range.

Snow leopards are smaller than the other big cats, measuring between 75 cm and 130 cm, and weighing between 27 kg and 54 kg. Their bodies are stocky, their fur is thick, and their ears are small and rounded, all of which help them to minimize heat loss and adapt for a life in a cold, mountainous environment. Their feet are wide, which distributes their weight better for walking on snow, and they have fur on their undersides to increase their traction on steep and unstable surfaces, as well as to assist with minimizing heat loss. In winter, it comes down into the forests to an altitude of around 1,200 -2,000 m.

Snow leopards in Bhutan face pressures in the form of falling prey base, poaching and retaliatory killings (by herders against acts of predation). But the bigger threat looms large in the form of climate change. Warming of temperatures and reduced snow cover in the alpine areas could push these beautiful cats out of existence.

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SECURING BIODIVERSITY

Having secured the NFC, the Government along with environmental agencies should now implement a conservation plan that reduces the pressures on the habitats and revitalizes the ecosystems.

The Northern Forest Complex (NFC) has everything that makes for an ecological paradise: pristine habitats teeming with wildlife and vegetation, rugged landscape interspersed with gushing rivers and alpine meadows, natural splendour and local people steeped in a culture that respects its natural environment.

Home to endangered species such as snow leopard, blue sheep, musk deer, the Himalayan black bear, red panda, the Royal Bengal tiger, marmot and several species of pheasants, the forest complex also supports Bhutan's national animal (takin), national bird (raven), national flower (blue poppy) and national tree (*Tsendhey* or Cypress) *(see box)*.

The Jigme Dorji National Park (JDNP), in the north-western part of the NFC, is the only place in the world where the habitats of the snow leopard overlap with that of the tiger. The Bumdeling Wildlife Sanctuary (BWS) and the Wangchuck Centennial Park (WCP) also have a good presence of globally vulnerable mammals. These include musk deer, leopard, snow leopard, the Himalayan serow, blue sheep and the Himalayan black bear. The Tibetan wolf is regarded as the symbol of WCP since it has not been reported anywhere in Bhutan *(see box)*.

Temperate broadleaf forests have a large number of mammal and avian species such as barking deer, red panda and kaleej pheasant.

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Chart: Major forest types and the associated tree communities in NFC

Major Forest Types	Total area by forest types (Sq.km)	Share of NFC	Associated tree communities
Temperate Broadleaf Forest Warm Broadleaf Forest (1,000 m - 2,000 m-2,300 m) Cool Broadleaf Forest (2,000 m -4,200 m)	15,435.05	11%	Altingia excelsa, Bischofia javanica,Quercus indica, Schima wallichii, Michelia punduana, Persea fruticosa Acer campbellii, Quercus semecarpifolia, Quercus thomsonii, Persea clarkeana, Tetracentron sinensis, Magnolia campbellii, Michelia doltsopa, Magnolia globosa, Betula utilis, Rhododendron spp.
Conifer Forest a. Blue pine (Pinus wallichii) Forest (1,800 m - 3,000 m) b. Spruce (Picea spinolosa) Forest (2,400 m - 3,200 m) c. Hemlock (Tsuga dumosa) Forest (2,800 m - 3,300 m) d. Fir (Abies densa) (3,000 m - 4, 200 m) e. Juniper (Juniperus) Forest	10,744.96	50%	Pinus wallichii, Quercus grifffithii, Rhododendron arboretum, Quercus lanata, Lyonia ovalifolia, Spruce spinolosa, Spruce brachytyla, Acer cappadocium, Acer pectinatum, Larix griffithii, Salix daltoniana, Magnolia campbellii, Cupressus himalaica Tsuga dumosa, Sorbus thibetica, Betula utilis, Litsea sericea, Rhodo falconeri, R. kesangiae, R.hodgsonii, R.camelliflorum, Thamnocalamus spathiflorus, Abies densa, Rhododendron hodgsonii, Betula utilis, Acer caudatum, Borinda grossa Juniperus recurva, J.pseudo-sabina, J.squamata, Salix spp., R.lepidotum, Primula sikkimensis, Pedicularis megalantha, Pedicularis siphonantha

Bird Life

In terms of bird life, the three protected areas of the complex have recorded a rich proliferation of species. WCP, for instance, has recorded a total of 134 species of birds, including rare bird species like the Brandt's mountain finch, white-browed tit warbler, raven and Himalayan monal.

JDNP, on its part, harbours globally- and regionally-threatened birds such as the great white-bellied heron, monal pheasant, raven, beautiful nuthatch, Himalayan griffon, black eagle, satyr tragopan, blood pheasant and Mrs. Gould's sunbird.

BWS, to its credit, has five globally threatened bird species—the rufous-necked hornbill, the black-necked crane, Palla's fish eagle, chestnut-breasted partridge and wood snipe. Bomdeling Valley in the sanctuary is one of main wintering spots in Bhutan for the migratory rare black-necked crane.

The Northern Forest Complex also has a rich proliferation of insect life. Bumdeling Sanctuary alone has 32 species of butterflies, of which 10 were common, 13 uncommon and 7 rare. Of the 39 butterflies recorded in JDNP, six belong to uncommon species.

Interestingly, topographic and altitudinal variations have a strong bearing on mammalian behaviour. For example, musk deer, snow leopards, marmots, red panda and tragopans use a narrow range of habitats. Others such as the tiger, common leopard, Himalayan black bear, sambar, wild boar and wild dog use a wider range. Some like the blue sheep and takin migrate between habitat types easily.

The alpine meadows (4,000-5,000 metres) in the Northern Park Complex are known for a large number of valuable medicinal herbs, some of which are dwindling due to over collection.

© Sherub

Several rare bird species—including pheasants and partridges—and mammals such as goral, Himalayan yellow throated marten are known to occupy pine forest habitats.

© Sherub

Flora

The topographic changes also exert a discernible influence on vegetation. With altitudes ranging from 200 to more than 7000 meters, the NFC contains as many as 8 of the 11 vegetation types found in Bhutan—alpine scree slopes, alpine meadows, alpine scrub, sub-alpine, mixed conifer, pine, temperate conifer and riverine.

A total of 750 species of vascular plants have been recorded in the region. Several of them have commercial, medicinal, traditional and religious value.

The tree communities include elements from temperate East Asia and the Palaearctic region *(see chart)*. The warm temperate evergreen broadleaf forests are dominated by conifers (such as *Pinus, Cycas*) and tropical moist deciduous species (e.g. *Michelia, Schima*). The cool temperate forests, the largest of the forest types in the complex, are dominated by evergreen broadleaf trees *(Quercus, Lauraceae)*, conifers *(Spruce, Pinus, Taxus, Cupressus)* and winter-deciduous broadleaf species *(Acer, Betula, Magnolia)* as elevation rises from 2,000-3,000 metres. In drier slopes, stands of *Rhododendron* with oak *(Quercus semecarpifolia)* are prominent. Above 3,000 metres, the subalpine conifer forests begin with dominant tree species like *Tsuga*, *Abies* and *Juniperus*. From the treeline to about 4,700 metres, the vegetation consists of moist alpine scrub community of dense *Juniper*, *Rhododendron* shrubberies and low-growing herbs such as *Primula* and *Meconopsi*.

The Jigme Dorji Park is a genetic repository for these valuable plants and is an important natural conservatory of the Himalayan ecosystems. Several plant species in the JDNP are of high conservation and commercial value. These include the Himalayan yew or *Taxus baccata* (a tree of high medicinal value), *Cordyceps*

sinensis (an important alpine fungus with medicinal and aphrodisiacal properties), *Podophyllum hexandrum*, *Aconitum spp.*, *Polygonatum spp.* (for their valuable alkaloids and various medicinal properties), and *Corylopsis himalayana*, *Helwingia himalaica* (rare endemic species in Bhutan).

This rich natural resource was threatened by extraction of timber and medicinal plants, livestock overgrazing. Biological habitats in alpine meadows, sub-alpine and temperate forestlands were getting degraded. Poaching too was becoming a growing menace in some parts of the complex.

Having secured the NFC, the Royal Government along with environmental agencies has now charted a conservation plan that tackles these growing threats, reduces the pressures on the habitats, and revitalizes the ecosystems before it is too late.

Holy Smoke

Cypress *(Cupressus cashmeriana)*, or *Tsendhey* as it is called locally, is the national tree of Bhutan. This medium- to large-sized coniferous tree, which grows to 20-45 m in height and 3 m in diameter, is found at moderately high altitudes of 1,250-2,800 m. Its foliage grows in strongly pendulous sprays of blue-green, very slender, flattened shoots.

Bhutanese consider the cypress tree sacred and respect its nature and ability to survive in difficult terrain. It is widely planted around monasteries, temples and *dzongkhags*. The leaves of the tree are invariably used as incense and its smoke is used to purify the air during auspicious occasions.

Divine Clone

Takin *(Budorcas taxicolor whitei)* is the national animal of Bhutan. Standing 100-130 cm at the shoulder and weighing up to 650 kg (1,400 lb), Takin are found in bamboo forests at altitudes of 2,000 to 4,000 m, where they eat grass, buds and leaves. They are covered in thick golden wool which turns black under the belly.

Takin has a strong connection with the country's religious history and mythology. Legend has it that when Lama Drukpa Kunley (called "the divine madman") visited Bhutan in the 15th century, a large congregation of devotees from across the country gathered to witness his magical powers.

On being urged to perform a miracle, the saint, in his idiosyncratic and outrageous way, demanded that he first be served a whole cow and a goat for lunch. He devoured these with relish and left only the bones. After letting out a large and satisfied burp, he took the goat's head and stuck it onto the bones of the cow. And then with a snap of his fingers, he commanded the strange beast to rise up and graze on the mountainside. To the amazement of the people, the animal arose and ran up to the meadows to graze. This animal came to be known as the *dong gyem tsey* (takin).

Ferocious Hunter

The Tibetan wolf *(Canis lupus chanco)*, also known as the Woolly Wolf, is a subspecies of grey wolf, which is native to Central Asia and Western Himalayas. A smallish sub-species which rarely exceeds 45 kg, the Tibetan wolf resembles the Eurasian wolf, but has shorter legs. Some scientists think the Tibetan wolf to be the most likely ancestor of the domestic dog.

In Bhutan, the canine is reported to be found only in the higher alpine stretches of the Wangchuk Centennial Park (WCP). The wolf generally hunts in pairs or threes, and is said to be a more prominent predator—of marmots, blue sheep, and livestock like goats, sheep and yaks—than the snow leopard. Surveys show that Tibetan wolves have killed even adult yaks in WCP.


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SECURING LIVELIHOODS AND TRADITIONS

Forests can no longer be an everlasting resource base for traditional communities. But a pragmatic conservation and development strategy for NFC can save their livelihoods.

For centuries, the green expanses of plenty provided them with shelter, food, fuel and medicine. In return, they lived in harmony with their environment, and took care to nurture and protect the delicate natural balance.

Forests and alpine meadows provide most of the natural resources to human, livestock and wild herbivores in Bhutan's Northern Forest Complex (NFC). Though these areas are rich in biodiversity of global importance, they are also one of the least developed parts in the country, in terms of basic social amenities.

Most communities in the NFC consist of subsistence farmers (in the southern temperate forests) and semi-nomadic pastoralists (in the northern highlands) who rear and herd yak and sheep. They trade and sell yak products like meat, cheese and butter in exchange for rice, chillies, salt, tea leaves, sugar, clothing, and other amenities *(see box)*. Transhumance (the practice of moving livestock between different grazing lands according to season) has been a way of life for herders in this region.

The local people derive valuable goods from the NFC such as wood for construction, fencing, flag poles and energy. They also obtain non-wood products such as food, medicine, fodder and natural pasture (for their livestock). With legalization of *Cordyceps sinensis* (Chinese caterpillars) in 2005, many communities now collect and sell these worms as an alternative source of income *(see box)* besides trading other forest products like incense sticks and paper.

According to a preliminary study by Tashi S. et al. 2010, income from the sale of *Cordyceps* is rapidly changing the lifestyle of people in a remote gewog (block) like Lunana. Male members in communities here now no longer migrate to lower valleys like Punakha and Wangduephodrang during winter (which lasts more than six months) in search of manual jobs. They stay back with families through this period since income from *Cordyceps* is adequate to make ends meet for their families.

For families not dependent on either semi-pastoralism or agriculture, handicrafts and tourism-related activities offer new occupational avenues. Local people in Jigme Dorji National Park (JDNP) are reported to have earned a decent income by offering tourist guide services, portering, renting of yaks and pack horses for treks. The preliminary study points out that households in the Jigme Dorji National Park (JDNP) have earned on an average as much as US $1,163 a year.

On a larger scale, the benefits accruing from NFC's two protected areas (JDNP and BWS) in 2008 have been valued at US $2.64 million for people, communities and businesses, according to a preliminary assessment by the Royal Government *(see table)*.

Table: Matrix of annual socio-economic contributions from JDNP and BWS, 2008

Scale	Socio-economic clusters	Valued contribution (US $ million)	
		JDNP	BWS
Local Level	Resource utilization (timber, NWFP, pasture)	1.577	0.490
	Ecosystem services (drinking water and irrigation)	0.005	0.018
	Conservation (fines/ reward)	0.005	0.001
	Tourism (portering and sale of handicrafts to visitors)	0.287	0.265
	TOTAL	1.874	0.774

Source: (Report 2010, "Systematization and analysis of the contributions of the national parks and biological reserves to the social and economic development in Benin, Bhutan and Costa Rica". RGoB.

On the flip side, however, traditional communities in the NFC are bracing up for an uncertain future since their habitats today face serious threats from a host of factors: rising demand for forest products from urban and rural population, reckless felling of trees for wood, livestock overgrazing, slash-and-burn cultivation, and conversion of land for agriculture and infrastructure.

Also, with modernization creeping into the remotest corners of the NFC, the traditional barter system is slowly giving way to a cash economy. While this may benefit local communities in terms of alternative career opportunities, it could also lead to more human intrusion and impact on the ecosystem.

For the Government and environmental conservation agencies like the WWF, the big challenge is to strike the right balance—between empowering people for new employment options, and preserving traditional livelihoods through community forestry, dairy farming and horticulture projects.

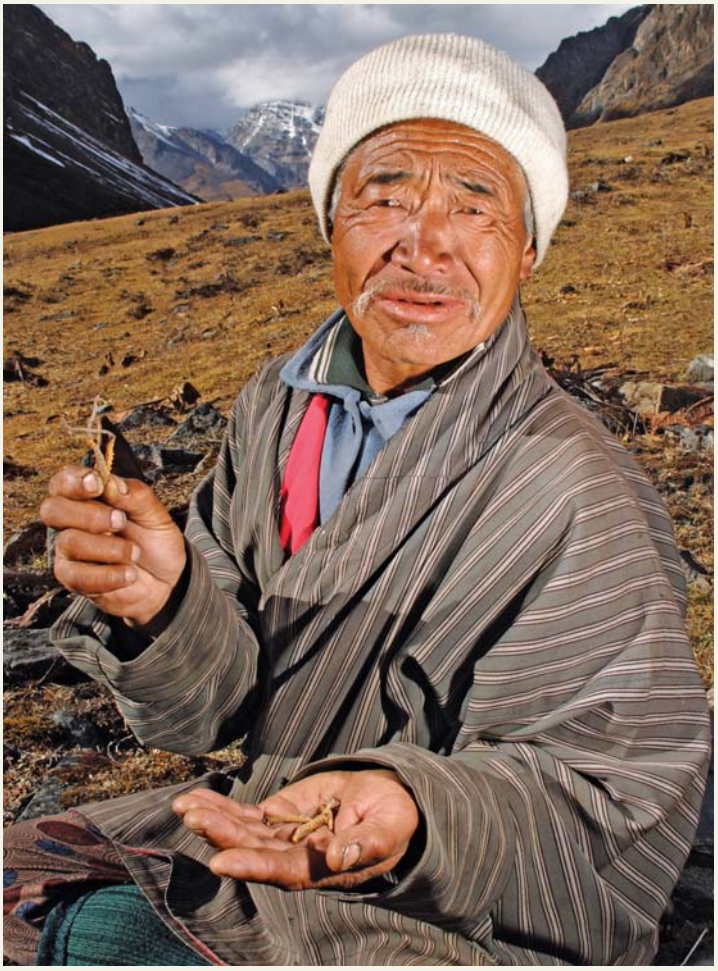
Wealth in Worms

For many among the local people living on the alpine area of the Northern Forest Complex, this medicinal product has come as a boon, giving them an alternative source of income and improving their lives.

Cordyceps sinensis, also known as caterpillar worm, is sought after for its aphrodisiacal, high protein and curative value (for various ailments) in countries like China, Thailand and Korea and Japan.

Cordyceps is actually a fungus that invades the body of a *Thitarodes* caterpillar, filling its entire body cavity with mycelium and eventually killing and mummifying it. The caterpillars die near the tops of their burrows. The dark brown to black fruiting body emerges from the ground in spring or early summer, always growing out of the forehead of the caterpillar. The long, usually columnar fruiting body reaches 5–15 cm above the surface and releases spores.

Ever since the Bhutan Government legalised its trade in 2005, the market price of *Cordyceps* has steadily gone up to reach the current level of Nu 1,80,000 per kg. But collection of the worm is a tough act, often involving months of painstaking work in severe conditions, including attacks by poachers from neighbouring Tibet.



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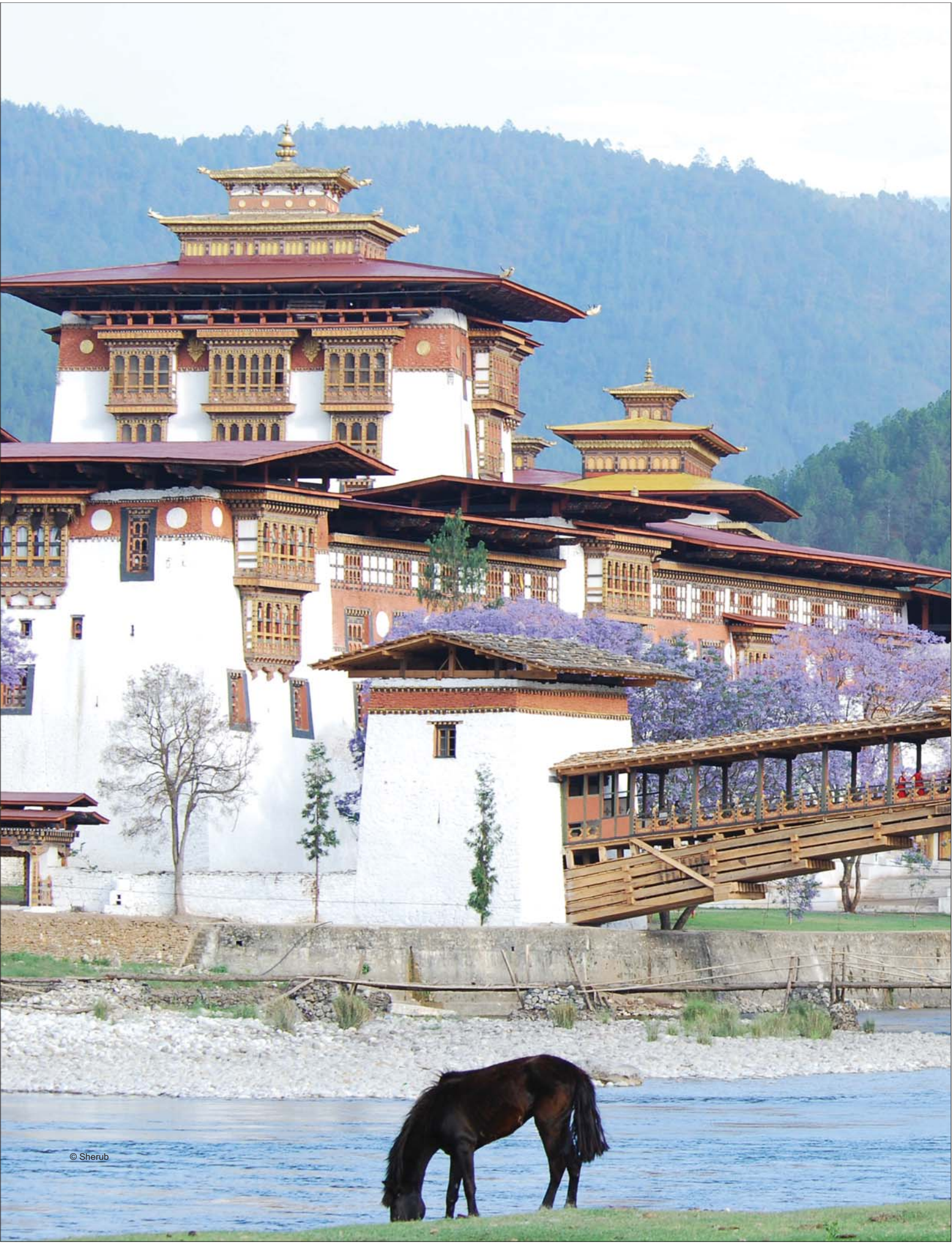
Ship of the Alpine Desert

Yaks *(Bos grunniens)* in Bhutan are found at altitudes higher than 4,500 m and normally do not descend below 3,500 m. These sturdy, long-haired bovines stand nearly 2-2.2 m tall at the shoulder. Males weigh 350 to 580 kg and females about 225 to 255 kg. Their larger lungs and heart, greater capacity to transport oxygen through their blood and shaggy hair (and thick woolly underlayer) help these animals better survive in cold and inhospitable environments.

Yak rearing is a traditional practice common among the semi-nomadic herders of alpine regions of Bhutan. These herders are known as Bjobs in western Bhutan and Brokpas in central and eastern Bhutan. Both *Bjobs* and *Brokpas* mean 'pastoralist' or people dependent on pastures.

As in other Himalayan regions, yaks in the Northern Forest Complex (NFC) provide a range of products: food (milk and meat), hair (for ropes, tents and sacks), wool (clothes/blankets), butter (for tea and lighting candles/lamps), hide (boots/saddles) and dung (as fuel). Local people trade these products for grain, clothing and other items of daily use.

Pack yaks are used to transport goods. In recent years, yaks are increasingly being used in the high altitude tours and trekking industries. Today, the number of yak herders in the country may be decreasing but the age-old tradition of appeasing the yak deity *(yak lha)* is still widely practised by them in Bhutan. The herders believe the ceremony will bring good fortune to the people and good health to the animals and keep them safe from predators.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SECURING CULTURE QUOTIENT

The Northern Forest Complex is one of the few regions in the world which offers a heady concoction of nature, wildlife, culture and religion.

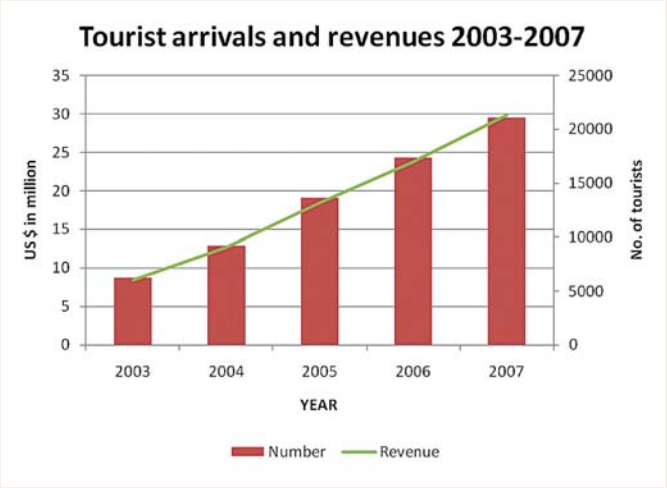
Balancing Tourism and Conservation

Bhutan opened its gates to foreign tourists in 1974. Since then, tourism has become one of the key drivers of economic growth and service industry.

Surveys show that the major pull factors to Bhutan are 'unique culture', 'nature', 'undiscovered country', 'wildlife' and 'Buddhism'. The most popular destinations for foreign tourists were dzongs, temples and monasteries.

The Government has so far followed a 'high-value' policy to tourism development through a combination of high tariff structure and stringent operational regulations. This approach has helped limit negative environmental and social impacts on its well-preserved culture and relatively unspoilt natural landscapes.

But with the number of tourist arrivals increasing each year *(see chart)*, Bhutan will have to liberalize its tourism industry and improve its hospitality infrastructure. Alongside, the Government will also have to take steps to balance the surge in tourism with the dictates of environmental conservation.



Bird Deity

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The raven (*Corvus corax)* is the national bird of Bhutan and is a protected species found in the upper reaches of the Bhutanese Himalayas. During winter, ravens migrate to lower altitudes at 2,300 m and can be seen nesting in monasteries and *dzongs* throughout Bhutan. They are found either in pairs or in a huddle (of a dozen). By nature, ravens are wild, wary and bold, and love to fly.

The raven is depicted on the crown of the Bhutanese monarch. It represents *Legoen Jarog Dongchen*, one of the three protector deities of Bhutan besides *Yeshey Goenpo* (also known as *Mahakala*) and *Palden Lhamo (Mahakali)*. As the Divine Trinity, they are believed to safeguard the well-being of the Royal Kingdom and protect the King and people from harm and adversity.

Legoen Jarog Dongchen is believed to have helped the Bhutanese army repel many military attacks from Tibet, Mongolia and British India during the 17th and 18th centuries.

As a mark of respect and reverence to the deity's role in shaping the country's history, the Raven Crown or *Uzha Jarog Dongchen* was adopted as the crown of the leader of Bhutan. The Raven Crown is an enduring symbol of the Bhutanese hereditary monarchy, but its symbolism transcends the ordinary and the temporal.

Dzongs in the Wild

The Northern Forest Complex (NFC) is one of the few places on the earth where wildlife habitats coexist with cultural and religious monuments. For instance, Bumdeling Wildlife Sanctuary has several culturally important sites such as *Rigsum Gonpa, Dechhenphodrang Lhaghang* (one of the most scenic monasteries in the country), *Minkhar Gonpa, Aja Ney and Singye Dzong*.

Interestingly, the Singye Dzong area, which is a place of cultural and religious importance for Buddhists, is also in important habitat of the snow leopard.

Punakha, one of the *dzonghkag* (districts) bordering Jigme Dorji National Park (JDNP), was the ancient capital of Bhutan and today is an important cultural and religious destination for Buddhists. The *Dolay Soenay* ritual performed by pazabs or warriors of Wang, relate Bhutan's history in a nutshell.

Hot and Healthy Dips

Scattered across the biodiverse-rich forests of the Northern Park Complex (NFC) are geothermal outlets that are source to mineral-rich hot springs, known as *Tshachu*. Visitors from Bhutan take a dip in these springs to cure themselves of various ailments, especially those related to bone and skin.

Of the estimated 10 hot springs in the country, 8 are in the NFC. These include *Gnyes tshachu* and *Yonten Kuenjong tshachu* in *Lhuentshe dzonkhag*, *Dur tshachu* in *Bumthang dzongkhag*, *Koma tshachu* and *Chu Phug tshachu* in *Punakha dzongkhag*, and *Gasa tshachu, Laya tshachu* and *Wachi tshachu* in *Gasa dzonkhag*.

These springs, which also provide salt requirements for wildlife, are associated with microbial diversity which lie at the base of food chain and reportedly support hundreds of higher species.

Tiger Tales

Bhutan is probably the only country in the world where the Royal Bengal tigers *(Panthera tigris tigris)* are found at a height of 14,000 feet, with their habitats overlapping those of snow leopards.

But tigers at high mountains have always been part of local folklore and mythology. For instance, Taktsang Monastery or The Tiger's Nest, a prominent Tibetan Buddhist monastery of the Nyingma (Red Hat Sect), is located at a precipitous height of 10,240 feet of the upper Paro valley. It was built in 1692, around the *Taktsang Senge Samdup* cave where Guru Padmasambhava, Bhutan's tutelary deity, is said to have meditated for three months in the 8th century. Today, Paro Taktsang is the best known of the thirteen taktsang or "tiger lair" caves in which he meditated.

According to the legend, Guru Padmasambhava (better known as Guru Rinpoche) flew to this location from Tibet on the back of a tigress.

Another holds that a former wife of an emperor, known as Yeshe Tsogyal, willingly became a disciple of Guru Rinpoche in Tibet. She transformed herself into a tigress and carried the Guru on her back from Tibet to Taktsang. In one of the caves here, the Guru then performed meditation and emerged in eight incarnated forms (manifestations) and the place became holy. Subsequently, the place came to be known as the "Tiger's Nest.

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Blessings from Winter Visitors

As November signals the onset of winter in Bhutan, the courtyard of Gangtey Monastery, a 16th century temple on top of a hill projecting into the Phobjikha Valley, becomes the venue of an important festival to celebrate the arrival of winged visitors from Tibet: the Black-necked Cranes *(Grus nigricollis)*. Several thousands of local people gather to exult in a day of music and dance as the first groups of birds land in the valley.

Black-necked cranes are revered in Buddhist traditions and hold a hallowed place in the Bhutanese culture. Farmers in the country believe that these birds confer a special blessing by circling over agricultural lands. In many places, crops of winter wheat are not planted until the fields have been blessed by the visitors hovering in the sky.

These cranes spend nearly the whole day foraging on the ground in small groups, often walking long distances between the feeding spots. Besides tubers of sedges, plant roots, earthworms, insects and frogs, they also feed on fallen grains of barley, oats and buckwheat, potatoes, carrots and turnips.

Phobjikha Valley in central Bhutan and Bomdeling Valley in the east are the major feeding areas for these cranes. In summer, intensive grazing by cattle and horses helps to prune the bamboo wetlands of Phobjikha into a comfortable foraging ground for the birds. The wintering cranes in Bomdeling Valley feed mainly on waste grain in unploughed rice fields.

Come spring, and it's time for the visitors to migrate over the Himalayas to spend the summer on wetlands in nearby Tibet where they breed.

TIME TO CEMENT THE WALL

Bhutan, India and Nepal can work on a unified strategy to secure the future of the Eastern Himalayas from regional environmental threats and development pressures.

In terms of natural grandeur and magnificence, the Himalayas have no geographical parallel on the earth. Studded with mighty peaks, mountains, landscapes and rivers, the 3,000-kilometer mountain range harbours a staggering range of species across the animal and vegetation kingdoms. Its shimmering landscape, which crowns the Indian subcontinent, has also sustained a diverse variety of humanity and cultures for millennia.

Towards the east of the Himalayan crown is an ecological jewel that contains an incredible wealth of biodiversity, people and traditions. The Eastern Himalayas, as they are called, stand at the intersection of two continental plates, representing two bio-geographical realms: the lowland Indo-Malayan Realm to the south and the elevated Palearctic Realm to the north. The tectonic collision of these disparate worlds millions of years ago spawned a region that is one of the biologically richest in the world.

Spanning Bhutan, the north-eastern Indian states of Arunachal Pradesh, Assam, West Bengal (north) and Sikkim, the far north of Myanmar (Burma), Nepal and southern parts of Tibet, the rugged and largely inaccessible landmass contains a biological cornucopia of about 10,000 plants, 300 mammals, 977 birds, 176 reptiles, 105 amphibians and 269 freshwater fish. This includes Asian elephants, clouded leopards, wild water buffaloes, hornbills, geckos, snow leopards, red pandas, black bears and blue sheep, to name a few.

The Eastern Himalayas can also boast of several habitats with the densest populations of the tiger in the world. They are also the only surviving haven of the one-horned rhinoceros.

Over 350 new species have been discovered in this region between 1998 and 2008. This includes 242 plants, 16 amphibians, 16 reptiles, 14 fish, two birds and two mammals, and at least 61 new vertebrates. A third of all plants and reptiles are endemic, as are 40% of all amphibians.

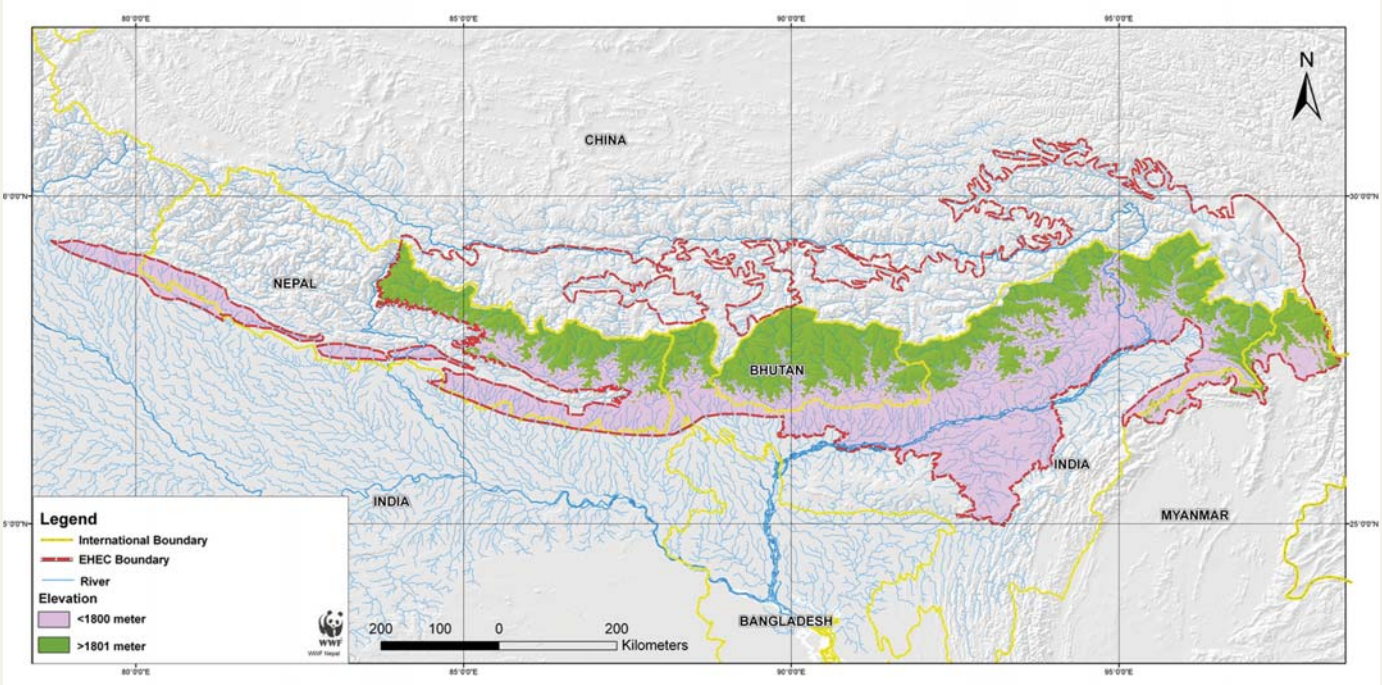
Marked by climatic variability and altitudinal gradation, the landscape reflects startling contrasts in physical profile—from the world's highest mountains and deepest gorges to sub-tropical jungles, temperate forests, tall grasslands, savannas and rich alpine meadows.

The glaciers and ice fields, and large swathes of forests and freshwater systems of the Eastern Himalayas are headwaters of large river systems, on which depend millions of people across the region.

A multitude of communities, faiths and traditions live in harmony with this enchanting array of natural environments, adding more layers of richness and depth to the vibrant mosaic.

Even as scientists and anthropologists believe that a large part of this biological and cultural frontier is still unexplored, much of this immense wealth faces the risk of being devastated by reckless and unsustainable development in the region, fuelled primarily by unplanned economic growth and flawed market policies. These impacts could be amplified by climate change, which has already led to increased melting of glaciers and formation of dangerous glacial lakes on the alpine ranges of the region.

Degradation of the fragile ecology, for one, would undoubtedly



render irreparable damage to its biodiversity and potential to provide essential ecosystem services. Crucially, it could also have severe repercussions on livelihoods and availability of essential food and freshwater in the region, and push people living here deeper into the abyss of poverty and deprivation.

Increasing competition for land and other resources has set the stage for intense conflicts between humans and wildlife. Retaliation against tigers and snow leopards for killing livestock, and against elephants and rhinoceros for crop depredation, is on the rise.

Alongside, poaching and unsustainable hunting for the commercial wildlife trade are major threats to the flagship species. The demand for tiger and rhinoceros parts, which are highly prized in East Asian medicine, places these species under extreme danger.

The value system (nature, wildlife, people and culture) of the Eastern Himalayas is of vital importance to the economies and people of Bhutan, India and Nepal. Ignoring the dangers to these ecosystems will only imperil our communities.

The imperative for us is to work on a unified initiative to secure the 1500-mile long Eastern Himalayan rampart from regional environmental threats and development pressures arising from poor economic planning and management. The more the delay in taking and implementing that decision, the faster the destruction of the ecological treasure house of the Himalayas.

Bhutan has already contributed to the initiative by securing three protected areas within its Himalayan rim on the north, also known as the Northern Forest Complex (NFC). For Bhutan, which has done exceptionally well in sheltering and nurturing its environment and biodiversity over the past two decades, the NFC is another commendable achievement.

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Way forward

Bhutan, India and Nepal can come together in a collective endeavour to secure an Eastern Himalayan rampart across national borders.

While the Northern Forest Complex is—and will be—a key ecological bulwark for Bhutan, the region itself could face the brunt of new strains and loads as the country moves through a critical phase of economic and political transition.

Over the next decade, the mountain kingdom's development paradigm, underpinned by the philosophy of Gross National Happiness (GNH), will face new challenges as it opens its economy to meet the needs of a growing and modernizing population—ranging from education, jobs, food to housing, water and infrastructure.

Surge in economic growth could lead to adverse impacts on Bhutan's environment. So, bolstering protected zones such as the NFC from growth pressures will be vital to ensure an uninterrupted flow of ecosystem services and resources like water, hydropower, irrigation, timber, firewood and medicinal plants to the country.

Protecting the NFC is also crucial in the larger interests of securing the Eastern Himalayas. Over the past decades, this ecologically fragile region has been witness to growing pressures from a variety of anthropogenic factors. Soaring demand for forest products, water, energy and infrastructure in regional and global markets, unsustainable and illegal logging, poaching and wildlife trade have already done a lot of damage to the ecosystems. Emerging threats like overgrazing by livestock on the highlands, unsustainable fuel wood collection, hydropower development and mining are adding to the impact.

Today, only 25% of the original habitats in the region remain intact and 163 species here are considered globally threatened, according to studies.

Looming large over these threats and dangers is the spectre of climate change. Studies show that the Eastern Himalayas are extremely vulnerable to variations in temperature, rainfall, and extreme events. Projections indicate that climate change will not only amplify the human impacts but also have far-reaching consequences on the biodiversity, water cycle, and socio-economic condition of the people in this region.

The biggest fear is that change in weather and rainfall patterns could affect flow of water in the major rivers arising from the Eastern Himalayas and its subsequent availability for millions of people and biodiversity downstream.

The best way to respond to climate change would be to build climate resilience in vulnerable regions. And the first step towards building that resilience would be to secure its ecosystems and biodiversity rich areas.

Thanks to its exceptional track record in conservation over the past two decades, Bhutan can take the lead in any regional initiative to conserve the Himalayan ecosystems. Bhutan, India and Nepal can work collectively to create a common wall of protection around their east Himalayan stretch.

Bolstering the wall would have several synergistic advantages for all stakeholders. For one, it will help create a secure ecological corridor that would allow free movement of wildlife. For another, it will ensure continued water flows in our river systems. Also, such a measure will help create resilience in our ecosystems and help fight back the impacts of climate change. And most importantly, fortifying the Eastern Himalayas rampart might be the only recourse left to save one of the last surviving natural treasure troves from degradation and with it the values we care for most - water, life and culture.

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Jigme Dorji National Park

Jigme Dorji National Park (JDNP), spread over an area of 4,316 square km, is the second largest and most diverse of all protected areas in Bhutan. The park is located in the north-western part of the country. Its northern border coincides with the international border between Bhutan and China.

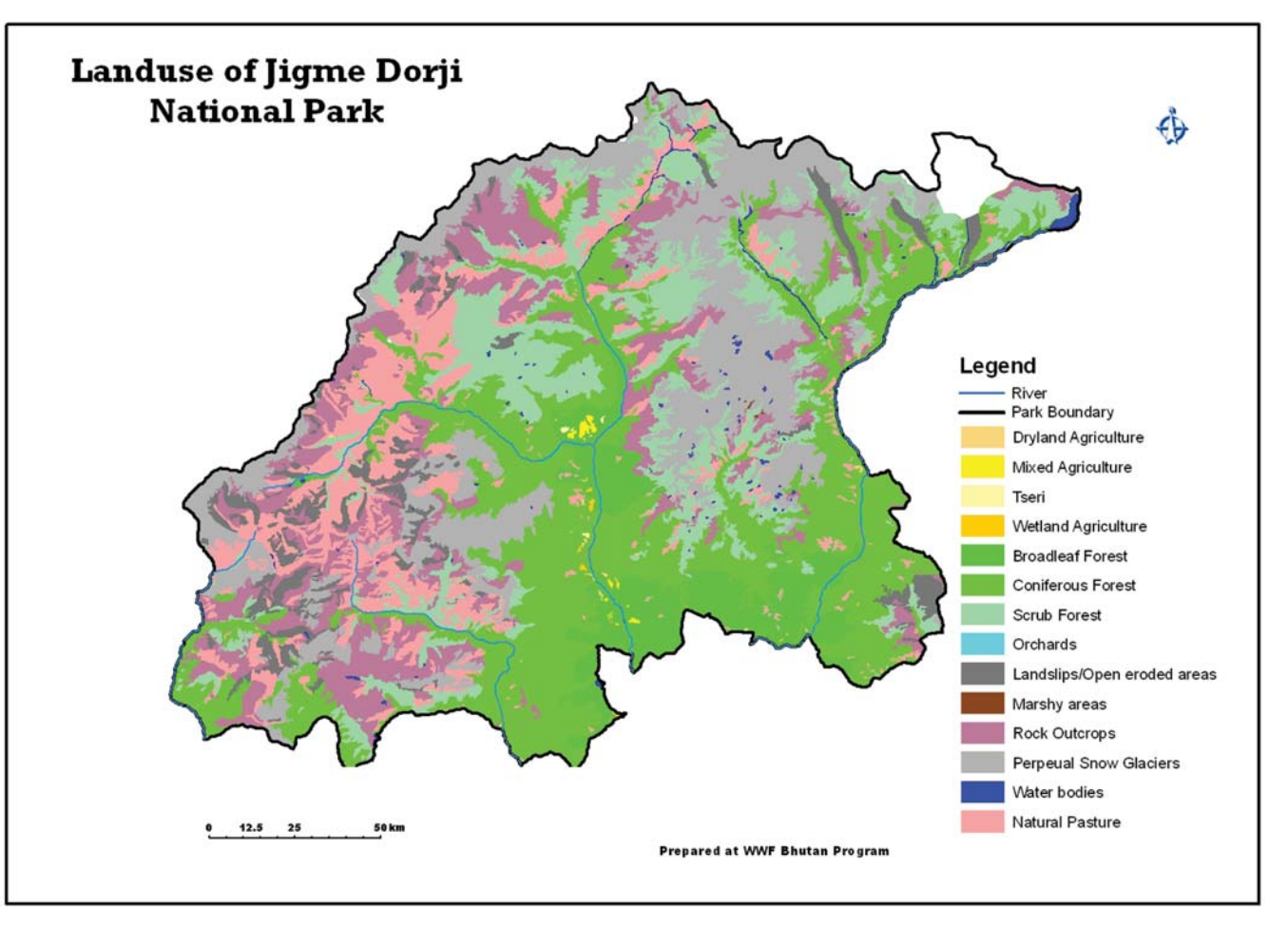
JDNP falls mainly within the political jurisdictions of five dzongkhags (districts) of Thimpu, Paro, Gasa, Punakha and Wangduephodrang. It was notified as a Wildlife Sanctuary in 1974, and was amalgamated in 1988 with Gasa and Laya Wildlife Sanctuaries to form the Jigme Dorji Wangchuk Wildlife Sanctuary. In 1993, the Wildlife Sanctuary was upgraded to a National Park and officially gazetted with that status in 1995 with the appointment of a Park Manager. Approximately 6,500 people comprising 1,249 households live in and around the park boundary (JDNP 2008).

The park, situated in the upper Himalaya range, has a mountainous and rugged topography. The ridges and peaks above 4,600 meters are barren and rocky, and remain snow covered during the winter months. The peaks above 5,000 meters are usually covered by snow throughout the year. The gentler slopes between the treeline and rocks consist of alpine meadows and scrub lands and form a substantial portion of the park's geographical area.

The park is one of the important headwaters for the major rivers in the country: Pa Chhu, Wang Chhu, Pho Chhu and Mo Chhu. The park is also one of the most visited sites by the international tourists. Three of the most popular trekking routes that park offers are: Jumolhari Trek, Laya-Lingshi Trek and Snowmen Trek. The rich culture of layaps and lunaps communities is unique to JDNP.

In general, north-facing slopes are steeper than south-facing slopes, with the vegetation cover much higher in the northern aspects. Agricultural lands account for 5 per cent of the JNDP area.

There is considerable seasonal and local variation in climatic conditions in JNDP owing to latitudinal position, altitudinal range and terrain. The park, which is located at 27 degree north of the equator and north of the Tropic of Cancer, is in the temperate realm and influenced by seasonal changes. Third, the mountainous terrain contributes to local variation in climate, such as warmer, moister conditions in the southern river valleys, and colder, drier conditions in higher elevations.



Wangchuck Centennial Park

Wangchuck Centennial Park (WCP) was formally designated to be included under Bhutan's protected area system on 10 June 2008 as 10th national park of Bhutan. The park, named as a tribute to the ruling Wangchuck Dynasty, is the mountain kingdom's largest national park with an area of 4,914 square km.

It has an exquisite habitat status as one of the last large and undisturbed tracts in the eastern Himalayan eco-region.

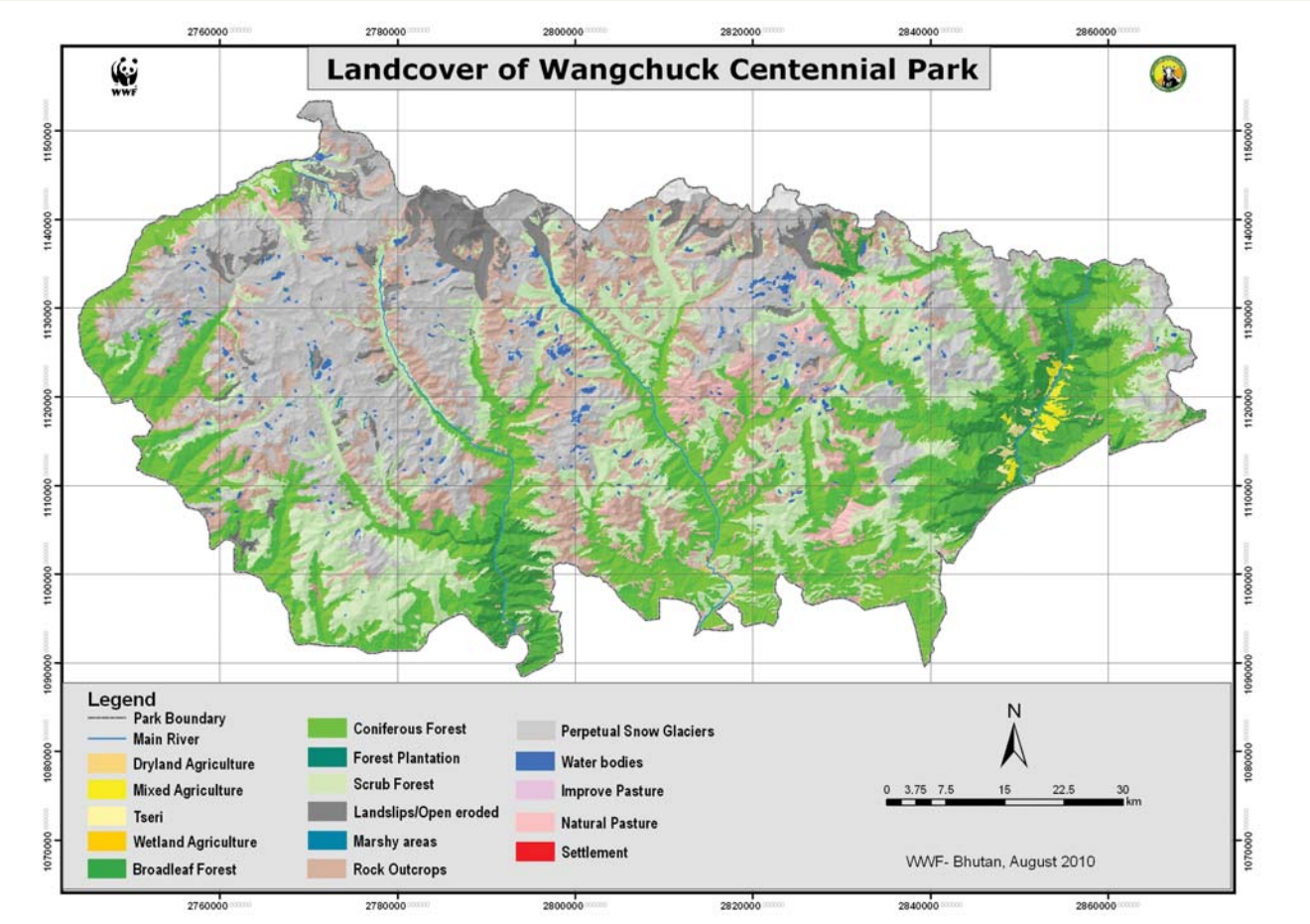
WCP is strategically located in the central north part of the country: to the east, it is adjacent to Bumdeling Wildlife Sanctuary, and to the west it is adjacent to Jigme Dorji National Park. In the south it is bordered by continuous biological corridor. Thus, WCP forms up integral part of a protected area complex in the country and in the region.

One of the best examples of the middle Himalayan ecosystems, containing several ecological biomes ranging from bluepine forests to alpine meadows, and snows at higher altitudes, the park is spread over nine geogs (sub-districts) of Gasa, Wangdue Phodrang, Trongsa, Bumthang and Lhuentse dzongkhags (districts).

WCP is composed of glacial mountains, several glacial lakes and alpine lakes or most important high water towers feeding four major rivers of Bhutan namely Punatshang Chhu (Sunkosh), Mangde Chhu, Chamkar Chhu and Kuri Chhu (tributaries of Manas).

The park, situated in the upper Himalayan Range, has mountainous and rugged topography. The ridges and peaks above 4,600 metres are barren and rocky, and remain snow covered during the winter months. The peaks above 5,000 metres can be snow covered all year round.

The wide range in altitude contributes to climate change along park's north-south axis, and the mountainous terrain contributes to local variation in climate, such as warmer and moisture conditions in the southern river valleys; and colder, drier conditions in the high elevations. Varying altitude and rainfall create extremely wide diversity in climate. Southwest monsoon rain falls from June to September contributing most of annual rainfall in park area.



Bumdeling Wildlife Sanctuary

The Bumdeling Wildlife Sanctuary (BWS), located in North-eastern Bhutan, is spread over an area of 1,521 square km covering Trashi Yangtse and Lhuentse dzongkhags (districts). Nearly 5,094 people reside in the park.

It is bordered by the Khoma Chhu river in the west, Tibet (China) in the north, Arunachal Pradesh (India) in the north-east, rivers Womenang Chhu and Kulong Chhu in the east, and the Nindari and Sheri Chhu in the south.

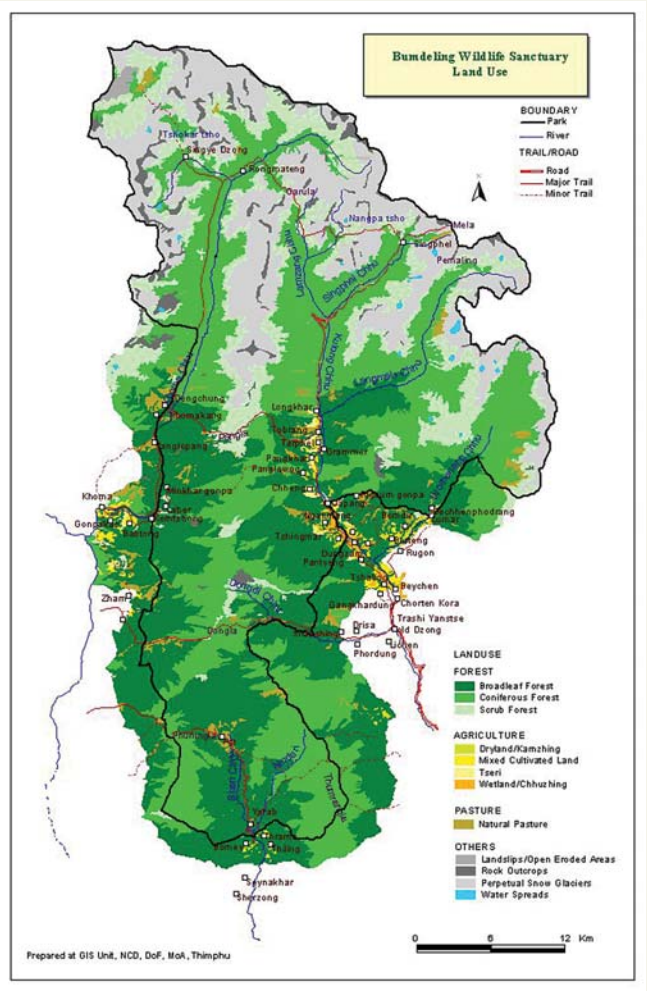
The sanctuary ranges from 1,500 to 6,450 m in elevation. The natural landscape and ecosystems range from sub-tropical forests to alpine meadows with scenic alpine lakes in the higher elevations. BWS also has swathes of cool and warm broadleaf forest, coniferous forest and alpine scrub and pastures, all of which are considered critical for the existing mammal fauna. Landslides are a common feature in the landscape and block rivers or streams.

The sanctuary consists mostly of mountainous (often steep to very steep) terrain, including cliffs, rocky peaks, permanent snow, small glaciers and glacial lakes, and is dissected by several steep river valleys.

The landscape has been mostly formed by river erosion and mass wasting processes—such as landslides and debris flows—and glaciers (at higher altitudes). Two thirds of the sanctuary is covered by forest, and more than a quarter by snow and scrub.

The climate in the sanctuary ranges from warm temperate in the south to alpine in the mountainous areas in the north. Rainfall is around 1,500 mm per year, and most of this falls between May and September. Rainfall varies with altitude, aspect and topography. Snowfall in the mountains blocks most of the passes between Lhuentse and Trashi Yangtse and those into Tibet during winter.

In the lower parts of the sanctuary, mean monthly maximum temperatures vary between 15-25 degree C and minimum temperatures between 5-15 degree C. In the north, some areas are permanently covered by snow.



List of Endemic and Endangered Flora and Fauna in the NFC

		Global Threat Status			Distribution	
Scientific Name	Common Name	Critical	Endangered	Vulnerable	Bhutan	NFC
1. Aglaia perviridis				VU	+	
2. Andrewsianthus ferrugineus			EN		+	
3. Aquilaria malaccensis				VU	+	
4. Bazzania bhutanica		CR			+	
5. Cupressus himalaica				VU	+	+
6. Scaphophyllum speciosum				VU	+	
7. Schistochila macrodonta			EN		+	

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Nature's treasury of the Living Himalayas

The Himalayas are one of the biologically richest areas on Earth, harbouring a staggering 10,000 plant species, 977 birds, 300 mammals, 269 freshwater fish, 176 reptiles and 105 amphibians.

The Eastern Himalayas is home to the world's highest mountains and deepest gorges, subtropical jungles, temperate forests, tall grasslands, savannas and alpine meadows.

Bhutan is one of the Asian nations that enjoy the rare distinction of having 72.5% of its landmass covered by forests.

The Nothern Forest Complex (NFC) harbours keystone animal and bird species like the snow leopard, tiger, Bhutan takin, the Himalayan black bear, pheasants, raven adn tragopans.

WWF

WWF Mission:

WWF's Mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

http://www.wwfbhutan.org.bt

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