

The Fifth National Report
National Environment Commission
Secretariat
Royal Government of Bhutan
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Contents

Abbreviations and Acronyms	5
Glossary of Bhutanese Terms	7
1.0 Executive summary	8
1.1 Biodiversity	8
1.2 Main threats to biodiversity	9
1.3 Biodiversity targets set under NBSAP	9
2.0 Introduction	11
2.1 Natural Resources	11
2.2 Governance, Development Policy, and Institutional structure	11
2.3 Bhutan’s Conservation history	13
3.0 An update on biodiversity status, trends, and threats and implications for human well-being	13
3.1 Ecosystem Diversity	13
3.2 Aquatic Ecosystems	15
3.2.1 Rivers	15
3.2.2 Lakes	15
3.2.3 Marshlands	15
3.2.4 Hot Springs	15
4.0 Agricultural Ecosystem	16
4.1 Wild species diversity	16
4.1.2 Vascular plants	16
4.1.3 Non-vascular plants	17
4.1.4 Fungus	17
4.1.5 Insect-Fungi	17
4.1.6 Lichens and Lichenicolous fungus	17
4.2 Mammals	17
4.2.1 Avifauna	18
4.2.2 Herpetofauna	19
4.2.3 Invertebrates	19
4.2.4 Fish Fauna	20
4.3 Domestic Biodiversity	20
4.3.1 Crops	20
4.3.2 Livestock	20
5.0 Protected Areas	22
6.0 Values of biodiversity and ecosystem in the Bhutanese context	22
7.0 Update on the Status of Environmental Related Policies	23
7.1 Environment Related Policies	23
7.1.2 Environment Related Legislation	24
8.0 Lessons learned from the earlier NBSAP(s)	24

9.0 Threats to Biodiversity: Direct and Indirect pressures affecting biodiversity	25
9.1 Direct pressures.....	25
9.1.1 Land use conversion.....	25
9.1.2 Forest Fire	25
9.1.3 Over extraction of Timber and Fuel wood.....	26
9.1.4 Overgrazing.....	26
9.1.5 Forest offences and wildlife poaching	26
9.1.6 Unsustainable agricultural practices	26
9.1.7 Pollution.....	27
9.1.8 Invasive species.....	27
9.1.9 Human Wildlife Conflict	28
9.2 Indirect Pressures	28
9.2.1 Climate change.....	28
9.2.2 Population	28
9.2.3 Poverty	29
10.0 Impacts of changes in the biodiversity for ecosystem services and socio-economic and cultural	29
10.1 Loss of species.	30
10.2 Increased establishment of invasive species	32
10.3 Increased risk of forest fire	32
10.4 Loss of agro-biodiversity	32
10.5 Increased incidences of pests and diseases	33
10.6 Loss of livelihood, traditional knowledge and practices (“Biocultural” loss).	34
11.0 Possible future changes for biodiversity and their impacts.....	34
12.0 Biodiversity targets set under NBSAP.....	37
13.0 Procedure for formulation of the NBSAP.....	38
14.0 Actions taken to implement the Convention since the fourth national reports and its outcomes .	40
14.1 New policies and legal frameworks adopted since 2009:.....	40
15.0 Institutional and Cooperative Mechanism	41
16.0 New programs and actions initiated since 2009 which support implementation of CBD	41
17.0 Mainstreaming of biodiversity into relevant sectoral and cross-sectoral strategies, plans and programs	42
18.0 Implementation status of the BAP	44
19.0 Contribution of actions to implement the Convention towards achievement of the relevant 2015 targets of the Millennium Development Goals	45
20.0 Major Interventions.....	45
21.0 Lessons learned from the implementation of the Convention	47
21.1 Weak implementation of the past biodiversity action plans	47
21.2 Knowledge Gap on different areas of biodiversity	48
21.3 Need to establish and strengthen monitoring mechanism for biodiversity by establishing baseline data and information	48

21.4 Need for an appropriate fund mobilization strategy	48
21.5 Mainstreaming biodiversity into national and local development plans and programs	48
21.6 Lack of adequate feedbacks and assessment of the national reports by the CBD Secretariat ..	49
Reference	50

Abbreviations and Acronyms

ABS	Access and Benefit Sharing
BAP	Biodiversity Action Plan
BC	Biological Corridor
BCH	Biosafety Clearing-House
BIT	Business Income Tax
CAs	Competent Authorities
CBD	Convention on Biological Diversity
cft	Cubic feet
CHM	Clearing House Mechanism
CIT	Corporate Income Tax
CP	Cartagena Protocol
CSO	Civil Society Organization
CWR	Crop Wild Relatives
DoFPS	Department of Forests and Park Services
DFO	Divisional Forest Office
DoL	Department of Livestock
EDP	Economic Development Policy
FMU	Forest Management Units
FYP	Five Year Plan
GEF	Global Environment Facility
GNH	Gross National Happiness
GNHC	Gross National Happiness Commission
GRF	Government Reserved Forest
HAW	High Altitude Wetlands
IAS	Invasive Alien Species
IBA	Important Bird Areas
ICIMOD	International Centre for Integrated Mountain Development
LCMP	Bhutan Land Cover Assessment
LG	Local Government
masl	metres above sea level
MDG	Millennium Development Goal
MoAF	Ministry of Agriculture and Forests
MW	Megawatt
NAP	National Action Plan (NAP) to Combat Land Degradation
NBC	National Biodiversity Centre
NBF	National Biodiversity Framework
NBSAP	National Biodiversity Strategies and Action Plan
NCA	National Centre for Aquaculture
NC	National Council of Bhutan
NCA	National Centre for Aquaculture
NEC	National Environment Commission
NECS	National Environment Commission Secretariat
NFP	National Forest Policy
NGO	Non-Governmental Organization
NP	Nagoya Protocol
NRDCL	Natural Resources Development Corporation Limited
NTF	National Task Force
NWFP	Non-Wood Forest Products
PAs	Protected Areas
PES	Payment for Environmental Services
REDD+	Reducing Emissions from Deforestation and forest Degradation
RGoB	Royal Government of Bhutan
RSPN	Royal Society for Protection of Nature
Sq.m	Square metre

Sq.km	Square Kilometer
TK	Traditional Knowledge
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
UWICE	Ugyen Wangchuck Institute for Conservation and Environment
WCD	Wildlife Conservation Division
WWF	World Wildlife Fund

Glossary of Bhutanese Terms

<i>Chatrim</i>	Act, statute
<i>Cbbu</i>	River
<i>Chusups</i>	Village Water Guards/In-charge of drinking and irrigation water in a village
<i>Cbbuzhing</i>	Wetland cultivation
<i>Dru Na Gu</i>	Nine important food grains
<i>Dzongkbag</i>	District
<i>Dzong</i>	Fortress-like structure which serves as a centre for public administration and religious affairs
<i>Dzongkha (Dz)</i>	National language
<i>Genog</i>	Smallest public administration unit made up of a block of villages
<i>Kamzhing</i>	Dryland cultivation
<i>Ladam</i>	Customary practices which restrict access to sacred mountain passes during certain time of the year
<i>Lhakhangs</i>	Temples
<i>Lhomenjong</i>	The southern valley of medicinal herbs
<i>Lhotsamkha (Lh)</i>	Language spoken in southern part of Bhutan
<i>Meesups</i>	Forest Fire Watchers
<i>Ridam</i>	Customary practices which restrict access to mountains, groves, lakes, etc. during certain time of the year
<i>Reesups</i>	Village Forest Guards
<i>Sharshopkha (Sh)</i>	Language spoken in eastern part of Bhutan
<i>Shingsungpa</i>	Agricultural Crop Damage Arbitrator
<i>Sokshing</i>	A plot of land with rights for leaf litter production and collection.
<i>gSo-ba Rig-pa</i>	Traditional Bhutanese Medicine
<i>Tsamdro</i>	Grazing land
<i>Tseri</i>	Shifting cultivation
<i>Tshachu</i>	Hot Springs

1.0 Executive summary

The Kingdom of Bhutan is a landlocked country with an area of 38,394 km² situated on the southern slope of the Eastern Himalaya, bordering China to its North and India to its south, east and west. Today, Bhutan is known for its proactive approach to modern development characterized by its emphasis on environmental preservation in development process and more recently the pursuit and promotion of GNH as an alternative approach to modern development. This development philosophy is based on four pillars of GNH namely: equitable socio-economic development; preservation of the environment; promotion of culture and traditions; and Good governance.

A number of Institutions in the government are mandated to regulate, plan, coordinate, and implement programs to safeguard the environment and promote sustainable utilization of natural resources. The key organizations are the NEC and the Ministry of Agriculture and Forests (MoAF). The others are GNHC and the CSO- the RSPN.

1.1 Biodiversity

The Flora of Bhutan records more than 5,600 species of seed plants out of which approximately 94 percent are native species and about 105 species are endemic to Bhutan. In terms of fungal diversity, about 350 species have been identified and recorded (NMC publication). Approximately 287 lichens and lichenicolous fungi are known, although experts estimate the occurrence of more than 1,000 species. (Fungal diversity paper, 2002)

Close to 200 species of mammals are known to occur in the country, including 27 globally threatened species. Around 700 species of birds are estimated to be found in Bhutan out of which 18 are globally threatened. Bhutan has 61 species of amphibians and 124 species of reptiles recorded thus far (Wangyal, pers.comAug, 2014). Bhutan is reportedly expected to have 800 to 900 species of butterfly (van der Poel P and Wangchuk T, 2007). Of the expected 800 to 900 species, the RSPN has catalogued 140 species with photographs in 2007, while UWICE further catalogued 42 species of swallowtails and 186 species of brush-footed butterflies/Nymphalids in 2012. The first preliminary report on macro-invertebrates at Nikachu, Mangdechu, Chamkharchu and Kurichu rivers and heir tributaries catalogued at least 1, 107 fresh water insects belonging to nine orders (WCP &WWF, 2012).

Currently, from an inventory done in a few selected pockets in the country, 50 species of Odonata is recorded (Mitra, 2008). In case of hymenopterans, about six species of bees are recorded from Bhutan, out of which two are native. Preliminary studies have reported a total of 91 freshwater native fish species (Gurung, et al.,2013) inclusive of the 49 species identified earlier (Dubey, 1978).

Bhutan is rich in agricultural diversity having more than 100 species of agricultural crops. NBC has so far recorded 384 landraces of rice, 105 of maize, 36 of wheat, 10 of sweet buck wheat, 11 of bitter buckwheat, 32 of barley, 22 of amaranth and 36 of millets. In terms of Crop Wild Relatives (CWR), around 230 species belonging to 120 genera in 51 families are expected to occur in Bhutan (Tamang, 2003).

1.2 Main threats to biodiversity

Some of the direct pressures to biodiversity are: land use conversion; forest fire; over extraction of timber and fuel wood; overgrazing; forest offences and wildlife poaching; unsustainable agricultural practices; pollution; invasive species; and human wildlife conflict. The indirect pressures are: climate change; population; and poverty.

The potential impacts of climate are: loss of species; increased establishment of invasive species; increased risk of forest fire; loss of agro-biodiversity; increased incidences of pests and diseases; and loss of livelihood, traditional knowledge and practices (“Biocultural” loss).

1.3 Biodiversity targets set under NBSAP

The following are the National Targets set in the revised NBSAP of Bhutan 2014, which was submitted to the 11th Conference of the Parties in 2014:

- National Target 1: By 2018, at least 60 percent of the population are aware of values of biodiversity and steps they can take to conserve and use it sustainably;
- National Target 2: By 2018, establish national capacity for valuation of biodiversity and ecosystem services to integrate into national development planning and policy making process and national accounting system, as appropriate;
- National Target 3: By 2020 incentives harmful to biodiversity are reformed and positive incentives are enhanced;
- National Target 4: By 2020, relevant stakeholders adopt the principles of sustainable production and consumption of natural resources and have kept the impacts of use of natural resources well within safe ecological limits;
- National Target 5: By 2018, high-biodiversity value habitats are mapped, the rate of losses is accounted, trends monitored and overall loss and fragmentation reduced;
- National Target 6: By 2020, baseline for fish and key aquatic biodiversity established for implementation of sustainable management plans, as appropriate;
- National Target 7: Areas under agriculture and forestry are managed through the adoption of sustainable management practices, ensuring conservation of biological diversity;
- National Target 8: By 2020, pollution from different sources, including from use of fertilizers and agro-chemicals affecting biodiversity and ecosystem functions are maintained within the national environmental standards;
- National Target 9: By 2020, IAS and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment;
- National target 10: By 2020, potential impacts of climate change on vulnerable ecosystems identified and adaptation measures strengthened;
- National Target 11: Maintain the current Protected Area System with enhanced management effectiveness and financial sustainability;
- National Target 12: By 2020, the information on conservation status of prioritized taxonomic groups available and actions are taken to improve the status of prioritized species;
- National Target 13: By 2018 genetic diversity of key cultivated plants and domesticated animals, including that of crop wild relatives are documented and conserved;

- National Target 14: By 2020, key ecosystems and ecosystem services are identified, assessed and safeguarded for human well-being;
- National Target 15: By 2020, priority degraded ecosystems and habitats are identified and rehabilitated;
- National Target 16: By 2015, the NP is implemented through ABS legislative, administrative and institutional frameworks, which are consistent with the NP;
- National Target 17: By 2015, revised NBSAP adopted for implementation as a national guiding document for conservation and sustainable use of biodiversity;
- National Target 18: By 2020, TK and customary practices of communities, relevant to biodiversity conservation and sustainable use are documented and used, and where appropriate revived and protected;
- National Target 19: By 2020, science-based knowledge and technologies related to biodiversity are improved, made accessible and applied, where appropriate; and
- National Target 20: By 2016, funding requirement for implementation of NBSAP identified and funds mobilized.

As an obligation under the Protocol, the government is implementing the NBF Framework Bhutan with financial assistance from UNEP-GEF, the following activities were undertaken:

- The Biosafety Clearing-House (BCH) was revised and further guidance and training was provided to the relevant stakeholders;
- The First Regular National Report under the CP on Biosafety was submitted as an obligation under the CP in consultation with various relevant stakeholders.;
- Ratification of the NP;
- Drafting of the ABS policy and implementation of the interim ABS policy in Bhutan; and
- Declaration of two RAMSAR sites: Bumdeling and Khotakha in 2012.

New programs and actions initiated since 2009 which support implementation of CBD

- Guidelines for zonation of National Parks and Wildlife Sanctuaries 2012 (DoFPS working document 2/2013)- effective protected areas management;
- National Forestry Inventory initiated in 2015;
- More biodiversity assessments and publications leading to increased biodiversity information: e.g. Assessment of the status of endemic plants of Bhutan, Fish diversity, initiated, biodiversity portal in 2013- address knowledge gap in biodiversity; and
- Smart Patrolling initiated in the PAs since 2011- effective PAs management.

2.0 Introduction

The Kingdom of Bhutan is a landlocked country with an area of 38,394 km² situated on the southern slope of the Eastern Himalaya, bordering China to its North and India to its south, east and west. It is a mountainous country with altitudes ranging from 150 to 7,500 masl. Straddling the two major Indo-Malayan and Palearctic biogeographic realms, Bhutan is part of the Eastern Himalayan region which contains parts of three global biodiversity hotspots, 60 ecoregions, 330 IBAs, 53 Important Plant Areas, and a large number of wetlands and 29 Ramsar sites (ICIMOD, 2010).

2.1 Natural Resources

Bhutan has a wide variety of forest ecosystems ranging from tropical lowland forests along the southern foothills to coniferous and temperate broadleaf forests in the central mountains and valleys, and alpine meadows and scrub forests in the northern highlands. Forests make up 70.46 percent of the country's land cover (BLCA, 2010) and constitute the most important natural resource base for the ecological and economic sustainability of the country.

Records indicate that there are over 5000 vascular plant species, 200 mammal species, over 700 species of avifauna, 36 species of amphibians, 83 species of reptiles, and 91 fish species¹. 27 of the mammals and 18 of the avifauna recorded are globally threatened. 94.5 percent of the recorded seed plants are known to be native and 105 are endemic.

Bhutan is also richly endowed with water resources. Its water resources lie in the form of snow and ice/glaciers, freshwater lakes, rivers, streams, and underground aquifers. The average flow is estimated at 2,325 m³/s (73,000 million m³/s per annum) and an estimated hydropower generation potential of 30,000 MW.

Only 33 percent of the country is geologically mapped and prospected (RGOB, 2010) indicating the potential for further discovery of minerals in the unexplored parts of the country. The known non-renewable natural resources primarily includes minerals such Copper ore, Lead – Zinc ore, Tungsten ore, Coal, Dolomite, Graphite, Gypsum, Limestone, Marble Slate, Talc, Ferro Silicon grade Quartzite, Shale and Iron ore.

2.2 Governance, Development Policy, and Institutional structure

Bhutan's political system transitioned from absolute monarchy to parliamentary democracy in 2008. The parliament comprises of the apolitical 25 members NC and the NA with 47 members. The bureaucracy is comprised of ten Ministries², four constitutional bodies³, and several

¹ Information derived from Bhutan Biodiversity Portal (<http://biodiversity.bt/>), an initiative of a consortium of biodiversity related agencies under the Ministry of Agriculture and Forests of the Royal Government of Bhutan and the College of Natural Resources, Royal University of Bhutan.

² Ten Ministries are: Ministry of Agriculture and Forests, Ministry of Economic Affairs, Ministry of Education, Ministry of Finance, Ministry of Foreign Affairs, Ministry of Health, Ministry of Home and Cultural Affairs, Ministry of Information and Communications, Ministry of Labor and Human Resources, Ministry of Works and Human Settlements.

³ The constitutional bodies are: Royal Civil Service Commission, Royal Audit Authority, Election Commission of Bhutan, and Anti Corruption Commission.

autonomous agencies⁴. Today, it is known for its proactive approach to modern development characterized by its emphasis on environmental preservation in development process and more recently the pursuit and promotion of GNH as an alternative approach to modern development. This development philosophy is based on four pillars of GNH namely:

- i. equitable socio-economic development,
- ii. preservation of the environment,
- iii. promotion of culture and traditions and
- iv. Good governance.

A number of laws have been enacted to safeguard the environment. Some of the prominent ones include the Water Act of Bhutan 2011, Waste Prevention and Management Act 2009, National Environment Protection Act 2007, the Biodiversity Act of Bhutan 2003, the Environmental Assessment Act of 2000, and the Forest and Nature Conservation Act 1995.

A number of Institutions in the government are mandated to regulate, plan, coordinate, and implement programs to safeguard the environment and promote sustainable utilization of natural resources. The NEC is the highest decision making body on all matters relating to the environment and its management in the country. The NEC Secretariat is entrusted with the mandate of developing environmental standards and regulating compliance to the standards with support of CAs primarily consisting of the Ministries and *Dzongkhag* administrations.

The MoAF functions to ensure sustainable social and economic wellbeing of the Bhutanese people through adequate access to food and natural resources. Within the Ministry, the DoFPS has the primary function of regulating and ensuring sustainable management of forest resources, efficient and effective forestry administration and service delivery. The functions are discharged through the park managements, WCD, and DFO based in the districts. The NBC seeks to provide approaches for sustainable use of natural resources, ensure balance between conservation and utilization of natural resources and between in-situ and ex-situ conservation.

The GNHC as the national planning commission has a significant role in mainstreaming environment in development plans, ensuring the integration of environmental conservation priorities in the five year plans, and mobilizing and allocating resources for the implementation of the plans.

LG comprising of the *Dzongkhags* represented by the *Dzongkhag Tshogdu* and the *Genog Tshogdu* are mandated to promote conditions that will enable the pursuit of GNH, implying preservation of the environment as one of the four pillars of GNH. Specifically, the LG Act of Bhutan 2009 requires the local governments to *'undertake any activity consistent with other relevant laws and policies of the country which may conserve and enhance the environment within the limits of the areas under its jurisdiction'*(RGOB, 2009).

In the non-governmental sector, the RSPN promotes environmental education, conservation of endangered species such as the Black-necked cranes and White-bellied herons, sustainable livelihoods, and research and advocacy.

⁴ Autonomous Agencies: Bhutan InfoComm & Media Authority, Bhutan Narcotics Control Agency, Cabinet Secretariat, Center for Bhutan Studies, Construction Development Board, Dzongkha Development Commission, Gross National Happiness Commission, National Commission for Women & Children, National Environment Commission, National Land Commission, National Statistical Bureau, Office of the Attorney General, Royal Education Council, Royal Institute of Management, Royal University of Bhutan, and Tourism Council of Bhutan.

2.3 Bhutan's Conservation history

Formal conservation programs in Bhutan started as early as the 1960s, when Bhutan embarked on the FYP development cycle in 1961, with the designation of the Northern and the Southern Wildlife Circles and the subsequent designation of the first protected area, the Manas Wildlife Sanctuary in 1966. The Forest Act of Bhutan 1969 was the first modern Act to be enacted by the RGOB, which stipulated the requirement for the maintenance of a minimum of 60 percent of the total land area under forest cover for all time. Currently, the country has 70.46 percent of the total area under forest cover (LCMP, 2010) and 51.44 percent of the total area secured as protected areas and biological corridors. The total forest cover for Bhutan including shrubs is 80.89 percent (LCMP 2010).

Bhutan's current status of conservation and biodiversity is a result of the far-sighted vision and leadership of our Kings and our rich tradition of living in harmony with nature throughout the centuries. This has been further strengthened through the formal adoption of the development philosophy of GNH, which categorically states environmental conservation as one of the four pillars of GNH.

3.0 An update on biodiversity status, trends, and threats and implications for human well-being

3.1 Ecosystem Diversity

Forest Ecosystem

Forests⁵ constitute the dominant ecosystem in Bhutan, with 70.46 percent⁶ (LCMP, 2010) of the country under forest cover. Further, as a result of variance in the altitudinal range, with corresponding variation in climatic conditions, the country supports a wide range of forest types and vegetation zones. Broadly speaking, the country can be divided into three distinct eco-floristic zones with different forest types (Ref: Table 1).

Table 1: Eco-Floristic Zones (Adapted from Ohsawa (1987) and LCMP (2010))

Eco –Floristic Zones	Main Forest Types and dominant flora (plants)	Main fauna (animals)
Alpine Zone Altitude – (4000 + masl)	Alpine meadows and scrubs dominated by Rhododendron scrubs, Juniper and medicinal plants and herb species such as <i>Aconitum</i> , <i>Gentiana</i> , <i>Nardostachys</i> , <i>Delphinium</i> , <i>Rhodolia</i> , <i>Meconopsis</i> , <i>Osnomas</i> , <i>Dactylorhiza</i> , <i>Ophiocordyceps sinensis</i> , <i>Picorrhiza</i> , <i>Fritillaria</i> , etc.	Snow leopard, Lynx, Blue sheep, Himalayan marmot, Tibetan wolf, Takin, Musk deer.
Temperate Zone	Fir Forest – 3000 masl+	Goral, Serow, Black bear,

⁵ The “Forests” refer to a minimum area of land of 0.05-1.0 hectare with tree cover (or equivalent stocking level) of more than 10-30 percent with trees with the potential to reach a minimum height of 2-5 meters at maturity in situ (LCMP 2010).

⁶ The total forest cover for Bhutan including the shrubs is 80.89 percentage (LCMP 2010).

<p>Altitude – (2000-4000 masl)</p>	<p>Fir forest consists either of largely pure stands of <i>Abies densa</i> or mixed with other species such as <i>Juniperus</i>, <i>Taxus</i> and <i>Larix</i>.</p> <p>Mixed Conifer Forest – 2500- 3500 masl Mixed conifer forest includes mixed stands of spruce, hemlock, juniper, fir, larch, taxus. Some broadleaf are also common particularly <i>Quercus semecarpifolia</i>, <i>Quercus griffithii</i>, <i>Rhododendron spp.</i>, <i>Acer spp.</i>, <i>Betula sp.</i></p> <p>Blue Pine Forest- 1500- 3200 masl Blue pine forest consists of pure or dominant stands of blue pine. It is sometimes mixed with <i>Quercus semecarpifolia</i>, <i>Populus rotundifolia</i> and <i>Rhododendron spp.</i></p> <p>Broadleaf mixed with Conifer – 2000-2500 masl Consists of blue pine mixed with poplar, and other species such as <i>Castanopsis</i>, <i>Quercus</i>, <i>Persea</i>, <i>Litsea</i>, <i>Populus ciliate</i>.</p>	<p>Grey langur, Red panda, Assamese macaque, Leopard</p>
<p>Sub Tropical Zone – (150-2000 masl)</p>	<p>Broadleaf Forest – 1000-2000 masl Represented by species of <i>Castanopsis</i>, <i>Lithocarpus</i>, <i>Schima</i>, and <i>Quercus</i>.</p> <p>Chir pine Forest – 700- 2000 masl Pure stands of Chir pine or in association with <i>Quercus lanata</i>, <i>Quercus griffithii</i>, <i>Quercus glauca</i> and <i>Alnus nepalensis</i> along water courses.</p> <p>Tropical Lowland Forest - <700 masl Broadly classified as semi- evergreen but varies from almost totally deciduous on exposed dry slopes to almost evergreen in the moist valleys. Forests are multi- storied with high species diversity. Floristic composition consists of tropical species like <i>Shorea robusta</i>, <i>Terminalia myriocarpa</i>, <i>Bombax ceiba</i>, <i>Daubanga grandifolia</i>, <i>Sterculia villosa</i>, <i>Acacia catechu</i>, <i>Terminalia nudiflora</i>.</p>	<p>Water buffalo, Golden langur, Sambar deer, Tiger, Golden cat, Clouded leopard, Capped langur, Gaur</p>

3.2 Aquatic Ecosystems

The aquatic ecosystems of Bhutan consist mainly of rivers, lakes, marshlands and hot springs.

3.2.1 Rivers

Due to the presence of large number of glaciers and glacial lakes, high level of precipitation and the relatively well-preserved forests and watersheds, Bhutan is endowed with tremendous inland water resources in the form of rivers, rivulets, springs and streams. The four major river basins are Amo Chu (Torsa), Drangme Chu (Manas), Puna Tsang Chu (Sunkosh and Wang Chu). Drangme Chu, the largest river basin, drains more than one-third of the country's area.

3.2.2 Lakes

There are large numbers of small and medium-sized lakes that spread across the country. Rajbanshi and Csavas (1982) had listed 52 lakes from which about 24 were above 3,000 masl and added eight as unexplored HAWs⁷ in the Dagala area. Further, Mool et al (2001) recorded a total of 2,674 glacial lakes in the country, with 24 posing potentially high risks. An inventory of HAW by the UWICE (2010) reports about 3,027 HAWs (2,963 lakes and 63 marshes) covering 0.26 percent of the country's total land cover with sizes varying from the smallest at about 35 sqm to the largest at about 1.5 sqkm. The HAWs in Bhutan include the supra-snow lakes, supra-glacial and glacial lakes, open water lakes (in alpine meadows) and marshes and serve as the main source of freshwater in Bhutan. The largest of all the lakes is the glacial lake at the terminus of Luggye glaciers at 4,506 masl (UWICE & WWF, 2010). However, currently, except for glacial lakes and HAWs there is inadequate assessment of the area and location of various lakes in other parts of the country.

3.2.3 Marshlands

In addition to rivers and lakes, marshlands in the form of depressions and water-logged areas are envisaged to be a major part of the aquatic ecosystem in the country. However, there has been no proper assessment carried out so far, except for 63 high altitude marshlands reported by UWICE. Marshlands are generally known to be rich in biota and are good habitats for resident as well as migratory birds, reptiles, amphibians and fishes. The best-known marshland in the country is the Phobjikha valley (1,244 ha.) at an altitude of 2,900 masl, where the globally threatened Black-necked Cranes roost in large numbers during winter.

The valley is also highly valued for its outstanding scenery and cultural ethnicity. Other important marshlands recognized as wetlands of international importance are Bumdeling (142 ha) (Ramsar site No. 2032) and Khotokha (114 ha) (Ramsar Site No. 2033) (www.ramsar.org).

3.2.4 Hot Springs

Hot springs, known as *Tshachu* in Dzongkha, are very popular in Bhutan. People mainly use hot springs for therapeutic benefits to ease ailments, especially those affecting bone and skin. So far, ten hot springs have been officially reported in the country but the number could be more. Some

⁷ High Altitude Wetlands (HAWs): Open water lakes and marshes above 3000 m of elevation (UWICE-WWF Bhutan Program, undated)

of the popular hot springs are Gasa *Tsachu* (Gasa), Duenmang *Tsachu* (Zhemgang), Dhur *Tsachu* (Bumthang) and Chubu *Tsachu* (Punakha).

4.0 Agricultural Ecosystem

The country is known to have six major agro-ecological zones corresponding with altitudinal range and climatic conditions. Table 2 gives an overview of the major agro-ecological zones along with characteristic features of these zones in terms of agriculture practices followed.

Table 2: Agro-ecological Zones of Bhutan (Adapted from MoAF 9th FYP and BAP III)

Agro-ecological zone	Altitude (m.a.s.l)	Rainfall (mm/annum)	Farming systems, major crops and agriculture produce
Alpine	3600-4600	< 650	Semi-nomadic people, yak herding, dairy products, barley, buckwheat, mustard and vegetables.
Cool Temperate	2600-3600	650-850	Yaks, cattle, sheep & horses, dairy products, barley, wheat & potatoes on dryland, buckwheat & mustard under shifting cultivation; temperate fruits and vegetables
Warm Temperate	1800-2600	650-850	Rice on irrigated land, double cropping with wheat and mustard, barley and potatoes on dryland, temperate fruit trees, vegetables, cattle for draft and manure, some machinery & fertilizers used.
Dry sub-tropical	1200-1800	850-1200	Maize, rice, millet, pulses, fruit trees and vegetables, wild lemon grass, cattle, pigs & poultry, up land rice.
Humid sub-tropical	600-1200	1200-2500	Irrigated rice rotated with mustard, wheat, pulses and vegetables, tropical fruit trees.
Wet sub-tropical	150-600	2500-5500	As for the humid zones-irrigated rice rotated with mustard, wheat, pulses and vegetables, tropical fruit trees.

4.1 Wild species diversity

4.1.2 Vascular plants

The country's diverse ecosystems and eco-floristic zones harbour a rich array of vascular plants. The Flora of Bhutan records more than 5,600 species of seed plants out of which approximately 94 percent are native species and about 105 species are currently endemic to Bhutan. The Bhutanese flora is also rich in plant species with enormous commercial and scientific values. The Institute of Traditional Medicine Services uses more than 200 plant species for formulation of various kinds of traditional medicines and local healers use more than 160 species as recorded in the National TK database housed within National Biodiversity Center. In terms of Pteridophyte diversity (Ferns and allies), currently 411 species in 27 families are recorded in the country (NBC, 2009).

4.1.3 Non-vascular plants

Although there are many species of non-vascular plants, such as sphagnum mosses, liverworts and hornworts, there is no detailed inventory of this group of plants, indicating a huge research and information gap in comprehending the biodiversity of the country. Currently, only 282 species under 156 genera of mosses are recorded from Bhutan (David Long paper-Journal of Bryology)

4.1.4 Fungus

In terms of fungal diversity in the country, currently, about 350 species have been identified and recorded, although the number could be much higher once a complete survey is carried out and species identity determined. The current number is based on a partial inventory carried in the country and only of those species whose identity is confirmed. Out of this, about 53 are edible mushroom species. Many of these edible mushrooms are local delicacies and contribute to the livelihoods and nutrition of the rural poor (NMC publication).

4.1.5 Insect-Fungi

The diversity and complexity of the associations of fungi and insects are poorly understood worldwide and more so in Bhutan. However, even with the limited studies on this group of organisms, more than 100 species are currently recorded, out of which sixty are already determined and several species are suspected to be new to science (NMC publication).

4.1.6 Lichens and Lichenicolous fungus

Lichens are a conspicuous element of the biodiversity all over Bhutan. However, very little studies are undertaken in this group. Currently only about 287 lichens and lichenicolous fungi are known from Bhutan, although experts estimate the occurrence of more than 1,000 species. Most species are those common to the Himalayas, however, there are also some eastern North American species occurring in Bhutan. For example, the rare *Ropalospora chlorantha*, so far only known from eastern North America is reported to occur in Bhutan. *Lepraria nigrocincta* is another species first reported in the Northern Hemisphere from Bhutan while *Pyrrhospora bhutanensis* is described as new to science (Fungal diversity paper, 2002)

4.2 Mammals

Close to 200 species of mammals are known to occur in the country, including 27 globally threatened species (Table 3). Bhutan is also known to be rich in wild felids. It harbours 11 of the 36 global species record. Furthermore, in a study conducted in Royal Manas National Park in 2012, in an area as small as 74 sq.km, six felid species were recorded, which is about 16 percent of the global felid species, confirming Bhutan to be a hotspot for wild felids (Tempa et al 2013).

Table 3: List of Globally threatened mammal species found in Bhutan.

S/N	Species	Common name	Global Threat Category
1	<i>Sus salvanius</i>	Pygmy Hog	Critically Endangered
2	<i>Trachypithecus geei</i>	Golden Langur	Endangered
3	<i>Trachypithecus pileatus</i>	Capped Langur	Endangered
4	<i>Cuon alpinus</i>	Dhole/ Wild Dog	Endangered

5	<i>Ailurus fulgens</i>	Red Panda	Endangered
6	<i>Panthera tigris tigris</i>	Bengal Tiger	Endangered
7	<i>Uncia uncia</i>	Snow Leopard	Endangered
8	<i>Elephas maximus</i>	Asian Elephant	Endangered
9	<i>Rhinoceros unicornis</i>	One-horned Rhinoceros	Endangered
10	<i>Bubalus bubalis</i>	Asiatic Water Buffalo	Endangered
11	<i>Caprolagus hispidus</i>	Hispid Hare	Endangered
12	<i>Platanista gangetica</i>	Ganges River Dolphin	Endangered
13	<i>Macaca assamensis</i>	Assamese Macaque	Vulnerable
14	<i>Melursus ursinus</i>	Sloth Bear	Vulnerable
15	<i>Ursus thibetanus laniger</i>	Himalayan Black Bear	Vulnerable
16	<i>Moschus chrysogaster</i>	Himalayan Musk Deer	Vulnerable
17	<i>Lutrogale perspicillata</i>	Smooth-coated Otter	Vulnerable
18	<i>Prionailurus viverrinus</i>	Fishing Cat	Vulnerable
19	<i>Pardofelis marmorata</i>	Marbled Cat	Vulnerable
20	<i>Neofelis nebulosa</i>	Clouded Leopard	Vulnerable
21	<i>Catopuma temmincki</i>	Asiatic Golden Cat	Vulnerable
22	<i>Cervus duvauceli</i>	Swamp Deer	Vulnerable
23	<i>Bos gaurus</i>	Gaur	Vulnerable
24	<i>Capricornis sumatraensis</i>	Serow	Vulnerable
25	<i>Budorcas taxicolor</i>	Takin	Vulnerable
26	<i>Myotis sicarius</i>	Mouse-eared Bat	Vulnerable
27	<i>Rattus sikkeimensis</i>	Sikkim Rat	Vulnerable

4.2.1 Avifauna

Bhutan is recognized as a part of several globally important bird areas, such as Sino-Himalayan mountain forests, Indo-Burmese forests, Indo-Gangetic grasslands, South Asian arid habitats, and Tibetan plateau wetlands (Bird Life International). This explains the rich bird diversity that Bhutan has within its small geographic area. Currently, around 700 species are estimated to be found in Bhutan out of which 18 are globally threatened. Of the three critically endangered species found in Bhutan (see table 4), the White-bellied heron is the most studied species with a population of 22 number out of the estimated global population of 50-200 birds.

Table 4: List of globally threatened bird species found in Bhutan.

S/N	Species	Common Name	Category
1	<i>Gyps bengalensis</i>	White-rumped Vulture	Critically endangered
2	<i>Ardea insignis</i>	White-bellied Heron	Critically endangered
3	<i>Sarcogyps calvus</i>	Red-headed Vulture	Critically endangered
4	<i>Aythya baeri</i>	Baer's Pochard	Critically endangered
5	<i>Arborophila mandellii</i>	Chestnut-breasted Partridge	Vulnerable
6	<i>Tragopan blythii</i>	Blyth's Tragopan	Vulnerable
7	<i>Aceros nipalensis</i>	Rufous-necked Hornbill	Vulnerable
8	<i>Apus acuticauda</i>	Dark-rumped Swift	Vulnerable

9	<i>Grus nigricollis</i>	Black-necked Crane	Vulnerable
10	<i>Gallinago nemoricola</i>	Wood Snipe	Vulnerable
11	<i>Haliaeetus leucoryphus</i>	Pallas's Fish-eagle	Vulnerable
12	<i>Sitta formosa</i>	Beautiful Nuthatch	Vulnerable
13	<i>Prinia cinereocapilla</i>	Grey-crowned Prinia	Vulnerable
14	<i>Aquila clanga</i>	Greater Spotted Eagle	Vulnerable
15	<i>Aquila heliaca</i>	Eastern Imperial Eagle	Vulnerable
16	<i>Mulleripicus pulverulentus</i>	Great Slaty Woodpecker	Vulnerable
17	<i>Chlamydotis undulata</i>	Houbara Bustard	Vulnerable
18	<i>Saxicola insignis</i>	White-throated Bushchat	Vulnerable

Source: BirdLife International (2014) Country profile: Bhutan. Available from: <http://www.birdlife.org/datazone/country/bhutan>. Checked: 2014-07-15

4.2.2 Herpetofauna

In terms of herpetofauna, there are limited studies and documentation carried out in the country so far. Nevertheless compiling all the past records (Bauer & Günther 1992; Das & Palden 2000; Wangyal & Tenzin 2009; Wangyal 2011, 2012; Wangyal et al. 2012; Wangyal & Gurung 2012a,b; Wangyal 2013), Bhutan has 61 species of amphibians (59 anurans, one caudata, one caecilian) and 124 species of reptiles (82 snakes, 20 lizards, two crocodile, 20 turtles and tortoise) recorded thus far (Wangyal, pers.comAug, 2014)

4.2.3 Invertebrates

Invertebrate is one of the least studied groups in the country giving an incomplete picture of the diversity of this species-rich group of biodiversity. The information presented here are of those groups, which are studied to some extent. Although, Bhutan is reportedly expected to have 800 to 900 species of butterfly (van der Poel P and Wangchuk T, 2007), there is no annotated checklist to confirm the number. Of the expected 800 to 900 species, the Royal Society for Protection of Nature has catalogued 140 species with photographs in 2007, while UWICE further catalogued 42 species of swallowtails and 186 species of brush-footed butterflies/Nymphalids in 2012. The first preliminary report on macro-invertebrates at Nikachu, Mangdechu, Chamkharchu and Kurichu rivers and heir tributaries catalogued at least 1, 107 fresh water insects belonging to nine orders (WCP &WWF, 2012). There is also a record of a relict species of dragon fly, *Epiophlebia laidlawii*, an indicator of pristine water quality, from the head waters of Dreychu stream above Dechencholing, Thimphu and Lamchela Chu in Chendepji, Tongsa (BEO, 2008).

Odonates have been studied to some extent. Currently, from an inventory done in a few selected pockets in the country, 50 species of Odonata is recorded (Mitra, 2008). In case of hymenopterans, about six species of bees are recorded from Bhutan, out of which two are native honeybees (*Apis cerana* and *Trigona iridipennis*), while *Apis mellifera* is an exotic species introduced for commercial beekeeping. The other native bee species are *Apis laboriosa*, *Apis dorsata* and *Apis florea*.

4.2.4 Fish Fauna

Preliminary studies have reported a total of 91 freshwater native fish species (Gurung, et al.,2013) inclusive of the 49 species identified earlier (Dubey, 1978). However, it is widely believed that the current list of fish species in Bhutan is a gross underestimate of the actual freshwater fish diversity. Amongst the known species, Golden Mahseer (*Tor putitora*) is considered endangered and is enlisted as totally protected species in the Forest and Nature Conservation Act, 1995. The National Centre for Riverine and Lake Fisheries has recently initiated a comprehensive scientific study of fish fauna in the country's major water bodies.

As part of the conservation efforts initiated for native fish species, the NCA in Gelephu is spearheading the development of breeding techniques of important native fish species and enhancement of fish stock (fish breeding and stocking). The Centre released the first lot of 1200 hatchery-bred Golden Mahseer fingerlings in March, 2013 in natural waters for augmentation of its natural population (NCA report 2013- MoAF website).

Apart from the currently known native species, there are nine introduced fish species being promoted to increase fish production to enhance national food security.

4.3 Domestic Biodiversity

4.3.1 Crops

As a country that is predominantly agricultural, Bhutan is rich in agricultural diversity. More than 100 species of agricultural crops are known to occur in the country. The crop species diversity can be further broken down into numerous landraces that occur as a consequence of adaptation to microenvironments created by altitudinal and climatic variations. NBC has so far recorded 384 landraces of rice, 105 of maize, 36 of wheat, 10 of sweet buck wheat, 11 of bitter buckwheat, 32 of barley, 22 of amaranth and 36 of millets. Several of the varieties and land races represent adaptation to some of the highest agricultural lands in the world, with cultivation in the alpine agro-ecological zone extending up to 4,600 masl. While wheat is not an indigenous crop, varieties grown around Laya at 3,839 masl, are adapted to higher altitudes and colder climatic conditions than wheat varieties in other parts of the world. Similarly, maize and barley have undergone a natural process of breeding and selection to evolve into high-elevation varieties.

In terms of Crop Wild Relatives (CWR), around 230 species belonging to 120 genera in 51 families are expected to occur in Bhutan (Tamang, 2003). For example, *Fagopyrum debotrys*, a putative wild relative of buckwheat and *Setaria viridis* of Foxtail millet are reported from Bhutan. Further, at least three wild relatives of rice *Oryza minuta* and *Oryza rufipogon* are reported in the Flora of Bhutan, while *Oryza officinalis* Wall. ExWatt was recorded from Southern Bhutan in 2012 (Sanam Drubdey 2012).

4.3.2 Livestock

Although at the species level, the livestock diversity of Bhutan is not different from those commonly occurring elsewhere in the Himalayas, there are many livestock breeds with marked genetic differences. For example, amongst the cattle breeds, the *Nublang*, a traditional cattle breed of Bhutan believed to have originated in Sangbay geog of Haa, is genetically distinct from any other cattle breeds (NBC, MoAF 2008- AnGR of Bhutan). Mithun is a descendant of Gaur, which originated in Northeast India but has been bred in Bhutan since the 17th century. Mithuns

are considered an important genetic resource due to the unique tradition of crossbreeding mithun (male) with *Nublang* (female) to reproduce *Jatsa* and *Jatsbam*, which are superior compared to either of the parent breeds. Similarly, yaks in Bhutan have distinct genetic differences between the population in eastern and western Bhutan.

Horse breeds found in the country are also considered to be unique. These breeds are *Yuta*, *Boeta*, *Merak-Saktenpa*, and *Jata*. Bhutanese sheep have been genetically investigated and classified into three types, namely *Jakar*, *Sipsu* and *Sakten* types. In particular the *Jakar* type is unique to central Bhutan and is highly endangered as farmers are giving up sheep husbandry as they are no longer economically viable. Table 5: Livestock Diversity of Bhutan.

Table 5: Traditional livestock and poultry breeds of Bhutan

S/N	Livestock Species	Traditional Breeds and crosses	Exotic breed and crosses
1	Cattle (<i>Bos indicus</i> and <i>Bos taurus</i>)	Nublang	Jersey
		Jaba	Brown Swiss
		Bajo	Jersey crosses
		Goleng	Brown Swiss crosses
2	Mithun (<i>Bos frontalis</i>)	Mithun/ Mithun crosses	
3	Yak (<i>Bos grunniens</i>)	Yak,	
		Yak Crosses (<i>Zo, Zom- Dz.</i>)	
4	Buffalo (<i>Bubalis bubalis</i>)	Buffalo (non descript)	
5	Pigs (<i>Sus scrofa</i>)	<i>Jitupha- Dz/ Sapha- Sh.</i>	Large black
		<i>Dhompba- Dz.</i>	Saddle back
			Duroc jersey
6	Chicken (<i>Gallus gallus</i>)	Pure black (<i>Yubja Naap- Dz .</i>)	Ross 308 (Broiler strain)
		Naked neck (<i>Khuilay- Lh</i>)	Hyline Brown (Layer strain)
		Hairy comb (<i>Belochem- Dz</i>)	
		Frizzled (<i>Pulom- Dz/ Dumsey- Lh</i>)	
		Native white (<i>Yubja kaap- Dz</i>)	
		Barred Yubja	
		<i>Jarizam- Dz./ Kaurey- Lh.</i>	
		<i>Jatey- Dz/ Sekini- Lh</i>	
	<i>Bailetey- Lh.</i>		
7	Goat (<i>Capra hircus</i>)	Goat(non descript)	
8	Sheep (<i>Ovis aries</i>)	<i>Jakar type,</i>	Comeback cross
		<i>Sakten type</i>	
		<i>Sipsoo type</i>	
10	Horse (<i>Equus cabalus</i>)	<i>Yuta</i>	Hequ
		<i>Boeta ,</i>	Spiti
		<i>Merak-Saktenpata,</i>	Haflinger crosses

5.0 Protected Areas

Since the first BAP 1998, there has been an increase in the Protected Area System from 26.23 percent to 51.44 percent. Management zonation completed in three parks - Sakteng Wildlife Sanctuary, Bumdeling Wildlife Sanctuary and Royal Manas National Park. The RGoB declared nine percent of country's area as BCs in 1999 as a gift to the earth from the people of Bhutan. Royal Botanical Garden was established in 1999 in Serbithang, Thimphu. Two Ramsar sites in Bumdeling and Khotokha were declared.

6.0 Values of biodiversity and ecosystem in the Bhutanese context

Biodiversity conservation has always been a pivotal part of Bhutan's rich heritage. As an agrarian society, biodiversity holds great economic, social, ecological, cultural and spiritual importance and has always been a source of sustenance, tradition and spiritual well being. The distinct customary practices and traditions associated with biodiversity is testimony to the harmonic and vibrant relationship that exists between nature and culture. For example, the use of *Dru Na Ngu* (nine important food grains) in offerings and rituals signifies the sacred role of biodiversity in culture and traditions and is very much alive even today.

The Bhutanese use biodiversity for a myriad of purposes ranging from fuel-wood, food, fiber, shelter, medicine, household implements, and handicrafts to several other purposes. About 69 percent of Bhutan's population living in rural areas depend directly or indirectly on natural resources highlighting their dependence on biodiversity and the ecosystem services provided by it. In the last five years (2008-2013), about 50 million cubic feet (cft.) of timber has been allotted for commercial and rural purposes, out of which 16 million cft is allocated for firewood (Forestry facts, 2013). Firewood still remains a major source of energy in rural areas with 58.96 percent of the energy coming from biomass, which is primarily firewood (Dhital, 2009: Asia Pacific Forestry sector outlook study 2). Other significant biological resources utilized include more than 60 species of NWFP such as edible mushrooms, medicinal plants, wild vegetables, bamboos and canes, with over 99 NWFP management groups formed in the country(SFD database 2014). The most well known insect fungus, *Ophicordyceps sinensis*, found in the alpine meadows of the country is highly valued biological resources due to its medicinal properties. It plays a significant role in uplifting the livelihoods and economic prosperity of alpine dwellers due to its commercial value. In 2013, a total of 684 kgs of *Ophicordyceps sinensis* were auctioned and traded, fetching upto Nu. 1.2 million per kilogram, earning Nu. 4.79 million in royalties (www.moaf.gov.bt /2013)

The two major drivers of economic growth in the country are Hydropower and tourism, contributing 20 percent [11th FYP, 2013] to the GDP. Hydropower is a major derivative of the ecosystem services provided by biodiversity through critical watersheds and abundant supply of clean water, with a potential to produce 20,000 MW of electricity. Second to hydropower, the tourism industry is a major beneficiary of the pristine environment and rich biodiversity; earning the country 63.49 million USD in revenue (Bhutan Tourism Monitor, 2013). Bhutan's tourism policy of 'High Value, Low Impact' ensures limited impact of tourism on the culture and environment. In terms of visitor profile, more than 77 percent are cultural tourists and only about 19 percent are nature-based tourists (TCB Monitor 2013), reflecting the huge untapped potential in nature tourism. This has led to recent government initiatives in promoting nature based tourism through opening more landscapes and trekking routes, promoting community-based nature tourism and training more nature guides.

A recent study by Kubiszewski et al., (2013) provides an initial estimate of the value of the ecosystem services in Bhutan using simple benefit transfer techniques. The study estimates the total ecosystem service mean value⁸ of Bhutan at approximately about USD 15.5 billion per year. The major contributing ecosystems in terms of essential ecosystems services are temperate forest, cropland, grassland, lakes/rivers and inland wetland, with forests as leading contributor. A significant finding of the study was that 53 percent of ecosystem services provided by Bhutan's environment benefit those outside Bhutan.

7.0 Update on the Status of Environmental Related Policies

7.1 Environment Related Policies

The NFP of 1974 which had recognized forest as a source of raw materials for wide range of industries and also a major share of the contribution to the national exchequer was revised in 2011.

The NFP 2011 has a goal to manage forest resources and biodiversity sustainably and equitably to produce a wide range of social, economic and environmental goods and services. It has reaffirmed the commitment to maintain 60 percent of the land under forest at all times to come. Some of the objectives of the policy are: to sustainably produce economic and environmental goods and services; maintain species persistence and ensure long-term sustainability of biodiversity, ecosystem services and natural habitats; manage watershed for reliable supply of high quality of water; and meet timber demands from their own community forests and derive economic benefits from sustainable management. It has retained the current ban of export of round logs and sawn timber. The policy supports the industries to develop commercial plantation, on leased land to produce industrial timber. It has also recommended organizational and institutional reforms.

The EDP developed in 2010 has a vision to promote a green and self-reliant economy sustained by an IT enabled knowledge society guided by the philosophy of GNH.

Some of the strategies mentioned under the policy are to: diversify the economic base with minimal ecological footprint; harness and add value to natural resources in a sustainable manner; reduce dependency on fossil fuel – transportation; economic development process shall take into account environmental mainstreaming in a phased manner; provide incentives for the promotion of green technology – micro-hydro, solar, wind, etc; protection of biodiversity, genetic resources and promotion of indigenous knowledge.

The policy has recognized mineral resources as finite and non-renewal natural resources – use in a sustainable manner ensuring environmental considerations. It promotes organic farming and encourages phasing out of use of harmful chemical fertilizers and pesticides.

The policy also recommends provision of incentives in the waste management services. It mentions that for recycling plants processing domestic wastes shall be exempted from Custom duty and sales tax on plant and machinery and also exempted from CIT/BIT for 15 years and will also be provided with land on nominal lease. Similarly, for all waste management plant/activities for domestic wastes shall be exempted from Custom duty and sale tax on plant

⁸ Mean value for provisioning, regulating and cultural services.

and machinery and also exempted from CIT/BIT for 15 years and will be also provided with land on nominal lease.

7.1.2 Environment Related Legislation

There are numerous environment related legislations. But after the publication of BAP III in 2009, the Waste Prevention and Management Act was enacted in 2009. The Act applies to all forms of waste: solid, liquid, or gaseous, hazardous or non-hazardous, organic or inorganic, from residential, agricultural, commercial, medical or industrial sources, produced by any person, including materials being stored for recycling or in the process of recycling, including the transportation of waste in any form, and import and export of waste in Bhutan.

The purpose of the Act is to reduce the generation of waste at source; promote the segregation, reuse and recycling of wastes; disposal of waste in an environmentally sound manner; and effective functioning and coordination among implementing agencies. In order to help implement the Act, relevant implementing agencies have been identified.

The Water Act of Bhutan was enacted in 2011 to ensure that the water resources are protected, conserved and/or managed in an economically efficient, socially equitable and environmentally sustainable manner.

The Water Act has reiterated that the water resources are the property of the State. The Royal Government as the public trustee of the nation's water resources shall ensure that water is protected, conserved and/or managed. One of the most important elements of the Act is the requirement for development of Integrated Water Resources Management Plan. The Act has also identified competent authorities for smooth implementation and enforcement. The Act has water use priorities. It has provisions on the prevention and control of water pollution, declaration of water management areas and payment of watershed services, to mention a few.

8.0 Lessons learned from the earlier NBSAP(s)

The process for preparation of BAPs has progressed since the release of BAP I in 1998 to BAP III in 2009. The following are the major lessons learnt from the development and implementation of past BAPs:

- The BAP development process brought together different stakeholders under one umbrella, which was instrumental in preparing comprehensive and integrated biodiversity action plans;
- The Action Plans provided a good reference on biodiversity and emerging issues, assisting preparation of project proposals for funding by institutions and individuals;
- While the past BAPs had strategies and actions outlined to address the issues related to biodiversity, lack of clear targets and indicators, including monitoring and evaluation mechanism, made it difficult to assess progress and achievements;
- Lack of fund projections and mobilization strategy for the actions outlined in the past BAPs led to poor implementation;
- The past BAPs lacked a communication and outreach approach, which resulted in lack of ownership and poor implementation by partners;

- Relevant institutions established to support the implementation of actions outlined in BAPs were not delegated with rightful authorities and opportunities; and
- The lack of a national mechanism for coordination, fund mobilization and implementation of various programs of works under CBD also resulted in poor implementation of past BAPs.

9.0 Threats to Biodiversity: Direct and Indirect pressures affecting biodiversity

9.1 Direct pressures

9.1.1 Land use conversion

Given the fast pace of socio-economic development⁹ in the country, forest areas are either lost or cleared for various activities such as construction of hydro-power and transmission lines, roads, schools, hospitals, mining and quarrying, etc. A total of 38, 577 acres of GRF has been allocated for developmental activities from 2008 to 2013 (Forestry facts and figures, 2013). Out of the total forest land converted for various uses, land allotted for construction of power transmission lines and road make up 49 per cent, while land leased for other purpose account to 30 percent. Pressures from mining on ecosystem and biodiversity result mainly from clustering of mines within a certain geographical area as reflected by the fact that 48 percent of the mines in Bhutan are concentrated within one district of Samste (National Council 2013). These activities not only lead to loss of natural habitat vis-à-vis forest land but also trigger habitat fragmentation and degradation, impacting negatively on biodiversity and often resulting in human-wildlife conflict.

Further, construction of hydropower development is seen as one of the key threats to aquatic biodiversity due to fragmentation of river ecosystem resulting in destruction of habitats and spawning ground and physical barriers to fish migration.

9.1.2 Forest Fire

Forest fire is one of the main causes of forest degradation and loss of forest and its associated biodiversity in Bhutan. DoFPS has recorded an average of 47 fire incidents annually in the last five years (Forestry Facts and Figure 2013) causing damage to a total of 47,501 acres of forest land. Although the incidence of forest fire is seen to decline over the years with just 34 cases in 2012-2013 in comparison to 74 in 2008-2009, the area destroyed has increased from 4,211.3 acres to 12,175.2 acres in those years. Therefore, forest fire still remains a serious threat. While forest fires are not always detrimental to biodiversity, especially in fire adapted ecosystem or when used as management tool, however, recurrent forest fires can lead to gradual degeneration of the site and obliteration of associate species, rendering the site vulnerable to land degradation and ecosystem change. Forest fires in Bhutan generally spread to steep, inaccessible areas beyond the intended ecosystem/habitat and ravages everything in its path, leading to detrimental effects that far outweigh any potential benefits. Moreover, the causes of fires are mostly man-made such as increasing area for cattle foraging, preventing wildlife invasions and other accidental cases.

⁹ Real growth rate averaging 8 per cent per annum over the five years of the 10th plan, (11th FYP, RGOB)

9.1.3 Over extraction of Timber and Fuel wood

The current trend of timber extraction is of serious concern given the fact that most of the timber resources are supplied on an ad-hoc basis from unmanaged forests. The NRDCL has extracted about 10 million cft of commercial timber in the last five years (2008-12) from forest management units and working schemes, based on the annual allowable cuts determined by the DoFPS. In addition, during the same period, the DoFPS allotted about 40 million cft of timber for various uses from areas, much of which were supplied on ad hoc basis (Forestry facts and figures 2013). Therefore, the sustainable limits of these forest resources, particularly those supplied from areas outside FMU systems are not known.

9.1.4 Overgrazing

There is a general perception in Bhutan that rangelands are degrading due to overgrazing while some others believe that vegetation change may have resulted from other factors such as forest fire, lack of fire (discontinuation of the use of fire in range land management regimes in the alpine region,) extreme weathers and natural events (Gyamtsho, 1996; Gibson, 1991).

While detailed assessment of rangeland resources and their potential have not yet been made and there is a lack of quantitative data to support widespread claims of overgrazing and resulting rangeland degradation (Gyeltshen, undated). The current estimated density of livestock (cattle and yaks) at 221 animals per km² of pasture land, translating to about 11 animals/acre of pasture land, is considered slightly above the carrying capacity of 10 animals/acre of pasture land (Kezang Wangchuk 2013), possibly leading to over grazing resulting in poor quality of pasture.

9.1.5 Forest offences and wildlife poaching

The most common forest offence reported pertains to illegal trade and transport of timber (Forestry facts and figures 2013). Other offences include wildlife poaching, illegal harvesting of NWFP, fishing, retaliatory killings, forest fire, etc. The driving factors are booming construction sector, lucrative market for high value medicinal species, and expansion of farm roads.

9.1.6 Unsustainable agricultural practices

Factors contributing to unsustainable agriculture practice are farming on steep slope, increasing and imbalance use of inorganic fertilizer, shifting cultivation, and increasing use of chemical pesticides (NAP- UNCCD 2008). These factors are of concern when we consider the fact that only 2.93 percent of the country's area is cultivated agricultural land (LCMP, 2010).

Problems from steep slope agriculture arise mainly due to the fact that 31 percent of farming is on land with more than 50 percent slope. Imbalance in use of inorganic fertilizer is largely due to high use of urea (nitrogen supplying compound) which is affordable compared to other inorganic fertilizers. This has resulted in an increasing gap between the application of N (Nitrogen) and that of P (Phosphorus) and K (Potassium), creating an imbalance in soil nutrient management with the average national NPK ratio of 6:1:1 (NAP, 2008).

Although increasing use of chemical pesticides is identified as one of the unsustainable agriculture practices, the impacts of chemical pesticides on land and environment is not yet known (NAP, 2008).

9.1.7 Pollution

Pollution is an emerging concern and different sources of pollution are all indicative of the rapid socio-economic development, urbanization, increasing population densities in localized areas and industrialization. Solid waste is a major source of land pollution. Domestic sewage, waste oil and effluents from automobile and industries are the major water pollutants. CO₂ emissions from industries, energy sector and vehicles and ambient dust from industries are the main sources of air pollution. Measures in place to control and manage pollution include adoption and enforcement of vehicle emission and industrial discharge and emission standards 2004 to control air and water pollution. The Clean Technology and Environmental Management (CTEM) Fund was also established to support industries which existed before the enactment of the Environmental Assessment Act 2000, to upgrade pollution abatement equipment to meet the industrial emission standards. Furthermore, Waste Prevention and Management Act 2009 address pollution from all kinds of waste (BEO, 2008).

Bhutan started using synthetic agro-chemicals like fertilizers and pesticides in agriculture in the 1960's as a way to increase food production. The use of these chemicals is however restricted to the regions that are accessible by roads and mainly for a few major food and cash crops such as potato, apple, rice and maize. The import and use of synthetic agrochemicals and fertilizers are regulated by government and currently only about 30 percent of farmers use inorganic fertilizers, which is mostly mixed with farm yard manure. Although the import of agro-chemical and fertilizers have been rising, the rate of inorganic fertilizer application at the current estimated rate of 24.6 kg/ha cropped land is also considered low compared to global fertilizer application rate. The use of pesticides also show an increasing trend which is mainly due to the increasing use of herbicide *Butalchlor* and *Metribuzin* for weed control in rice and potato respectively (NOP master plan).

9.1.8 Invasive species

Global Invasive Species database records 46 Invasive Species from Bhutan out of which 11 are alien. However, there has been no systematic and comprehensive inventory of IAS in Bhutan, apart from few scattered studies. A pilot inventory carried out by the NBC recorded more than 30 invasive plant species, out of which eight were categorized as major invasive plant species.

There is also no assessment carried out on the socio-economic and environmental impacts of IAS. However, the spread of some of the IAS such as *Trifolium repens* (white clover), *Ageratina adenophora*, *Chromolaena odoratum*, *Eichbornia crassipes*, into the local landscape and water bodies is well known. Concerns also arise from the accelerated establishment of IAS due to changing climate and native plant species, such as *Potamogeton distinctus* becoming invasive, which is reported to reduce rice yield by 35 percent (http://www.rcbajo.gov.bt/technology/plant_protection.php- accessed on 22nd April 2014).

9.1.9 Human Wildlife Conflict

Human wildlife conflict is becoming a growing concern in a country that has more than half of its total area under protected area system and at least two thirds of the populace dependent on agriculture and livestock farming. Livestock depredation and crop damage are two major problems caused by wildlife, posing serious threats to livelihood and domestic diversity. Records show that about 55 percent of the crop damage in the country is attributed to wildlife damages, while livestock losses account to more than 2,035 numbers from 2002-12. Continual conflicts impact rural livelihood and quality of life and lead to agriculture land fallowing and rural-urban migration.

Since human wildlife conflict causes substantial economic and social costs to the rural communities, it also results in retaliatory killings, resentment against policies, and lack of support towards conservation initiatives. For example, retaliatory killing through poisoning of dholes few decades ago almost eliminated the species from the wild (HWF report, WCD, 2013).

9.2 Indirect Pressures

9.2.1 Climate change

Although there are no systematic studies of climate change impacts, there are observations of Bluepine (*Pinus wallichiana*) encroachment into spruce/maple/birch forests and decline of *Abies densa* forests on the mountain tops in the 1980s due to moisture stress (Gratzer et al, 1997). Such affects could be further exacerbated due to increased incidences of moisture stress from rising temperature. Concerns are similar for the montane cloud forests of Bhutan which occur around 2500 m in the inner deep dry valley slopes of Dochula-Bajo series (Wangda and Ohsawa, 2010) and around 2000 m along the mid hills of Gedu-Darla series (Wangda et al, in press). These are vulnerable to change in temperature and human disturbances which could lead to habitat loss for some important relict plant species like *Taxus*, *Magnolia*, *Tetracentron* and endangered bird species such as hornbills.

Other threats to biodiversity which could be exacerbated due to climate change include loss of agro-biodiversity, increased incidence of pests and diseases, accelerated establishment of IAS, forest fires and bio-cultural loss.

9.2.2 Population

The total population of the country is estimated at 7,33,004¹⁰ Despite gradual decrease in population growth rate from 3.1 per cent in 1994 to 1.3 per cent in 2005, population is projected to grow to around 8,09,937 in 2020 (SYB, 2013). The population density will increase from 16 persons (2005 estimate) to about 21 persons per square km (11th FYP doc). Although the overall population is still low, the limited arable and habitable land could result in demographic pressures on the natural environment.

¹⁰ Based on the exponential growth rate of 1.8 percent derived from population projections (2005-2030).

9.2.3 Poverty

According to the Poverty Analysis Report 2012, poverty incidence has declined from 31.7 percent in 2003 to 12 percent in 2012. Rural poverty has decreased from 38.3 to 16.7 percent. Nevertheless, all three reports of 2003, 2007 and 2012 reveal poverty to be a rural phenomenon. This is significant considering that rural poor are dependent on natural resources for their livelihood, often engaging in unsustainable harvesting of timber and non-wood forest products resulting in depletion of these resources.

10.0 Impacts of changes in the biodiversity for ecosystem services and socio-economic and cultural

It is predicted that the resilience of many ecosystems will be threatened by an unprecedented combination of climate change, associated disturbances (e.g. flooding, drought, wildfire, insects, etc) and other global change drivers (e.g. land use change, pollution, fragmentation of natural systems, and overexploitation of resources (IPCC 2007, CBD, 2009). Modeling studies indicate significant changes in the state of some ecosystems, mainly due to rising temperature and altered precipitation regimes. It is predicted that such changes will first happen at the present boundaries between different ecosystems, such as a shift in tree line. In addition to shifting the location of ecosystems and their boundaries, climate change will alter the composition of many ecosystems leading to changes in the ecosystem functions and services (Campbell et al, 2009, Rosenzweig, et al., 2007).

In the Alpine ecosystem (above 4000 masl), the results of the survey 2010 indicate that Juniper scrub forest is increasing in area while the availability of alpine plants (eg: *Picorrhiza kuroo*, *Gentiana urnula* and *Fritillaria spp.*) are decreasing. In scrub forests, changes in management practices like fire suppression and forestry rules have led to an increase in scrub forest coverage. Locals report that the discontinuation of the use of fire in range land management regimes in the alpine region, has led to the acceleration of the incursion by woody species. It is likely that with the climate becoming warmer in future, the increasing upward movement of conifer scrub forest could result in habitat encroachment of medicinal plants such as *Picorrhiza spp.*, *Fritillaria spp.* and *Rhodiola spp.*

Many alpine species are able to start their growth with the supply of snow melt water, well before the commencement of monsoon. This is important to understand from the point of view of glaciers in the country. The average rate of glacial retreat in Bhutan from 1963 to 1993 is estimated to be about 2 m/year vertically and about 7 m/year horizontally, with 8.1 percent area shrinkage in 66 selected glaciers in 30 years (Karma et al, 2003). Reports state that in the coming decades, many Himalayan glaciers will retreat, with some smaller glaciers disappearing altogether (Eriksson et al, 2009). If the glaciers disappear, the growth and life cycle of alpine plants can be disrupted because of the lack of snow melt water (Singh, Year missing). This could lead to change in species composition, structure and functioning of alpine meadows leading to the habitat alteration and disappearance of ecologically sensitive and economically important species such as *Ophiocordyceps sinensis* and plants (*Picorrhiza*, *Fritillaria* and *Rhodiola*, etc).

In the forest ecosystems, although there are no studies with systematic records of treeline shifts, Bluepine (*Pinus wallichiana*) encroachment into spruce/maple/birch forests is observed. The strong correlation between the upper limit of evergreen broad-leaved species and the winter temperature is also reported (Wangda & Ohsawa 2006a & b). The distribution of evergreen broad-leaved species along the altitudinal slope of dry valley mid – hills is limited by winter

temperature (coldest month's mean temperature) of minus one degree celsius which coincides at 2900 masl. (Wangda & Ohsawa 2006a). With the increasing trend of winter temperature over the past ten years, according to unpublished meteorological data of the Research and Development Centre (RDC), Yusipang, there is a probability of increasing the upper limit of evergreen broad-leaved species from 2900 m (current) to higher altitudes in the near future. This could lead to the disruption of conifer forest ecosystems. Similarly, the upper limit of conifer species like *Abies*, *Tsuga* and *Juniperus* may shift higher or may become extinct in the process.

In the cold temperate forest ecosystem, *Abies densa* forests on the mountain tops declined in the 1980s due to moisture stress (Gratzer et al, 1997). With rising temperature, leading to increased incidences of moisture stresses, the vulnerability of this forest type is high. Concerns are similar for the montane cloud forests of Bhutan which occur around 2,500 m in the inner deep dry valley slopes of Dochula-Bajo series (Wangda & Ohsawa, 2010) and around 2,000 m along the mid hills of Gedu-Darla series (Wangda et al, in press). These are vulnerable to change in temperature and human disturbances which could lead to habitat loss for some important relict plant species like *Taxus*, *Magnolia*, *Tetracentron* and endangered bird species such as hornbills.

Climate change may also accelerate the damage to wetlands and fresh water ecosystems, such as lakes, marshes and rivers. Increasing temperature will cause water quality to deteriorate and have negative impacts on aquatic organisms, with the possibility of some species becoming extinct (Campbell, 2009). Although studies on our wetlands and freshwater ecosystem are very limited, wetlands are already under threat from anthropogenic activities such as infrastructure development, resource extraction, agriculture, mega hydropower projects, urban expansion/encroachment, etc. For instance, it is feared that agriculture, continuous grazing and encroachment by bluepine and scrubs into marshy areas are altering the wetlands of Phobjikha, and thereby the habitat of the globally vulnerable black-necked cranes. In future, with the increasing effects of climate change, such wetland ecosystems could gradually disappear or become unsuitable for wintering and breeding of these birds.

10.1 Loss of species.

Many of the Earth's species are already at risk of extinction due to pressures arising from natural processes and human activities. Climate change will further exacerbate these pressures especially for threatened and vulnerable species (Gitay et al, 2002). According to the IPCC AR4, up to 30 percent of the higher plant and animal species are likely to be at an increased risk of extinction if global average temperature increase exceeds 1.5 to 2.5 degree celsius over the present temperature (Campbell et al, 2009).

Climate change will impact species mainly through changes in distribution and population status. It will also affect phenology, which in turn could affect the plant-pollinator interactions and prey-predator dynamics (Campbell et al, 2009). The risk of extinction will increase especially for those that are already at risk due to factors such as slower life history trait, limited dispersal abilities, low reproduction rate, small population size and specialist and range-restricted species, limited climatic ranges, or occurrence on low-lying islands or near mountain tops (Campbell et al, 2009, Gitay, 2002). It is also reported that endemic species are the most affected when no migration is assumed in model projections.

These predictions raise concerns for Bhutan which has about 105 endemic plants and a number of globally threatened species. The continued existence of high altitude species will be threatened due to the higher impacts of climate change in the alpine region and as land areas decrease with

increasing elevation (Campbell et al, 2009). This could result in the potential loss of restricted Himalayan endemics such as the pygmy hog, Himalayan field mouse, and flying squirrel and high altitude medicinal/endemic plant species. In addition, the existence of large predators such as the tiger and the snow leopard are already threatened by shrinking or fragmented habitats making them more vulnerable to the impacts of climate change. Therefore, implementing species specific conservation programs that include securing habitats for the persistence of species at risk is an absolute priority.

While there are no systematic studies in the country on climate change impacts on species as well as species response, survey 2010 lists population change in a number of animal species (Table 6) and about 16 plant species with observed changes in flowering time (Table 7.)

Table 6: Observed changes in population of animal species (Survey 2010)

Eco-floristic zones	Observed increase in species population	Observed decrease in species population
Alpine – above 4000 masl Altitude -4000m + Mean Temp-5.5 ^o C/y Rainfall <550 mm/year	tibetan fox, blue sheep, wild boar, takin and snow leopard, blood pheasant and monal pheasant	musk deer and barking deer
Inner Valleys Altitude -(2000-4000 m) Mean Temp-9.9 ^o C-12.5 ^o C /y Rainfall -650-850 mm/year	bear, wild boar and sambar, black necked crane, mynah, yellow-billed blue magpie.	barking deer, wild fox, leopard and tiger, eagle
Mid valleys Altitude -(1000-2000 m) Mean Temp-17.2 ^o C-18.5 ^o C /y Rainfall -850-2500 mm/year	macaque, wild boar, deer, laughing thrush and common crow.	jackal, tiger, bear, musk deer, leopard, jungle fowl, hornbill, pheasant, cuckoo and vulture
Foothills – 150 – 1500 masl Altitude -(150-1000 m) Mean temp- 23.6 ^o C- Rainfall-2500-5500 mm/year	rabbit, wild boar, sambar, macaque, barking deer, porcupine, gaur, bear	asian elephant, wild dog, tigers, hornbill, common crow, vulture and ring dove

Table 7: Observed changes in flowering time of different plant species (Survey 2010).

Eco-floristic zones	Species	Flowering time (Current)	Flowering time (10-20 years ago)
High Mountains	<i>Rhododendron spp.</i>	March	April
	<i>Magnolia sp.</i>	March	April
Inner valleys	<i>Rosa sp.</i>	May	June
	<i>Juglans sp.</i>	July	August
	<i>Rhododendron sp.</i>	Feb-May	Apr-June
	<i>Populus sp.</i>	December	January
Mid valleys	<i>Michelia doltsopa</i>	February/March	April
	<i>Prunus sp.</i>	March	April
	<i>Castanopsis sp.</i>	April	May
	<i>Quercus sp.</i>	January	February
Foothills	<i>Erythrina sp.</i>	August	September
	<i>Terminalia sp.</i>	September	October
	<i>Bombax sp.</i>	October	December

	<i>Daubanga sp.</i>	September	November
	<i>Bauhinia sp.</i>	August	September
	<i>Justicia adatodha</i>	December	January

10.2 Increased establishment of invasive species

The threat to biodiversity due to alien invasive species is considered only second to that of habitat loss. Climate change will expedite the colonization of some areas by invasive species in both terrestrial as well as fresh water ecosystems, which will have severe ramifications on native species (Campbell et al, 2009, CBD, 2009). Survey 2010 reported a significant increase in the diversity of invasive species such as *Mikania micarantha*, *Parthenium spp.*, *Opuntia spp.*, *Eupatorium ordoratum*, *Lantana camara*, *Commelina*, *Galinsoga* and *Phyllanthus*. Local newspapers have also carried articles on the emergence of ‘foreign weeds’ attributed to hotter climates by local residents (Kuensel, 7th July, 2007). Such increase of noxious invasive species may result in the decline of native species diversity in addition to lowering the production of agricultural crops through competition. This spells the need for a strong regulatory and management mechanism to control the entry and establishment of invasive species.

10.3 Increased risk of forest fire

Forest fires are considered to be one of the key threats to coniferous forests in the country with 526 incidents of forest fire, affecting over 70, 000 ha of forest between 1999/2000 to 2007/2008 (BAP, 2009). While most fires in Bhutan are caused by human activity, the rising temperature and long spells of drought due to climate change are likely to increase the risk of forest fires resulting in further reduction and degradation of forest resources. Such examples include the fires in the winter of 1998/99 which was characterized by a prolonged spell of dry (snow-less) weather with forest fire incidents even in places without a known history of forest fires (BAP, 2009). However, forest fires are also an essential part of the natural process in the functioning of many ecosystems. Fire suppression in fire-adapted ecosystems or ecosystems that depend on fire often results in reduced biodiversity and increased vegetation and fuel density, often amplifying risks of catastrophic fire over time. Furthermore, the fire-ecosystem relationship is also being altered by climate change, with significant consequences for ecological processes and biodiversity. Effective biodiversity conservation therefore requires allowing fire to play their role in maintaining ecosystem functioning, without posing a threat to biodiversity or human well-being through excessive occurrence (CBD, 2009). While forest fire is considered a threat for timber production in the country, its role as a conservation tool for Bhutan’s forests needs to be understood and applied under both present and future climatic conditions.

10.4 Loss of agro-biodiversity

Agricultural biodiversity plays a crucial role for adapting to altered climatic conditions through the genetic variability of crops and livestock species which can be bred to better adapt to climate change impacts. It is widely accepted that genetic diversity is important both in its own right and in determining the resilience of species to the impacts of climate change and other pressures. The introduction of modern crop varieties and breeds has led to the erosion of genetic diversity (Fowler and Mooney, 1990) with estimates that 75 percent of the genetic diversity of agricultural

crops has been lost since the beginning of the twentieth century (FAO,1997). Now climate change poses an additional threat to agricultural biodiversity by increasing genetic erosion of landraces and threatening wild species, including crop wild relatives (Jarvis et al., 2008). On the other hand, climate change will also bring new and enhanced demand for genetic resources. National and international breeding programs for a number of crops are already targeting new varieties with adaptations to future climatic stresses. The effort to breed for traits valued both today and in the future is likely to increase the demand and value of genetic diversity.

Bhutan's agriculture ecosystems are diverse and fragile, and lie between 150 to 4, 600 masl. Farming is predominantly at a subsistence level and a majority of Bhutanese farmers continue to grow traditional crops and crop varieties. Rice and maize are the major staple crops and other commonly grown crops are wheat, barley, buckwheat, millets, oil seeds, grain legumes, orange, apple, cardamom, etc. Bhutan has over 350 traditional rice varieties grown at different agro-ecological zones starting from 150 to 2,800 masl and is home to over 80 species of other crops (BAP, 2009).

The principal factors that could lead to reduced agro-biodiversity are the prevailing rise in temperature and changes in precipitation leading to increased incidence of extreme weather events (Chettri et al, 2010). This in turn could lead to low yield, higher incidences of pests and diseases, and disappearance of some species, varieties and breeds. Even as the correlation between the increase of these pests and diseases to climate change needs to be ascertained, the rice blast in 1995 caused by a fungus *Pyricularia grisea*, occurred on an epidemic scale in the high altitude warm temperate rice growing areas causing as high as 71 percent yield loss and loss of traditional rice varieties. In maize, a new maize disease Gray Leaf Spot (GLS) caused by the fungus *Cercospora zeae maydis* that was never reported in Bhutan, devastated the entire maize growing area in the east affecting about 3,835 households covering 4, 711.76 acres of maize crop threatening the household food security and existence of about 38 traditional maize varieties (Bhutan Observer, 24th July 2010).

Resilience – the ability to revert to a stable equilibrium following ‘shocks’- and ‘sustainability’- the ability to adapt by meeting needs in new ways, are the ecosystem properties that will be increasingly important for helping agriculture to maintain production in the face of climate change (FAO, 2011). Diversity of crops, breeds and diversification of management strategies are the basis of these ecosystem properties. Therefore conserving the broadest possible genetic diversity as an insurance against risks posed by climate change is a compelling argument for both *in situ* and *ex situ* agro-biodiversity conservation to prevent the loss of Bhutan's rich genetic diversity.

10.5 Increased incidences of pests and diseases

Recent moderate warming has been linked to improved forests productivity, but these gains are expected to be offset by the effects of increasing drought, fire and insect outbreaks as a result of further warming (Campbell et al, 2009). Survey 2010 results showed that the productivity of *Abies densa*, *Pinus wallichiana*, *Quercus glauca* and *Quercus griffithii* forests suffered set-backs due to periodic diebacks and insect attacks. Further the survey indicated that pests and diseases in forests and agriculture had increased over the years in general. There were outbreaks of bark beetle in spruce forests, increased incidence of mistletoe infestation, and moisture–stress related problems in blue pine forests. It is likely that with rising temperature and erratic dry and moist periods, intensity and incidences of diseases and pests will increase. In less than 16 years (1992-2008), five incidences of pine die-backs were observed (1994, 1999, 2001, 2003 & 2008) along

the Paachu-Wangchu valley. The study found that pine die-back was strongly correlated with higher temperature and lower rainfall during the die-back incidences in the area (Wangda et al. 2009).

In agro-biodiversity, the survey reported a high incidence of pests such as ants in potatoes, trunk borer (in rice and wheat), and fruit fly in Citrus and diseases like Citrus greening, Turicum Leaf Blight (TLB) and GLS in maize, ginger rot, cardamom rot, potato blight, maize root rot and Foot and Mouth Disease in livestock.

This clearly emphasizes the need to strengthen the national capacity in surveillance, identification and management of pest and diseases.

10.6 Loss of livelihood, traditional knowledge and practices (“Biocultural” loss).

The Bhutanese have always lived in harmony with nature and have used biodiversity for a myriad of purposes ranging from fuel-wood, food, fiber, shelter, medicine, household implements, and handicrafts to several other purposes. Bhutan has a rich tradition which is closely linked to biodiversity. For example, the use of *Dru Na Ngu* (nine important food crops) in offerings and rituals signifies the sacred role of biodiversity in culture and traditions. If climate and land-use change lead to losses in biodiversity, including loss of habitats, the livelihoods of local communities will be adversely affected, (Gitay et al 2002). Destruction of vegetation as a result of heavy grazing or exposure of soil could encourage the establishment of southerly weedy species under a warmer climate leading to adverse impacts on native biodiversity and local livelihoods (Gitay et al, 2002). Loss of alpine habitat from encroachment could lead to the loss of *Ophiocordyceps sinensis* and other high value medicinal plants which will have significant impacts on the livelihoods of high altitude pastoral communities.

The loss of biodiversity could also lead to the erosion of cultural practices, beliefs and traditional knowledge that will occur through the disappearance of local plant species resulting in the loss of a traditional heritage, an era, a way of life (Maffi, 2007; Singh et al, 2011). This “biocultural” loss could also act as a factor that increases poverty.

Local livelihoods are already made vulnerable by human-wildlife conflicts. It is possible that the situation will be exacerbated with climate change due to its effects on behavior and habitats of wildlife. There are already reports of change in the hibernation and movement patterns of the Himalayan black bear, leading to conflicts with farmers. The southern part of Bhutan frequently reports the destruction of crops by elephants. There is a need to study the impacts of climate change on wildlife and develop strong adaptation and coping mechanisms as well as to assess the implementation of the existing Human Wildlife Management strategy.

11.0 Possible future changes for biodiversity and their impacts

The future changes for biodiversity and their impacts cannot be discussed in isolation to the role of biodiversity and the different drivers that influence or affect biodiversity. The universally accepted roles of biodiversity are that it is a major source of livelihood, and a primary source of food for humans and animals; it plays a critical role for provision of biological resources and ecosystem services, helps in maintaining the balance of the ecosystem that ranges from recycling and storage of nutrients, regulation of different forms of pollution, stabilizing climate,

protecting water resources, forming and protecting soil and; providing many social benefits that range from recreation, tourism, biological resources for human health and industry.

The roles and functions of biodiversity are either positively or negatively influenced by the different drivers of change. Thus any possible future changes for biodiversity and their impacts will depend on the drivers of changes. The degree of impact of the drivers of change will be best indicated by the extent to which the roles and functions of biodiversity are influenced. Potential anticipated future changes of biodiversity and their impacts as influenced the different drivers of change in the Bhutanese context are summarized in Table 8 below.

Table 8 Drivers of change, possible future changes and their impacts on biodiversity in the Bhutanese context

No	Drivers of Change	Relevance to Bhutan	Possible Future Changes for biodiversity and Impacts
1	Policies	Very High	<ul style="list-style-type: none"> • Bhutan has a highly enabling policy framework which is supportive of conservation of environment which will have a positive impact on the conservation of all forms of biodiversity • The constitution mandates the country to maintain 60% of its area under forest cover at all times to come • The national goal of going out all organic will positively enhance biodiversity • Pro-environment enabling polices will ensure the allocation of financial resources from government for the sustainable preservation of biodiversity
2	Changes in land and water use and management	Very High	<ul style="list-style-type: none"> • Exclusionary PAs (>50% of the geographical area) that will be likely the dominant form of land use system which has many conservation benefits could further increase human wildlife conflicts affecting local communities and agriculture diversity • Rapid fragmentation of arable land and increasing demand for land will further degrade agriculture diversity • Increasing pressure on mining could negatively impact biodiversity through loss and degradation of natural habitats
3	Climate Change(CC)	Very High	<ul style="list-style-type: none"> • CC will directly influence the availability of water which is critical for all forms of biodiversity which in turn will impact the provision of biological resources and ecosystem services for overall human well being • The impact of CC on agricultural diversity will affect the form of distribution and diversity. The primary climatic factors that are most likely to affect are the rise in temperature and changes in precipitation which leads to extreme weather

			<p>events. Overtime the higher frequency of extreme weather events will affect farmers' traditional seed system</p> <ul style="list-style-type: none"> • CC will enhance the frequency of extreme climate events that could result in the unprecedented loss of biodiversity
4	Natural disasters	Very High	<ul style="list-style-type: none"> • GLOF, Flash Floods, landslides, hail storms, wind storms and forest fire directly influenced by CC that degrade the ecosystem, habitat change, loss of arable land, crop failures will intensify the rapid loss of biodiversity • Habitat changes from natural disasters could substantially increase the extent of human wildlife conflict
5	Pests, diseases, alien invasive species	Very High	<ul style="list-style-type: none"> • Insurgence of new pest and diseases in epidemic scale which is indirectly influenced by climate change can wipe out arable crops and species Eg. Incidence of Rice Blast in 1995, Gray Leaf Spot disease of maize 2007, Citrus greening • The increasing spread of alien and invasive species could influence the depletion and richness of native species
6	Pollution and external inputs	High	<ul style="list-style-type: none"> • The increasing trend and improved access in the use of external inputs (inorganic fertilizers and pesticides) in agriculture could significantly proliferate pollution
7	Markets, trade and the private sector	High	<ul style="list-style-type: none"> • Biopiracy, overharvesting and illegal trades of different biological resources are likely to be more pronounced negatively impacting biodiversity due to increased opportunities for markets, trade and interest from private sector on commercial farming and bio-prospecting • Increasing market demand for a species (eg. Large Cardamom) could rapidly displace food crops and increase the erosion of domestic agro-diversity
8	Population growth and urbanization	High	<ul style="list-style-type: none"> • Bhutan has only 2.93 % of its geographical area as arable land which is under immense pressure from rapid urbanization. The rapid pace of socio-economic development and the demand for land for infrastructures will continue to erode biodiversity
9	Advancements and innovations in science and technology	Medium	<ul style="list-style-type: none"> • Displacement of native species, varieties and breeds by more productive and robust exotic species, varieties and breeds could increase • The drive for commercialization of farming could lead to mono cropping and decline of the extent of domestic diversity in agriculture

Part II: The national biodiversity strategy and action plan, its implementation, and the mainstreaming of biodiversity

12.0 Biodiversity targets set under NBSAP

The following are the National Targets set in the revised NBSAP of Bhutan 2014, which was submitted to the 11th Conference of the Parties in 2014. These targets are based on the issues, threats, gaps and opportunities identified through a series of stakeholder consultation workshops carried out throughout the country. It is also based on the result of the review of the past Biodiversity Action Plans and guided by the national priorities and Aichi Biodiversity targets:

- National Target 1: By 2018, at least 60 percent of the population are aware of values of biodiversity and steps they can take to conserve and use it sustainably;
- National Target 2: By 2018, establish national capacity for valuation of biodiversity and ecosystem services to integrate into national development planning and policy making process and national accounting system, as appropriate;
- National Target 3: By 2020 incentives harmful to biodiversity are reformed and positive incentives are enhanced;
- National Target 4: By 2020, relevant stakeholders adopt the principles of sustainable production and consumption of natural resources and have kept the impacts of use of natural resources well within safe ecological limits;
- National Target 5: By 2018, high-biodiversity value habitats are mapped, the rate of losses is accounted, trends monitored and overall loss and fragmentation reduced;
- National Target 6: By 2020, baseline for fish and key aquatic biodiversity established for implementation of sustainable management plans, as appropriate;
- National Target 7: Areas under agriculture and forestry are managed through the adoption of sustainable management practices, ensuring conservation of biological diversity;
- National Target 8: By 2020, pollution from different sources, including from use of fertilizers and agro-chemicals affecting biodiversity and ecosystem functions are maintained within the national environmental standards;
- National Target 9: By 2020, IAS and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment;
- National target 10: By 2020, potential impacts of climate change on vulnerable ecosystems identified and adaptation measures strengthened;
- National Target 11: Maintain the current Protected Area System with enhanced management effectiveness and financial sustainability;
- National Target 12: By 2020, the information on conservation status of prioritized taxonomic groups available and actions are taken to improve the status of prioritized species;
- National Target 13: By 2018 genetic diversity of key cultivated plants and domesticated animals, including that of crop wild relatives are documented and conserved;
- National Target 14: By 2020, key ecosystems and ecosystem services are identified, assessed and safeguarded for human well-being;
- National Target 15: By 2020, priority degraded ecosystems and habitats are identified and rehabilitated;

- National Target 16: By 2015, the NP is implemented through ABS legislative, administrative and institutional frameworks, which are consistent with the NP;
- National Target 17: By 2015, revised NBSAP adopted for implementation as a national guiding document for conservation and sustainable use of biodiversity;
- National Target 18: By 2020, TK and customary practices of communities, relevant to biodiversity conservation and sustainable use are documented and used, and where appropriate revived and protected;
- National Target 19: By 2020, science-based knowledge and technologies related to biodiversity are improved, made accessible and applied, where appropriate; and
- National Target 20: By 2016, funding requirement for implementation of NBSAP identified and funds mobilized.

13.0 Procedure for formulation of the NBSAP

Unlike the past BAPs, which were generally formulated by consultants through the support of technical working groups and only a few rounds of stakeholder consultations at national level, the fourth NBSAP (2014) was prepared by a NTF representing key biodiversity stakeholders in the country under the coordination of the NBC. More importantly, rigorous consultations were made with biodiversity stakeholders at every level, from field implementer to policy makers over a period of two years.

The process of a NTF leading the revision of NBSAP was adopted mainly to strengthen national capacity, ease mainstreaming NBSAP in sectorial development plans and programs, and promote ownership of the NBSAP as a guiding document. In brief, the following process was adopted for the revision and finalization of NBSAP 2014:

- Stakeholder mapping to identify agencies to constitute the NTF for the revision of the NBSAP;
- Review of existing biodiversity conservation and use programs in the country and understanding of 2020 Aichi Targets;
- Formulation of NBSAP 2014 framework and conceptual features;
- Review of past BAPs to understand the progress of implementation of programmes of work and thematic areas, and identification of gaps, issues and opportunities;
- Identification of current threats and trends affecting biodiversity conservation and sustainable use;
- Taking stock of the baseline information;
- Identification and prioritization of issues related to biodiversity in setting national targets;
- Setting of draft national targets and indicators based on the national context and guided by the 2020 Aichi Targets;
- Development of strategies and actions to achieve the set national targets;
- Stakeholder mapping to identify stakeholders to be involved in the consultation workshops;
- Sub-national (in three regions of the country, East, West and South-Central) and National consultation workshops in a participatory and inclusive manner through group discussions, questionnaires, quiz, etc, to identify and incorporate national/local issues and prioritize draft national targets;
- Stakeholder mapping for identification of key implementing agencies in the NBSAP implementation framework;

- Presentation and discussion of the draft NBSAP 2014 to conservation institutions in the Asia region;
- Sharing of the draft NBSAP with biodiversity target and indicator champions in international organizations to get their feedbacks and comments;
- Presentation of the draft NBSAP to policy makers for further review and consensus; and
- Endorsement of the revised NBSAP by the government and its adoption as the national guiding document on biodiversity management in the country.

In addition to the difference in process of updating the NBSAP 2014 from the past BAP, the NBSAP 2014 also has recognized the gaps in the past BAP and has made an attempt to address them. The following are the key gaps identified in the past BAPs and actions taken in the NBSAP 2014:

1.

- **Measurable targets:** The past BAP contained only strategies without measurable targets, making it difficult to measure the progress of implementation. The revised NBSAP of 2014 has addressed this gap by identifying 20 measurable national targets with specific indicators, timeline and strategies for achievement of these targets.
- **Strategies to address threats to biodiversity:** Current and emerging threats to biodiversity have been identified and grouped under relevant national target and strategies to address these threats have been clearly spelled out.
- **Coordination mechanism-** As one of the biggest challenges in the past for the implementation of the NBSAP has been the lack of coordination and ownership of the document, the NBSAP 2014 has proposed National Coordination structure which identifies lead coordinating agency and coordination mechanism with clear terms of reference.
- **Funding:** Targeted funding for the implementation of the past BAP has also been one of the key weaknesses. Recognizing this gap, the NBSAP 2014 has proposed approach to fund mobilization and has plan for the development of Resource mobilization strategy as the first step to implementation of the NBSAP.
- **Awareness on NBSAP:** During the stakeholder consultation workshops, rapid survey on awareness about BAPs revealed lack of awareness on the existence of the document as one of the main gaps in implementing the past BAPs. This was mainly attributed to poor communication and outreach efforts. Therefore, in order to address this gap, the NBSAP 2014 outlines development of Communication and Outreach plan as one of the key actions. Activities such as translation of the NBSAP into national language and organization of awareness campaigns at local as well as national levels are planned activities. Development of national Clearing House Mechanism on biodiversity is also planned to support communication and outreach of the national targets and strategies.
- **Accountability:** Lack of coordination structure with clear delineation of responsibility has also been identified as factor contributing to poor accountability in the implementation of the past BAP. To address this gap, NBSAP 2014 proposes establishment of Monitoring and Evaluation Unit and has developed a NBSAP Implementation, Monitoring and Evaluation Framework.

- **Capacity:** A review of the past BAPs has identified the lack of capacity as one of the main challenges in the implementation of the action plan. Thus, the NBSAP 2014 identifies key capacity gaps and needs under each target and proposes development of capacity development plan.
- **Integration and mainstreaming:** While some achievements have been made in integration of biodiversity consideration into broader national plans, there are still untapped opportunities to strengthen biodiversity considerations into sector specific plans and programs. The NBSAP 2014 identifies engaging non-traditional biodiversity stakeholders into biodiversity awareness raising initiatives, National Biodiversity Committee and resource mobilization process as some of the potential actions to strengthen integration and mainstreaming biodiversity.

14.0 Actions taken to implement the Convention since the fourth national reports and its outcomes

The following are key actions taken to implement the Convention since the fourth report since the submission of the fourth National Report submitted in 2009.

14.1 New policies and legal frameworks adopted since 2009:

- EDP was developed in 2010 which recognizes that the sustainable economic growth continues to remain a major challenge. The vision of this policy is to promote a green and self-reliant economy sustained by an Information Technology enabled knowledge society guided by the philosophy of GNH. Some of the strategies are to harness and add value to natural resources in a sustainable manner; promote Bhutan as an organic brand; and reduce dependency on fossil fuel especially in respect to transportation.
- The NFP was amended in 2011. The policy has several principles: equity and justice in terms of access, utilization and conservation of forest resources and its ecosystem services; contribution of forest products and services to poverty reduction; people-centred forest management and decision making including management of state forest areas outside Forest Management Units, Community Forest and Private Forests; and the application of good science and indigenous or local knowledge should underpin all aspects of forest planning and management.
- The goal of the policy is that Bhutan's forest resources and biodiversity are managed sustainably and equitably to produce a wide range of social, economic and environmental goods and services for the optimal benefit of all citizens while still maintaining 60 percent of the land under forest, thereby contributing to Gross National Happiness.
- The overall intention of each policy objective has a number of important characteristics: A minimum of 60 percent forest cover is retained across the country, in conformance with the Constitutional requirement; the unique character of Bhutan's landscape and the integrity and biological diversity of its associated natural environment is maintained; a holistic and integrated area-based approach is adopted to plan for and manage forests for all their values to optimise benefits to society;

priority is given to indirect benefits from forests such as a reliable supply of high quality water for domestic use, irrigation and hydro-power, income from carefully targeted eco-tourism and environmental services; forests are used as a platform to contribute towards rural poverty reduction by balancing conservation and development objectives, and focusing on channeling benefits to the poor; local communities are empowered in sustainable forest resource management through community management of forests in close cooperation with public forest managers to satisfy the forest product needs of local communities, income generation, employment opportunities and to complement conservation and utilization objectives of public forests; forest management is more people-centered and is responsive to the expectations of civil society; organizational roles and institutional mandates are clarified and operational mechanisms streamlined to ensure effective coordination and integration.

- The Waste Prevention and Management Act of Bhutan 2009: One of the emerging environmental issues has been waste management. Despite numerous efforts undertaken by various institutions, the waste management in the country still remained ineffective. Therefore, in 2009, The Waste Prevention and Management Act was enacted. This Act prohibits littering on land, air and water.
- The Biosecurity Policy of the Kingdom of Bhutan 2020: From 2011, as an obligation under the Protocol, the government is implementing the National Bio-safety Framework Bhutan with financial assistance from UNEP-GEF, the following activities were undertaken:
 - The BCH was revised and further guidance and training was provided to the relevant stakeholders;
 - The First Regular National Report under the CP on Biosafety was submitted as an obligation under the CP in consultation with various relevant stakeholders.;
 - Ratification of the NP;
 - Drafting of the ABS policy and implementation of the interim ABS policy in Bhutan; and
 - Declaration of two RAMSAR sites: Bumdeling and Khotakha in 2012.

15.0 Institutional and Cooperative Mechanism

Bhutan- one of the countries to establish South Asia Wildlife Enforcement Network in 2011 to counter transboundary illegal wildlife trade.

16.0 New programs and actions initiated since 2009 which support implementation of CBD

- Guidelines for zonation of National Parks and Wildlife Sanctuaries 2012 (DoFPS working document 2/2013)- effective protected areas management;
- National Forestry Inventory initiated in 2015;

- More biodiversity assessments and publications leading to increased biodiversity information: e.g. Assessment of the status of endemic plants of Bhutan, Fish diversity, initiated, biodiversity portal in 2013- address knowledge gap in biodiversity; and
- Smart Patrolling initiated in the Protected areas since 2011- effective protected areas management.

17.0 Mainstreaming of biodiversity into relevant sectoral and cross-sectoral strategies, plans and programs

The 11th Five Year Plan (FYP) (2014-2018) which is the main development planning framework of Royal Government of Bhutan, with its underlying objective to achieve “Self-Reliance and Inclusive Green Socio- Economic Development recognizes conservation of natural environment as means to sustainable economic development and improvement of resilience to natural disasters. Out of the 17 National Key Result Areas (NKRA) indentified for the 11th FYP under the four pillars of Gross National Happiness¹¹, four NKRA under the pillar of “Conservation and Sustainable Utilization of Environment are identified to contribute to overall achievement of the national goals of 11th FYP.

¹¹ Four pillars of Gross National Happiness: Sustainable and Equitable Socio-Economic Development; Preservation and Promotion of Culture; Conservation and sustainable utilization of environment; Promotion of Good governance

The following table reflects biodiversity considerations in the non-traditional biodiversity stakeholder's sectoral plans and programs of the government for the 11th FYP.

Key sectors	Sectoral Key Result Areas under the environmental conservation pillar as proxy for the status of biodiversity consideration in 11 th FYP	Key Performance Indicator	Gaps
Education	Environment education enhanced in schools	Percent of schools practising green initiatives	
	Eco-efficient and disaster resilient infrastructure developed	New Schools constructions are eco-efficient/disaster resilient infrastructure	
Health	Eco-efficient, disaster resilient and differently-abled health infrastructure ensured	Percentage of new facilities constructed with eco-efficient/disaster resilient component	
	Medical waste management improved	Percentage of Hospital Acquired Infections	Focus on impact of medical waste on human health only
Renewable Natural Resources (RNR)	Enhanced Conservation of plants and animal genetic resource and natural environment	Inventory of traditional knowledge	KPI does not measure SKRA
	Enhanced sustainable land and biodiversity resource management	Land area under organic/natural production (Acres)	Impact on agrobiodiversity from cc not addressed strongly
Tourism	Environment conservation promoted and wellbeing of rural communities improved through eco-tourism	Rural communities benefitting from tourism	
		% of tourist on eco-tourism	
Trade and Investment	Promote Environment friendly trade	No. Of trade on environment friendly goods facilitated	
		Improve fuel quality	
Industry	Promote Green industries and eco-efficient technology	Industries using low polluting and emission technology	
Geo-Mining	Environmental impact from snow and glacier melt reduced	Climate change induced GLOF risk mitigated	
Energy	Meaningful and	No. Of households	Need to know the

	purposeful alternate renewable energy promoted	using bio-fuel as source of cooking/heating	impact of biofuel use on biodiversity before promoting bio fuel as alternate source of energy
Hydrometeorology	Delivery of weather, climate, GLoF, water and related environmental information and service enhanced	No. Of research in climate prediction/projection to improve the skills of seasonal, decadal, and longer time scale	Stress on disaster to physical environment and human, no attention on biodiversity
		No. Of pamphlets, outlooks, guidance related to extreme hydromet events	

The Mainstreaming Reference Group, or MRG, set up by the GNHC with support from UNDP and the UNEP-UNDP Poverty Environment Initiative consists of representatives from various ministries, academia and other key stakeholders. This group is it is tasked in reviewing policies using the GNH ‘policy screening tool’ to ensure compliance of the policies with the 9 domains of GNH. This activity thus aims to ensure no negative impact of new policies on the natural environment and biodiversity

The EDP 2010 formulated with the vision “to promote a green and self-reliant economy sustained by an IT-enabled knowledge society guided by the GNH philosophy” also ensures biodiversity conservation with some of its key strategies:

- diversifying the economic base with minimal ecological footprint;
- harnessing and adding value to natural resources in a sustainable manner;
- promoting Bhutan as an organic brand; and
- reducing dependency on fossil fuel especially in respect of transportation.

18.0 Implementation status of the BAP

The MoAF has so far developed four Biodiversity Action Plans (BAP) - BAP-I (1998), BAP-II (2002), BAP-III (2009) and NBSAP (2014). Review of the past three BAPs during the formulation of the 4th version (NBSAP 2014) revealed notable achievements in biodiversity conservation. In the thematic area of Policy and Legislation, over 12 Acts, policies and strategies supporting biodiversity conservation and use were developed. In the thematic component on the protection of biodiversity, the country declared 51.44 percent as protected area network and two RAMSAR sites were designated. In the thematic component on conservation of species diversity, amongst others, notable achievements includes establishment of Human Wildlife Conflict (HWC) Endowment Fund and Species conservation programs on Tiger, Snow Leopard, White-bellied Heron and Black-necked Crane. To address the component on genetic diversity, major achievements include establishment of National Crops and Animal Gene Bank, conservation of indigenous livestock breed of *Nublang* and *Jakar* sheep, institutionalization of participatory on-

farm conservation of cultivated crops and establishment of community seed banks To promote sustainable use of biological resources, a national strategy for Non- Wood Forest Products was implemented and 553 community forests established. Bio-prospecting and traditional knowledge unit was also established to protect traditional knowledge, innovations and practices as well as to promote sustainable utilization of biodiversity. To enhance education and awareness on biodiversity values, a national Biodiversity Portal was developed and organization of Biodiversity fair and celebration of Annual International Biodiversity Day institutionalized and strengthen.

The following are some of the key issues identified repeatedly since the 1st BAP of 1997 and which are not adequately addressed as of 2014:

- Development of institutional and technical capacity in various aspects of biodiversity management such as : taxonomic expertise,, species conservation, ecosystem valuation, invasive species management, etc;
- Legal status of conservation areas outside protected areas;
- Formulation of management plan for biological corridors;
- Expansion of targeted species conservation program;
- Management of Human-Wildlife Conflict;
- Inventory of crop wild relatives and their habitat to initiate conservation;
- Biodiversity Information; and
- Coordinated approach to advocate awareness in biodiversity.

19.0 Contribution of actions to implement the Convention towards achievement of the relevant 2015 targets of the Millennium Development Goals

Bhutan fully subscribes to the Millennium Development Goals and they are in tune with the country's national development priorities, including the overarching goal of GNH. With poverty reduction as the main theme of Tenth Plan (2008-2013), the MDGs are integrated into the national development planning process.

The Bhutan MDG Needs Assessment and Costing report is the result of the needs assessment and costing exercise and it presents a detailed assessment of what Bhutan requires in terms of financial, human and institutional resource needs and policy reforms to meet the MDGs by 2015. The report focuses on seven of the eight MDGs relating to the goals of reducing poverty and hunger, securing universal primary education, promoting gender equality and women's empowerment, reducing child mortality, improving maternal health, combating the spread of communicable diseases and promoting environment sustainability including improving access to safe sanitation and drinking water. The needs assessment also covered non-MDG sectors such as transport and energy infrastructure needs as well as good governance through capacity development. These interventions are expected to contribute to and support the realization of the core MDGs and are also vital for national socioeconomic development.

20.0 Major Interventions

Under agriculture and rural development, the main interventions are grouped into three clusters of raising agricultural productivity, enhancing other rural income generation opportunities and

improving rural access. These interventions were identified by the TTFs and the Core Working Group as those that were most likely to have the greatest potential impact on improving the livelihoods of the poor and the food insecure in the country.

It is expected that, in keeping with the Tenth Plan Guidelines, the rural development interventions identified by the MDG Needs Assessment and Costing exercise will reduce the proportion of the population living below the national poverty line from 31.7 percent in 2003 to 20 percent by 2015. The proposed interventions to increase agricultural productivity and promote other rural income generation seek to triple rural per capita income by 2012. Furthermore, the improving rural access will reduce the proportion of the rural population living more than an hour's walk from the nearest road to less than 20 percentage from the current 40 percent.

The main interventions in the education sector are to sustain and improve the enrolment and the quality of education at the primary and secondary levels, raise the country's adult literacy rates and expand access to special education for the disabled. It is expected that the proposed interventions will help accelerate progress towards attaining the MDG goal of universal primary education and the long term national goal of realizing a knowledge-based society. The interventions in the education sector are expected to simultaneously contribute to the reduction of poverty and as well as to the progress in achieving many of the MDG health targets.

Although the country remains on track towards achieving the third MDG of promoting gender equality and women's empowerment, there are some significant challenges that need to be addressed. These include the weak transition of girls to tertiary level education and the workplace, high levels of female youth unemployment and underemployment, low levels of female participation in political and high public office, and the reality of domestic violence prevalent in many households. Hence, the main interventions in this sector are directed at helping the transition of girls to work, encouraging political participation and representation for women and ending violence against women.

In view of the fact that over 30 percent of Bhutan's population comprise of young people, the MDG interventions in the health sector are concentrated in the areas of child health, maternal health, and emerging and re-emerging diseases like HIV/AIDS, Malaria and TB. Under child health, various interventions have been identified in the Vaccine Preventable Disease Program (VPDP), control of diarrhoeal diseases and acute respiratory infection, and nutrition programs. Under health systems, interventions have been identified for infrastructure, human resources, infection control and waste management, disability and telemedicine. HIV/AIDS, Malaria and TB are covered under interventions to combat communicable diseases.

In the environment sector, the thrust of the interventions are aimed at mainstreaming environmental concerns and their mitigation measures so that all development activities systematically take environmental issues into consideration as early as possible in the decision-making process. Interventions have been identified to strengthen the legal and policy framework and ensure timely management of emerging environmental concerns and issues. Building capacities of relevant agencies such as National Environment Commission, Environmental Units within ministries, the Disaster Management Division in the Ministry of Home and Cultural Affairs (MoHCA), Dzongkhag Environment Committees, and Dzongkhag Environmental Officers are expected to increase the country's limited environmental management capacity. Interventions also target the building of national capacity to improve poverty and environment linkages so as to ensure that outcomes that matter to the poor are not overlooked.

The major water and sanitation interventions are to provide access to safe drinking water through the construction of public stand posts and increasing access to improved toilets in the rural areas. In the urban areas, the major interventions are to construct public stand posts as well as provide piped connections to homes. Access to basic sanitation in urban areas will be through the provision of pour-flush latrines and new sewerage and waste-water treatment plants in larger urban areas.

The interventions in this sector also include improving drinking water standards through monitoring of water quality and training to build up the capacity of local stakeholders and relevant government staff. Rehabilitation and repair of old and non-functional infrastructure will continue and awareness and educational programs will also be undertaken to highlight the importance of safe drinking water and basic sanitation.

While energy is also not a direct MDG target, providing households with energy for lighting and cooking will reduce poverty and hunger and also facilitate the achievement of the other MDGs. The main interventions in the energy sector include expanding rural electrification through grid and off-grid electrification. The major MDG targets are to provide grid electricity to 83 percent of the households by 2015 and to off-grid sources like solar photovoltaic sets and micro hydroelectric plants to 12 percent of the households.

The key challenge in the transport sector is to expand the country's relatively new and small road network. In this regard, the major interventions include the expansion of national highways, district and feeder roads, and motorable bridges, where necessary. The construction, rehabilitation and maintenance of pedestrian suspension bridges for rural communities dependent on mule tracks have also been included. Although transportation is not identified as a MDG, it is expected that the interventions identified in the transport sector will increase access of communities to socioeconomic facilities and opportunities, reduce poverty and facilitate the achievement of the other MDGs.

21.0 Lessons learned from the implementation of the Convention

Bhutan became a party to the Convention on Biological Diversity (CBD) in 1995. The National Environment Commission (NEC) is the nodal agency in the country for the implementation of CBD. It liaises with relevant stakeholders across the country for the implementations of the CBD. As the focal agency for the country, NEC is also responsible for preparation and submission of all communications to the CBD Secretariat. To accelerate the achievements of the NBSAP targets there is a need to reflect positively on the lesson learned so far. Different lessons learned from the implementation of the CBD are briefly summarized below:

21.1 Weak implementation of the past biodiversity action plans

Since the ratification of the CBD, Bhutan has prepared three Biodiversity Action Plans (BAPs) and the one National Biodiversity Action Plan (NBSAP) engaging different stakeholders at the national level. The review of the past BAPs undertaken during the preparation of the NBSAP has revealed that the implementation of the identified strategies has been relatively weak. A suitable intuitional arrangement and a more proactive coordination of CBD across the different sectors are seen as the potential actions to accelerate and ensure better implementation and accomplishment of the NBSAP targets. To improve and accelerate the implementation of the

NBSAP targets formation of thematic groups representing relevant stakeholders has been proposed and is under consideration.

21.2 Knowledge Gap on different areas of biodiversity

Biodiversity is broad and cuts across different sector involving different stakeholders including local communities, policy makers, public sectors, private sectors and general population is involved directly and indirectly involved in the utilization of biodiversity. Currently there is a wide knowledge gap on the different areas of biodiversity including the values. This has led to the insufficient integration of biodiversity issues into broader policies, strategies and development programs of the government in the different sectors that directly and indirectly deal with biodiversity. For example the understanding on health and biodiversity, climate change and biodiversity, ecosystem and biodiversity, poverty as a driver of biodiversity loss and biodiversity for sustainable food production is poor and in adequately included in the national development programs.

21.3 Need to establish and strengthen monitoring mechanism for biodiversity by establishing baseline data and information

There is an urgent need to establish current status, trends and future scenarios for effective monitoring and assessing the achievements of the national targets. The establishment of baseline national baseline information on biodiversity should be done by initiating well designed studies through the involvement of relevant stakeholders. The data from such studies should also be made available for planning and decision making at all levels. By making the information on trends and status of biodiversity available and accessible preparation of the future national reports and NBSAP is will be easier.

21.4 Need for an appropriate fund mobilization strategy

The implementation of biodiversity action plans and achievements of set targets directly depend on financial and technical resources. To overcome the current financial and technical gaps there is a need to establish an appropriate national fund mobilization strategy to ensure the sustained flow of resources from national and international sources.

21.5 Mainstreaming biodiversity into national and local development plans and programs

The level of awareness and understanding on all areas of biodiversity among the stakeholders is poor. The awareness and understanding of the values of biodiversity to the entire society is weak but increasing. The integration of biodiversity in the national policies, strategies and development plans at present is relatively weak. To ensure the sustainable conservation, utilization and the appreciation of the values of biodiversity by all beneficiaries', sincere efforts have to be made to accelerate the inclusion of biodiversity agenda into local and national plans adopting multi-sectorial and multi-dimensional approaches. There is a need for enhancing the awareness, making information on biodiversity available and accessible, participatory planning and capacity development on all aspects of biodiversity.

21.6 Lack of adequate feedbacks and assessment of the national reports by the CBD Secretariat

The National Report is currently the only basis that CBD Secretariat uses as the means to monitor and assess the achievement of NBSAP targets and the status of biodiversity of the party. There is no feedback and follow up on the national reports submitted by the parties. To make the parties more accountable and to adequately measure the progress of achievements of the targets, CBD should put in place a forum or an appropriate monitoring mechanism to assess and validate the national reports.

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