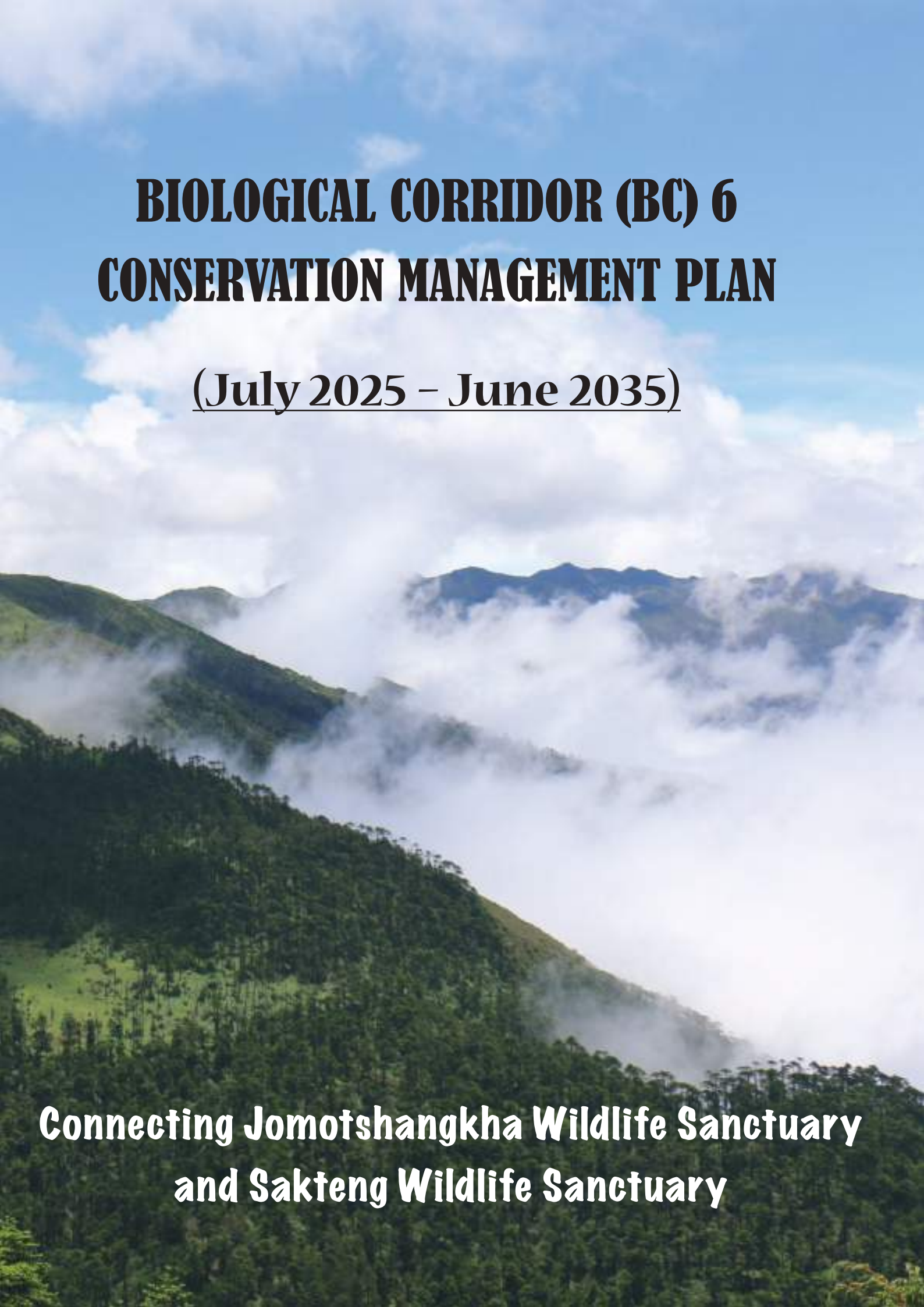

BIOLOGICAL CORRIDOR (BC) 6 CONSERVATION MANAGEMENT PLAN

(July 2025 – June 2035)

Connecting Jomotshangkha Wildlife Sanctuary and Sakteng Wildlife Sanctuary

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Ministry of Energy and Natural Resources
Department of Forests and Park Services
DIVISIONAL FOREST OFFICE
TRASHIGANG

Endorsement and Approval of the Royal Government of Bhutan

In accordance with the provisions under Section 9 subsection (3) of Forest and Nature Conservation Act of Bhutan 2023"

Submitted for Approval:

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FOREWORD

Elsewhere, the conservation and protection of natural heritage face major challenges due to the unprecedented rate of deforestation, landscape degradation, and fragmentation to meet economic needs. Bhutan, however, is fortunate today to have 52% of its land cover intact, with multiple networks of protected areas under the leadership of our selfless and visionary monarch. Guided by visionary leadership, strong policies, and environmentally friendly development practices, Bhutan has earned recognition as a global champion of conservation.

In addition to securing landscape connectivity between Sakteng Wildlife Sanctuary and Jomotshangkha Wildlife Sanctuary, BC6 also harbors several key species of both national and global significance. This landscape represents an important ecosystem in eastern Bhutan, further connected to the biodiverse region of Arunachal Pradesh in India. Understanding its significance and future needs, BC6 should be managed in a way that upholds and strengthens its values as a cost-effective and reliable strategy to conserve meta-populations of wide-ranging species, facilitate gene flow for all species, and enable species to adapt to climate change.

For this, a conservation management plan is a crucial document to guide the overall management of BC6 for species conservation, habitat management, and community well-being. Yet, despite its establishment in 1999, there was no management plan. Recognizing this gap and its importance, I am delighted to learn that the Divisional Forest Office, Trashigang, has initiated and successfully developed a conservation management plan. The plan has come at the right time, with a clear vision and objectives, incorporating appropriate management prescriptions in line with the overall goals of protected area management in Bhutan.

Therefore, I would like to congratulate the management of the Divisional Forest Office, Trashigang, for producing this important document and wish them all the best in the successful implementation of the plan.

Tashi Delek!

DIRECTOR
Department of Forests and Park Services

AKNOWLEDGEMENT

The management of the Divisional Forest Office, Trashigang, is deeply indebted to the Department of Forest and Park Services for entrusting us with the responsibility of managing BC6.

Financial support is crucial to the successful implementation of any activity. Therefore, we are sincerely grateful to the Bhutan for Life (BFL) project and the Royal Government of Bhutan for their generous funding, which made the preparation of this document possible. We also extend our thanks to the Nature Conservation Division, DoFPS, for their invaluable technical support, without which this work could not have been accomplished smoothly.

The management would like to express our deepest gratitude to the field staff who undertook data collection in challenging environments. Without their dedication, the development of this plan would not have been possible.

Lastly, we would like to extend our heartfelt appreciation to all stakeholders and institutions who, directly or indirectly, contributed to making this plan a success.

Management
Divisional Forest Office, Trashigang

Acronyms

BC	Biological Corridor
BFL	Bhutan for Life
BTFEC	Bhutan Trust Fund for Environmental Conservation
CCVA	Climate Change Vulnerability Assessment
CF	Community Forest
DFO	Divisional Forest Office
DoA	Department of Agriculture
DOT	Department of Tourism
DoFPS	Department of Forests and Park Services
EBA	Evidence Based Approaches
FYP	Five-Year Plan
GEF	Global Environment Facility
HWC	Human Wildlife Conflict
JWS	Jomotshangkha Wildlife Sanctuary
LFMP	Local Forest Management Plan
LULC	Land Use Land Cover
METT+	Management Effectiveness Tracking Tool
NCD	Nature Conservation Division
NWFP	Non-Wood Forest Product
NTS	National Tiger Survey
NFI	National Forest Inventory
RBA	Rapid Biodiversity Assessment
RGoB	Royal Government of Bhutan
RSPN	Royal Society for Protection of Nature
SMCL	State Mining Cooperation Limited
SRFL	State Reserved Forest Land
SWS	Sakteng Wildlife Sanctuary
UAV	Unmanned Aerial Vehicle
UNDP	United Nation Development Program
WWF	World Wildlife Fund

Executive summary

In 1999, the Biological Corridor (BC) 6 was conceived as a connecting landscape between Jomotshangkha Wildlife Sanctuary and Sakteng Wildlife Sanctuary. It covers parts of Serthig, Samrang, Martshala, and Lauri Gewogs under Samdrup Jongkhar Dzongkhag and part of Kangpara and Merak Gewogs under Trashigang Dzongkhag. Other than the seasonal herding communities, there are no permanent settlements inside the landscape.

Characterized by diverse ecological zones ranging from subtropical to temperate climates, BC6, with an area of 232.76 km², provides secure habitats for rare, charismatic, and threatened species such as the Red Panda, Asiatic Elephant, Gaur, Musk Deer, Clouded Leopard, Blyth's Tragopan, Temminck's Tragopan, Rufous-necked Hornbill, and *Sapria himalayana*. However, without an instituted management plan, there was no clear direction to guide the implementation of necessary management interventions.

Based on the first Rapid Biodiversity Assessment (RBA), opportunistic listing, National Forest Inventory (NFI), National Tiger Survey (NTS), and socio-economic survey (SES), BC6 has 38 species of mammals, 188 species of birds, and 485 species of plants. Although there are no permanent settlements within BC6, herding communities and villagers living on the periphery are predominantly dependent on livestock and agriculture for their livelihoods.

Threat analysis identified nine threats in the context of species conservation, habitat management, and community and livelihood well-being. Among these, human-wildlife conflict and climate change are identified as the major threats and challenges.

The current conservation management plan is based on the findings of surveys conducted in compliance with the Forest and Nature Conservation Code of Best Management Practices of Bhutan, Volume IV: Protected Area Management. There are 59 actions from 19 strategies set to fulfil five objectives, enabling the realization of the vision of maintaining a landscape where wildlife populations

thrive in their natural habitats, through enhanced ecological integrity and resilience of protected areas with decent ecological connectivity.

The plan will be valid for a ten-year period, effective from July 2025 to June 2035, covering the 13th and 14th Five Year Plans of the Royal Government of Bhutan.

The financial estimate of Nu. 68.2 million (Ngultrum sixty-eight million two hundred thousand only) is proposed for the conservation of wild flora and fauna, as well as to enhance the socio-economic livelihoods of communities through the mitigation of human-wildlife conflict and other sustainable, climate-resilient initiatives in the locality.

The major source of funding for these activities is expected to come from the Bhutan for Life project and the Royal Government of Bhutan. However, other potential conservation donors will also be explored for additional funding.

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CHAPTER I
INTRODUCTION

1.1. Background of the Biological Corridors (BC) in Bhutan

Biological corridors (BCs) in Bhutan were first declared in the year 1999 and presented as the gift to the earth from the people of Bhutan (DoFPS, 2021). Initially there were 12 BCs, which were designed to facilitate landscape connectivity to then the network of nine protected areas across the country (Wangchuk, 2007). However, later in 2008 with establishment of Wangchuck Centennial National Park, three BCs of northern landscape were subsumed and then BC9 was merged with BC7 (WCD, 2010), leaving only eight BCs.

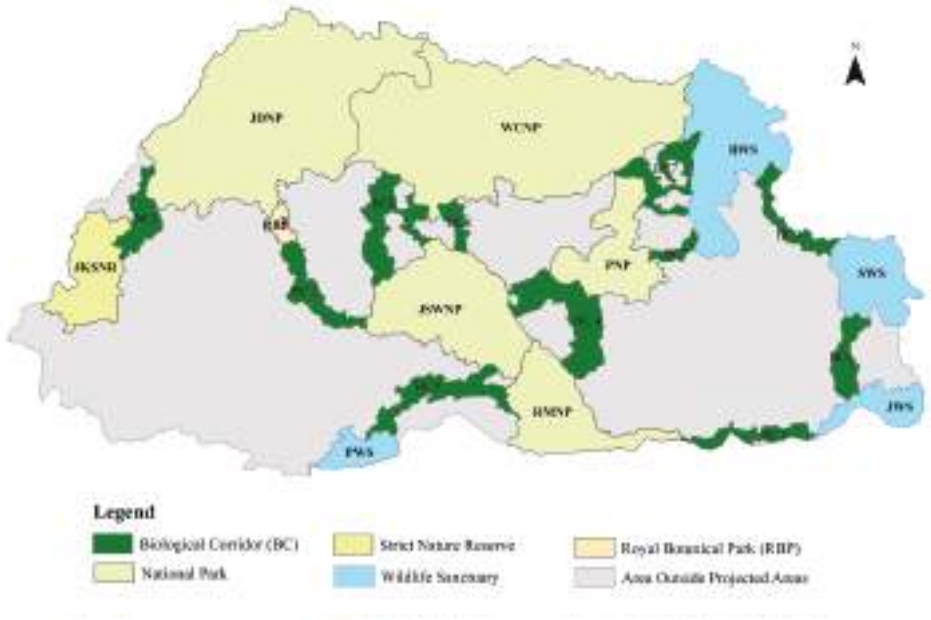


Figure 1. Map showing the protected areas and biological corridors of Bhutan. JDNP (Jigme Dorji National Park), WCNP (Wangchuck Centennial National Park), BWS (Bumdeling Wildlife Sanctuary), JKSNR (Jigme Khesar Strict Nature Reserve), JSWNP (Jigme Singye Wangchuck National Park), PNP (Phrumsengla National Park), SWS (Sakteng Wildlife Sanctuary), PWS (Phibsoo Wildlife Sanctuary), RMNP (Royal Manas National Park), and JWS (Jomotsangkha Wildlife Sanctuary. BCs numbered 1-9 are Biological Corridors.

In 2023, additional one more BC was declared as BC9 connecting SWS and BWS. At present there are nine BCs covering 8.28% of the total geographical area and helps in providing landscape connectivity to network of existing 10 protected areas (Figure 1).

1.2. Brief function of BC6

Primarily, BCs are designed for facilitating landscape connectivity between two or more isolated protected areas or area of conservation interest. Landscape connectivity supports wildlife movement in search of food, fodder, shelter and dispersal that are inevitable for the survival of the species (Rudnick *et al.*, 2012). Landscape connectivity in the form of BC can enhance ability of species to recolonize after local extinction, gene flow, seasonal migration and impact of climate change in the form of shift of a species geographic range (Damschen, *et al.,* 2019).

BC6 in the eastern landscape function as the connecting landscape between Sakteng Wildlife Sanctuary in the east and Jomotshangkha Wildlife Sanctuary in southeastern part of Bhutan. It is expected to enable safe vertical movement of wildlife between southern foothills in Jomotshangkha to alpine habitats in mountains of Merak and Sakteng region.

1.3. Basic information of BC6

The approximate length of the BC6 is 38.98km (polygon map centerline) with an area of 232.76 km^2 spanning across part of Serthig (62.14 km^2), Samrang (1.26 km^2), Martshala (64.9 km^2) and Lauri (42.24 km^2) gewog under Samdrup Jongkhar Dzongkhag and part of Kangpara (0.14 km^2) and Merak (62.08 km^2) gewog under Trashigang Dzongkhag. Approximately, 73.3% of the total BC6 area falls under the jurisdiction of Samdrup Jongkhar and remaining 26.7% in Trashigang Dzongkhag. Other than the seasonal herding communities, there are no permanent settlements inside the BC6.

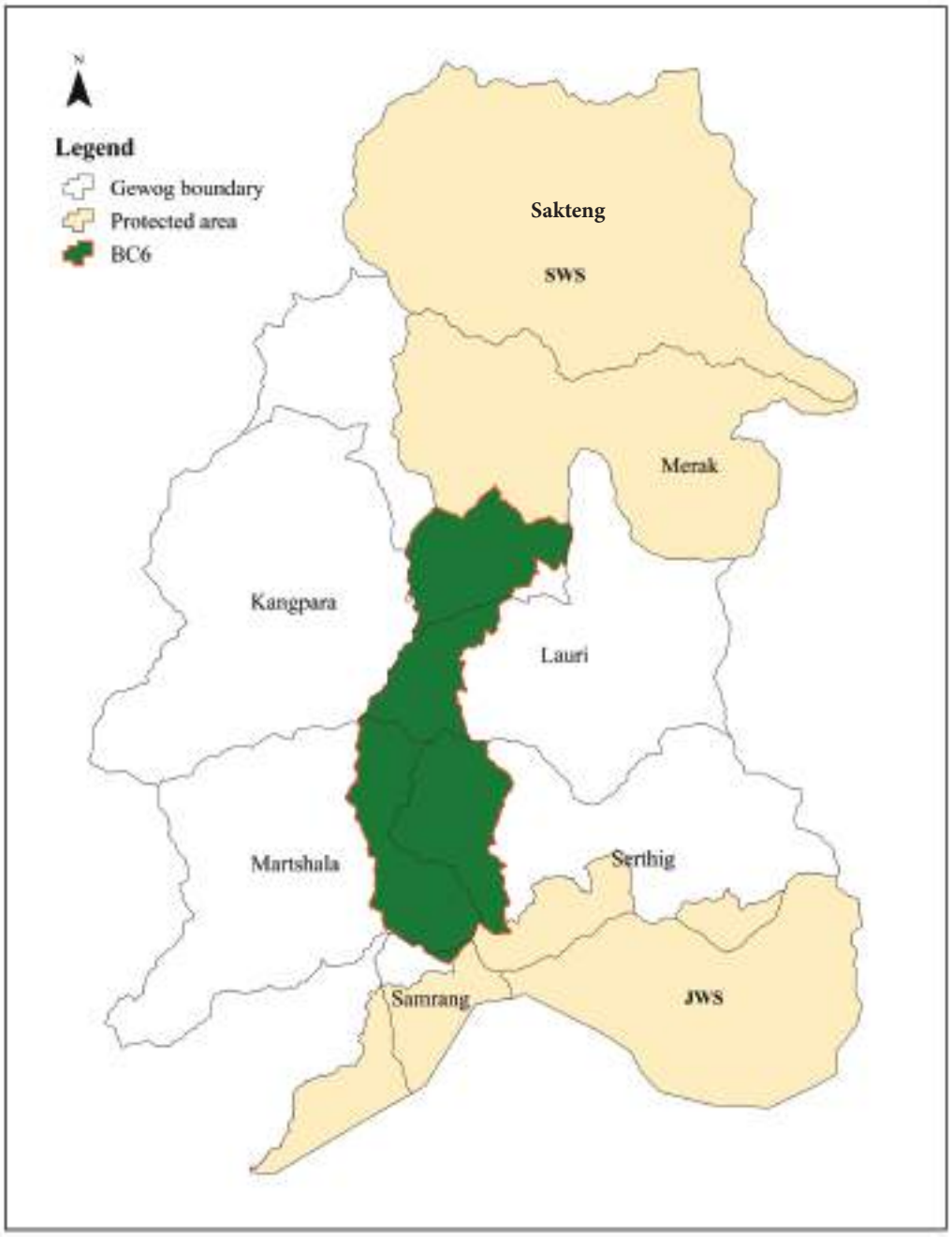


Figure 2. Map showing the location of BC6 connecting Jomotshangkha Wildlife Sanctuary (JWS) and Sakteng Wildlife Sanctuary (SWS)

1.4. Vision, Mission, Goal and Objectives

Vision:

A landscape where wildlife population thrives in natural habitat through enhanced ecological integrity and resilience of protected areas with decent ecological connectivity.

Mission:

To facilitate continuous gene flow between different wildlife habitats of Eastern Bhutan to ensure healthy and perpetual ecosystem or wildlife population.

Goal:

To ensure landscape connectivity between Sakteng Wildlife Sanctuary and Jomotshangkha Wildlife Sanctuary that promote safe movement of wildlife to enable effective genetic dispersal and fostering a climate-resilient landscape for harmonious coexistence

Objectives:

1. To provide a secured migratory habitat to facilitate movement of key species between the two wildlife sanctuaries
2. To protect and conserve wildlife species to maintain viable population
3. To enhance socio-economic wellbeing through sustainable services and products
4. To ensure climate resilient landscape for co-existence of wildlife and human
5. To improve institutional capacity development for effective service delivery

1.5. Scope of the plan

This plan is informed by extensive surveys and assessments and offers a structured, science-based framework for the conservation and management of Biological Corridor(BC) 6. It is designed to directly address the identified threats while balancing ecological priorities with the needs of local communities. The approach integrates data-driven conservation measures, habitat restoration, livelihood enhancement, and climate-resilient management practices.

Through the implementation of this plan, BC6 will be managed in a scientifically sound and sustainable manner, with the overarching goal of fostering a vibrant, interconnected network of protected areas where both wildlife and people can coexist in harmony.

The plan will be operational from July 1, 2025, through June 30, 2035, covering a ten-year period. Its successful execution depends on securing sufficient financial resources, which the Trashigang Divisional Forest Office of the Department of Forests and Park Services (DoFPS) will pursue in partnership with conservation partners and relevant line agencies.

CHAPTER II
CURRENT STATUS

2.1. Physical features

2.1.1. Biological corridor 6 boundary description

BC6 falls within the extent of 26.938424° N to 27.228972°N and 91.772602°E to 91.929680°E. In the north, it shares border with Sakteng Wildlife Sanctuary (SWS) from Tsegom Jong (27.215987°N, 91.83728°E) until Phangtshu Zurtshe (27.205177°N, 91.926187°E) via Thongphu (27.208092°N, 91.854904°E) and Gangkam Zor (27.226943°N, 91.875425°E) in Merak as shown in Figure 3.

While in the south, it shares border with Jomotshangkha Wildlife Sanctuary (JWS) from Tshophangma (26.935766°N, 91.823544°E) in Samrang to Nonai (26.957041°N, 91.883763°E) in Serthig. In the east, it stretches along the ridge and valleys of Kemajong (27.026294°N, 91.87651°E) in Serthig to Borang Tshephu Zor (27.186493°N, 91.925531°E) in Merak and Lauri boundary via above Taksang (27.104045°N, 91.856585°E) in Lauri, Benangwong (27.158052°N, 91.883564°E) above Phajogoenpa and Chongtharchen (27.164623°N, 91.889236°E) above Khashiteng village under Merak. In the west, BC6 boundary is aligned along the Tshophangma ridge (26.939695°N, 91.842762°E) above SMCL mining in Samrang to Ningsangla (27.162971°N, 91.817852°E) in Merak via ridge and valleys of Thelemthang/Dalemthang (26.973089°N, 91.790529°E) in Martshala and Chenla (27.088196°N, 91.782953°E) in Kangpara (Figure 3).

Figure 3. Map showing the boundary of BC6 along with location of boundary pillars

2.1.2. Topography and climate

The landscape of BC6 is characterized by diverse topography. Based on the slope classification standard for developing Local Forest Management Plan (LFMP) of Bhutan, 59.3% of the BC6 landscape is classified as gentle (slope < 35º), followed by 26.9% as moderate (slope 35º-45º) and 13.8% as steep slope (slope >45 º). These slopes are mostly south facing (42.9%), followed by north (32.6%), east (17%) and west (7.4%) as shown in Figure 4.

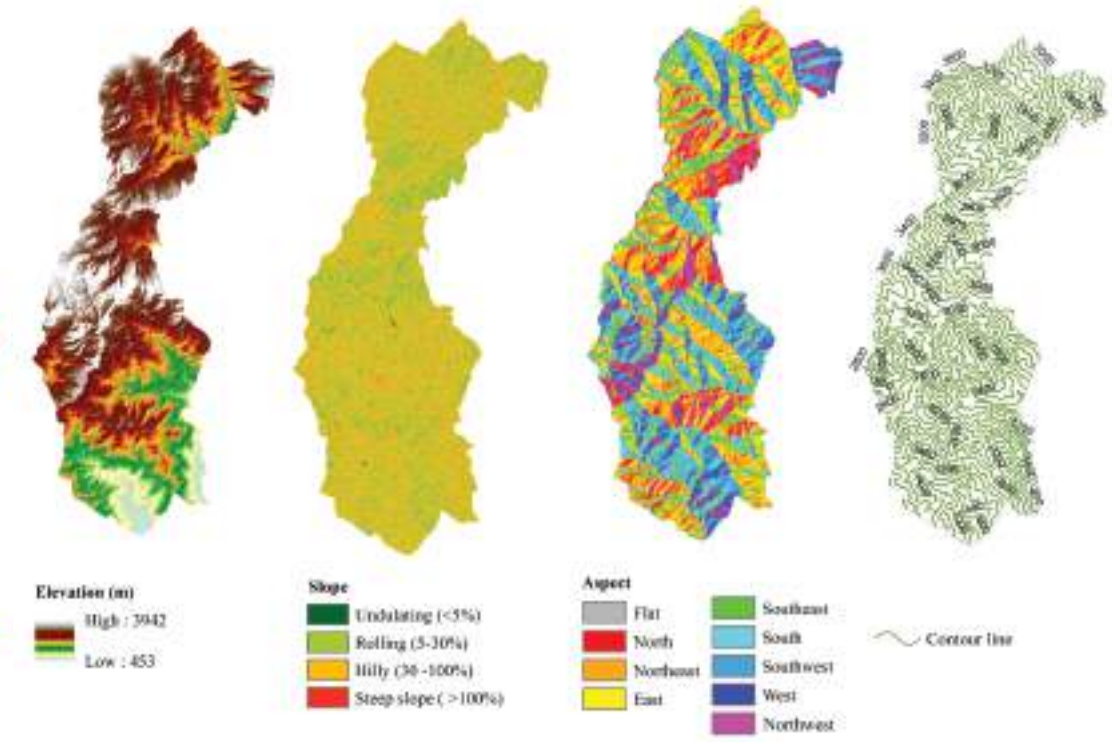


Figure 4. Geophysical map of BC6. The cyan color on the elevation map shows the lowest elevation and the white shows the highest. Numbers on the contour line shows the elevation

Elevation rises from approximately 453m in Samrang to 3942m on the peak of Chenla. Almost, 67% of the landscape is located above 2000m, thus experiencing temperate climate and remaining 33% occur in the elevation below 2000m that experience subtropical climate (DoFPS, 2022b). However, according to Bhutan map of Köppen climate classification, BC6 falls in dry-winter humid subtropical climate or warm temperate climate with dry winter and hot summer (Cwa) under humid subtropical climate or warm temperate climate. It is characterized by dry winter and wet summer influenced by monsoon (Kottek et al., 2006).

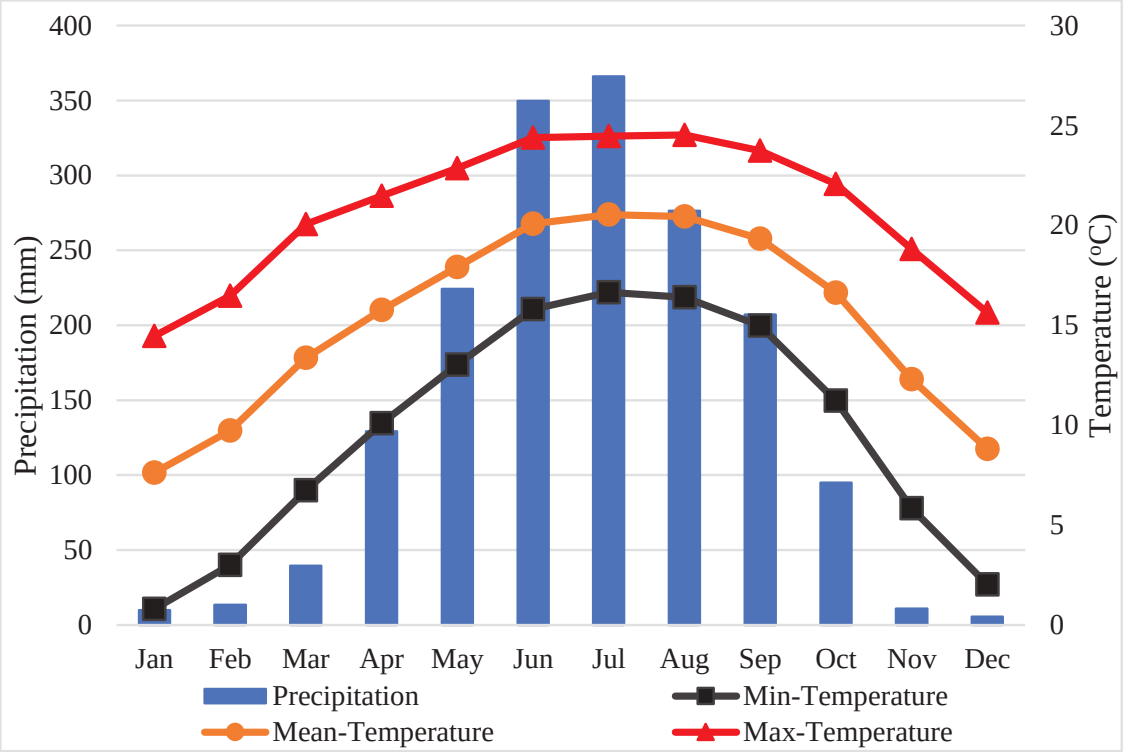


Figure 5. Monthly climatology of minimum temperature, maximum temperature, mean temperature and precipitation 1991-2020 (Data source: Climate change knowledge portal for development practitioners and policy maker)

BC6 landscape experiences average mean temperature of approximately 7°C to 20°C year-round. However, during the peak cold season (December to

February), temperature drops to below zero degree with snowfall in high elevation areas and lower regions experience hot summer with temperature rising above 25°C during June to August. Average monthly precipitation in the landscape ranges from 5.5mm to 366.2mm (avg. approximately 144mm) with majority of the precipitation in the month of June to August (Figure 5).

2.1.3. Water bodies

There are several seasonal and permanent networks of streams flowing through the landscape. Collection of this stream network contributes significantly as the tributaries for Jomori river that flows through Jomotshangkha, Nonai river at Nonai and Samrang river at Samrang. Small river of Phajogoenpa and Taksang village also originates from BC6 that later joins Jomori river as shown in Figure 6.

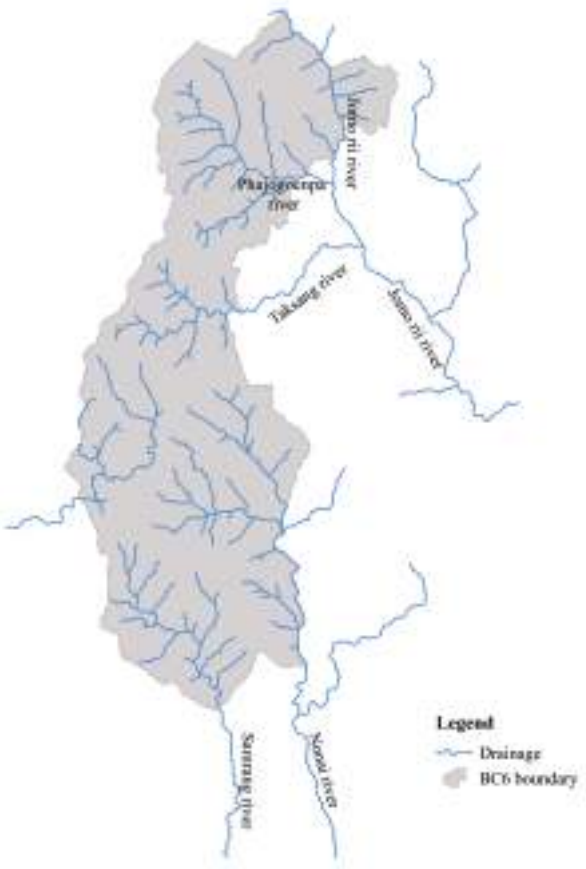


Figure 6. Map showing the drainage network in BC6

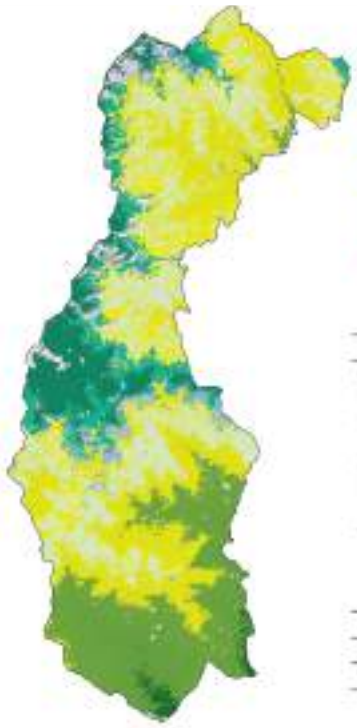
2.1.4. Choke points

Choke point in context of BC is considered as part of the landscape where the corridor narrows or obstruct the movement of wildlife due to presence of infrastructures and settlements. Other than seasonal herding of livestock, there are no permanent settlements and road or linear infrastructures inside the BC6, which could function as potential choke points.

2.2. Biological features

2.2.1. Vegetation and forest types

The elevation ranges from approximately 453m to 3942m. Within BC6 there is a great variability in elevation based on which the landscape can be divided into two major ecological zones comprising of sub-tropical (elevation <2000m) and temperate zone (2000-4000m) (DoFPS, 2022b). There are 10 distinct forest types occurring in BC6 (DoFPS, 2022a). Cool broadleaved forest, warm broadleaved forest and evergreen oak forest are three dominant forest types (Figure 7) harboring diverse floristic and faunal composition.



Forest types

- Blue Pine Forest
- Chirpine Forest
- Cool Broadleaved Forest
- Dry Alpine Scrub
- Evergreen Oak Forest
- Fir Forest
- Hemlock Forest
- Juniper Rhododendron Scrub
- Spruce Forest
- Subtropical Forest
- Warm Broadleaved Forest
- Non Forest

Forest types	Coverage (%)
Cool Broadleaved Forest	36.38
Warm Broadleaved Forest	20.16
Evergreen Oak Forest	19.37
Fir Forest	8.56
Hemlock Forest	7.60
Blue Pine Forest	2.89
Juniper Rhododendron Scrub	1.40
Subtropical Forest	0.94
Spruce Forest	0.48
Dry Alpine Scrub	0.17
Subtotal: Area under forest	
Non-forest area	2.05
Total area	**100.00**

Figure 7. Forest types in BC6

2.2.2. Floristic composition

Based on free listing and rapid biodiversity assessment (RBA), floristic compositions consist of 485 plant species belonging to 102 families. From 102 families recorded, majority were Ericaceae (*n=58*), followed by Rosaceae (*n=34*), Asteraceae (*n=30*), Orchidaceae (*n= 27*), Rafflesiaceae (*n=1*), Trochodendraceae (*n=1*), and Thymelaeaceae (*n=1*). Among 485 plant species recorded, 207 were herbs, 81 trees, 26 orchids, 7 ferns and 4 lianas. However, only 274 species were recorded during RBA and analyzed using PC-ORD.

A small stretch along Chenla-Threlphu recorded 33 species of Rhododendron with two varieties of *Rhododendron arboreum* var. *roseum* and *Rhododendron kesangiae* var. *album*. The area is home to significant and endangered species like *Sapria himalayana, Bulbophyllum trongsaense, Illicium griffithii* and *Taxus wallichiana* and other vulnerable species like *Aristolochia griffithii, Rhododendron dalhousiae and Merriliopanax alpinus.*

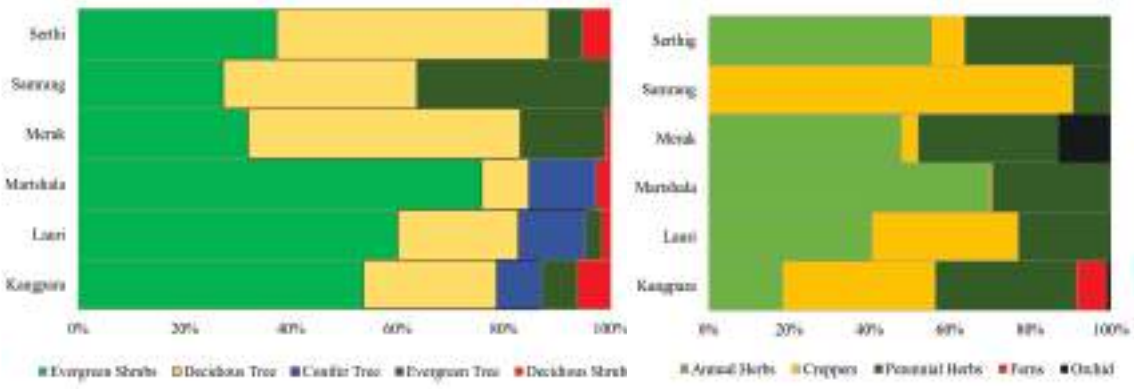


Figure 8. Floristic composition of Tree and Shrub (Left) and Herbs (Right)

Based on the tree and shrub composition, there are five vegetation types such as conifer, deciduous, evergreen, mixed and deciduous vegetation. It has considerable proportion of relative abundance among all the vegetation types. Evergreen shrub forms the major composition with 55.2% (*n=73)*, followed by deciduous trees (26.35 %, *n=43*), conifer tree (8.09%, *n=6*), evergreen tree (6.45%, *n=13*) and deciduous shrubs (3.86%, *n=7*) from six Gewog (Figure8).

Further, herbs are classified into five categories of annual, perennial, creepers, ferns and orchids. Relative abundance from annual herbs forms major life form with 53.17% (n=58), followed by perennial herbs (31.36%, n=45), creepers (13.72%, n=12). While ferns and orchids contribute only 1.45% (n=6) and 0.27% (n=11) species respectively.

All six Gewog comprising of Kangpara, Martshala, Merak, Lauri, Serthig and Samrang are predominantly composed of evergreen shrub and deciduous tree. While, herb composition is considerably composed with equal proportion of annual and perennial herbs. However, Samrang Gewog was predominately covered with creepers, such as *Sorbus microphylla, Cardamine macrophylla, Smilax munita, Clematis* sp., *Agapetes variegate, Rubia cordifolia, Sorbus wallichii, Ageratina adenophora, Chromolaena odorata, Carex* sp. *and Menkanthis* sp.

The plant diversity and richness were recorded highest from Kangpara (H'=2.623, n=59) and Lauri Gewog (H'=2.600, n=57). The other interesting plant species such as *Tetracentron sinense*, a monophyte genus in family Tetracentraceae considered as living fossil plant and *Sapria himalayana* a rare holoparasitic under rafflesiacea family were also recorded.

A cluster analysis is carried out using species variance with 50% information remaining based on relative abundance (Figure 9). Three broad group of vegetation were identified based on cluster dendrogram. Rhododendron Forest formed first group (Type I Forest), while Hemlock & Fir Forest formed second group (Type II Forest). Evergreen Oak Forest (Type III Forest) forms the third group. These three different types of forest were identified through cluster analysis using Sorensen Similarity method.

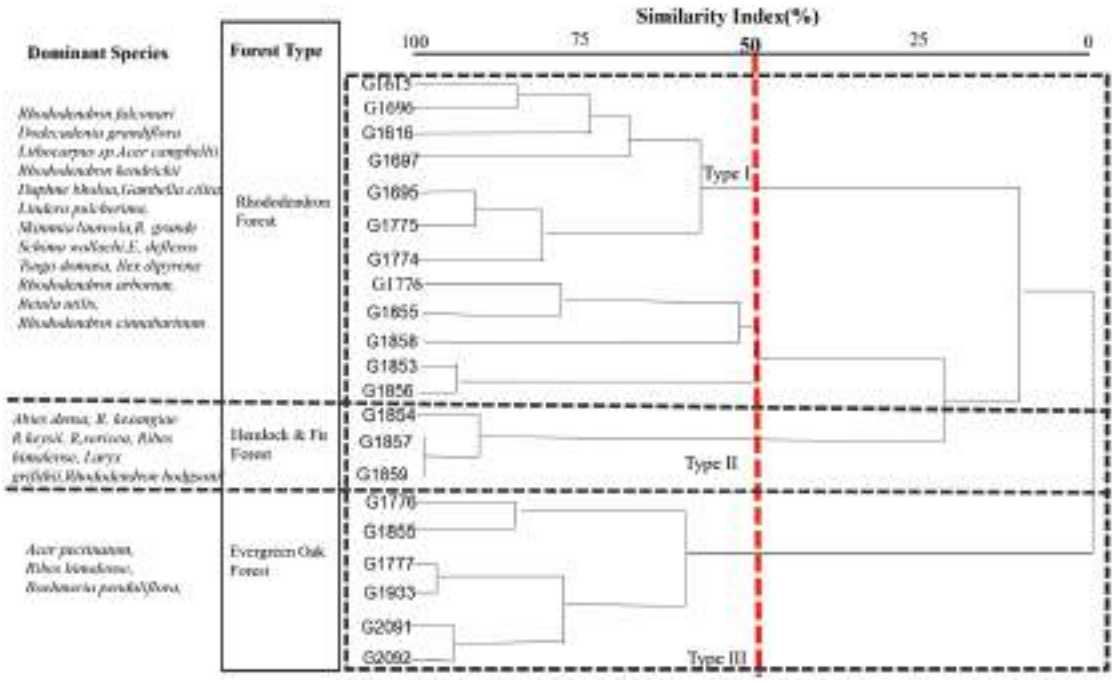


Figure 9. Forest types based on species similarity index using dendrogram. The vertical line represents the distance or dissimilarity between clusters, and the length of these lines indicates the level of similarity or dissimilarity. The red dashed lines are used to indicate a specific threshold or cut-off point for the cluster formation

Overall, while species richness (S) varies significantly among the locations, the diversity and evenness indices suggest a relatively balanced ecosystem across the landscape. The plant Shannon diversity (H') ranges from 2.491 and 1.996 with similar evenness (E) rating of 0.671 and 0.666 for tree and herbs respectively (Figure 10). Kangpara & Lauri Gewog has the highest species richness(S=60), while Martshala (S = 30) and Merak Gewog (S =30) have the lowest. Species evenness (E), Shannon-Wiener(H), and Simpson's index(D') shows relatively stable trends across all landscape, indicating similar diversity and evenness pattern despites differences in species richness.

Some of the invasive plant species consisting of *Ageratina adenophora, Mikania micrantha, Lantana camara, Parthenium* sp., and *Chromolaena odorata* were also recorded in BC6.

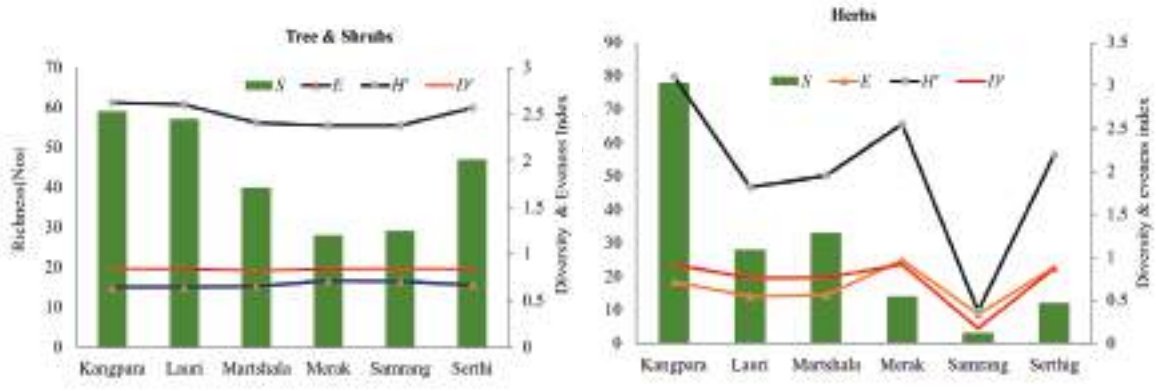


Figure 10.Graph showing the species richness, diversity and evenness index (left) Tree and shrubs and (right) herbs.. The figure presents bar and the line chart depicting biodiversity metric across six locations: Kangpara, Lauri, Marsala, Merak, Samrang, and Serthi. Left Y-axis represent species richness(S), indicated by green bar, while Right Y-axis represent diversity indices (E, H, D') depicted by the lines for tree and Herbs category.

2.2.3. Faunal composition

2.2.3.1. Mammal

The corridor is sanctuary to many charismatic and conservation significant mammals as described in table 1. During rapid biodiversity assessment (RBA) the camera trapping exercise was conducted using 22 camera traps installed inside the 4km x 4km survey grids. Camera trap survey resulted in an effort of 1210 trapping nights that captured 32287 images. Of the total images, 341 independent photographic capture events (IPCE) were of 24 mammalian species representing 24 genera, 16 families and five orders. Remaining recorded images were birds, humans and livestock. While previous surveys documented 38 species of mammals, only 24 were captured by current camera traps and subsequently described.

Of the 24 mammal species recorded, 17% (n=4) were classified as endangered (EN), 21% (n=5) as vulnerable (VU), 13% (n=3) as near threatened (NT), and the remaining 50% (n=12) as least concern (LC). In total, 12 species, or 50% of the recorded mammals, are globally threatened. Musk deer, Asiatic elephant,

and clouded leopard were also recorded inside BC6 which are protected under Schedule I of the Forest and Nature Conservation Act of Bhutan, 2023.

Figure 11. Musk deer in the landscape

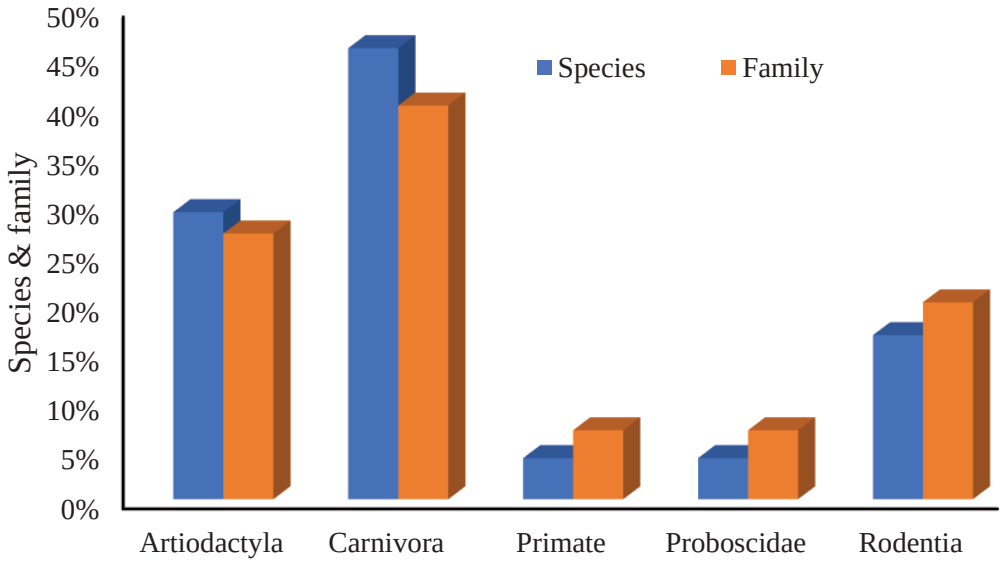


Figure 12. Mammalian order with species and family in percent

Among the five mammalian orders recorded, carnivore has the highest family and species representation of 40% (n= 6) and 46% (n= 11), followed by Artiodactyl 27% (n= 4) and 29% (n= 7) and least by primate and Proboscidea 7% and 4 % (n= 1 each) respectively.

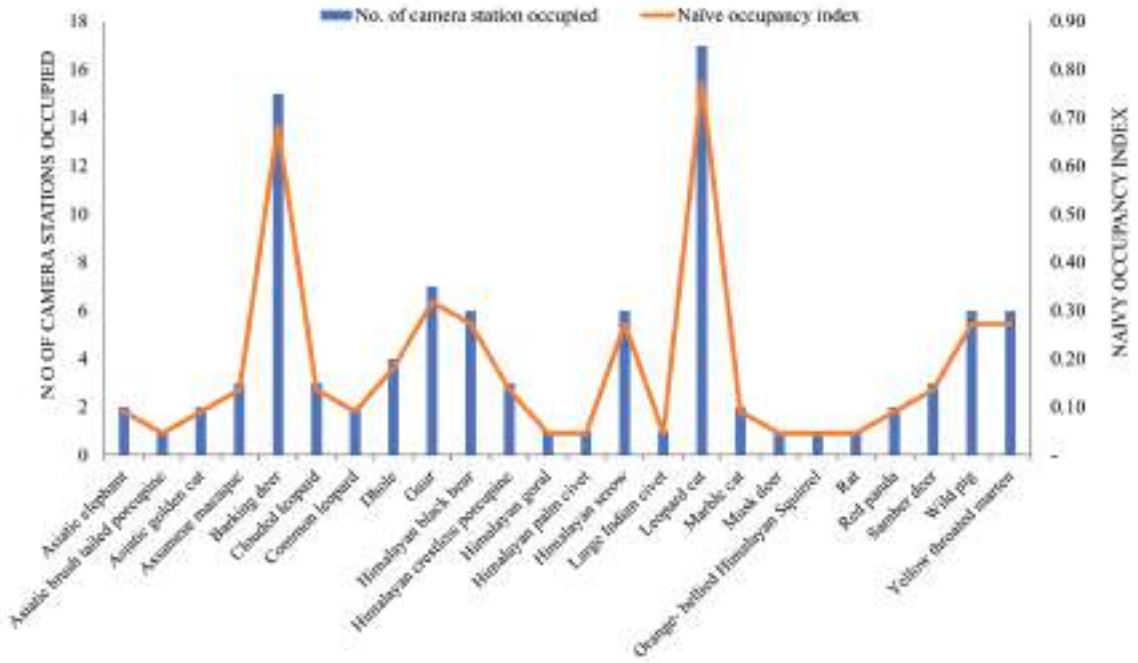


Figure 13. Mammal species naive occupancy proportion

In terms of abundance and independent photographic capture event (IPCE=n), barking deer showed the highest trap success (11.40, n=138), followed by leopard cat (4.3, n= 52), Gaur (3.06, n= 37), Wild pig (1.24, n= 15), Yellow throated marten (0.91, n= 11), Himalayan serow & Himalayan black bear (0.83, n= 10 each), Dhole (0.58, n= 7), Asiatic elephant, Common leopard, Sambar deer and Orange bellied squirrel (0.5, n= 6 each), Assamese macaque (0.41, n= 5), Clouded leopard (0.33, n= 4), Asiatic golden cat, Asiatic brush tailed porcupine, Himalayan crestless porcupine, Marbled cat, Musk deer & Large Indian civet (0.25, n= 3 each), Red panda & rat (0.17, n= 2 each) and the least with Himalayan goral (0.08, n= 1). Likewise, the naïve occupancy was found highest for Leopard cat (0.77) which spread across 17 camera trap stations,

followed by Barking deer (0.68) from 15 camera stations. The Asiatic brush tailed porcupine, Himalayan goral, Large Indian civet, Himalayan palm civet and Musk deer have least naive occupancy (0.05 each), captured from only 1 camera station (Figure 13).

Table 1. Details of mammal species recorded in BC6 landscape with camera trap records, total capture events, relative abundance index (RAI) and naïve occupancy.

Species	Total Image count	Independent capture event	Trap success/ RAI	No. of camera station occupied	Naïve occupancy index
Asiatic elephant	7	6	0.50	2	0.09
Asiatic brush tailed porcupine	3	3	0.25	1	0.05
Asiatic golden cat	24	3	0.25	2	0.09
Assamese macaque	62	5	0.41	3	0.14
Barking deer	1119	138	11.40	15	0.68
Clouded leopard	12	4	0.33	3	0.14
Common leopard	18	6	0.50	2	0.09
Dhole	128	7	0.58	4	0.18
Gaur	130	37	3.06	7	0.32
Himalayan black bear	30	10	0.83	6	0.27
Himalayan crestless porcupine	30	3	0.25	3	0.14
Himalayan goral	1	1	0.08	1	0.05
Himalayan palm civet	5	5	0.41	1	0.05
Himalayan serow	70	10	0.83	6	0.27
Large Indian civet	3	3	0.25	1	0.05
Leopard cat	115	52	4.30	17	0.77
Marbled cat	17	3	0.25	2	0.09
Musk deer	10	3	0.25	1	0.05
Orange- bellied Himalayan Squirrel	23	6	0.50	1	0.05
Rat	2	2	0.17	1	0.05
Red panda	2	2	0.17	2	0.09
Samber deer	72	6	0.50	3	0.14
Wild pig	15	15	1.24	6	0.27
Yellow throated marten	57	11	0.91	6	0.27

2.2.3.2. Avifauna

Total of 1374 individuals were recorded adopting McKinnon bird listing method belonging to 188 species categorized under 57 families and 17 orders. All 188 species play an important ecological role in an ecosystem and few are of utmost significance at national and global context Table 2.

Table 2. Species checklist of international and national importance

IUCN status	Species
Vulnerable (VU)	Beautiful Nuthatch (*Sitta formosa*), Great Hornbill (*Buceros bicornis*), & Rufous-necked Hornbill (*Aceros nipalensis*)
Near Threatened (NT)	Satyr Tragopan (*Tragopan satyra*) & Gray-headed Parakeet (*Psittacula finschii*)
Schedule Species (FNCA, Bhutan)	Monal Pheasant (*Lophophorus impejanus*), Rufous-necked Hornbill (*Aceros nipalensis*), Beautiful Nuthatch (*Sitta formosa*), Great Hornbill (*Buceros bicornis*)

Figure 14. Rufous - necked hornbill inside BC6. Photo credit Tandin Jamtsho, FR II

From a Shannon Wiener Diversity Index (H'), it reveals that BC6 harbors high bird diversity (H'= 4.54) with highest Margalef species richness index and individual record in *Anthus hodgsonii* (n=115, R'=15.77), *Anthus trivialis* (n=57, R'=7.75), *Garrulax leucolophus* (n=49, R'=6.64), *Prunella collaris* (n=42, R'=5.67), *Fulvetta ludlowi* (n=41, R'=5.5), *Aceros nepalensis* (n=27, R'=3.59), *Tragopan satyra* (n=19, R'=2.49), *Lophophorus impejanus* (n=16, R' =2.07) and *Buceros bicornis* (n=4, R'=0.41).

Leiotrichidae family was dominant (n=45), followed by Muscicapidae (n= 42), Phasianidae (n=28) and Corvidae (n=27) and Passeriformes as most dominant orders in the survey area.

2.3. Socio-economic characteristics

Given the absence of permanent settlements within BC6, the socio-economic survey focused on surrounding communities reliant on the BC6's resources for livestock grazing and other subsistence activities. Specifically, herders from Merak and Sakteng, along with farmers from Lauri (Momring, Ralnang, Taksang and Phajogoenpa), Serthig (Larjab), and Kangpara Gewog (Threlphu, Zordung and Khangpara) were included in the survey. Communities in Martshala and Samrang Gewogs, with minimal reliance on BC6 resources, were excluded from the survey.

2.3.1. Households' demographics

Sixty herders from Merak and Sakteng, seven from Kangpara (1 Kangpara, 3 each from Zordung and Threlphu) and 29 from Lauri gewog (Momring 16, Phajogoenpa 9 and 2 each from Ralnang and Taksang) graze their cattle/livestock in and around the landscape of BC6.

Total of 78 households were surveyed and total population of 501 are directly dependent on BC6. The population comprise of 50.5% female and 49.5% male

with mean age of 31.6 and 21.6 years for female and male respectively. The oldest member in community is 84 years old and the youngest 9 months of age. The household size ranges from 2 to 14 with mean household size of seven.

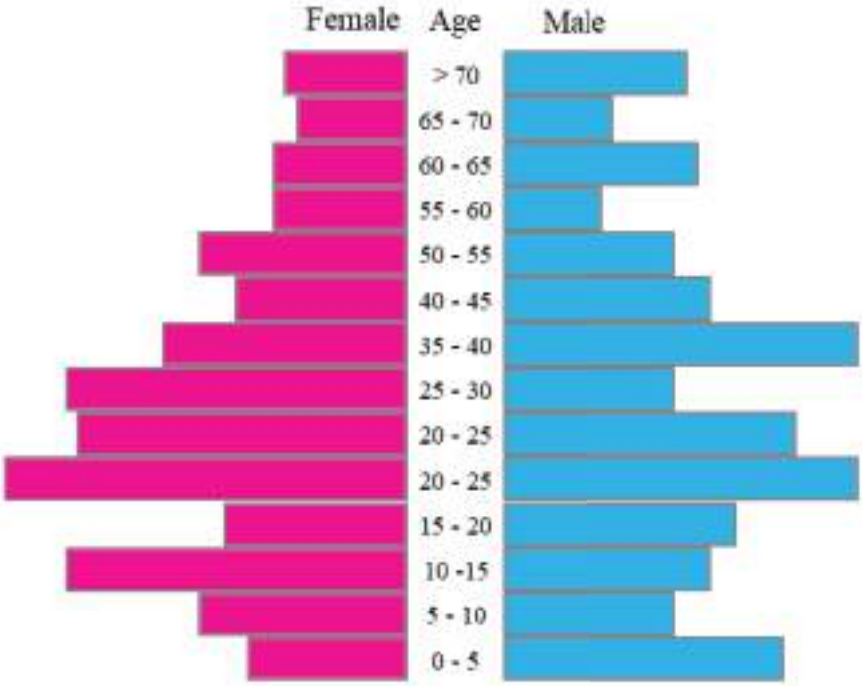


Figure 15. Demographic information of survey household

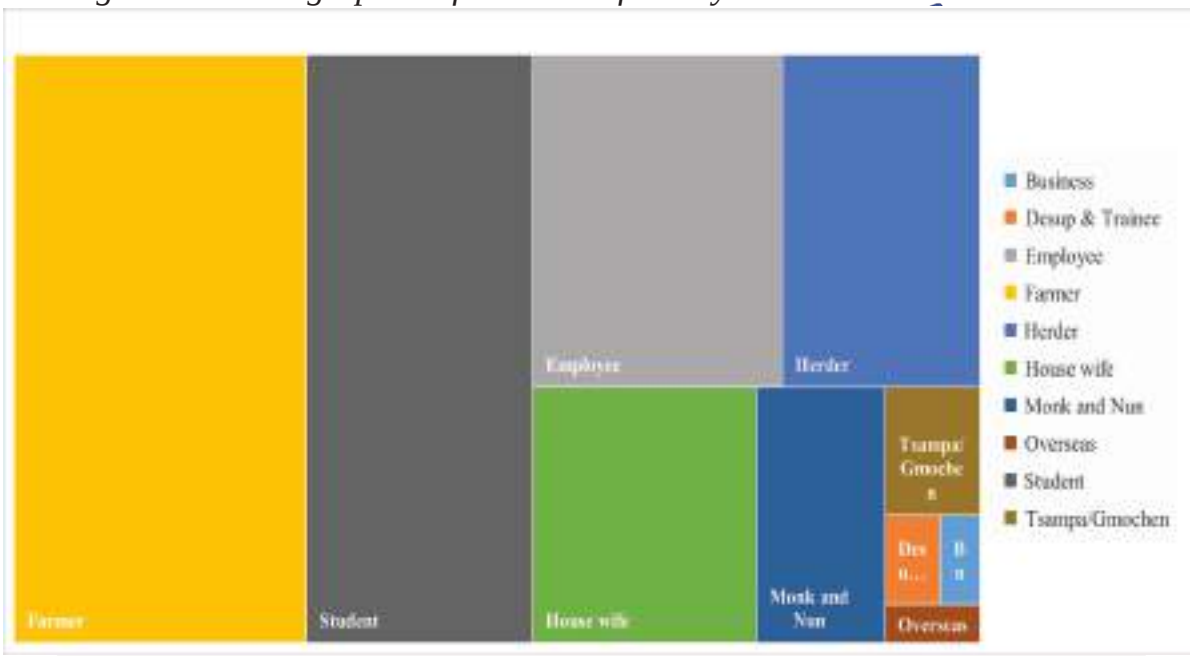


Figure 16. Occupation of the surveyed household members

Top five major occupational groups of the sampled household are farmers followed by student, employee (other off-farm activities), herders and housewife (Figure 16). All the respondents from Merak and Sakteng were herders primarily dependent on livestock and majority from Khashiteng were Tsampa or religious practitioner. While respondents from Phajogoenpa, Ralnang, Momring and Larjab, Threlphu, Zordung and Kangpara were predominantly farmers.

The working age population comprises 63.1% of the total household population that were sampled in this survey. However, majority (57.7%) of the working population are non-resident with most working outside their village. Total dependency ratio is 36.9% (elder 6.9% and younger 30%) among which 80% of elderly and 53.6% younger dependency population stay in the village (Figure 17). The higher ratio of dependency age and lower number of working age population in the village indicates that the people in working group have to support more non-working people, either young or old.

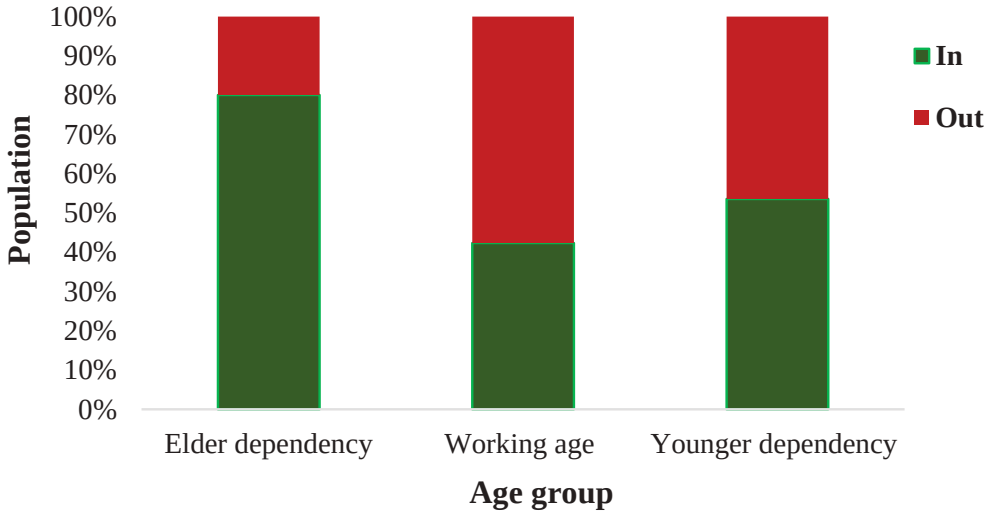


Figure 17. Household members age dependency ratio. Those members who stay with the household for more than 6months are categorized as 'In' and vice versa as 'Out'.

2.3.2. Land categories and holdings

Surveyed household own various types of land consisting of Chhuzhing, Kamzhing, Khimsa, Tsamdro and Orchard. However, this land holding is outside BC6. Majority of herders of Merak and Sakteng owns Tsamdro compared to other types of land. While majority of people from Lauri and Serthig Gewog (Phajogoenpa, Momring, Ralnang, Taktsang and Larjab) and Khashiteng under Merak owns Kamzhing. Threlphu, Kangpara and Zordung under Kangpara gewog owns both Chhuzhing and Kamzhing.

Table 3. Land types and their status in the study area

Land type	**Status**	**Land coverage (acre)**			
		Minimum	**Maximum**	**Mean**	**Std. Deviation**
Chhuzhing	Cultivated	0	4	0.25	0.74
	Fallow	0	1	0.06	0.20
Kamzhing	Cultivated	0	7	1.57	1.80
	Fallow	0	10	1.44	2.12
	Rented in	0	2	0.08	0.29
	Rented out	0	0.6	0.01	0.07
Khimsa	Cultivated	0	1	0.15	0.23
	Fallow	0	0.2	0.01	0.03
	Rented in	0	0.5	0.02	0.09
Orchard	Cultivated	0	1	0.10	0.22
	Fallow	0	0.3	0.01	0.04
Tsamdro	Own	0	1000	104.12	207.06
	Rented in	0	1000	31.92	140.25

2.3.3. Household source of income and expenses

Livestock was ranked as major source of income followed by agriculture and least from employment (both private and government job) as shown in Figure 18. Despite overall contribution, livestock is also a sole source of income and food for the surveyed household of Merak and Sakteng. Though employee constitutes large segment of occupational category, their contribution to respondents' income source is very minimum because they are civil servant, private employee and arm forces mostly staying away from village. Occasional financial support from non-resident members working in government and private sectors also forms their source of income.

Overall, majority of the expenditure is incurred for household utilities (38.9%) followed by children's education (18.9%), ritual (12.8%), transportation (8.5%), pilgrimage (7.3%), and combination of leisure items, maintenance of farm machineries, livestock feeding and other contributes to less than 13% of total expenditure (Figure 18).

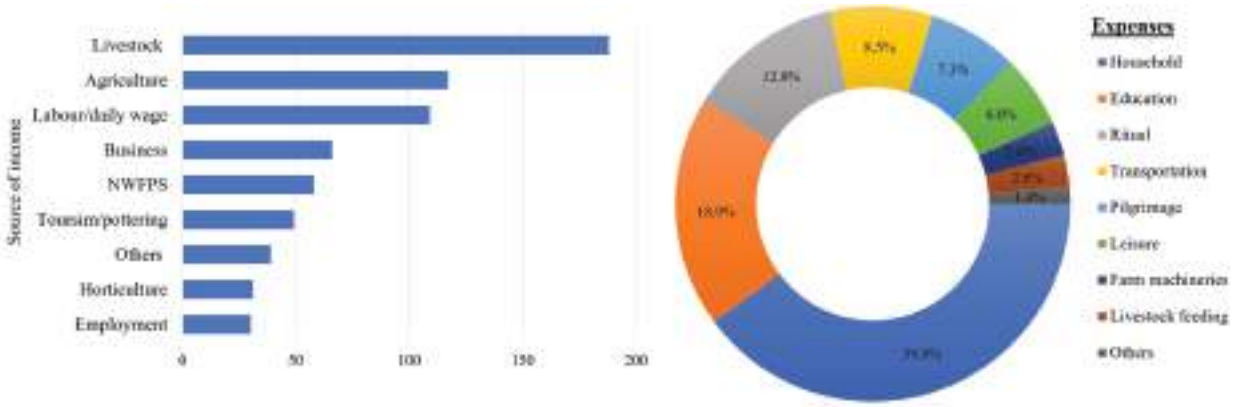


Figure 18. Source of income of the sampled households (Left) and source of household expenditure (Right)

2.3.4. Agriculture: its contribution to livelihood and challenges

Subsistence agriculture plays a crucial role in the surveyed households (excluding those from Merak and Sakteng), primarily characterized by small-scale, rain-fed dry land farming. With agriculture as the dominant occupation, these households cultivate a variety of cereals and vegetables. Maize is the most preferred crop, followed by chili, vegetables, paddy, potato, and other cereals like wheat, buckwheat, millet, and mustard. The higher preference for maize is likely due to poor agricultural land, steep topography and limited irrigation facilities, which hinder the large-scale cultivation of other cereal crops. Among cash crops, chili is the most favored, followed by potato, hazelnut, and cardamom (Figure 19).

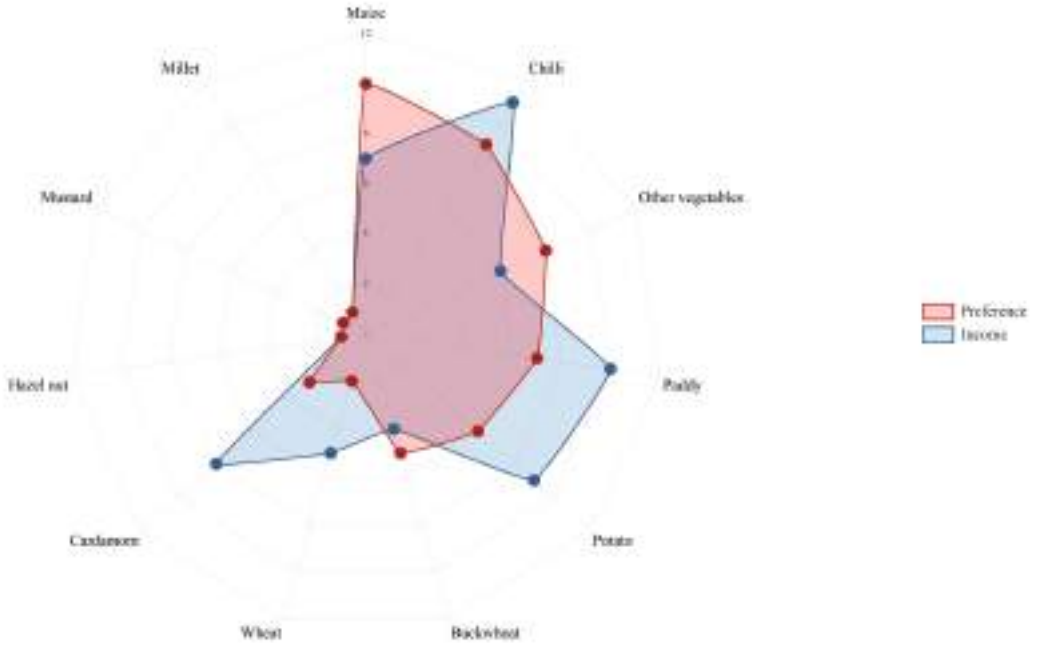


Figure 19. Agriculture crop preference ranking and its contribution to the household income

Maize is one of the important and preferred crops; however, it has a negligible contribution to cash flow. Maize is predominantly consumed as staple food in mixture with rice, production of local beverage (ara and bangchang), snack (*Asham Tengma* or flatten maize) and livestock feeding. The income from agriculture is primarily generated from the sales of chili, paddy, potato, broccoli, cabbage, cauliflower and cardamom. Out of 78 surveyed households, 34 households (Sakteng: 11 & Merak: 23) does not practice agriculture. On average, remaining 44 household generates sum of Nu. 21,283.00/hh/year from the sales of agriculture products with chili being the highest contributor amounting to Nu. 14,603.00/hh/year (Figure 19). Through the benefit of ongoing million fruit tree planting project and improving accessibility, household income from horticulture products is expected to increase significantly in coming years.

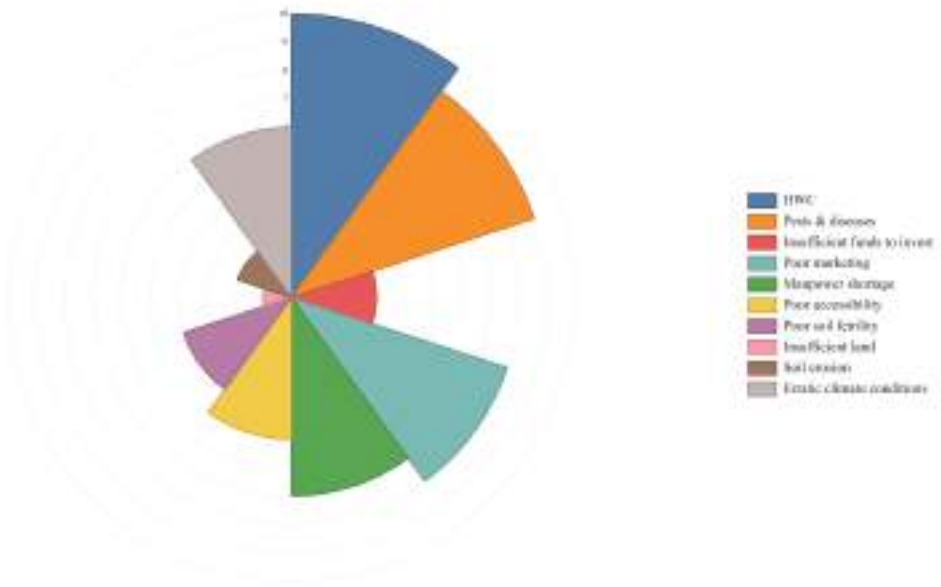


Figure 20. Problem and challenges faced by the households related to agriculture

Damage and loss of agricultural crops/products due to wild animals, outbreaks of new pests and diseases, poor market accessibility, workforce shortages, and erratic climate conditions were identified as the five major problems and challenges faced by households engaged in agriculture (Figure 20). The damage caused by wildlife and limited market access can be linked to the geographical location of these settlements, which are surrounded by dense forest and situated far from formal markets. Workforce shortages are attributed to the migration of potential workers to other districts in search of better opportunities, a relatively high dependency ratio, and the engagement of more males in prime working age in religious practices.

2.3.5. Livestock: its contribution to livelihood and challenges

Livestock plays an integral role in the lives of surveyed household. They rear different category of livestock consisting of Yak, Dzo/Dzom (hybrid of yak and domestic cattle), local cattle, Jatsa/Jatsamin (hybrid of Mithun and local cattle), goat, sheep, horse, poultry and dogs. Livestock rearing is the core livelihood for households from Merak and Sakteng who along with other category of livestock primarily raise Yak, Dzo, Dzomo, goat and sheep. Surveyed household from Kangpara, Lauri and Serthig Gewog rear only Jatsa/Jatsamin, local cattle breed, horse and poultry as part of their agriculture system. A single case of bee keeping was also reported from the Threlphu chiwog under Kangpara Gewog. Jatsamin and Dzomo are most preferred livestock species by the surveyed household owing to high productivity and robustness.

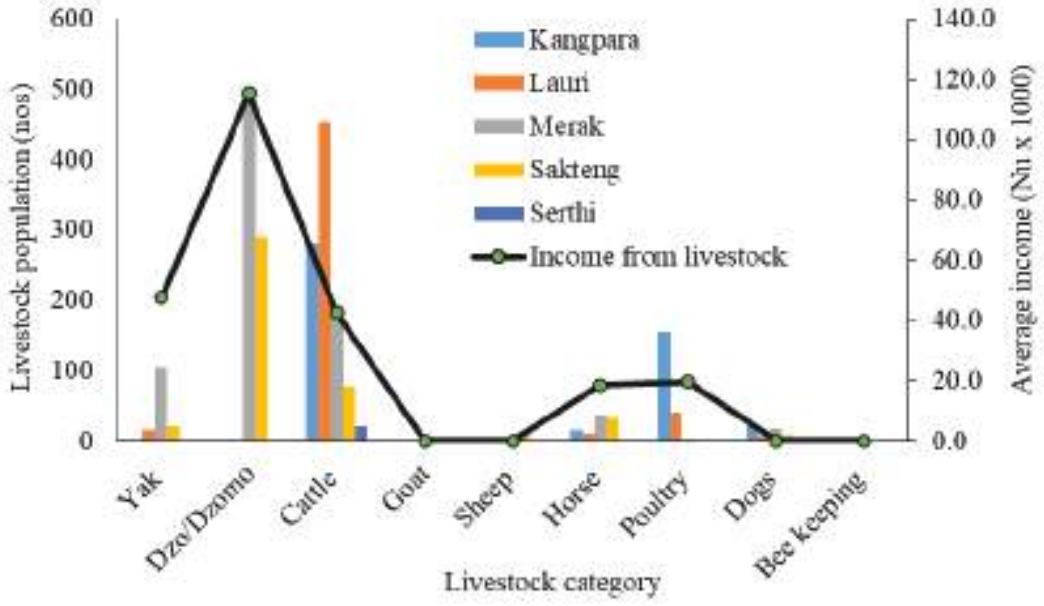


Figure 21. Different category of livestock raised by surveyed household and average income from livestock

Tangible benefit from the livestock to the household vary with category of livestock own by the household. The household generates highest mean annual income from rearing or sales of products from Dzomo (Nu. 11,5400.00) followed by Yak (Nu. 47,600.00), cattle (inclusive of all breeds) (Nu. 42,660.00), poultry (Nu. 19,471.40) and horse (Nu.18,600.00). Remaining category of livestock does not generate income, yet they play important role in guarding (dog), source of fiber (wool from sheep) and as traditional antidote for some particular livestock disease (goat).

The respondent ranked livestock as pivotal source of income followed by source of food, manure, mode of transportation, draught power and least as fibre (Figure 22).

Nevertheless, household also face numerous problem and challenges in rearing the livestock. Livestock loss to predator was ranked as major problem followed by insufficient grazing land, insufficient fodder, poor quality grazing land, outbreak of diseases, low quality local breeds, few extension's services and manpower shortage (Figure 22).

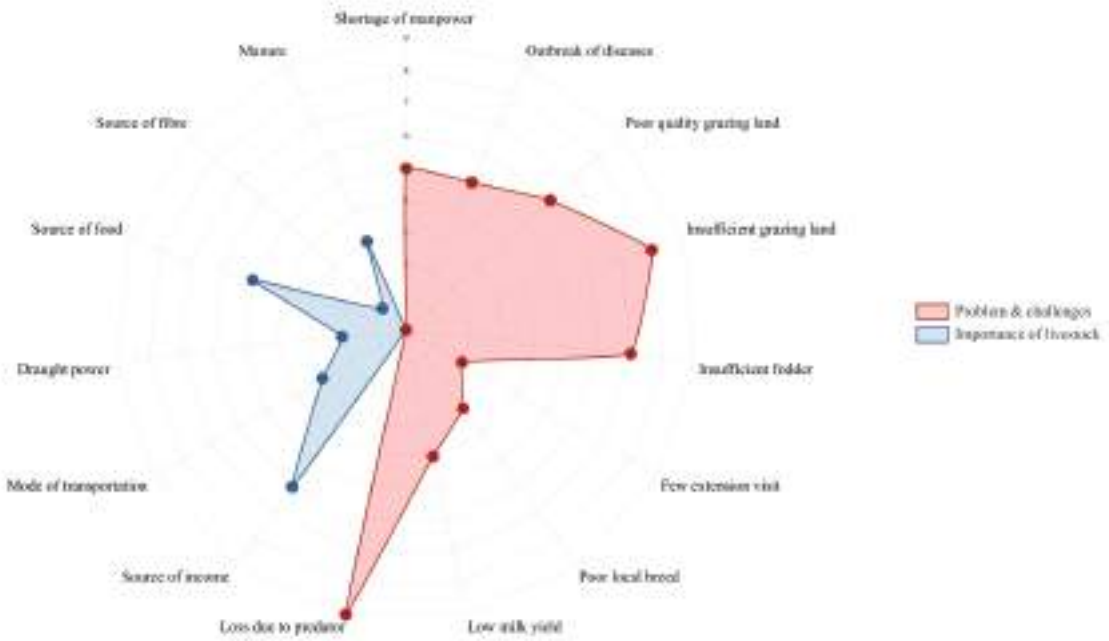


Figure 22. Importance of livestock, problem and challenges in rearing livestock faced by the surveyed households

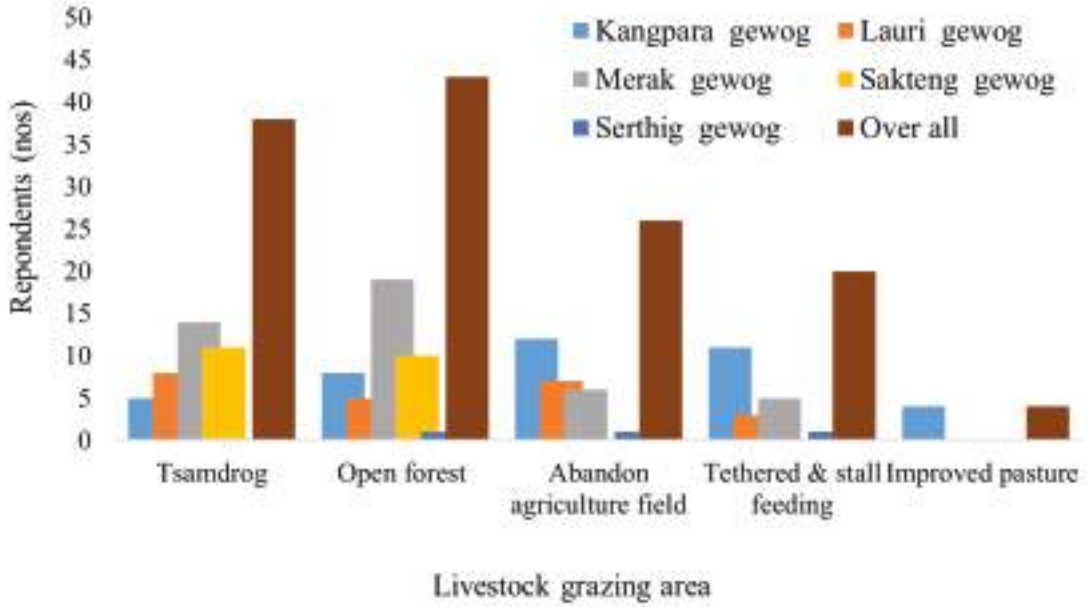


Figure 23. Different categories of grazing areas used by thee surveyed households

Due to high dependency of household to livestock for income, food and agriculture production, loss of livestock to wild predator like Dhole cause substantial economic hindrance to the household.

Overall, livestock are predominantly grazed in open forest, Tsamdro, abandon agriculture field, tethered/stall feeding and least in improved pasture. Tsamdro and open forest grazing is primarily practiced by household of Merak and Sakteng who are transhumant and does not practice agriculture. In addition to open forest, grazing in abandon agriculture field, tethered and stall feeding and improved pasture are practice by household of remaining Gewogs who owns relatively less population of livestock (Figure 23).

2.5.6. Forest resource use, people's livelihood and threat

Bhutan with intact forest cover, people derive a considerable share of both tangible and intangible benefits from forest and its resources. Benefits are in the form of food, fodder, fuel, fertilizer, fibre and regulating services. Survey revealed that 96.2% of the surveyed population collect forest resource primarily for household consumption (85.9%) and other 14.1% for commercial purpose. Firewood, bamboo, fodder, mushroom and ferns are some of the prominent forest produces collected for household consumption. Those resource which are collected for commercial use are generally NWFPs like *Swertia chirayita*, *Illicium griffithii*, *Rubia cordifolia* and *Girardinia diversifolia*. Approximately, 84% of the resource requirement are met from State Reserve Forest (SRFL) and remaining 16% from Community Forest (CF).

The surveyed households had an estimated mean annual firewood consumption of 15.2 m^3, which is significantly higher than the national per capita average of 3.7 m^3 (UNDP, 2012). This figure represents the total firewood extracted from both within and outside BC. Consequently, we were unable to quantify the specific amount of firewood extracted from BC6. Around 12% of the surveyed

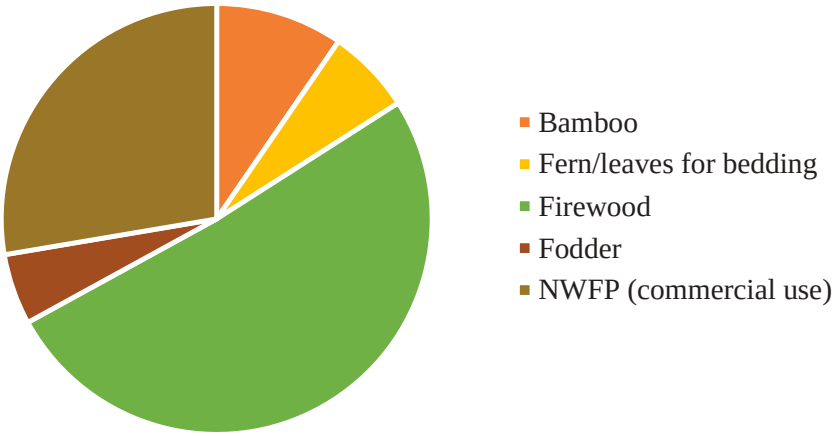


Figure 24. Category of forest resource in use by the surveyed household

households collected bamboo, averaging 167 pieces per year, from the BC6 landscape and its surroundings. Firewood is mainly used for cooking, heating, and preparing livestock feed, while bamboo is used for fencing and weaving mats for roofing cowsheds and other temporary structures to store agricultural produce.

Figure 25. Resource trend exercise

A household who collects NWFPs generates estimated mean annual income of Nu.6,566.00 through the sale of raw product within the range of Nu 100 to Nu 20,000.00. Though mean annual income generated from sales of NWFP is negligible in terms of absolute figure, it helps to supplement the hard earn household income.

Champ (*Michelia* species), *Alnus nepalensis*, Bhutan pine (*Pinus bhutanica*), Chirpine (*Pinus roxbhurghii*) and Birch (*Betula alnoides)* are most preferred timber species for construction while *Quercus* spp. is one of the sought firewood species by the surveyed household (Figure 26).

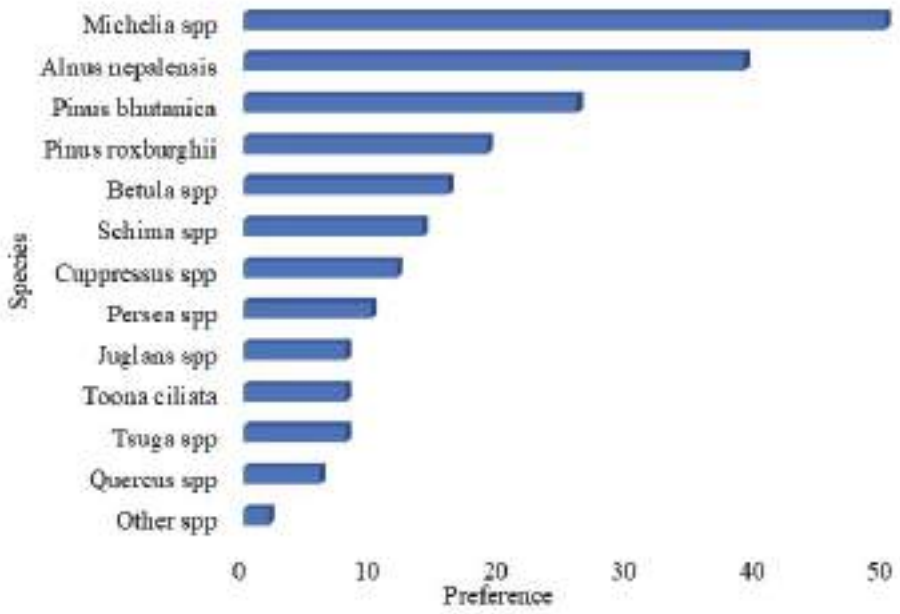


Figure 26. Timber species preferred by the surveyed households

Surveyed household perceived open grazing by huge livestock population, excessive lopping for fodder, encroachment of barren land by unpalatable species, extraction of firewood, outbreak of forest fire, pest and disease and climate change as some of the prominent threats to the forest in and around BC6 landscape. Nonetheless, people expressed that health and coverage of the forest has improved drastically in comparison to past due to ban in practice of shifting cultivation and burning of pastureland.

2.3.7. Wildlife and people's perception

According to the surveyed households, they sight approximately 21 different species of wildlife. Barking deer, common leopard, dhole, elephant, goral, grey langur, guar, Himalayan black bear, leopard cat, monkey, porcupine, sambar deer, serow, jungle cat, squirrel, tiger, wild pig, yellow throated martin, monal pheasant, kalij pheasant are some of the species in the locality. People perceive that wildlife population is increasing due to ban in shifting cultivation, reduced hunting, increase in forest cover, more fallow land and strict conservation rules and policy. Close to 60% of the surveyed household expressed that they dislike wildlife due to increasing incidence of human wildlife conflict (Figure 27).

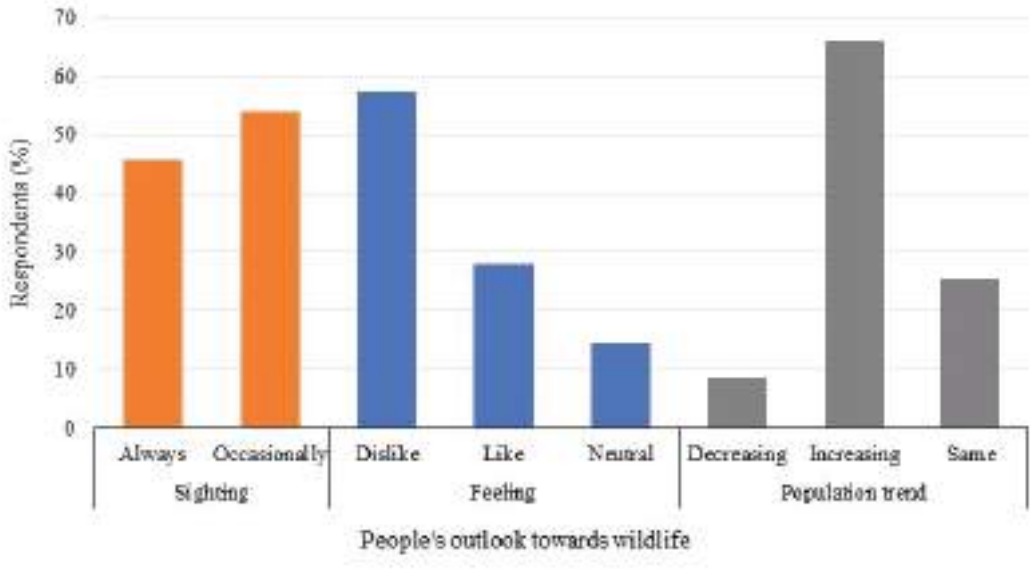


Figure 27. Overall outlook of people towards wildlife in their locality

Wild pig, monkey, barking deer, dhole and porcupine are five top wildlife species which are most disliked by the surveyed household due to their negative interaction with livestock and agriculture crops. People also perceive these species as nuisance whose population has drastically increased over last few decades.

2.3.8. Human wildlife conflict

Livestock and subsistence agriculture is the main livelihood of the surveyed household similar to other rural settings in Bhutan. Human wildlife conflict (HWC) in the form of crop damage and livestock depredation by wild animal was significant in the landscape. It was found that 80.8% of the surveyed household experienced one or more form of HWC in past three year. The intensity of HWC was assessed as 'severe' if degree of damage is high and 'minor' if degree of damage is not significant and "no" if they did not experience HWC in past 3 year. Damage and impact of HWC was considered from the perspective of crop damage, livestock predation, property damage, social harassment and disease transmission.

The survey revealed that 38.5% of households suffered severe crop damage, while 24.4% experienced minor crop loss. Conversely, 37.1% reported no crop damage. Livestock predation affected 23.1% of households severely, 20.5% moderately, and 56.4% not at all. In terms of social harassment, 12.8% was severe, 16.7% minor and remaining 70.5% no issue. Property damage and disease transmission were less prevalent, affecting only 9% and 6.4% of households respectively as shown in figure 28.

Survey revealed that a household lost their livestock to wild predator annually. Approximately, 51 individuals of livestock belonging to 30 households were killed by wild predator in past three year. Of the total kill, 87% were productive livestock encompassing of Jatsamin (29.4%), followed by local breed (23.5%) and remaining 47% were combination of other livestock like bull, Dzo/Dzomo, yak, horse, poultry, sheep and improved breed. Taking into account of current market price, a mean loss incurred by a household through livestock depredation was estimated at Nu. 26,922.00.

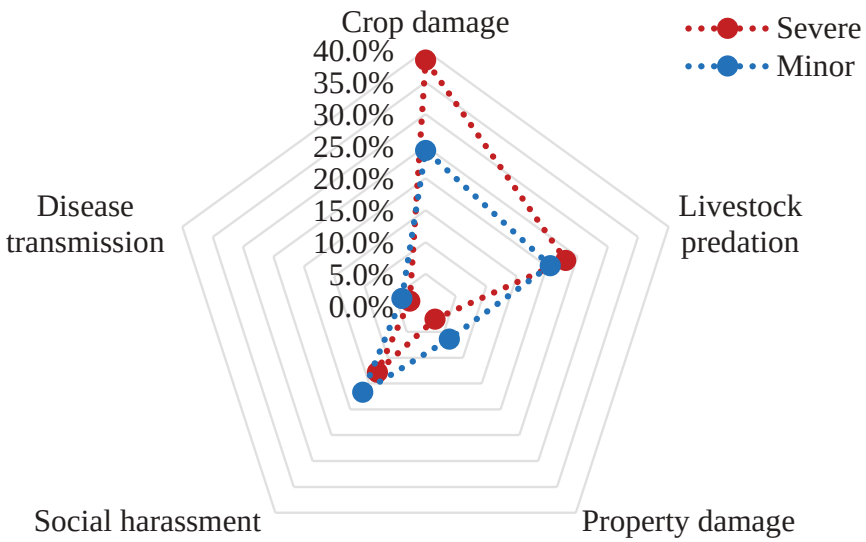


Figure 28. Human wildlife conflict and their impact

Surveyed household expressed that 85% of the livestock kill was by dhole followed by common leopard (10.2%) and 2.6% each by Himalayan black bear and vulture. However, vulture might be perceived threat, as they are carrion feeders. Predators were identified based on direct sighting (45%) followed by pugmarks (32%), killing behavior (13%) and sound of an animal (10%).

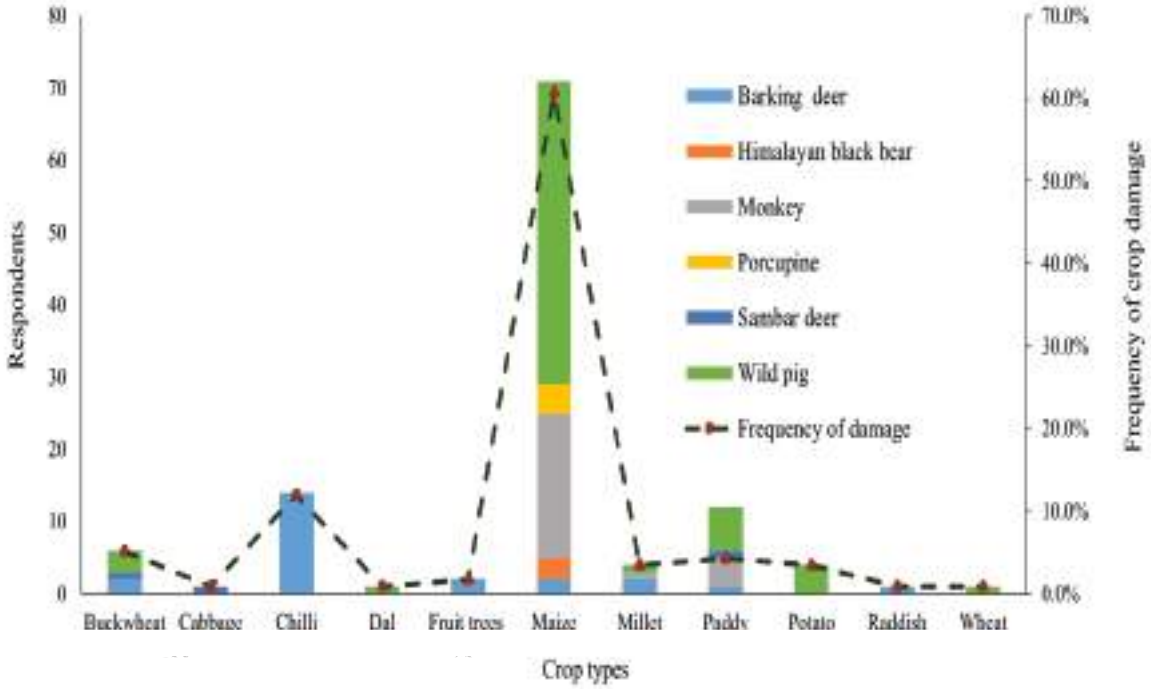


Figure 29. Crop damage by wildlife species and frequency of damage across different crop types

Livestock being docile and easy prey relative to wild ungulates, grazing inside open forest, shortage of manpower to guard livestock, increasing population of predator species and settlement proximity to forest were some of the reasons identified for cause of livestock depredation.

Except the herder of Merak and Sakteng, the entire surveyed household experienced loss of agriculture crop to wild animal (64%). Mean annual crop loss by a household from wild animal damage is approximately 102.7kg equivalent to estimated Nu. 3,310.00. Maize suffers the most extensive crop damage, caused by a variety of wildlife species including wild pigs, monkeys, porcupines, and sambar deer. Wild pigs and monkey, in particular, are the main contributors. The high frequency of damage to maize aligns with the large number of respondents reporting losses from multiple wildlife species. Overall, maize, chili and paddy are the top three crops that experienced high frequency of damage from wild animal (Figure 29).

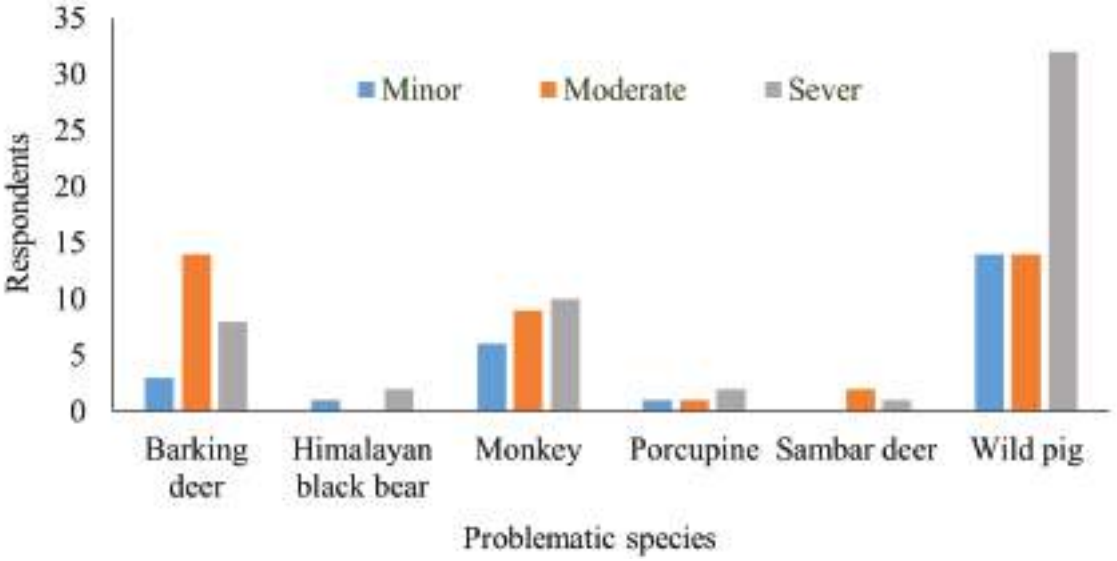


Figure 30. Household perception on magnitude damage by respective wild animal

Among the household who experienced crop damage, 45.8% ranked it as severe problem followed by moderate (33.3%) and minor (20.8%). Surveyed household identified wild pig, monkey and barking deer as the most conflicted wild animal in context to agriculture crop damage (Figure 30).

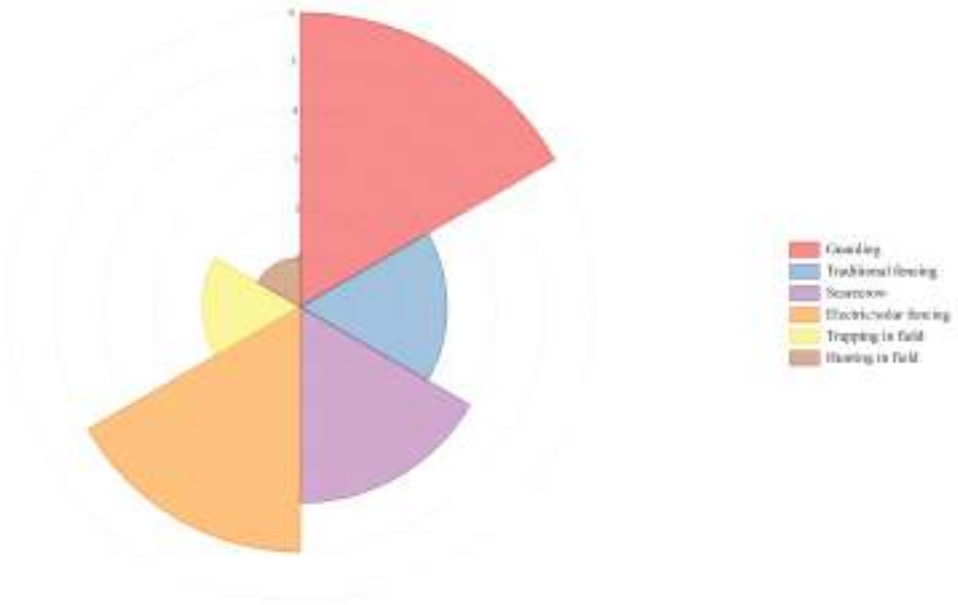


Figure 31. Existing human wildlife conflict mitigation measures adopted by the households

Currently, guarding of livestock and crops was the key HWC mitigation measure adopted by the household followed by installation of electric fencing, scarecrow and traditional fencing with bamboo and woods (Figure 31). Households suggested that installation of electric/solar fencing was effective only for few years, thus guarding was found to be most effective mitigation measures. However, it was found to cause social harassment and also time consuming.

Chain link fencing, green net fencing, enrichment plantation (fruits) in wild habitat and population control through selective culling of problematic species are some of the mitigation measures suggested by the surveyed households.

2.3.9. Climate change: people's perception and impact to their livelihood

Majority of surveyed household (92.3%) are aware of climate change and its impact to the locality. Approximately, 83.3% of the household expressed that they have experienced impact of climate change in their locality in the form of erratic weather pattern, outbreak of pest and disease and drying up of water source.

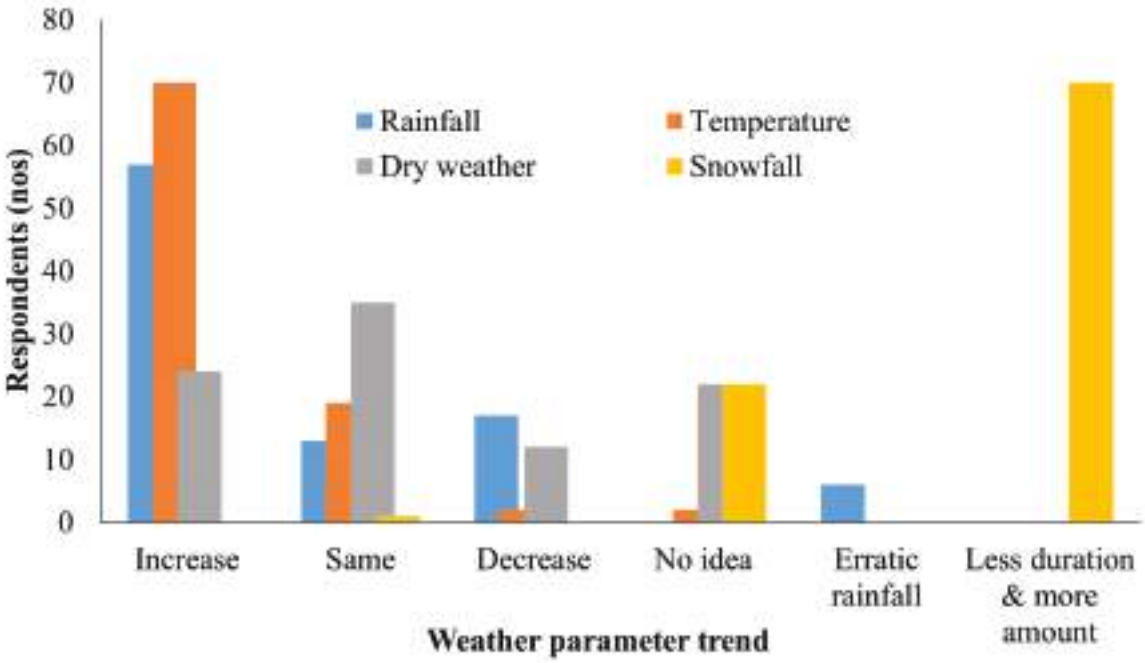


Figure 32. Household perception on climate pattern in their locality

Households' perception on climate change in the locality was assessed based on rainfall, temperature, dry weather condition and snowfall pattern. According to the survey, 75.3% respondents perceived increase temperature as climate change while 61.3% of the respondents also perceive increased in rainfall as climate change. Majority of the household (75.3%) expressed their experience of less duration and more amount of snowfall. However, their perception on snowfall might be prejudiced from the unusual snowfall a year prior to this survey. Subsequently, 57.7% of the surveyed households expressed that

vulnerability and impact of climate change to locality is increasing yearly. Over the duration of last 10 years, 35.9% of the surveyed household experienced extreme weather events.

Outbreak of pest and disease, prolonged rain, delayed onset of rain, hail storm/wind and landslide are ranked as top five-climate variability that has affected the locality (Table 1). Damage and reduction of crop productivity was the major impact of climate change.

Survey revealed that 60% of the people witnessed drying of water source in their locality attributed to climate change.

Table 4. Impact of climate variability in locality in past 10 years. Ranking is in ascending order

Impact of climate change	**Rank**	**Type of properties impacted by climate variability in past 10 years (frequency count)**								
		Bridge	Business	Crop	Foot path	House roof	Land	Livestock	Road	Tsamdro
Pest & disease	1	-	-	16	-	-	-	2	-	-
Prolonged rain	2	1	-	3	-	-	-	1	-	-
Delayed onset of rain	3	1	-	5	1	-	-	2	-	-
Hail storm/wind	4	-	-	8	-	2	-	-	-	-
Landslide	5	-	1	2	-	-	1	3	1	1
Flood	6	-	2	-	-	-	1	1	1	-
Drought	7	-	-	5	-	-	1	6	-	-
Soil erosion	8	-	-	2	-	-	-	-	-	-
Early onset of rain	9	-	-	2	-	-	-	-	-	-
Scanty rain	10	-	-	3	-	-	-	1	1	-
Forest fire	11	-	-	1	-	-	-	-	-	-
Erratic rainfall	12	-	-	2	-	-	-	-	-	-
Heavy snowfall	13	-	-	-	-	-	-	2	-	-

2.4. Resource use and present land use status

Currently, there is no community forest, transmission line, motorable road and agriculture land inside the BC6. However, livestock grazing is prevalent in upper part of BC6 by the people of Merak and Sakteng in winter, Phajogoenpa, Momring, Taksang, and Ralnang from Lauri gewog and Threlphu, Kangpara and Zordung from Kangpara gewog in summer (Figure 33 & Annexure.4).

According to LULC 2016, 0.97sq km of the land inside the BC is classified as meadow (potential grazing land) and another 0.4743 sq km as registered private fallow land. (0.0312 sq km under Samdrup Jongkhar and 0.4431 sq km under Tashigang District). People also extract bamboo and NWFP from within and periphery of BC6. The relatively higher demand for firewood by the migratory herders inside and communities in the periphery of BC6 indicates need for detail resource assessment as per the LFMP guidelines.

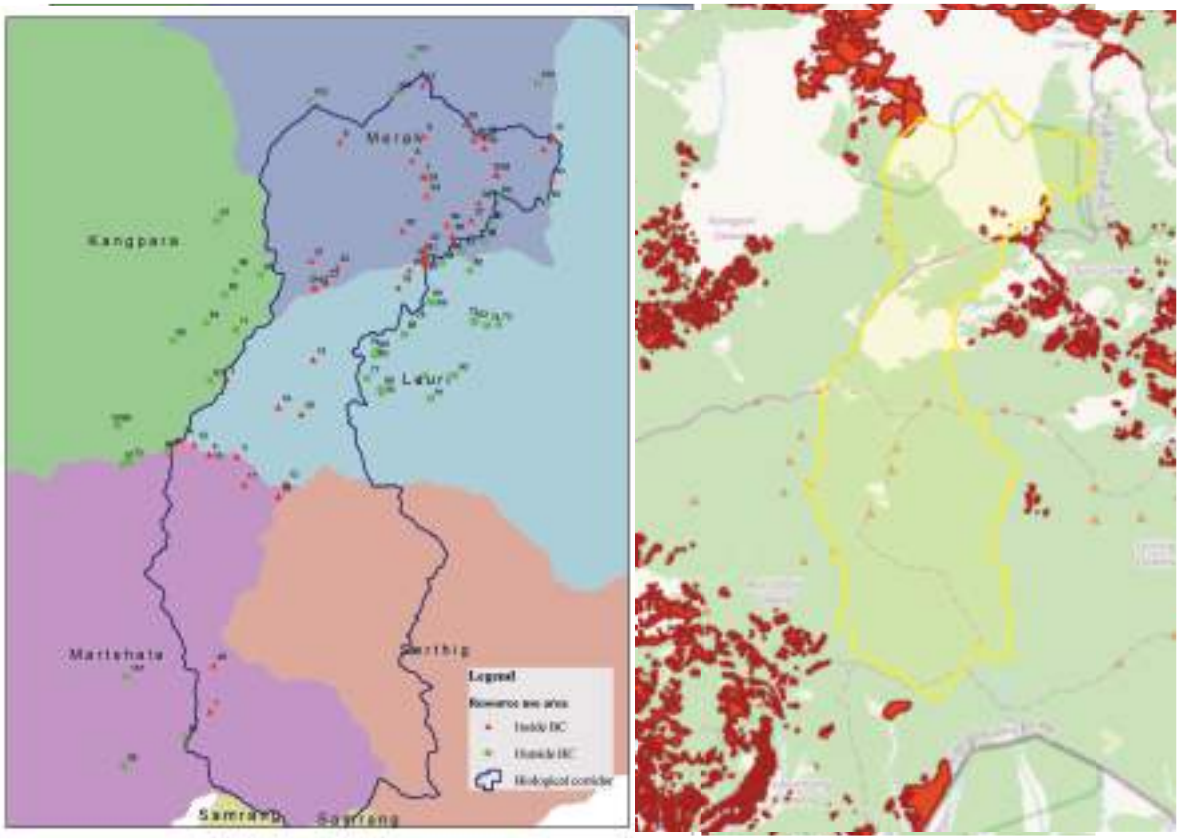


Figure 33. Resource use map within and periphery of biological corridor (left) and private registered land indicated by red polygons (right). Resource use are in the form of livestock grazing and resource extraction (NWFP).

CHAPTER III
THREAT ANALYSIS

3.1. Conservation threats in BC

Threat assessment forms an integral part of the conservation planning and management of significant species. Threat analysis determines the scope, severity and irreversibility of threats under major conservation themes and identifying strategies to minimize or reduce threats inside BC over management plan period. Threats were assessed to derive relevant strategies and intervention actions for better management of the corridor and help in improving the livelihood of the communities. Details of each threat are discussed in the subsequent section.

3.1.1. Wildlife Poaching

Wildlife poaching is one of the main threats to the conservation efforts in the global scenario. Similarly poaching has become prominent deterrent to wildlife conservation in Bhutan. According to the past record (2018-2020) maintained by the Department of Forest & Park Services, wildlife poaching accounted 149 cases, and around 40 poachers were apprehended across the country.

In the year 2017, relayed through informal information received from the local community of the Kangpara Gewog, the forestry personnel of Wamrong Range, Trashigang Forest Division had initiated detail investigation and recovered two pairs of elephant tusk from the three cow herders. A forestry team through field verification had discovered decomposed elephant carcass at Dung Dung and Gangkampa forest area under Martshala Gewog, Samdrup Jongkhar. This discovery of carcass highly suggest that the elephant was potentially poached. The Dung Dung and Gangkhampa forest area falls inside the BC6, and also those miscreants are residential in proximity to BC 6 (Figure 35).

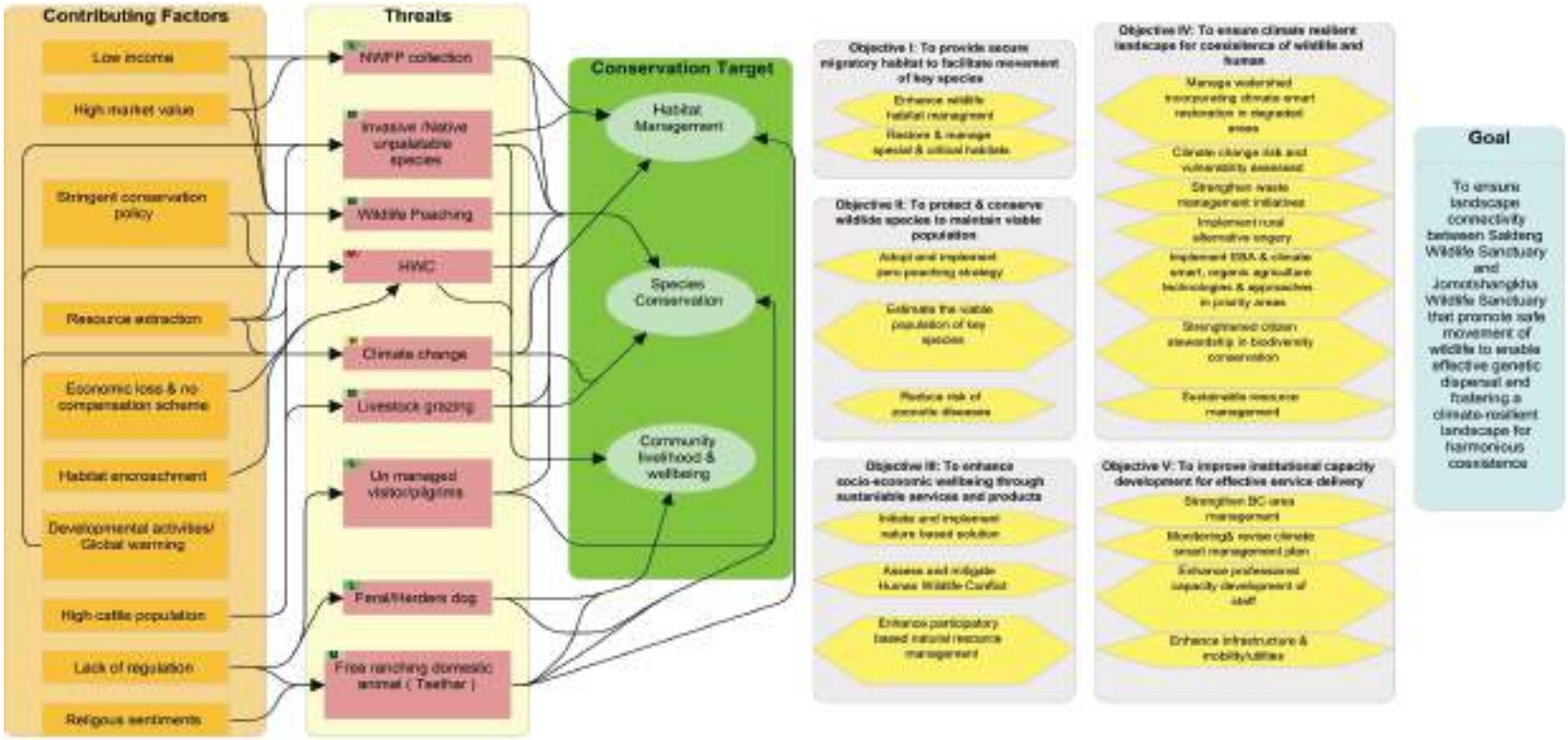


Figure 34. Threat analysis framework which highlights a holistic approach that addresses the interconnections between contributing factors, threats, conservation targets, and objectives to achieve the overarching goal BC6. The contributing factors (highlighted in dark yellow) lead to various threats (shown in pink), which directly impact the three core conservation targets (in green). These threats are addressed through different strategies (represented by light yellow elongated hexagons) under specific objectives. Successfully mitigating these threats will help achieve the conservation targets and ultimately fulfill the overall goal (indicated in pale green on the right).

Figure 35. Recovered elephant carcass and two pairs of tusks (Photo credit: Wamrong Forest Range)

3.1.2. Wildlife-Domestic intersection

During RBA survey, we have observed a significant degree of biotic interference such as presence of livestock, horse and dog that indicates anthropogenic pressure and disturbances to key wildlife species. Further, captured through recent National Tiger Survey Camera trapping, we have recorded substantial number of herder's dog, which can be imminent threat to important species like Red panda and also potential source of zoonotic disease outbreak (Figure 36). With increasing herds of free ranching cattle (Tshethar cattle observed inside Dalemtang & Tshotshalu Forest area), there is interspecific competition to elephant and gaur for limited resources compounded by other communities dependent on natural resource.

Figure 36. Herders accompanied by their dogs inside BC6

3.1.3. Human wildlife conflict

Human-wildlife conflict is a critical and existing threat to both wildlife and livelihood of the community. With increase in incidences of human wildlife conflict, the consequences and implications it brings are devastating to conservation of wildlife.

In consistent with socio economic survey report of BC6, 51 individuals of productive cattle (*Jatsamin*, local breeds, improved breed, Yak, Bull, *Dzo & Dzom*, Sheep) were lost to the Common leopard, Dhole, Himalayan black bear, and Vulture in the past three years. Moreover, the local community resides in proximity to the BC6 and thereby, experience a large-scale loss of agriculture crops to wild herbivores, primates, rodents and birds comprising of elephant,

sambar deer, barking deer, wild pig, monkey, porcupines, squirrels, kalij pheasant, large bellied crow, grey treepie. Therefore, HWC is one of the major issues impeding both conservation effort and livelihood/economic aspect of the local community.

Figure 37. Negative impact of human wildlife conflict to both livelihood and wildlife. Dhole was killed while defending the calf's life by the farmer (Photo © Pema Tshewang, RO Jamkhar)

3.1.4. Retaliatory killing

Retaliatory killings are a reactionary response stemmed from wildlife predation of livestock and crop depredation which has direct bearing on the livelihood of local community.

One such account of retaliatory killing was reported in 2019 at Merda Chiwog, Kangpara Gewog, where one common leopard was killed in retaliation to predation of the guard dog. During field investigation, it was observed that the owner had used poisoned bow and arrow to kill a leopard using dog carcass as a bait.

Figure 38. A carcass of common leopard & arrow on neck, and skin and recovered bow and arrow from the site (Photo credit: Phuntsho Wangdi, Forest Ranger II, Kangpara Forest Beat).

3.1.5. Illegal collection of Forest Resources

With increase in demand for rural house building timber, the pressure on timber resources is increasing. This is further coupled by significant number of cattle herds inside BC which has resulted in lopping and girdling of trees to meet the fodder demand, firewood, timber and opening for pasture or cattle grazing area expansion. Similarly, there is also rampant illegal collection of NWFP resources such as *Rubia* spp., *Paris polyphylla*, *Swertia chirata*, bamboo and wood burrs. With burgeoning market for NWFP and important plant species across the border, there are widespread unaccounted incidences of illegal collection of such resources.

3.1.6. Invasive Species

Biological invasion has now become a global issue causing significant loss to economy through negative impacts on crops, animal and human health, development and importantly on biodiversity loss. If left unmanaged, it can have devastating effect on biodiversity, leading to decline/extinction of native

wildlife population. As per RBA report, we have recorded invasive flora species such as *Ageratina adenophora, Mikania micrantha, Lantana camara, Parthenium* sp., and *Chromolaena odorata* distributed in sub-tropical zone of the BC area.

Figure 39. Area infested by invasive Ageratina adenophora

We have also recorded many other exotic species distributed sporadically inside the BC landscape. Therefore, there is urgent need to design specific intervention to mitigate further invasion.

Besides plant, some of the fauna species like wild pig, porcupine, rodents, barking deer, sambar deer create nuisance and are considered pest by the local communities.

3.1.7. Unmanaged visitors to Chenla

Chenla is sacred and popular religious site blessed by Drupthop Drupwang Drakpa Gyaltshen alias Lama Khenjey, and is situated at elevation of 4000msl. The place is believed to be blessed by pawos, pamos and khandromas thereby, alluring many local pilgrims and visitors enroute from Kangpara, Trashigang and Lauri, Samdrup Jongkhar. Hence, there is greater sense of concern pertaining to huge influx of unmanaged visitors and negative impacts it fetches from generation of waste, cutting of trees and disturbances to wildlife. Local tourism needs to be regulated and emphasis stressed to implement strategies to ameliorate the negative impacts.

Figure 40. Visitors along with pony enroute to Chenla pilgrim site (Photo © Sapana Sunar)

The recent National Tiger Survey Camera trapping have captured preponderance of human images, suggesting huge visitors at the site. According to Threlphu Tshogpa, Kangpara Gewog, approximately 200 individuals visited to Chenla via Threlphu within the month of October to November 2022. Similarly, more than 100 people from Lauri Gewog had visited to Chenla via Momring-Taktsang route in the same month.

3.1.8. Waste disposal in the forest trail and streams

With increase in unmanaged visitors/trekkers and presence of cow herder within the BC area, waste management has become an impending threat to the surrounding environment and survival of species. There are numerous sites within the BC area, where indiscriminate disposal of plastic and other non-degradable waste is visible along footpath and streams. Therefore, there is need for appropriate waste management guidelines and strategies in place to minimize the waste.

3.1.9. Drying of wetland and water source

With the accelerating climate change, shift in land use pattern and due to varied developmental programs, the impact of degrading watershed and drying water sources are felt across the country.

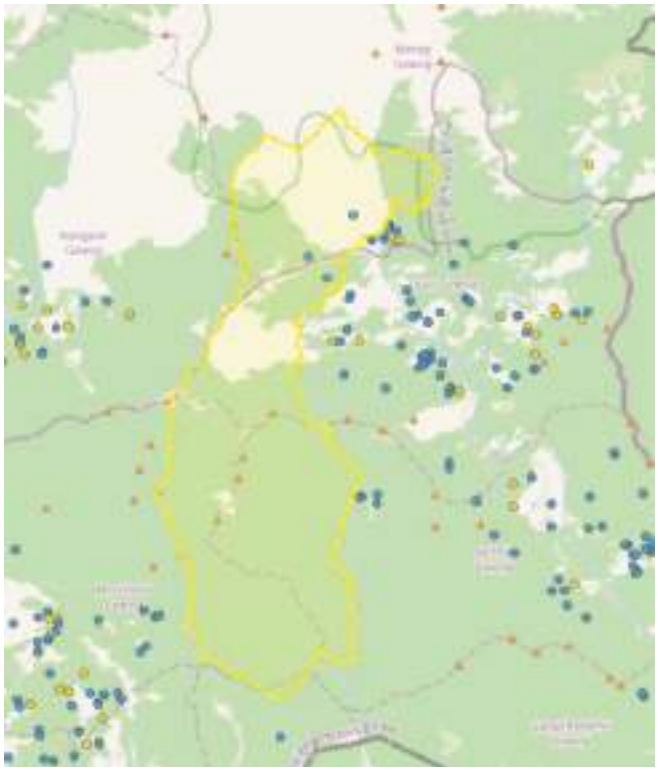


Figure 41. Map showing the location of water source in the locality. Yellow dot indicates drying water source while blue are water source with no changes (source: SDSS)

In concurrent with the nation-wide water source survey conducted in 2020 and as per local key informants' interview, majority of the water source were found to be in state of drying. The consequences of degrading watersheds and water sources within BC area can have far reaching negative impact to the persistence of wildlife as well as livelihood of the people. Hence,

it is timely to adopt appropriate interventions and management to restore degraded watersheds and revive drying water source.

3.1.10. Grazing

A social survey conducted with herders from Merak and Sakteng and communities (Khasiteng and Kangpara under Trashigang Dzongkhag and Larjab, Morning, Ralnang and Phajogoenpa under Samdrup Jongkhar Dzongkhag) near BC6 revealed that the corridor is a valuable grazing area for cattle owned by approximately 80 households. These cattle, including yaks, dzos, jatshams, and local breeds, share limited grazing ground with wildlife, leading to resource competition.

Encroachment of palatable plant species with less desirable ones has resulted to depletion of grazing land further increasing the competition. This necessitates pasture land improvement. To address fodder shortages, trees are often lopped, contributing to forest degradation visible in several location during the survey.

Figure 42. Livestock grazing inside BC6 landscape

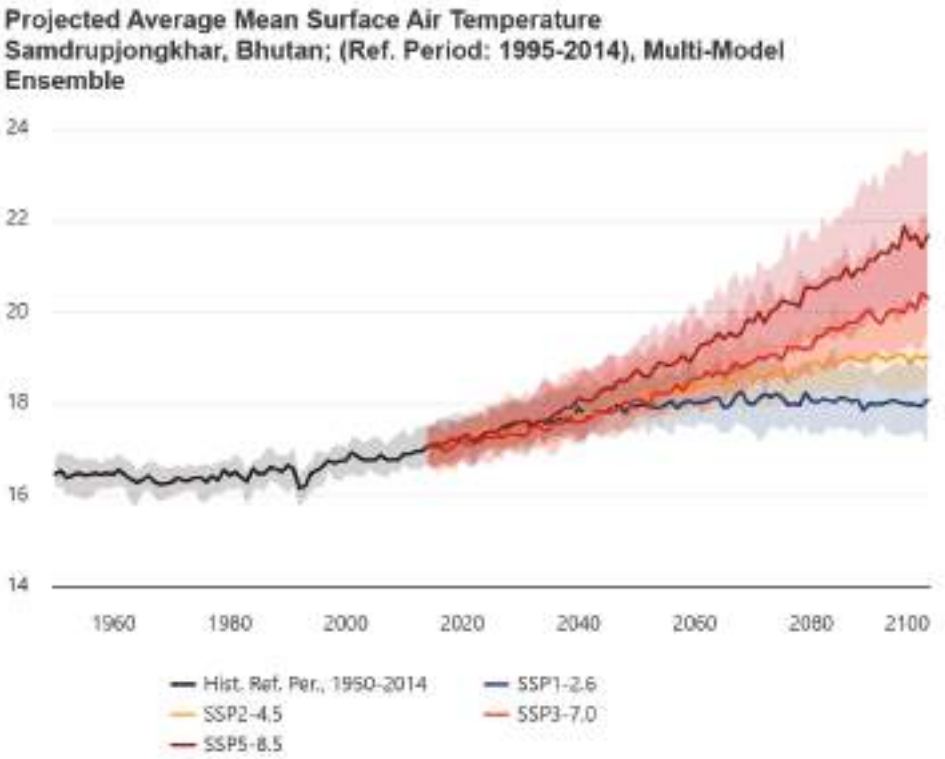
3.1.11. Potential impact of climate change

Changes in weather and climate pattern are already having an impact on fragile mountain ecosystems in the country. This is evident by significant drop in size and distribution of mountain glaciers, water scarcity, altitudinal shift of species range, proliferation of invasive species, pest and disease outbreak, recurrent flash floods and erratic rainfall pattern. Such irregularities bring in direct and indirect adverse impacts on species, wildlife habitat, environment, development and livelihood thereof.

The local community residing within proximity to the corridor expressed their concern on repeated occurrence of extreme weather patterns and devastating damages it fetched to crops through pest and disease outbreak, erratic rainfall and hailstorm, ultimately unfavorably implicating their livelihoods. One such harrowing account was the heavy snowfall spell that occurred in 2021, that nearly wiped-out cash crops such as cardamom, hazelnut, pears, apples and other winter crops in the northern fringes of the BC.

People also shared a concern of appearance of alien and lowland invasive plant species in the higher areas. Similarly, there is also sighting of lowland bird species. One such instance shared was disappearance of house sparrow and arrival of white crested laughing thrush in Lauri Gewog, Samdrup Jongkhar. The frequent landslides and soil erosions were also experienced in the recent years.

The figure 43 depicts the projected change in precipitations and temperature pattern under Trashigang and Samdrup Jongkhar Dzongkhag. The precipitation and temperature are projected to increase in all climate scenarios in coming decades, thus anticipating potential impact to livelihood and biodiversity in the region.



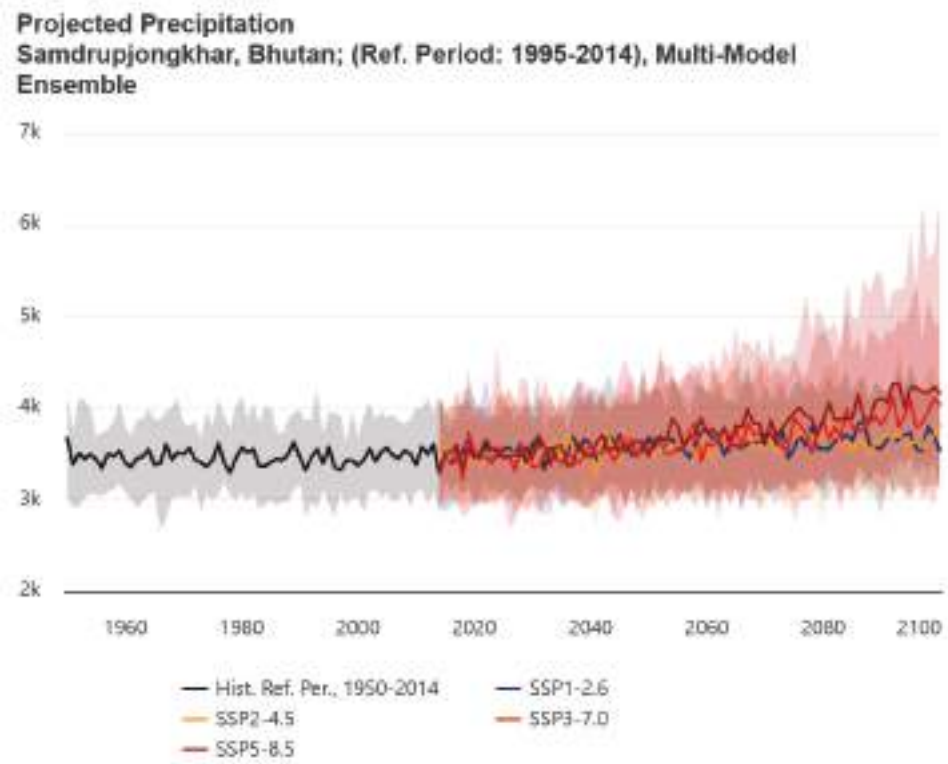


Figure 43. Projected change in climate variabilities under different climate scenarios (source:https://climateknowledgeportal.worldbank.org/country/bhutan/climate-data-projections)

3.2 Threat ranking

The Miradi software was used to assess the conservation threats facing the corridors. This assessment considered three key factors: the scope, severity, and irreversibility of the threats. The results indicated a very high level of overall threat to the corridors, primarily due to human-wildlife conflicts and climate change.

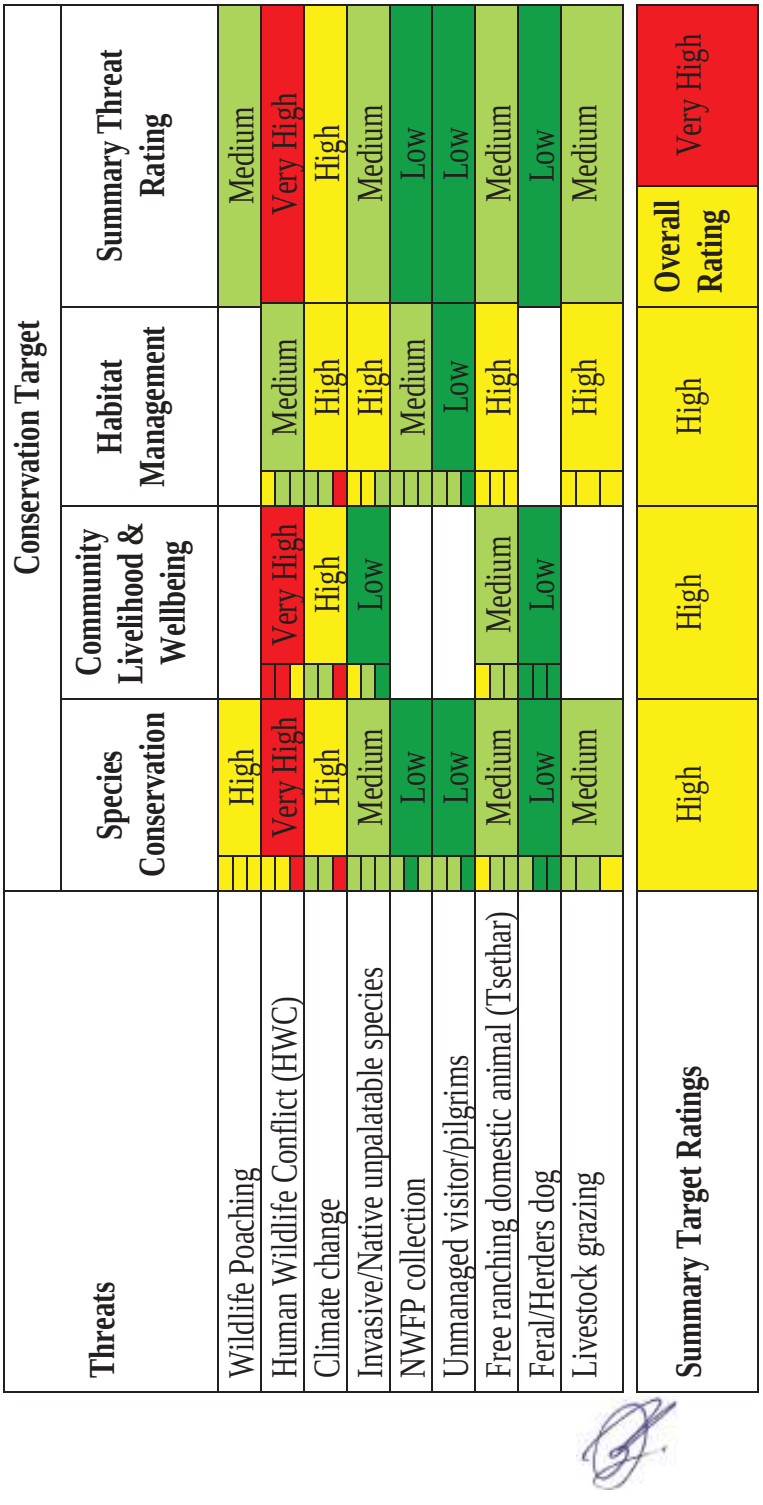


Figure 44. Threat ranking

3.3. Management challenges

Human resources and capacity are critical for the effective management of biological corridors. Currently, the Trashigang Divisional Forest Office manages BC6, though the majority of the corridor lies within the administrative areas of the Samdrup Jongkhar Forest Division and Jomotshangkha Wildlife Sanctuary. This arrangement complicate coordination and the execution of conservation activities.

Challenges include the lack of dedicated office infrastructure, insufficient technical staff, and the remote location of BC6 relative to the Trashigang Forest Division. The rugged terrain and limited accessibility, further complicated by the absence of motorable roads, make monitoring and patrolling particularly difficult. Additionally, inadequate biodiversity data and information hinders evidence-based conservation efforts.

Local communities near BC6 are generally unaware of the corridor's existence. It is essential to engage these communities to increase their understanding of the corridor's significance, its conservation needs, and the potential economic benefits it can provide

3.4. Conservation opportunities

Despite challenges, BC6 also has significant opportunities for conservation as follows

- ✓ Secure indispensable landscape connectivity between two wildlife sanctuaries, JWS and SWS.
- ✓ The corridor landscape is sanctuary to significant conservation flagship mammal species such as Red panda, musk deer, elephant, guar, clouded leopard and tiger.

- ✓ Blyth’s tragopan and Temminck’s tragopan is also evident in the landscape in addition to diverse Galliformes (one of the classification order of birds). The landscape is also secured haven to four hornbill species.
- ✓ Serve as a home to rare plant species such as *Sapria himalayana* and 33 species of rhododendron.
- ✓ Important catchment area for downstream settlements
- ✓ Potential site of eco and cultural tourism to boost local economy

3.5. Important habitats

The map illustrates the potential habitats of several threatened wildlife species, like Red panda, musk deer, dhole, and Asiatic elephant. These habitats were identified using a species distribution modeling technique called MaxEnt, which incorporates species occurrence data and environmental variables. This information is crucial for conservation efforts, as it helps identify areas that need to be protected or restored to ensure the survival of these species.

The red panda's high-suitability habitat is primarily in the northern part of the region, with medium-suitability areas extending slightly to the south, while most of the region has low habitat suitability. For the musk deer, high-suitability areas are concentrated in a small northern-central region, surrounded by medium suitability, and the southern part mostly shows low habitat potential. The dhole has a broad range of high-suitability habitat, particularly in the northern and central areas, with medium-suitability extending southward and lower potential in the far south. The Asiatic elephant's high-suitability habitat is mainly in the southern region, with medium-suitability areas in the central zone, and low potential habitat in the north (Figure 45).

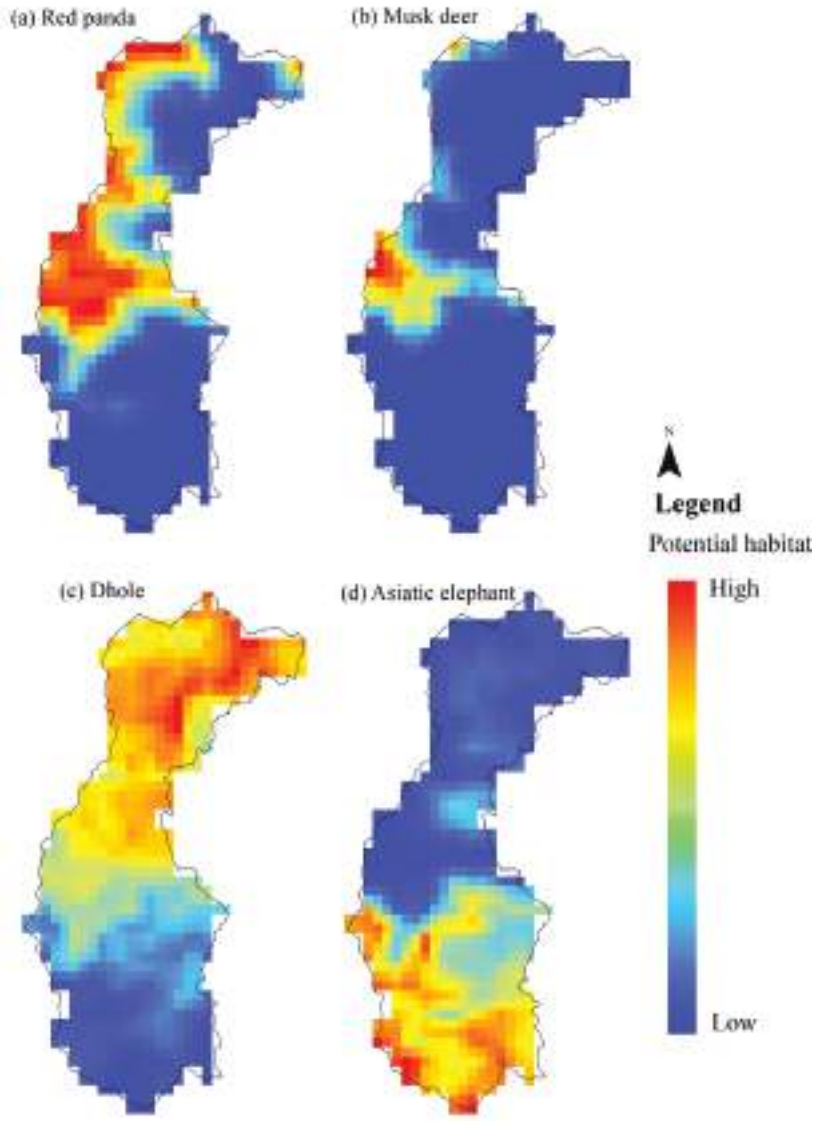


Figure 45. The map depicting the potential habitat within BC6 for some of the threatened wildlife species using a color gradient to indicate suitability levels, ranging from low (blue) to high (red)

Overall, the maps reveal that habitat preferences differ by species. The red panda and musk deer are more suited to northern areas, while the dhole and Asiatic elephant thrive in central and southern regions. This information highlights different conservation priorities based on species and habitat zones, suggesting that efforts should focus on areas of high suitability for each species.

CHAPTER IV

MANAGEMENT INTERVENTIONS

The strategies and actions were derived from analysis of conservation strength, weakness, opportunities and threats to address species and its habitat conservation in pursuit of enhancing socio-economic livelihood dependent on biological corridor for forest resources. The intervention plan includes 59 actions, 19 strategies to achieve five objectives and conservation goal of the BC6.

Objective 1: To provide a secured migratory habitat to facilitate movement of key species between the two wildlife sanctuaries

Strategy 1.1. Enhance wildlife habitat management

Action 1.1.1. Carry out alpine meadow improvement activities for wild ungulates and herbivores

Action 1.1.2. Carry out enrichment plantation with native palatable and fruit tree species for birds and mammals

Action 1.1.3. Carry out management of unpalatable species

Action 1.1.4. Identify and map critical bamboo habitats

Action 1.1.5. Carry out survey to identify choke (bottlenecks) points for necessary management intervention

Action 1.1.6. Carry out mapping of grazing land and study on grazing carrying capacity to regulate rangeland management

Strategy 1.2. Restore and manage special and critical habitat

Action 1.2.1. Conduct survey to identify potential/critical waterhole, grassland, snag, saltlicks and any critical habitats

Action 1.2.2. Create and improve identified waterhole, snag and saltlicks

Action 1.2.3. Restoration of degraded bamboo habitat of Red panda

Action 1.2.4. Carry out survey to map and document bat diversity and their habitats

Objective 2: To protect and conserve wildlife species to maintain viable population

Strategy 2.1. Assess species distribution and threats for effective conservation

Action 2.1.1. Conduct survey to assess distribution and threat to Musk deer

Action 2.1.2. Conduct survey to assess Galliformes diversity

Action 2.1.3. Conduct survey to assess status and distribution of threatened & protected flora

Action 2.1.4. Carry out survey to estimate population status and distribution of some lesser-known species like Dhole, clouded leopard, Himalayan black bear

Action 2.1.5. Carry out camera trapping for annual monitoring of wildlife

Action 2.1.6. Conduct assessment for invertebrates' diversity (aquatic and terrestrial)

Action 2.1.7. Carry out small mammal survey

Strategy 2.2. Adopt and implement zero poaching strategy

Action 2.2.1. Conduct SMART patrolling

Action 2.2.2. Conduct anti-poaching activities for musk deer

Action 2.2.3. Integrate Unmanned Aerial Vehicle (UAV) into SMART patrolling

Strategy 2.3. Reduce risk of zoonotic diseases

Action 2.3.1. Conduct zoonotic disease mapping and awareness to herders

Action 2.3.2. Monitor, immobilize and relocate feral/stray dog

Objective 3: To enhance socio-economic wellbeing through sustainable services and products

Strategy 3.1. Initiate and implement nature base solution

Action 3.1.1. Design and develop ecotourism products, Chenla

Action 3.1.2. Promote and support Menchu management, Mankhar

Action 3.1.3. Support Non wood forest product group (Swertia & Cane propagation-Larjab/ management group)

Action 3.1.4. Support bamboo enterprise development, Kangpara

Strategy 3.2. Assess and mitigate Human Wildlife Conflict natural resource

Action 3.2.1. Carry out survey to map Human Wildlife Conflict (HWC) prone areas

Action 3.2.2. Implement of appropriate HWC management intervention

Action 3.2.3. Improvement of pasture/grazing land

Strategy 3.3. Enhance participatory-based natural resource management

Action 3.3.1. Revise community forest management plan

Objective 4: To ensure climate resilient landscape for co-existence of wildlife and human

Strategy 4.1. Manage watershed/catchment areas incorporating climate smart restoration in degraded land areas

Action 4.1.1. Assess watershed/spring shed and water source

Action 4.1.2. Classify and map spring shed employing hydrogeological aspect

Action 4.1.3. Implement appropriate intervention measures for drying water source

Strategy 4.2. Climate change risk and vulnerability addressed

Action 4.2.1. Conduct awareness and outreach program on climate change

Action 4.2.2. Implement Adaptation measures based on BC Climate Change Vulnerability Assessment (CCVA)

Action 4.2.3. Install Data Logger for long term Monitoring

Action 4.2.4. Periodic Monitoring of Weather Data Logger

Strategy 4.3. Strengthen waste management initiatives

Action 4.3.1. Institute and implement Waste-in and Waste Out initiative (Kangpara and Lauri)

Action 4.3.2. Installation of waste bin, signages and information boards in strategic location

Action 4.3.3. Facilitate village waste management group

Strategy 4.4. Implement rural alternative energy (bio gas, storm water management & solar energy)

Action 4.4.1. Construct/support rain water harvesting infrastructures, Chenla

Action 4.4.2. Support Supply solar lighting equipment and infrastructure to herders

Action 4.4.3. Facilitate bio-gas installation initiative of Department of Livestock

Strategy 4.5. Implement Evidence-Based Approaches (EBA) and climate smart, organic agriculture technologies and approaches

Action 4.5.1. Facilitate climate-smart agriculture program of Department of Agriculture

Action 4.5.2. Facilitate to Livestock intensification Program

Action 4.5.3. Facilitate Livestock products value chain

Strategy 4.6. Strengthened citizen stewardship towards biodiversity conservation

Action 4.6.1. Initiate community based biodiversity conservation program (citizen science)

Action 4.6.2. Support nature club and non-formal education (NFE)

Strategy 4.7. Sustainable resource management

Action 4.7.1. Revise local forest management plan (LFMP)

Objective 5: To improve institutional capacity development for effective service delivery

Strategy 5.1. Strengthen BC area management

Action 5.1.1. Demarcate and fix boundary pillar

Strategy 5.2. Monitoring and revise climate smart management plan

Action 5.2.1. Monitoring and evaluation as per Bhutan METT+

Action 5.2.2. Midterm review of conservation management plan

Action 5.2.3. Final evaluation of Conservation Management Plan

Strategy 5.3. Enhance professional capacity development of staff

Action 5.3.1. Refresh technical staff on SMART data collection, planning, reporting and intelligence

Action 5.3.2. Need based capacity development to use latest tools and technology in the field of conservation

Strategy 5.4. Enhance infrastructure and mobility/utilities

Action 5.4.1. Procurement of mobility and survey equipment

Action 5.4.2. Construction of ranger's transit camp, Kangpara

Action 5.4.3. Purchase laptop and accessories

Action 5.4.4. Procurement of office furniture

CHAPTER V

IMPLEMENTATION SCHEDULE & BUDGET

There are 59 actions from 19 strategies set to fulfil five Objectives of conservation of BC6. It will be valid for 10 years with effective from July 2025 to June 2035 covering 13th and 14th Five Year Plan (FYP) of the Royal Government of Bhutan.

The financial estimates of Nu. 68.2 million is being proposed for the conservation of wild flora & fauna and enhance socio-economic status of community through mitigation of Human Wildlife Conflict (HWC) and other sustainable green infrastructure in the locality.

The conservation operation plan for implementation of the conservation management actions will be prepared annually and it will guide the effective implementation of the actions framed under each strategy.

The major source of funding for these activities is expected to be secured from Bhutan for Life (BFL) and Royal Government of Bhutan. The budget proposal and implementation will be implemented as per the Governments financial rules, regulation, norms and circulars following financial year of RGoB (July to June). However, other sources of funding from other conservation donors like WWF-Bhutan, GEF-UNDP, GCF-UNDP, Helvetas-Bhutan, Royal Society for Protection of Nature (RSPN, Bhutan Foundation, and Bhutan Trust Fund for Environmental Conservation (BTFEC) will be explored.

Table 5. Implementation framework and budget outlay

Objective	Strategy	Action	Year along with budget (in Nu. m)										Sub total	Lead implementing Agency	Remarks
			1	2	3	4	5	6	7	8	9	10			
1. To provide a secure migratory habitat to facilitate movement of key species	***1.1. Enhance wildlife habitat management***	1.1.1. Carry out alpine meadow improvement activities for wild ungulates and herbivores		0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	**1.35**	DoFPS	Alpine region of Merak, Kangpara & Lauri inside BC6
		1.1.2. Carry out enrichment plantation with native palatable and fruit tree species for birds and mammals		0.5		0.5		0.5		0.5		0.5	**2.50**	DoFPS	Feasible BC area
		1.1.3. Carry out management of unpalatable species		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	**0.45**	DoFPS	Meadows/grazing area inside BC area
		1.1.4. Identify and map critical bamboo habitat		0.35									**0.35**	DoFPS	In potential red panda habitat
		1.1.5. Carry out survey to identify choke (bottlenecks) points for necessary management intervention	0.5										**0.50**	DoFPS	Entire BC area
		1.1.6. Carry out mapping of grazing land and study on grazing carrying capacity to regulate rangeland management	0.5										**0.50**	DoFPS	Entire BC area
		1.2.1. Conduct survey to identify potential/critical waterhole, grassland, snag, saltlicks and any critical habitats		0.8									**0.80**	DoFPS	Entire BC area

	1.2. Restore and manage special and critical habitat	1.2.2. Create and improve identified waterhole, snag and saltlicks			0.15		0.15		0.15				**0.45**	DoFPS	Place that require intervention identified during survey
		1.2.3. Restoration of degraded bamboo habitat of Red panda			0.5			0.5					**1.00**	DoFPS	In potential red panda habitats
		1.2.4. Carry out survey to map and document bat diversity and their habitats				0.3							**0.30**	DoFPS	Entire BC area
2.To protect and conserve wildlife species to maintain viable population	***2.1. Assess species distribution and threats for effective conservation***	2.1.1. Conduct survey to assess distribution and threat to Musk deer	0.8										**0.80**	DoFPS	Areas with elevation above 3500 m
		2.1.2. Conduct survey to assess Galliformes diversity			0.55								**0.55**	DoFPS	Entire BC area
		2.1.3. Conduct survey to assess status and distribution of threatened & protected flora							1.2				**1.20**	DoFPS	Entire BC area.
		2.1.4. Carry out survey to estimate population status and distribution of some lesser-known species like Dhole, clouded leopard, Himalayan black bear									0.45		**0.45**	DoFPS	Dhole, clouded leopard, Himalayan black bear
		2.1.5. Carry out camera trapping for annual monitoring of wildlife	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	**3.50**	DoFPS	Entire BC area
		2.1.6. Conduct assessment for invertebrates' diversity (aquatic and terrestrial)								0.25			**0.25**	DoFPS	Tributaries of Jomori river Nonai river & Samrang river
		2.1.7. Carry out small mammal survey							0.25				**0.25**	DoFPS	Entire BC area

	2.2. Adopt and implement zero poaching strategy	2.2.1. Conduct SMART patrolling	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	**5.00**	DoFPS	Entire BC area
		2.2.2. Conduct anti-poaching activities for musk deer	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	**1.50**	DoFPS	In musk deer habitat identified through survey
	2.3. Reduce risk of zoonotic diseases	2.2.3. Integrate Unmanned Aerial Vehicle (UAV) into SMART patrolling				0.08			0.08			0.08	**0.24**	DoFPS	In accessible areas
		2.3.1. Conduct zoonotic disease mapping and awareness to herders		0.05									**0.05**	DoFPS/ DoL	To herders from Merak & Sakteng
		2.3.2. Monitor, immobilize and relocate feral/stray dog					0.05						**0.05**	DoFPS/ DoL	Parts of Kangpara, Lauri & Merak where herders are present
3. To enhance socio-economic wellbeing through sustainable services and products	***3.1. Initiate and implement nature base solution***	3.1.1. Design and develop ecotourism products, Chenla		4.0						2.0			**6.00**	DOT/ DoFPS	Kangpara gewog
		3.1.2. Promote and support Menchu management, Mankhar						1.0					**1.00**	LG/DoFPS	Kangpara gewog
		3.1.3. Support Non wood forest product group (Swertia & Cane propagation-Larjab/ management group)			0.5						0.15		**0.65**	DoFPS	Lauri and Serthig Gewog
		3.1.4. Support bamboo enterprise development, Kangpara				0.32							**0.32**	DoFPS	Kangpara gewog

	3.2. Assess and mitigate Human Wildlife Conflict	3.2.1. Carry out survey to map Human Wildlife Conflict (HWC) prone areas	0.54										**0.54**	DoFPS	Entire BC area
		3.2.2. Implement of appropriate HWC management intervention					0.9						**0.90**	DoA/ DoFPS	HWC hotspot area identified from hotspot mapping survey
		3.2.3. Improvement of pasture/grazing land			0.5				0.5				**1.00**	DoL/ DoFPS	Chenla area
	3.3. Enhance participatory based natural resource management	3.3.1. Revise community forest management plan	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	**1.20**	DoFPS	CF in the periphery of BC area
4.To ensure climate resilient landscape for co-existence of wildlife and human	***4.1. Manage watershed areas incorporating climate smart restoration in degraded land***	4.1.1. Assess watershed/spring shed and water source		0.3									**0.30**	DoW/ DoFPS	Kangpara and Lauri
		4.1.2. Classify and map spring shed employing hydrogeological aspect		0.2									**0.20**	DoW/ DoFPS	Kangpara and Lauri
		4.1.3. Implement appropriate intervention measures for drying water source			0.8								**0.80**	DoW/ DoFPS	Areas identified based on survey
	4.2. Climate change risk and vulnerability addressed	4.2.1. Conduct awareness and outreach program on climate change				0.3							**0.30**	DoFPS	Settlements in near BC area
		4.2.2. Implement Adaptation measures based on BC Climate Change Vulnerability Assessment (CCVA)					1.3						**1.30**	DoFPS	Risk area identified by CCVA

	4.2.3. Install Data Logger for long term Monitoring	0.3	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	**0.75**	DoFPS	Chenla
	4.2.4. Periodic Monitoring of Weather Data Logger		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	**0.90**	DoFPS	Chenla
4.3. Strengthen waste management initiatives	4.3.1. Institute and implement Waste-in and Waste Out initiative (Kangpara and Lauri)		0.3					0.3				**0.60**	LG/ DoFPS	Along the route to Chenla from Kangpara & Lauri
	4.3.2. Installation of waste bin, signages and information boards in strategic location			0.2					0.2			**0.40**	LG/ DoFPS	Along the route to Chenla from Kangpara & Lauri
	4.3.3. Facilitate village waste management group		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	**0.90**	LG/DoFPS	Kangpara
4.4. Implement rural alternative energy (bio gas, storm water management & solar energy)	4.4.1. Construct/support rain water harvesting infrastructures, Chenla						0.5					**0.50**	DoFPS	Chenla
	4.4.2. Support/Supply solar lighting equipment and infrastructure to herders	0.3										**0.30**	DoFPS	Herders inside BC area
	4.4.3. Facilitate bio-gas installation initiative of Department of Livestock		0.5									**0.50**	DoL/ DoFPS	Martshala
4.5. Implement EBA and climate smart, organic agriculture technologies and approaches	4.5.1. Facilitate climate-smart agriculture program of Department of Agriculture			0.9								**0.90**	DoA/ DoFPS	Settlements near BC area
	4.5.2. Facilitate to Livestock intensification Program					0.78						**0.78**	DoL/ DoFPS	Herder inside BC area
	4.5.3. Facilitate Livestock products value chain			0.3								**0.30**	DoL/ DoFPS	Herders inside BC area

5. To improve institutional capacity development for effective service delivery	***4.6. Strengthened citizen stewardship towards biodiversity conservation***	4.6.1. Initiate community base biodiversity conservation program (citizen science)								DoFPS	Herders inside BC area
		4.6.2. Support nature club and NFE	0.02	0.02	0.02	0.02	0.02	0.02	0.02	DoFPS	School and NFE in periphery of BC6
	4.7. Sustainable resource management	4.7.1.Revise local forest management plan (LFMP)							1	DoFS	Kangpara gewog
	5.1. Strengthen BC area management	5.1.1. Demarcate and fix boundary pillar	0.6							DoFPS	Entire BC area
	5.2. Monitoring and revise climate smart management plan	5.2.1. Monitoring and evaluation as per Bhutan METT+	0.05	0.05	0.05	0.2	0.05	0.05	0.05	DoFPS	Entire BC area
		5.2.2. Midterm review of conservation management plan				0.3				DoFPS	5th year
		5.2.3. Final evaluation of Conservation Management plan							1.0	DoFPS	9th year
	5.3. Enhance professional capacity development of staff	5.3.1. Refresh technical staff on SMART data collection, planning, reporting and intelligence	1.0	1.0	1.0	1.0	1.0	1.0	1.0	DoFPS	BC staff
		5.3.2. Need based capacity development to use latest tools and technology in the field of conservation		1.0	1.0		1.0		1.0	DoFPS	BC staff
			5.00	**10.00**	**0.30**	**1.00**	**0.80**	**0.60**	**1.00**		
				DoFPS	DoFPS	DoFS	DoFPS	DoFPS	DoFPS		
				Herders inside BC area	School and NFE in periphery of BC6	Kangpara gewog	Entire BC area	Entire BC area	5th year		

	5.4. Enhance infrastructure and mobility/utilities	5.4.1. Procurement of mobility and survey equipment		0.5		0.5		0.5					**1.50**	DoFPS	Wamrong range
		5.4.2. Construction of ranger's transit camp, Kangpara							2.0				**2.00**	DoFPS	Kangpara
		5.4.3. Purchase laptop and accessories		0.8						0.8			**1.60**	DoFPS	Wamrong range
		5.4.4. Procurement of office furniture	0.2					0.3					**0.50**	DoFPS	Wamrong range
Total			**6.8**	**13.4**	**9.6**	**6.2**	**6.2**	**7.4**	**7.4**	**7.7**	**4.5**	**5.1**	**68.2**		

CHAPTER VI
MONITORING & EVALUATION

Monitoring is a continuous process to assess the progress of planned activities. It ensures that outputs, deliveries, and schedules are met and identifies and addresses any issues promptly. The Divisional Forest Office, Trashigang will conduct monitoring throughout the implementation phase using the PA Monitoring Framework as outlined in Volume IV of the Forest Management Code of Bhutan 2020 and PA monitoring framework as outline in forest monitoring and evaluation framework 2024. The Bhutan METT+ protocol will measure the management effectiveness of the BC and the implementation effectiveness of the conservation management plan. Overall monitoring and evaluation will be guided by the Monitoring and Evaluation framework presented in table 7.

Table 6. Monitoring and evaluation framework

Objective	Strategy	Action	Output Indicator	Baseline	Unit	Yearly Target									
						1	2	3	4	5	6	7	8	9	10
1. To provide a secured migratory habitat to facilitate movement of key species between the two wildlife sanctuaries	***1.1. Enhance wildlife habitat management***	1.1.1. Carry out alpine meadow improvement activities for wild ungulates and herbivores	Hectares of alpine meadow managed	0	Ha		10	10	10	10	10	10	10	10	10
		1.1.2. Carry out enrichment plantation with native palatable and fruit tree species for birds and mammals	Hectares of fruit tree planted	0	Ha		5		5		5		5		5
		1.1.3. Carry out management of unpalatable species	Hectares of land cleared	0	Ha		5	5	5	5	5	5	5	5	5
		1.1.4. Identify and map critical bamboo habitat	Assessment Report	0	No		1								
		1.1.5. Carry out survey to identify choke (bottlenecks) points for necessary management intervention	Assessment Report	0	No	1									
		1.1.6. Carry out mapping of grazing land and study on grazing carrying capacity to regulate rangeland management	Report and spatial data	0	No	1									
		1.2.1. Conduct survey to identify potential/critical waterhole, grassland, snag, saltlicks and any critical habitats	Survey Report	0	No		1								

	1.2. Restore and manage special and critical habitat	1.2.2. Create and improve identified waterhole, snag and saltlicks	Hectares of waterhole improved	0	Ha			1		1		1			
		1.2.3. Restoration of degraded bamboo habitat of Red panda	Degraded habitat restored	0	Ha			5			5				
		1.2.4. Carry out survey to map and document bat diversity and their habitats	Survey Report	0	No				1						
2.To protect and conserve wildlife species to maintain viable population	***2.1. Assess species distribution and threats for effective conservation***	2.1.1. Conduct survey to assess distribution and threat to Musk deer	Survey Report	0	No	1									
		2.1.2. Conduct survey to assess Galliformes diversity	Survey Report	0	No			1							
		2.1.3. Conduct survey to assess status and distribution of threatened & protected flora	Survey Report	0	No							1			
		2.1.4. Carry out survey to estimate population status and distribution of some lesser-known species like Dhole, clouded leopard, Himalayan black bear	Survey Report	0	No									1	
		2.1.5. Carry out camera trapping for annual monitoring of wildlife	Survey Report	1	No	1	1	1	1	1	1	1	1	1	1

		2.1.6. Conduct assessment for invertebrates' diversity (aquatic and terrestrial)	Survey Report	0	No								1		
		2.1.7. Carry out small mammal survey	Survey Report	0	No							1			
	2.2. Adopt and implement zero poaching strategy	2.2.1. Conduct SMART patrolling	Patrolling conducted	4	No	1	1	1	1	1	1	1	1	1	1
		2.2.2. Conduct anti-poaching activities for musk deer	Patrolling Report	0	No	1	1	1	1	1	1	1	1	1	1
		2.2.3. Integrate Unmanned Aerial Vehicle (UAV) into SMART patrolling	Report	0	No				1			1			1
	2.3. Minimize/ reduce risk of zoonotic diseases	2.3.1. Conduct zoonotic disease mapping and awareness to herders	Awareness Report	0	No		1								
		2.3.2. Monitor, immobilize and relocate feral/stray dog	Report	0	No					1					
3. To enhance socio-economic wellbeing through sustainable services and products	***3.1. Initiate and implement nature base solution***	3.1.1. Design and develop ecotourism products, Chenla	No of product	0	No		1								
		3.1.2. Promote and support Menchu management, Mankhar	No of product	0	No						1				
		3.1.3. Support Non wood forest product group (Swertia & Cane propagation-Larjab/ management group)	No of Group supported	0	No			1						1	

		3.1.4. Support bamboo enterprise development, Kangpara	No of Group supported	1	No				1							
	3.2. Assess and mitigate Human Wildlife Conflict	3.2.1. Carry out survey to map Human Wildlife Conflict (HWC) prone areas	Survey Report	0	No	1										
		3.2.2. Implement of appropriate HWC management intervention	Area covered by intervention	0	Ha					5						
		3.2.3. Improvement of pasture/grazing land	Hectares of pasture improved	0	Ha			5				5				
	3.3. Enhance participatory based natural resource management	3.3.1. Revise community forest management plan	No of CF revised/created	6	No	1	1	1	1	1	1	1	1	1	1	1
4. To ensure climate resilient landscape for coexistence of wildlife and human	***4.1. Manage watershed areas incorporating climate smart restoration in degraded land***	4.1.1. Assess watershed/spring shed and water source	Assessment Report	0	No		1									
		4.1.2. Classify and map spring shed employing hydrogeological aspect	Classification Report	0	No		1									
		4.1.3. Implement appropriate intervention measures for drying water source	Hectares of intervention areas	0	Ha			20								
		4.2.1. Conduct awareness and outreach program on climate change	No of Gewog	0	No				5							

	4.2. Climate change risk and vulnerability addressed	4.2.2. Implement Adaptation measures based on BC Climate Change Vulnerability Assessment (CCVA)	Implementation Report	0	No					1					
		4.2.3. Install Data Logger for long term Monitoring	No of logger	0	No	1									
		4.3.4. Periodic Monitoring of Weather Data Logger	Monitoring Report	0	No		1	1	1	1	1	1	1	1	1
	4.3. Strengthen waste management initiatives	4.3.1. Institute and implement Waste-in and Waste Out initiative (Kangpara and Lauri)	Reports	0	No		1					1			
		4.3.2. Installation of waste bin, signages and information boards in strategic location	No of Location	0	No			10					10		
		4.3.3. Facilitate village waste management group	No of Village	0	No		5	5	5	5	5	5	5	5	5
	4.4. Implement rural alternative energy (bio gas, storm water management & solar energy)	4.4.1. Construct/support rain water harvesting infrastructures, Chenla	No of structure	0	No						1				
		4.4.2. Support/Supply solar lighting equipment and infrastructure to herders	Household	0	No	30									

		4.4.3. Facilitate bio-gas installation initiative of Department of Livestock	Household	0	No		2									
	4.5. Implement EBA and climate smart, organic agriculture technologies and approaches in priority	4.5.1. Facilitate climate-smart agriculture program of Department of Agriculture	Household	0	No			10								
		4.5.2. Facilitate to Livestock intensification Program	Household	0	No					10						
		4.5.3. Facilitate Livestock products value chain	Household	0	No			10								
	4.6. Strengthened citizen stewardship towards biodiversity conservation	4.6.1. Initiate community base biodiversity conservation program (citizen science)	Household/member	0	No				15							
		4.6.2. Support nature club and NFE	No of schools supported	0	No	1	1	1	1	1	1	1	1	1	1	
	4.7. Sustainable resource management	4.7.1. Revise local forest management plan (LFMP)	No of LFMP Plan Revised	1	No									1		
5. To improve institutional capacity development for effective service delivery	***5.1. Strengthen BC area management***	5.1.1. Demarcate and fix boundary pillar	Completion report	1	No	1										
	5.2. Monitoring and revise climate smart management plan	5.2.1. Monitoring and evaluation as per Bhutan METT+	Monitoring Report	1	No	1	1	1	1	1	1	1	1	1	1	
		5.2.2. Midterm review of conservation management plan	Report	0	No					1						

		5.2.3. Final evaluation of Conservation Management plan	Approved management plan	0	No									1	
	5.3. Enhance professional capacity development of staff	5.3.1. Refresh technical staff on SMART data collection, planning, reporting and intelligence	Number of technical staff	20	No	10	10	10	10	10	10	10	10	10	10
		5.3.2. Need based capacity development to use latest tools and technology in the field of conservation	Number of technical staff	0	No		10		10		10		10		10
	5.4. Enhance infrastructure and mobility/utilities	5.4.1. Procurement of mobility and survey equipment	Equipment procured	0	No		1		1		1				
		5.4.2. Construction of ranger's transit camp, Kangpara	Transit camp constructed	0	No							1			
		5.4.3. Purchase laptop and accessories	Number of laptops	3	No		10						10		
		5.4.4. Procurement of office furniture	Number of offices	0	No	5					5				

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Annexure 1. List of Mammal

S/n	Common Name	Scientific Name	Family	IUCN Status
1	Asiatic Elephant	*Elephas maximus*	Elephantidae	NT
2	Asiatic Brush-tailed Porcupine	*Atherurus macrourus*	Hystricidae	LC
3	Asiatic Golden Cat	*Catopuma temminxkii*	Felidae	NT
4	Assamese macaque	*Macaca assamensis*	Cercopithecidae	NT
5	Barking Deer	*Muntiacus munjak*	Cervidae	LC
6	Bengal slow Loris	*Nycticebus bengalensis*	Lorisidae	VU
7	Bhutan Giant flying Squirrel	*Petaurista nobilis*	Sciuridae	NT
8	Binturong	*Arctictis binturong*	Viverridae	VU
9	Capped Langur	*Trachypithecus pileatus*	Cercopithecidae	VU
10	Clouded Leopard	*Neofelis nebulosa*	Felidae	VU
11	Common Leopard	*Panthera pardus*	Felidae	VU
12	Dhole	*Cuon alpinus*	Canidae	EN
13	Giant monitor Lizard	*Varanus bengalensis*	Squamata	LC
14	Gaur	*Bos gaurus*	Bovidae	VU
15	Himalayan Black Bear	*Ursus thibetanus*	Ursidae	VU
16	Himalayan Crestless Porcupine	*Hystrix brachyuran*	Hystrucidae	LC
17	Himalayan Goral	*Naemorhaedus goral*	Bovidae	NT
18	Himalayan Palm Civet	*Paguma larvata*	Viverridae	LC
19	Himalayan Pika	*Ochotona macrotis*	Ochotonidae	LC
20	Himalayan serow	*Capricornis sumatraensis*	Bovidae	VU

21	Himalayan Stripe Squirrel	*Tamiops mcclellandii*	Sciuridae	LC
22	Hoary-bellied Himalayan Squirrel	*Callosciurus pygerythrus*	Sciuridae	LC
23	Jungle cat	*Felis chaus*	Felidae	LC
24	Large Indian Civet	*Viverra zibetha*	Viverridae	NT
25	Leopard Cat	*Prionailurus bengalensis*	Felidae	LC
26	Malayan giant squirrel	*Ratufa bicolor*	Sciuridae	NT
27	Marbled Cat	*Pardofelis marmorata*	Felidae	VU
28	Mongoose	*Herpestes* sp.	Herpestidae	LC
29	Musk Deer	*Moschus* spp.	Ceruidae	EN
30	Rat	*Rattus* spp.	Muridae	LC
31	Red Panda	*Ailurus fulgens*	Ailuridae	EN
32	Sambar Deer	*Rusa unicolar*	Cervidae	NT
33	Spotted linsang	*Priobodon pardicolor*	Viverridae	LC
34	Squirrel	*Dremomys lokriah*	Sciuridae	LC
35	Three-striped Squirrel	*Funambulus palmarum*	Sciuridae	LC
36	Tiger	*Panthera tigris*	Felidae	EN
37	Wild Pig	*Sus scrofa*	Suidae	LC
38	Yellow-throated marten	*Martes flavigual*	Mustelidae	LC

Annexure 2. Bird checklist

S/n	Common Name	Scientific Name	Family	IUCN status
1	Alpine Accentor	*Prunella collaris*	Prunellidae	LC
2	Ashy Drongo	*Dicrurus leucophaeus*	Dicruridae	LC

3	Ashy-throated Warbler	*Phylloscopus maculipennis*	Phylloscopidae	LC
4	Asian Barred Owlet	*Glaucidium cuculoides*	Strigidae	LC
5	Asian-fairy Bluebird	*Irena puella*	Irenidae	LC
6	Banded Bay Cuckoo	*Cacomantis sonneratii*	Cuculidae	LC
7	Barred-cuckoo Dove	*Macropygia unchall*	Columbidae	LC
8	Bar-throated Siva	*Actinodura strigula*	Leiothrichidae	LC
9	Bay Woodpecker	*Blythipicus pyrrhotis*	Picidae	LC
10	Beautiful Nuthatch	*Sitta formosa*	Sittidae	VU
11	Beautiful Sibia	*Heterophasia pulchella*	Leiothrichidae	LC
12	Bhutan Laughingthrush	*Trochalopteron imbricatum*	Leiothrichidae	LC
13	Black Bulbul	*Hypsipetes leucocephalus*	Pycnonotidae	LC
14	Black Drongo	*Dicrurus macrocercus*	Dicruridae	LC
15	Black Eagle	*Ictinaetus malaiensis*	Accipitridae	LC
16	Black Stork	*Ciconia nigra*	Ciconiidae	LC
17	Black-crested Bulbul	*Rubigula flaviventris*	Pycnonotidae	LC
18	Black-faced Laughingthrush	*Trochalopteron affine*	Leiothrichidae	LC
19	Black-hooded Oriole	*Oriolus xanthornus*	*Oriolidae*	LC
20	Black-napped Monarch	*Hypothymis azurea*	Monarchidae	LC
21	Black-throated Green Warbler	*Setophaga virens*	Parulidae	LC
22	Black-throated Sunbird	*Aethopyga saturata*	Nectariniidae	LC
23	Black-throated Thrush	*Turdus atrogularis*	Turdidae	LC
24	Black-throated Tit	*Aegithalos concinnus*	Aegithalidae	LC

25	Black-winged Cuckoo shrike	*Coracina melaschistos*	Campephagidae	LC
26	Blood Pheasant	*Ithaginis cruentus*	Phasianidae	LC
27	Blue Rock Thrush	*Monticola solitarius*	Muscicapidae	LC
28	Blue Whistling Thrush	*Myophonus caeruleus*	Muscicapidae	LC
29	Blue-bearded Bee-eater	*Nyctyornis athertoni*	Meropidae	LC
30	Blue-capped Rock Thrush	*Monticola cinclorhyncha*	Muscicapidae	LC
31	Blue-fronted Redstart	*Phoenicurus frontalis*	Muscicapidae	LC
32	Blue-throated Barbet	*Psilopogon asiaticus*	Megalaimidae	LC
33	Blue-winged Laughingthrush	*Trochalopteron squamatum*	Leiothrichidae	LC
34	Bronzed Drongo	*Dicrurus aeneus*	Dicruridae	LC
35	Brown Dipper	*Cinclus pallasii*	Cinclidae	LC
36	Brown Parrot Bill	*Cholornis unicolor*	Sylviidae	LC
37	Brown Shrike	*Lanius cristatus*	Laniidae	LC
38	Brownish-flanked Bush Warbler	*Horornis fortipes*	Scotocercidae	LC
39	Cattle Egret	*Bubulcus ibis*	Ardeidae	LC
40	Chestnut-bellied Rock Thrush	*Monticola rufiventris*	Muscicapidae	LC
41	Chestnut-crowned Laughingthrush	*Trochalopteron erythrocephalum*	Leiothrichidae	LC
42	Chestnut-crowned Warbler	*Phylloscopus castaniceps*	Phylloscopidae	LC
43	Chestnut-tailed Starling	*Sturnia malabarica*	Sturnidae	LC
44	Collared Grosbeak	*Mycerobas affinis*	Fringillidae	LC
45	Common Green-Magpie	*Cissa chinensis*	Corvidae	LC

46	Common Hill Myna	*Gracula religiosa*	Sturnidae	LC
47	Common hoopoe	*Upupa epops*	Upupidae	LC
48	Common Kestrel	*Falco tinnunculus*	Falconidae	LC
49	Common Kingfisher	*Alcedo atthis*	Alcedinidae	LC
50	Common Myna	*Acridotheres tristis*	Sturnidae	LC
51	Common Rose finch	*Carpodacus erythrinus*	Fringillidae	LC
52	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	LC
53	Common Tailorbird	*Orthotomus sutorius*	Cisticolidae	LC
54	Crested Kingfisher	*Megaceryle lugubris*	Alcedinidae	LC
55	Crested Serpent Eagle	*Spilornis cheela*	Accipitridae	LC
56	Crimson Sunbird	*Aethopyga siparaja*	Nectariniidae	LC
57	Crimson-breasted Woodpecker	*Dryobates cathpharius*	Picidae	LC
58	Crimson-brown Finch	*Neochmia phaeton*	Estrildidae	LC
59	Darjeeling Woodpecker	*Dendrocopos darjellensis*	Picidae	LC
60	Dark-sided flycatcher	*Muscicapa sibirica*	Muscicapidae	LC
61	Dollar Bird	*Eurystomus orientalis*	Coraciidae	LC
62	Emerald Dove	*Chalcophaps indica*	Columbidae	LC
63	Eurasian Cuckoo	*Cuculus canorus*	Cuculidae	LC
64	Eurasian Wren	*Troglodytes troglodytes*	Troglodytidae	LC
65	Fire-tailed Myzornis	*Myzornis pyrrhoura*	Sylviidae	LC
66	Fire-tailed Sunbird	*Aethopyga ignicauda*	Nectariniidae	LC
67	Forest Wagtail	*Dendronanthus indicus*	Motacillidae	LC
68	Golden Babbler	*Cyanoderma chrysaeum*	Timaliidae	LC
69	Golden Bush-Robin	*Tarsiger chrysaeus*	Muscicapidae	LC

70	Golden-fronted Leafbird	*Chloropsis aurifrons*	Chloropseidae	LC
71	Golden-napped Finch	*Pyrrhoplectes epauletta*	Fringillidae	LC
72	Golden-throated Barbet	*Psilopogon franklinii*	Megalaimidae	LC
73	Gray Bush chat	*Saxicola ferreus*	Muscicapidae	LC
74	Gray Treepie	*Dendrocitta formosae*	Corvidae	LC
75	Gray Wagtail	*Motacilla cinerea*	Motacillidae	LC
76	Gray-backed Shrike	*Lanius tephronotus*	Laniidae	LC
77	Gray-capped Pygmy Woodpecker	*Yungipicus canicapillus*	Picidae	LC
78	Gray-chinned Minivet	*Pericrocotus solaris*	Campephagidae	LC
79	Gray-crested Tit	*Lophophanes dichrous*	Paridae	LC
80	Gray-headed Canary-Flycatcher	*Culicicapa ceylonensis*	Stenostiridae	LC
81	Gray-headed Parakeet	*Psittacula finschii*	Psittaculidae	NT
82	Great Barbet	*Psilopogon virens*	Megalaimidae	LC
83	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	LC
84	Great Hornbill	*Buceros bicornis*	Bucerotidae	VU
85	Greater Golden back	*Chrysocolaptes guttacristatus*	Picidae	LC
86	Greater Necklaced Laughingthrush	*Pterorhinus pectoralis*	Leiothrichidae	LC
87	Greater Rufus-headed parrotbill	*Psittiparus bakeri*	Sylviidae	LC
88	Greater Yellow nape	*Chrysophlegma flavinucha*	Picidae	LC
89	Green-backed Tit	*Parus monticolus*	Paridae	LC
90	Green-billed Malkoha	*Phaenicophaeus tristis*	Cuculidae	LC

91	Green-tailed Sunbird	*Aethopyga nipalensis*	Nectariniidae	LC
92	Grey-headed Woodpecker	*Picus canus*	Picidae	LC
93	Grey-winged Blackbird	*Turdus boulboul*	Turdidae	LC
94	Hair-crested Drongo	*Dicrurus hottentottus*	Dicruridae	LC
95	Hill Partridge	*Arborophila torqueola*	Phasianidae	LC
96	Himalayan Buzzard	*Buteo refectus*	Accipitridae	LC
97	Himalayan Monal	*Lophophorus impejanus*	Phasianidae	LC
98	Hoary-throated Barwing	*Actinodura nipalensis*	Leiothrichidae	LC
99	Hodgson's Treecreeper	*Certhia hodgsoni*	Certhiidae	LC
100	Indian Pond-Heron	*Ardeola grayii*	Ardeidae	LC
101	Indian Roller	*Coracias benghalensis*	Coraciidae	LC
102	Jungle Myna	*Acridotheres fuscus*	Sturnidae	LC
103	Jungle Owlet	*Glaucidium radiatum*	Strigidae	LC
104	Large Hawk-Cuckoo	*Hierococcyx sparverioides*	Cuculidae	LC
105	Large-billed Crow	*Corvus macrorhynchos*	Corvidae	LC
106	Large-tailed Nightjar	*Caprimulgus macrurus*	Caprimulgidae	LC
107	Lemon-rumped Warbler	*Phylloscopus chloronotus*	Phylloscopidae	LC
108	Lesser Yellow nape	*Picus chlorolophus*	Picidae	LC
109	Little Forktail	*Enicurus scouleri*	Muscicapidae	LC
110	Long-tailed Broadbill	*Psarisomus dalhousiae*	Eurylaimidae	LC
111	Long-tailed Minivet	*Pericrocotus ethologus*	Campephagidae	LC
112	Long-tailed Sibia	*Heterophasia picaoides*	Leiothrichidae	LC

113	Long-tailed Strike	*Lanius schach*	Laniidae	LC
114	Ludlow's Fulvetta	*Fulvetta ludlowi*	Sylviidae	LC
115	Mountain Imperial Pigeon	*Ducula badia*	Columbidae	LC
116	Ms. Gould's Sunbird	*Aethopyga gouldiae*	Nectariniidae	LC
117	Nepal Fulvetta	*Alcippe nipalensis*	Leiothrichidae	LC
118	Nepal House-Martin	*Delichon nipalense*	Hirundinidae	LC
119	Olive-backed Pipit	*Anthus hodgsoni*	Motacillidae	LC
120	Orange-headed Thrush	*Geokichla citrina*	*Turdidae*	LC
121	Oriental cuckoo	*Cuculus optatus*	Cuculidae	LC
122	Oriental skylark	*Alauda gulgula*	Alaudidae	LC
123	Oriental White-Eye	*Zosterops palpebrosus*	Zosteropidae	LC
124	Oriental-turtle Dove	*Streptopelia orientalis*	Columbidae	LC
125	Plain Mountain Finch	*Leucosticte nemoricola*	Fringillidae	LC
126	Plumbeous Water Redstart	*Phoenicurus fuliginosus*	Muscicapidae	LC
127	Red Crossbill	*Loxia curvirostra*	Fringillidae	LC
128	Red Junglefowl	*Gallus gallus*	Phasianidae	LC
129	Red-billed Leiothrix	*Leiothrix lutea*	Leiothrichidae	LC
130	Red-headed Bullfinch	*Pyrrhula erythrocephala*	Fringillidae	LC
131	Red-headed Trogon	*Harpactes erythrocephalus*	Trogonidae	LC
132	Red-tailed Minla	*Minla ignotincta*	Leiothrichidae	LC
133	Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	LC
134	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	LC
135	Red-whiskered Bulbul	*Pycnonotus jocosus*	Pycnonotidae	LC

136	Rufous Sibia	*Heterophasia capistrata*	Leiothrichidae	LC
137	Rufous Treepie	*Dendrocitta vagabunda*	Corvidae	LC
138	Rufous-bellied Woodpecker	*Dendrocopos hyperythrus*	Picidae	LC
139	Rufous-breasted Accentor	*Prunella strophiata*	Prunellidae	LC
140	Rufous-capped Babbler	*Cyanoderma ruficeps*	Timaliidae	LC
141	Rufous-necked Hornbill	*Aceros nipalensis*	Bucerotidae	VU
142	Rufous-vented Tit	*Periparus rubidiventris*	Paridae	LC
143	Rufous-vented Yuhina	*Yuhina occipitalis*	Zosteropidae	LC
144	Rusty-cheeked Scimitar Babbler	*Erythrogenys erythrogenys*	Timaliidae	LC
145	Rusty-flanked Tree Creeper	*Certhia nipalensis*	Certhiidae	LC
146	Satyr Tragopan	*Tragopan satyra*	Phasianidae	NT
147	Scaly-breasted Munia	*Lonchura punctulata*	Estrildidae	LC
148	Scarlet Minivet	*Pericrocotus speciosus*	Campephagidae	LC
149	Silver-eared Mesia	*Leiothrix argentauris*	Leiothrichidae	LC
150	Slaty-backed Forktail	*Enicurus schistaceus*	Muscicapidae	LC
151	Slaty-blue Flycatcher	*Ficedula tricolor*	Muscicapidae	LC
152	Slender-billed Oriole	*Oriolus tenuirostris*	Oriolidae	LC
153	Small Niltava	*Niltava macgrigoriae*	Muscicapidae	LC
154	Speckled Wood-pigeon	*Columba hodgsonii*	Columbidae	LC

155	Spotted Dove	*Spilopelia chinensis*	Columbidae	LC
156	Spotted Forktail	*Enicurus maculatus*	Muscicapidae	LC
157	Spotted Laughingthrush	*Ianthocincla ocellata*	Leiothrichidae	LC
158	Spotted Nutcracker	*Nucifraga caryocatactes*	Corvidae	LC
159	Streak-breasted Scimitar Babbler	*Pomatorhinus ruficollis*	Timaliidae	LC
160	Striated Bulbul	*Pycnonotus striatus*	Pycnonotidae	LC
161	Striated Laughingthrush	*Grammatoptila striata*	Leiothrichidae	LC
162	Striated Yuhina	*Staphida castaniceps*	Zosteropidae	LC
163	Stripe-throated Yuhina	*Yuhina gularis*	Zosteropidae	LC
164	Taiga Flycatcher	*Ficedula albicilla*	Muscicapidae	LC
165	Tickell's Leaf Warbler	*Phylloscopus affinis*	Phylloscopidae	LC
166	Tree Pipit	*Anthus trivialis*	Motacillidae	LC
167	Ultramarine Flycatcher	*Ficedula superciliaris*	Muscicapidae	LC
168	Verditer Flycatcher	*Eumyias thalassinus*	Muscicapidae	LC
169	Wedge-tailed Green-Pigeon	*Treron sphenurus*	Columbidae	LC
170	Whiskered Yuhina	*Yuhina flavicollis*	Zosteropidae	LC
171	Whistler's Warbler	*Phylloscopus whistleri*	Phylloscopidae	LC
172	White Wagtail	*Motacilla alba*	Motacillidae	LC
173	White-browed Fulvetta	*Fulvetta vinipectus*	Sylviidae	LC
174	White-browed Rose finch	*Carpodacus thura*	Fringillidae	LC
175	White-capped Redstart	*Phoenicurus leucocephalus*	Muscicapidae	LC

176	White-collared Blackbird	*Turdus albocinctus*	Turdidae	LC
177	White-crested Laughingthrush	*Garrulax leucolophus*	Leiothrichidae	LC
178	White-napped Yuhina	*Yuhina bakeri*	Zosteropidae	LC
179	White-throated Bulbul	*Alophoixus flaveolus*	Pycnonotidae	LC
180	White-throated Fantail	*Rhipidura albicollis*	Rhipiduridae	LC
181	White-throated Kingfisher	*Halcyon smyrnensis*	Alcedinidae	LC
182	White-throated Laughingthrush	*Pterorhinus albogularis*	Leiothrichidae	LC
183	White-throated Redstart	*Phoenicurus schisticeps*	Muscicapidae	LC
184	White-winged Grosbeak	*Mycerobas carnipes*	Fringillidae	LC
185	Yellow-bellied Fantail	*Chelidorhynx hypoxanthus*	Stenostiridae	LC
186	Yellow-billed Blue-Magpie	*Urocissa flavirostris*	Corvidae	LC
187	Yellow-breasted Greenfinch	*Chloris spinoides*	Fringillidae	LC
188	Yellow-vented Warbler	*Phylloscopus cantator*	Phylloscopidae	LC

Annexure 3. List of flora

S/n	Species	Family
1	*Abies densa*	Pinaceae
2	*Acacia gageana*	Fabaceae
3	*Acanthocalyx nepalensis*	Caprifoliaceae
4	*Acer campbellii*	Sapindaceae
5	*Acer hookeri*	Sapindaceae
6	*Acer pactinatum*	Sapindaceae
7	*Acer sterculiacum*	Sapindaceae
8	*Achyranthes aspera*	Amaranthaceae
9	*Achyrospermum wallichianum*	Lamiaceae
10	*Aconogonon campanulatum*	Polygonaceae
11	*Aconogonon molle*	Polygonaceae
12	*Agapetes incurvata*	Ericaceae
13	*Agapetes serpens*	Ericaceae
14	*Agapetes smithiana*	Ericaceae
15	*Agapetes variegata*	Ericaceae
16	*Ageratina adenophora*	Asteraceae
17	*Agrimonia pilosa*	Rosaceae
18	*Agrostophyllum callosum*	Orchidaceae
19	*Ainsliaea aptera*	Asteraceae
20	*Ainsliaea latifolia*	Asteraceae
21	*Alnus nepalensis*	Betulaceae
22	*Anaphalis contorta*	Asteraceae
23	*Anaphalis nepalensis*	Asteraceae
24	*Anaphalis triplinervis*	Asteraceae
25	*Androsace geranifolia*	Primulaceae
26	*Anemone rivularis*	Ranunculaceae

27	*Anemone rupestris*	Ranunculaceae
28	*Aphanamixis polystachya*	Meliaceae
29	*Ardisia macrocarpa*	Myrsinaceae
30	*Arisaema consanguinum*	Araceae
31	*Arisaema nepenthoides*	Araceae
32	*Arisema sp.*	Araceae
33	*Aristolochia griffithii*	Aristolochiaceae
34	*Artimesia myrantha*	Asteraceae
35	*Artocarpus chama*	Moraceae
36	*Arundina racemosa*	Orchidaceae
37	*Aster albescens*	Asteraceae
38	*Astilbe rivularis*	Saxifragaceae
39	*Astragallus sp*	Fabaceae
40	*Baliospermum montanum*	Euphorbiaceae
41	*Beilschmedia roxburghiana*	Lauraceae
42	*Beilschmiedia dalzellii*	Lauraceae
43	*Benthamedia capitata*	Cornaceae
44	*Berberis aristata*	Berberidaceae
45	*Berberis griffithi*	Berberidaceae
46	*Berberis sp.*	Berberidaceae
47	*Bergenia purpurescens*	Saxifragaceae
48	*Betula alnoides*	Betulaceae
49	*Betula utilis*	Betulaceae
50	*Bidens pilosa*	Asteraceae
51	*Bistorta macrophylla*	Polygonaceae
52	*Bistorta vaccinifolia*	Polygonaceae
53	*Bistorta vivipara*	Polygonaceae
54	*Bistota sp*	Polygonaceae
55	*Boehmeria penduliflora*	Urticaceae

56	*Boschniakia himalaica*	Orobanchaceae
57	*Brassaiopsis glomerata*	Araliaceae
58	*Brassaiopsis mitis*	Araliaceae
59	*Bulbophyllum reptanas*	Orchidaceae
60	*Bulbophyllum trongsaense*	Orchidaceae
61	*Calanthe minii*	Orchidaceae
62	*Calanthe plantaginea*	Orchidaceae
63	*Calanthe yuksumnensis*	Orchidaceae
64	*Campanulla pallide*	Campanulaceae
65	*Campylandra aurantiaca*	Asparagacea
66	*Campylandra* sp.	Asparagacea
67	*Canabis sativum*	Cannabaceae
68	*Capparis acutifolia*	Cannabaceae
69	*Capsella bursa-pastoris*	Brassicaceae
70	*Capylotropis speciosa*	Fabaceae
71	*Cardamine macrophylla*	Brassicaceae
72	*Cardamine* sp.	Brassicaceae
73	*Cardemine macrophylla*	Brassicaceae
74	*Cardiocrinum giganteum*	Liliaceae
75	*Carex* sp.	Cyperaceae
76	*Carpinus viniumna*	Betulaceae
77	*Cassiope fastigiata*	Ericaceae
78	*Castanopsis hystrix*	Fabaceae
79	*Castanopsis tribuloies*	Fabaceae
80	*Centella asiatica*	Apiaceae
81	*Chimonobambusa callosa*	Poaceae
82	*Chrisoprinam nepalensis*	Coriariaceae
83	*Chrysosplenium nepalense*	Saxifragaceae
84	*Chukrasia tabularis*	Meliaceae

85	*Cinnamomum javanicum*	Lauraceae
86	*Cinnamomum* sp.	Lauraceae
87	*Cirsium eriophoroides*	Asteraceae
88	*Cirsium lipskyi*	Asteraceae
89	*Clematis connata*	Ranunculaceae
90	*Clematis* sp.	Ranunculaceae
91	*Clerodendrum serratum*	Lamiaceae
92	*Clinopodium umbrosum*	Lamiaceae
93	*Clintonia udensis*	Liliaceae
94	*Codonopsis* sp.	Campanulaceae
95	*Coelogyne corymbosa*	Orchidaceae
96	*Commellina* sp.	Commelinaceae
97	*Conyzaa* sp.	Asteraceae
98	*Cortiella hookeri*	Apiaceae
99	*Corylopsis himaliayana*	Hamamelidaceae
100	*Corylux ferox*	Betulaceae
101	*Cotoneaster acuminatus*	Rosaceae
102	*Cotoneaster microphyllus*	Rosaceae
103	*Cotoneaster nitidus*	Rosaceae
104	*Craufurd speciosa*	Gentianaceae
105	*Crotalaria sessiliflora*	Fabaceae
106	*Croton bonplandianus*	Euphorbiaceae
107	*Croton joufra*	Euphorbiaceae
108	*Cyananthus macrocalyx*	Campanulaceae
109	*Cymbidium erythraeum*	Orchidaceae
110	*Cymbidium iridoides*	Orchidaceae
111	*Cymbopogon flexuosa*	Poaceae
112	*Cynoglosum furcatum*	Boraginaceae
113	*Daphne bhoula*	Thymelaeaceae

114	*Debregeasia longifolia*	Urticaceae
115	*Delphinium cooperi*	Ranunculaceae
116	*Delphinium* sp.	Ranunculaceae
117	*Dendrobium fuscescens*	Orchidaceae
118	*Dendrobium longicornu*	Orchidaceae
119	*Dendrobium nobile*	Orchidaceae
120	*Dendrocnide sinuata*	Urticaceae
121	*Desmodium* sp.	Fabaceae
122	*Dichroa febrifuga*	Hydrangeaceae
123	*Dichrocephala integrifolia*	Asteraceae
124	*Diplazium* sp.	Dennstaedtiaceae
125	*Diploknema* sp.	Sapotaceae
126	*Dipsacus inermus*	Caprifoliaceae
127	*Docynia indica*	Rosaceae
128	*Dodecadenia grandiflora*	Lauraceae
129	*Drynaria quercifolia*	Polypodiaceae
130	*Duchesnea indica*	Rosaceae
131	*Duetzia corymbosa*	Rosaceae
132	*Dufrenoya granulata*	Santalaceae
133	*Elaegnus parvifolia*	Elaeagnaceae
134	*Elaeocarpus* sp.	Elaeocarpaceae
135	*Elatostema linearilobatum*	Urticaceae
136	*Elatostema lineolatum*	Urticaceae
137	*Elatostema obtusum*	Urticaceae
138	*Elatostema platyphyllum*	Urticaceae
139	*Elatostema* sp.	Urticaceae
140	*Elsholtzia frticosa*	Lamiaceae
141	*Elsholtzia strobilifera*	Lamiaceae
142	*Elshotzia fructicosa*	Lamiaceae

143	*Engelhardia spicata*	Juglandaceae
144	*Enkianthus deflexus*	Ericaceae
145	*Epilobium royleanum*	Onagraceae
146	*Epilobium* sp.	Onagraceae
147	*Euonomous* sp.	Celastraceae
148	*Euonymus frigidus*	Celastraceae
149	*Euonymus tingens*	Celastraceae
150	*Euphorbia stracheyi*	Euphorbiaceae
151	*Eurya acuminata*	Pentaphylacaceae
152	*Eurya cavinervis*	Pentaphylacaceae
153	*Eurya cerasifolia*	Pentaphylacaceae
154	*Exbuclanda populnea*	Hamamelidaceae
155	*Fagopyrium dibotrys*	Polygonaceae
156	*Ficus auroculata*	Moraceae
157	*Ficus neriifolia*	Moraceae
158	*Ficus* sp.	Moraceae
159	*Fragaria nubicola*	Rosaceae
160	*Fragaria* sp.	Rosaceae
161	*Fraxinus floribunda*	Oleaceae
162	*Galingsoga parvifolia*	Asteraceae
163	*Galium aparine*	Rubiaceae
164	*Gaultheria fragnissiama*	Ericaceae
165	*Gaultheria griffithiana*	Ericaceae
166	*Gaultheria hookeri*	Ericaceae
167	*Gaultheria nummularioides*	Ericaceae
168	*Gaultheria pyroloides*	Ericaceae
169	*Gaultheria semi-infera*	Ericaceae
170	*Gaultheria trichophylla*	Ericaceae
171	*Gentiana elwesii*	Gentianaceae

172	*Gentiana gilvostriata*	Gentianaceae
173	*Gentiana tubiflora*	Gentianaceae
174	*Gentiania pedicellata*	Gentianaceae
175	*Gerinum nepalensis*	Gentianaceae
176	*Girardiana diversifolia*	Urticaceae
177	*Gleichenia gigantea*	Gleicheniaceae
178	*Glochidion velutinum*	Phyllanthaceae
179	*Goodyera foliosa*	Orchidaceae
180	*Goodyera schlechtendaliana*	Orchidaceae
181	*Hackelia uncenata*	Boraginaceae
182	*Hedera nepalensis*	Araliaceae
183	*Hemiphragma heteriophylum*	Scrophulariaceae
184	*Heracleum* sp.	Apiaceae
185	*Holboellia latifolia*	Lardizabalaceae
186	*Hydrangae heteromalla*	Hydrangeaceae
187	*Hydrangea macrophylla*	Hydrangeaceae
188	*Hydrocotyle himalica*	Apiaceae
189	*Hydrocotyle nepalensis*	Apiaceae
190	*Hymenopogon parasiticus*	Rubiaceae
191	*Hypericum esodeoides*	Hypericaceae
192	*Hypericum japonicum*	Hypericaceae
193	*Hyposis aurea*	Hypoxidaceae
194	*Hyrangae anomala*	Hydrangeaceae
195	*Ilex dipyrena*	Apocynaceae
196	*Ilex hookeri*	Apocynaceae
197	*Illicium griffithii*	Schisandraceae
198	*Imaptients* sp.	Balsaminaceae
199	*Impatiens arguta*	Balsaminaceae
200	*Impatiens stenantha*	Balsaminaceae

201	*Impatients* sp.	Balsaminaceae
202	*Indigofera* sp.	Fabaceae
203	*Isodon* sp.	Lamiaceae
204	*Ixora coccinea*	Rubiaceae
205	*Ixora javanica*	Rubiaceae
206	*Jacobaea vulgaris*	Asteraceae
207	*Jasminum disperum*	Oleaceae
208	*Juglans regia*	Juglandaceae
209	*Juncus* sp.	Juncaceae
210	*Juncus thomsonii*	Juncaceae
211	*Juniperus recurva*	Cupressaceae
212	*Koenigia campanulata*	Polygonaceae
213	*Koenigia mollies*	Polygonaceae
214	*Laportea terminalis*	Urticaceae
215	*Larix griffithii*	Pinaceae
216	*Leea asiatica*	Vitaceae
217	*Leea indica*	Vitaceae
218	*Lepionurus sylvestris*	Opiliaceae
219	*Leucas cilita*	Lamiaceae
220	*Leycesteria formosa*	Caprifoliaceae
221	*Ligularia amplexicaulis*	Asteraceae
222	*Ligularia atkinsonii*	Asteraceae
223	*Ligularia mortonii*	Asteraceae
224	*Ligustrium confuscum*	Oleaceae
225	*Lindera neesiana*	Lauraceae
226	*Lindera pulcherima*	Lauraceae
227	*Lindera* sp.	Lauraceae
228	*Liparis* sp.	Orchidaceae
229	*Lithocarpus fenestratus*	Fabaceae

230	*Lithocarpus sp.*	Fabaceae
231	*Litsea elongata*	Lauraceae
232	*Lobelia montana*	Campanulaceae
233	*Lonicera acuminata*	Caprifoliaceae
234	*Lonicera* sp.	Caprifoliaceae
235	*Lortia hookeri*	Caprifoliaceae
236	*Lycopodium*	Lycopodiaceae
237	*Lycopodium clavatum*	Lycopodiaceae
238	*Lycopodium serratum*	Lycopodiaceae
239	*Lyoni ovalifolia*	Ericaceae
240	*Lyonia villosa*	Ericaceae
241	*Lysimachia prolifera*	Primulaceae
242	*Lysionotos serratus*	Gesneriaceae
243	*Macaranga pustulata*	Euphorbiaceae
244	*Maesa chisia*	Myrsinaceae
245	*Maesa indica*	Myrsinaceae
246	*Maesa rugosa*	Myrsinaceae
247	*Magnolia campbelli*	Magnoliaceae
248	*Magnolia globosa*	Magnoliaceae
249	*Magnolia* sp.	Magnoliaceae
250	*Maianthemum fuscum*	Asparagacea
251	*Maianthemum oleraceum*	Asparagacea
252	*Mazus surculous*	Mazaceae
253	*Melanoseris cyanea*	Asteraceae
254	*Melissa axillaris*	Lamiaceae
255	*Melosma pinnata*	Sabiaceae
256	*Merriliopanax alpinus*	Araliaceae
257	*Mgrictis wallichi*	Asteraceae
258	*Michelia champaca*	Magnoliaceae

259	*Michelia doltsopa*	Magnoliaceae
260	*Michelia velutina*	Magnoliaceae
261	*Mitrephora harai*	Annonaceae
262	*Monachosorum henryi*	Dennstaedtiaceae
263	*Monotropa uniflora*	Ericaceae
264	*Myriactis wallichi*	Asteraceae
265	*Myrica esculanta*	Myricaceae
266	*Myrisene semiserrata*	Myrsinaceae
267	*Neolitsea foliosa*	Lauraceae
268	*Notochaete hamosa*	Lamiaceae
269	*Obernia filcata*	Orchidaceae
270	*Oberonia* sp.	Orchidaceae
271	*Ophiopogon clarkeii*	Asparagacea
272	*Osbeckia nepalensis*	Melastomataceae
273	*Osmanthus* sp.	Oleaceae
274	*Osmanthus suavis*	Oleaceae
275	*Osmuda cinnamonea*	Osmundaceae
276	*Ostodes paniculata*	Euphorbiaceae
277	*Otochillus* sp.	Orchidaceae
278	*Otochilus lancilabius*	Orchidaceae
279	*Oxalis corniculata*	Oxalidaceae
280	*Oxalis griffitaii*	Oxalidaceae
281	*Panax pseudogenshing*	Araliaceae
282	*Pantanpanax* sp.	Asteraceae
283	*Pantapanax fragrans*	Asteraceae
284	*Paracarpa carnosa*	Apocynaceae
285	*Parachetus communis*	Fabaceae
286	*Parasassafras* sp.	Lauraceae
287	*Paris polyphylla*	Melanthiaceae

288	*Peperomia tetraphylla*	Piperaceae
289	*Peracarpa carnosa*	Campanulaceae
290	*Persea clarkeana*	Lauraceae
291	*Persea duthiei*	Lauraceae
292	*Persea fructifera*	Lauraceae
293	*Persea* sp.	Lauraceae
294	*Persicaria capitata*	Polygonaceae
295	*Persicaria chinensis*	Polygonaceae
296	*Persicaria nepalensis*	Polygonaceae
297	*Persicaria runcinata*	Polygonaceae
298	*Phaius flavus*	Orchidaceae
299	*Phalaenopsis taenialis*	Orchidaceae
300	*Phoebe goalparensis*	Lauraceae
301	*Pholidota pallida*	Orchidaceae
302	*Photinia integrifolia*	Rosaceae
303	*Phyllanthus* sp.	Phyllanthaceae
304	*Pieris formosa*	Ericaceae
305	*Pilea hookeriana*	Urticaceae
306	*Pilea insilens*	Urticaceae
307	*Pilea microphylla*	Urticaceae
308	*Pilea* sp.	Urticaceae
309	*Pilea symmeria*	Urticaceae
310	*Pinalia leucantha*	Orchidaceae
311	*Pinus bhutanica*	Pinaceae
312	*Piper chuvya*	Piperaceae
313	*Piper longum*	Piperaceae
314	*Plagiogara pycnophylla*	Plagiogyriaceae
315	*Plantago erosa*	Plantaginaceae
316	*Platanthera sikkimensis*	Orchidaceae

317	*Pleione praecox*	Orchidaceae
318	*Pogostemon benghalensis*	Lamiaceae
319	*Pogostemon elsholtzioides*	Lamiaceae
320	*Polyalthia* sp.	Annonaceae
321	*Polygonatum punctatum*	Asparagacea
322	*Polystichum* sp.	Dennstaedtiaceae
323	*Polystichum squarrosum*	Dennstaedtiaceae
324	*Potentilla anserina*	Rosaceae
325	*Potentilla indica*	Rosaceae
326	*Pouzolzia hirta*	Urticaceae
327	*Primula bhutanica*	Primulaceae
328	*Primula bractosa*	Primulaceae
329	*Primula glabra*	Primulaceae
330	*Primula grasilipes*	Primulaceae
331	*Primula listeri*	Primulaceae
332	*Prunella vulgaris*	Lamiaceae
333	*Prunus himalaicus*	Rosaceae
334	*Prunus napaulensis*	Rosaceae
335	*Prunus rufa*	Rosaceae
336	*Prunus* sp.	Rosaceae
337	*Pseudognaphalium affine*	Asteraceae
338	*Pteridium aquilium*	Dennstaedtiaceae
339	*Pterospermum javanicum*	Malvaceae
340	*Pyrola corbiere*	Ericaceae
341	*Quercus glauca*	Fabaceae
342	*Quercus griffithi*	Fabaceae
343	*Quercus lamellosa*	Fabaceae
344	*Quercus oxyodon*	Fabaceae
345	*Rananculus chinensis*	Ranunculaceae

346	*Ranunculus diffusus*	Ranunculaceae
347	*Rheum* sp.	Polygonaceae
380	*Rhodendron falconeri*	Ericaceae
381	*Rhodendron griffithinium*	Ericaceae
382	*Rhodendron kendikeri*	Ericaceae
348	*Rhodendron keysii*	Ericaceae
349	*Rhodeodendron lindleyi*	Ericaceae
350	*Rhododendron anthopogon*	Ericaceae
351	*Rhododendron arborum*	Ericaceae
352	*Rhododendron arborum Var. roseum*	Ericaceae
353	*Rhododendron argipeplum*	Ericaceae
354	*Rhododendron barbatum*	Ericaceae
355	*Rhododendron camelliflorum*	Ericaceae
356	*Rhododendron campylocarpum*	Ericaceae
357	*Rhododendron cinnabarinum*	Ericaceae
358	*Rhododendron dalhousiae*	Ericaceae
359	*Rhododendron edgeworthii*	Ericaceae
360	*Rhododendron falconari*	Ericaceae
361	*Rhododendron fulgens*	Ericaceae
362	*Rhododendron glaucophyllum*	Ericaceae
363	*Rhododendron grande*	Ericaceae
364	*Rhododendron hodgsonii*	Ericaceae
365	*Rhododendron kendrickaii*	Ericaceae
366	*Rhododendron kesangai Var. album*	Ericaceae
367	*Rhododendron kesangiae*	Ericaceae
368	*Rhododendron kesangiae var. album*	Ericaceae
369	*Rhododendron keysii*	Ericaceae
370	*Rhododendron lanatum*	Ericaceae
371	*Rhododendron lepidotum*	Ericaceae

372	*Rhododendron lindlei*	Ericaceae
373	*Rhododendron maddenii*	Ericaceae
374	*Rhododendron papillatum*	Ericaceae
375	*Rhododendron pendulum*	Ericaceae
376	*Rhododendron setosum*	Ericaceae
377	*Rhododendron thomsonii*	Ericaceae
378	*Rhododendron triflorum*	Ericaceae
379	*Rhododendron wightii*	Ericaceae
383	*Rhus chinensis*	Amaranthaceae
384	*Rhus* sp.	Amaranthaceae
385	*Ribes himalense*	Grossulariaceae
386	*Ribes laciniatum*	Grossulariaceae
387	*Ribes* sp.	Grossulariaceae
388	*Rosa sericea*	Rosaceae
389	*Rubia cardifolia*	Rubiaceae
390	*Rubus biflorus*	Rosaceae
391	*Rubus calycinus*	Rosaceae
392	*Rubus ellipticus*	Rosaceae
393	*Rubus fockeanus*	Rosaceae
394	*Rubus lineatas*	Rosaceae
395	*Rubus nepalensis*	Rosaceae
396	*Rubus paniculata*	Rosaceae
397	*Rubus sikkimensis var. canescens*	Rosaceae
398	*Rubus* sp.	Rosaceae
399	*Rubus treutleri*	Rosaceae
400	*Rumex acetosella*	Polygonaceae
401	*Rumex nepalensis*	Polygonaceae
402	*Sabia campanulata*	Sabiaceae
403	*Sabia campanulata subsp. Campanulata*	Sabiaceae

404	*Salix* sp.	Salicaceae
405	*Salvia campanulata*	Lamiaceae
406	*Sambucus javanica*	Adoxaceae
407	*Sanicula elata*	Apiaceae
408	*Sapria himalayana*	Rafflesiaceae
409	*Sarcoccoca hookeriana*	Buxaceae
410	*Sarcosperma arboreum*	Sapotaceae
411	*Saurauja armata*	Actinidiaceae
412	*Saussurea* sp.	Asteraceae
413	*Schefflera elata*	Araliaceae
414	*Schefflera impressa*	Araliaceae
415	*Schefflera impressa*	Araliaceae
416	*Schicandra* sp.	Araliaceae
417	*Schima khasiana*	Taxaceae
418	*Schima wallachi*	Taxaceae
419	*Schisandra grandiflora*	Schisandraceae
420	*Scurrula* sp.	Loranthaceae
421	*Selinum* sp.	Apiaceae
422	*Senecio scandens*	Asteraceae
423	*Senecio* sp.	Asteraceae
424	*Shuteria involucrata*	Fabaceae
425	*Skimmia laureola*	Rutaceae
426	*Sloanea tomentosa*	Elaeocarpaceae
427	*Smilax munita*	Smilacaceae
428	*Sorbus insignis*	Rosaceae
429	*Sorbus microphylla*	Rosaceae
430	*Sorbus rufopilosa*	Rosaceae
431	*Sorbus* sp.	Rosaceae
432	*Sorbus vestita*	Rosaceae

433	*Sorbus wallichii*	Rosaceae
434	*Spergula arvensis*	Caryophyllaceae
435	*Spiraea bella*	Rosaceae
436	*Stellaria* sp.	Caryophyllaceae
437	*Sterllia vestita*	Caryophyllaceae
438	*Streptopes simplex*	Liliaceae
439	*Strobilanthes capiata*	Acanthaceae
440	*Strobilanthes cusia*	Acanthaceae
441	*Strobilanthes himalayana*	Acanthaceae
442	*Strobilanthes wallichii*	Acanthaceae
443	*Styrax grandiflorax*	Styracaceae
444	*Swida macrophylla*	Cornaceae
445	*Symplocos lucida*	Symplocaceae
446	*Symplocus dryophila*	Symplocaceae
447	*Sympolocus dryophila*	Symplocaceae
448	*Sympolocus glomerata*	Symplocaceae
449	*Sympolocus ramosissima*	Symplocaceae
450	*Sympolocus sumuntia*	Symplocaceae
451	*Synotis allata*	Asteraceae
452	*Synotis stetrantha*	Asteraceae
453	*Syzygium* sp.	Myrtaceae
454	*Tabernaemontana divaricata*	Apocynaceae
455	*Tairella polyphylla*	Saxifragaceae
456	*Taxus baccata*	Taxaceae
457	*Taxus wallichiana*	Taxaceae
458	*Tetracentron sinense*	Trochodendraceae
459	*Tetra-stigma serulutum*	Vitaceae
460	*Thalictrum foliolosum*	Ranunculaceae
461	*Thalictrum* sp.	Ranunculaceae

462	*Tiarella polyphylla*	Saxifragaceae
463	*Torenia violacea*	Scrophulariaceae
464	*Trifolium dubium*	Fabaceae
465	*Trillium tschonoskii*	Liliaceae
466	*Tripterospermum volubile*	Gentianaceae
467	*Tsuga domasa*	Pinaceae
468	*Turpinia pomifera*	Staphyleaceae
469	*Utrica diosca*	Urticaceae
470	*Vaccinium dunalianum*	Ericaceae
471	*Vaccinium nummularia*	Ericaceae
472	*Vaccinium retusum*	Ericaceae
473	*Vaccinium sikkimensis*	Ericaceae
474	*Vaccinium vacciniacum*	Ericaceae
475	*Vandopsis undulata*	Orchidaceae
476	*Viburnum cylindricum*	Viburnaceae
477	*Viburnum erubescens*	Viburnaceae
478	*Viburnum nervosum*	Viburnaceae
479	*Viola hookerii*	Violaceae
480	*Viola pilosa*	Violaceae
481	*Wallichia densiflora*	Arecaceae
482	*Wendlandia* sp.	Rubiaceae
483	*Xanthoxylum* sp.	Rutaceae
484	*Youngia japonica*	Asteraceae
485	*Yushina* sp.	Poaceae
486	*Zanthoxylum oxyphyllum*	Rutaceae

Annexure 4. Resource use site inside and periphery of BC6

To be referred with figure 33

Resource use inside BC		
User	**Location/site**	**Id no**
Sakteng	Resi ti toe	5
	Thonpo tse	6
	Thonpo tse	7
	Yomo yakpo	8
	Lopche	9
	Lopche	10
Relnang	Broksar	11
	Khashoonaang	12
	Bro-sheengmo	13
	Tumbula	14
	Helteng	15
	Sheemin-Mo	16
	Phangkheynadang	17
	Dongnagpoo Phu	18
Phajogeonpa	Rashubrangsaa	19
	Kholomshingraa or Meyjayee	20
	Zhulumpaa	21
	Lhazorthiil	22
	Phishingzor	23
	Gerbrang Lhazor	24
	Menchaphung	25
	Bynangwoong	26
	Private land	27

Kangpara	Reshiwoong	48
Momring	Broshengmo	28
	Torong shangmo	29
Merak	Chumbabtse	30
	Chuthrab, Ngoiteng	31
	Brateng	32
Khasiteng	Thonphu_ (bamboo)	33
	Ree_zor(bamboo)	34
	Benang_phangma	35
	Phuentsho brek	36
	Bemay rong tsamdro	37
	Bornag chetpo	38
	Rekpo	39
	Sangtengsa	40
	Phagchu	41
	Phashung	42
	Gerbrang_lazor	43
	Ngoiteng	44
	Khongkhongma	45
	Lasteng	46
	Margang	47
Threlphu	Chenla	2
	Wangshingzey	3
	Tumbula	4
Zordung	Martsheli (Noorwong)	1

Resource use within 3km periphery of BC		
Village	**Name of place**	**Id_no**
Threlphu	Demung Tsamdrok	54
	Sawoong	55
	Choktong	56
	Nangshinang	57
	Gerbang	58
	Dembora	59
	Sangshingwoong	60
	Khayangzeymu	61
	ChachungNgyelsa	62
Relnang	Baynang Phangma	63
	Renang Chaywoo	64
	Renang Chungwoo	65
	Taktshang	66
	Dokha-Bro	67
	Gakha_Bro	68
	Gorduumaa	69
	Chorphuu	70
	Chorphu Tshoo	71
	Kamtangzor	72
Momring	Gakhabro	78
	Chorphu	79
	Hakarlo provate land	80
	Brangsengmo	81
Phajogeonpa	Phajogeonpa	73
	Relnang	74
	Gawoong	75

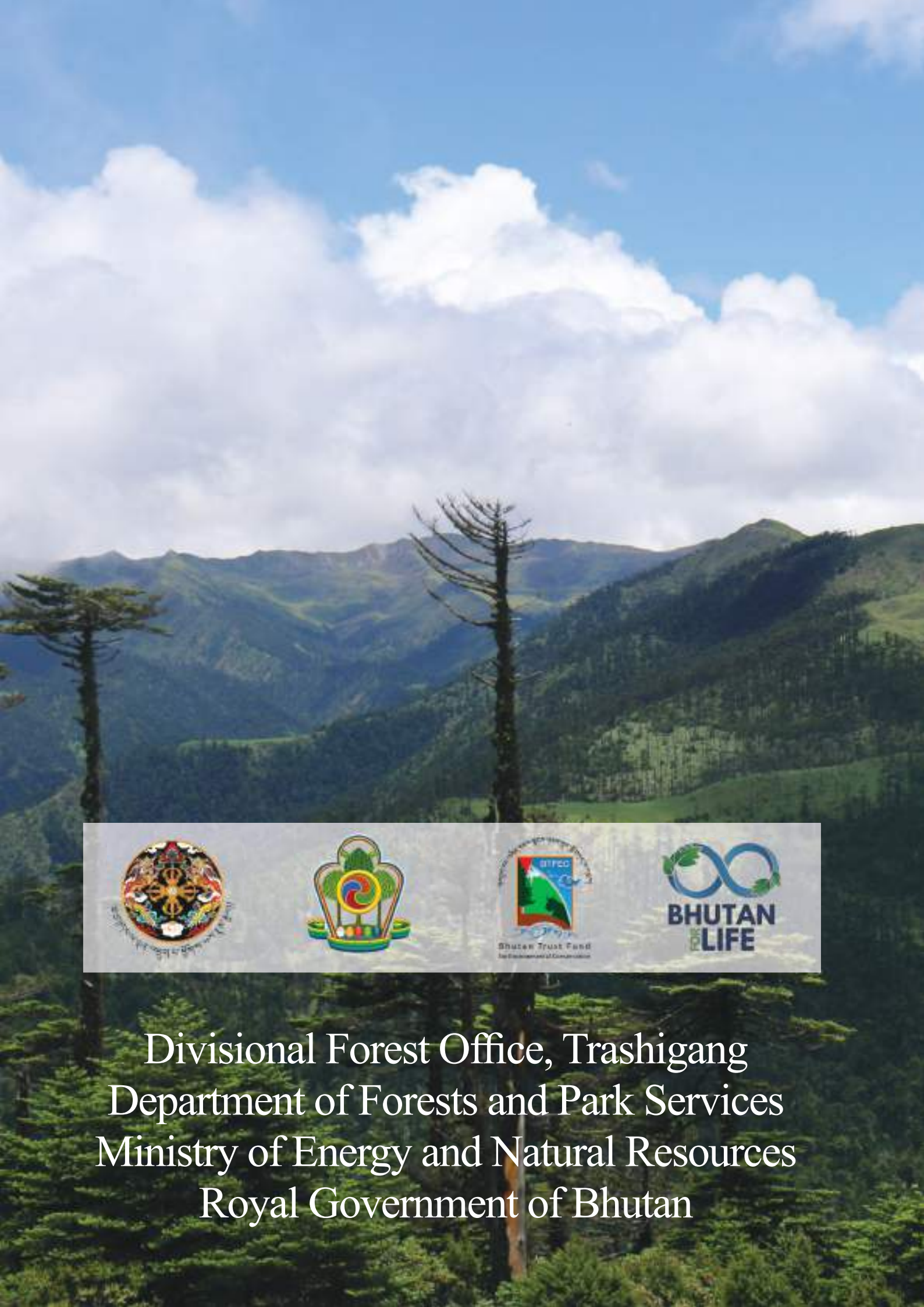
	Demong Pangthang	76
	Shingchong Lhazor	77
Khasiteng	Tshewang tharchen drupkhang	82
	Brengla	83
	Raabragtse	84
	Gayphe	85
	Shingkhar	86
	Benangwong	87
	Goenpa lazor	88
	Lopche	89
	Bronglo	90
	Margang toe	91
	Youlungpa	92
	Phranphrangla	93
Zordung	Sangshingwoong	49
	Chenla	50
	Khayangzaymu	51
	Tshotsalu	52
	Morshing	53

Annexure 5: BC boundary pillar information

Information on BC6 Boundary Pillars			
Pillar No	**GPS location (DD)**		**Place Name**
	Lat	**Long**	
1	27.16297	91.817923	Ningsangla
2	27.15865	91.821960	Gerbang
3	27.14991	91.824578	Lhazor toe
4	27.11353	91.802980	Wangshing Dogorboo
5	27.10012	91.790237	Zakarpo
6	27.08818	91.782933	Chenla
7	26.97282	91.790424	Thelemtang
8	26.94579	91.825217	Tshophangma
9	26.93852	91.841457	Tshophangma 2
10	26.95704	91.883763	**Nonai**
11	27.02629	91.876483	Kemajung
12	27.1035	91.856303	Taktsang
13	27.15799	91.882799	Benangwong
14	27.16500	91.889166	Chong Tharchen
15	27.18305	91.903888	Panphung
16	27.18777	91.925833	Borang Tshegpu Zor
17	27.20521	91.926235	Phangtshu Zurtshe
18	27.22699	91.875377	Gangkam Zor
19	27.20806	91.854940	Thonphu
20	27.21594	91.837227	Tshegom Jong

Disclaimer

The results of floristic composition may be biased due to increased survey efforts in Kangpara and Lauri Gewogs, as entry to other gewogs was restricted due to the pandemic (outbreak of corona virus) at the time of the Rapid Biodiversity Assessment.



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