CONSERVATION MANAGEMENT PLAN FOR BIOLOGICAL CORRIDOR 02

"Connecting Jigme Singye Wangchuck National Park and Royal Botanical Park"

(January 2025 – December 2034)

Divisional Forest Office, Wangdue
Department of Forests and Park Services

Ministry of Energy and Natural Resources

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Ministry of Energy and Natural Resources
Department of Forests and Park Services
Divisional Forest Office: Wangdue

Endorsement and Approval of the Royal Government of Bhutan

"In accordance with the provisions under Section 8 subsection (10) of Forest and Nature Conservation Act of Bhutan, 2023"

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13/6/25

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Ministry of Energy and Natural Resources

Foreword

The completion of the Biological Corridor 02 (BC-02) conservation management plan marks a significant milestone in our ongoing efforts to safeguard biodiversity and promote ecological resilience. This plan is not merely a document; it represents a collective commitment to preserving the intricate web of life that sustains our environment and communities. Recognizing its importance, I am delighted to know that the Divisional Forest Office, Wangdue, has initiated and successfully come up with the conservation management plan.

BC-02 plays a crucial role in facilitating the movement of wildlife between Jigme Singye Wangchuck National Park and Royal Botanical Park, ensuring genetic and ecological diversity. The successful implementation of this management plan will enhance habitat connectivity, allowing species to thrive and adapt in the face of changing environmental conditions.

As we move forward, we must remain vigilant and proactive in our conservation efforts. The strategies outlined in this plan will guide our actions in habitat restoration, monitoring, and community engagement, ensuring that we not only protect our forests but also foster sustainable development.

The BC-02 conservation management plan is a testament to our shared vision for a healthier planet. It is our responsibility to implement this plan with dedication and to inspire future generations to cherish and protect the natural world. Together, we can create a legacy of conservation that benefits both wildlife and humanity.

Tashi Delek!

Department of Forests and Park Services

Acknowledgement

The Divisional Forest Office, Wangdue is proud to be entrusted with the responsibility of managing Biological Corridor 02. Working closely with nature is not only a privilege but also a deeply fulfilling experience and rewarding to contribute to something that is timeless and profoundly meaningful.

We are thankful to the Nature Conservation Division, DoFPS, for their technical input and guidance in this work. We would also like to extend our deepest appreciation to the Bhutan for Life (BFL) initiative and the Royal Government of Bhutan for supporting financially for the development of this management plan.

The management would like to express its gratitude to all the field staff who worked tirelessly to gather information amid challenging environmental conditions. The members of the survey team played a pivotal role in the development of this management plan; without them, it would not have been possible.

Lastly, the management would like to sincerely thank all the institutions and stakeholders who helped to make this plan a success.

Divisional Forest Office, Wangdue

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Acronyms

BC	Biological Corridor
BFL	Bhutan for Life
CCVA	Climate Change Vulnerability Assessment
CF	Community Forest
DFO	Divisional Forest Office
DoFPS	Department of Forests and Park Services
FYP	Five-Year Plan
HWC	Human Wildlife Conflict
LFMP	Local Forest Management Plan
LULC	Land Use Land Cover
METT+	Management Effectiveness Tracking Tool Plus
NCD	Nature Conservation Division
NWFP	Non-Wood Forest Product
RBA	Rapid Biodiversity Assessment
RGoB	Royal Government of Bhutan
RSPN	Royal Society for Protection of Nature
SES	Socio-Economic Survey
SRF	State Reserved Forest
UAV	Unmanned Aerial Vehicle
UNDP	United Nation Development Program
UWIFoRT	Ugyen Wangchuk Institute for Forest Research and Training
WWF	World Wildlife Fund

Executive summary

Biological Corridors in Bhutan were first declared in the year 1999 and were presented as a "*gift to the earth from the people of Bhutan*". The conservation of Corridors is a fundamental component of the Protected Area (PA) System, as Biological Corridors provide PAs' vitality by facilitating the wildlife movement and maintaining ecological balance. A comprehensive framework for carrying out initiatives aimed at the management and conservation of the Corridor is thus anticipated to be provided by the creation of the first Corridor conservation management plan for Biological Corridor 02 (BC-02).

BC-02 was conceptualized concurrently as a landscape that connects Jigme Singye Wangchuck National Park and Royal Botanical Park. BC-02 covers part of Daga, Gasetshowom, Gasetshogom, Nahi, and Athang Gewogs under Wangdue Dzongkhag and part of Tseza Gewog under Dagana Dzongkhag. Communities are living inside and along the buffer of BC-02, including the nomadic herders. The BC-02 encompasses 291.76 km^2 of area ranging from subtropical to temperate climates, and offers safe havens for rare, fascinating, and endangered animals, including Tiger, Red panda, Musk deer, Clouded leopard, and Rufous-necked hornbill.

Preparation of the BC-02 management plan was first initiated in 2015; however, due to inadequate data, the management plan remained in draft form. The present conservation management plan, which spans over ten years from 2024 to 2034, is based on the results of a thorough evaluation of the socio-economic status and biodiversity assessment completed in 2024. The Biological Corridor has 27 species of Mammals, 186 species of Birds, 246 species of plants, 111 Orchid species and 122 Butterfly species based on the first rapid biodiversity assessment (RBA), opportunistic listing, National Forest Inventory (NFI), National Tiger Survey (NTS) and socio-economic survey (SES).

Threat analysis was carried out using Miradi 4.5.0 in consultation with the field forestry staff, and accordingly, ten threats were identified in the context of species conservation, habitat management, and community livelihood. Among them, Human-Wildlife Conflict and climate change were identified as major threats and challenges. In order to address the threats and challenges, goals, objectives, strategies, and activities have been identified.

There are two goals with four objectives, eleven strategies, and forty-one activities for enhancing and strengthening the conservation and maintenance of the Corridor over ten years.

CHAPTER I

INTRODUCTION

1.1. History of Biological Corridors (BC) in Bhutan

Biological Corridors (BCs) in Bhutan were first declared in the year 1999 and were 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 a network of nine protected areas across the country (Wangchuk, 2007). However, later in 2008, with the establishment of Wangchuck Centennial National Park, three BCs of the northern landscape were subsumed, and BC-09 was merged with BC-07 (WCD, 2010).

At present, there are nine BCs with the latest addition of BC-09 connecting Bumdeling Wildlife Sanctuary and Sakteng Wildlife Sanctuary, covering an area of 8.29% of the total geographical area and providing landscape connectivity to the network of existing 10 Protected areas (Figure 1).

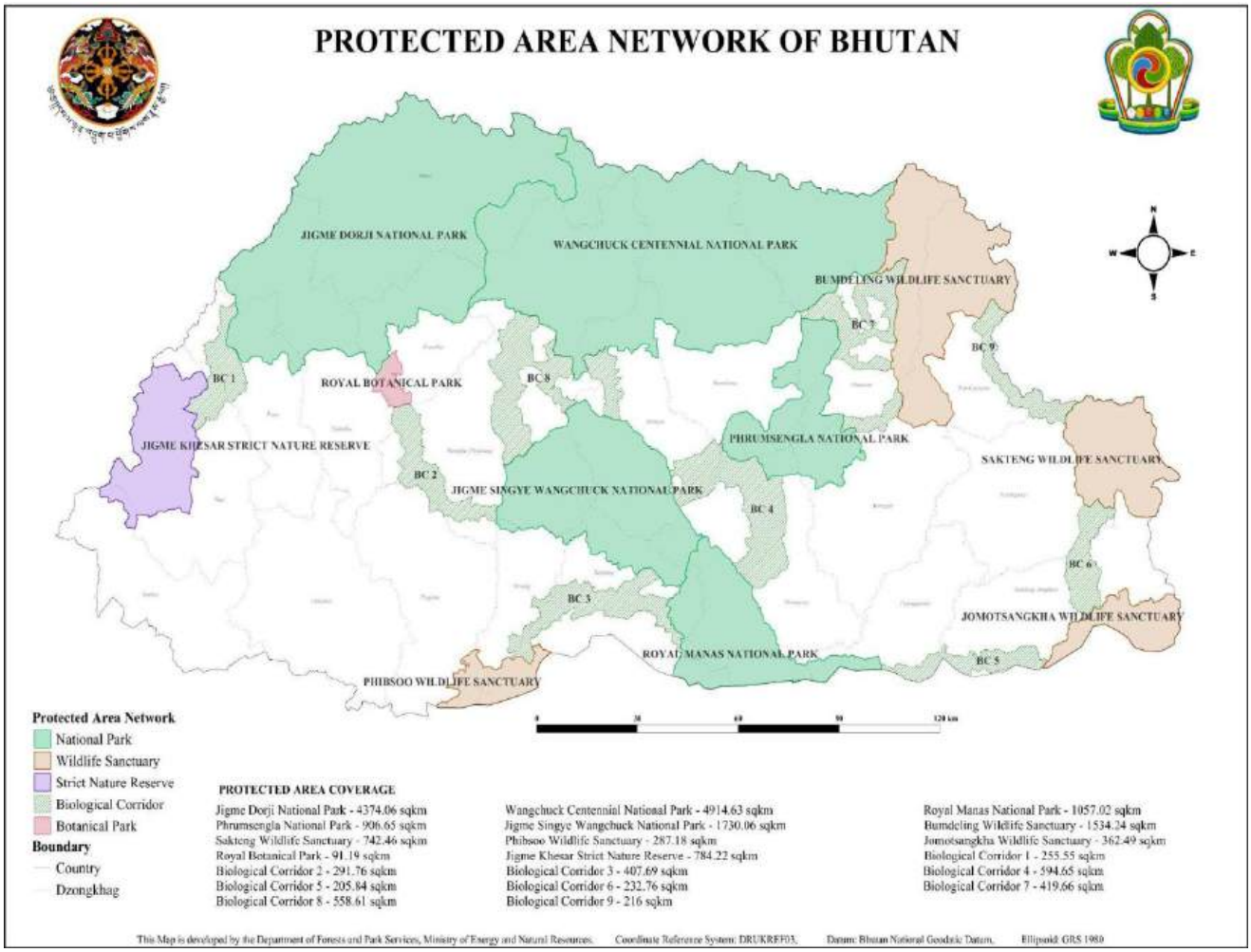

Figure 1: Map showing the protected areas and biological corridors of Bhutan

1.2. Brief information on BC-02

BC-02 has an area of 291.76 km^2 stretched across part of Daga (160.9 km^2), Gasetshowom (73.3 km^2), Nahi (45.9 km^2), Gasetshogom (2.5 km^2), and Athang (0.08 km^2) Gewog under Wangdue Dzongkhag and part of Tseza (9 km^2) Gewog under Dagana Dzongkhag. Approximately 96.9% of the total BC-02 area falls under the jurisdiction of Wangdue, and the remaining 3.08% in Dagana Dzongkhag.

BC-02 in the central landscape functions as the connecting landscape between Jigme Singye Wangchuck National Park and Royal Botanical Park, Lampelri, providing connectivity to the different habitats while:

a. Providing a secure migratory habitat to facilitate movement (dispersal or migration) of several threatened wildlife species, including Royal Bengal Tiger;

b. Maintaining genetic diversity of species and;

c. Providing a supplementary feeding habitat for animals

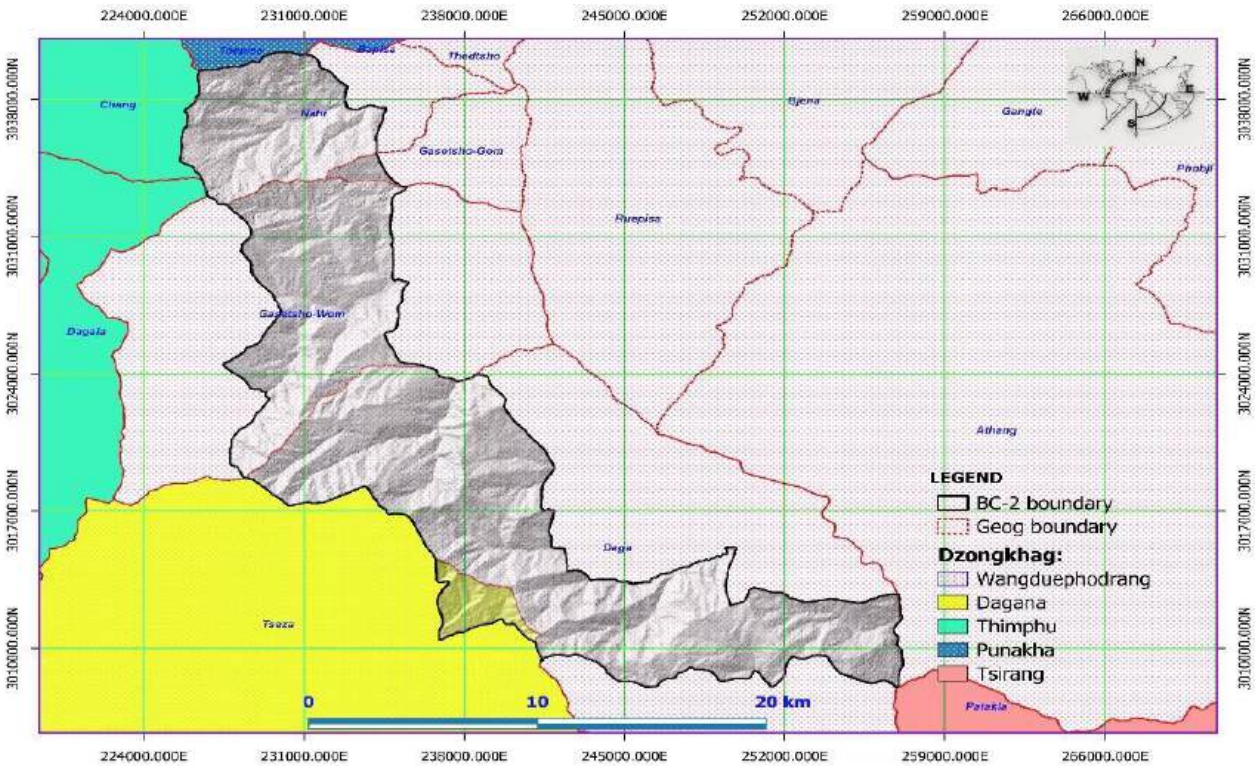

Figure 2: Administrative map of BC-02

1.3. Vision, Mission, Goal, and Objectives

Vision

A vibrant and interconnected landscape where diverse wildlife populations coexist in harmony with the community within a resilient ecosystem characterized by enhanced ecological connectivity

Mission

To ensure seamless connectivity between the Protected areas of Jigme Singye Wangchuck National Park and Royal Botanical Park, fostering enhanced biodiversity conservation and promoting human well-being through active community stewardship and sustainable practices

Goal:

1. To maintain ecological connectivity through the protection and conservation of biodiversity
2. To enhance the livelihood of the community through nature-based programs

Objectives:

1. To provide a secure migratory habitat for the efficient movement of wildlife between the two Protected areas
2. To protect and conserve wildlife species
3. To manage Human-Wildlife Conflict
4. To strengthen institutional capacity for effective management of the corridor

CHAPTER II

CURRENT STATUS

2.1. Physical features

2.1.1. Biological corridor 02 boundary description

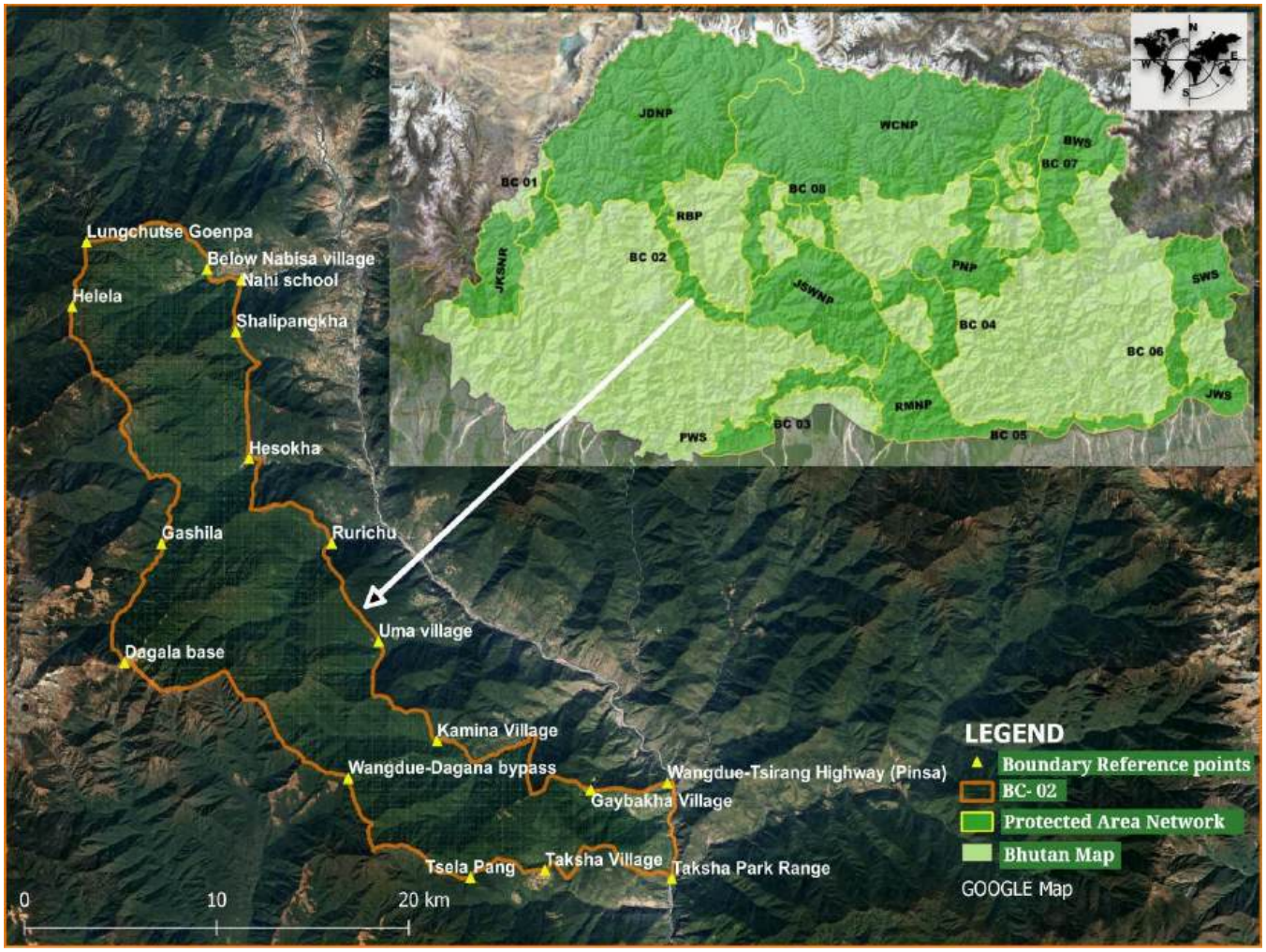

Figure 3: Boundary map of BC-02

The boundary of BC-02 is defined in a clockwise direction starting from Lungchuzey Goenpa, located above Dochula Pass at *27°28'2.58"N, 89°45'41.63"E,* and extends downwards, following the boundary of Lampelri Royal Botanical Park until it reaches the top of Nabesa village, located at *27°28'30.86"N, 89°48'30.21"E*. It then passes through Eusagom and Nabesa villages under Nahi Gewog *(27°27'13.90"N, 89°49'32.97"E* connecting Shalipangkha at *27°25'45.51"N, 89°50'22.58"E*, and enters Gasetshowom Gewog at *27°24'50.05"N, 89°51'11.15"E*.

Continuing along the forest without clear permanent landmarks, the boundary reaches Hesokha village at *27°22'14.13"N, 89°50'52.46"E*. It then follows the ridges above Hebesa village, exits the Gasetshogom Gewog and enters Daga Gewog at the upper course of the Rurichhu River at *27°19'28.64"N, 89°52'34.48"E*. From there, the boundary traverses rugged and inaccessible terrain, passing above Umakhatoe village in Daga Gewog at *27°17'33.98"N, 89°54'51.56"E*. It reaches the Wangdue Dagana Bypass above Kamina village at *27°14'13.68"N, 89°55'27.11"E*, and continues to Gaybakha village at *27°13'24.68"N, 90°1'40.03"E*. The boundary then follows the ridge of the Chirpine forest down to the Punatsangchu River at *27°13'35.29"N, 90°4'13.57"E.*

Following the Punatsangchu River until Harachuu at *27°6'48.74"N, 90°4'10.22"E*, the boundary ascends the ridge to Taksha village at *27°11'17.10"N, 89°59'56.96"E*. It then heads southwest to Silipang at 27°11'4.46"N and 89°57'49.66"E. The boundary continues through largely unknown areas along the ridges below the Dagala mountain range, passing through several points: (27°11'56.12"N 89°54'48.95" E), (27°13'53.67"N,89°52'1.59"E) (27°16'9.44"N,89°49'0.24"E), and (27°16'46.76"N, 89°46'57.35"E). It reaches the base of Dagala mountain and continues to Gashila at 27°19'56.63"N, 89°46'20.84"E and Heyleyla at 27°26'16.04"N, 89°45'13.34"E, eventually returning to Lungchuzey.

2.1.2. Topography and Terrain

Aspect

BC-02, encompassing an area of 291.75 square kilometers, is situated within a geographically diverse region characterized by varying topographical aspects. The predominant orientation of the landscape within BC-02 aligns with the broader Himalayan topography, primarily facing east and south. In contrast, only a small portion of the terrain exhibits north and west-facing slopes, as illustrated below in the raster histogram of the slope classification. The orientation of these slopes or aspects is crucial in shaping the microclimatic conditions that influence biodiversity within BC-02. South and East-facing slopes receive more solar radiation, leading to warmer and often drier conditions.

In contrast, North and West-facing slopes tend to be cooler and more humid. This variation in solar exposure significantly affects the thermal and moisture regimes of both soil and air, ultimately impacting the growth patterns, distribution, and diversity of plant and animal species in the area. The diverse aspects of the BC-02 landscape create a mosaic of microhabitats, each supporting distinct communities of flora and fauna. This heterogeneity, driven by the varying orientations of the landscape, is a crucial factor in determining the overall biodiversity within BC-02, highlighting the significance of its topographical features.

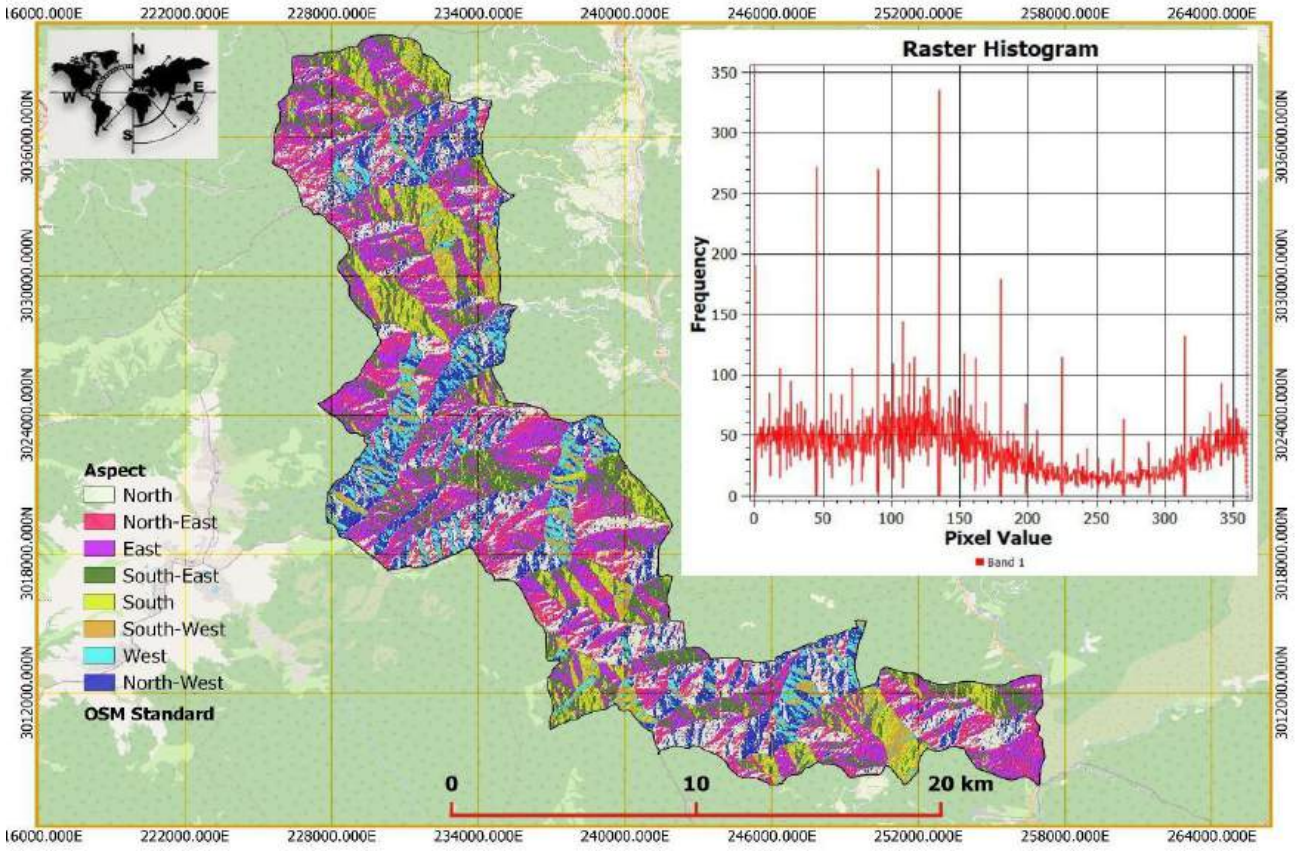

Figure 4: Aspect classification of BC-02

Slope

The slope classification of the BC-02 landscape relates to the steepness of the terrain, which is categorized based on topographical characteristics. A slope classification map details the steepness of the slopes in BC-02, providing essential insights into the overall topography. This map offers a general overview of the slope characteristics within the landscape, revealing that most areas fall within a mid-range slope of 10 to 40 percent, with the highest recorded slopes during GIS analysis reaching approximately 30 percent.

Slope classification is a critical factor for wildlife movement. Steep slopes can act as barriers, hindering animals, especially those with limited climbing abilities, thereby restricting their range and access to resources. Habitat preferences are also influenced by slope; some species favor flat or gently rolling areas for easier travel and foraging, while others thrive in rugged, mountainous regions. Human activities typically avoid steep slopes, resulting in these areas being less disturbed and safer for wildlife. In contrast, flatter regions are more susceptible to human encroachment, which can disrupt animal movement. Understanding the dynamics of slope in the BC-02 landscape is vital for effective conservation planning. By integrating slope-related factors into conservation strategies, we can create functional biological corridors that support wildlife movement and enhance biodiversity.

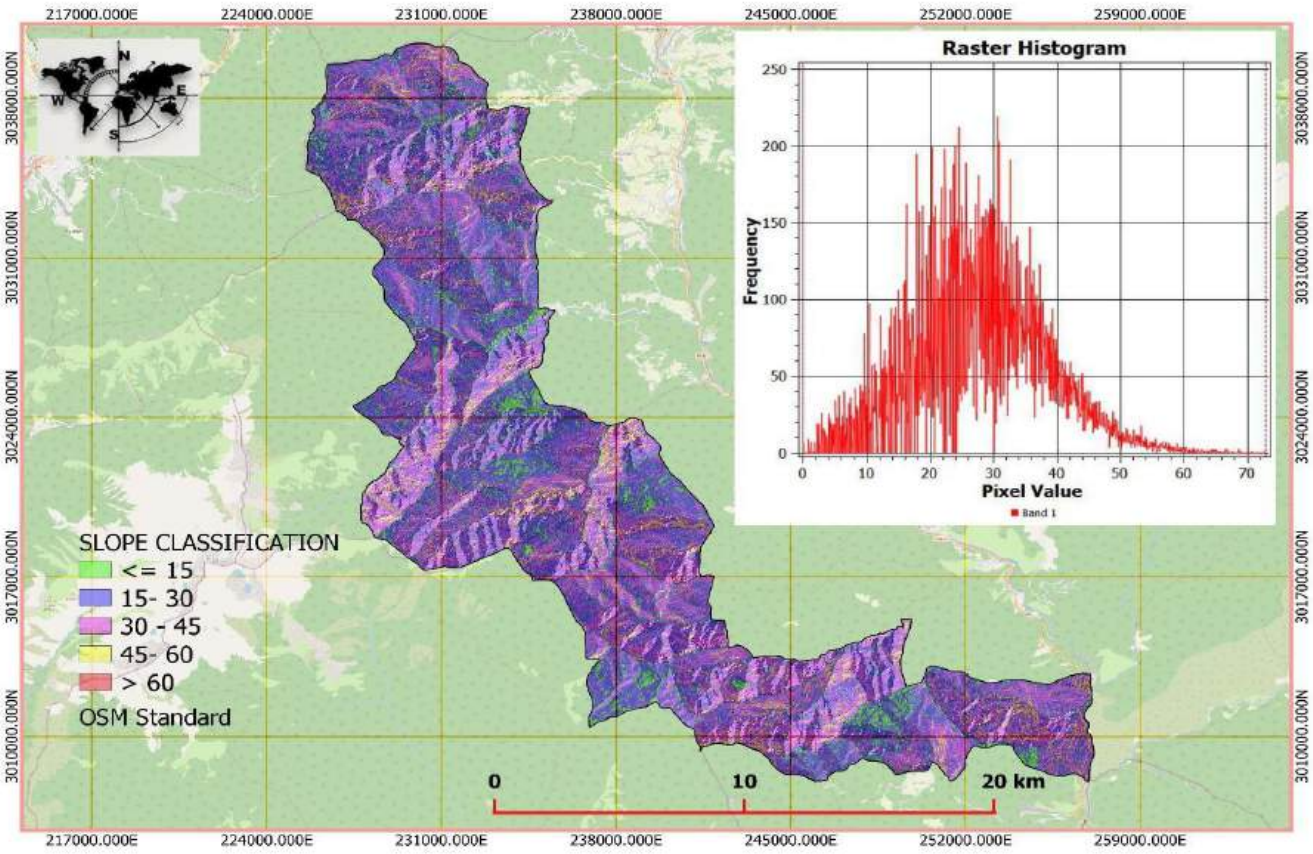

Figure 5: Slope classification of BC-02

Elevation

The BC-02 landscape is defined by its diverse altitude, which spans from 450 meters above sea level (masl) to 4050 masl. This dramatic elevation gradient fosters a variety of microclimates and habitats, each supporting distinct types of vegetation and wildlife. The lowest elevation in the BC-02 region is found in

the Harachuu area, at approximately 450 masl, and the highest elevations are recorded at Dagala, Heleyla, and Lungchuzey areas, reaching around 4050 masl. The major chunk of BC-02 lies within the elevation range of 1890 to 3330 masl.

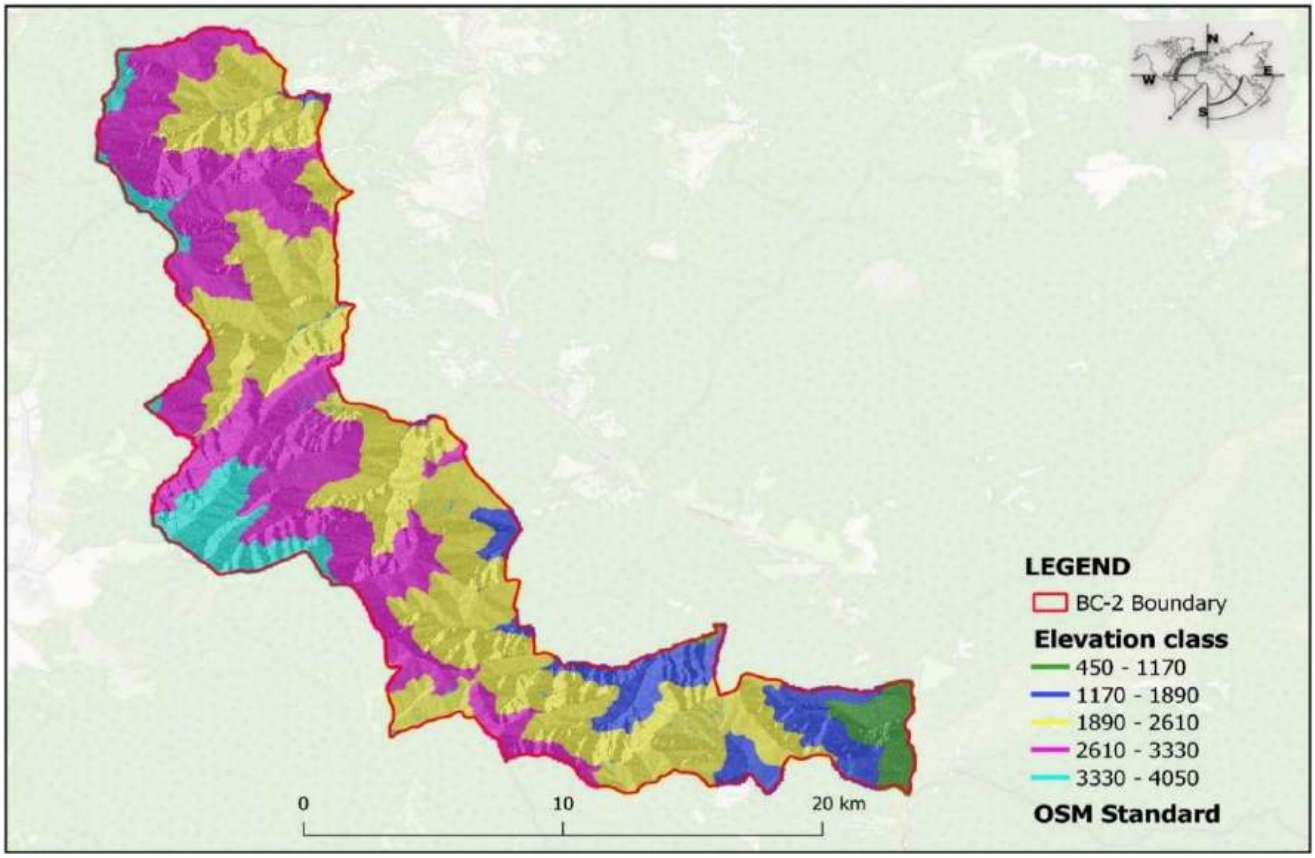

Figure 6: Elevation classification of BC-02

2.1.3. Drainage

BC-02 area is home to a diverse array of perennial and seasonal streams and springs, most of which drain into the main Punatsangchu River. It features eight prominent streams, including Nahi Chhu, Hesokha Chhu, Baso Chhu, Rurichhu, Baychhu, Kamina Chhu and Gaywachu, which serve as the vital lifeline for many downstream communities, providing water for both irrigation and drinking purposes.

Notably, Hesokha and Baso Chhu are utilized for hydropower generation at the Basochu Hydropower Plant. All streams and springs ultimately flow into the Punatsangchu River, which traverses the valley bottom. In the Gaywachu area, the Punatsangchu River forms the border of the BC-02 region.

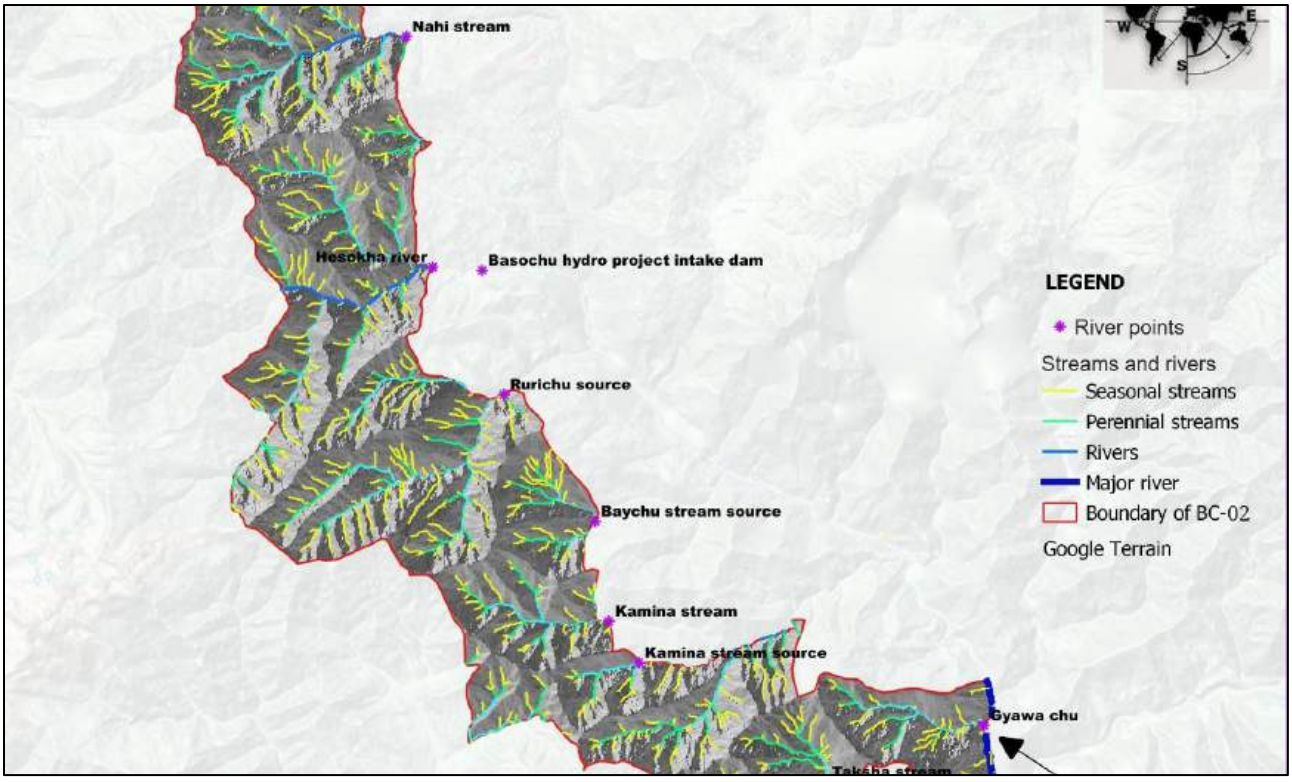

Figure 7: Drainage system of BC-02

2.1.4. Land Use Pattern

The BC-02 area is predominantly covered by Broad-leaved forests, which constitute approximately 63.5% of the total land area. Mixed conifer forests also have a significant presence, covering around 27% of the area. In contrast, minor land uses such as alpine scrub, built-up areas, Kamzhing, non-built-up areas, and rivers collectively occupy less than 0.1% of the total area. Chirpine and Fir forests have a moderate presence, representing about 5% and 2.9% of the area, respectively. Additionally, meadows and shrubs cover smaller, yet notable portions, at around 0.8% and 0.4%, respectively.

The distribution of land use in the BC-02 area is highly skewed towards Broadleaved and Mixed Conifer forests, which together account for approximately 90.5% of the total area. Other land-use classes have much smaller shares, indicating a lesser presence or utilization in the region. This analysis suggests several insights for land management, i.e., conservation efforts should prioritize Broadleaved and Mixed Conifer forests due to their extensive coverage and ecological importance. This comprehensive understanding of land-use distribution in the BC-02 area underscores the dominance of forested regions and the minimal but important presence of built-up and agricultural areas.

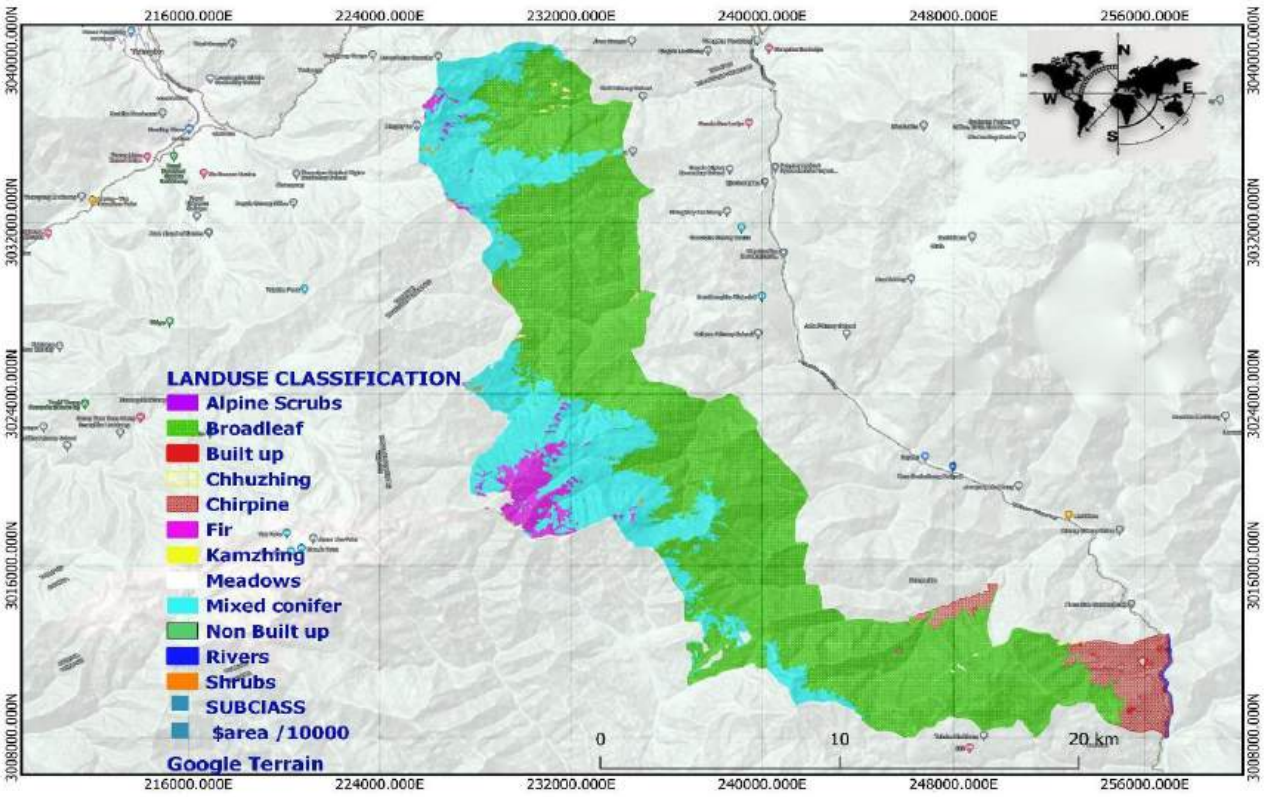

Figure 8: Land Use Classification of the Corridor

2.1.5. Choke Points

Choke points in Biological Corridors significantly impact wildlife movement by creating barriers or bottlenecks that hinder the safe and effective movement of animals. The most prominent barriers to wildlife movement in the Biological Corridor are the natural barriers of Punatsangchu, the high-tension transmission lines, and the Wangdue-Tsirang highway. While there are numerous smaller barriers, above mentioned are particularly notable. All the choke points are concentrated towards the southern part of the corridor, which can have a profound impact on wildlife movement and connectivity.

Regarding the natural barrier of Punatsangchu, the river acts as a formidable natural barrier, possibly restricting the movement of many terrestrial species that cannot fly or swim long distances. This river may isolate populations on either side during the monsoon season; however, during the drier seasons, there are several strategic locations where the animals could move from one location to another.

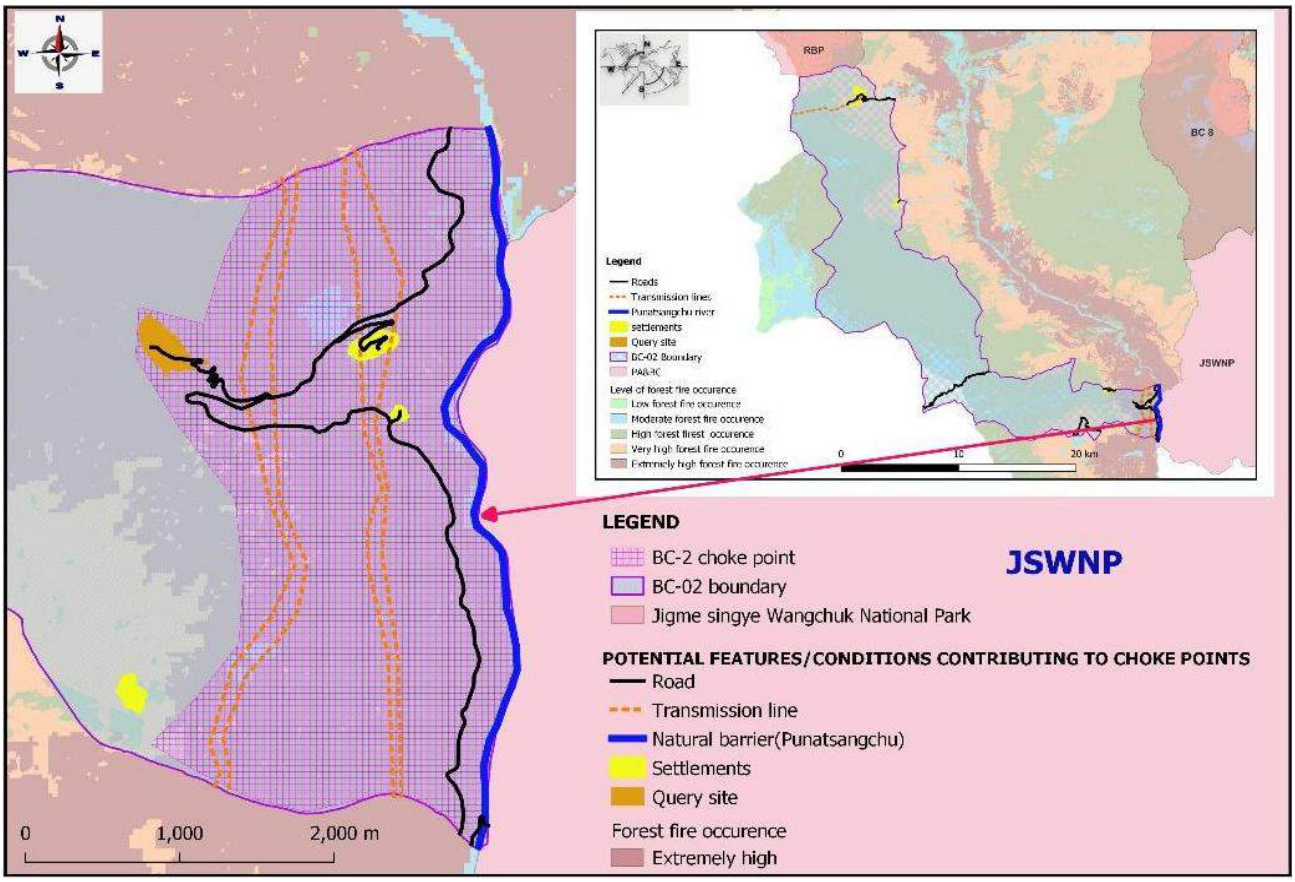

Figure 9: Choke points in BC-02

2.2. Biological features

2.2.1. Vegetation and forest types

Given the wide variability of altitudinal range, BC-02 has been divided into three major Ecological zones, comprising Sub-tropical (elevation < 2000m), Temperate (elevation 2000-4000), and Alpine zones (elevation > 4000m) (DoFPS, 2022). The forest type of Corridor is classified into ten major types based on the Land Use Land Cover, 2021.

Of the 11 forest types found in Bhutan, nine forest types are broadly depicted as per the cluster analysis inside the corridor within the elevation range of 463 (Taksha) to 4043 (Daga) meters. The group significance is mainly influenced by the Basal Area of the indicator species as reflected in *Figure 11*.

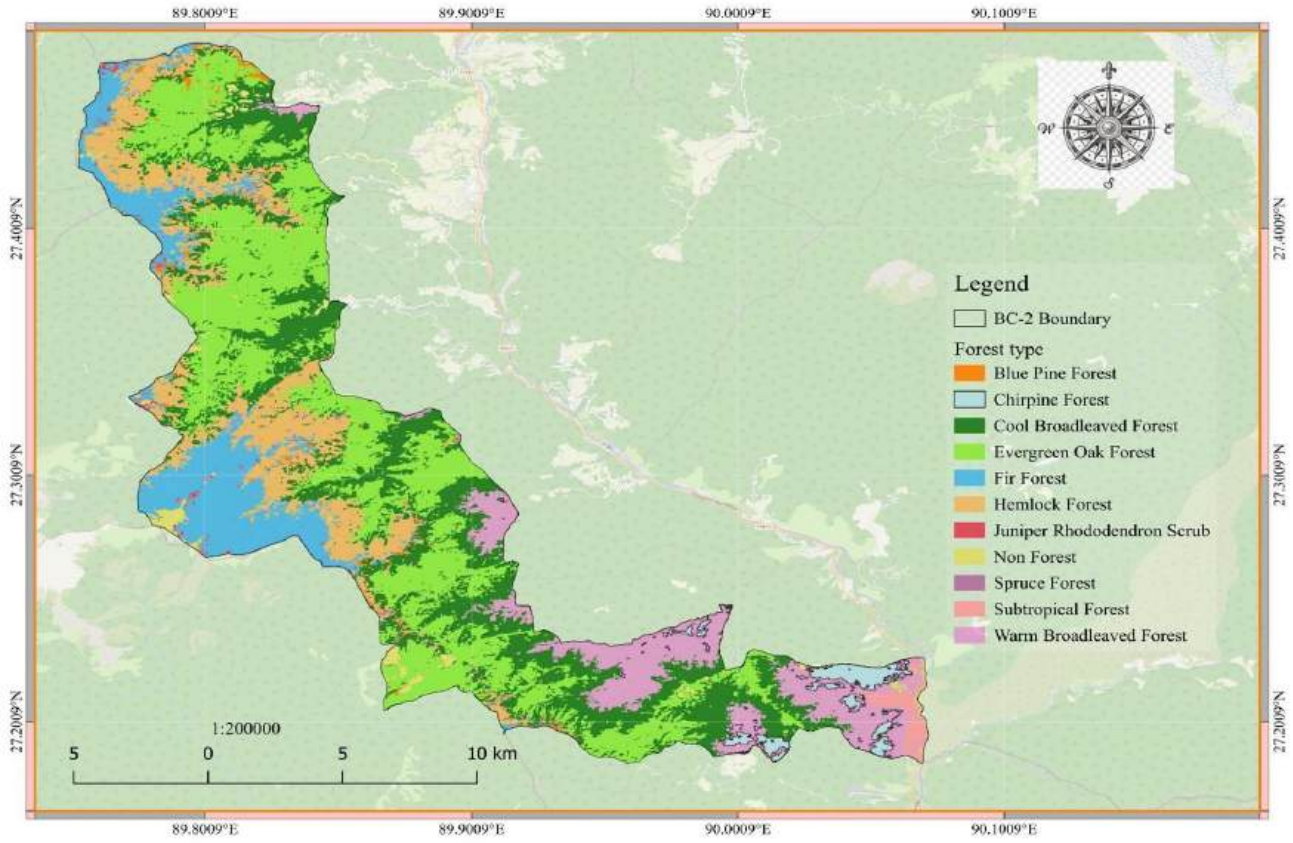

Figure 10: Forest types of BC-02

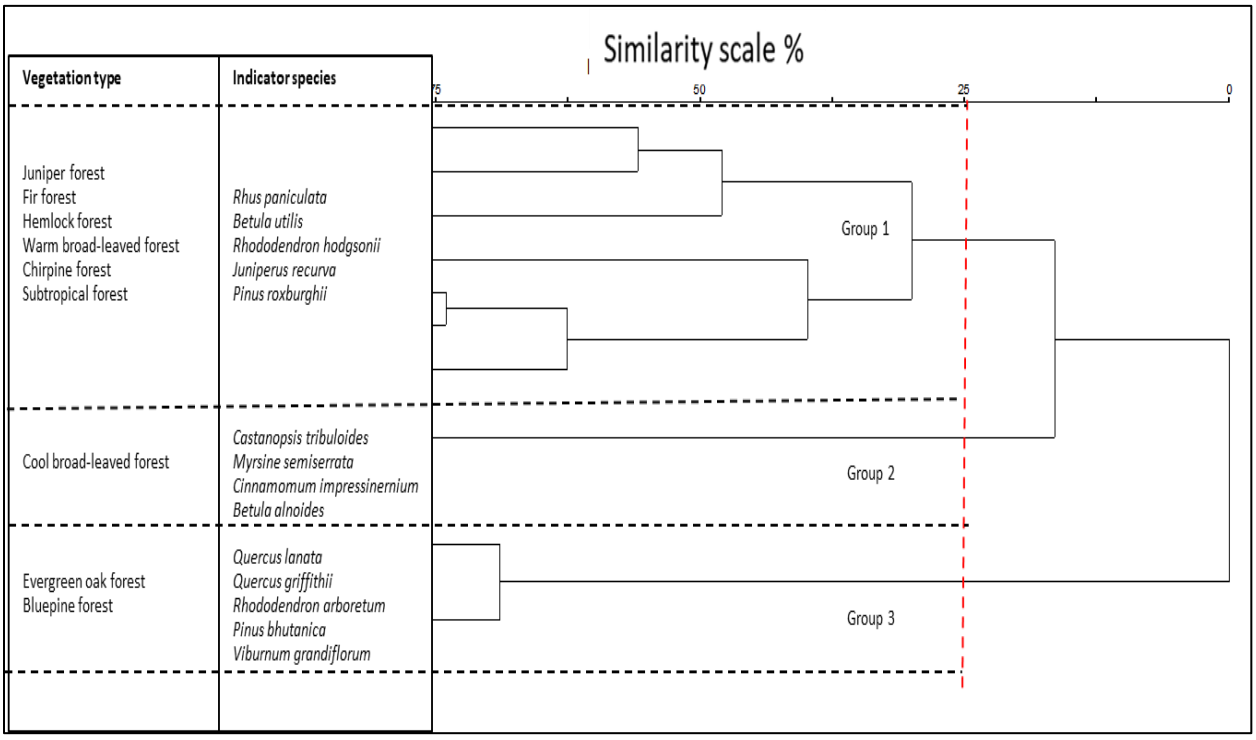

Figure 11: Cluster dendrogram depicting 3 clusters with indicator species and vegetation

Group 1

Group one consists of 13 plots representing various forest types, including Juniper Forest, Fir Forest, Hemlock Forest, Warm Broad-Leaved Forest, Chirpine Forest, and Subtropical Forest. The indicator species for this group are *Rhus paniculata, Betula utilis, Rhododendron hodgsonii, Juniperus recurva,* and *Pinus roxburghii*. However, the p-values for this group were not very significant due to the limited number of sample plots for each forest type.

Juniper Forest is found exclusively at Lungchutse, while Fir and Hemlock Forests are located in the upper reaches of the BC. Warm Broad-Leaved Forest is present around the Taksha area, and Chirpine Forest thrives along dry valleys in the Gaywachu area and partially at Taksha. Subtropical species are located in Harachhu and along the riverbanks of the Punatsangchu River.

Group 2

Group two consists of 5 plots represented by Cool Broad-leaved Forest with indicator species like *Castanopsis tribuloides* (p*0.0002), *Myrsine semiserrata* (p*0.0054), *Cinnamomum impressinervium* (p*0.0298), and *Betula alnoides* (p*0.0304). The p-values are very significant, depicting the Important Value Index (IVI) of the species' existence inside the Cool Broad-leaved Forest. This type of forest is spread across the Laptsakarchu, Taksha, Tsatseding, Tolomji, Nabisa, and Lamigora areas of the Corridor.

Group 3

Group three comprises 8 plots represented by Evergreen Oak Forest and Blue Pine Forest with indicator species like *Quercus lanata* (p*0.0002), *Quercus griffithii* (p*0.0006), *Rhododendron arboreum* (p* 0.0056), and *Pinus bhutanica* (p* 0.0134). The p-values are very significant, depicting the Important Value Index (IVI) of the species' existence inside the Evergreen Oak Forest and Blue Pine Forest. The Evergreen Oak Forest and Blue Pine Forest are found at Hetshokha, Nabesa area, and the Evergreen Oak Forest is predominantly seen at Taksha top. The dominant forest type of BC-02 is Evergreen Oak Forest, followed by Cool Broad-leaved Forest, Hemlock, and Fir *(Figure 12).*

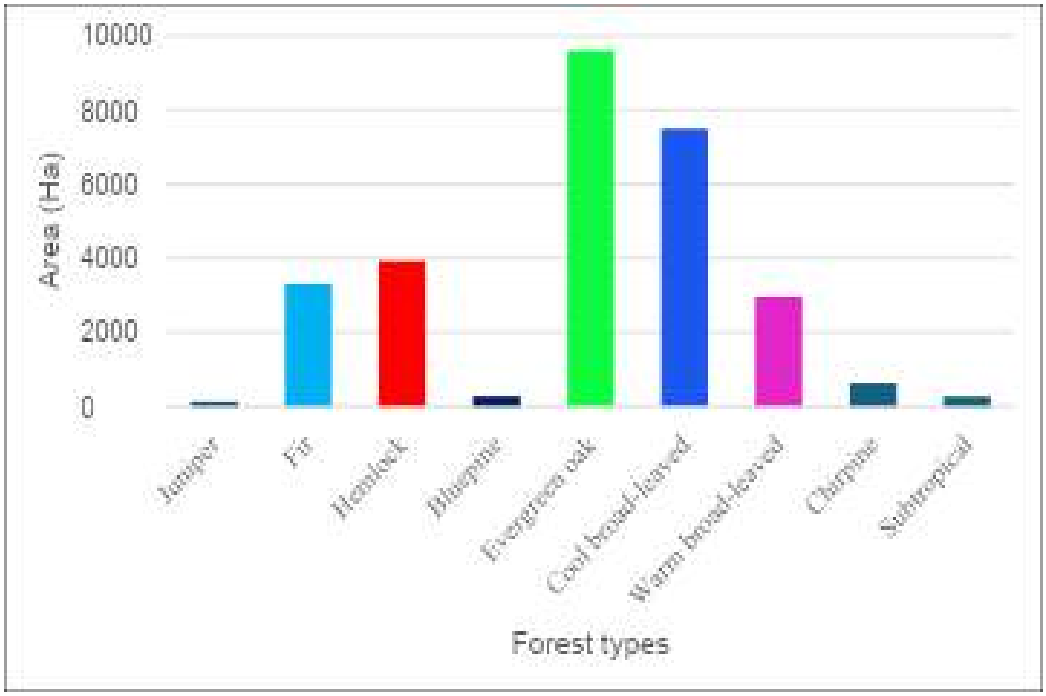

Figure 12: Dominant Forest Types in BC-02

2.2.2. Floral diversity

BC-02 has a total of 106 tree species and shrub species belonging to 47 families recorded within 9 forest types (Annexure III). Floral species composition in BC-02 includes four major life forms, such as Evergreen trees, Deciduous trees, Deciduous shrubs, Evergreen shrubs, as shown below in *Figure 13.*

All the life form groups form contrasting physiognomic patterns along altitudinal gradients. The Evergreen trees consist of 78%, Deciduous trees 19%, Deciduous shrubs 1.5%, and Evergreen shrubs 1.5%. The results recorded that the tree's vegetation was mostly dominated by *Castanopsis tribuloides, Quercus lanata,* and *Quercus griffithii* in the mid-elevations. In the upper reaches, the dominant species were *Juniperus recurva* and *Abies densa*.

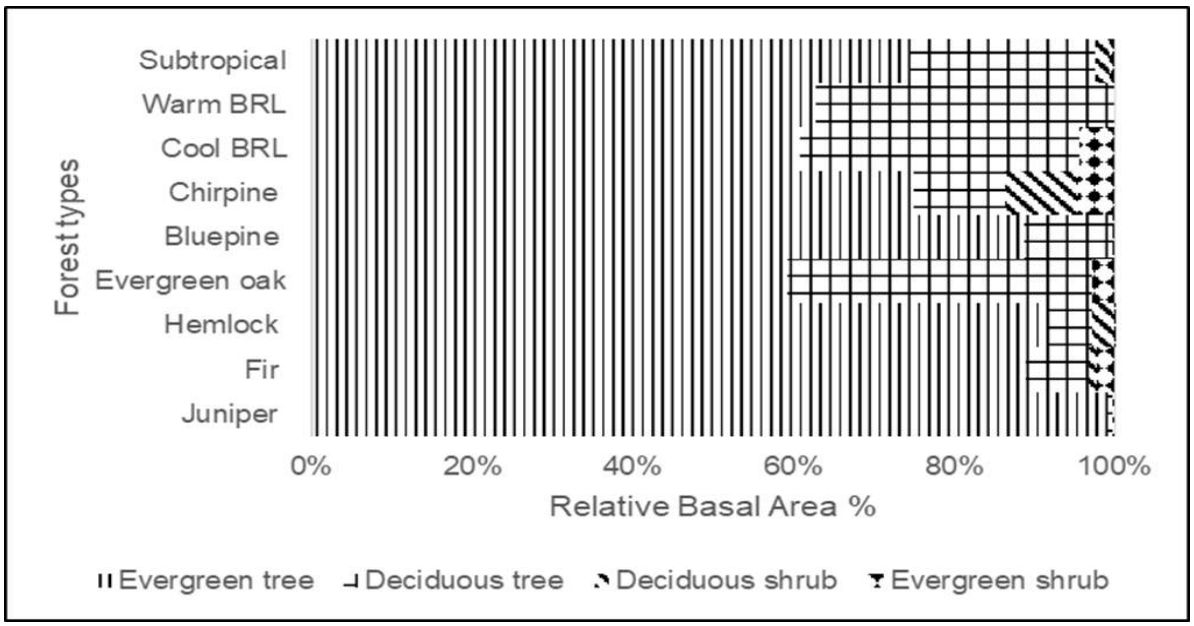

Figure 13: Distribution pattern of four major life-forms

Total ground vegetation was composed of 65 families, of which 24 were tree regeneration, 52 shrubs, 82 herbs, 17 perennial ferns, 9 grasses, and 4 orchid species. Tree regeneration consists of 10 %, shrubs 19%, herbs 42% and perennial ferns 8%, perennial grass 20%, and orchids 0.9% *(Annexure III)*. The results indicate that the ground vegetation was mostly dominated by *Fragaria nubicola, Rubus calycinus, Ophiopogon clarkei, Eupatorium adenophorum, Chromolaena odoratum, Pilea umbrosa, Bidens pilosa, Adiantum caudatum, Nephrolepis* sp, *Smilax* sp, and *Gaultheria fragrantissima,* etc. The tree regeneration mostly consists of *Pinus bhutanica* and *Quercus griffithii*.

Structural attributes

Structural traits along the altitudinal gradients were described based on six features (maximum height, maximum diameter at breast height, basal area, stem density, species number, and species diversity). The total number of species richness was assessed in two vegetation layers (tree & shrub and ground). The following *table 1* summarizes 8 variables in 10 grids.

The forest stand structural feature is illustrated by DBH class distribution arranged at an interval of 15 cm with 9 classes as shown below, and height class distribution was arranged at an interval of 5 meters with 7 classes as shown in the graph (*Figure 14*).

Variables	Juniper	Fir	Hemlock	E.Oak	B/pine	CBRL	WBRL	C/Pine	Sub-tro
No. of Plots	6	3	2	4	4	4	1	6	3
Tree plot size (m^2)	400	400	400	400	400	400	400	400	400
Herb plot size(m^2)	2	2	2	2	2	2	2	2	2
BA cm^2	69951	121284	72970	113173	32381	121284	505	4706	53799
Max. Diversity H' (Trees and shrubs)	0.52	1.41	1.47	1.18	1.17	2.04	1.17	1.29	2.17
Max. Diversity H' (Ground layer)	1.66	1.75	1.07	2.45	2.22	2.04	1.79	1.37	1.70
Max DBH (cm)	82	115	123	84	75	130	75	42	76
Max Ht. (m)	25	31	27	26	30	25	22	20	23

Table 1: Structural attributes

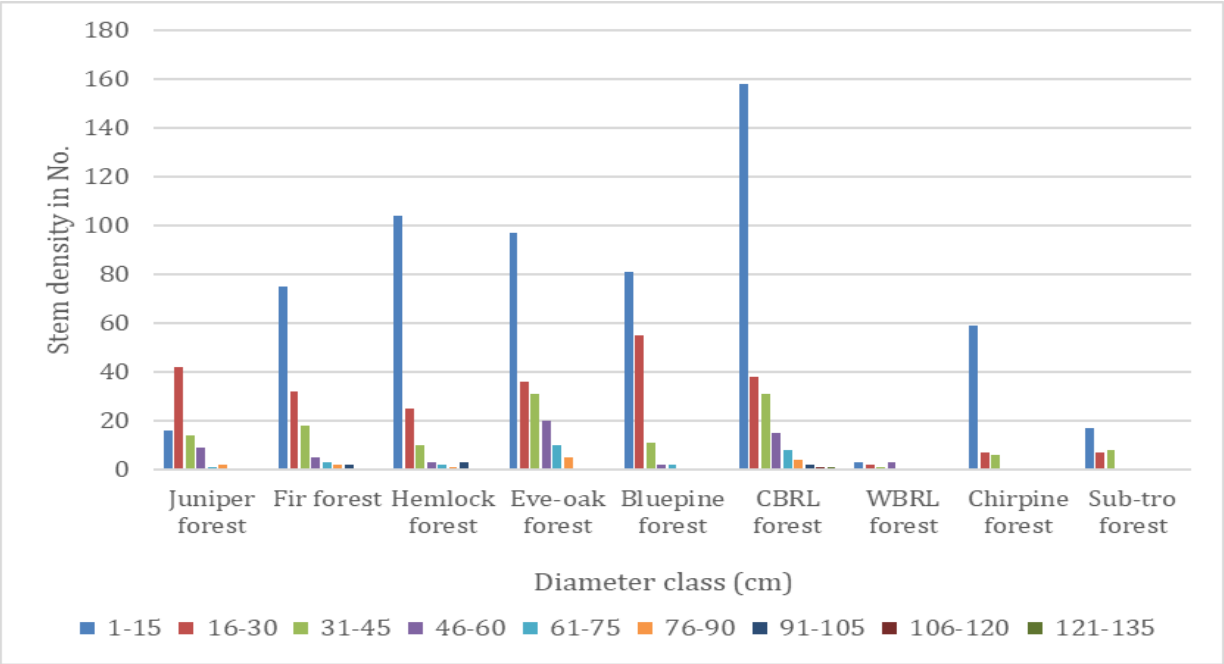

Figure 14: Diameter class distribution of trees and shrubs

2.2.3. Faunal Diversity

Mammal

A total of 27 Mammal species from 15 families were recorded in BC-02 through camera traps and transect surveys. Furthermore, additional secondary sources like the National Tiger Survey (NTS) and Biodiversity Monitoring Grids (BMG) were also used. Mammals of conservation importance, such as Tiger (*Panthera tigris),* Clouded leopard *(Neofelis nebulosa),* Asiatic golden cat *(Catopuma temminckii),* Leopard cat *(Pardofelis marmorata)*, Grey langur (*Semnopithecus entellus)*, Red panda (*Ailurus fulgens*), Himalayan Musk deer (*Moschus leucogaster*), Spotted Linsang (*Prionodon pardicolor*), and others, are found in BC-02.

Sl. No	IUCN Status	Species
1	Least Concern (LC)	Asian Palm Civet, Barking Deer, Grey langur, Himalayan Crestless porcupine, Hoary-bellied Himalayan squirrel, Jungle cat, Leopard cat, Orange-bellied Himalayan squirrel, Spotted Linsang, White bellied rat, Wild boar, Yellow-throated Marten, Indian Palm squirrel
2	Near Threatened (NT)	Asiatic Golden cat, Assamese macaque, Black Giant squirrel, Himalayan Goral, Marbled cat
3	Vulnerable (V)	Asiatic Black Bear, Clouded leopard, Common leopard, Himalayan Serow, Sambar
4	Endangered (EN)	Wild Dog, Musk Deer, Red Panda, Royal Bengal Tiger

Table 2: Threatened Mammals of BC-02

The presence of Tigers in BC-02 confirms that the natural environment is healthy, as Tigers are an indicative species of a healthy ecosystem. As apex predators, Tigers regulate prey populations, prevent overgrazing, and preserve the natural balance of the ecosystem. Of the 27 species of Mammals recorded *(Annexure I),* four species are categorized on the IUCN Red List of Threatened Species as Endangered, five as Near Threatened, and five as Vulnerable. Additionally, eleven species are protected under CITES

Appendix I, five under Appendix II, three under Schedule I of the FNCA 2023, and twelve under Schedule II of the FNCA 2023.

Camera trapping exercise was conducted from March 2024 to May 2024. A total of 16 camera traps were installed in the BC-02 area. The lowest camera trap night of a station was 28 days, and the highest trap night for a camera trap station was 44. A total of 8751 pictures were processed from 469 trap efforts. The independent event pictures of the species at a location were defined at 10-minute intervals (Lahkar et al., 2018). Based on photographic captures, Barking deer have the highest (n=119) independent capture rate, followed by Sambar deer (n=87), and the least captured species are Leopard cat (n=1) and Jungle cat (n=1).

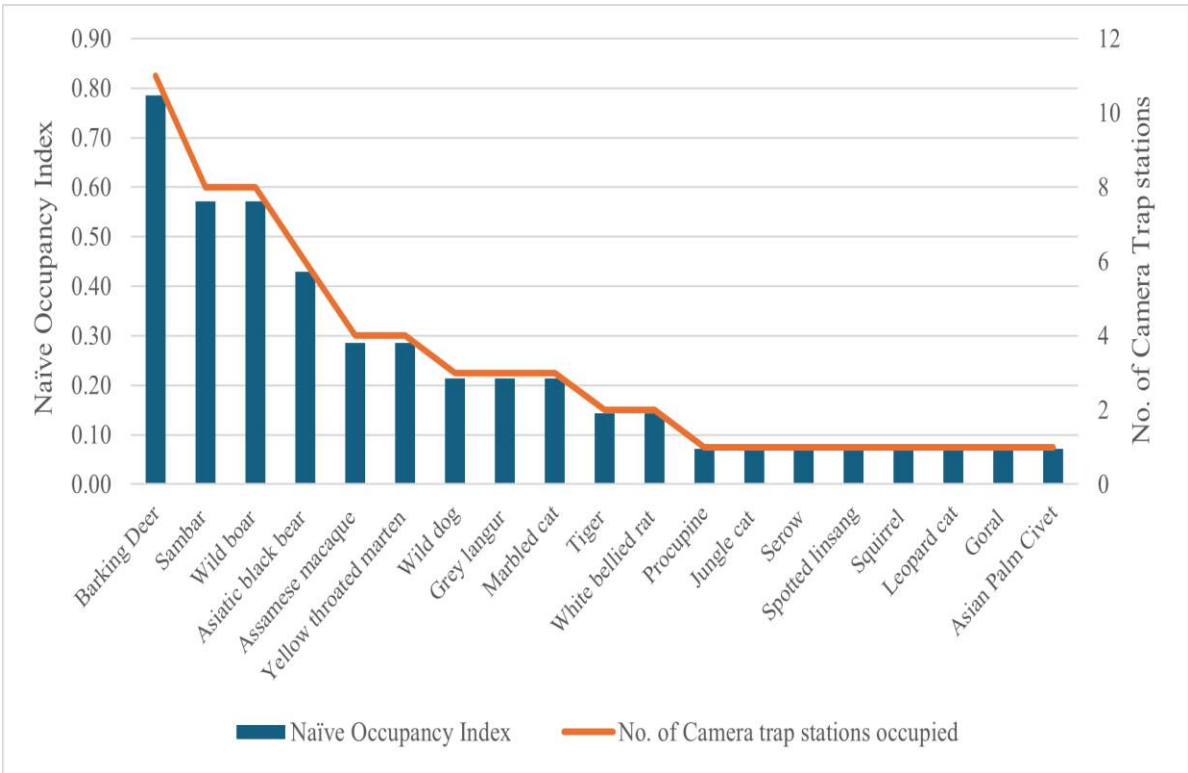

Figure 15: Mammal species naïve occupancy proportions

The naïve occupancy was found highest for Barking deer (0.79, n=11), followed by Sambar deer (0.57, n=8), Wild boar (0.57, n=8), and Asiatic black bear (0.57, n=8). Barking deer appear to be the most abundant species among those studied in the corridor. Sambar deer, wild boar, and Asiatic black bear show a similar level of occurrence, suggesting they might share similar habitat preferences or face comparable levels of human disturbance in the region.

Barking deer display a generalist feeding behavior, consuming a wide range of food sources, including fruits, leaves, and small plants. Their adaptability to various habitats and diverse dietary preferences plays a crucial role in their prevalence within the environment. Sambar, Barking deer, and Wild boar have been reported as the main food for Tigers in Nepal, India, and China (Carter et al., 2012; Karanth et al., 2017). These species are also the main food for Tigers in the corridor; there is a positive correlation in the temporal activity. This indicates a healthy habitat for apex predators like Tigers to survive, which in turn supports the whole ecology of the region.

Avifauna

A total of 186 Bird species under 48 families have been recorded in BC-02 (Annexure II), out of which 1 was critically endangered, 181 were Least Concerned, 3 were Near Threatened, 2 were Vulnerable, and 9 were under Schedule II of FNCRR 2023.

IUCN Status	Common Name
Critically Endangered (CR)	White-Bellied Heron (*Ardea insignis*)
Near Threatened (NT)	Satyr Tragopan (*Tragopan satyra*), Wards Trogon (*Harpectes wardi*), Yellow-rumped Honeyguide (*Indicator xanthonotus*)
Vulnerable	Great Hornbill (*Buceros bicornis*), Rufous-necked Hornbill (*Aceros nipalensis*)
Schedule II of FNCRR	White-Bellied Heron (*Ardea insignis)*, Satyr Tragopan (*Tragopan satyra)*, Ward's Trogon (*Harpectes wardi*), Yellow-rumped Honeyguide (*Indicator xanthonotus*), Great Hornbill (*Buceros bicornis*), Rufous Hornbill (*Aceros nipalensis*), Himalayan Monal (*Lophophorus impejanus*), Hill partridge (*Arborophila torqueola*)

Table 2: IUCN red list category of birds

Sl. No.	Forest Type	Diversity	Evenness	Abundance	Richness
1	CBL	4.528740914	0.931875665	410	129
2	BLUEPINE	3.996764147	0.968411439	100	62
3	WBL	3.863528322	0.968549454	75	54
4	FIR	3.228598037	0.97959886	33	27
5	MC	3.952829388	0.981983611	69	56
6	CHIRPINE	3.497937571	0.983852357	41	35

Table 3: Bird diversity, richness and evenness

Note. CBL: Cool Broad-Leaved Forest, WBL: Warm Broad-Leaved Forest, MC: Mixed Conifer Forest

The Rapid Biodiversity Assessment covered 14 transects in all 6 different forest types spanning around 53 kms with elevation ranging from 560 masl to 3556 masl. The highest number of Birds recorded are from the Muscicapidae (27) and Leiothrichidae (16). A total of 129 species were recorded in Cool Broad-leaved Forest, 62 in Blue Pine, 54 in Warm Broad-leaved, 27 in Fir Forest, 56 in Mixed Conifer and 35 in Chirpine. Shannon-Wiener Diversity Index (H) indicates that Bird diversity is highest in CBL followed by WBL and least in the Fir Forest.

2.2.4. Other Taxa diversity

Freshwater macro-invertebrates

A survey on freshwater macro-invertebrate diversity in BC-02 was conducted in the year 2021-2022 with funding support from GEF-LDCF. The survey methodology was based on the *"Survey protocol for conservation management planning"* developed by the Nature Conservation Division, 2020. The Biodiversity Monitoring Grid of 4x4 Km was laid for identifying the sample plots, and each sample plot had representatives from all major habitats and also covered all the representative microhabitats (i.e., riffles, pools, runs, cascades, and COPM). A total of 456 individuals of macro-invertebrates were captured, belonging to 10 orders and 29 families. The highest and the dominant species order was found to be Trichoptera and Ephemeroptera *(N=6)* followed by Diptera *(N=5),* Odonata *(N=3),* Plecoptera *(N= 3),* Coleoptera *(N=2),* and the least dominance of Diptera *(N=1),* Planaria *(N=1*) and Tipulinae *(N=1*).

Orchid

A total of 111 Orchid species (Annexure V) were found in BC-02, including a new record of *Bulbophyllum deergongense* in Bhutan. The results of this finding will provide valuable insights into BC-02 floral diversity and will be considered in the conservation management plan.

Butterfly

A total of 102 butterfly species (Annexure IV) were recorded under 6 families (Lycaenidae, Hesperiidae, Nymphalidae, Papilionidae, Pieridae & Riodinidae) & 22 sub-families. Most of the number of individuals & species were recorded from Nymphalidae family, and the least from Hesperiidae family. Most species were recorded from Daga Gewog (Taksha-silli, Kamichu, Wogayna). In addition to the 102 species observed during the survey, butterfly species that were previously recorded within the BC-02 area have also been added to this checklist, bringing the total species to 122 within the Corridor.

Fish

Opportunistic fish surveys were conducted using cast nets in rivers and electroshock methods in streams within the Corridor, adhering to the standard methodologies and ethical guidelines outlined in the Bhutan Fish and Freshwater Macroinvertebrate Monitoring Protocol, including catch-and-release practices. A total of three fish species were recorded within the Corridor: *Schizothorax richardsonii, Schizothorax progasta,* and *Labeo dyocheilus. Schizothorax richardsonii* was observed only in Nahi and Hetshokha streams, while all three species were found in the Punatsangchu River.

Additionally, the streams flowing through the Corridor and extending beyond its boundaries were found to host several other fish species, including *Schizothorax richardsonii, Schizothorax progasta, Neolissochilus hexagonolepis, Garra birostris, Psilorhynchus balitora, Pseudecheneis sulcata, Garra arupi*, and *Schistura spp*. These lower streams exhibited higher species richness compared to the upper sections of the corridor. This increased richness in the lower streams may be attributed to factors such as a wider range of habitats, greater nutrient availability, more stable environmental conditions, and enhanced connectivity with the Punatsangchu River.

2.3. Socio-economic characteristics

2.3.1. Demography and Social Structures

BC-02 caters natural resources to 378 households of 15 chiwogs under three Gewogs of Wangduephodrang Dzongkhag. Social data was collected from 254 households representing 67.2% of the total households in the Corridor, and a semi-structured interview was conducted from 25th March to 13th April 2024 to not only understand the demography, culture, and livelihoods but also to involve the communities in the BC-02 conservation programs.

Gewog & Total HHs		**Chiwog & HHs**		**n (Gewog sample size)**	**n (Chiwog Sample size)**
Gewog	***No. of HHs***	***Chiwog***	***No. HHs***		
Daga	165	Uma Khatoe	26	117	18
		Uma Khamey	48		34
		Wogayna	10		7
		Gaybakha	21		15
		Taksha-Silli	60		42
Gasetshowom	89	Hebesa	26	73	21
		Hesokha	12		10
		Shingkhey Khamaed	12		10
		Shingkhey Khatoe	14		11
		Tabchakha	25		20
Nahi	124	Eusagom	26	95	20
		Khujula	16		12
		Nabisa	29		22
		Eusawom	26		20
		Hebisa	27		21

Table 4: Total estimated population and household sample surveyed

A Simple Random Sampling technique involving Yamane's (1967) method was deployed to determine the household sample size for the survey. A sufficient sample size with a 95% margin of error (0.05) was considered to avoid biases. The ethnic group in the Corridor is Ngalops, speaking the Dzongkha language. Out of 254 respondents, 56% (n=142) were women and 44% (n=112) were male. Major respondents were from the working age group of 30-54, comprising 60% (n=152) of the sample size, which is a positive trend for farming activity (*Figure 16*). However, the number of non-residents outnumbers the number of residents in all three Gewogs, indicating the existence of a rural-to-urban migration trend (*Figure 17*).

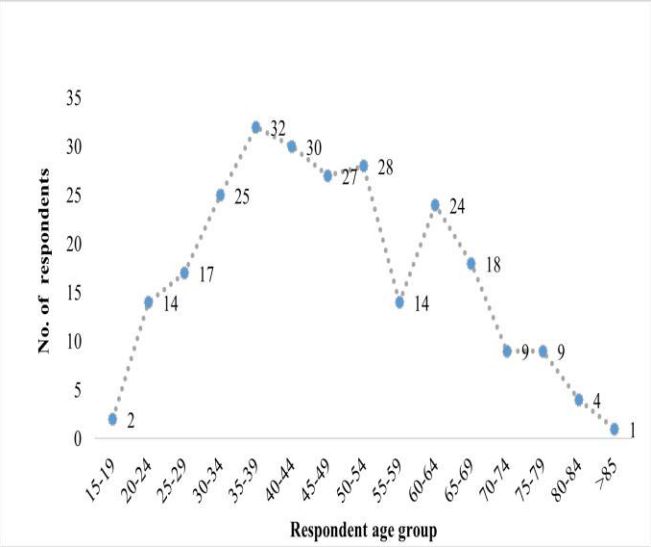

Figure 16: Age group classification

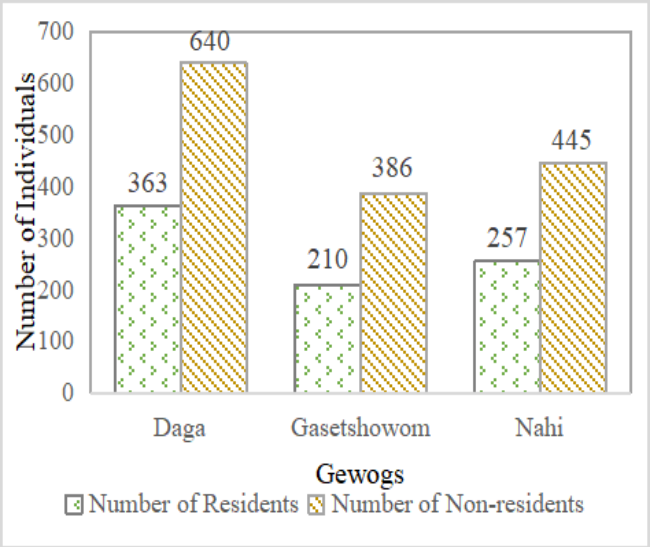

Figure 17: Residents and non-residents

2.3.2. Annual Income and Expenses of the Communities

Communities within and at the periphery of BC-02 carry out various activities for income generation. Income from other sources outranks the other income generated from agriculture, livestock, and forestry resources in all three Gewogs significantly (*Figure 18*). The income from other sources includes income generated through activities such as business, wages, salaries, and financial support from family members. Financial help from family members comprises 22% of the income generated from other sources for Daga Gewog, 42% for Gasetshowom, and 35% for Nahi Gewog.

The second highest income-generating activity for Daga and Nahi Gewogs is agriculture, while livestock generates more income for people of Gasetshowom Gewog. The annual expenditure of the communities

was assessed and listed under 14 categories. The community spends the most on conducting rituals, with each household spending an average of Nu.63,424.24 in a year. Expenses on household utilities, child education, and agriculture also load heavily on the BC-02 community (*Figure 19*).

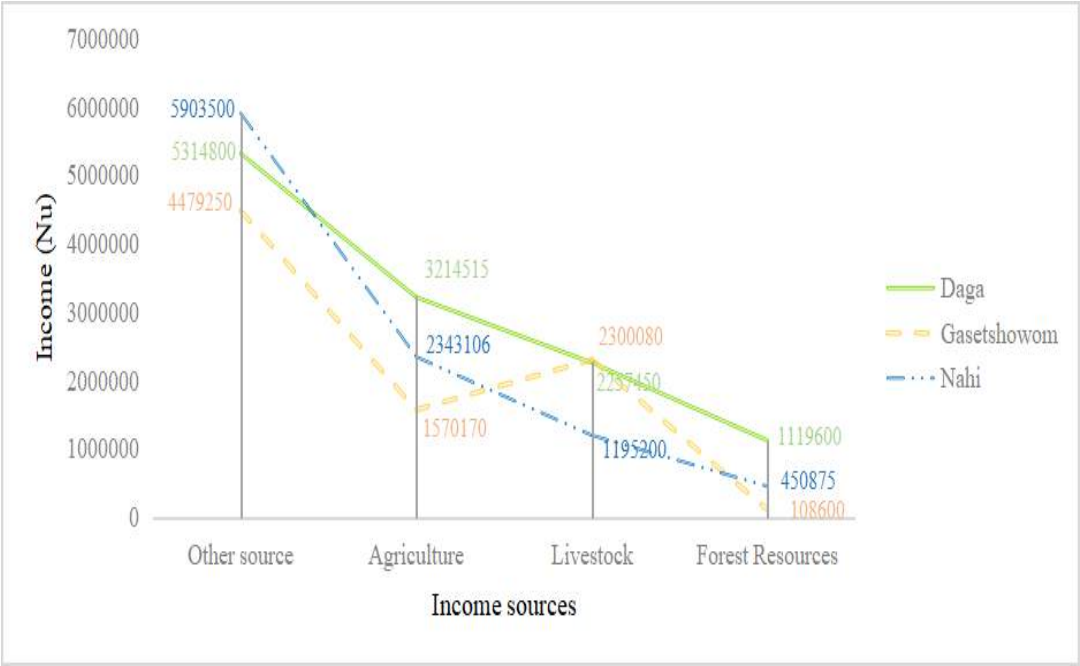

Figure 18: Income sources

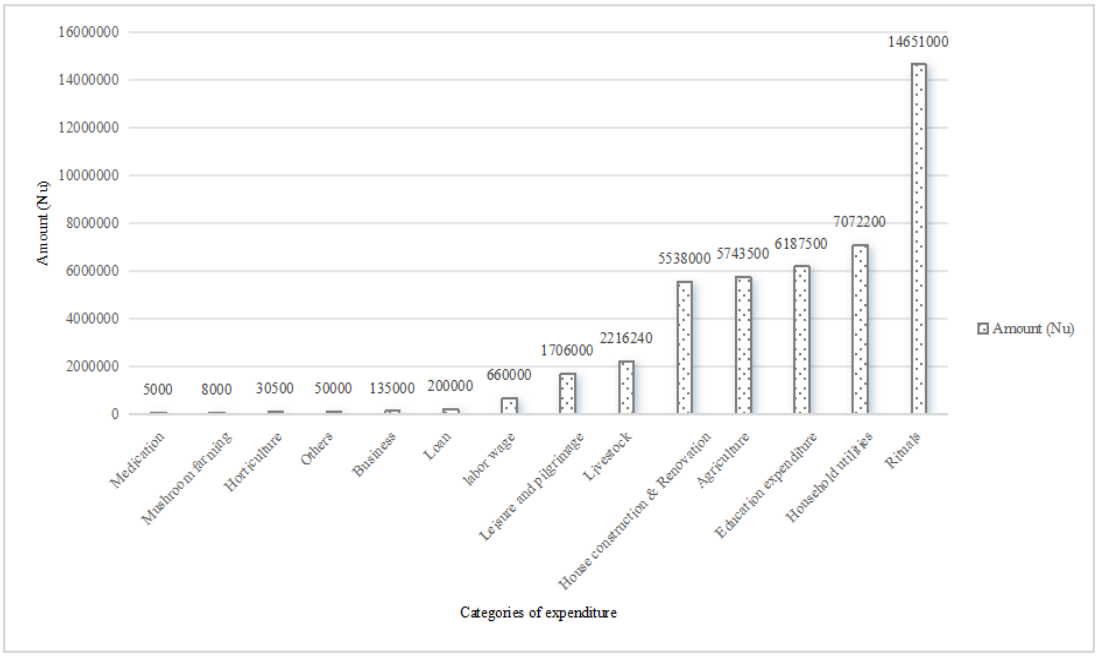

Figure 19: Annual Expenditure

2.3.3. Agriculture

Landholding and agricultural practices

The primary livelihood of communities residing in and around the Corridor is subsistence agricultural practices. However, few communities in Uma Khamey, Kamina and Wogayna under Daga Gewog, Hebesa under Gasetshowom gewog, Tongcheythangka, Nabisa, Khujula and Hebesa under Nahi Gewog have ventured into commercial agriculture farming.

In total, the residents of BC-02 grow 46 commercial crops (Annexure VI). Rice is the highest income-generating crop, which constitutes about 13.5% of income for Daga Gewog, 20.8% for Gasetshowom Gewog, and 24.9% for Nahi Gewog. Nahi Gewog alone has generated a sum of Nu 5,84,056 from the sale of rice in the year 2023. Daga Gewog has generated the highest income through the sale of crops (Nu. 3,214,515) and has the highest land holding with 682.025 acres in total (*Table 6*).

Gewog	**Chhuzhing**		**Kamzhing**		**Kitchen Garden/Residential plot**	**Orchard**
	Cultivated	***Fallow***	***Cultivated***	***Fallow***		
Nahi	224	14.38	50.65	9.23	2.26	0
Daga	318.5	9.39	304.15	38.745	8.91	2.33
Gasetshowom	152.91	13.15	67.73	26.43	3.53	2

Table 5: Land holding of three Gewogs in Wangdue Phodrang Dzongkhag

2.3.4. Livestock

Livestock holding and income

Besides agriculture, livestock rearing is another important component of rural livelihood. People rear livestock like cattle, pigs, poultry, and goat mainly for egg, dairy, meat, and manure production. All 65 sample households interviewed in Gasetshowom Gewog own one or more types of livestock *(Figure 20),* while 93.10% (81 households) in Nahi Gewog and 95.09% (97 households) in Daga Gewog also rear livestock. Communities across all three Gewogs practice poultry farming, although fish farming was

reported in only one household in Daga Gewog. The household with the highest number of cattle is in Wogayna village under Daga Gewog, with a total of 70 cattle. Cattle are the primary income-generating livestock for all the Gewogs in BC-02. In terms of income generated from the sale of livestock and their products, Gasetshowom Gewog reports the highest annual income, amounting to Nu. 2,300,080

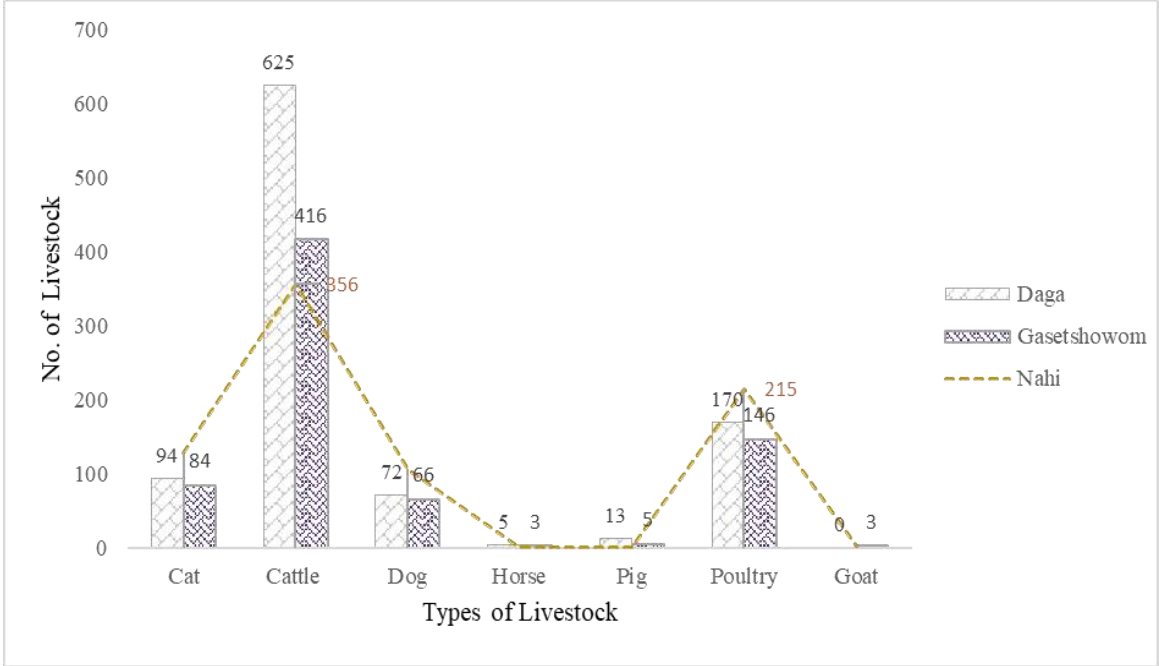

Figure 20: Types of Livestock reared

2.4. Current threats to the corridor

2.4.1. Crop depredation

Wildlife pests such as Barking deer and wild boar are widespread in all villages of BC-02, and people have reported that they have stopped vegetable farming because of constant damage caused by the Barking deer. Wild boars are mostly frequent during the paddy ripening season, while Sambar deer are often found in wheat and barley fields. Monkeys, barking deer, and Porcupines were reported to be the most problematic species amongst all, as they have high resistance against the existing Human Wildlife Conflict (HWC) mitigation measures such as electric fencing.

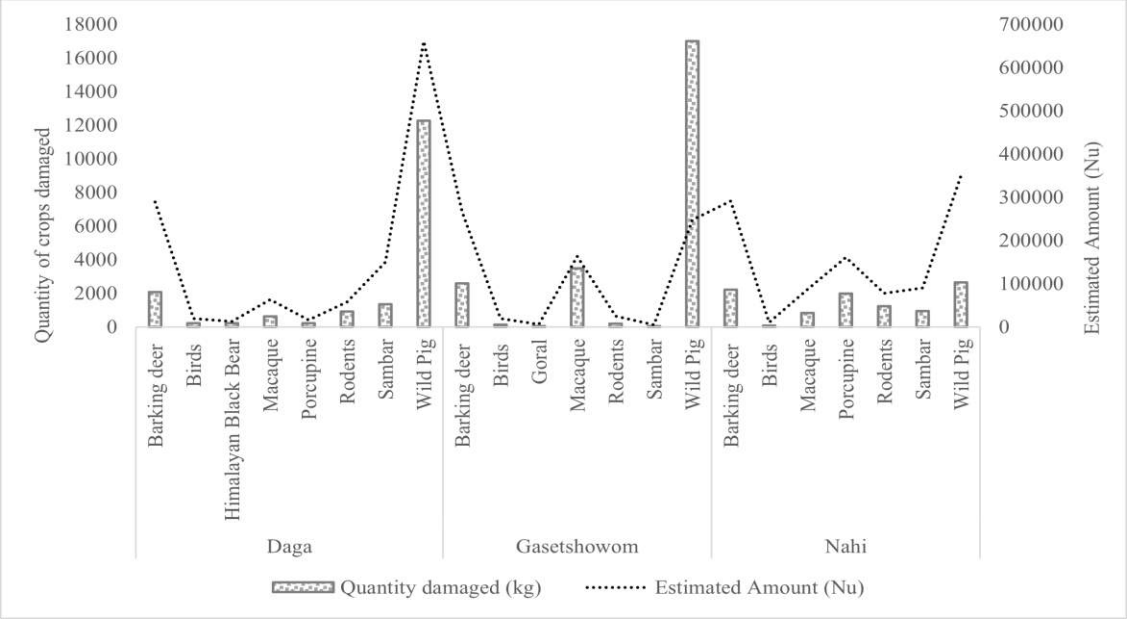

Figure 21: Crop depredation

About 98.03% (n=249) of the respondents reported loss of their crops to wildlife. Daga Gewog reported the highest crop depredation cases with 99 households (97.05%) losing their crops to the wild animals, which amounts to 17,880.6 kgs, equivalent to Nu.1,267,420 in the last year. Likewise, 64 households (98.46%) of Gasetshowom Gewog have lost about 23,506 kgs of different crop varieties, and 86 households (98.85%) of Nahi Gewog have lost about 9925 kgs of crops.

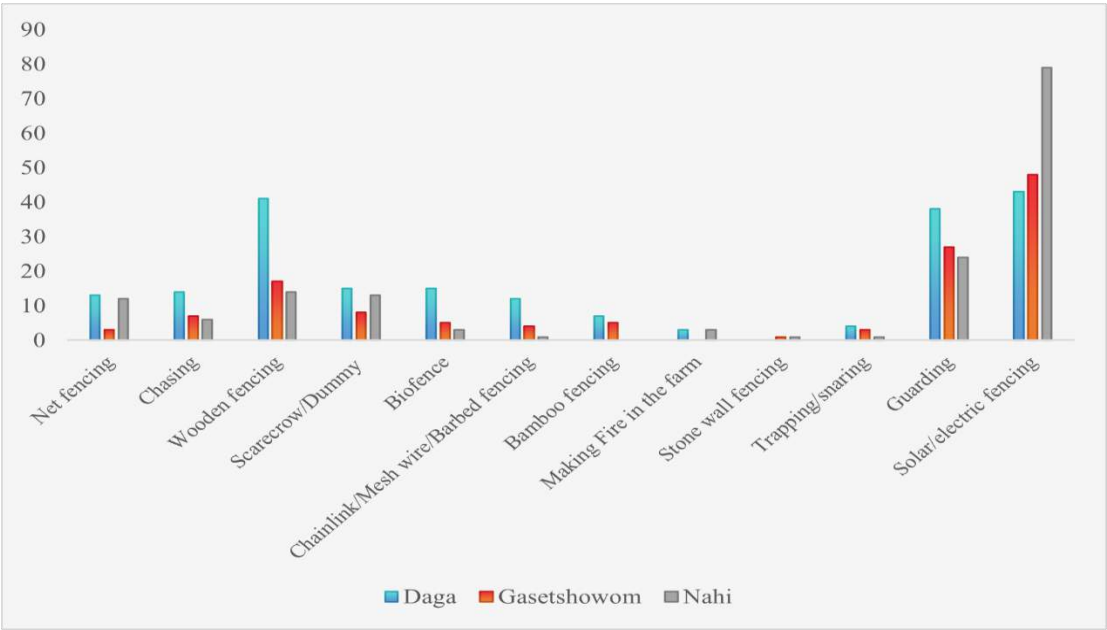

Figure 22: Crop guarding practices adopted by communities

The most common HWC mitigation measures adopted by BC-02 communities are electric fencing around farmlands. Additionally, communities utilize other forms of fencing, including wood fencing, bio-fencing, chain-linked fencing, and bamboo fencing. To specifically deter pests such as Barking deer and Kalij pheasant, communities employ crop guarding practices, such as the use of green nets *(Figure 22)*.

2.4.2. Livestock depredation

HWC related to livestock is one of the major challenges/constraints that the communities face while sustaining rural livelihoods. Daga Gewog has been reported to have lost the highest number of livestock, i.e, 101 cattle. The wildlife that has been reported for the highest number of livestock kills was Dhole (n=112) in all three Gewogs, followed by Common leopard (n=19) and Tiger (n=15). Depredation of local breed cattle is significantly higher in Nahi Gewog (n=49) and Daga Gewog (n=42) in the last three years (*Figure 23*).

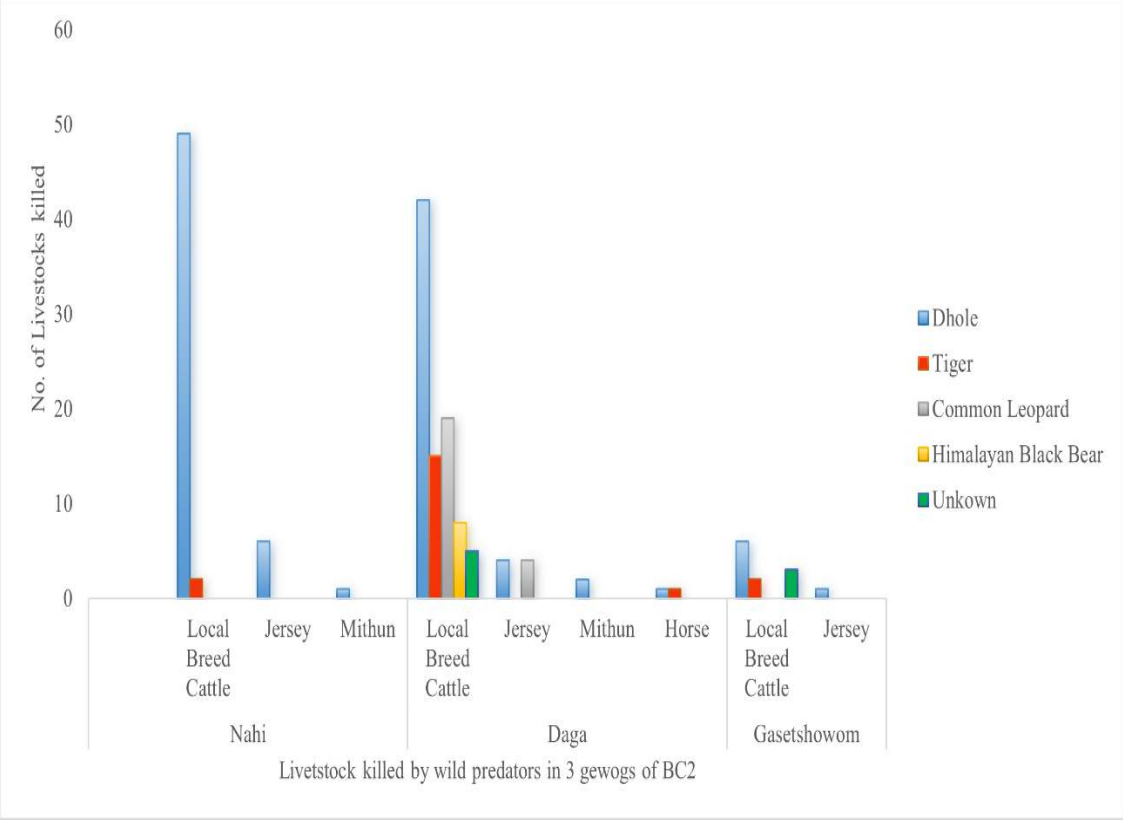

Figure 23: Livestock depredation cases

The communities in BC-02, according to SES, mostly engage in cattle-rearing practices such as free ranching and herding in open forest. This might be one of the reasons why the majority of cattle depredation cases happen in the forest (n=148) *(Table 7)*. Subsequently, challenges such as loss of livestock to wild predators (n=108) and labor shortage (n=106) are the top challenges among the eight listed challenges (*Table 8*). Communities reported that they face fodder constraints during lean seasons like winter.

Gewog	**Livestock depredation location**			
	Agriculture Land	***Open Area/ Grassland***	***Forest***	***Housing Premises***
Nahi	3	10	47	0
Daga	1	3	92	5
Gasetshowom			9	3

Table 6: Livestock depredation location wise

Challenges in livestock rearing	**Gewogs**		
	Daga	***Gasetshowom***	***Nahi***
Insufficient fodder	17	23	14
Poor quality local breed	16	6	13
Labor shortage	39	29	38
Loss to wild predators	52	17	39
Pest and diseases	11	12	4
Water shortage	3	8	8
Insufficient grazing land	7	5	2
Inadequate livestock support services	1	0	0

Table 7: Challenges faced in rearing of livestock

2.5. Forest Resource Area

2.5.1. Forest stand and stock condition of the Corridor

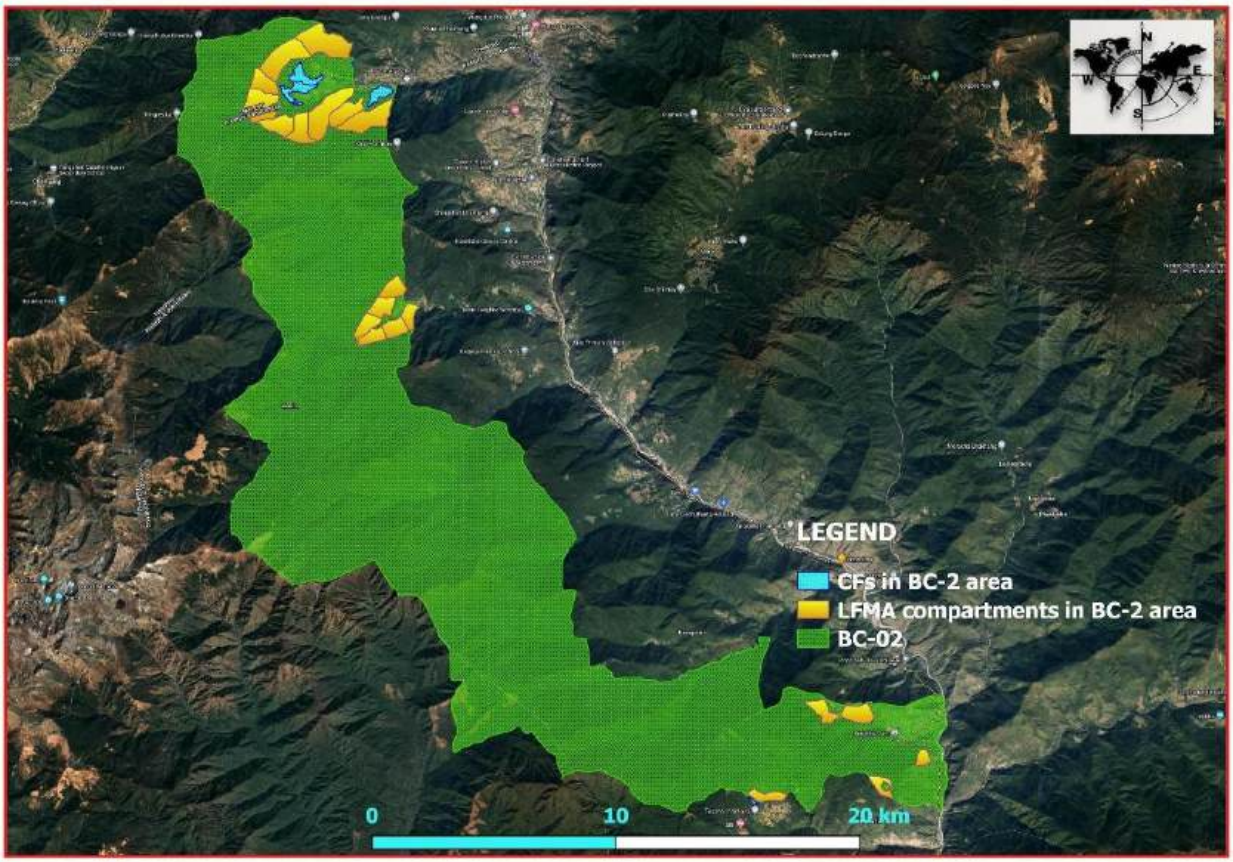

Figure 24: Forest Management Regimes

The communities residing inside the Corridor are dependent on natural resources. Most of the forest resources they depend on are timber, firewood, poles, and other non-wood forest products. In the BC-02 area, the collective expanse of three Community Forests (CFs) encompasses a substantial area of 151.505 hectares, and two LFMAs encompass an area of 3389.4 hectares, both with diverse dimensions of management practices exhibited in the management plan. The Corridor has an average basal area of 25.6 square meters per hectare and the average standing volume of 199 cubic meters per hectare, primarily contributed by Mixed hardwood conifer forests (52%), Hardwood species (27%), Mixed conifer species (14%), Chir pine species (6%) and 1 % from Blue pine species.

Unit	Area Distribution				
	Non-Production	Protection	Inaccessible	Net Production	Total
ha	46.1	296.9	409.6	1104.2	1856.8
%	2%	16%	22%	59%	100%

Average basal area (m2/ha)	Aver. Stand Volume (m3/ha)	No of accessible sample plots
25.6	199	221

Unit	Forest Type Distribution								
	Hemlock	Fir	Spruce	Mix. Con.	Blue pine	Chirpine	Hardwood	Mixed HC	Total
%	0%	0%	0%	14%	1%	6%	27%	52%	**100%**
Unit	**Age distribution**					**Stand type distribution**			
	young	immature	mature	Overmature	Total	plantation	natural	coppice	Total
%	2%	17%	81%	0%	**100%**	0%	100%	0%	**100%**
Unit	**Canopy closure**					**Condition**			
	dense	closed	open	unstocked	Total	good	average	poor	Total
%	33%	56%	11%	0%	**100%**	49%	48%	3%	**100%**

Site Condition									
Unit	Slope			Erosiveness			Soil Cover		
	gentle	moderate	steep	stable	moderate	unstable	high	moderate	low
%	49%	37%	14%	73%	25%	0%	22%	72%	6%

Forest Use						
Unit	Intensive Side Uses			Extensive Side Uses		
	grazing	sokshing	lopping	grazing	sokshing	lopping
ha	233.6	0.0	13.2	545.0	0.0	5.7
%	13%	0%	1%	29%	0%	0%

NWFP Occurrence and Firewood								
Unit	NWFP abundant				NWFP sparse			
	Firewood	Bamboo	Cane	Daphne	Firewood	Bamboo	Cane	Daphne
ha	438.2	149.5	0.0	28.0	917.9	373.0	0.0	452.7
%	24%	8%	0%	2%	49%	20%	0%	24%

Potential Production					
Unit	Timber				
	Drashing	Cham	Tsim	Poles, posts	Total
Ntot	10460	15926	12092	26536	**65014**
N/ha	9	14	11	24	**59**
m3	30635	14961	3298	1892	**50786**
m3/ha	27.7	13.5	3.0	1.7	**46.0**
Unit	**Firewood**				

	> 49cm	30-49cm	20-29 cm	10-19 cm	Total
Ntot	11037	17603	12685	14711	**56036**
N/ha	10	16	11	13	**51**
m3	33145	17682	3645	9087	**63559**
m3/ ha	30.0	16.0	3.3	8.2	**57.6**

Unit	Silvicultural Measures				
	Planting	Thinning	Felling (firewood)	Felling (timber)	No Activity
ha	0.0	18.5	1052.8	624.7	130.3
%	0	1	57	34	7

Yield Regulation		
AAC	**1820**	m3
	1.6	m3/ha
Prod. Potential / AAC	**63**	years

Table 8: BC-02 LFMA summary sheet

2.5.2. Community Forest Management Areas

The extraction of timber and firewood resources inside the Corridor is primarily guided by the CF management plans. CF management areas inside the Corridor and most resource utilizations are guided by the community management plans.

Sl. No.	Name of CF.	Gewog	Village	Dzongkhag	Area (Ha.)	No of Households
1	Nabesa CF	Nahi	Nabesa	Wangdue	51.08	18
2	Zomripang CF	Nahi	Tongchey Thangkha	Wangdue	52.86	18
3	Tshowa Lango CF	Nahi	Eusawom	Wangdue	42.21	23

Table 9: Community Forest inside the Corridor

2.5.3. Local Forest Management Areas

Two Local Forest Management Areas are designated to manage and utilize the significant forest resources in these areas.

Sl. No.	LFMA	Forest Type	Area(ha)
1	Gasetshowom LFMA	Mixed hardwood Conifer	1661.7
2	Nahi LFMA	Mixed hardwood Conifer	1727.7

Table 10: LFMAs inside the Corridor

Gasetshowom LFMA

The area of Gasetshowom LFMA measures 1661.7 hectares, and the households from Nahi Gewog are dependent on the LFMA for timber and firewood. The annual allowable cut is 1871 cubic meters.

Unit	Area Distribution						Average basal area (m2/ha)	Aver. Stand Volume (m3/ha)	No of accessible sample plots
	Non-Production	Protection	Inaccessible	Net Production	Total				
ha	66.6	240.0	206.8	1148.3	1661.7				
%	4%	14%	12%	69%	100%		26.6	197	241
Unit	**Forest Type Distribution**								
	Hemlock	**Fir**	**Spruce**	**Mix. Con.**	**Blue pine**	**Chirpine**	**Hardwood**	**Mixed HC**	**Total**
%	0%	0%	0%	0%	0%	0%	12%	88%	**100%**
Unit	**Age distribution**					**Stand type distribution**			
	young	**immature**	**mature**	**Overmature**	**Total**	**plantation**	**natural**	**coppice**	**Total**
%	0%	15%	85%	0%	**100%**	0%	100%	0%	**100%**
Unit	**Canopy closure**					**Condition**			
	dense	**closed**	**open**	**unstocked**	**Total**	**good**	**average**	**poor**	**Total**
%	3%	88%	10%	0%	**101%**	39%	61%	0%	**100%**

Site Condition									
Unit	**Slope**			**Erosiveness**			**Soil Cover**		
	gentle	**moderate**	**steep**	**stable**	**moderate**	**unstable**	**high**	**moderate**	**low**
%	33%	54%	13%	51%	49%	0%	4%	95%	2%

Forest Use						
Unit	Intensive Side Uses			Extensive Side Uses		
	grazing	sokshing	lopping	grazing	sokshing	lopping
ha	444.2	0.0	0.0	763.3	0.0	0.0
%	27%	0%	0%	46%	0%	0%

NWFP Occurrence and Firewood								
Unit	NWFP abundant				NWFP sparse			
	Firewood	Bamboo	Cane	Daphne	Firewood	Bamboo	Cane	Daphne
ha	101.5	119.4	0.0	17.4	1393.7	262.7	0.0	412.4
%	6%	7%	0%	1%	84%	16%	0%	25%

Potential Production					
Unit	Timber				
	Drashing	Cham	Tsim	Poles, posts	Total
Ntot	4958	7084	7033	11138	**30213**
N/ha	4	6	6	10	**26**
m3	13320	7143	1905	763	**23131**
m3/ha	11.6	6.2	1.7	0.7	**20.1**
Unit	**Firewood**				
	> 49cm	**30-49cm**	**20-29 cm**	**10-19 cm**	**Total**
Ntot	12338	19414	11683	23081	**66516**
N/ha	11	17	10	20	**58**
m3	35420	20036	3355	1655	**60466**
m3/ha	30.8	17.4	2.9	1.4	**52.7**

Unit	Silvicultural Measures				
	Planting	Thinning	Felling (firewood)	Felling (timber)	No Activity
ha	0.0	33.1	1371.0	205.9	49.4
%	0	2	83	12	3

Yield Regulation		
AAC	**1871**	m3
	1.6	m3/ha
Prod. Potential / AAC	**45**	years

Table 11: Gasetshowom LFMA

Nahi Local Forest Management Plan

Households from Nahi Gewog are dependent on Nahi LFMA for timber and firewood extraction. The area of Nahi LFMA measures 1727 hectares, and the forest type in the area is Mixed hardwood conifer forest. The annual allowable cut is 2186 cubic meters.

Unit	Area Distribution				
	Non-Production	Protection	Inaccessible	Net Production	Total
ha	4.4	226.2	415.1	1082.0	1727.7
%	0%	13%	24%	63%	100%

Average basal area (m2/ha)	Aver. Stand Volume (m3/ha)	No of accessible sample plots
31.4	248	190

Unit	Forest Type Distribution								
	Hemlock	Fir	Spruce	Mix. Con.	Blue pine	Chirpine	Hardwood	Mixed HC	Total
%	0%	0%	0%	16%	1%	2%	39%	42%	100%
Unit	**Age distribution**					**Stand type distribution**			
	young	immature	mature	Overmature	Total	plantation	natural	coppice	Total
%	3%	14%	83%	0%	100%	0%	100%	0%	100%
Unit	**Canopy closure**					**Condition**			
	dense	closed	open	unstocked	Total	good	average	poor	Total
%	32%	53%	15%	0%	100%	48%	48%	4%	100%

Site Condition									
Unit	Slope			Erosiveness			Soil Cover		
	gentle	moderate	steep	stable	moderate	unstable	high	moderate	low
%	45%	35%	20%	79%	20%	0%	12%	77%	10%

Forest Use						
Unit	Intensive Side Uses			Extensive Side Uses		
	grazing	sokshing	lopping	grazing	sokshing	lopping
ha	162.6	0.0	13.2	346.4	0.0	17.1
%	9%	0%	1%	20%	0%	1%

NWFP Occurrence and Firewood								
Unit	**NWFP abundant**				**NWFP sparse**			
	Firewood	**Bamboo**	**Cane**	**Daphne**	**Firewood**	**Bamboo**	**Cane**	**Daphne**
ha	606.4	174.4	0.0	15.0	712.3	481.4	0.0	321.4
%	35%	10%	0%	1%	41%	28%	0%	19%

Potential Production					
Unit	**Timber**				
	Drashing	**Cham**	**Tsim**	**Poles, posts**	**Total**
Ntot	12633	20411	17516	35830	86390
N/ha	12	19	16	33	80
m3	38039	19447	4909	2599	64994
m3/ha	35.2	18.0	4.5	2.4	60.1
Unit	**Firewood**				
	> 49cm	**30-49cm**	**20-29 cm**	**10-19 cm**	**Total**
Ntot	17494	26457	21478	22140	87569
N/ha	16	24	20	20	81
m3	53866	27222	6495	9656	97239
m3/ha	49.8	25.2	6.0	8.9	89.9

Unit	**Silvicultural Measures**				
	Planting	**Thinning**	**Felling (firewood)**	**Felling (timber)**	**No Activity**
ha	0.0	24.7	1006.4	588.6	83.2
%	0	1	58	34	5

Yield Regulation		
AAC	2186	m3
	2.0	m3/ha
Prod. Potential / AAC	74	years

s

Table 12: Nahi LFMA

CHAPTER III

THREAT ANALYSIS

Threat assessment forms an integral part of the conservation planning and management of significant areas and species. Threat analysis determines the scope, severity, and irreversibility of threats under major conservation themes and identifies strategies to minimize or reduce threats inside BC during the management plan period. Threats were assessed using Miradi to derive relevant strategies and intervention actions for better management of the Corridor and to help in improving the livelihoods of the communities. Ten threats were identified in the context of species conservation, habitat management, and community livelihood, and the detail of each threat is discussed in the subsequent sections.

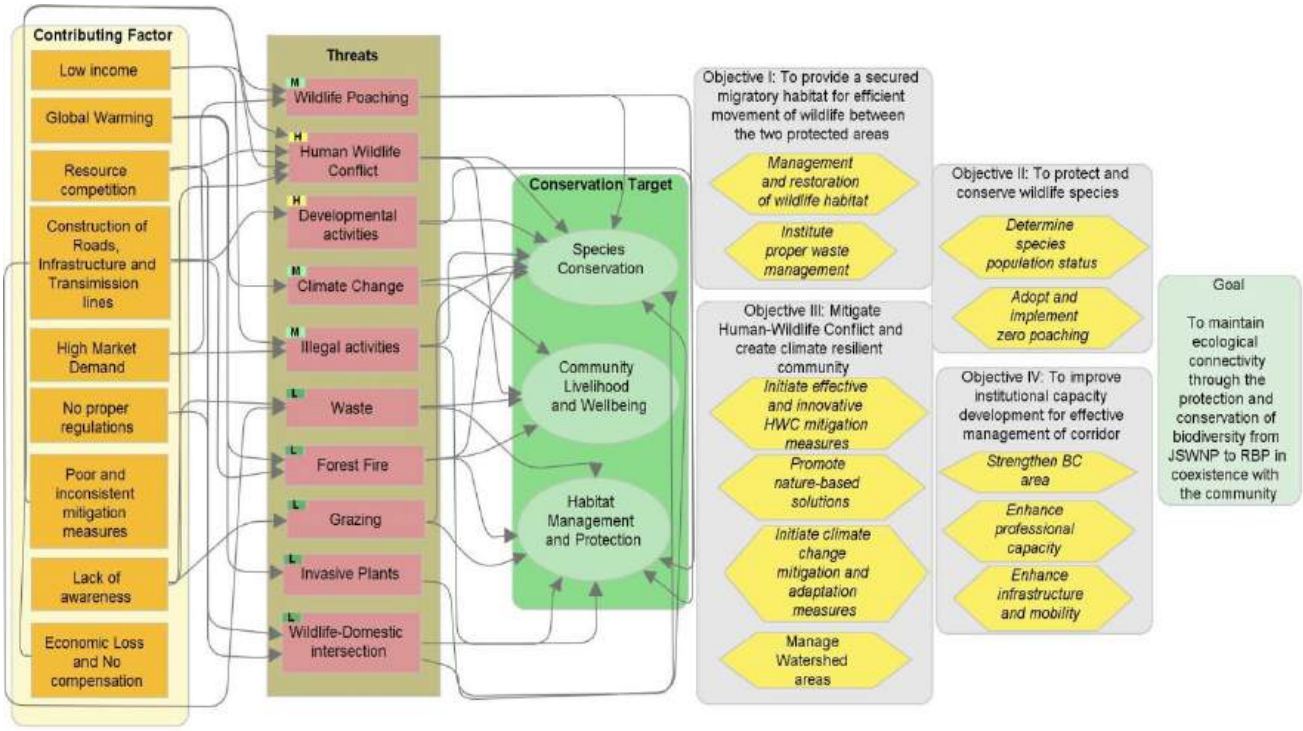

Figure 25: Threat Analysis Framework

3.1. Conservation threats in BC

3.1.1. Human Wildlife Conflict

Human wildlife conflict (HWC) is one of the major issues within BC-02. The primary cause of habitat loss and fragmentation are the primary cause of HWC. As development activities increase, it results in habitat loss and fragmentation, pushing wildlife out of their natural habitats and leading to conflicts (Sharma, 2021). As the human population continues to expand and reduce natural habitats, people and animals come into conflict over space and food. HWC is one of the significant threats to the survival of wildlife and the livelihood of the local communities.

The socio-economic survey report indicates that the most persistent challenge for agricultural farming is crop damage by wild animals (98.03% of HHs). This has significant implications for livelihoods and food security, with some farmers losing entire crops overnight, resulting in fueling resentment towards wildlife conservation, often leading to retaliatory killings.

Conflicts between humans and wildlife occur frequently throughout the Corridor. The camera trapping exercise undertaken in 2024 for the BC Mammal Survey captured a clear human-wildlife confrontation. On the evening of April 15, 2024, a Tiger was observed in Heybaysa attacking a cow. The camera retrieval crew discovered a carcass of a cow close to the camera station, providing more evidence of the conflict between humans and wildlife. Such incidents pose a significant threat to conservation efforts as affected farmers may resort to retaliation, thereby weakening their support for wildlife conservation.

Figure 26: Pictorial evidence of HWC

3.1.2. Developmental Activities

Various developmental activities are happening all over the country without exception of the Biological Corridors. Developmental activities like road construction and infrastructure development in BC-02 bring significant environmental challenges, especially to wildlife. These activities often result in habitat destruction, increased pollution, and disturbances to wildlife. Some of the major developmental activities happening in the BC-02 area include the construction of roads, the installation of power transmission lines, and the operation of the Gaybakha stone quarry. The majority of the developmental activities are concentrated in the southern part of the Corridor, which also acts as a choke point for wildlife movement.

There are five transmission lines within the Corridor. The first four lines, labelled as "High tension transmission line," are located in the South-East region of the BC-02. The fifth transmission line, "Wangdue to Thimphu transmission line," is significantly longer, measuring 7504.36 meters. The presence of these transmission lines within BC-02 could have several potential impacts on the Corridor's ecosystem. High-tension transmission lines often result in habitat fragmentation, which can disrupt wildlife movement and breeding patterns. The long stretches of cleared land required for these lines may lead to a reduction in vegetation cover, possibly affecting plant diversity and the overall health of the ecosystem. Furthermore, the construction and maintenance activities associated with these lines could lead to disturbances to wildlife movement.

Various roads are prevalent within the BC-02 area. The roads range significantly in length. Wangdue to Dagana bypass is the longest road present in the BC-02 area, measuring about 10,769.74 meters. Other notable roads include the Wangdue-Tsirang highway, Nabesa farm road, and Domsa farm road. The potential impact of these roads can be significant. However, the longer roads, such as the Wangdue to Dagana bypass and the Wangdue-Tsirang highway, will likely have a more substantial ecological impact due to their extensive lengths, possibly fragmenting habitats and disrupting wildlife movement.

3.1.3. Impact of Climate Change

Changes in weather and climate patterns are already having an impact on fragile mountain ecosystems in the country. This is evident from the significant drop in the size and distribution of mountain glaciers, water scarcity, altitudinal shift of species range, the proliferation of invasive species, pest/disease outbreaks, recurrent flash floods, and erratic rainfall (Chhogyel & Kumar, 2018). Such aberrations bring in direct and indirect adverse impacts on species, wildlife habitat, environment, development, and livelihood.

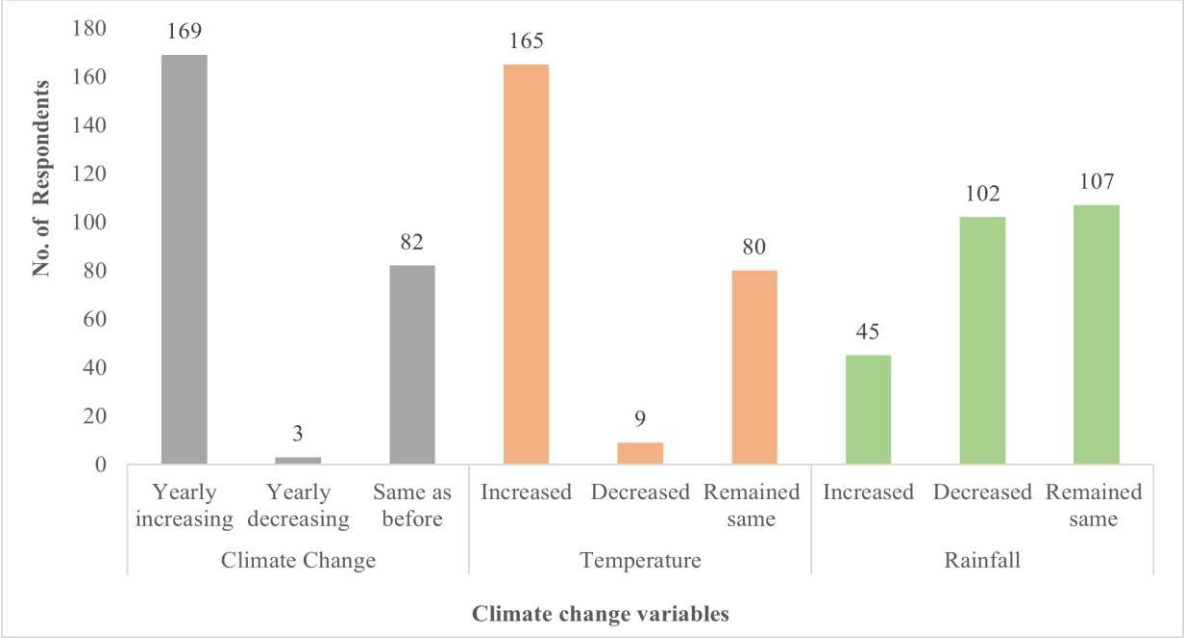

Figure 27: Climate change perception

The local community residing within the proximity to the Corridor expressed their concern on repeated occurrences of extreme weather patterns and the devastating damage to crops through pest and disease outbreaks, erratic rainfall, and hailstorms, which implicate their livelihoods. According to the Socio-Economic Survey (SES), 66.5% (n=169) of the households reported that they are increasingly observing climate change variables, while 32.28% (n=82) of the households feel that it has remained the same. Similarly, the majority of the respondents (n=165) feel that the temperature has increased over the past ten years (*Figure 27*).

3.1.4. Wildlife Poaching

Poaching of wildlife significantly contributes to the loss of biodiversity, particularly affecting Mammal and Bird populations. This issue has been exacerbated by the burgeoning global market for wildlife products, including luxury foods, pets, and medicinal remedies, which has already led to the extinction of several charismatic species. In Bhutan, the situation is critical due to its rich wildlife diversity and porous international borders, leading to rampant illegal wildlife trade with potential long-term environmental and social impacts.

Sl. No.	Offence type	Species	Place of offence
1	Wildlife & Poaching	Setting snares for ungulates	Daga
2	Wildlife & Poaching	Setting snares for ungulates	Daga
3	Wildlife & Poaching	Wild boar	Daga
4	Aquatic & Fishing	Fishing using closed/drag nets	Daga
5	Aquatic & Fishing	Fishing using closed/drag nets	Daga
6	Aquatic & Fishing	Fishing using closed/drag nets	Daga
7	Aquatic & Fishing	Fishing using closed/drag nets	Daga
8	Aquatic & Fishing	Fishing using closed/drag nets	Daga
9	Wildlife & Poaching	Asiatic black bear	Daga
10	Wildlife & Poaching	Barking deer	Daga
11	Wildlife & Poaching	Vespa mandarinia (Hornet)	Daga
12	Wildlife & Poaching	Wild boar	Gasetshowom
13	Wildlife & Poaching	Asiatic black bear	Gasetshowom
14	Wildlife & Poaching	Vespa mandarinia (Hornet)	Daga
15	Wildlife & Poaching	Vespa mandarinia (Hornet)	Daga
16	Wildlife & Poaching	Wild boar	Daga

Table 13: Wildlife offence cases from BC-02 (2018 to 2024)

One of the main challenges for BC-02 is wildlife poaching. During the Rapid Biodiversity Assessment conducted in 2024, traps and snares used for goral poaching were found around the Nahi ridges. These incidents demonstrate the prevalence of animal poaching in the corridor. *Table 14* indicates the wildlife offence cases reported from 2018 to 2024 within the Corridor. There are undoubtedly instances of wildlife poaching that were carried out covertly without the forest officials' notice; this data only displays the incidents that were either investigated after complaints were filed or detected during patrolling.

Figure 28: Trophies of Bear apprehended from Hetshokha, Gasetshowom

3.1.5. Illegal collection of forest resources

BC-02 is home to a variety of edible NWFPs and economically important timber, and there are many instances of illicit resource harvesting in the area (*Table 15*). Communities inside and outside of the Corridor rely on the forest resources for both personal usage and economic gain. Illegal harvesting of timber is relatively prevalent in BC-02, with walnut timber being the most sought-after forest resource. In the BC-02 region, illegal harvesting of timber is relatively prevalent. The abundance of commercially significant timber species, along with the easily accessible roads, stimulates the high rate of illicit activities occurring in BC-02, which has huge potential to cause significant harm to the natural habitat of wildlife species.

Sl. No.	Year of offence	Offence type	Gewog
1	2024	Illegal Timber	Nahi
2	2024	Illegal Timber	Nahi
3	2024	Illegal Timber	Gasetshogom
4	2024	Illegal Timber	Gasetshogom
5	2023	Illegal Timber	Nahi
6	2023	Illegal Timber	Nahi
7	2023	Illegal Timber	Daga
8	2023	Illegal Timber	Daga
9	2023	Illegal Timber	Daga
10	2023	NWFP	Nahi
11	2023	NWFP	Nahi
12	2023	NWFP	Nahi
13	2023	NWFP	Nahi
14	2023	NWFP	Nahi
15	2023	NWFP	Nahi
16	2023	NWFP	Nahi
17	2023	NWFP	Nahi
18	2023	Illegal Timber	Athang
19	2023	Illegal Timber	Athang
20	2023	NWFP	Daga
21	2023	NWFP	Gasetshogom
22	2023	NWFP	Gasetshogom
23	2023	Illegal Timber	Gasetshogom
24	2023	Illegal Timber	Gasetshogom
25	2021	Illegal Timber	Gasetshowom
26	2021	Illegal Timber	Nahi
27	2021	Illegal Timber	Nahi
28	2021	Illegal Timber	Nahi
29	2021	Illegal Timber	Nahi

30	2021	Illegal Timber	Nahi
31	2021	Illegal Timber	Nahi
32	2021	Illegal Timber	Nahi
33	2021	Illegal Timber	Nahi
34	2021	Illegal Timber	Daga
35	2021	Illegal Timber	Daga
36	2021	Illegal Timber	Daga
37	2021	Illegal Timber	Daga
38	2021	Illegal Timber	Daga
39	2021	Illegal Timber	Daga
40	2021	Illegal Timber	Daga
41	2020	Illegal Timber	Nahi
42	2020	Illegal Timber	Nahi
43	2020	Illegal Timber	Nahi
44	2020	Illegal Timber	Nahi
45	2020	Illegal Timber	Nahi
46	2020	Illegal Timber	Nahi
47	2020	Illegal Timber	Nahi
48	2020	Illegal Timber	Daga
49	2020	Illegal Timber	Daga
50	2019	Illegal Timber	Daga
51	2019	Illegal Timber	Nahi
52	2019	Illegal Timber	Nahi
53	2019	Illegal Timber	Nahi
54	2019	Illegal Timber	Nahi
55	2018	Illegal Timber	Daga
56	2018	Illegal Timber	Daga
57	2018	Illegal Timber	Daga
58	2018	Illegal Timber	Nahi

Table 14: Timber and NWFPs offence cases from BC-02 (2018 – 2024)

3.1.6. The impact of domestic animals on wildlife conservation

Rapid Biodiversity Assessment (RBA) survey documented a substantial level of human disturbance within the corridor. This included the presence of domestic animals such as horses, dogs, and cattle, indicating significant human pressure on the ecosystem. The presence of herd dogs was particularly noteworthy, with numerous detections recorded by recent mammal camera traps, Biodiversity Monitoring Grids cameras, and National Tiger Survey cameras. These observations highlight the potential for human-wildlife conflict and disruptions to the behavior and habitat of important wildlife species.

Furthermore, Wildlife rescue data from Wangdue Forest Division reports feral dogs' attacks being the topmost cause for wildlife injuries and mortality. Feral dog attacks accounted for 65% of all animals rescued between 2019 and 2024 (*Table 16*). These dogs pose a threat to critically endangered species like Red pandas and may be the source of an outbreak of zoonotic diseases. There is interspecific rivalry amongst ungulates for scarce resources as herds of free-ranging cattle increase.

Date	Wildlife species	Place of rescue	Cause
19/03/2019	Sambar	Nahi	Chased by dogs
06/04/2019	Barking Deer	Kamichu	Chased by dogs
24/04/2019	Barking Deer	Kamichu	Attacked by dogs
08/05/2018	Bear cubs (1 nos.)	Athang	Abandoned by the mother
14/05/2019	Sambar	Nahi	Attacked by dogs
27/07/2019	Goral	Kamichu	Chased by dogs
30/10/2019	Goral	Jarogang	Washed by river
20/2/2020	Barking Deer	Kamichu	Chased by dogs
22/2/2020	Barking Deer	Kamichu	Separated from mother

23/2/2020	Sambar	Nahi	Chased by dogs
23/04/2020	Sambar Deer	Hali, Nahi gewog	Chased by dogs
21/02/2021	Barking Deer	Nahi school	Chased by dogs
09/03/2021	Samber	Hebesa School	Chased by dogs
05/05/2021	Goral	Kamichu	Abandoned
06/05/2021	Sambar Deer	Kamichu	Chased by dogs
01/07/2021	Barking Deer	Kamichu	Chased by dogs
18/08/2021	Monkey	Kamichu	Injured right hand
28/05/2022	Barking deer	Basochu	Chased by dogs
20/06/2022	Barking deer	Nabesa, Nahi	Chased by dogs
18/07/2022	Himalayan Goral	Waklayter	Fell from the cliff
4/4/2023	Barking deer	Nahi	Abandoned by family
1/5/2023	Wild boar	DoR compound	Chased by dogs
8/6/2023	Barking deer	Pangsho, Gasetshogom,	Chased by dogs
8/6/2023	Sambar deer	Zawakha, Daga	Chased by dogs
10/7/2023	Gray langur	Zawakha, Daga	Unknown
11/7/2023	Sambar deer	Zawakha, Daga	Attacked by dogs
11/7/2023	Grey langur	Zawakha, Daga	Road Killed
12/7/2023	Barking deer	Kamichu	Attacked by dogs

24/5/2024	Barking deer	Gaychuthang, Uma	Chased by dogs
24/5/2024	Leopard cat	Kamichu	Injured
16/06/2024	Rock python	Kamichu	Injured

Table 15: Wildlife rescued from BC-02

3.1.7. Grazing

The data for grazing land in BC-02 presents an overview of the distribution of grazing land in the BC-02 area, each distinguished by a specific name and area measured in hectares *(Figure 29).* Collectively, 33 grazing sites were surveyed and mapped, covering a total of 434.37 hectares. The significant presence of the grazing area is at Dagala, comprising 70.91 hectares. Similarly, the Dagana Bypass area has a grazing area spanning over 117.12 hectares across four areas. Gashila covers 82.05 hectares, distributed in three areas. Other regions such as Hebesa Top, Helela, Hesogoenpa, Joripang, Lungchuzey, Shalipangkha, and Taksha also have small grazing sites. The largest single grazing area is Joripang 1, covering 75.84 hectares, and the smallest is Lungchuzey 2, with only 0.36 hectares.

These designated grazing lands are crucial resources for local communities, especially for the yak herders from the Dagala Gewog who hold customary grazing rights. Most of the grazing sites at higher altitudes serve as winter pastures for the highland cattle herders. In summer, yak herders migrate to grazing sites located at even higher altitudes on the Dagala Mountain, beyond the BC-02 area. Only a few of the sites are utilized by lowland cattle, while many free grazing areas closer to the communities remain unmapped, and their exact areas are undetermined. There is considerable overlap in the use of pastureland between domestic animals and wildlife, which intensifies competition for limited resources. Additionally, vegetation intrusion into the limited grazing areas has led to the depletion of native palatable species in some regions. This depletion has the potential to disrupt the ecological balance and decrease the availability of suitable grazing resources for both cattle and wild ungulates.

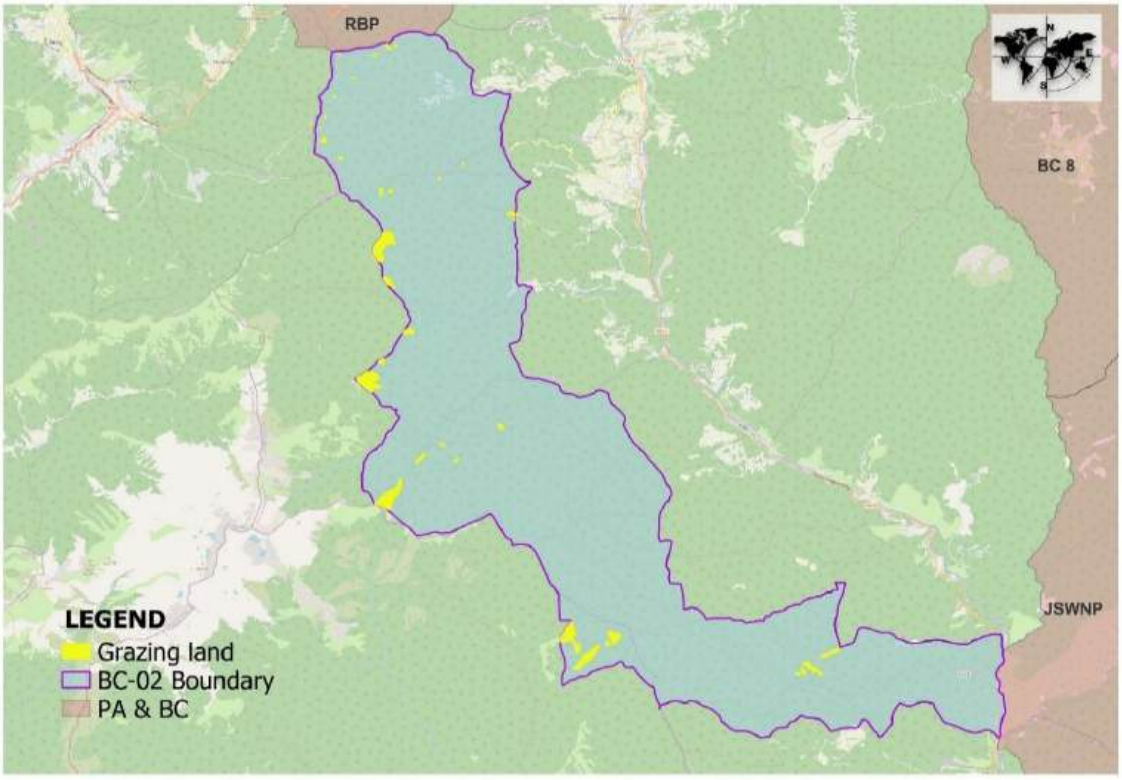

Figure 29: Grazing area in BC-02

3.1.8. Invasive species

Invasive species have been identified as a primary factor for the decline of native biodiversity across terrestrial and aquatic ecosystems (Kopp, 2010; D.B. Gurung, 2018). The recent proliferation of invasive plant species like *Chromolaena odoratum and Ageratina adenophora* has significantly surpassed native flora. These invasive plants are prevalent in various geographical zones of Wangdue Dzongkhag, with specific species dominating certain elevation ranges.

Invasive species often outcompete native flora and fauna for resources, and eventually this competition can lead to a decline in native species population (Sharma, et al., 2022). Vegetation survey results indicate the spread of *Chromolaena odorata* in the Chirpine forest of Gaywachu area and *Ageratina adenophora* in and around Hetshokha valley. The presence of these invasive species not only disrupts ecological balance but also poses socioeconomic challenges by reducing agricultural yields.

3.1.9. Waste

The increase in unmanaged visitors, trekkers, and cow herders within the BC-02 area has made waste management an impending threat to the surrounding environment and the survival of species. There are numerous sites within the BC area where indiscriminate disposal of modern waste is visible along footpaths and streams. Therefore, there is a pressing need for appropriate waste management guidelines and strategies to minimize the negative impact of waste on the ecosystem.

3.1.10. Forest fire

Forest fires can have detrimental effects on wildlife habitat, movement, and overall ecosystem health. According to the potential forest fire map, small areas in the Harachuu area fall within the category of high forest fire susceptibility and occurrence area (*Figure 30*). Forest fires can significantly impact biological corridors, which are essential pathways that connect different habitats. Fires can lead to the loss of vegetation cover, altering the structure and composition of the Corridor, which in turn can disrupt the movement and survival of wildlife species. Additionally, fires are expected to create barriers within the Biological Corridors, fragmenting habitats.

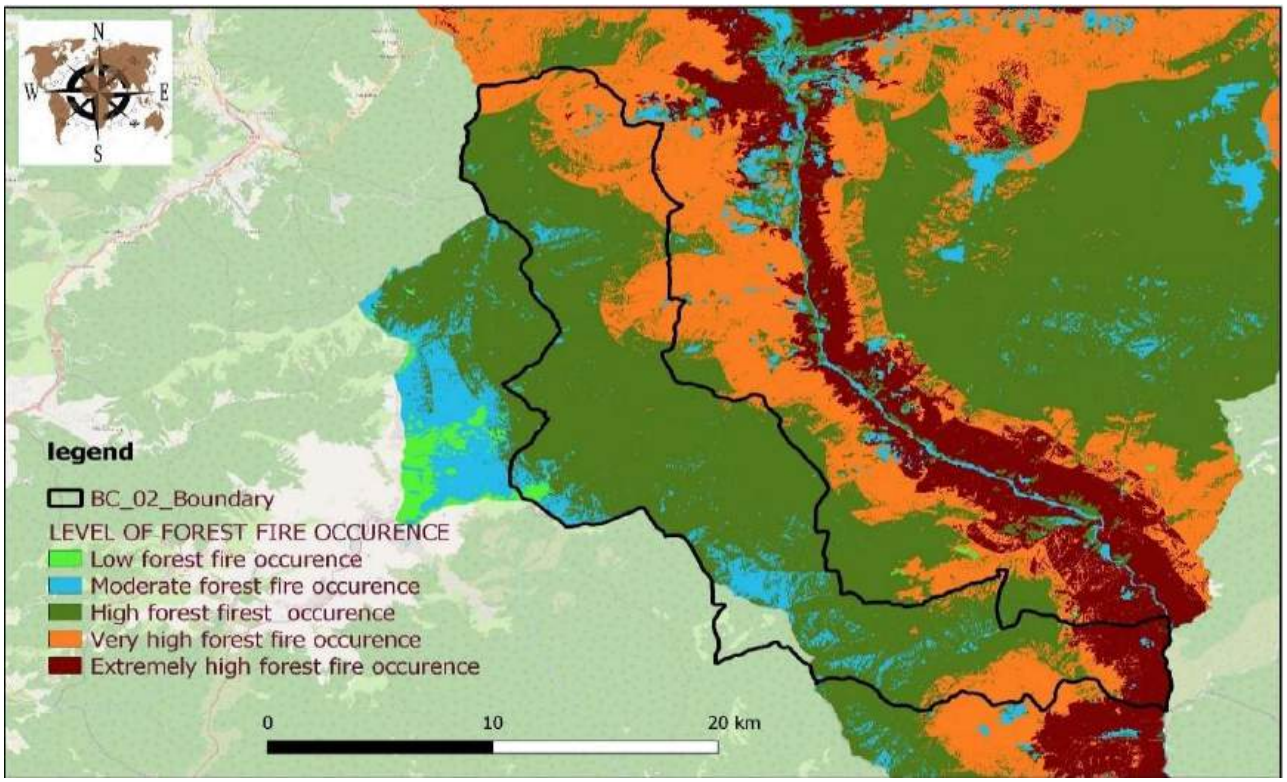

Figure 30: Forest fire-prone areas

3.2. Threat Ranking

The conservation threat ranking was performed using the Miradi software, considering the three major ranking criteria: *1. Scope, 2. Severity and 3. Irreversibility*. The overall threat ranking for the Corridor's target conservation was very high. The threat ranking is contributed to by the impacts of HWC and climate change.

Threats \ Targets	Habitat Management and Protection	Community Livelihood and Wellbeing	Species Conservation	Summary Threat Rating
Illegal activities	Medium		High	Medium
Waste	Low	Medium		Low
Grazing	Low		Medium	Low
Forest Fire	Low	Medium	Low	Low
Climate Change		Medium	High	Medium
Wildlife Poaching	Medium		High	Medium
Human Wildlife Conflict		High	High	High
Developmental activities	High		High	High
Invasive Plants			Medium	Low
Wildlife-Domestic intersection	Low		Low	Low
Summary Target Ratings:	Medium	Medium	High	**Overall Project Rating** High

Figure 31: Threat ranking

3.3. Management challenges

Biological Corridors are crucial for maintaining biodiversity, facilitating species movement, and ensuring ecosystem connectivity. However, their management involves several challenges:

- Capacity building and human resource management are essential to conserving the Corridor. In Bhutan, Biological Corridors are managed by the Divisional Forest Offices. Since two Dzongkhags share the Corridor boundary, it is extremely difficult to coordinate the implementation of conservation efforts. Additionally, there is a lack of fully functional office space and technical personnel to manage the BC operations. Therefore, to have devoted employees who are well-

versed in BC management, staff capacity needs to be upgraded regularly.

- The perspective of the communities residing in the Biological Corridor is that it offers no benefits, and their lack of knowledge about the significance of safeguarding wildlife and the laws that control their activities impedes conservation efforts inside the Corridor. Thus, the gap between the development sector (improvement of livelihood) and the environmental sector needs to be narrowed for better BC management.

- The elevation of the Corridor ranges from 450 to 4500 masl, indicative of a vast ascent in elevation and the indication of rugged topography. Most of the Corridor area is inaccessible and has a central uninhabited area. The lack of motorable roads and inaccessibility make monitoring and patrolling a more strenuous task.

- The science-based conservation and management of wildlife in the Corridor was hindered by a scarcity of data and information on the target species and the Corridor as overall. For instance, no species in the Corridor has yet had an extensive study or the state of its abundance determined.

3.4. Conservation Opportunities

BC-02, while facing various threats, holds significant conservation opportunities that are vital for biodiversity and ecosystem health. Below are the primary conservation opportunities associated with Biological Corridor 02.

3.4.1. Secure indispensable landscape connectivity between two National Parks, Jigme Singye Wangchuk National Park and Royal Botanical Park, Lampelri.

3.4.2. The Corridor landscape is a sanctuary with significant conservation flagship Mammal species such as Tigers, Musk deer, and Red pandas.

3.4.3. Important catchment areas for downstream settlements.

3.4.4. Serves as a home for diverse plant species.

CHAPTER IV
MANAGEMENT INTERVENTIONS

The conservation management strategies and strategic actions are:

Objective 1. To provide a secure migratory habitat for efficient movement of wildlife between the two Protected areas
Strategy 1.1. Manage and restore wildlife habitat
Action 1.1.1. Improve identified waterholes and grasslands
Action 1.1.2. Carry out enrichment plantation with native palatable and wild fruit tree species in degraded areas within the Corridor
Action 1.1.3. Conduct study on carrying capacity of grazing area for rangeland management
Action 1.1.4. Management of invasive species
Strategy 1.2. Institute proper waste management actions
Action 1.2.1. Waste management awareness and sensitization to the local communities and relevant stakeholders

Objective 2. To protect and conserve wildlife species
Strategy 2.1. Determine species population status and ensure survival through research and monitoring
Action 2.1.1. Conduct survey to estimate population status and distribution of threatened species in the Corridor including Tiger, Musk deer, Red Panda, Monal Pheasants, Hornbills etc.
Action 2.1.2. Conduct survey on understudied groups of plants
Action 2.1.3. Identify and monitor permanent sample plots for Mammals, Birds and Flora annually
Action 2.1.4. Conduct biodiversity assessment for macro-invertebrates and fish
Action 2.1.5. Conduct small Mammal survey
Action 2.1.6. Conduct preliminary study on Herpetofauna
Action 2.1.7. Develop a repository of biodiversity of BC-02 for awareness and dissemination of information
Action 2.1.8. Identify and support nature and wildlife-based clubs in schools
Strategy 2.2. Adopt and implement zero poaching strategy
Action 2.2.1. Conduct SMART patrolling
Action 2.2.2. Enhance Rangers knowledge on the SMART patrolling approach and zero poaching strategy through refresher training and workshop

Action 2.2.3. Conduct education and awareness campaigns among communities on ills of wildlife poaching (FNCA, FNCRR and Penal Code of Bhutan)
Objective 3. Mitigate Human-Wildlife Conflict and create climate resilient community
Strategy 3.1. Initiate effective and innovative HWC mitigation measures
Action 3.1.1. Assess and map HWC hotspots area
Action 3.1.2. Educating and engaging local communities and relevant stakeholders on conservation through audio-visuals
Action 3.1.3. Conduct anti-snaring campaigns and provide support to mitigate HWC like electric fencing, chain link fencing etc.
Action 3.1.4. Equip wildlife rescue through purchase of rescue equipment (Drugs, first aids, cylinder, darts, etc.)
Strategy 3.2. Promote nature-based solutions to supplement the livelihood of the local communities
Action 3.2.1. Formation of NWFP management and marketing groups
Action 3.2.2. Initiate Payment for Ecosystem Services (PES) Scheme
Action 3.2.3. Capacity building of the local community on propagation of *Cymbidium* orchids to help generate income and promote conservation efforts
Action 3.2.4. Support to enhance the Ruchhu Menchu management
Action 3.2.5. Maintenance of traditional trails (Rurichhu to Taksha and Gaselo to katozey to Chamgang)
Action 3.2.6. Development of cultural and spiritual sites (Tshechu ney)
Strategy 3.3. Initiate climate change mitigation and adaptation measures
Action 3.3.1. Conduct Climate Vulnerability and Capacity Assessment for local communities residing in BC area
Action 3.3.2. Implementation of sustainable and climate-resilient forest management practices (CF, LFMP)
Strategy 3.4. Manage watershed/catchment areas, incorporating climate smart restoration in degraded land areas
Action 3.4.1. Assess the watershed/spring shed and water sources

Action 3.4.2. Conduct Hydrogeological mapping of the recharge areas
Action 3.4.3. Initiate the implementation of Spring revival activities
Action 3.4.4. Conduct advocacy and awareness on springshed and watershed management
Objective 4. To improve institutional capacity development for effective management of the Corridor
Strategy 4.1. Strengthen BC area management
Action 4.1.1. Demarcate and fix boundary pillars for the Biological Corridor
Action 4.1.2. Mid-term revision of BC-02 Management plan
Action 4.1.3. Revision of BC-02 management plan
Action 4.1.4. Conduct the Bhutan METT+ for BC-02
Strategy 4.2. Enhance the professional capacity development of staff
Action 4.2.1. Conduct need-based capacity development programs for using the latest tools and technology for wildlife conservation and Protected area management
Action 4.2.2. Organize training and exposure trips for BC staff on PA management and wildlife conservation
Strategy 4.3. Enhance infrastructure and mobility/utilities
Action 4.3.1. Procurement of forest firefighting equipment
Action 4.3.2. Procurement of computers and peripherals
Action 4.3.3. Construction and maintenance of the office

CHAPTER V

IMPLEMENTATION SCHEDULE AND BUDGET

5.1. Implementation schedule and Budgeting

There are 41 actions from 11 strategies set to fulfill four objectives for the conservation of the Biological Corridor. This plan will be valid for a period of ten financial years, effective from 2025 to 2034, aligning with the 13th and 14th Five-Year Plans of the Royal Government of Bhutan. A monetary estimate of Nu. 50 million has been proposed to fund activities aimed at conserving wild flora and fauna while enhancing the socio-economic status of the community through measures that manage HWC and promote sustainability.

Objective	Strategy	Action	Financial Yearly Target										Budget Total
			1	2	3	4	5	6	7	8	9	10	
To provide secure migratory habitat for efficient movement of wildlife between the two Protected areas	Management and restoration of wildlife habitat	Improve identified waterholes and grasslands			0.2				0.2				0.4
		Carry out enrichment plantation with native and palatable wild fruit bearing trees species			0.2			0.2			0.2		0.6
		Study on grazing carrying capacity to regulate rangeland management						0.3					0.3
		Management of invasive species				0.3					0.3		0.6
	Institute proper waste management actions	Waste management awareness and sensitization to the local communities and relevant stakeholders	0.5				0.5				0.5		1.5
To protect and conserve wildlife species	Determine species population status and ensure survival through research and monitoring	Conduct survey to estimate population status and distribution of threatened species of the Corridor including Tiger, Musk deer, Red panda, Monal Pheasants, Hornbills etc.		0.7			0.3			0.3			1.3
		Conduct survey on understudied groups of plants			0.45								0.45
		Identify and monitor permanent sample plots for Mammal, Birds and Flora annually	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.6
		Conduct biodiversity assessment for Macro-invertebrates/fish								0.3			0.3
		Conduct small Mammal survey			0.35								0.35
		Conduct preliminary study on				0.2							0.2

		Herpetofauna											
		Develop a repository of biodiversity of BC-02 for awareness and dissemination of information		0.3									0.3
		Identify and support nature and wildlife-based clubs in schools				0.2				0.2			0.4
	Adopt and implement Zero poaching strategy	Conduct SMART patrolling	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	0.42	4.2
		Enhance Ranger's knowledge of the SMART patrolling approach and zero poaching strategy through refresher training and workshops						0.3					0.3
		Conduct education and awareness campaigns among communities on ills of wildlife poaching (FNCA, FNCRR and Penal Code of Bhutan)			0.3								0.3
Mitigate Human-Wildlife Conflict and create climate resilient community	Initiate effective and innovative HWC mitigation measures	Assess and map HWC hotspots area		0.25									0.25
		Educating and engaging local communities and relevant stakeholders on conservation through audio-visuals					0.6						0.6
		Conduct anti-snaring campaigns and provide support to mitigate HWC like electric fencing, chain link fencing etc.			5			5			5		15
		Equip wildlife rescue through purchase of rescue equipment (Drugs, first aids, cylinder, darts, etc.)				0.5							0.5
		NWFP management and marketing group formation		0.07			0.07						0.14

	Promote nature-based solutions to supplement the livelihood of the local communities	Initiate PES scheme	0.1										0.1
		Capacity building of local community on propagation of Cymbidium orchids to help generate income and promote conservation efforts		0.2				0.2					0.4
		Support to enhance the Menchu management				0.7							0.7
		Maintenance of traditional trails			0.8				0.8				1.6
		Development of cultural and spiritual sites (Tshechu ney)					0.7						0.7
	Initiate climate change mitigation and adaptation measures	Conduct Climate Vulnerability and Capacity Assessment and surveys of human responses to climate change		1									1
		Implementation of sustainable and climate-resilient forest management practices (CF, LFMP)		0.4		0.4		0.2					1
	Manage watershed/catchment areas incorporating climate smart restoration in degraded land areas *(Lead agency: Department of Water)*	Assess watershed/spring shed and water sources			0.5								0.5
		Hydrogeological mapping of the Corridor area				0.45							0.45
		Initiate the implementation of Spring revival activities					1						1
		Conduct awareness and advocacy on spring shed management			0.3								0.3
To improve institutional capacity development for effective management of corridor	Strengthen BC area management	Demarcate and fix boundary pillars	0.1										0.1
		Mid-term review of BC-02 management plan					0.1						0.1

		Revision of BC-02 management plan										1.5	1.5
		Monitoring and evaluation as per Bhutan METT+				0.2					0.2		0.4
	Enhance professional capacity development of staff	Need-based capacity development to use latest tools and technology in the field of conservation		0.15						0.15			0.3
		Organize training and exposure trips for BC staff on BC management and wildlife conservation				2			2				4
	Enhance infrastructure and mobility/utilities	Procurement of forest fire fighting equipment's					0.5					0.5	1
		Procurement of computers and peripherals			0.6				0.6				1.2
		Construction and maintenance of office	1.1	4									5.1
Total Budget			2.3	7.6	9.2	5.4	4.3	6.7	4.1	1.4	6.7	2.5	***50***

CHAPTER VI
MONITORING AND EVALUATION

6.1. Monitoring

Monitoring is a continuous assessment process designed to provide all stakeholders with timely and detailed information on the progress or delays of planned activities. Its purpose is to determine whether the intended outputs, deliveries and schedules have been achieved, enabling prompt actions to address any shortfalls. Field-level monitoring will be conducted continuously by the Divisional Forest Office, Wangdue throughout the implementation phase, utilizing the Protected Area (PA) Monitoring Framework. Progress in implementing planned activities and achieving the strategies and objectives of the conservation plan will be monitored and evaluated based on a comprehensive logical framework.

The effectiveness of management within the Corridor and the implementation of the conservation management plan will be assessed using the Bhutan METT+ protocol, as outlined in Volume IV of the *Forest Management Code of Best Management Practices of Bhutan 2020*. Overall monitoring and evaluation of the conservation management plan will be guided by the Monitoring and Evaluation framework.

6.2. Evaluation

Evaluation of the conservation management effectiveness of the conservation management plan will be conducted using the Management Effectiveness Tracking Tool (Bhutan METT+). The METT+ assessment will occur at two levels: Internal Assessment and External Assessment, with evaluations taking place once every five years. The internal assessment will be a self-evaluation conducted by the Divisional Forest Office, Wangdue prior to the external assessment.

The external assessment will be coordinated by the Forest Monitoring and Information Division (FMID) and carried out in collaboration with relevant offices in Wangdue to ensure that the results from the internal assessment remain unbiased. This external evaluation may include specialists from the Department, representatives from each Functional Divisions, members from UWIFoRT and representatives from Jigme Singye Wangchuck National Park (JSWNP), Royal Botanical Park (RBP) and Jigme Dorji National Park (JDNP).

Objective	Strategy	Action	Output Indicator	Baseline	Unit	Financial Yearly Target									
						1	2	3	4	5	6	7	8	9	10
To provide secure migratory habitat for efficient movement of wildlife between the two protected areas	Management and restoration of wildlife habitat	Improve identified waterholes and grasslands	No. of Waterholes improved	*5*	*Nos.*			7				7			
		Carry out enrichment plantation with native and palatable wild fruit bearing trees species	No. of wild fruit bearing plants planted	*0*	*Ha.*			2			2			2	
		Study on grazing carrying capacity to regulate rangeland management	Study conducted	*0*	*Nos.*						1				
		Management of invasive species	Hectares of grasslands improved	*0*	*Nos.*				5					5	
	Institute proper waste management	Waste management awareness and sensitization to the local communities, stakeholders and others	No. of local farmers, schoolchildren, and stakeholders imparted with waste awareness	50	*Nos.*	100				100				100	
To protect and conserve wildlife species	Determine species population status and ensure survival through research and monitoring	Conduct survey to estimate population status and distribution of threatened species of the corridor including Tiger, Musk deer, red panda, Monal Pheasants, Hornbills etc.	No. of survey conducted, and report generated	*0*	*Nos.*		1			1			1		
		Conduct survey on understudied groups of plants	Conducted survey and listed flora species	*0*	*Nos.*			1							
		Identify & monitor permanent sample plots for mammal, birds and flora	No. of permanent sample plots monitored	*3*	*Nos.*	5	5	5	5	5	5	5	5	5	5
		Conduct biodiversity assessment for macro-invertebrates/fish	No. of assessment conducted	*0*	*Nos.*								1		
		Conduct small mammal survey	No. of survey conducted	*0*	*Nos.*			1							
		Conduct preliminary study on herpetofauna	No. of survey conducted	*0*	*Nos.*				1						
		Develop a repository of biodiversity of BC 2 for awareness and dissemination of	Data repository of biodiversity for BC 2 set up	*0*	*Nos.*		1								

		information													
		Identify and support nature and wildlife-based clubs in the school	No. of schools where nature-based clubs were supported	*0*	*Nos.*				2				2		
	Adopt and implement zero poaching strategy	Conduct SMART patrolling	No. of SMART patrolling conducted		*Nos.*	4	4	4	4	4	4	4	4	4	4
		Enhance Ranger's knowledge of the SMART patrolling approach and zero poaching strategy through refresher training and workshops	No. of Trainings conducted	*3*	*Nos.*						1				
		Conduct education and awareness campaigns among communities on ills of wildlife poaching	No. of gewogs involved	*0*	*Nos.*			5							
Mitigate Human-Wildlife Conflict and create climate resilient community	Initiate effective and innovative HWC mitigation measures	Assess and map HWC hotspots area	No. of survey report generated	*0*	*Nos.*		1								
		Educating and engaging local communities and relevant stakeholders on conservation through audio-visuals	No. of Documentary produced	*0*	*Nos.*					1					
		Conduct anti-snaring campaigns and provide support to mitigate HWC like electric fencing, chain link fencing etc.	No. of communities provided with electric and chain link fencing	*0*	*Nos.*			1			1			1	
		Equip wildlife rescue through purchase of rescue equipment (Drugs, first aids, cylinder, darts, etc.)	No. of wildlife rescue equipment's procured and used	*0*	*Nos.*				5						
	Promote nature-based solutions to supplement the livelihood of the local communities	NWFP management and marketing group formation	No. of NWFP M&MG established in local community	*0*	*Nos.*		1			1					
		Initiate PES scheme	No. of activity conducted	*0*	*Nos.*	1									
		Capacity building of local community on propagation of Cymbidium orchids to help generate income and promote conservation efforts	No. of community provided training on cymbidium propagation	*0*	*Nos.*		2				2				
		Support to enhance the Menchu management	No of communities benefited	*0*	*Nos.*				2						
		Maintenance of traditional trails	No. of traditional trails	*0*	*Nos.*			1				1			

			developed												
		Development of cultural and spiritual sites (Tshechu ney)	No. of spiritual sites developed/renovated	*0*	*Nos.*					1					
	Initiate climate change mitigation and adaptation measures	Conduct Climate Vulnerability and Capacity Assessment and surveys of human responses to climate change	No. of gewogs	*0*	*Nos.*		5								
		Implementation of sustainable and climate-resilient forest management practices (CF, LFMP)	No. of CFs and LFMP	*0*	*Nos.*		2		2		1				
	Manage watershed/catchment areas incorporating climate smart restoration in degraded land areas	Assess spring and water sources	No. of assessment reports generated	*0*	*Nos.*			1							
		Hydrogeological mapping for important water sources	No. of reports generated	*0*	*Nos.*				1						
		Initiate revival of the drying water sources	No. of activities initiated	*0*	*Nos.*					1					
		Conduct advocacy and awareness on spring shed management	No. of gewogs where awareness was conducted	*0*	*Nos.*			4							
To improve institutional capacity development for effective management of corridor	Strengthen BC area management	Demarcate and fix boundary pillars	No. of Boundary pillar fixed	*0*	*Nos.*	10									
		Mid-term review of BC 02 management plan	No. of review report generated	*0*	*Nos.*					1					
		Revision of BC 02 management plan	Approved management plan	*0*	*Nos.*										1
		Monitoring and evaluation as per Bhutan METT+	No. of METT+ assessments carried out	*1*	*Nos.*				1					1	
	Enhance professional capacity development of staff	Need-based capacity development to use latest tools & technology and wildlife and protected area management	No. of technical staff trained	*0*	*Nos.*		40						40		
		Organize training and exposure trips for BC staff on PA management and wildlife conservation	No. of Staff trained	*0*	*Nos.*				7			7			
	Enhance infrastructure and mobility/utilities	Procurement of forest fire fighting equipment's	No. of Equipment's procured	*0*	*Nos.*					40					40
		Procurement of computers and	No. of Equipment's procured	*0*	*Nos.*			5				5			

		peripherals													
		Construction and maintenance of office	No. of structures maintained	*0*	*Nos.*	1	1								

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Annexure

Annexure I: List of Mammals

Sl. No	Common Name	Scientific Name	Family	IUCN Category	CITES	FNCA 2023
1	Asian Palm Civet	*Paeadoxurs hermaphroditus*	Viverridae	Least Concern	Appendix III	
2	Asiatic Black Bear	*Ursus thibetanus*	Ursidae	Vulnerable	Appendix I	Schedule II
3	Asiatic Golden Cat	*Catopuma temminckii*	Felidae	Near Threatened	Appendix I	Schedule II
4	Assam macaque	*Assamese macaque*	Cercopithecidae	Near Threatened	Appendix II	Schedule III
5	Barking Deer	*Muntiacus muntjak*	Cervidae	Least Concern	_	Schedule III
6	Black Giant squirrel	*Ratufa bicolor*	Sciuridae	Near Threatened	Appendix II	
7	Clouded leopard	*Neofelis nebulosa*	Felidae	Vulnerable	Appendix I	Schedule I
8	Common leopard	*Panthera pardus*	Felidae	Vulnerable	Appendix I	Schedule II
9	Dhole	*Cuon alpinus*	Canidae	Endangered	Appendix II	Schedule II
10	Gray Langur	*Semnopithecus entellus*	Cercopithecidae	Least Concern	Appendix I	Schedule II
11	Himalayan Crestless Porcupine	*Hystrix brachyura*	Hystricidae.	Least Concern	_	Schedule III
12	Himalayan Goral	*Naemorhedus goral*	Bovidae	Near Threatened	Appendix I	Schedule II
13	Himalayan Serow	*Capricornis sumatraensis*	Bovidae	Vulnerable	Appendix I	Schedule II
14	Hoary-bellied Himalayan squirrel	*Callosciurus pygerythrus*	Sciuridae	Least Concern	_	
15	Jungle cat	*Felis chaus*	Felidae	Least Concern	Appendix II	Schedule II
16	Leopard Cat	*Prionailurus bengalensis*	Felidae	Least Concern	Appendix II	Schedule II
17	Marbled Cat	*Pardofelis marmorata*	Felidae	Near Threatened	Appendix I	Schedule II
18	Musk deer	*Moschus chrysogaster*	Moschidae	Endangered	Appendix II	Schedule I

19	Orange-bellied Himalayan Squirrel	*Dremomys lokriah*	Sciuridae	Least Concern	_	Schedule III
20	Red panda	*Ailurus fulgens*	Ailuridae	Endangered	Appendix I	Schedule II
21	Royal Bengal Tiger	*Panthera tigris*	Felidae	Endangered	Appendix I	Schedule I
22	Sambar	*Rusa unicolor*	Cervidae	Vulnerable	_	Schedule II
23	Spotted Linsang	*Prionodon pardicolor*	Prionodontidae	Least Concern	Appendix I	
24	White bellied rat	*Niviventer niviventer*	Muridae	Least Concern	_	
25	Wild Pig	*Sus scrofa*	Suidae	Least concern		Schedule III
26	Yellow-throated Marten	*Martes flavigula*	Mustelidae	Least Concern	Appendix III	Schedule III
27	Indian palm squirrel	*Funambulus palmarum*	Sciuridae	Least Concern		

Annexure II: List of Birds

Sl. No.	**Species**	**Family**
1	Aberrant Bush Warbler	Scotocercidae
2	Alpine Thrush	Turdidae
3	Ashy Drongo	Dicruridae
4	Ashy Wood Pigeon	Columbidae
5	Ashy-throated Warbler	Phylloscopidae
6	Asian Barred Owlet	Strigidae
7	Barred Cuckoo Dove	Columbidae
8	Bar-winged Flycatcher-shrike	Vangidae
9	Bay Woodpecker	Picidae
10	Besra	Accipitridae
11	Bhutan Laughingthrush	Leiothrichidae
12	Black Bulbul	Pycnonotidae
13	Black Eagle	Accipitridae
14	Black Redstart	Muscicapidae
15	Black-chinned Yuhina	Zosteropidae

16	Black-crested Bulbul	Pycnonotidae
17	Black-eared Shrike Babbler	Vireonidae
18	Black-faced Laughingthrush	Leiothrichidae
19	Black-tailed Crake	Rallidae
20	Black-throated Sunbird	Nectariniidae
21	Black-throated Tit	Aegithalidae
22	Black-winged Cuckoo shrike	Campephagidae
23	Blood Pheasant	Phasianidae
24	Blue Whistling Thrush	Muscicapidae
25	Blue-capped Rock Thrush	Muscicapidae
26	Blue-fronted Redstart	Muscicapidae
27	Blue-throated Barbet	Megalaimidae
28	Blue-winged Siva	Leiothrichidae
29	Blyth's Leaf Warbler	Phylloscopidae
30	Bronzed Drongo	Dicruridae
31	Brown Bullfinch	Fringillidae
32	Brown Parrotbill	Paradoxornithidae
33	Brown-flanked Bush Warbler	Scotocercidae
34	Chestnut Thrush	Turdidae
35	Chestnut-bellied Nuthatch	Sittidae
36	Chestnut-crowned Laughingthrush	Leiothrichidae
37	Chestnut-crowned Warbler	Phylloscopidae
38	Chestnut-headed Tesia	Scotocercidae
39	Coal Tit	Paridae
40	Collared Owlet	Strigidae
41	Common Green Magpie	Corvidae
42	Common Kestrel	Falconidae
43	Common Myna	Sturnidae
44	Common Rose finch	Fringillidae
45	Common Tailorbird	Cisticolidae
46	Crested Serpent Eagle	Accipitridae
47	Crimson Sunbird	Nectariniidae
48	Darjeeling Woodpecker	Picidae

49	Dark-rumped Rose finch	Fringillidae
50	Dark-sided Flycatcher	Muscicapidae
51	Eurasian Jay	Corvidae
52	Fire-breasted Flowerpecker	Dicaeidae
53	Fire-capped Tit	Paridae
54	Fire-tailed Myzornis	Paradoxornithidae
55	Golden Bush Robin	Muscicapidae
56	Golden-napped Finch	Fringillidae
57	Golden-throated Barbet	Megalaimidae
58	Great Barbet	Megalaimidae
59	Great Hornbill	Bucerotidae
60	Green Shrike Babbler	Vireonidae
61	Green-backed Tit	Paridae
62	Green-billed Malkoha	Cuculidae
63	Green-crowned Warbler	Phylloscopidae
64	Greenish Warbler	Phylloscopidae
65	Green-tailed Sunbird	Nectariniidae
66	Grey Bush chat	Muscicapidae
67	Grey Treepie	Corvidae
68	Grey-cheeked Warbler	Phylloscopidae
69	Grey-chinned Minivet	Campephagidae
70	Grey-crested Tit	Paridae
71	Grey-headed Canary Flycatcher	Stenostiridae
72	Grey-headed Woodpecker	Picidae
73	Grey-hooded Warbler	Phylloscopidae
74	Grey-sided Bush Warbler	Scotocercidae
75	Grey-sided Laughingthrush	Leiothrichidae
76	Grey-winged Blackbird	Turdidae
77	Hair-crested Drongo	Dicruridae
78	Hill Partridge	Phasianidae
79	Hill Prinita	Cisticolidae
80	Himalayan Bluetail	Muscicapidae
81	Himalayan Bulbul	Pycnonotidae

82	Himalayan Buzzard	Accipitridae
83	Himalayan Cuckoo	Cuculidae
84	Himalayan Cutia	Leiothrichidae
85	Himalayan Monal	Phasianidae
86	Hoary-throated Barwing	Cisticolidae
87	Hodgson's Redstart	Leiothrichidae
88	Indian Cuckoo	Muscicapidae
89	Kalij Pheasant	Cuculidae
90	Large Hawk Cuckoo	Phasianidae
91	Large Niltava	Cuculidae
92	Large-billed Crow	Muscicapidae
93	Large-billed Leaf Warbler	Corvidae
94	Lemon-rumped Warbler	Phylloscopidae
95	Lesser Racket-tailed Drongo	Dicruridae
96	Lesser Yellownape	Phylloscopidae
97	Little Bunting	Picidae
98	Little Pied Flycatcher	Emberizidae
99	Long-tailed Minivet	Muscicapidae
100	Long-tailed Shrike	Campephagidae
101	Maroon Oriole	Laniidae
102	Mountain Bulbul	Oriolidae
103	Mountain Hawk Eagle	Pycnonotidae
104	Mrs. Gould's Sunbird	Accipitridae
105	Nepal Fulvetta	Nectariniidae
106	Olive-backed Pipit	Leiothrichidae
107	Orange-bellied Leafbird	Motacillidae
108	Oriental Turtle Dove	Chloropseidae
109	Oriental White-eye	Columbidae
110	Plain Mountain Finch	Zosteropidae
111	Plumbeous Water Redstart	Fringillidae
112	Purple Sunbird	Muscicapidae
113	Pygmy Blue Flycatcher	Nectariniidae
114	Red-billed Leiothrix	Muscicapidae

115	Red-headed Bullfinch	Leiothrichidae
116	Red-headed Trogon	Fringillidae
117	Red-tailed Minla	Trogonidae
118	Red-vented Bubul	Leiothrichidae
119	Rufous Sibia	Pycnonotidae
120	Rufous-bellied Niltava	Leiothrichidae
121	Rufous-bellied Woodpecker	Muscicapidae
122	Rufous-breasted Accentor	Picidae
123	Rufous-capped Babbler	Prunellidae
124	Rufous-chinned Laughingthrush	Timaliidae
125	Rufous-fronted Tit	Leiothrichidae
126	Rufous-gorgeted Flycatcher	Aegithalidae
127	Rufous-necked Hornbill	Muscicapidae
128	Rufous-vented Yuhina	Bucerotidae
129	Rufous-winged Fulvetta	Zosteropidae
130	Russet Bush Warbler	Pellorneidae
131	Russet Sparrow	Locustellidae
132	Rusty-cheeked Scimiter Babbler	Passeridae
133	Rusty-flancked Treecreeper	Timaliidae
134	Rusty-fronted Barwing	Certhiidae
135	Sapphire Flycatcher	Leiothrichidae
136	Satyr Tragopan	Muscicapidae
137	Scaly-breasted Wern Babbler	Phasianidae
138	Scarlet Minivet	Troglodytidae
139	Short-billed Minivet	Campephagidae
140	Slaty-backed Forktail	Campephagidae
141	Slender-billed Oriole	Muscicapidae
142	Small Niltava	Oriolidae
143	Snowy-browed Flycatcher	Muscicapidae
144	Speckled Piculet	Muscicapidae
145	Speckled Wood Pigeon	Picidae
146	Spotted Dove	Columbidae
147	Spotted Elachura	Columbidae

148	Spotted Laughingthrush	Elachuridae
149	Spotted Nutcracker	Leiothrichidae
150	Spot-winged Grosbeak	Corvidae
151	Straited Bulbul	Fringillidae
152	Straited Laughingthrush	Pycnonotidae
153	Straited Prinia	Leiothrichidae
154	Straited Yuhina	Zosteropidae
155	Streaked-breasted Scimiter Babbler	Timaliidae
156	Stripe-throated Yuhina	Zosteropidae
157	Sultan Tit	Paridae
158	Taiga Flycatcher	Muscicapidae
159	Tickell's Leaf Warbler	Phylloscopidae
160	Ultramarine Flycatcher	Muscicapidae
161	Verditer Flyctacher	Muscicapidae
162	Ward's Trogon	Trogonidae
163	Wedge-tailed Green Pigeon	Columbidae
164	Whiskered Yuhina	Zosteropidae
165	Whistler's Warbler	Phylloscopidae
166	White-browed Shrike-babbler	Vireonidae
167	White-bellied Erpornis	Vireonidae
168	White-bellied Heron	Ardeidae
169	White-browed Bush Robin	Muscicapidae
170	White-browed Fulvetta	Paradoxornithidae
171	White-browed Rosefinch	Fringillidae
172	White-capped Water Redstart	Muscicapidae
173	White-collared Blackbird	Turdidae
174	White-crested Laughingthrush	Leiothrichidae
175	White-naped Yuhina	Zosteropidae
176	White-tailed Nuthatch	Sittidae
177	White-tailed Robin	Muscicapidae
178	White-throated Fantail	Rhipiduridae
179	White-throated Laughingthrush	Leiothrichidae
180	White-winged Grosbeak	Fringillidae

181	Yellow-bellied Fantail	Stenostiridae
182	Yellow-billed Blue Magpie	Corvidae
183	Yellow-breasted Greenfinch	Fringillidae
184	Yellow-browed Tit	Paridae
185	Yellow-cheeked Tit	Paridae
186	Yellow-vented Warbler	Phylloscopidae

Annexure III: List of Flora

Trees and Shrubs

Sl. No.	Species name	Family	IUCN
1	*Juniperus recurva*	Cupressaceae	Least Concern
2	*Rhododendron arboreum*	Ericaceae	
3	*Rhododendron hodgsonii*	Ericaceae	
4	*Abies densa*	Pinaceae	Least Concern
5	*Quercus semicarpifolia*	Fagaceae	Least Concern
6	*Tsuga dumosa*	Pinaceae	Least Concern
7	*Quercus oxyodon*	Fagaceae	Least Concern
8	*Ilex dipyrena*	Aquifoliaceae	Least Concern
9	*Taxus baccata*	Taxaceae	Least Concern
10	*Ilex hookeri*	Aquifoliaceae	Least Concern
11	*Osmanthus suavis*	Oleaceae	Least Concern
12	*Schefflera impressa*	Araliaceae	Least Concern
13	*Rhododendron falconeri*	Ericaceae	Least Concern
14	*Exbucklandia populnea*	Hamamelidaceae	Least Concern
15	*Symplocos ramosissima*	Symplocaceae	Least Concern
16	*Quercus lanata*	Fagaceae	Least Concern
17	*Castanopsis tribuloides*	Fagaceae	Least Concern
18	*Quercus glauca*	Fagaceae	Least Concern
19	*Pinus bhutanica*	Pinaceae	Least Concern
20	*Schima wallichii*	Theaceae	Least Concern
21	*Symplocos lucida*	Symplocaceae	Least Concern
22	*Myrica esculenta*	Myricaceae	Least Concern
23	*Viburnum cylindricum*	Viburnaceae	Least Concern
24	*Shoepfia griffithii*	Schoepfiaceae	Least Concern
25	*Symplocos glomerata*	Symplocaceae	Least Concern
26	*Ilex crenata*	Aquifoliaceae	

27	*Pinus wallichiana*	Pinaceae	Least Concern
28	*Pinus roxburghii*	Pinaceae	Least Concern
29	*Acer oblongum*	Sapindaceae	Least Concern
30	*Cinnamomum bejolghota*	Lauraceae	Least Concern
31	*Persea sp.*	Lauraceae	
32	*Quercus lamellosa*	Fagaceae	Near Threatened
33	*Castanopsis hystrix*	Fagaceae	
34	*Michelia doltsopa*	Magnoliaceae	Data deficient
35	*Macropanax dispermus*	Araliaceae	Least Concern
36	*Cinnamomum impressinernium*	Lauraceae	
37	*Litsea albescens*	Lauraceae	
38	*Casearia glomerata*	Salicaceae	Least Concern
39	*Illex sp*	Aquifoliaceae	
40	*Engelhardia spicata*	Juglandaceae	Least Concern
41	*Daphniphyllum himalaense*	Daphniphyllaceae	
42	*Persea bootanica*	Lauraceae	
43	*Bischofia javanica*	Phyllanthaceae	Least Concern
44	*Syzygium cumini*	Myrtaceae	Least Concern
45	*Duabanga grandiflora*	Lythraceae	Least Concern
46	*Ficus semicordata*	Moraceae	Least Concern
47	*Calicarpa arborea*	Lamiaceae	Least Concern
48	*Terminalia myriocarpa*	Combretaceae	
49	*Boehmeria sp*	Urticaceae	
50	*Sapindus rarak*	Sapindaceae	
51	*Altingia excelsa*	Altingiaceac	Least Concern
52	*Casearia graveolens*	Salicaceae	
53	*Alangium chinensis*	Cornaceae	
54	*Ficus sp*	Moraceae	
55	*Garuga floribunda*	Burseraceae	Least Concern
56	*Mecaranga denticulata*	Euphorbiaceae	Least Concern
58	*Acer campbellii*	Sapindaceae	Least Concern
59	*Acer pectinatum*	Sapindaceae	Least Concern
60	*Acrocarpus fraxinifolius*	Fabaceae	
61	*Albizia lebbeck*	Fabaceae	Least Concern
62	*Albizia sp*	Fabaceae	
63	*Alnus nepalensis*	Betulaceae	Least Concern
64	*Betula alnoides*	Betulaceae	Least Concern
65	*Betula utilis*	Betulaceae	Least Concern
66	*Bombex ceiba*	Malvaceae	Least Concern
67	*Carpinus viminea*	Betulaceae	Least Concern

68	*Docynia indica*	Rosaceae	
69	*Erythrina arborescens*	Fabaceae	
70	*Gamblea ciliata*	Araliaceae	Least Concern
71	*Hovenia aserba*	Rhamnaceae	Least Concern
72	*Juglans regia*	Juglandaceae	Least Concern
73	*Lyonia ovalifolia*	Ericaceae	Least Concern
74	*Magnolia campbellii*	Magnoliaceae	Least Concern
75	*Melia azedarach*	Meliaceae	Least Concern
76	*Prunus carmisina*	Rosaceae	
77	*Prunus sp*	Rosaceae	
78	*Quercus griffithii*	Fagaceae	Least Concern
79	*Rhus chinensis*	Anacardiaceae	Least Concern
80	*Rhus hookeri*	Anacardiaceae	
81	*Rhus javanica*	Simaroubaceae	Least Concern
82	*Sapium insignis*	Euphorbiaceae	
83	*Sorbus thibetica*	Rosaceae	
84	*Sterculia Villrosa*	Malvaceae	
86	*Bridelia retusa*	Phyllanthaceae	Least Concern
87	*Coriaria nepalensis*	Coriariaceae	
88	*Decaisnea insignis*	Lardizabalaceae	
89	*Desmodium elegans*	Fabaceae	
90	*Desmodium sp*	Fabaceae	
91	*Enkianthus deflexus*	Ericaceae	Least Concern
92	*Ribes sp*	Grossulariaceae	
93	*Solanum mauritianum*	Solanaceae	
94	*Sorbus microphylla*	Rosaceae	
95	*Viburnum grandiflorum*	Viburnaceae	
96	*Woodfordia fruticosa*	Lythraceae	Least Concern
98	*Eurya acuminata*	Theaceae	
99	*Luculia gratissima*	Rubiaceae	
100	*Murraya koenigii*	Rutaceae	Least Concern
101	*Myrsine semiserrata*	Primulaceae	Least Concern
102	*Pentapanax racemosus*	Araliaceae	
103	*Phyllanthus emblica*	Phyllanthaceae	Least Concern
104	*Rapanea capitellata*	Primulaceae	
105	*Rhododendron barbatum*	Ericaceae	
106	*Rhus paniculata*	Anacardiaceae	

Herbs

Sl. No.	Species name	Family
1	*Fragaria nubicola*	Rosaceae
2	*Rubus calycinus*	Rosaceae
3	*Artemisia tukuchaensis*	Asteraceae
4	*Geranium nepalense*	Geraniaceae
5	*Oxalis corniculata*	Oxalidaceae
6	*Organum sp*	
7	*Roscoea alpina*	Zingiberaceae
8	*Aconitum bisma*	Ranunculaceae
9	*Oxalis leucolepsis*	Oxalidaceae
10	*Ainsliaea aptera*	Asteraceae
11	*Cirsium sp*	Asteraceae
12	*Ophiopogon clarkei*	Asparagaceae
13	*Ophiopogon sp*	Asparagaceae
14	*Galium aparine*	Rubiaceae
15	*Viola bhutanica*	Violaceae
16	*Pilea sp*	Urticaceae
17	*Elsholtzia sp*	Lamiaceae
18	*Blysmus compressus*	Cyperaceae
19	*Selliguea hastata*	Polypodiaceae
20	*Hedychium sp*	Zingiberaceae
21	*Ophiopogon wallichianus*	Asparagaceae
22	*Eupatorium adenophorum*	Asteraceae
23	*Peperomia tetraphylla*	Piperaceae
24	*Youngia japonica*	Asteraceae
25	*Desmodium Podocarpum*	Fabaceae
26	*Ainsliaea latifolia*	Asteraceae
27	*Trachelospermum assamense*	Apocynaceae
28	*Viola biflora*	Violaceae
29	*Ophiopogon intermedius*	Asparagaceae
30	*Commelina benghalensis*	Commelinaceae
31	*Houttuynia cordata*	Saururaceae
32	*Anaphalis busua*	Asteraceae
33	*Esholtzia strobilifera*	Lamiaceae
34	*Holboelia latifolia*	Lardizabalaceae
35	*Rubia cordifolia*	Rubiaceae
36	*Anisomeles indica*	Lamiaceae
37	*Leucas ciliata*	Lamiaceae

38	*Clinopodium umbrosum*	Lamiaceae
39	*Persicaria nepalensis*	Polygonaceae
40	*Adenostemma lavenia*	Asteraceae
41	*Plectranthus barbatus*	Lamiaceae
42	*Chromolaena odorata*	Asteraceae
43	*Hydrocotyl*	Araliaceae
44	*Achyranthes aspera*	Amaranthaceae
45	*Urtica sp*	Urticaceae
46	*Pilea pumila*	Urticaceae
47	*Cautleya spicata*	Zingiberaceae
48	*Viola diffusa*	Violaceae
49	*Ranunculus repens*	Ranunculaceae
50	*Cannabis sativa*	Cannabaceae
51	*Rumex nepalensis*	Polygonaceae
52	*Tridax procumbens*	Asteraceae
53	*Piper sp*	Piperaceae
54	*Panax pseudo-ginseng*	Araliaceae
55	*Tretrastigma aplinianum*	Vitaceae
56	*Peperomia sp*	Piperaceae
57	*Clematis togulensis*	Ranunculaceae
58	*Girardinia sp*	Urticaceae
59	*Sanicula elata*	Apiaceae
60	*Cynoglossum furcatum*	Boraginaceae
61	*Hydrocotyle himalaica*	Araliaceae
62	*Potentilla sp*	Rosaceae
63	*Paris polyphylla*	Melanthiaceae
64	*Hylodesmum podocarpum*	Fabaceae
65	*Thalictrum pubescens*	Ranunculaceae
66	*Drymaria cordata*	Caryophyllaceae
67	*Thunbergia coccinea*	Acanthaceae
68	*Solanum khasianum*	Solanaceae
69	*Viola betonicifolia*	Violaceae
70	*Pilea umbrosa*	Urticaceae
71	*Viola indica*	Violaceae
72	*Stellaria millisafolia*	Caryophyllaceae
73	*Urena lobata*	Malvaceae
74	*Bidens pilosa*	Asteraceae
75	*Clerodendrum splendens*	Lamiaceae
76	*Ageratum conyzoides*	Asteraceae
77	*Cayratia japonica*	Vitaceae

78	*Mikania micrantha*	Asteraceae
79	*Parabanea sagittata*	Menispermaceae
80	*Apios carnea*	Fabaceae
81	*Heracleum sublineara*	Apiaceae
82	*Roscoea purpurea*	Zingiberaceae
83	*Adiantum caudatum*	Pteridaceae
84	*Nephrolepis sp*	Nephrolepidaceae
85	*Drynaria delavayi*	Polypodiaceae
86	*Lepisorus sp*	Polypodiaceae
87	*Pteridium aquilinum*	Dennstaedtiaceae
88	*Asplenium*	Aspleniaceae
89	*Polystichum sp*	Dryopteridaceae
90	*Onychium japonicum*	Pteridaceae
91	*Dryopsis sp*	Dryopteridaceae
92	*Plagiogyria pycnophylla*	Plagiogyriaceae
93	*Pyrrosia lingua*	Polypodiaceae
94	*Goniophlebium argutum*	Polypodiaceae
95	*Ophioglosum vulgatum*	Ophioglossaceae
96	*Ptries cretica*	Pteridaceae
97	*Diplazium maximum*	Athyriaceae
98	*Pronephrium triphyllum*	Thelypteridaceae
99	*Diplazium himalayense*	Athyriaceae
100	*Arthraxon sp*	Poaceae
101	*Yushania microphylla*	Poaceae
102	*Carex sp*	Cyperaceae
103	*Oplismenus sp*	Poaceae
104	*Phleum bertolonii*	Poaceae
105	*Carex stricta*	Cyperaceae
106	*Setaria pumila*	Poaceae
107	*Uadala tsa*	
108	*Arundinella nepalensis*	Poaceae
109	*Agapetes serpens*	Ericaceae
110	*Rosa sericea*	Rosaceae
111	*Daphne bholua*	Thymelaeceae
112	*Smilax sp*	Smilacaceae
113	*Ardisia crispa*	Primulaceae
114	*Smilax myrtillus*	Smilacaceae
115	*Breynia retusa*	Phyllanthaceae
116	*Hedera nepalensis*	Araliaceae
117	*Ardisia macrocarpa*	Primulaceae

118	*Pogostemon sp*	Lamiaceae
119	*Berberis asiatica*	Berberidaceae
120	*Berberis aristata*	Berberidaceae
121	*Polygala arillata*	Polygalaceae
122	*Tetrastigma serrulatum*	Vitaceae
123	*Cassia sp*	Fabaceae
124	*Clausena excavata*	Rutaceae
125	*Viburnum nervosum*	Viburnaceae
126	*Strobilanthes sp*	Acanthaceae
127	*Zanthoxylum armatum*	Rutaceae
128	*Boemeria polystachya*	Urticaceae
129	*Piper suipigua*	Piperaceae
130	*Gaultheria fragrantissima*	Ericaceae
131	*Desmodium microphyllum*	Fabaceae
132	*Inula cappa*	Asteraceae
133	*Indigofera dosua*	Fabaceae
134	*Indigofera sp*	Fabaceae
135	*Boehmeria macrophylla*	Urticaceae
136	*Vitex sp*	Lamiaceae
137	*Dichroa febrifuga*	Hydrangeaceae
138	*Ardisia solanacea*	Primulaceae
139	*Mahonia nepaulensis*	Berberidaceae
140	*Garuda floribunda*	Burseraceae
141	*Jasminum officinal*	Oleaceae
142	*Osyris lanceolata*	Santalaceae
143	*Clerodendrum sp*	Lamiaceae

Annexure IV: List of Butterfly

Sl. No.	Common Name	Scientific Name	Author	Family
1	Azure sapphire	*Heliophorus moorei*	Hewitson, 1865	Lycaenidae
2	Common hedge blue	*Acytolepis puspa*	Horsfield, 1828	Lycaenidae
3	Blue tit	*Hypolycaena kina*	Hewitson, 1869	Lycaenidae
4	Scarce Shot silverline	*Cigaritis elima*	Moore, 1877	Lycaenidae
5	Hill hedge blue	*Celastrina argiolus*	Linnaeus, 1758	Lycaenidae
6	Pea blue	*Lampides boeticus*	Linnaeus, 1767	Lycaenidae
7	Forest Quaker	*Pithecops corvus*	Fruhstorfer, 1919	Lycaenidae

8	Bright Sunbeam	*Curetis bulis*	Westwood, 1851	Lycaenidae
9	Purple Sapphire	*Heliophorus epicles*	Godart, 1824	Lycaenidae
10	Slate Flash	*Rapala manea*	Hewitson, 1863	Lycaenidae
11	Dingy lineblue	*Petrelaea dana*	de Nicéville, 1884	Lycaenidae
12	Plain Hedge Blue	*Celastrina lavendularis*	Moore, 1877	Lycaenidae
13	Straightwing blue	*Orthomiella pontis*	Elwes, 1887	Lycaenidae
14	Himalayan spotted flat	*Celaenorrhinus munda*	Moore, 1884	Hesperiidae
15	Indian awlking	*Choaspes benjaminii*	Guérin-Méneville, 1843	Hesperiidae
16	Mussoorie bush bob	*Pedesta masuriensis*	Moore	Hesperiidae
17	White-spotted Grass Dart	*Taractrocera danna*	Moore, 1865	Hesperiidae
18	Grass demon	*Udaspes folus*	Cramer, 1775	Hesperiidae
19	Common spotted flat	*Celaenorrhinus leucocera*	Kollar, 1844	Hesperiidae
20	Oriental Palm Bob	*Suastus gremius*	Fabricius, 1798	Hesperiidae
21	Spotted demon	*Notocrypta feisthamelii*	Boisduval, 1832	Hesperiidae
22	Painted lady	*Vanessa cardui*	Linnaeus, 1758	Nymphalidae
23	Chocolate Tiger	*Parantica melaneus*	Cramer, 1775	Nymphalidae
24	Chocolate pansy	*Junonia iphita*	Cramer, 1779	Nymphalidae
25	Common beak	*Libythea lepita*	Moore, 1858	Nymphalidae
26	Common jester	*Symbrenthia lilaea*	Hewitson, 1864	Nymphalidae
27	Map Butterfly	*Cyrestis thyodamas*	Doyère, 1840	Nymphalidae
28	Hill Sergeant	*Athyma opalina*	Kollar, 1844	Nymphalidae
29	Golden emperor	*Dilipa morgiana*	Westwood, 1851	Nymphalidae
30	Lilacine bushbrown	*Mycalesis francisca*	Stoll, 1780	Nymphalidae
31	Tabby	*Pseudergolis wedah*	Kollar, 1844	Nymphalidae
32	Veined Labyrinth	*Neope pulaha*	Moore, 1858	Nymphalidae
33	Blue pansy	*Junonia orithya*	Linnaeus, 1758	Nymphalidae
34	Bluetail jester	*Symbrenthia niphanda*	Moore, 1872	Nymphalidae
35	Common sailer	*Neptis hylas*	Linnaeus, 1758	Nymphalidae
36	Glassy tiger	*Parantica aglea*	Stoll, 1782	Nymphalidae
37	Less Rich Sailer	*Neptis nashona*	Swinhoe, 1896	Nymphalidae
38	Indian red admiral	*Vanessa indica*	Herbst, 1794	Nymphalidae

39	Straight banded treebrown	*Lethe verma*	Kollar, 1844	Nymphalidae
40	Striped Tiger	*Danaus genutia*	Cramer, 1779	Nymphalidae
41	Yellow coster	*Acraea issoria*	Hübner, 1819	Nymphalidae
42	Bhutan Sergeant	*Athyma jina*	Moore, 1858	Nymphalidae
43	Black Prince	*Rohana parisatis*	Westwood, 1851	Nymphalidae
44	Indian tortoiseshell	*Aglais caschmirensis*	Kollar, 1844	Nymphalidae
45	Plain Sailer	*Neptis cartica*	Moore, 1872	Nymphalidae
46	Plain tiger	*Danaus chrysippus*	Linnaeus, 1758	Nymphalidae
47	Stately Nawab	*Charaxes dolon*	Westwood, 1848	Nymphalidae
48	Striped blue crow	*Euploea mulciber*	Cramer, 1777	Nymphalidae
49	Rusty Forester	*Lethe bhairava*	Moore, [1858	Nymphalidae
50	Himalayan Queen Fritillary	*Issoria issaea*	Doherty, 1886	Nymphalidae
51	Blue tiger	*Tirumala limniace*	Cramer, 1775	Nymphalidae
52	Palmfly	*Elymnias patna*	Westwood, 1851	Nymphalidae
53	Bright-eye Bushbrown	*Telinga nicotia*	Westwood, 1850	Nymphalidae
54	Circe	*Hestinalis nama*	Doubleday, 1844	Nymphalidae
55	Common evening brown	*Melanitis leda*	Linnaeus, 1758	Nymphalidae
56	Common five-ring	*Ypthima baldus*	Fabricius, 1775	Nymphalidae
57	Common maplet	*Chersonesia risa*	Doubleday, 1848	Nymphalidae
58	Common palmfly	*Elymnias hypermnestra*	Linnaeus, 1763	Nymphalidae
59	Creamy sailer	*Neptis soma*	Moore, 1858	Nymphalidae
60	Dark blue tiger	*Tirumala septentrionis*	Butler, 1874	Nymphalidae
61	Dark Evening Brown	*Melanitis phedima*	Cramer, 1780	Nymphalidae
62	Great eggfly	*Hypolimnas bolina*	Linnaeus, 1758	Nymphalidae
63	Indian purple emperor	*Mimathyma ambica*	Kollar, 1844	Nymphalidae
64	Orange staff sergeant	*Athyma cama*	Moore, 1858	Nymphalidae
65	Pale Forester	*Lethe latiaris*	Hewitson, 1862	Nymphalidae
66	Pale Green Sailer	*Neptis zaida*	Doubleday, 1848	Nymphalidae
67	Pallid argus	*Callerebia scanda*	Kollar, 1844	Nymphalidae
68	Blue-spotted Crow	*Euploea midamus*	Linnaeus, 1758	Nymphalidae
69	Spotted jester	*Symbrenthia hypselis*	Godart, 1824	Nymphalidae
70	Staff Sergeant	*Athyma selenophora*	Kollar, 1844	Nymphalidae

71	White-edged Blue Baron	*Euthalia phemius*	Doubleday, 1848	Nymphalidae
72	White-edged bushbrown	*Telinga mestra*	Hewitson, 1862	Nymphalidae
73	Paris peacock	*Papilio paris*	Linnaeus, 1758	Papilionidae
74	Glassy bluebottle	*Graphium cloanthus*	Westwood, 1841	Papilionidae
75	Rose windmill	*Byasa latreillei*	Donovan, 1826	Papilionidae
76	Six bar swordtail	*Byasa latreillei*	Donovan, 1826	Papilionidae
77	Lesser mime	*Papilio epycides*	Hewitson, 1862	Papilionidae
78	Common bluebottle	*Graphium sarpedon*	Linnaeus, 1758	Papilionidae
79	Common peacock	*Papilio bianor*	Cramer, 1777	Papilionidae
80	Great windmill	*Byasa dasarada*	Moore, 1858	Papilionidae
81	Common Mormon	*Papilio polytes*	Linnaeus, 1758	Papilionidae
82	Dark clouded yellow	*Colias fieldii*	Ménétriés, 1855	Pieridae
83	Indian cabbage white	*Pieris canidia*	Linnaeus	Pieridae
84	Lesser brimstone	*Gonepteryx mahaguru*	Gistel, 1857	Pieridae
85	Great blackvein	*Aporia agathon*	Gray, 1831	Pieridae
86	Plain puffin	*Appias indra*	Moore, 1858	Pieridae
87	White Orange-tip	*Ixias marianne*	Cramer, 1779	Pieridae
88	Yellow orangetip	*Ixias pyrene*	Linnaeus, 1764	Pieridae
89	Common gull	*Cepora nerissa*	Fabricius, 1775	Pieridae
90	Hill Jezebel	*Delias belladonna*	Fabricius, 1793	Pieridae
91	Spot puffin	*Appias lalage*	Doubleday, 1842	Pieridae
92	One-spot grass yellow	*Eurema andersonii*	Moore, 1886	Pieridae
93	Mottled emigrant	*Catopsilia pyranthe*	Linnaeus, 1758	Pieridae
94	Spotless grass yellow	*Eurema laeta*	Boisduval, 1836	Pieridae
95	Three-spot grass yellow	*Eurema blanda*	Boisduval, 1836	Pieridae
96	Lesser Punch	*Dodona dipoea*	Hewitson, 1866	Riodinidae
97	Striped Punch	*Dodona adonira*	Hewitson, 1866	Riodinidae
98	Tailed Punch	*Dodona eugenes*	Bates,[1868	Riodinidae
99	Tailed sulphur	*Dodona eugenes*	Bates,[1871	Riodinidae
100	Punchinello	*Zemeros flegyas*	Cramer, 1780	Riodinidae
101	Orange Punch	*Dodona egeon*	Westwood, 1851	Riodinidae
102	Dark Judy	*Abisara fylla*	Westwood, 1851	Riodinidae
103	Large-spotted Bush Bob	*Pedesta masuriensis*	Moore, 1878	Hesperiidae

104	Common Lineblue	*Prosotas nora*	C. Felder, 1860	Lycaenidae
105	Golden Sapphire	*Heliophorus brahma*	Moore, 1858	Lycaenidae
106	Zebra Blue	*Leptotes plinius*	Fabricius, 1793	Lycaenidae
107	Green Commodore	*Sumalia daraxa*	Doubleday, 1848	Nymphalidae
108	White Commodore	*Parasarpa dudu*	Westwood, 1850	Nymphalidae
109	Large Silverstripe	*Argynnis childreni*	Gray, 1831	Nymphalidae
110	Blue Admiral	*Kaniska canace*	Linnaeus, 1763	Nymphalidae
111	Peacock Pansy	*Junonia almana*	Linnaeus, 1758	Nymphalidae
112	Common Castor	*Ariadne merione*	Cramer, 1777	Nymphalidae
113	Chestnut Tiger	*Parantica sita*	Kollar, 1844	Nymphalidae
114	Common Woodbrown	*Lethe sidonis*	Hewitson, 1863	Nymphalidae
115	Lemon Pansy	*Junonia lemonias*	Linnaeus, 1758	Nymphalidae
116	Common Leopard	*Phalanta phalantha*	Drury, 1773	Nymphalidae
117	Elongated Freak	*Calinaga gautama*	Moore, 1902	Nymphalidae
118	Bhutan Glory	*Bhutanitis lidderdalii*	Atkinson, 1873	Papilionidae
119	Common Birdwing	*Troides helena*	Linnaeus, 1758	Papilionidae
120	Red Helen	*Papilio helenus*	Linnaeus, 1758	Papilionidae
121	Lemon Emigrant	*Catopsilia pomona*	Fabricius, 1775	Pieridae
122	Dark Jezebel	*Delias berinda*	Moore, 1872	Pieridae

Annexure V: List of Orchids

Sl. No.	Species
1	*Agrostophyllum callosum Rchb.f.*
2	*Annectochilus brevilabris Lindl.*
3	*Arachnis cathcartii (Lindl.) J.J.Sm)*
4	*Ascocentrum himalaicum (Deb, Sengupta & Malick) Christenson*
5	*Bulbophyllum cylindraceum Wall. ex Lindl.*
6	*Bulbophyllum deergongense J.L.Miao & J.W.Zhai*
7	*Bulbophyllum ellatum (Hook.f.) JJ Sm.1912)*
8	*Bulbophyllum emarginatum (Finet) J.J.Sm.1912*
9	*Bulbophyllum gamblei Hook. F. 1912*

10	*Bulbophyllum griffithii (Lindl.) Rchb. F. 1864*
11	*Bulbophyllum gymnopus Hook.f. 1890*
12	*Bulbophyllum hymenanthum Hook.f.*
13	*Bulbophyllum kingii Hook.f. 1890*
14	*Bulbophyllum leopardinum (Wall.) Lindl. 1830*
15	*Bulbophyllum odoratissimum (Sm.) Lindl. Ex Wall*
16	*Bulbophyllum punakhaense P.Gyeltshen,K.Rabgay & Kumar*
17	*Bulbophyllum purpureofuscum J.J.Verm., Shuit. & de Vogel*
18	*Bulbophyllum reptans (Lindl.) Lindl. Ex Wall*
19	*Bulbophyllum retusiusculum Rchb.f.*
20	*Bulbophyllum roeseopictum J.J.Verm.,Schuit. & de Vogel*
21	*Bulbophyllum scabratum Rchb. f. 1864*
22	*Bulbophyllum secundum Hook.f.*
23	*Bulbophyllum straitum (Griff.) Rchb.f.*
24	*Bulbophyllum umbellatum Lindl.*
25	*Calanthe alpina Hook.f.ex Lindl.*
26	*Calanthe brevicornu Lindl.*
27	*Calanthe mannii Hook.f. 1890*
28	*Calanthe masuca(D.Don) Lindl.*
29	*Calanthe plantaginea Lindl.1833*
30	*Calanthe triplicata(Willemet) Ames*
31	*Callostylis ridgida Blume*
32	*Ceratostylis himaliaca Hook.f.*
33	*Cheirostylis yunnanensis Rolfe*
34	*Chrysoglossum ornatumBlume*
35	*Cleisostoma racemiferum (Lindl.) Garay*
36	*Coelogyne barbata Lindl. ex Griff.*
37	*Coelogyne corymbosa Lindl. 1853*
38	*Coelogyne cristata Lindl.*
39	*Coelogyne fimbriata Lindl.*

40	*Coelogyne fuscescens Lindl.*
41	*Coelogyne ocultata Hook.f. 1890*
42	*Coelogyne prolifera Lindl.*
43	*Coelogyne raizadaeS.K.Jain & S. Das*
44	*Coelogyne stricta (D. Don) Schltr. 1919*
45	*Cremastra appendiculata (D.Don) Makino*
46	*Cryptochilus lutea Lindl. 1859*
47	*Cryptochilus sanguineus Wall.*
48	*Cymbidium cochleare Lindl. 1858*
49	*Cymbidium cyperifolium Lindl. 1833*
50	*Cymbidium devonianumPaxton*
51	*Cymbidium erythereum Lindl.*
52	*Cymbidium faberi Rolfe*
53	*Cymbidium hookerianum Rchb.f.*
54	*Cymbidium iridiodesD.Don*
55	*Cymbidium lancifolium Hook.*
56	*Dendrobium amplumLindl.*
57	*Dendrobium chrysanthumWall. ex Lindl.*
58	*Dendrobium falconeri Hook. f. 1856*
59	*Dendrobium fimbriatum Hook.*
60	*Dendrobium fuscescens Griff.*
61	*Dendrobium heterocarpumWall. ex Lindl. 1830*
62	*Dendrobium hookerianum Lindl. 1859*
63	*Dendrobium longicornu Lindl. 1828*
64	*Dendrobium moniliforme (L.) Sw. 1799*
65	*Dendrobium moschatum (Buchanan-Hamilton) Sw. 1806*
66	*Eria carinata Gibson ex Lindl. 1859*
67	*Eria clausa King & Pantling 1896*
68	*Gastrochilus calceolaris (Buch.-Ham. ex Sm.) D.Don*
69	*Gastrochilus distichus (Lindl.) Kuntze 1891*

70	*Goodyera biflora (Lindl.) Hook.f.*
71	*Goodyera foliosa (Lindl.) Benth. ex C.B.Clarke*
72	*Goodyera hemsleyana King & Pantl. 1895*
73	*Goodyera repens (Linne) R. Brown 1813*
74	*Goodyera schlechtendaliana Rchb.f.*
75	*Goodyera viridiflora (Blume) Blume*
76	*Goodyera vittata (Lindl.) Benth. ex Hook.f.*
77	*Liparis bootanensis Griff.*
78	*Liparis cathcartii Hook.f.*
79	*Liparis cespitosa (Lam.) Lindl.*
80	*Liparis resupinata Ridl.*
81	*Mycaranthes floribunda (D.Don) S.C.Chen & J.J.Wood*
82	*Neogyna gardneriana (Lindl.) Rchb.f.*
83	*Oberonia acaulis Griff.*
84	*Oberonia caulescens Lindl.*
85	*Oberonia obcordata Lindl.*
86	*Oberonia pachyrachis Rchb.f. ex Hook.f.*
87	*Otochilus fuscus Lindl.*
88	*Otochilus lancilabius Seidenf.*
89	*Papilionanthe vandarum (Rchb.f.) Garay*
90	*Peristylus biermannianus (King & Pantling) X.H.Jin, Schuit., & W.T.Jin.*
91	*Phaius mishmensis (Lindl. & Paxton) Rchb.f.*
92	*Phaius wallichii Lindl. 1831*
93	*Phalaenopsis difformis (Wall. ex Lindl.) Kocyan & Schuit.*
94	*Phalaenopsis taenialis (Lindl.) Christenson & Pradhan*
95	*Pholidota articulata Lindl.*
96	*Pholidota pallida Lindl.*
97	*Pholidota protracta Hook.f.*
98	*Pholidota recurva Lindl. 1830*
99	*Pinalia amica (Rchb.f.) Kuntze*

100	*Pinalia graminifolia (Lindl.) Kuntze*
101	*Pinalia spicata (D.Don) S.C.Chen & J.J.Wood*
102	*Pleione hookeriana (Lindl.) Rollisson*
103	*Pleione praecox (Sm.) D.Don*
104	*Satyrium nepalense D.Don var. ciliatum 1890*
105	*Thrixspermum japonicum (Miq.) Rchb. f. 1878*
106	*Tipularia josephi Rchb.f. ex Lindl.*
107	*Vanda cristata Wall. ex Lindl.*
108	*Vanda griffithii Lindl.*
109	*Vandopsis undulata (Lindl.) J.J.Sm.*
110	*Zeuxine goodyeroides Lindl.*
111	*Zeuxine nervosa (Wall. ex Lindl.) Benth. ex Trimen*

Annexure VI: Income generating crops

Sl. No.	Crop Type	Income from sale of crops (Nu)
1	Apple	4000
2	Asparagus	52200
3	Avocado	49000
4	Banana	22900
5	Barley	13000
6	Beans	784850
7	Bitter buckwheat	13000
8	Brinjal	17500
9	Brocolli	221500
10	Cabbage	483200
11	Cardamom	371025
12	Carrot	38000
13	Cauliflower	488900
14	Chilli	553100
15	Coriander	56250
16	Crows' beak (Olachoto)	6000
17	Cucumber	203600
18	Garlic	377550
19	Ginger	108300
20	Guava	226100

21	Hazelnut	25000
22	Kiwi	15000
23	Lemon	30500
24	Maize	55250
25	Mango	155000
26	Millet	3000
27	Mushroom	82500
28	Mustard	7870
29	Onion	107800
30	Orange	749200
31	Orchids	27000
32	Pea	97700
33	Peach	3000
34	Pear	15000
35	Potato	154850
36	Pulses (Beans)	35000
37	Pumpkin	1000
38	Radish	18460
39	Rice	1342806
40	Spinach	114330
41	Squash	2500
42	Sugarcane	4000
43	Tomato	8250
44	Walnut	132900
45	Wheat	61500
46	Zhimtse (Perilla)	94020
Total Income (Nu)		7433411