



CONSERVATION MANAGEMENT PLAN FOR BIOLOGICAL CORRIDOR 02

“Connecting Jigme Singye Wangchuck National Park and Royal Botanical Park”
(July 2025 – June 2035)



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

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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!



DIRECTOR

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 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 the development of this management plan financially.

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 km² 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, spanning ten years from 2025 to 2035, is based on the results of a thorough evaluation of 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).

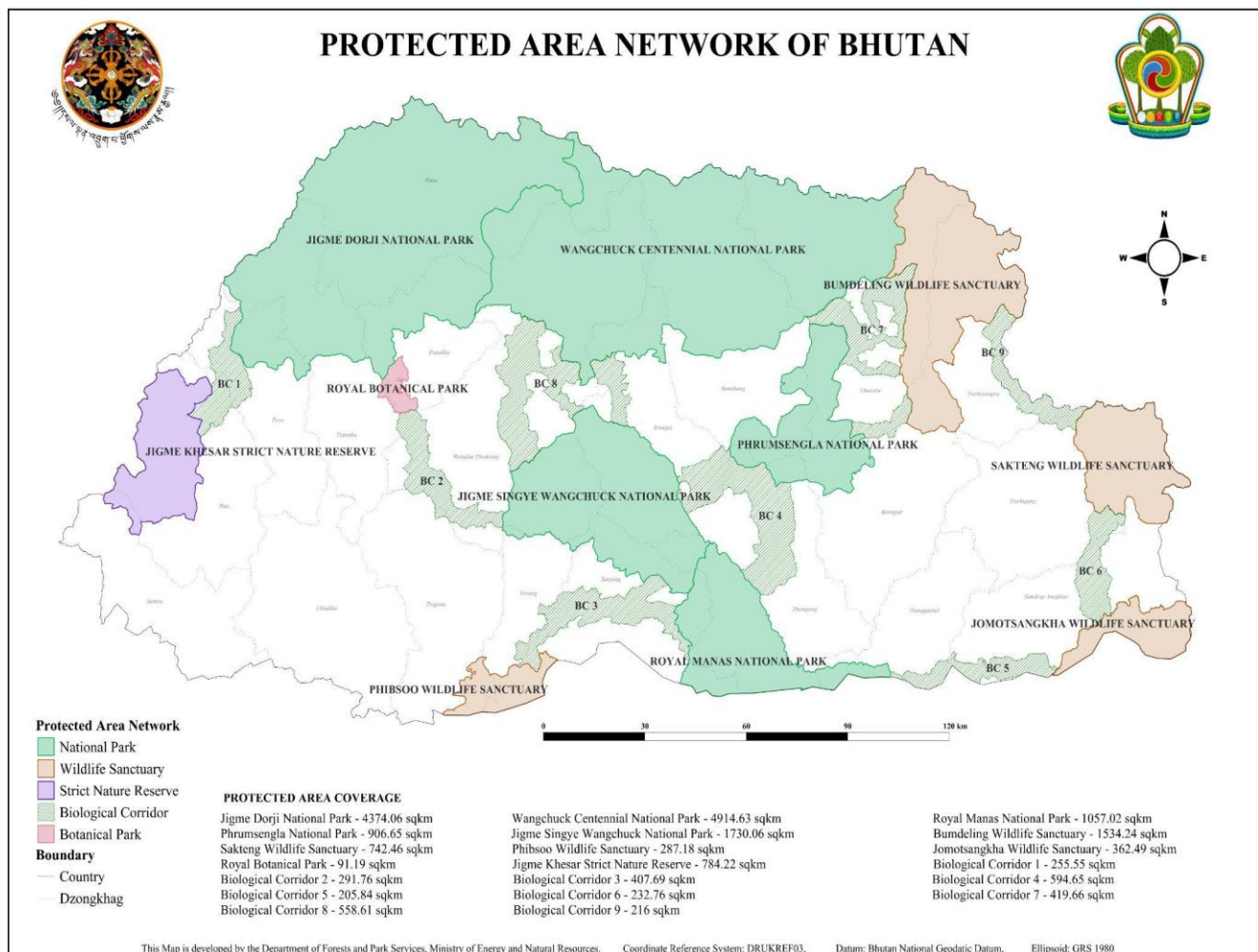


Figure 1: Map showing the protected areas and biological corridors of Bhutan

1.2. Brief information on BC-02

BC-02 has an area of 291.76 km² stretched across part of Daga (160.9 km²), Gasetshowom (73.3 km²), Nahi (45.9 km²), Gasetshogom (2.5 km²), and Athang (0.08 km²) Gewog under Wangdue Dzongkhag and part of Tseza (9 km²) 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:

- Providing a secure migratory habitat to facilitate movement (dispersal or migration) of several threatened wildlife species, including Royal Bengal Tiger;
- Maintaining genetic diversity of species and;
- Providing a supplementary feeding habitat for animals

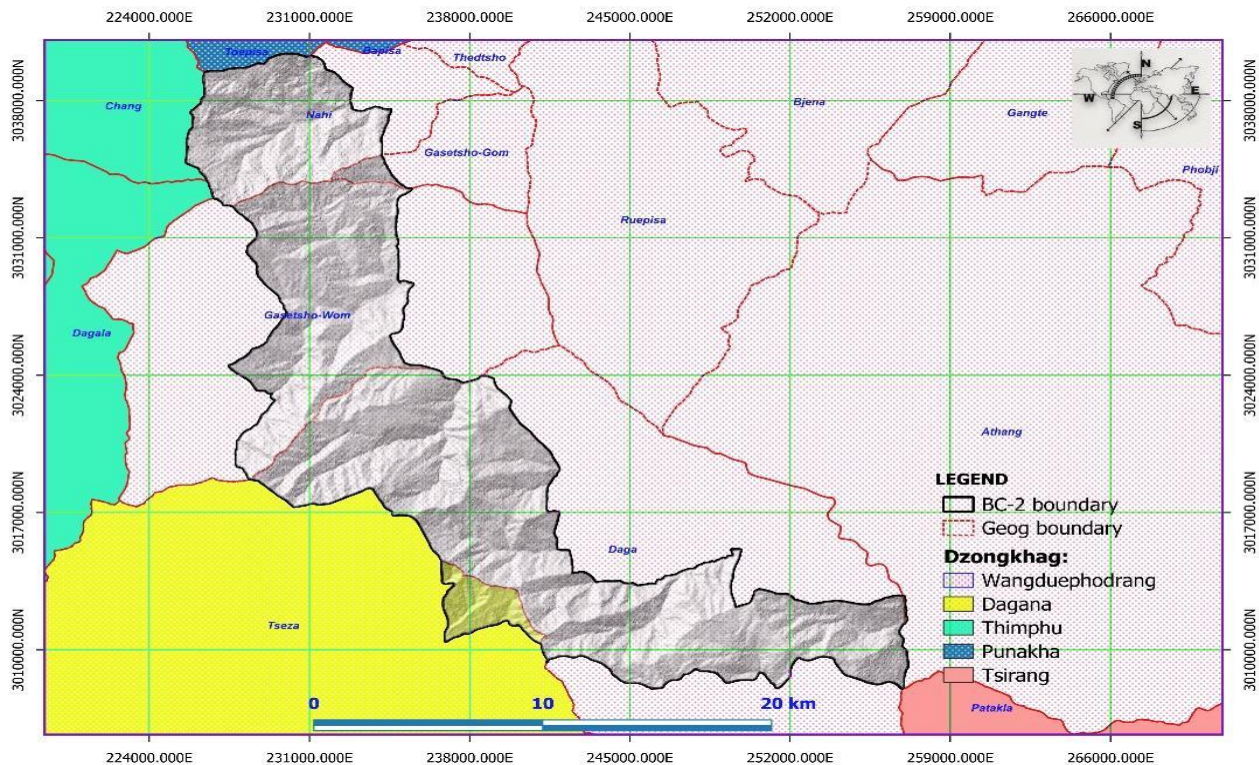


Figure 2: Administrative map of BC-02

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

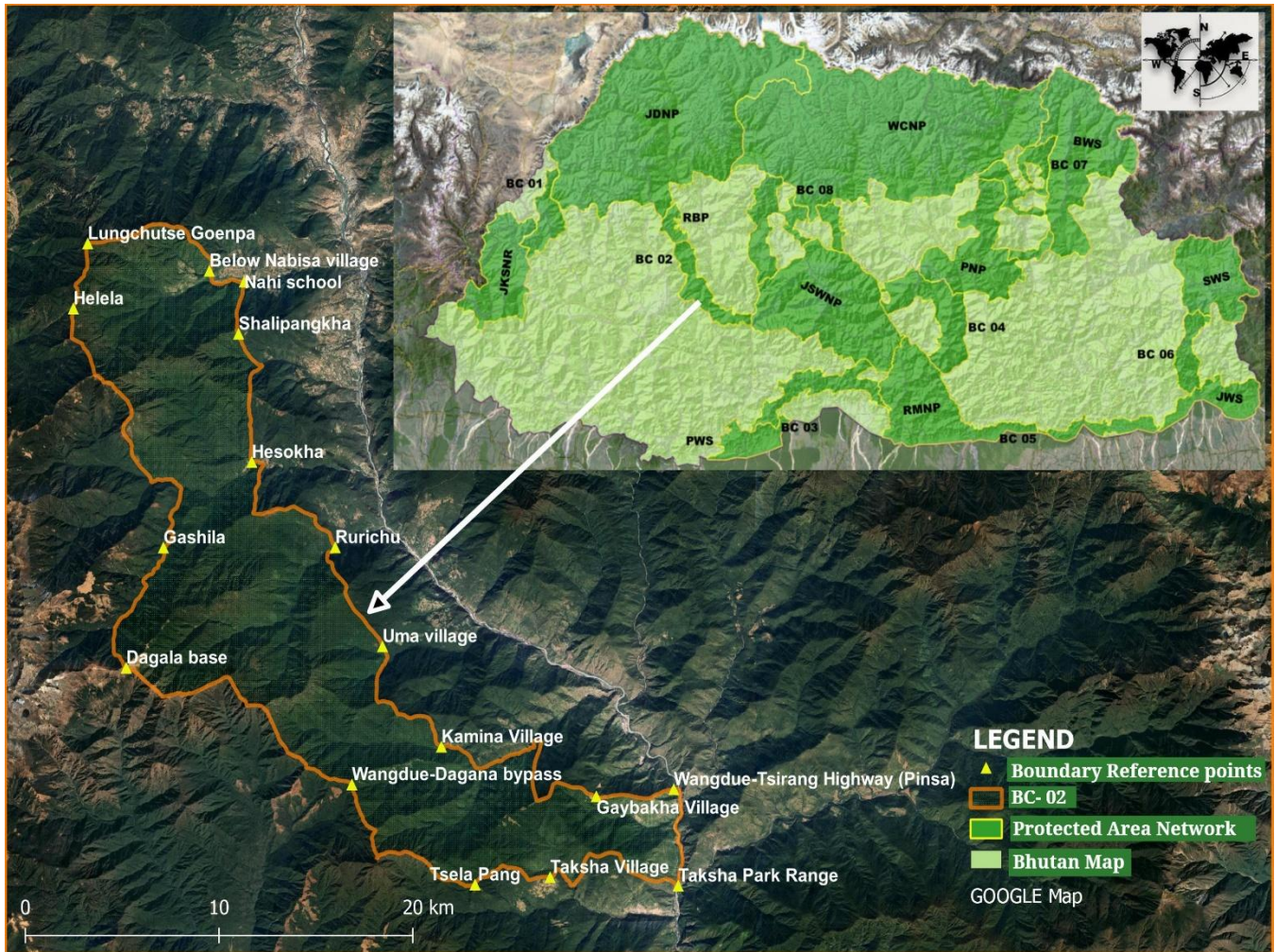


Figure 3: Boundary map of BC-02

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

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

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

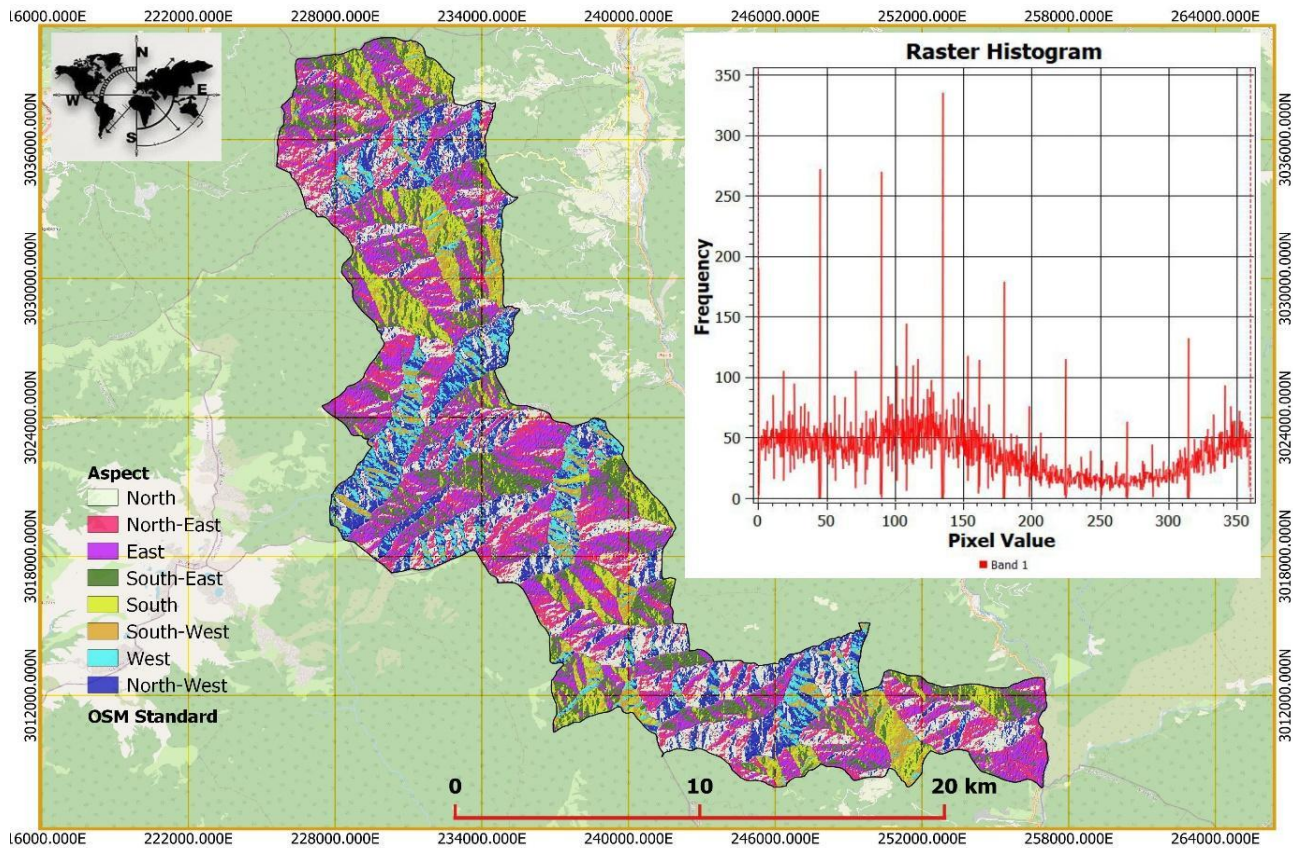


Figure 4: Aspect classification of BC-02

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.

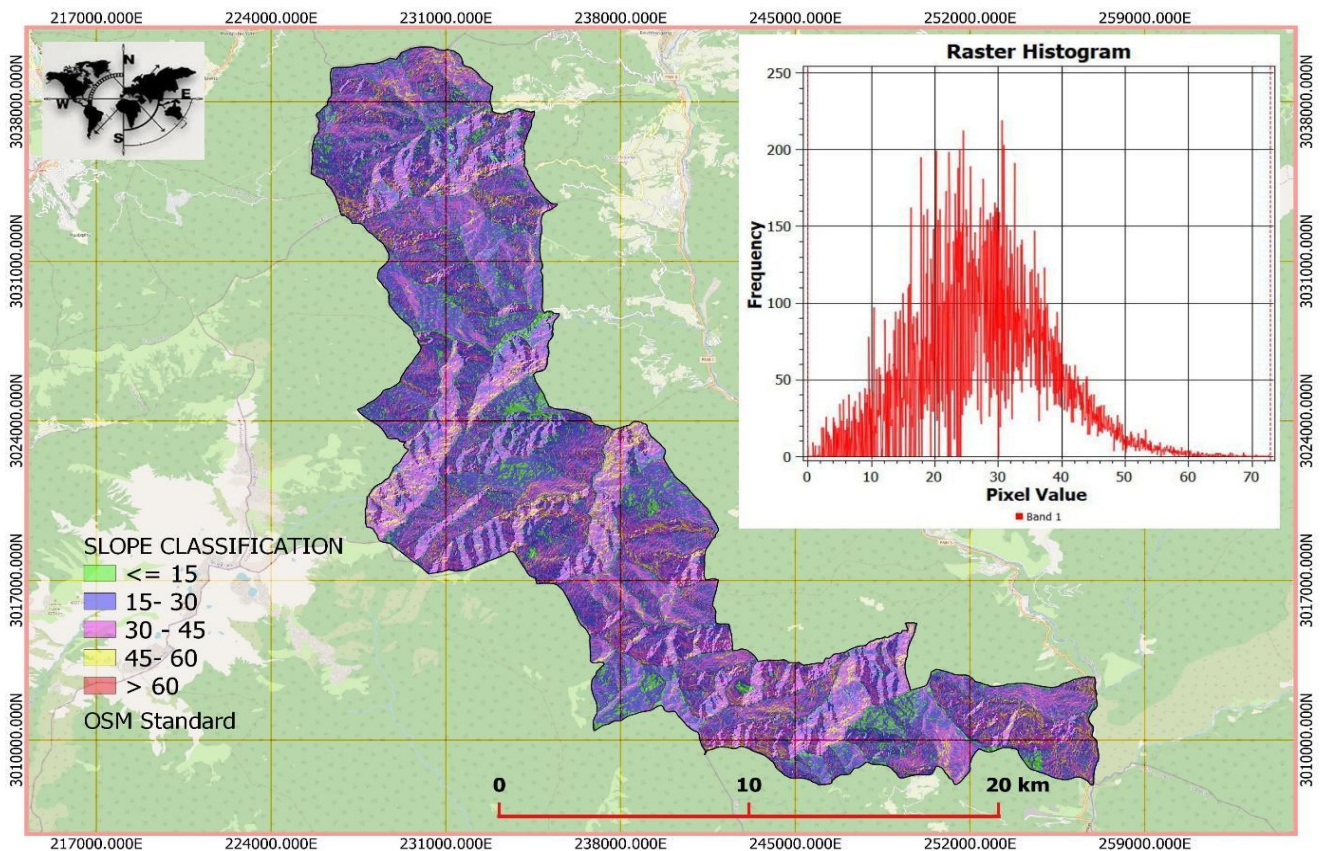


Figure 5: Slope classification of BC-02

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.

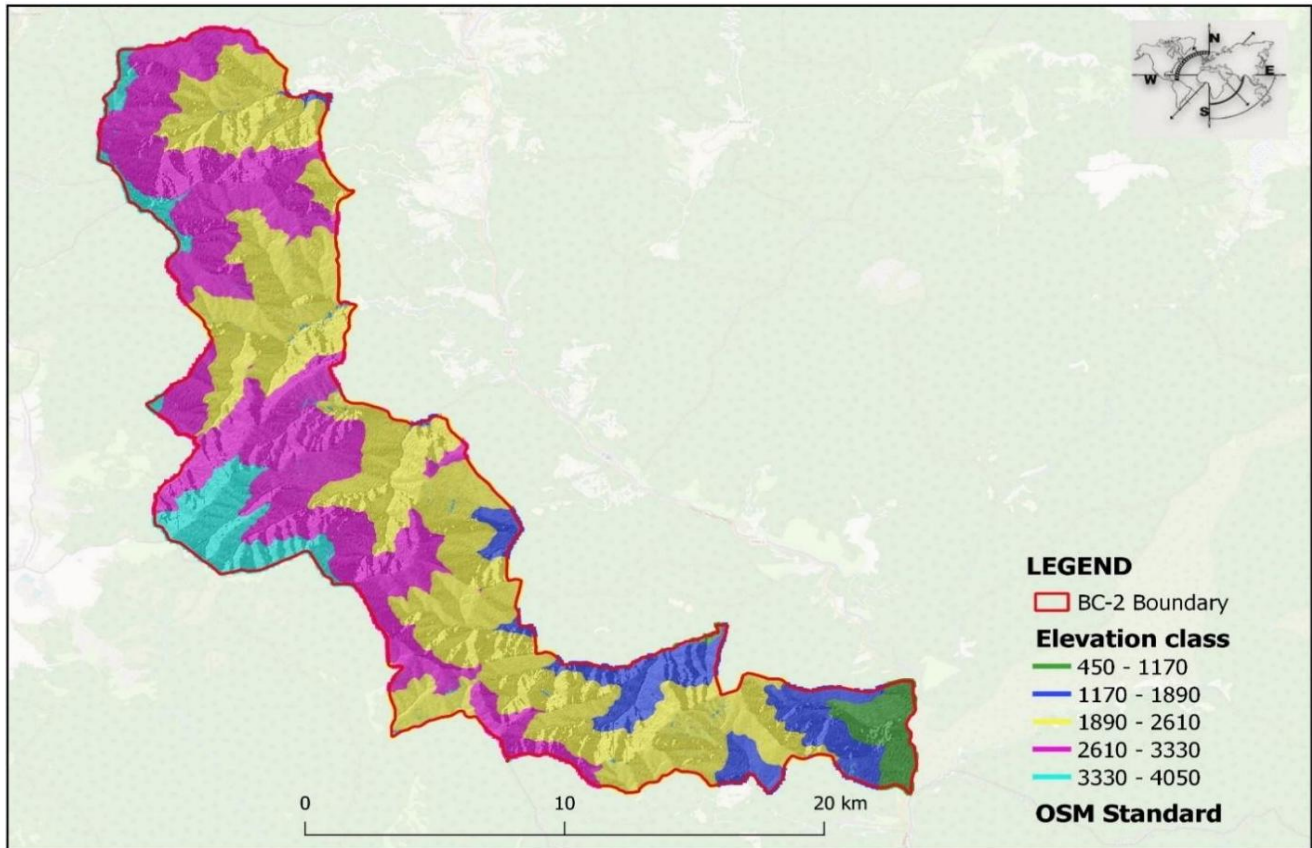


Figure 6: Elevation classification of BC-02

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.

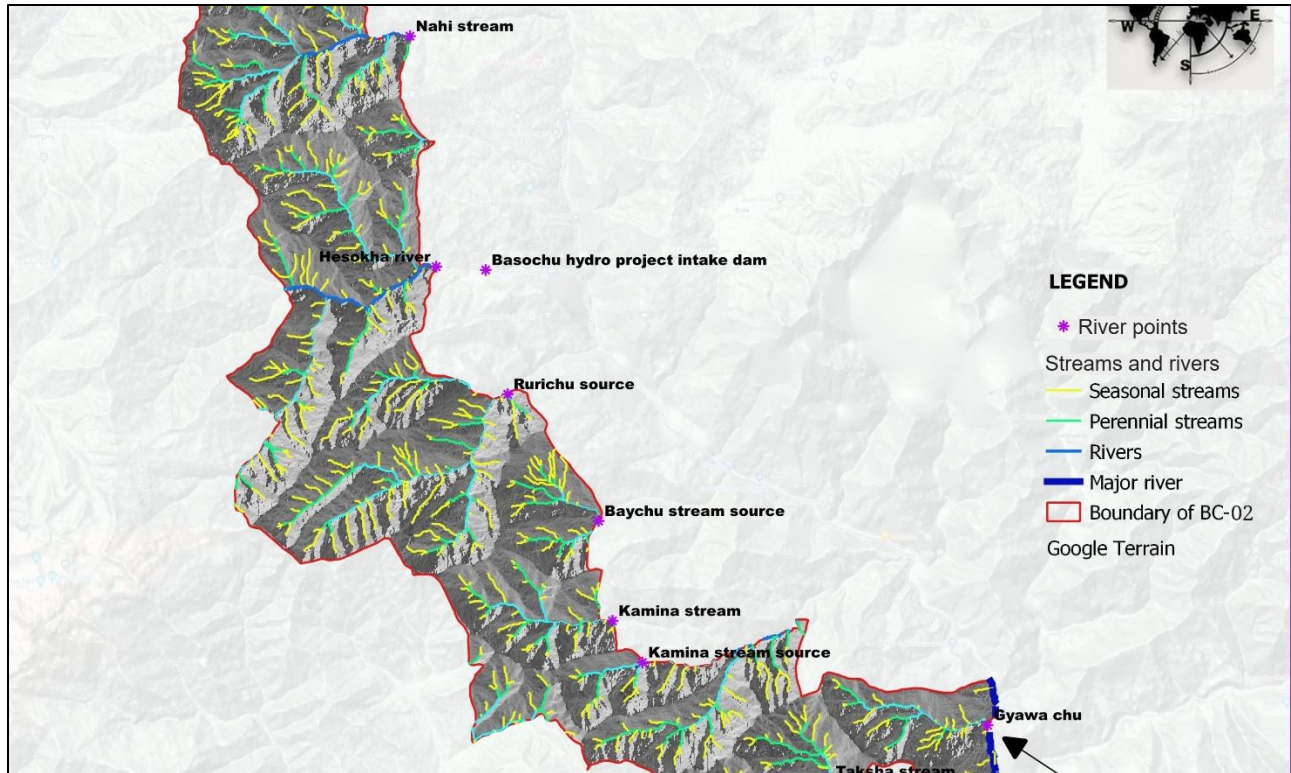


Figure 7: Drainage system of BC-02

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.

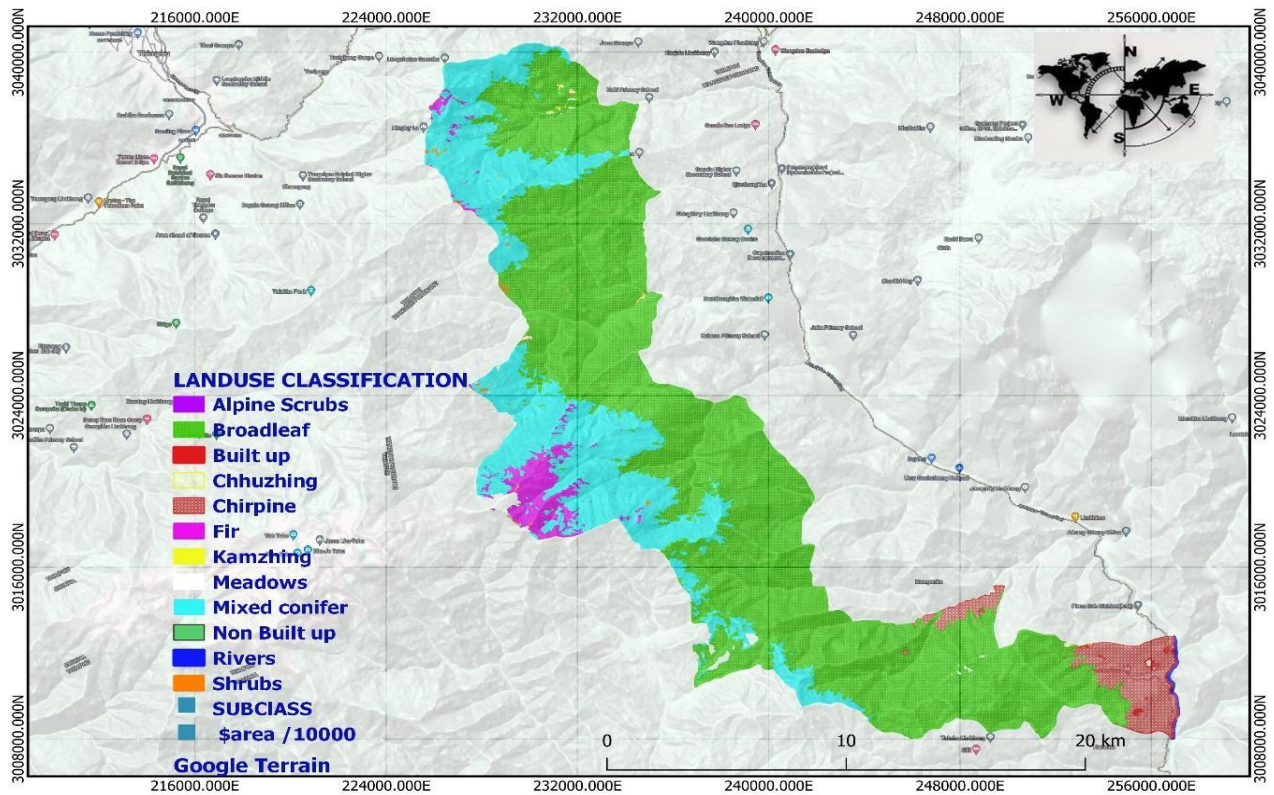


Figure 8: Land Use Classification of the Corridor

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.

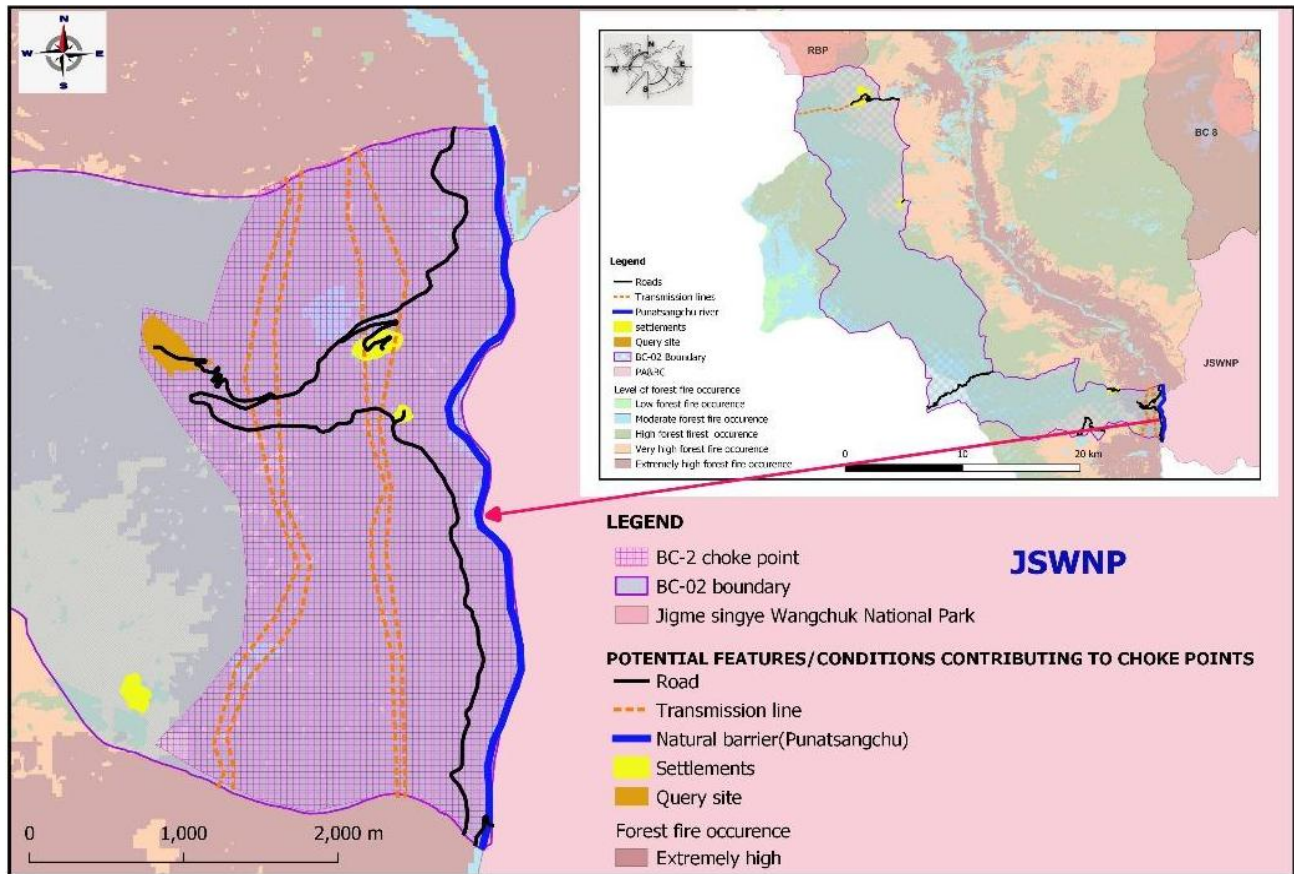


Figure 9: Choke points in BC-02

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*.

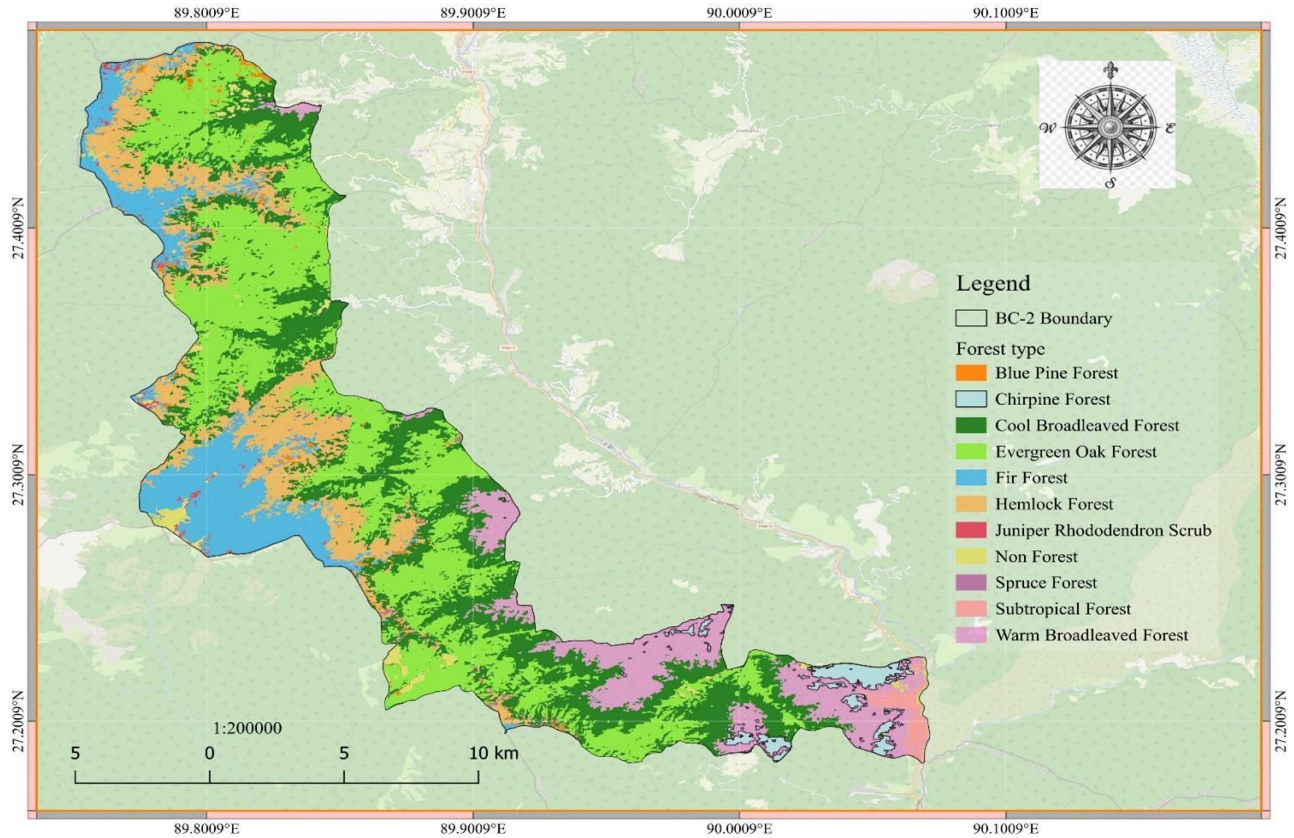


Figure 10: Forest types of BC-02

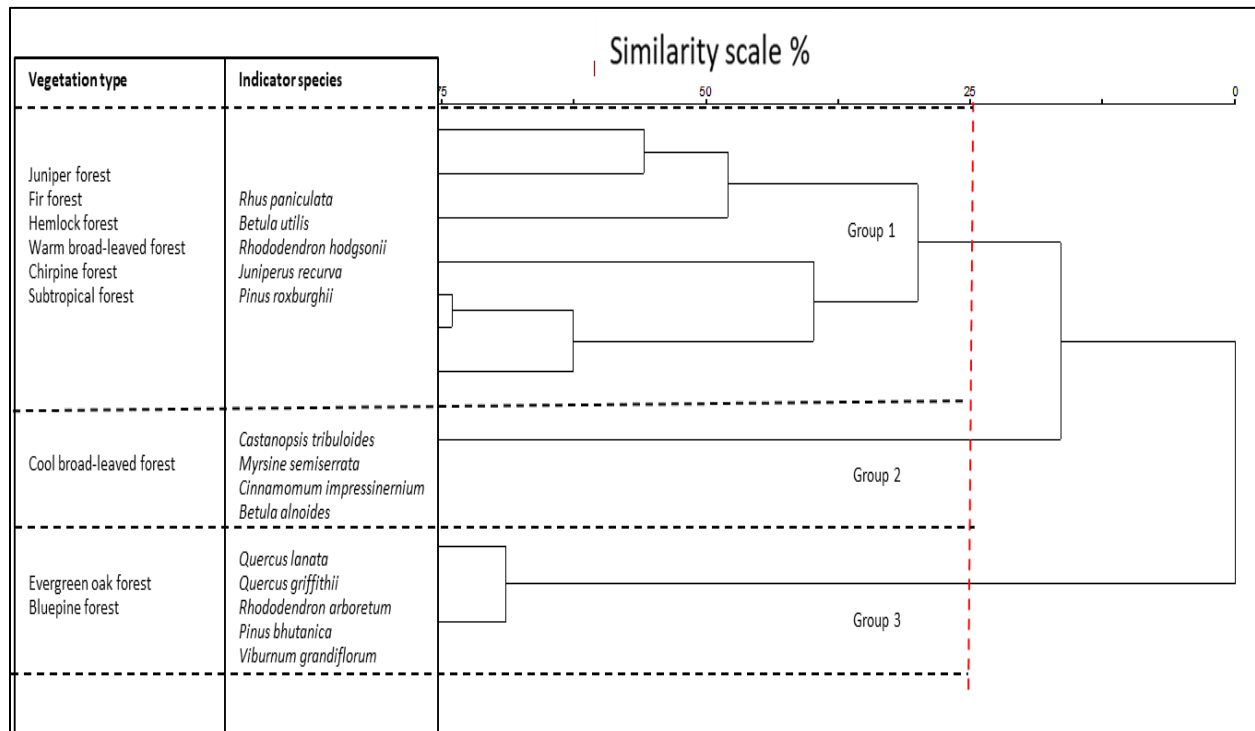


Figure 11: Cluster dendrogram depicting 3 clusters with indicator species and vegetation

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 Lapsakarchu, 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*).

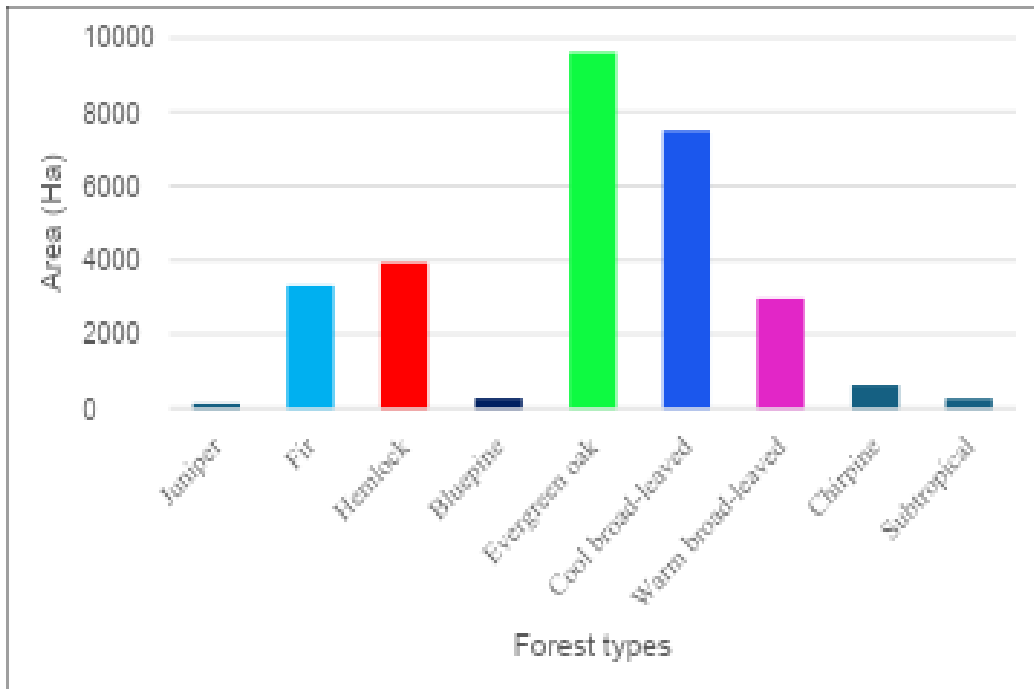


Figure 12: Dominant Forest Types in BC-02

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*.

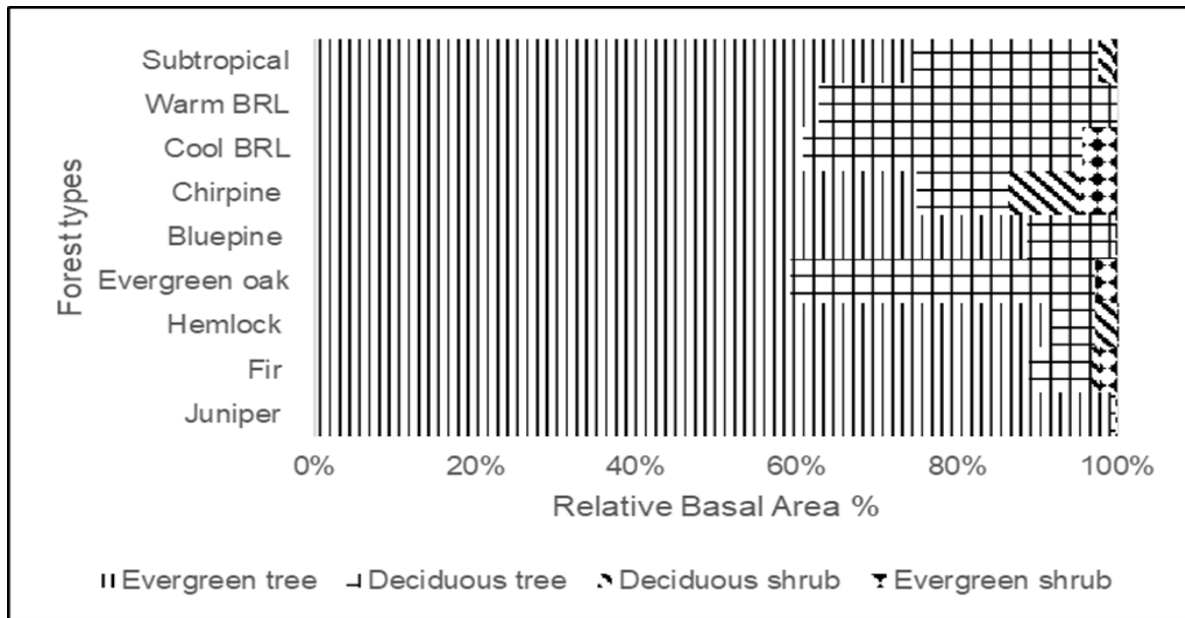


Figure 13: Distribution pattern of four major life-forms

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

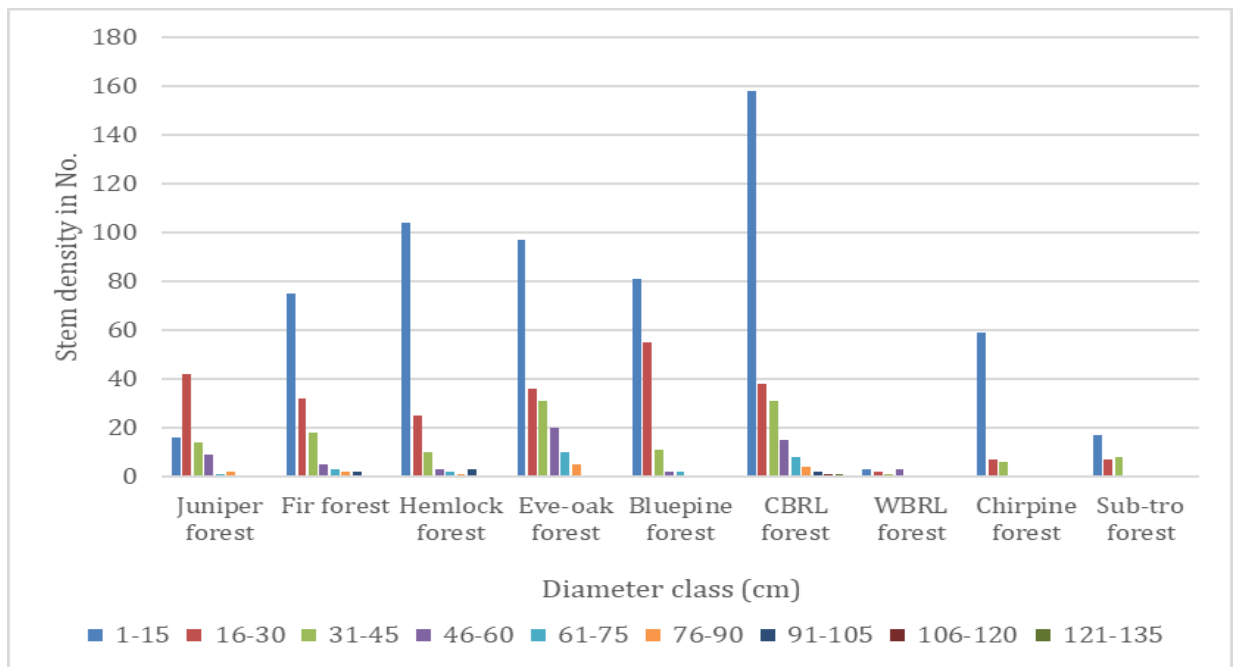


Figure 14: Diameter class distribution of trees and shrubs

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 pig, 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).

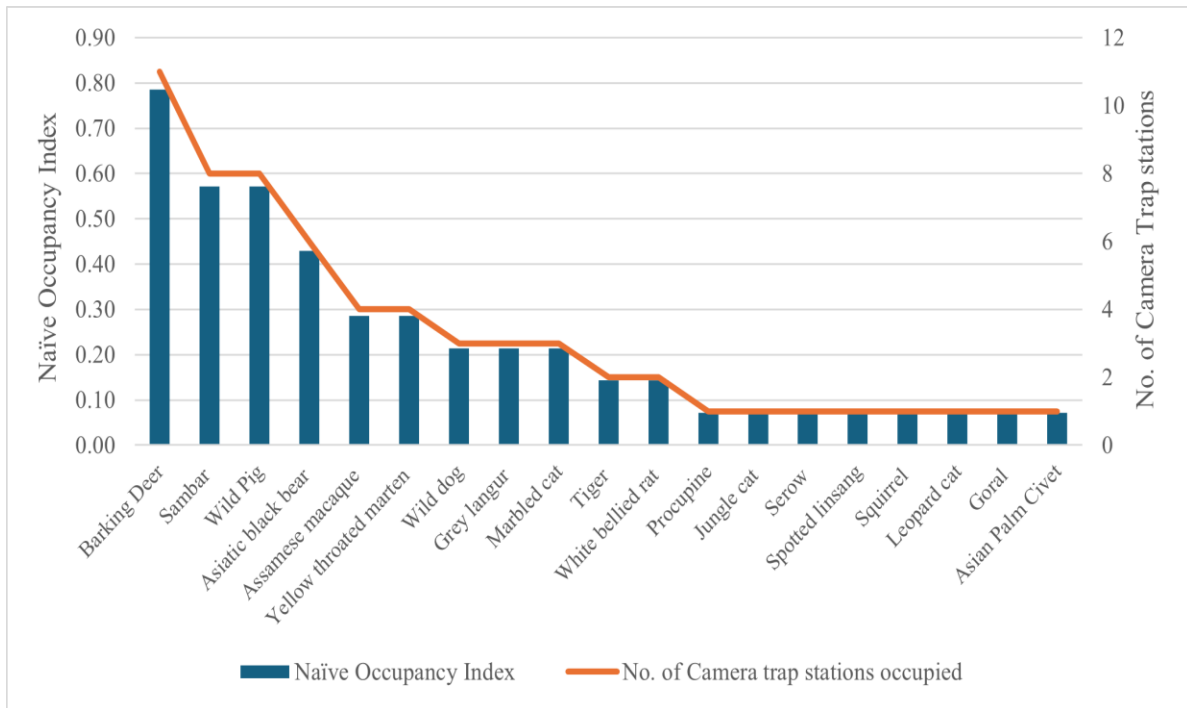


Figure 15: Mammal species naïve occupancy proportions

The naïve occupancy was found highest for Barking deer (0.79, n=11), followed by Sambar deer (0.57, n=8), Wild pig (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 pig 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 (<i>Ardea insignis</i>) |
| Near Threatened (NT) | Satyr Tragopan (<i>Tragopan satyra</i>), Wards Trogon (<i>Harpectes wardi</i>), Yellow-rumped Honeyguide (<i>Indicator xanthonotus</i>) |
| Vulnerable | Great Hornbill (<i>Buceros bicornis</i>), Rufous-necked Hornbill (<i>Aceros nipalensis</i>) |
| Schedule II of FNCRR | White-Bellied Heron (<i>Ardea insignis</i>), Satyr Tragopan (<i>Tragopan satyra</i>), Ward's Trogon (<i>Harpectes wardi</i>), Yellow-rumped Honeyguide (<i>Indicator xanthonotus</i>), Great Hornbill (<i>Buceros bicornis</i>), Rufous Hornbill (<i>Aceros nipalensis</i>), Himalayan Monal (<i>Lophophorus impejanus</i>), Hill partridge (<i>Arborophila torqueola</i>) |

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, Hesperidae, Nymphalidae, Papilionidae, Pieridae & Riodinidae) & 22 sub-families. Most of the number of individuals & species were recorded from Nymphalidae family, and the least from Hesperidae 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).

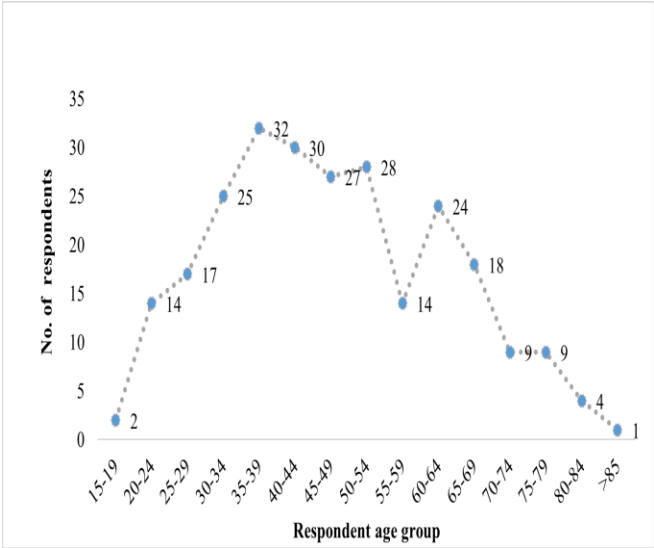


Figure 16: Age group classification

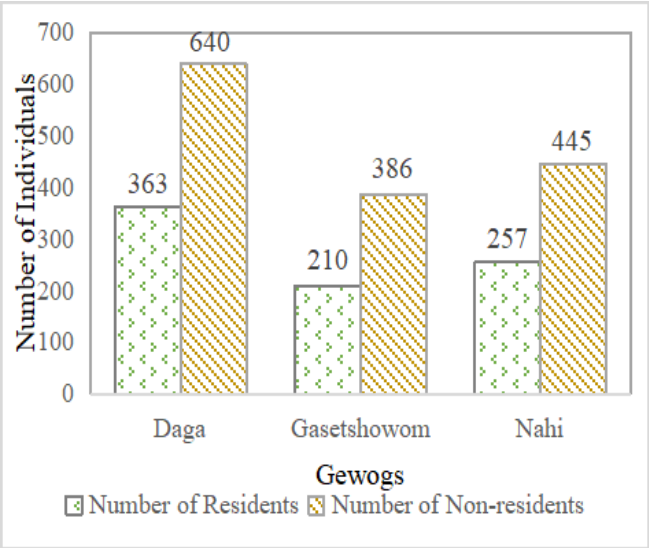


Figure 17: Residents and non-residents

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*).

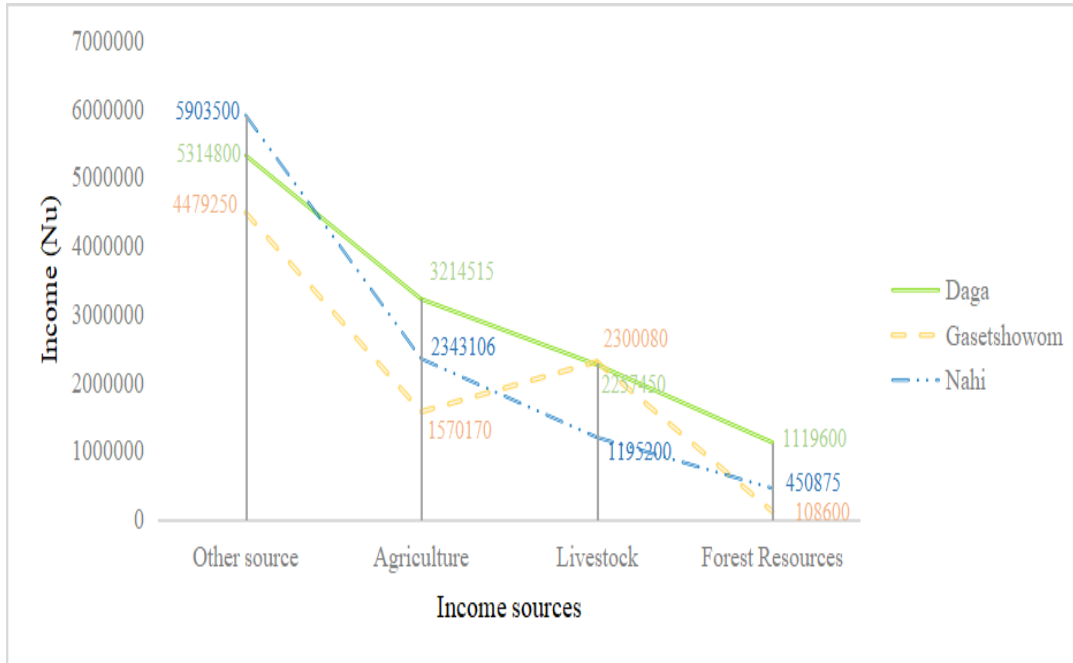


Figure 18: Income sources

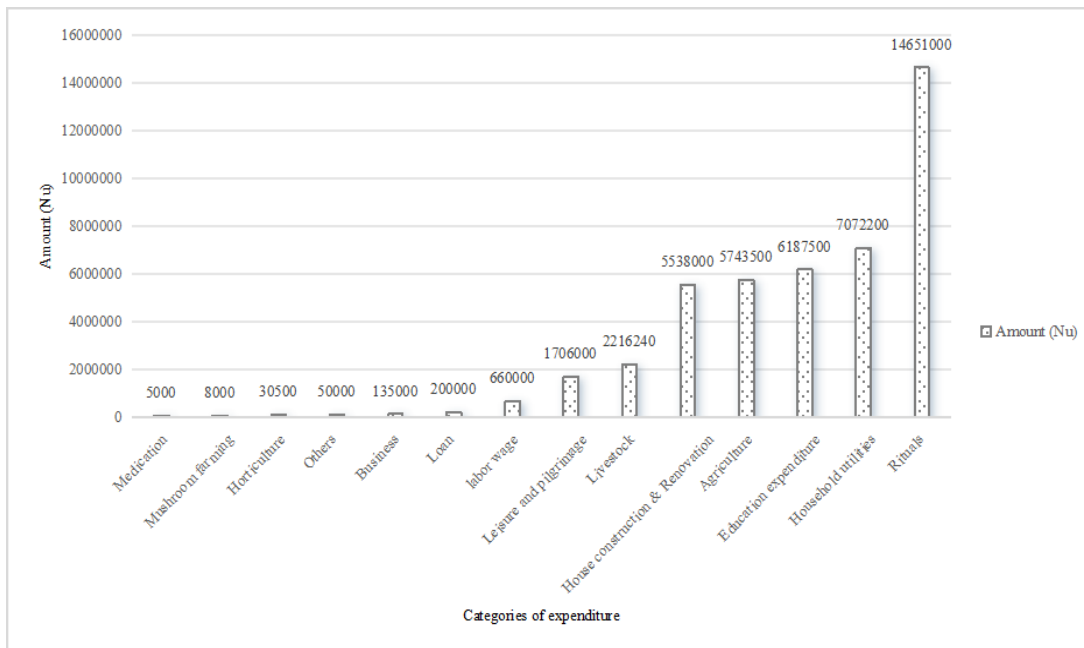


Figure 19: Annual Expenditure

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 |
|--------------|-------------------|---------------|-------------------|---------------|---------------------------------|---------|
| | <i>Cultivated</i> | <i>Fallow</i> | <i>Cultivated</i> | <i>Fallow</i> | | |
| Nahi | 224 | 14.38 | 50.65 | 9.23 | 2.26 | 0 |
| Daga | 318.5 | 9.39 | 304.15 | 38.745 | 8.91 | 2.33 |
| Gasetsho wom | 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

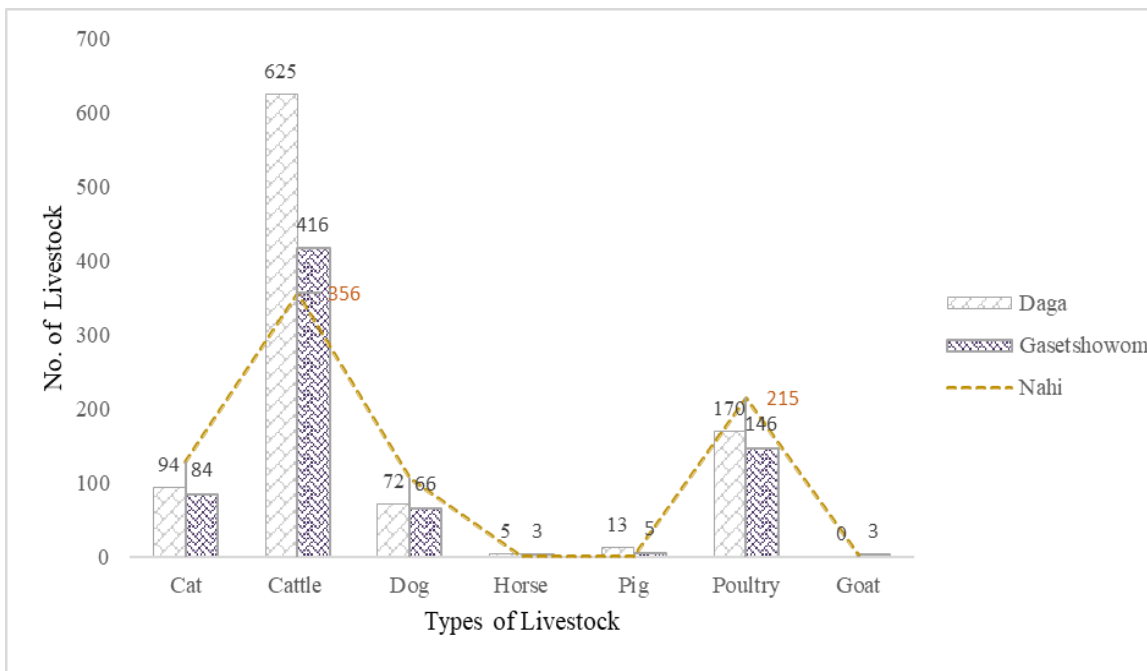


Figure 20: Types of Livestock reared

2.4. Current threats to the corridor

2.4.1. Crop depredation

Wildlife pests such as Barking deer and wild pig 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 pigs 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.

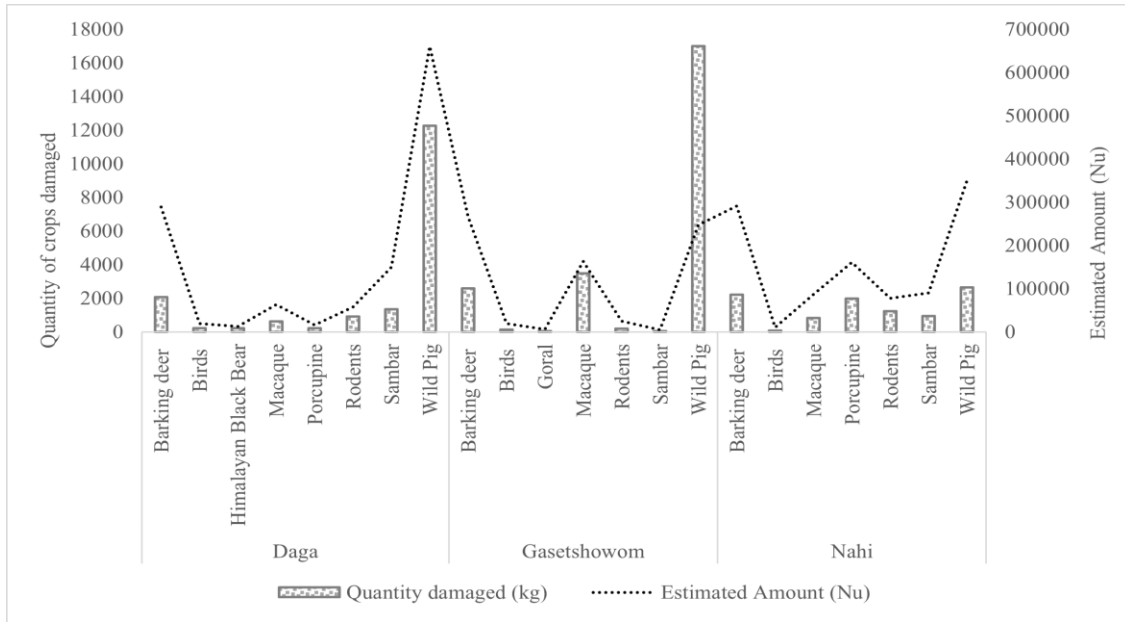


Figure 21: Crop depredation

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.

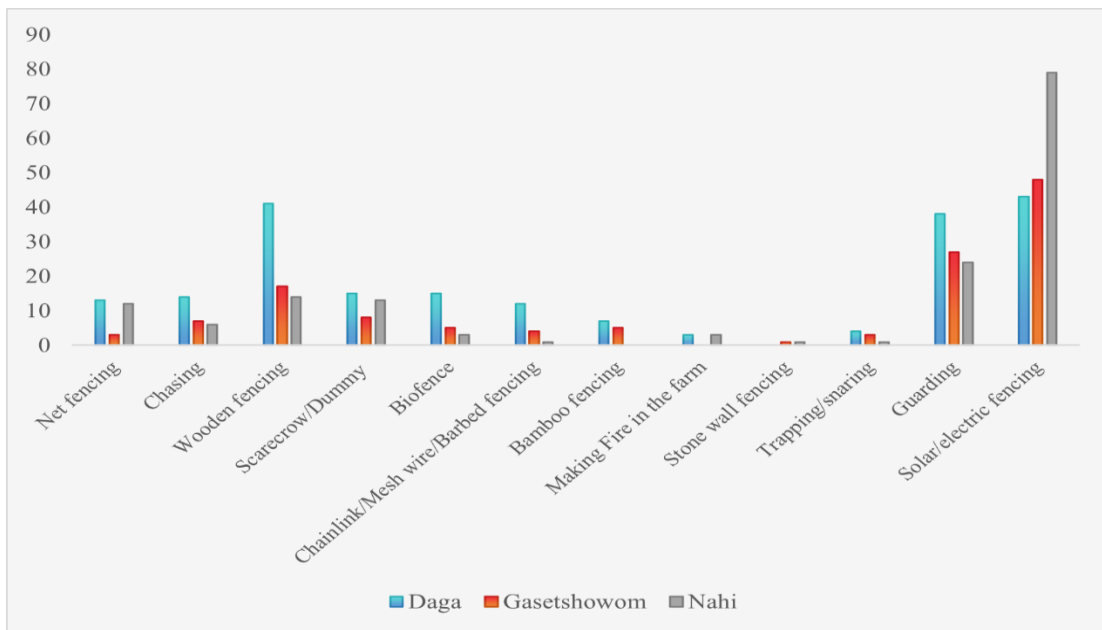


Figure 22: Crop guarding practices adopted by communities

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).

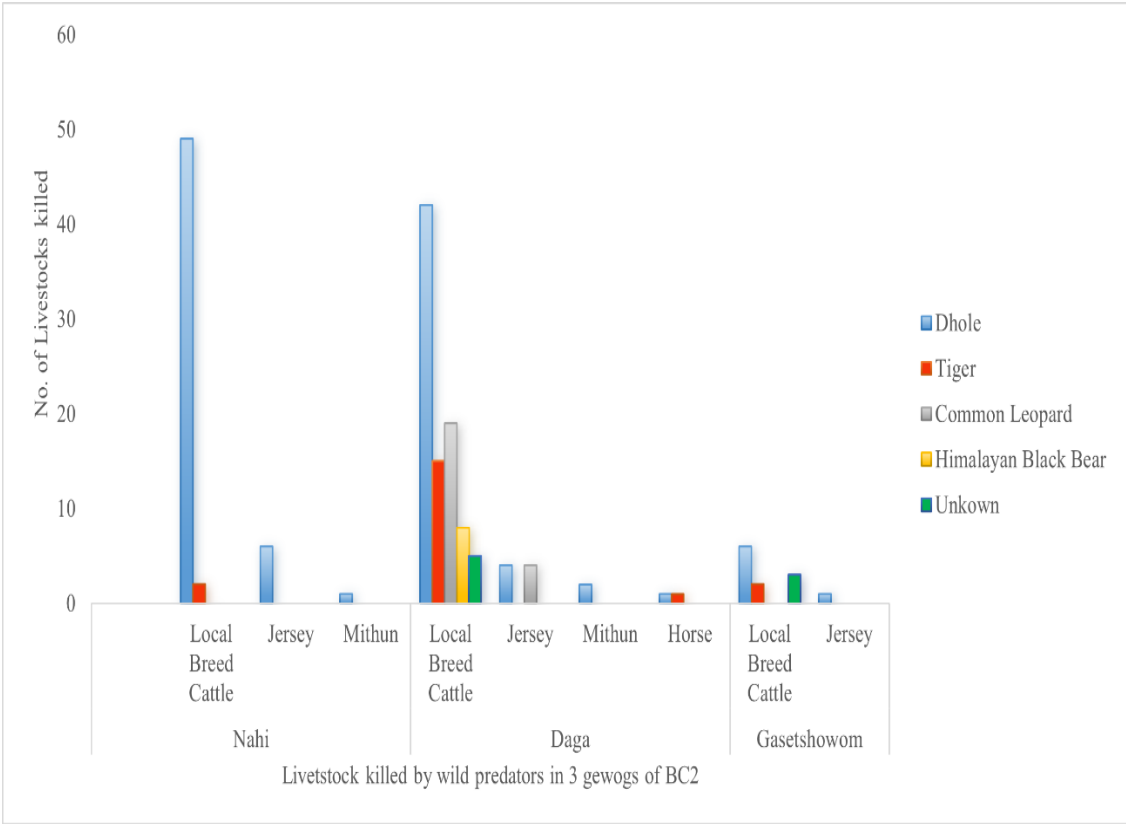


Figure 23: Livestock depredation cases

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 | | | |
|--------------|---------------------------------------|-----------------------------|---------------|-------------------------|
| | <i>Agriculture Land</i> | <i>Open Area/ Grassland</i> | <i>Forest</i> | <i>Housing Premises</i> |
| Nahi | 3 | 10 | 47 | 0 |
| Daga | 1 | 3 | 92 | 5 |
| Gasetshowom | | | 9 | 3 |

Table 6: Livestock depredation location wise

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

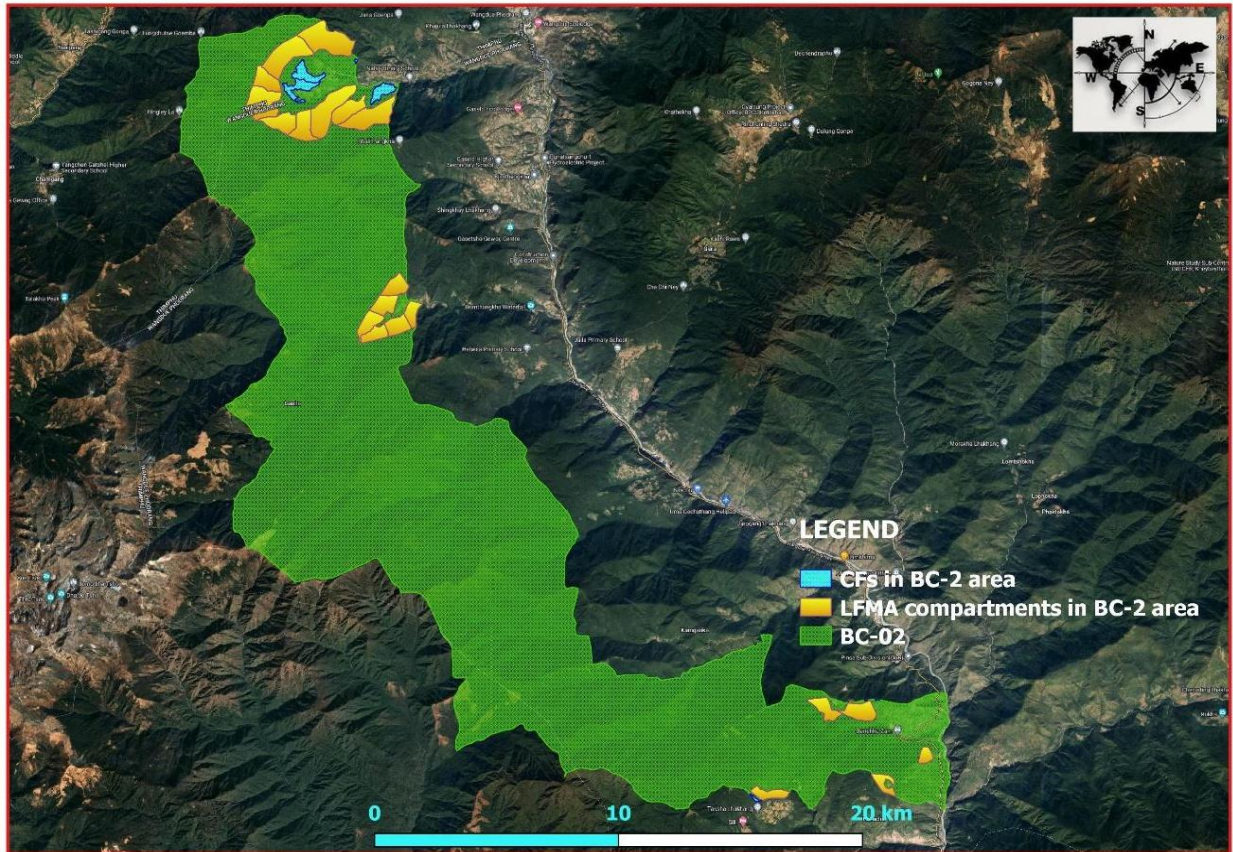


Figure 24: Forest Management Regimes

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 (m ² /ha) | Average Stand Volume (m ³ /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 |
| m ³ | 30635 | 14961 | 3298 | 1892 | 50786 |
| m ³ /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: LFMA 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 (m ² /ha) | Aver. Stand Volume (m ³ /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 |

| Silvicultural Measures | | | | | |
|------------------------|----------|----------|--------------------|------------------|-------------|
| Unit | 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 | | | | | Average basal area (m ² /ha) | Aver. Stand Volume (m ³ /ha) | No of accessible sample plots |
|------|-------------------|------------|--------------|----------------|--------|---|---|-------------------------------|
| | Non-Production | Protection | Inaccessible | Net Production | Total | | | |
| ha | 4.4 | 226.2 | 415.1 | 1082.0 | 1727.7 | | | |
| % | 0% | 13% | 24% | 63% | 100% | 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.

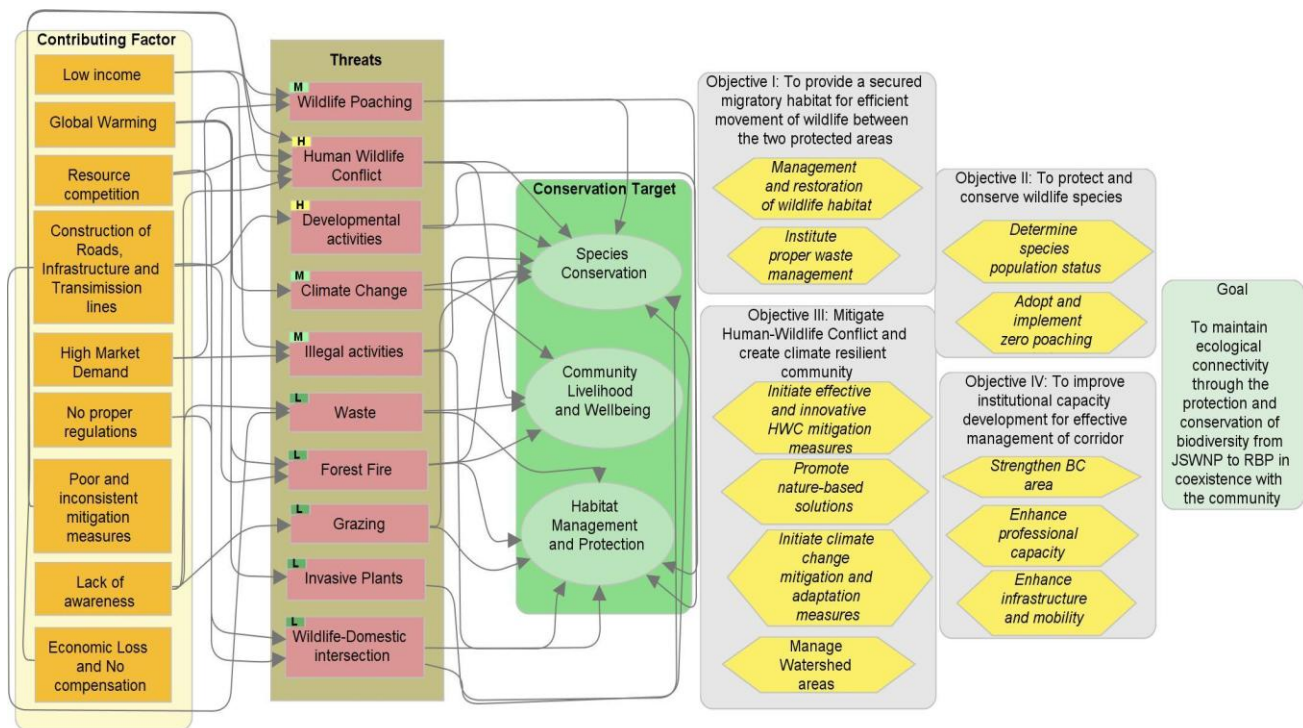


Figure 25: Threat Analysis Framework

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.

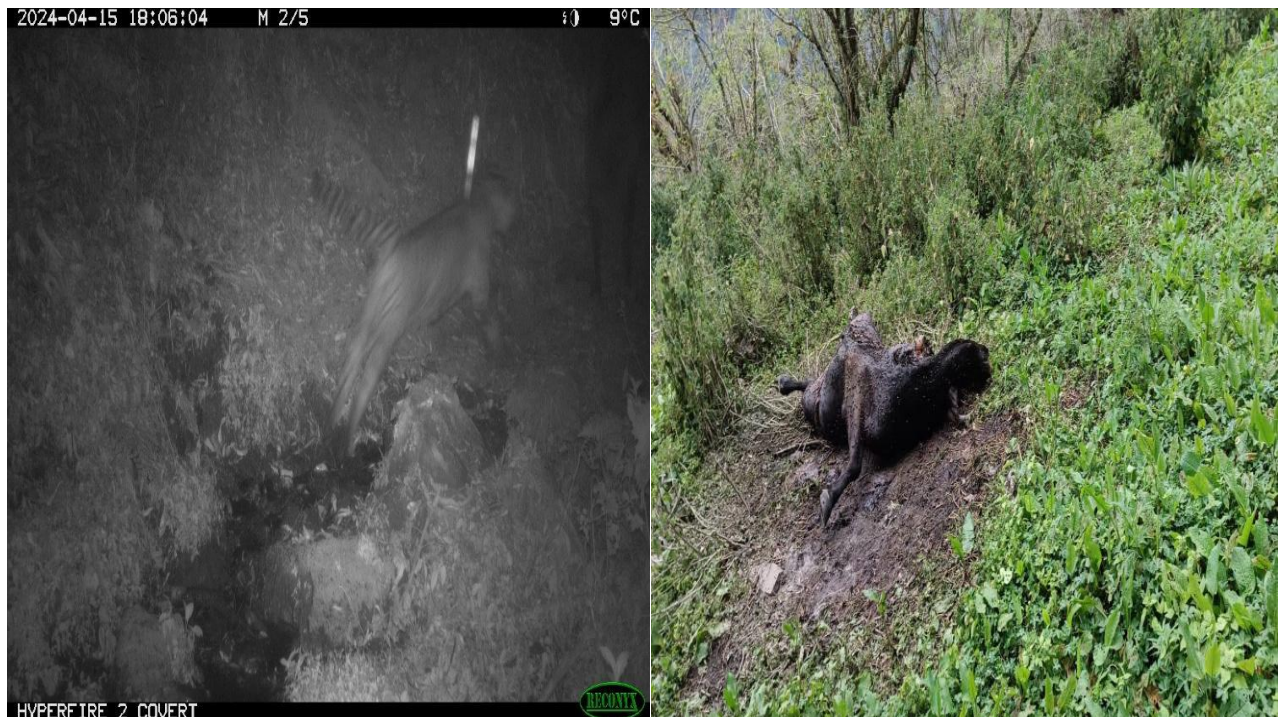


Figure 26: Pictorial evidence of HWC

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.

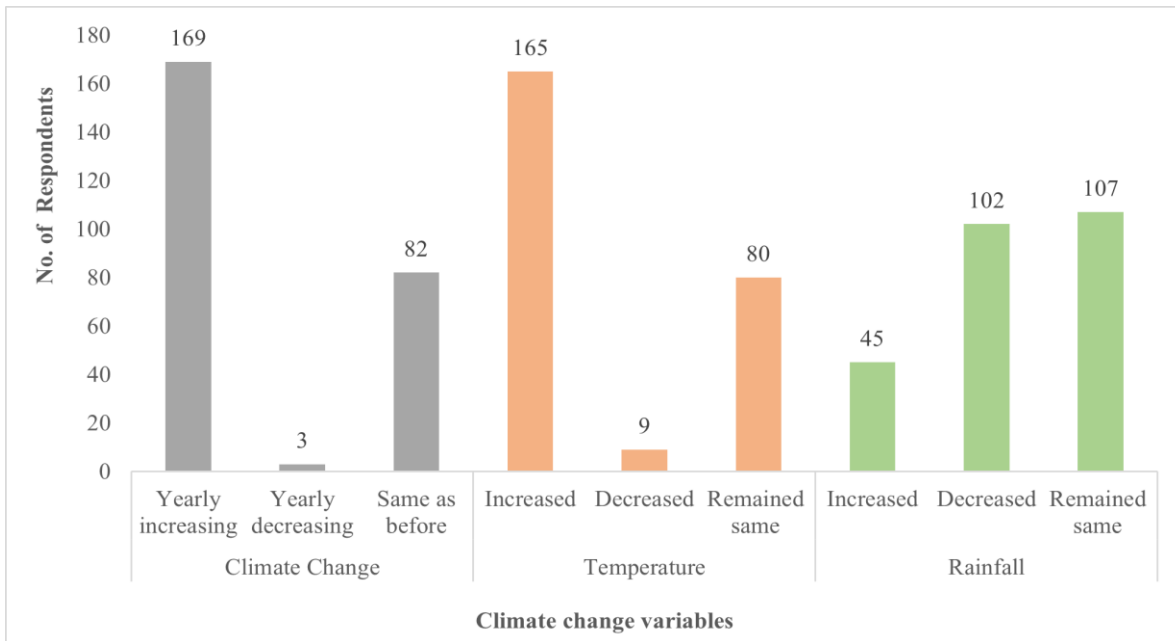


Figure 27: Climate change perception

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 pig | 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 pig | 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 pig | 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 no.) | 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 the 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 pig | 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.

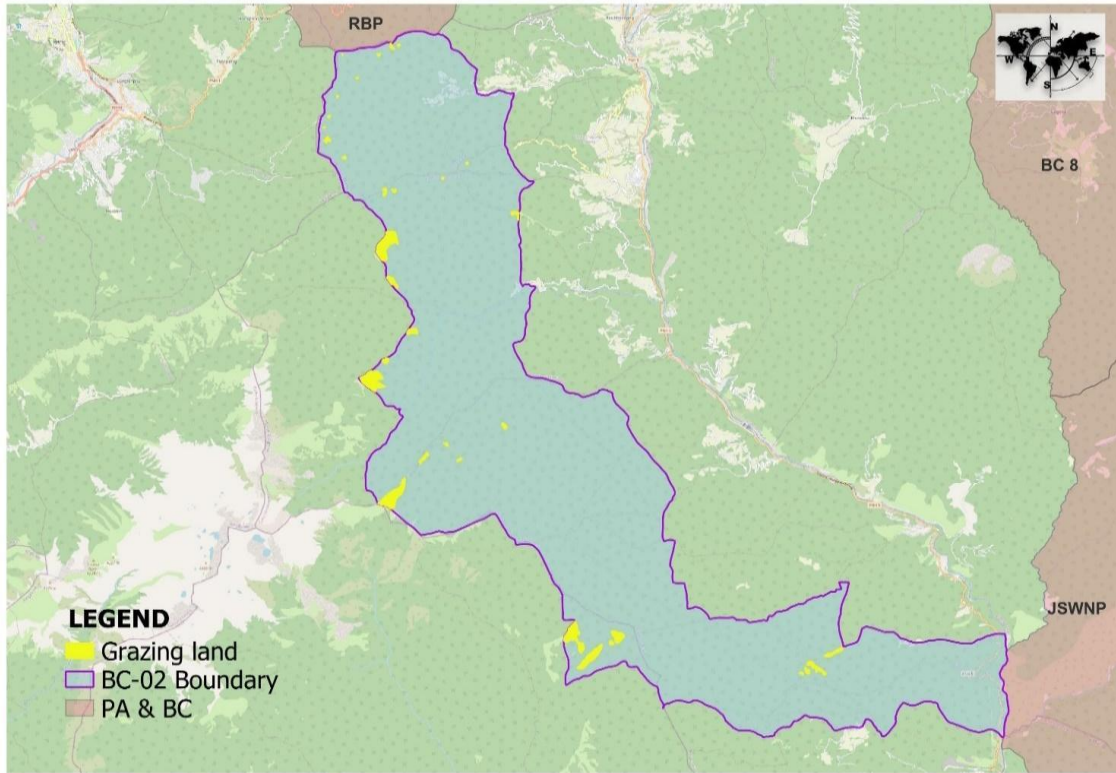


Figure 29: Grazing area in BC-02

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.

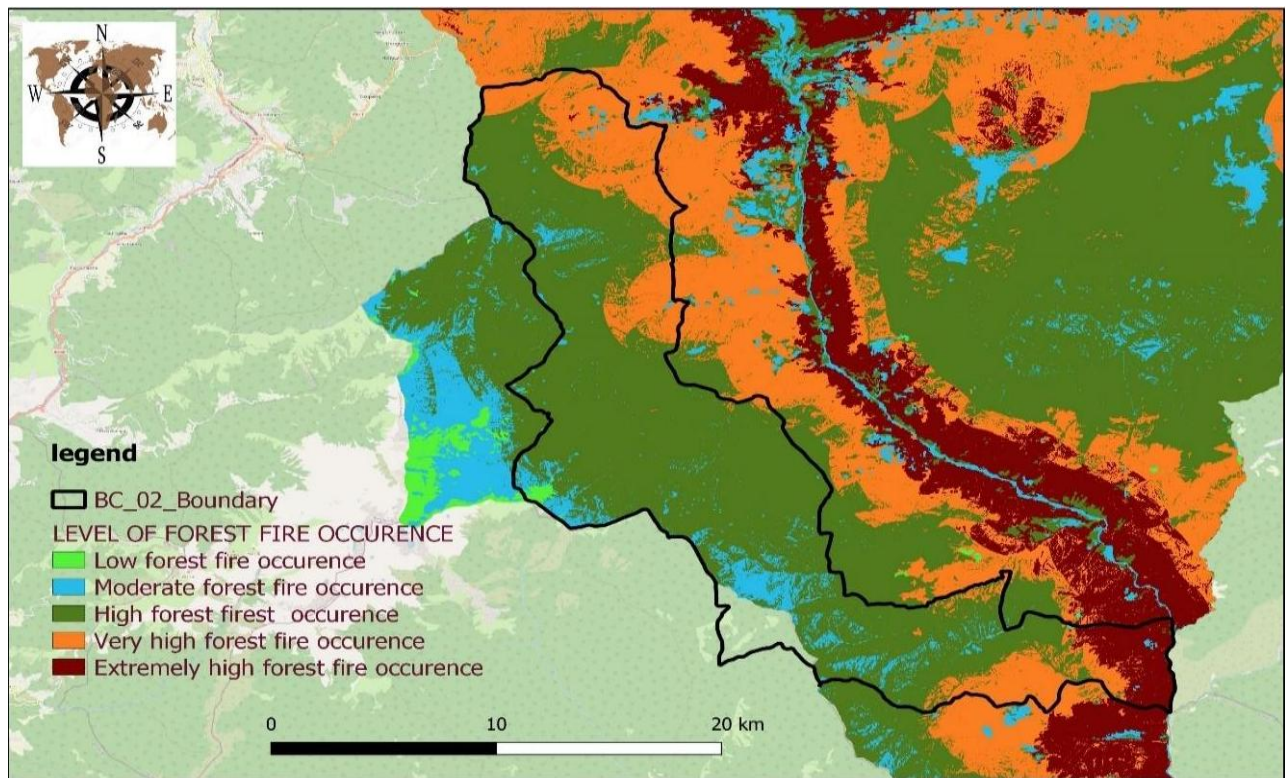


Figure 30: Forest fire-prone areas

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 the 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 a study on carrying capacity of the 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 a 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 a 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 a biodiversity assessment for macroinvertebrates and fish

Action 2.1.5. Conduct a small Mammal survey

Action 2.1.6. Conduct a 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 the ills of wildlife poaching (FNCA, FNCRR, and Penal Code of Bhutan)

Objective 3. Mitigate Human-Wildlife Conflict and create a climate-resilient community

Strategy 3.1. Initiate effective and innovative HWC mitigation measures

Action 3.1.1. Assess and map the HWC hotspot 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 the purchase of rescue equipment (Drugs, first aid, cylinders, 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 a Climate Vulnerability and Capacity Assessment for local communities residing in the 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 2035, 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 a secure migratory habitat for the 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 tree 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 a 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 a survey on understudied groups of plants | | | 0.45 | | | | | | | | 0.45 | |
| | | Identify and monitor permanent sample plots for Mammals, Birds, and Flora annually | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.6 |
| | | Conduct a biodiversity assessment for macroinvertebrates/fish | | | | | | | | 0.3 | | | | 0.3 |
| | | Conduct a small Mammal survey | | | 0.35 | | | | | | | | | 0.35 |
| | | Conduct a preliminary study | | | | 0.2 | | | | | | | | 0.2 |

| | | | | | | | | | | | | | | |
|--|---|---|------|------|------|------|------|------|------|------|------|------|------|-----|
| | | on 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 a 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 | 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 the ills of wildlife poaching (FNCA, FNCRR, and Penal Code of Bhutan) | | | | 0.3 | | | | | | | | | 0.3 | |
| Mitigate Human-Wildlife Conflict and create a climate-resilient community | Initiate effective and innovative HWC mitigation measures | Assess and map the HWC hotspot 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 the purchase of rescue equipment (Drugs, first aid, cylinders, 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 the PES scheme | 0.1 | | | | | | | | | | 0.1 | |
| | | Capacity building of the 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 <i>(Lead agency: Department of Water)</i> | Assess the 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 the | Strengthen BC area management | Demarcate and fix boundary pillars | | 0.1 | | | | | | | | | 0.1 |
| | | | Mid-term review of the BC-02 management plan | | | | | 0.1 | | | | | | 0.1 |

| | | | | | | | | | | | | | | |
|----------|--|---|-----|------|-----|-----|-----|-----|-----|-----|------|-----|-----|-----------|
| corridor | | Revision of BC-02 management plan | | | | | | | | | | 1.5 | 1.5 | |
| | | Monitoring and evaluation as per Bhutan METT+ | | | | 0.2 | | | | | 0.2 | | 0.4 | |
| | Enhance the professional capacity development of staff | Need-based capacity development to use the 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 the 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 conducted every five years. The internal assessment will be a self-evaluation conducted by the Divisional Forest Office, Wangdue, before 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 Division, 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 | Base-line | Unit | Financial Yearly Target | | | | | | | | | | |
|--|---|--|--|-----------|------|-------------------------|---|---|---|---|-----|---|---|---|-----|---|
| | | | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| To provide a secure migratory habitat for the 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 tree 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 a survey to estimate the population status and distribution of threatened species of the corridor, including Tiger, Musk deer, red panda, Monal Pheasants, Hornbills, etc. | No. of surveys conducted, and report generated | 0 | Nos. | | 1 | | | 1 | | | 1 | | | |
| | | Conduct a survey on understudied groups of plants | Conducted a survey and listed flora species | 0 | Nos. | | | 1 | | | | | | | | |
| | | Identify & monitor permanent sample plots for mammals, birds, and flora | Number of permanent sample plots monitored | 3 | Nos. | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | | Conduct a biodiversity assessment for macro-invertebrates/fish | No. of assessments conducted | 0 | Nos. | | | | | | | | 1 | | | |
| | | Conduct a small mammal survey | No. of surveys conducted | 0 | Nos. | | | 1 | | | | | | | | |
| | | Conduct a preliminary study on herpetofauna | No. of surveys conducted | 0 | Nos. | | | | 1 | | | | | | | |
| | | Develop a repository of biodiversity of BC 2 for awareness and dissemination of information | Data repository of biodiversity for BC 2 set up | 0 | Nos. | | 1 | | | | | | | | | |
| | | 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 a zero-poaching strategy | Conduct SMART patrolling | No. of SMART patrols conducted | | Nos. | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | |
| | | Enhance Ranger's knowledge of | No. of Trainings conducted | 3 | Nos. | | | | | | 1 | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|---|--|---|--|---|------|---|---|--|---|---|---|---|--|--|---|--|--|--|--|
| | | the SMART patrolling approach and zero poaching strategy through refresher training and workshops | | | | | | | | | | | | | | | | | |
| | | 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 (Nahi) | 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 developed | 0 | Nos. | | 1 | | | | | 1 | | | | | | | |
| | | Development of cultural and spiritual sites (Tshechu ney) | No. of spiritual sites developed/renovated | 0 | Nos. | | | | | 1 | | | | | | | | | |
| | Initiate climate change mitigation | Conduct Climate Vulnerability and Capacity Assessment and | No. of gewogs | 0 | Nos. | 5 | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|------|---|----|---|---|---|----|---|--|---|--|----|---|----|
| | and adaptation measures | surveys of human responses to climate change | | | | | | | | | | | | | | | | |
| | | 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 peripherals | No. of Equipment's procured | 0 | Nos. | | | | 5 | | | | | 5 | | | | |
| | | 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 | <i>Paeadoxurs hermaphroditus</i> | Viverridae | Least Concern | Appendix III | |
| 2 | Asiatic Black Bear | <i>Ursus thibetanus</i> | Ursidae | Vulnerable | Appendix I | Schedule II |
| 3 | Asiatic Golden Cat | <i>Catopuma temminckii</i> | Felidae | Near Threatened | Appendix I | Schedule II |
| 4 | Assam macaque | <i>Assamese macaque</i> | Cercopithecidae | Near Threatened | Appendix II | Schedule III |
| 5 | Barking Deer | <i>Muntiacus muntjak</i> | Cervidae | Least Concern | – | Schedule III |
| 6 | Black Giant squirrel | <i>Ratufa bicolor</i> | Sciuridae | Near Threatened | Appendix II | |
| 7 | Clouded leopard | <i>Neofelis nebulosa</i> | Felidae | Vulnerable | Appendix I | Schedule I |
| 8 | Common leopard | <i>Panthera pardus</i> | Felidae | Vulnerable | Appendix I | Schedule II |
| 9 | Dhole | <i>Cuon alpinus</i> | Canidae | Endangered | Appendix II | Schedule II |
| 10 | Gray Langur | <i>Semnopithecus entellus</i> | Cercopithecidae | Least Concern | Appendix I | Schedule II |
| 11 | Himalayan Crestless Porcupine | <i>Hystrix brachyura</i> | Hystriidae. | Least Concern | – | Schedule III |
| 12 | Himalayan Goral | <i>Naemorhedus goral</i> | Bovidae | Near Threatened | Appendix I | Schedule II |
| 13 | Himalayan Serow | <i>Capricornis sumatraensis</i> | Bovidae | Vulnerable | Appendix I | Schedule II |
| 14 | Hoary-bellied Himalayan squirrel | <i>Callosciurus pygerythrus</i> | Sciuridae | Least Concern | – | |
| 15 | Jungle cat | <i>Felis chaus</i> | Felidae | Least Concern | Appendix II | Schedule II |
| 16 | Leopard Cat | <i>Prionailurus bengalensis</i> | Felidae | Least Concern | Appendix II | Schedule II |
| 17 | Marbled Cat | <i>Pardofelis marmorata</i> | Felidae | Near Threatened | Appendix I | Schedule II |
| 18 | Musk deer | <i>Moschus chrysogaster</i> | Moschidae | Endangered | Appendix II | Schedule I |

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

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|----|-------------------------------|-------------------|
| 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 |

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|-----|-----------------------------|----------------|
| 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 |

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|-----|--------------------------------|----------------|
| 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 Wren 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 |

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|-----|------------------------------------|-------------------|
| 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 Flycatcher | 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 | <i>Juniperus recurva</i> | Cupressaceae | Least Concern |
| 2 | <i>Rhododendron arboreum</i> | Ericaceae | |
| 3 | <i>Rhododendron hodgsonii</i> | Ericaceae | |
| 4 | <i>Abies densa</i> | Pinaceae | Least Concern |
| 5 | <i>Quercus semicarpifolia</i> | Fagaceae | Least Concern |
| 6 | <i>Tsuga dumosa</i> | Pinaceae | Least Concern |
| 7 | <i>Quercus oxyodon</i> | Fagaceae | Least Concern |
| 8 | <i>Ilex dipyrena</i> | Aquifoliaceae | Least Concern |
| 9 | <i>Taxus baccata</i> | Taxaceae | Least Concern |
| 10 | <i>Ilex hookeri</i> | Aquifoliaceae | Least Concern |
| 11 | <i>Osmanthus suavis</i> | Oleaceae | Least Concern |
| 12 | <i>Schefflera impressa</i> | Araliaceae | Least Concern |
| 13 | <i>Rhododendron falconeri</i> | Ericaceae | Least Concern |
| 14 | <i>Exbucklandia populnea</i> | Hamamelidaceae | Least Concern |
| 15 | <i>Symplocos ramosissima</i> | Symplocaceae | Least Concern |
| 16 | <i>Quercus lanata</i> | Fagaceae | Least Concern |
| 17 | <i>Castanopsis tribuloides</i> | Fagaceae | Least Concern |
| 18 | <i>Quercus glauca</i> | Fagaceae | Least Concern |
| 19 | <i>Pinus bhutanica</i> | Pinaceae | Least Concern |
| 20 | <i>Schima wallichii</i> | Theaceae | Least Concern |
| 21 | <i>Symplocos lucida</i> | Symplocaceae | Least Concern |
| 22 | <i>Myrica esculenta</i> | Myricaceae | Least Concern |
| 23 | <i>Viburnum cylindricum</i> | Viburnaceae | Least Concern |
| 24 | <i>Shoepfia griffithii</i> | Schoepfiaceae | Least Concern |
| 25 | <i>Symplocos glomerata</i> | Symplocaceae | Least Concern |
| 26 | <i>Ilex crenata</i> | Aquifoliaceae | |

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

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

Herbs

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

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

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

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

Annexure IV: List of Butterfly

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

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

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

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

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

Annexure V: List of Orchids

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

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

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

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

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

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 | Broccoli | 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 |

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|-------------------|--------------------|---------|
| 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 | Zhimitse (Perilla) | 94020 |
| Total Income (Nu) | | 7433411 |

