Conservation Management Plan Biological Corridor 03

(Connecting Jigme Singye Wangchuck National Park, Phibsoo Wildlife Sanctuary and Royal Manas National Park)

2023-2033

Towards ensuring ecological connectivity and species persistence

CONSERVATION MANAGEMENT PLAN FOR BIOLOGICAL CORRIDOR 03

*Connecting Jigme Singye Wangchuck National Park, Phibsoo Wildlife Sanctuary and Royal Manas National Park***)**

(1st January 2023-31st December 2033)

Divisional Forest Office,
Sarpang
Department of Forests and Park Services

Ministry of Energy and Natural Resources

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Royal Government of Bhutan
Ministry of Energy and Natural Resources
Department of Forests and Park Services
Divisional Forest Office, Sarpang

Royal Government Endorsement and approval

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

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Foreword

The completion of the Biological Corridor 03 (BC-03) 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, Sarpang has initiated and successfully come up with the conservation management plan.

BC-03 plays a crucial role in facilitating the movement of wildlife between Jigme Singye Wangchuck National Park, Phibsoo Wildlife Sanctuary and Royal Manas National 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, it is imperative that we 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-03 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 Conservation Management plan for Biological Corridor 03 (BC-03) is an outcome of the efforts of different institutions and individuals without whose support we would not have been able to publish. Therefore, we would like to express deep appreciation to all the staff and institutions who have contributed to making this plan successful.

We would like to extend our heartfelt gratitude to Bhutan for Life (BFL) project for the funding support in developing the conservation Management plan that will contribute to preserving the rich biodiversity of our country. We would also like to express our sincere appreciation to the Nature Conservation Division, Department of Forests and Park Services for their continued support and guidance.

We are grateful to the field colleagues of Divisional Forest Office, Sarpang and Tsirang, who have played an active role in the assessment and field survey.

Phub Dhendup
Chief Forestry Officer
Divisional Forest Office, Sarpang

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List of common acronyms

AAC	*Annual Allowable Cut*
B2C2	*Bhutan Biological Conservation Complex*
BC 03	*Biological Corridor Number 03*
BC	*Biological Corridor*
CBF	*Cool Broadleaved Forest*
FRA	*Forest Resource Assessment*
FMID	*Forest Monitoring and Information Division*
FGD	*Focus Group Discussion*
FMU	*Forest Management Unit*
FNCRR	*Forest and Nature Conservation Rules and Regulations*
GRF	*Government Reserve Forests*
GPS	*Global Positioning System*
GLOFs	*Glacial Lake Outburst Floods*
HWC	*Human Wildlife Conflict*
HWRSD	*Hydrology and Water Resources Services Division*
IUCN	*International Union for Conservation of Nature*
JSWNP	*Jigme Singye Wangchuck National Park*
KBA	*Key Biodiversity Area*
LC	*Least concern*
LFMP	*Local Forests Management Plan*
LULU	*Land Use Land Cover*
Masl	*Meter above sea level*
NFI	*National Forest Inventory*
NTFP	*Non-Timber Forest Product*
NT	*Near Threatened*
NWFP	*Non-Wood Forest Produce*
NCD	*Nature Conservation Division*
NEC	*National Environment Commission*
PWS	*Phibsoo Wildlife Sanctuary*
QGIS	*Quantum Geographic Information System*
RMNP	*Royal Manas National Park*
SGI	*Sustainable Green Infrastructure*
SRF	*State Reserved Forests*
STF	*Subtropical Forest*
SFD	*Sarpang Forest Division*
SMART	*Spatial Monitoring and Reporting Tools*
TFD	*Tsirang Forest Division*
TAC	*Technical Advisory Committee*
WCSD	*Weather and Climate Services Division*
WBF	*Warm Broadleaved Forest*
VU	*Vulnerable*

Executive summary

The Conservation Management Plan for Biological Corridor 03 (BC-03) aims to ensure ecological connectivity and species persistence by linking Jigme Singye Wangchuck National Park, Phibsoo Wildlife Sanctuary and Royal Manas National Park. Covering an area of 407.69 km², BC-03 serves as a critical habitat corridor for key wildlife species such as the Royal Bengal Tiger and Asian Elephant.

This comprehensive plan (2023-2033) was developed to address the challenges and opportunities in managing BC-03. It provides a strategic framework to conserve biodiversity, mitigate threats and improve community livelihoods. The document outlines the following key objectives:

Objective 1: Securing and enhancing wildlife habitats through mapping critical resources, controlling invasive species and implementing various restoration and enrichment activities.
Objective 2: Mitigating Human-Wildlife Conflict (HWC) by developing community-based initiatives, raising awareness and improving conservation strategies.
Objective 3: Combating poaching and illegal resource extraction through enhanced enforcement, patrolling and advocacy programs.
Objective 4: Expanding the knowledge base on species and habitats by conducting surveys, research and monitoring biodiversity trends.

The threats such as habitat loss due to developmental activities, spread of invasive species, landslide hazards, Human-Wildlife Conflict and poaching are identified. These threats are ranked based on their scope, severity and irreversibility using the Miradi Software. Management strategies are designed to address these challenges, focusing on sustainability, community engagement and biodiversity conservation.

A detailed implementation plan emphasizing a collaborative approach to the effective management of BC-03—by involving local communities, government agencies, and conservation partners—will ensure its success as a vital ecological corridor.

CHAPTER I

INTRODUCTION

1.1. History of Biological Corridors in Bhutan

Bhutan has more than half of the total geographical area of the country set aside for the conservation of rare, endemic and endangered species of flora and fauna. This area constituting 51.44% is declared as Protected Area Networks (National Parks, Wildlife Sanctuaries, Strict Nature Reserve and Biological Corridors). The Biological Corridor (BC) system in Bhutan was declared in 1999 as a '*Gift to the Earth from the People of Bhutan'* by Her Majesty Ashi Dorji Wangmo Wangchuck. The management of Biological Corridors is vested with the Divisional Forest Offices. Initially, the status of Biological Corridors was set above State Reserved Forests (SRF) but below that of the Protected Areas. However, recognizing the importance of Biological Corridors, the Forest and Nature Conservation Rules and Regulations of Bhutan (2023) now provide the Biological Corridors with equivalent legal protection status as the other Protected Areas. There are 9 BCs in the country, which connect the National Parks, Wildlife Sanctuaries and Strict Nature Reserve, forming the critical Bhutan Biodiversity Conservation Complex (B2C2).

1.2. Functions of Biological Corridors

Biological Corridors are defined as an area that connects one or more Protected Areas and provides ecological connectivity between landscapes, ecosystems, and habitats. It ensures the movement of flora and fauna, creating links between Protected Areas directly or indirectly. "Corridors are meant to connect habitats for the effective conservation of populations, community and maintenance of ecological processes in landscapes" *(Bennett, 2003).* The Corridor enables migration, colonization and interbreeding of plants and animals by providing landscape connectivity between more prominent habitat areas. Similarly in Bhutan, Biological Corridors provide continuous gene flow through uninterrupted wildlife movements and succession of habitats.

Biological Corridors in Bhutan focusses on conserving six focal species, including Tigers, Asian Elephants, Snow Leopard, Red pandas, Golden Langur and Takin; these species require a wide range of habitats, and corridors assist them in connecting their habitats. Biological Corridor 03, which connects the Jigme Singye Wangchuck National Park, Royal Manas National Park and Phibsoo Wildlife Sanctuary, provides a wildlife movement Corridor to several threaten wildlife such as Royal Bengal Tiger and Asian Elephant.

1.3. Vision, Mission, Goal, and Objective of the BC-03

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, Phibsoo Wildlife Sanctuary and Royal Manas National Park fostering enhanced biodiversity conservation and promoting human wellbeing through active community stewardship and sustainable practices

Goals:

1. To conserve habitats, ecosystems and their integrity for species persistence in the landscape.
2. To promote harmonious co-existence between nature and transhumance communities.

Objectives

The objective of the Biological Corridor is to provide habitat linkages for the movement of faunal and floral biodiversity to enable migration, colonization and interbreeding of plants and animals.

- Secure and Enhance Wildlife Habitats.
- Mitigate Human-Wildlife Conflict and Improve Community Livelihoods.
- Combat Poaching and Illegal Resource Extraction.
- Expand Knowledge Base on Species and Habitats.

CHAPTER II

CURRENT STATUS OF BIOLOGICAL CORRIDOR 03

2.2. Physical features

2.2.1. Boundary Description

Biological Corridor 03 (BC-03) encompasses an area of *407.69 sq km*, with an approximate length of *57.68 km* and a width of *27.47 km*. BC-03 forms a connection between Jigme Singye Wangchuck National Park, Phibsoo Wildlife Sanctuary and Royal Manas National Park. It shares an area of *6,329.20 ha (63.29 sq km)* with the Divisional Forest Office, Tsirang, accounting for 15.52% of the BC-03 area. The remaining 84.48% of BC-03 falls within the jurisdiction of the Divisional Forest Office, Sarpang. Geographically, it is situated approximately between the latitudes of *26°04'09.43"N* and *26°49'06.39"N* and the longitudes of *90°04'05.84"E* and *91°38'16.93"E*. The altitude of Biological Corridor 03 varies from 353 meters above sea level (masl) to 2360 masl. The primary vegetation composition of Biological Corridor 03 consists of Sub-tropical forest, Warm Broadleaved Forest and Cool Broadleaved Forest. BC-03 encompasses a total of 11 Gewogs under the Divisional Forest Offices, Sarpang and Tsirang. Nine Gewogs fall under Sarpang, and two Gewogs fall under Tsirang Dzongkhag.

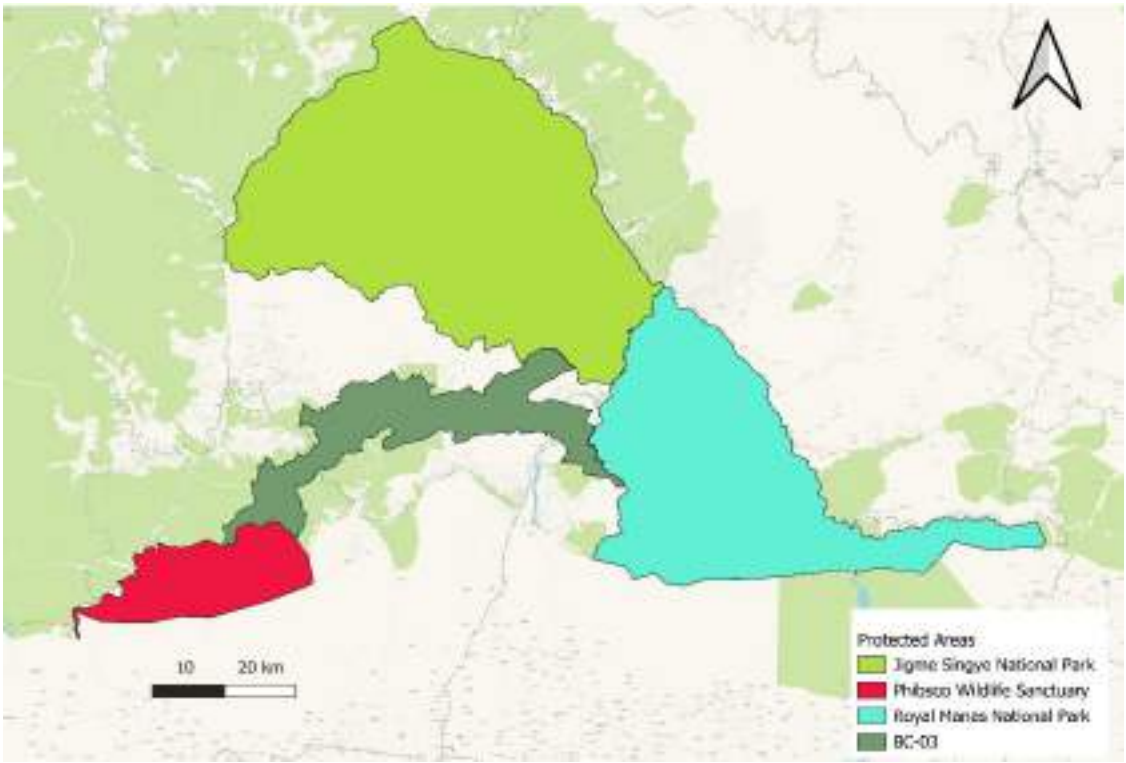


Figure 1: Map of Bhutan showing Biological Corridor 03

2.2.2. Slope and Aspect

Biological Corridor 03 features a topography divided between gentle and moderately steep slopes, with a smaller proportion of steep slopes and other areas being accessible. In terms of aspect, most areas in BC-03 have South and West-facing slopes, ensuring ample sunlight for growth, while the least area faces North, receiving minimal sunlight.

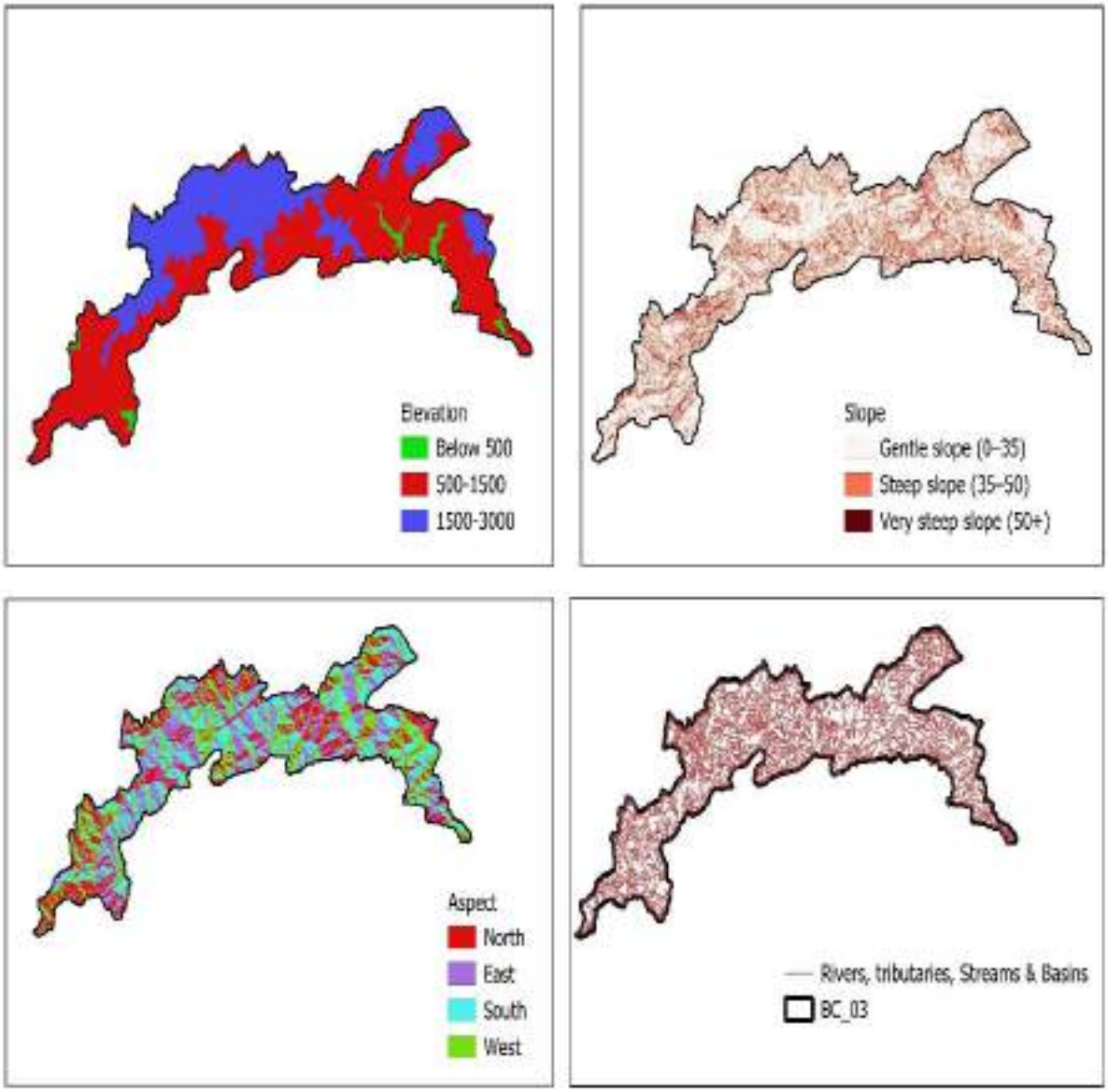


Figure 2: Elevation, Slope, Aspect & Drainage patterns of BC-03

2.2.3. Climate: Temperature and Precipitation

During the ten-year period from 2011 to 2021, climatic data for Biological Corridor 03 (BC-03) in Sarpang indicated significant seasonal temperature variations. The recorded data demonstrated that the highest average maximum temperature attained was *30°C*, occurring in October, whereas the lowest average minimum temperature observed was *13°C* in January. In terms of hydrology,

the same decade's data for BC-03 (Sarpang) revealed notable fluctuations in precipitation levels. The peak average precipitation was recorded at *410 mm* in the month of July. Conversely, the months of November and December each exhibited the lowest average precipitation, measuring at a mere *2 mm*.

2.2.4. Drainage

Multiple rivers and seasonal streams flow through the Corridor, most notably the Maokhola and Sarpang Khola. Additionally, several other streams, such as Taklaikhola and Threywarkhola, are present. These rivers and streams serve as vital water sources for drinking, irrigation, manufacturing bottled water, and various other industrial uses.

2.3. Biological features

The primary ecosystem within BC-03 consists of Subtropical Forest, Warm Broadleaved Forest and Cool Broadleaved Forest. The lower elevations are dominated by tree species like *Duabanga grandiflora, Terminalia myriocarpa, Toona ciliate, Altingia exelsa, Schima wallichii, and Ailianthus grandis*. Mid-elevation areas feature species such as *Alnus spp and Macaranga spp*, while higher elevations are characterized by Cool Broadleaf species, including Oak (*Quercus lamellosa*), *Castanopsis* species, *Persia fructifera and Belschiedia sikkimensis*. These species distributions reflect the varied ecological conditions within BC-03, underscoring its rich and diverse biological makeup.

2.3.1. Vegetation Composition and Forest Types

BC-03 comprises of mostly Subtropical Forests, Warm and Cool Broadleaf Forests.

1. **Sub-Tropical Forest**

These forests are found between altitudes of *200* and *1000* meters above sea level (masl), with some instances reaching up to *1200 masl*. They receive an annual precipitation of *2500-5000mm (Arun and Dawa, 2022).* The indicator species identified was *Pterospermum acerifolium* ($p < 0.05$). These forests dominate the foothills, forming dense jungles on steep slopes and riverbanks. Characteristic species found in Sub-tropical Forests include *Gmelina arborea, Chukrasia tabularis, Acrocarpus fraxinifolius, Ailanthus grandis, Bombax ceiba, Duabanga grandiflora, Shorea robusta,* and *Tetrameles nudiflora*, among others.

2. **Warm Broadleaved Forest**

It occurs at a higher altitude with lower rainfall and contains a mixture of evergreen and deciduous Broad-leaf tree species like that of Subtropical Forest. Warm Broad-leaved Forest is present between an altitude of *1000 to 2000 masl (-2300 masl)* and precipitation of *2300- 4000mm (Arun*

and Dawa, 2022). Albizia lebbeck, Schima wallichii, Lagestroemia parviflora, Castanopsis hystrix species were recorded as indicator species ($p<0.05$). Some of the characteristics species found in this forest type are; *Alangium chinense, Alnus nepalensis, Betula alnoides, Bischofia javanica, Callicarpa arborea, Castanopsis indica, Cordia obliqua, Dendrocalamus hookeri, Dichroa febrifuga, Engelhardia spicata, Entada spp. Helicia nilagirica, Lithocarpus elegans, L. pachyphyllus, Macaranga spp. Maesa spp., Mussaenda roxburghii, Ostodes paniculata, Pouzolzia sanguinea, Rhaphidophora eximea, Schima wallichii, Stereospermum personatum, Trevesia palmata* etc.

3. **Cool Broadleaved Forest**

This forest type is typically located at higher elevations on the moister side of the mountain. It is characterized by a mixture of Broad-leaved tree species, including both deciduous and evergreen varieties, with Oak trees being relatively less common. *Alnus nepalenis* has been identified as the predominant indicator species ($p<0.05$). The Cool Broad-leaved Forest occurs within an elevation range of *2000* to *2900* meters above sea level and experiences an annual precipitation of *2000* to *3000* millimeters *(Arun and Dawa, 2022).* This forest exhibits a close ecological connection with Oak Forest. Notable species found in this forest include *Acer campbellii, Betula alnoides, Beilschmiedia sikkimensis, Brassaiopsis spp., Daphniphyllum himalense, Elatostema spp., Exbucklandia populnea, Ilex fragilis, Lecanthus peduncularis, Michelia doltsopa, Michelia velutina, Persea clarkeana, Persea fructifera, Pilea bracteosa, Rubus lineatus, Symplocus spp.,* and others.

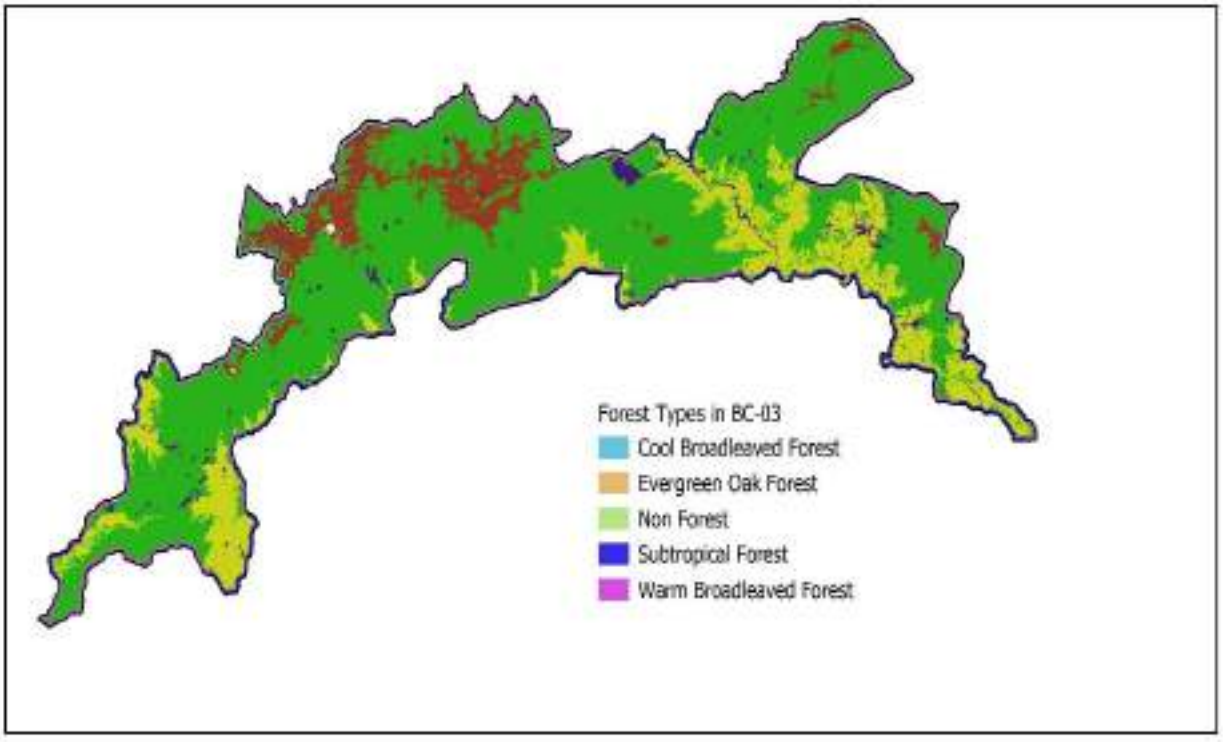


Figure 3: Forest Types in BC-03

2.3.2. Mammal diversity

Key Mammal species in the Corridor includes the Royal Bengal Tiger (*Panthera tigris*), Asian Elephant (*Elephas maximus*), Clouded Leopard (*Neofelis nebulosa*), Golden Langur (*Trachypithecus geei*), Asiatic Wild Dog (*Cuon alpinus*), Himalayan Black Bear (*Ursus thibetanus laniger*), Red Panda (*Ailurus fulgens*) and Gaur (*Bos gaurus*). Additionally, the Corridor provides habitat for critically endangered species such as the Chinese Pangolin (*Manis pentadactyla*) and Rufous-Necked Hornbill (*Aceros nepalensis*).

Table 1: List of Mammals found in BC along with their conservation status

Sl. No.	Scientific name	Common/Local name	Family	Conservation status
1	*Paguma larvata*	Himalayan Plam Civet, Bja zig (Dzo)	Viverridae	LC
2	*Catopuna temmincki*	Asiatic Golden Cat	Felideae	LR
3	*Muntiacus mutjak*	Barking Deer, Kasha (Dzo)	Ceruidae	LR
4	*Capriconis sumatraensis*	Himalayan Serow, Jha (Dzo)	Ceruidae	LR
5	*Sus scrofa*	Wild Boar, Rephag (Dzo)	Suidae	LR
6	*Felis bengalensis*	Leopard Cat, Bjazig (Dzo)	Felideae	LR
7	*Cervus unicolor*	Sambar, Shaw (Dzo)	Ceruidae	LR
8	*Felis Marmorata*	Marbled Cat	Felideae	LR
9	*Ursus tibetanus laniger*	Himalayan black Bear, Dhom (Dzo)	Ursidae	E
10	*Panthara tigris*	Tiger, Tag (Dzo)	Felideae	E
11	*Hysterix brachyura*	Himalayan Crestless Porcupine, Bjithru (Dzo)	Hystricidae	LC
12	*Wiverra zibetha*	Large Indian Civet, Bjazig (Dzo)	Viverridae	LR
13	*Herpestes edvardsii*	Common Mangoose, Neuli (Dzo)	Herpestidae	-
14	*Martes foina*	Stone Marten, Shing Sam (Dzo)	Mustelinae	LR
15	*Trachypithecus geei*	Golden Langur, Chakarsergidogchen (Dzo)	Primateae	E
16	*Apodemus syvatics*	Wood Mouse, Jise (Dzo)	Muridae	-
17	*Bos gaurus*	Gaur, Relang (Dzo)	Bovidae	LR
18	*Ratufa bicolor*	Malayan Giant Squirrel	Pteromyidae	-
19	*Macaque assamese*	Assamese macaque, Cha (Dzo)	Primatae	LR
20	*Neofelis nebulosa*	Clouded leopard, Gung (Dzo)	Felideae	LR
21	*Cuon alpinus primaevus*	Wild dog, Phaw (Dzo)	Canideae	E
22	*Panterea pardus*	Common leopard, Zig (Dzo)	Felideae	LR
23	*Elephas maximus*	Asian Elephant, Lamchey (Dzo)	Proboscidae	E
24	*Herpestes urva*	Crab Eating Mongoose	Herpestidae	LC
25	*Macaca mulata*	Rhesus Macaque, Pcha (Dzo), Pra (Kheng)	Primatidae	LR
26	*Viverricula indica*	Small Indian Civet	Viverridae	LR
27	*Lepus nigricollis*	Black Napped Hare	Leporidae	LC
28	*Callosciurus erythraeaus*	Red-Bellied squirrel	Pteromyidae	-
29	*Funambulus pennati*	Five Stripe Palm Squirrel	Pteromyidae	LC
30	*Petaurista petaurista*	Red Giant Flying Squirrel	Pteromyidae	LC
31	*Calllosciurus pygerythrus*	Hoary Bellied Squirrel	Pteromyidae	LC

32	*Aonynx cincerea*	Small Clawed Otter	Mustelidae	LR
33	*Lutra lutra*	Common Otter, Saam (Dzo), Samu (Shar)	Mustelidae	LR
34	*Herpestes javanicus*	Small Asian Mongoose	Herpestidae	LC
35	*Martes flavigula*	Yellow-throated martin	Mustelinae	LC
36	*Atherurus macrourus*	Asiatic brush-tailed porcupine	Hystricidae	LC

Mammal species are integral to ecosystems, offering numerous ecological, cultural, and economic benefits. Their conservation and protection are essential for the well-being of our planet and its inhabitants *(T. Wangchuk et al., 2003).* In Bhutan, there are 129 species of Mammals *(NBC, Biodiversity Status Report, 2021)*. In Sarpang, there have been records of 36 Mammal species from 9 different families *(Tenzin et al., 2022).* There are 5 endangered (E) species, 10 species classified as LC (Least Concern) and 17 species classified as LR (Low Risk) *(Tenzin et al., 2021).*

Key Wildlife Habitats within the Biological Corridor

From the camera trap study conducted in Biological Corridor 03, Bukuteydrangra (NFI Grid 2204) recorded the highest number of wildlife images, with a total of 3,230 captures encompassing 11 species. This area, predominantly under the jurisdiction of Tsirang Division, demonstrated the most significant wildlife activity in the study. Subsequently, Jandeydara (NFI Grid No. 1900) in Sarpang Division recorded seven different species. The key factors contributing to this high frequency of wildlife captures in these areas were the intact forest cover and the availability of water sources, essential for supporting a diverse range of wildlife species.

Critical Habitat Corridors for Globally Threatened Felid Species in BC-03

The survey within Biological Corridor 03 (BC-03) documented the presence of six felid species, namely the Tiger (*Panthera tigris*), Common Leopard (*Panthera pardus*), Clouded Leopard (*Neofelis nebulosa*), Asiatic Golden Cat (*Catopuma temminckii*), Marbled Cat (*Pardofelis marmorata*) and Leopard Cat (*Prionailurus bengalensis*). BC-03 plays a pivotal role as a corridor in facilitating the movement of the Tiger population among the Royal Manas National Park (RMNP), Jigme Singye Wangchuck National Park (JSWNP) and Phibsoo Wildlife Sanctuary (PWS). This connectivity is crucial for the conservation of genetic diversity of these globally threatened species, underscoring the importance of BC-03 in regional conservation efforts.

A Tiger habitat use and suitability model also indicated a high probability of use in the areas of the corridor adjoining Royal Manas National Park (RMNP) and areas closer to Phibsoo Wildlife Sanctuary (PWS) (NCD, 2019). In contrast to the findings of the Nature Conservation Division (NCD) in 2019, our survey predominantly recorded Tiger sightings in the central region of BC-

03, with fewer captures near RMNP and PWS. Additionally, the endangered Dhole (Cuon alpinus), was also observed in the area.

Elephant presence was detected in 6 out of 21 surveyed grids in BC, indicating an occupancy rate of approximately 28% within the Corridor. The site use probability analysis for elephants, conducted by NCD in 2018, suggests that at least 80% of the potential habitat within BC-03, excluding human-inhabited areas, are suitable for elephants. Furthermore, major prey species such as Gaur (*Bos gaurus*), Himalayan Serow (*Capricornis sumatraensis thar*), Goral (*Nemorhaedus goral*), Sambar Deer (*Rusa unicolor*), Barking Deer (*Muntiacus muntjak*) and Wild Boar (*Sus scrofa*) were found to be widely distributed throughout the Corridor, highlighting its significance as a diverse habitat for various wildlife species.

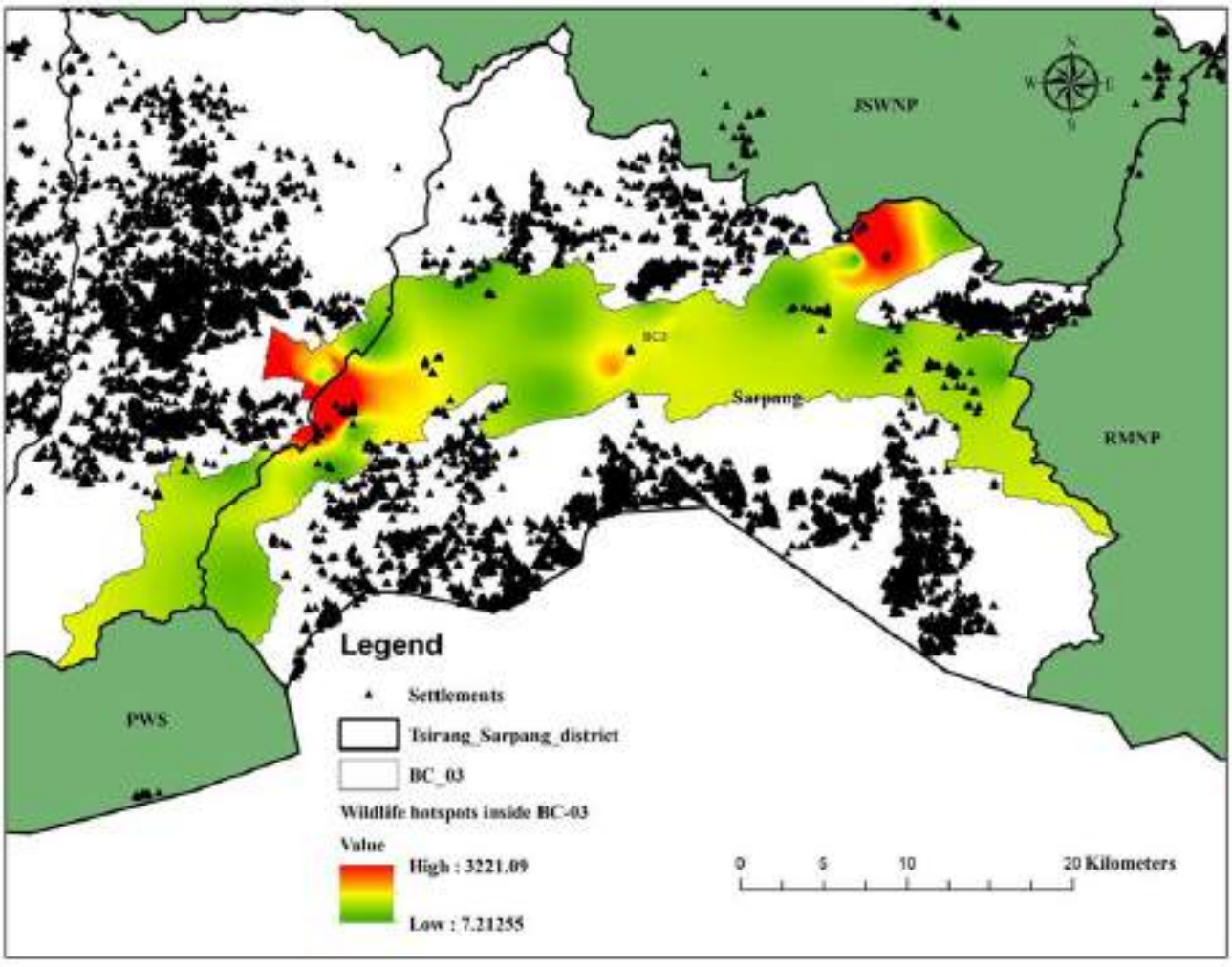


Figure 4: Map of Key Wildlife Habitats within the Biological Corridor

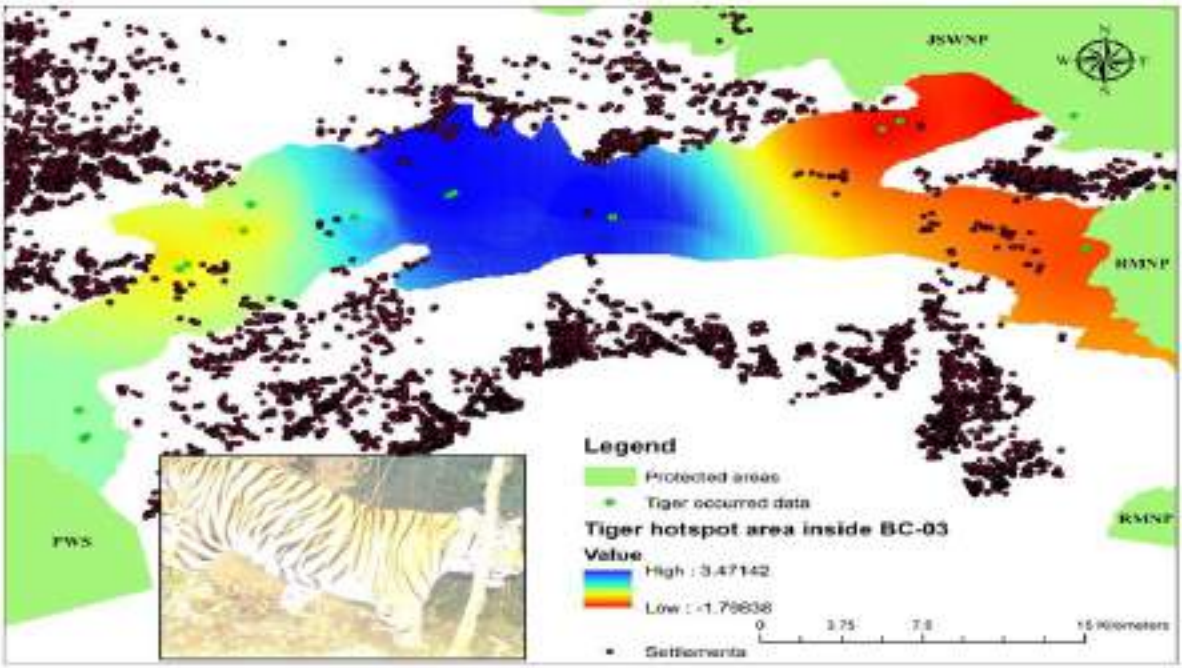


Figure 5: Tiger hotspot map inside the BC-03

2.3.3. Avifauna Diversity

Birds are integral to natural ecosystems, functioning as key components of the food chain, as highlighted by Paulsch and Müller-Hohenstein (2008) and Whelan et al. (2008). Understanding the diversity and abundance of Bird species across different habitats is critical for their conservation. There are 179 avian species across three forest types: Subtropical Forest (STF), Warm Broadleaved Forest (WBF) and Cool Broadleaved Forest (CBF). Most Bird species were observed in the Warm Broadleaved Forest (n = 148), followed by Subtropical Forest (n = 49) and Cool Broadleaved Forest (n = 44). Notably, species such as Rufous Sibia, Green-backed Tit, Black Bulbul and Whiskered Yuhina were recorded abundantly in BC-03. Additionally, species of conservation concern, including the Mountain Hawk-Eagle (Near Threatened), Steppe Eagle (Endangered), Rufous-necked Hornbill (Vulnerable) and Himalayan Vulture (Near Threatened) were also recorded. These findings underscore the importance of BC-03 as a habitat for a diverse range of avian species, including those under threat.

Few species that were most common and found widely distributed across BC-03 are as follows:

Table 2: Most common and widely distributed bird species across habitat in BC-03

Sl.no	Family	Common Name	Scientific Name	Numbers detected
1	Dicruridae	Black drongo	*Dicrurus macrocercus*	28
2	Pycnonotidae	Black bulbul	*Hypsipetes leucocephalus)*	36
3	Pycnonotidae	Black-crested bulbul	*Rubigula flaviventris*	18
4	Muscicapidae	Blue whistling thrush	*Myophonus caeruleus*	13
5	Sittidae	Chestnut-bellied nuthatch	*Sitta cinnamoventris*	13
6	Nectariniidae	Crimson sunbird	*Aethopyga siparaja*	7
7	Megalaimidae	Great barbet	*Psilopogon virens*	20
8	Corvidae	Grey treepie	*Dendrocitta formosae*	21
9	Campephagidae	Scarlet minivet	*Pericrocotus speciosus*	10
10	Chaimarrornis	White-capped redstart	*Chaimarrornis leucocephalus*	12

2.3.4. Key Forest Resource Potential Zones in the Biological Corridor

To assess the resource potential of BC-03 to meet the increasing demand of local communities, a comprehensive Forest Resources Assessment (FRA) was conducted, adhering to the protocols outlined in the Local Forest Management Plan. This assessment was designed to contribute to the development of scientific management strategies.

Extensive consultations were conducted with the local populace residing in and around the BC-03 area. These discussions were pivotal for the identification of specific zones within BC-03 to be

managed for resource extraction. This collaborative approach was instrumental in delineating areas for a more focused and efficacious FRA. Based on the assessment, the identified sites are proposed as potential forest resource allocation areas, aimed at benefiting the communities in BC-03 *(Table 3)*.

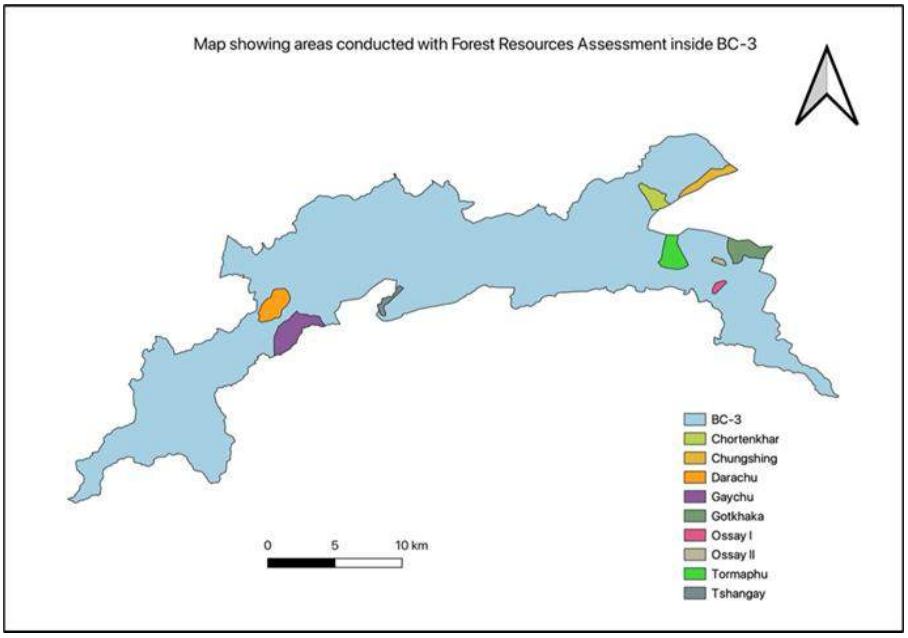


Figure 6: Map of Potential Forest Resources Allocation Sites

Table 3: Area of Potential Forest Resources Allocation Sites

Sl.no	Name of the area	Gewog	Area (ha)
1	Chortenkhar	Jigmecholing	257
2	Chungshing	Jigmecholing	231
3	Darachu	Gakidling	372
4	Gaychu	Gakidling	558
5	Gotkhaka	Jigmecholing	374
6	Ossay I	Jigmecholing	53
7	Ossay II	Jigmecholing	38
8	Tormaphu	Jigmecholing	361
9	Tshagay	Gakidling	99
	Total		**2343**

Identified Forest Resource Potential Sites and Their Production Capacities

1. **Chortenkhar**

Production Potential (N, Volume)					
Product size		N total	N/ha	%	(m3)
>50	Drashing	1830	11	32	4810
	Firewood	780	5		2145
30-49	Cham	5138	31	39	4648
	Firewood	4167	25		3883

20-29	Tsim	9150	56	18	2696
	Firewood	4110	25		1196
10-19	Poles, etc.	18740	114	12	1300
	Firewood	17447	106		1243
Silvicultural Measures					
Measure			Area (ha)		in %
Planting			16.3		44
Thinning			16.3		44
Felling (firewood)			1.5		4
Felling (timber)			3.0		8
No activity					

2. Chungshing

Production Potential (N, Volume)					
Product size		N total	N/ha	%	(m3)
>50	Drashing	384	2	89	1291
	Firewood	283	2		816
30-49	Cham	135	1	11	144
	Firewood	84	1		103
20-29	Tsim				
	Firewood				
10-19	Poles, etc.				
	Firewood				
Silvicultural Measures					
Measure			Area (ha)		in %
Planting			16.3		44
Thinning			16.3		44
Felling (firewood)			1.5		4
Felling (timber)			3.0		8
No activity					

3. Darachu

Production Potential (N, Volume)					
Product size		N total	N/ha	%	(m3)
>50	Drashing	2256	10	30	6108
	Firewood	1509	7		3565
30-49	Cham	8161	37	40	7285
	Firewood	6845	31		5842
20-29	Tsim	13479	60	16	4069
	Firewood	4041	18		1274
10-19	Poles, etc.	55652	249	14	4142

	Firewood	6279	28		478
Silvicultural Measures					
Measure			Area (ha)		in %
Planting			105.1		28
Thinning			60.1		16
Felling (firewood)			99.4		27
Felling (timber)			107.4		29
No activity			1.2		0

4. Gaychu

Production Potential (N, Volume)					
Product size		N total	N/ha	%	(m3)
>50	Drashing	3708	11	31	10893
	Firewood	3435	10		10011
30-49	Cham	15818	46	36	14067
	Firewood	10947	32		10139
20-29	Tsim	28374	82	21	8513
	Firewood	19480	57		5784
10-19	Poles, etc.	67768	197	13	5022
	Firewood	48456	141		3624
Silvicultural Measures					
Measure			Area (ha)		in %
Planting			39.9		7
Thinning			160.7		29
Felling (firewood)			139.5		25
Felling (timber)			218.0		39
No activity			1.2		0

5. Gothkhaka

Production Potential (N, Volume)					
Product size		N total	N/ha	%	(m3)
>50	Drashing	314	3	72	989
	Firewood	242	2		698
30-49	Cham	30	0	20	37
	Firewood	493	4		442
20-29	Tsim			5	
	Firewood	462	4		125
10-19	Poles, etc.			2	

	Firewood	802	7		56
Silvicultural Measures					
Measure			Area (ha)		in %
Planting			8.1		24
Thinning			12.9		38
Felling (firewood)			9.7		29
Felling (timber)			1.6		5
No activity			1.6		5

6. Ossay I

Production Potential (N, Volume)					
Product size		N total	N/ha	%	(m3)
>50	Drashing	9	3	26	18
	Firewood				
30-49	Cham	40	13	74	50
	Firewood				
20-29	Tsim				
	Firewood				
10-19	Poles, etc.				
	Firewood				
Silvicultural Measures					
Measure			Area (ha)		in %
Planting			97.2		65
Thinning			8.8		6
Felling (firewood)			26.5		18
Felling (timber)			13.3		9
No activity			4.4		3

7. Ossay II

Production Potential (N, Volume)					
Product size		N total	N/ha	%	(m3)
>50	Drashing	9	5	91	35
	Firewood	4	2		10
30-49	Cham			9	
	Firewood	4	2		4
20-29	Tsim				
	Firewood				
10-19	Poles, etc.				
	Firewood				
Silvicultural Measures					
Measure			Area (ha)		in %
Planting			17.1		57

Thinning	4.3	14
Felling (firewood)	4.3	14
Felling (timber)	2.1	7
No activity	2.1	7

8. Tormaphu

Production Potential (N, Volume)					
Product size		N total	N/ha	%	(m3)
>50	Drashing	311	2	27	922
	Firewood	311	2		841
30-49	Cham	1220	8	34	1231
	Firewood	1007	6		992
20-29	Tsim	2339	14	20	773
	Firewood	1569	10		519
10-19	Poles, etc.	9903	61	19	802
	Firewood	5308	33		430
Silvicultural Measures					
Measure			Area (ha)		in %
Planting			20.2		6
Thinning			42.0		12
Felling (firewood)			163.4		45
Felling (timber)			135.4		37

9. Tshagay

Production Potential (N, Volume)					
Product size		N total	N/ha	%	(m3)
>50	Drashing	109	2	16	296
	Firewood	96	2		216
30-49	Cham	640	10	38	583
	Firewood	732	12		637
20-29	Tsim	3366	54	42	1070
	Firewood	894	14		278
10-19	Poles, etc.	1241	20	3	95
	Firewood				
Silvicultural Measures					
Measure			Area (ha)		in %
Planting			5.8		24
Thinning			9.3		38
Felling (firewood)			7.0		29
Felling (timber)			1.2		5
No activity			1.2		5

2.4. Socio-Economic Profiles and Livelihood Dynamics

2.4.1. Demographic Features

There are approximately 500 households in BC-03, all of which are permanent residents. Most of these residents live in the villages of Mao-gang, Jangchubling, Gong, and Jigmechoeling. The majority are farmers, with a few civil servants, while the remainder are school-going children

2.4.2. Economic Profile: Primary Income Sources and Earnings in BC-03 Communities

Source of Income

The primary sources of income for the residents in BC-03 were identified as horticulture (45.66%), agriculture (40.22%) and livestock (14.12%). In terms of priority, horticulture emerged as the foremost source of income, followed by agriculture and livestock, as depicted in *Figure 5*. The annual average income of the respondents was calculated to be Nu. 79,764.62. Notably, a substantial portion of this income was derived from the sale of cash crops, particularly cardamom and oranges, highlighting their significant role in the local economy.

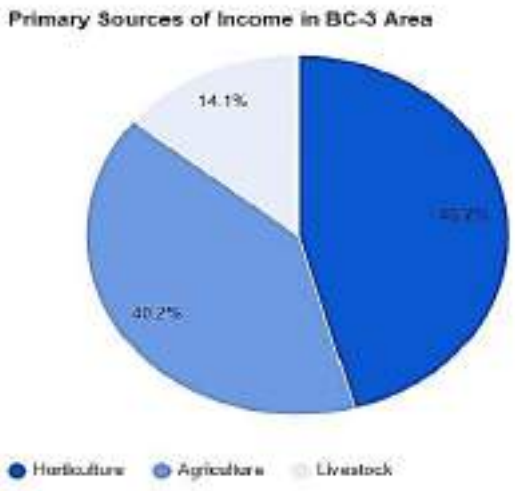


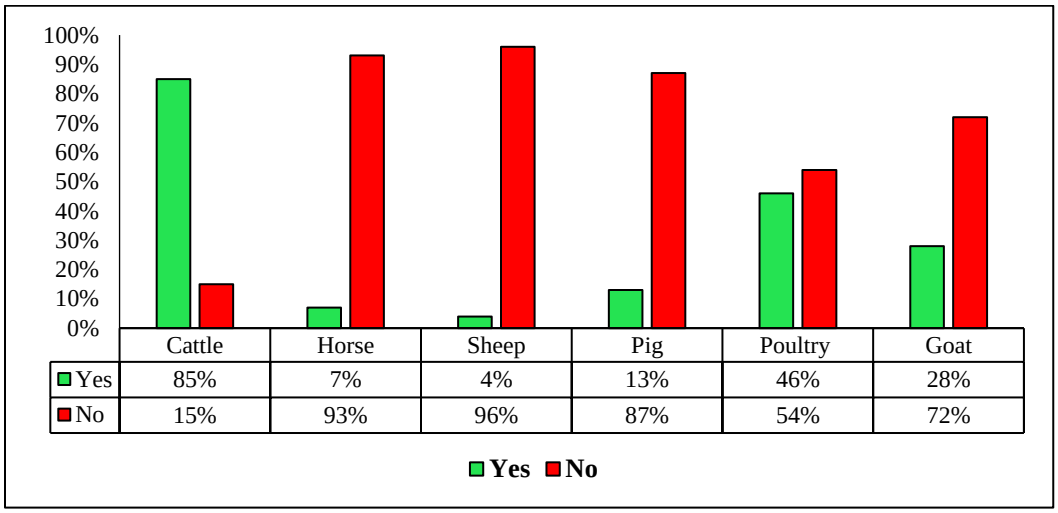
Figure 7: Primary Sources of income for People Residing in Biological Corridor

2.4.3. Livestock Management and Challenges in BC-03

Overview of Livestock Rearing Practices

In the BC-03 area, livestock rearing predominantly involves cattle (85%), poultry (46%) and goats (28%). The primary purpose for rearing these animals is diverse: cattle are mainly kept for milk and milk products, poultry for eggs and meat and goats exclusively for meat. The average income derived from livestock per respondent is Nu. 16,117.53. Notably, most of the respondents do not own horses (93%), sheep (96%) or pigs (89%). With 254 cattle reported within BC-03, there is a

potential overlap in resource use between livestock and wildlife, suggesting a need for studies on livestock number and its impact on wildlife to foster coexistence.



	Cattle	Horse	Sheep	Pig	Poultry	Goat
Yes	85%	7%	4%	13%	46%	28%
No	15%	93%	96%	87%	54%	72%

Figure 8: Distribution of Livestock Ownership Among Respondents

Purpose of Livestock Holdings

A significant portion of the livestock is raised for self-consumption (46.8%) with other uses including manure production for agriculture (17.8%), income generation through the sale of livestock products (13%) and draught power for plowing fields (9.7%). Interestingly, 13% of respondents do not engage in livestock rearing.

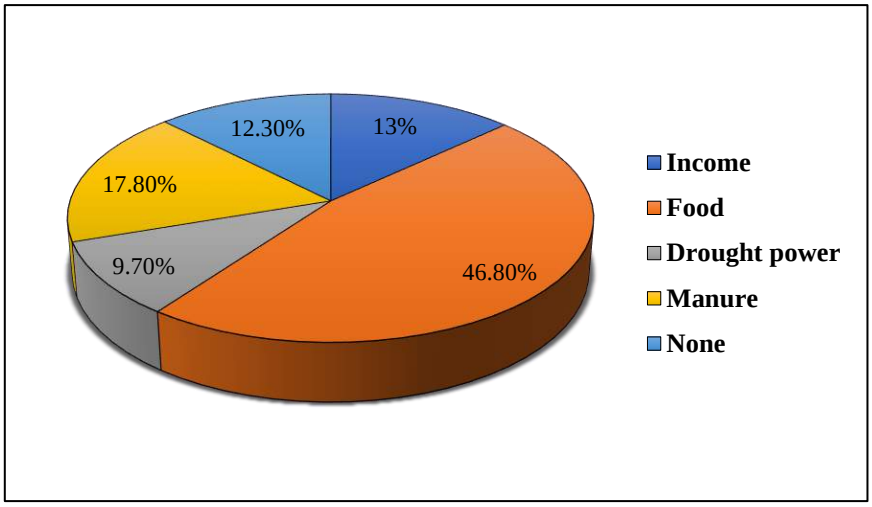


Figure 9: Purpose of livestock.

Grazing Land Availability and Practices

Only 28.43% of respondents have access to pastureland for grazing their cattle, leaving a majority without dedicated grazing areas. This situation has led to 34% of the cattle being grazed in Government reserved forests and 29% in abandoned agricultural fields. Additionally, 17% of the

livestock is tethered and stall-fed, while 7% graze in improved pastures. Notably, 13% of respondents do not own cattle.

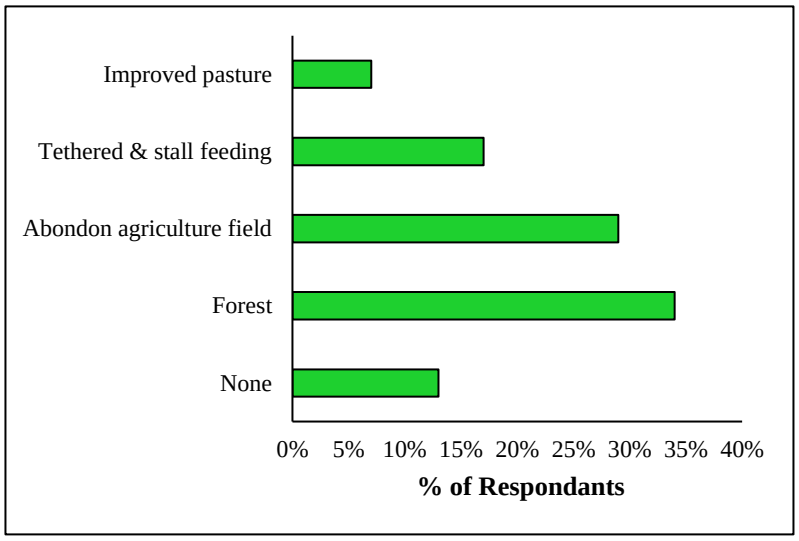


Figure 10: Different Kinds of Grazing Practices Adopted by Residents

Challenges in Livestock Rearing

The primary challenges faced by livestock owners include insufficient fodder (28.76%), lack of adequate grazing land (17.73%) and poor livestock breed quality (15.38%). These issues contribute to lower yield due to poor fodder or grazing quality (8.03%). Other challenges include livestock diseases and parasites (6.69% and 5.35%, respectively), and inadequate veterinary services (5.69%). Additionally, 6.02% of livestocks are lost to wildlife predators, highlighting the Human-Wildlife Conflict in the area.

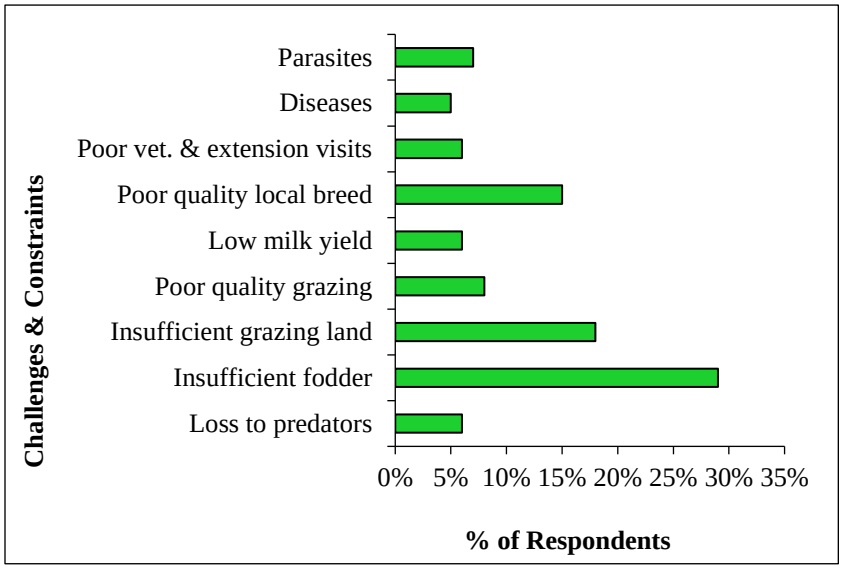


Figure 11: Challenges and Limitations in Livestock Management

2.4.4. Agricultural Practices and Challenges in BC-03

Crop Cultivation and Seasonal Patterns

The agricultural landscape in the BC-03 area is diverse, encompassing cereals, cash crops and vegetables. A detailed seasonal calendar *(Table 4)* illustrates the varied planting and harvesting times. Notably, some crops are harvested twice a year, while others, like cardamom, require three years to reach maturity. The average annual income from agriculture for respondents is Nu. 63,647.09, reflecting the economic significance of this sector.

Table 4: Seasonal calendar of Major Agricultural Crops

Crops/Season	J	F	M	A	M	J	J	A	S	O	N	D	Remarks
Paddy				S	S	TP	TP			H	H		
Maize		S	S			S	H			H			
Millet						S	S				H		
Buckwheat	S			H				S			H		
Mustard	H	H	H					S	S				
Dal						S	S				H	H	
Beans				S		H		S			H		*H 2 times in a year*
Potato	S	S				H	H	S				H	*H 2 times in a year*
Radish									S		H		
Cabbage	H								S			H	
Cauliflower	H								S			H	
Carrot									S			H	
Broccoli									S			H	
Spinach							S		H				
Pea	H	S				H			S				*H 2 times in a year*
Squash	H		P				H	H	H	H	H	H	*Fruiting goes on*
Cucumber		S			H	H							
Pumpkin		S			H	H	H	H					
Cardamom			P							H			*H after 3 yrs. of planting*
Ginger		P	P								H	H	
Orange	H											H	
Brinjal					S	S		H	H				
Chilli	P			H	H								
Crow Beak			S	S							H		
Tree-tomato			P							H	H		*H after 1 yr. of planting*
Bitter Gourd			S	S			H	H					
Long beans			S	S							H		

*****Code: S = sow, P = plant, TP = transplant, H = harvest*****

Constraints in Agricultural Practices

The constraints in agricultural practices includes shortage of labor (22.74%), wildlife-induced crop damage (15.05%) and insufficient irrigation water for paddy cultivation (14.70%). Additionally, 14.05% of respondents face a lack of sufficient land for agriculture and 1.34% lack financial resources required for the crop production. Soil-related issues, such as erosion and poor fertility, affect 1.34% and 5.69% of respondents, respectively. Quality seed availability is a concern for 6.02% of farmers, while 2.01% report that erratic climate conditions hinder crop production and 4.35% struggle with pests and diseases.

Market Access and Crop Protection Strategies

A significant challenge is the difficulty in selling excess crops due to poor market accessibility, affecting 12.71% of respondents and leading to substantial crop wastage. Only 2.3% of respondents have altered their cropping patterns in response to these challenges. To protect crops from wildlife damage, traditional methods are employed: 29% of respondents guard their crops, 17% use fencing and other techniques include making noise, setting fires, using scarecrows and in some cases, setting traps or snares, poisoning, or directly harming wildlife. Additionally, 3% clear bushes to reduce wildlife presence near fields, and 1% use dogs for crop protection.

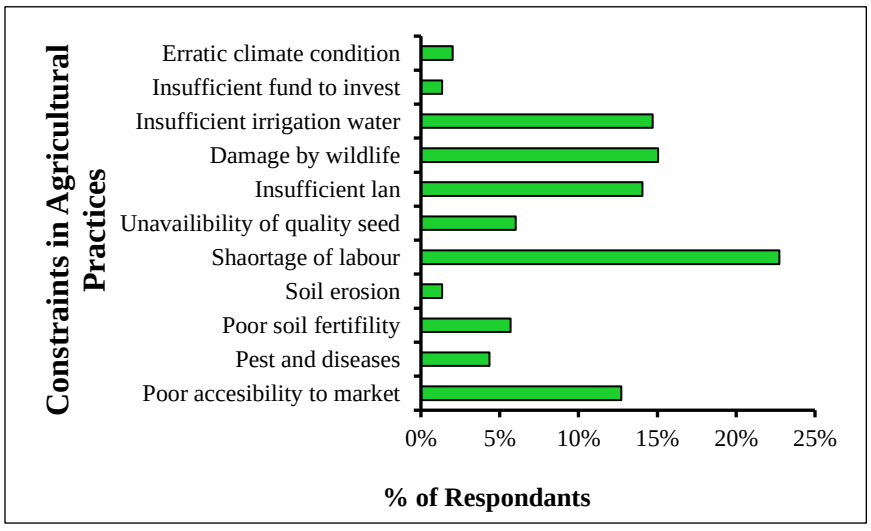


Figure 12: Constraints in Agricultural Practices

2.4.5. Community Perspectives on Wildlife and Human-Wildlife Conflict in BC-03

Attitudes Toward Wildlife

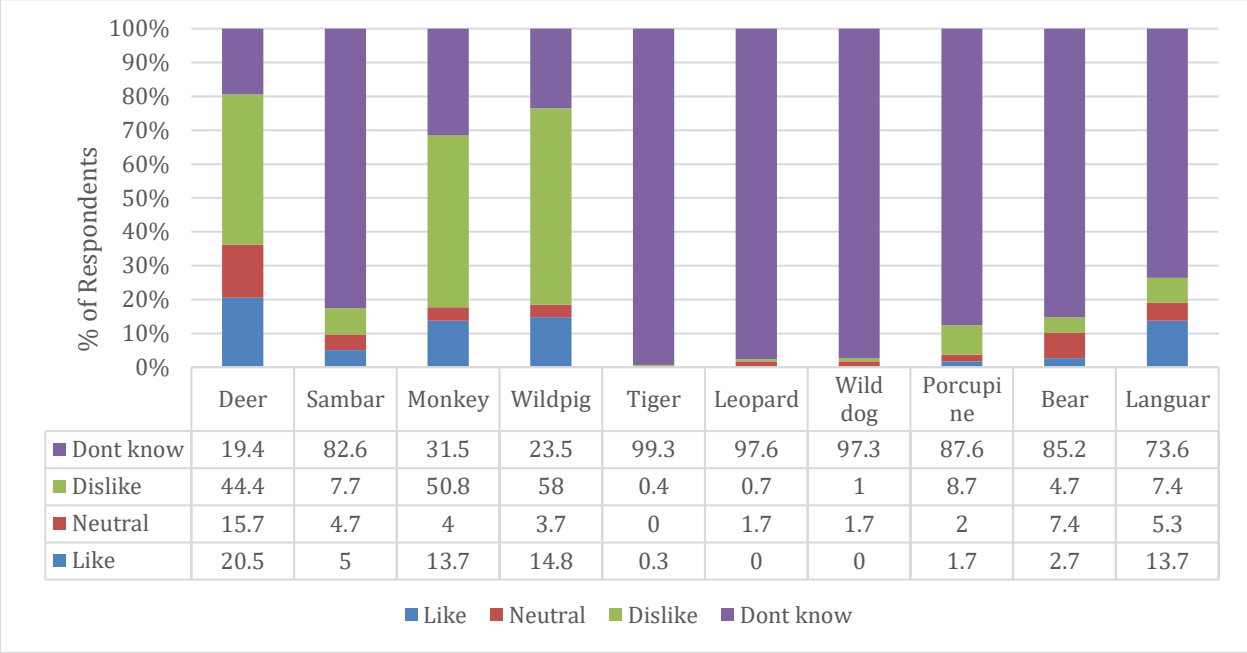
In BC-03 area, the most disliked wildlife, as depicted in Figure 13, is Wild Boar, with 58% of respondents expressing a negative view, primarily due to crop damage. This sentiment is closely shared with monkeys and deer, disliked by 50.8% and 44.4% of the respondents, respectively. The range of positive feelings towards wildlife is relatively low, spanning from 0 to 20.5%, while neutral attitudes vary from 0 to 15.7%. A significant portion of respondents lacked a definitive perception or knowledge about various wildlife species, including Deer (19.4%), Sambar (82.6%) and Monkeys (31.4%), with even higher percentages for species like Tigers, Leopards, and Dholes.

Perceptions on Wildlife Population Trends

Regarding wildlife population trends, 61.2% of respondents believe that the Wild Boar population is increasing, followed by perceptions of increasing Deer and Monkey populations (53.8% and 52.8%, respectively). These views are based on the frequency of sightings in agricultural fields and nearby forests, as shown in *Figure 15*. However, there is a notable lack of awareness about the population trends of several species, including Tigers, Leopards and wild dogs.

Awareness of Poaching in Biological Corridor

Poaching appears to be a minimal concern in the area, with only 0.75% of respondents acknowledging its prevalence. Conversely, 76.6% believe there is no poaching and 22.7% are unaware of the situation.



	Deer	Sambar	Monkey	Wildpig	Tiger	Leopard	Wild dog	Porcupine	Bear	Languar
Dont know	19.4	82.6	31.5	23.5	99.3	97.6	97.3	87.6	85.2	73.6
Dislike	44.4	7.7	50.8	58	0.4	0.7	1	8.7	4.7	7.4
Neutral	15.7	4.7	4	3.7	0	1.7	1.7	2	7.4	5.3
Like	20.5	5	13.7	14.8	0.3	0	0	1.7	2.7	13.7

Figure 13: Perception of respondents towards wild animals

Perception on Severity of Human-Wildlife Conflict

Human-wildlife Conflict is perceived as severe by 37% of respondents, while 23% consider it to be moderate. Additionally, 29% view the conflict as minor and 11% believe there is no issue at all.

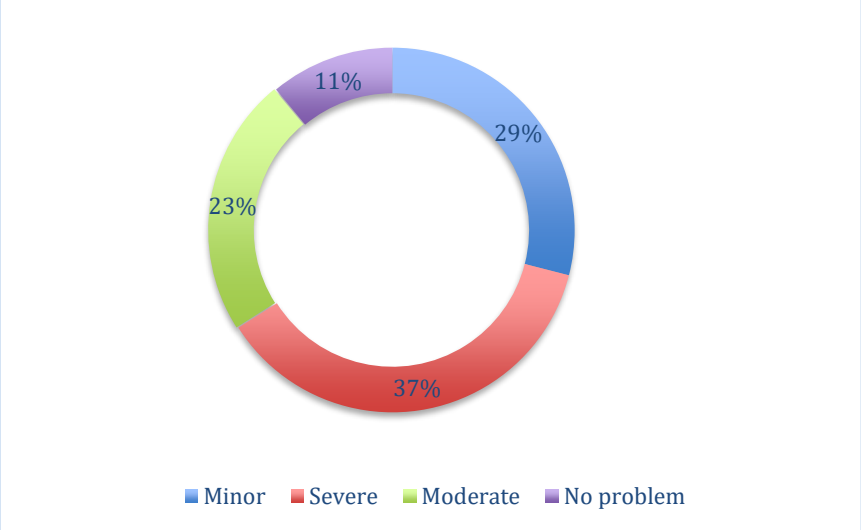
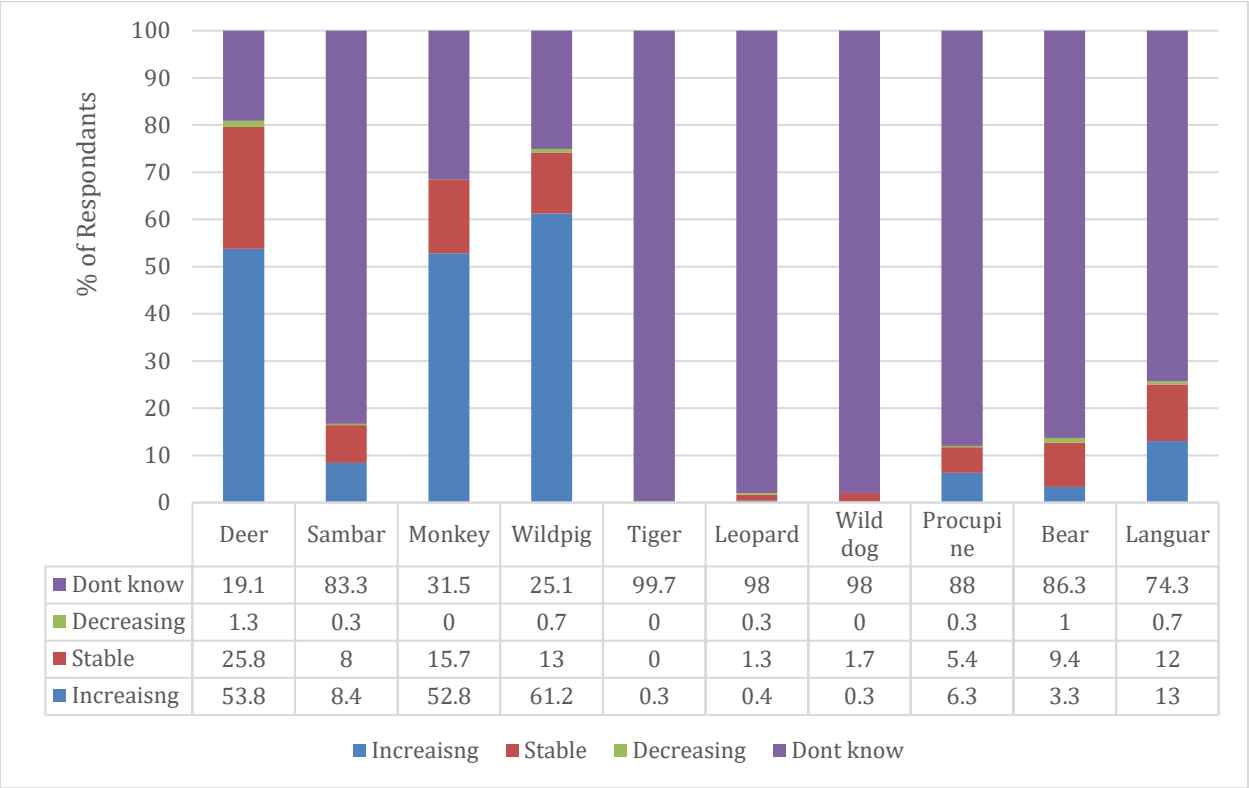


Figure 14: Respondents' perception of severity of human wildlife conflict



	Deer	Sambar	Monkey	Wildpig	Tiger	Leopard	Wild dog	Procupine	Bear	Languar
Dont know	19.1	83.3	31.5	25.1	99.7	98	98	88	86.3	74.3
Decreasing	1.3	0.3	0	0.7	0	0.3	0	0.3	1	0.7
Stable	25.8	8	15.7	13	0	1.3	1.7	5.4	9.4	12
Increaisng	53.8	8.4	52.8	61.2	0.3	0.4	0.3	6.3	3.3	13

Figure 15; People's Perceptions of Wildlife Population Trends

Community Insights on Commonly Encountered Wildlife Conflicts

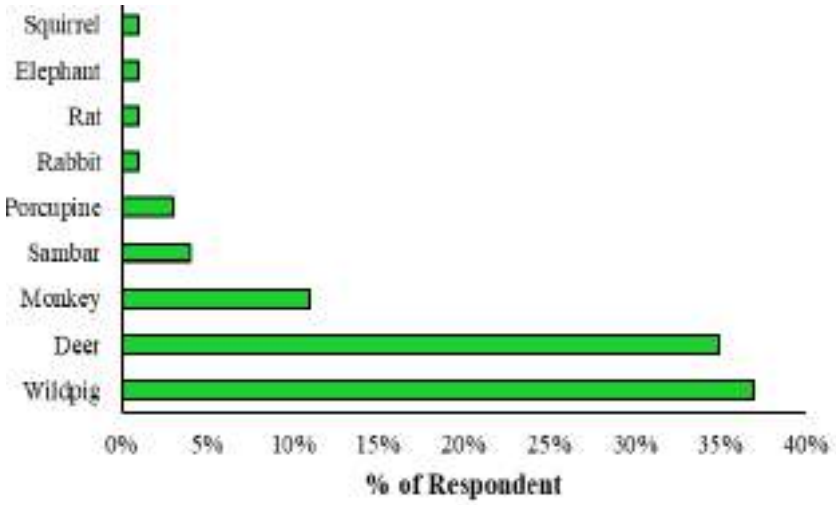


Figure 16: Community Insights on Commonly Encountered Wildlife Conflicts

In the context of Human-Wildlife Conflict within the surveyed region, resident perceptions indicate a higher frequency of encounters with specific wildlife species. Predominantly, conflicts are most frequently reported with Wild Boars, Barking deer and Monkeys. These species are identified as the primary contributors to the prevalent wildlife-related issues faced by the

community. Whereas encounters with Langurs, Squirrels and Elephants are notably less frequent, suggesting a lower level of conflict or interaction with these species in the same geographical area.

2.4.6. Trends and Practices in Forest Resource Utilization Among BC-03 Communities

Current Usage of Forest Resources

In the surveyed area, 14% of respondents reported using timber, with 133 planning to construct or renovate their houses. The most utilized forest resource is firewood, used by 26% of respondents, followed by the collection of fern tops (17%) and mushrooms (14%). An equal percentage of respondents (12%) gather fodder and bedding leaves from the forest for their cattle. The collection of medicinal plants, bamboo and cane is relatively less common, ranging from 1-2%.

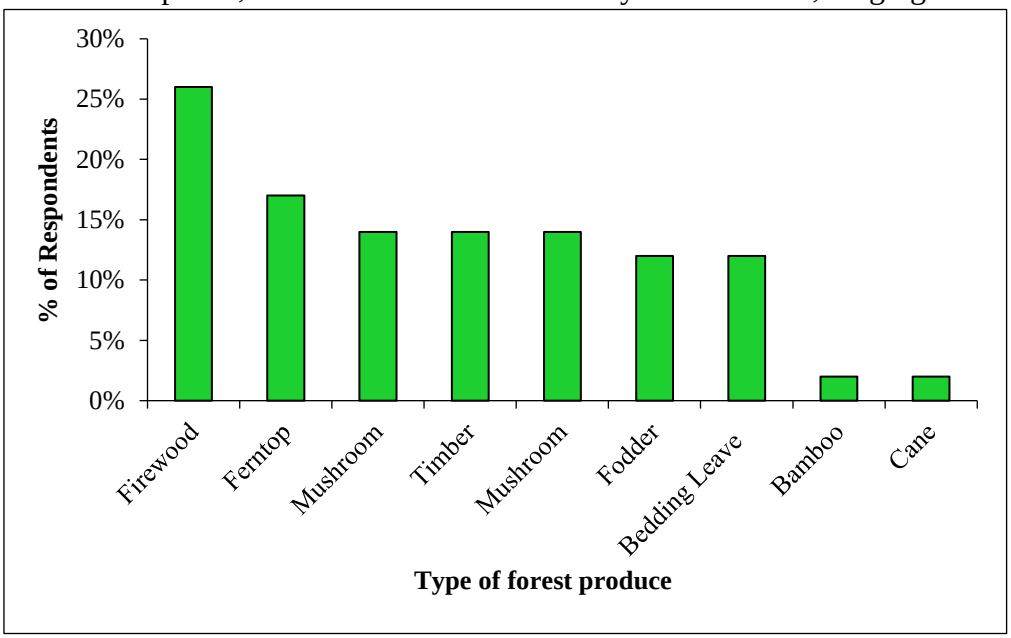


Figure 17: Forest Resource Utilization Categories

Harvesting Patterns and Regulations

The harvesting of timber for rural house construction and renovation adheres to the Forest and Nature Conservation Rules and Regulations 2017 (FNCRR 2017). The harvesting calendar, detailed in Table 2, specifies the permitted times for various forest resources, including bamboo, cane, and chirata. Honey collection occurs twice a year, once in summer and once in winter. Cannabis, while not harvested for consumption or sale, has specific sowing and harvesting times. Fishing and egg-laying periods for different species are also outlined.

Table 5: Harvesting Calendar of Forest Resources

Forest Resources	J	F	M	A	M	J	J	A	S	O	N	D	Remarks
Timber	H	H									H	H	*As per FNCRR 2023*
Bamboo	H	H										H	
Cane						H	H						
Chirata	H											H	
Honey collection					H	H	H				H	H	*H 2 times a year*
Cannabis	S	S									H	H	*They don't harvest*
Fishing	H	E	E	H	H	E	E	H	H	H	H	H	*Different fishes*
Poaching	P										P	P	

Code:** S = Sow seed, H = harvest, E = egg laying and P = poaching

Trends in Timber Use

Historically, high-quality timber species like *Morus laevigata, Michelias spp and Phoebe spp* were used for house construction. However, due to their declining availability in the forest, residents have shifted to utilization of species like *Toona ciliata, Choerospondias axillaris, Beilschmiedia sikkimensis, Schima wallichii, Altingia excelsa* and *Castanopsis spp*. With 133 respondents planning to apply for timber for construction or renovation, this trend suggests a significant future demand for timber, potentially leading to the harvesting of large volumes of timber within BC-03.

2.4.7. Community Perspectives on Conservation in BC-03

General Attitude Towards Conservation

Most respondents (83.9%) view conservation as beneficial to their community, while 16.1% hold a negative view. When it comes to the necessity of wildlife conservation, 32% strongly agree with its importance in their areas and an additional 40% agree, albeit less emphatically. However, 11% do not agree with the need for wildlife conservation and 17% have no opinion on the matter.

Support for Conservation Initiatives

A significant 98% of respondents expressed support for conservation programs initiated by the Department of Forests and Park Services in the surveyed areas. Despite this high level of support, a notable 81.6% of respondents were unaware of the existence of BC-03, indicating a gap in awareness and understanding of local conservation efforts.

CHAPTER III

THREATS ANALYSIS

3.1. Threats

3.1.1. Landslide Hazards in BC-03

In BC-03, landslides have emerged as the most significant ecological threat, causing displacement of human settlements and adversely affecting wildlife habitats. Notably, two major landslides within this region have had profound impacts on both local communities and the environment. The Ossay landslide, situated at *26.58'54.85" N, 90.31'32.16"* E, encompasses approximately 35 hectares and recurrently affects the Sarpang-Zhemgang highway. Annual monsoons trigger substantial landslides in this area, leading to land degradation and habitat loss, with the region being prone to further instability. Similarly, the Lhayul landslide, one of the largest in BC-03 spans 144 hectares at *27.00'29.59" N, 90.23'50.66" E*. It causes annual erosion of several acres of land. Despite its proximity to human settlements (300m away), it necessitates the implementation of land reclamation activities for ecological restoration.

Figure 18: Landslides at Ossay and Lhayul

3.1.2. The Menace of Invasive Species

Invasive species have been identified as a primary factor in the decline of native biodiversity across terrestrial and aquatic ecosystems in BC-03 *(Kopp, 2010; D.B. Gurung, 2018).* The introduction of 12 fish species by the end of the 20th century in Bhutan and the recent proliferation of invasive plant species like *Lantana camara, Chromolaena odoratum, Mikania micrantha and Ageratina Adenophor*a have significantly surpassed native flora. These invasive plants are prevalent in various geographical zones of Sarpang and Tsirang Dzongkhags, with specific species dominating

certain elevation ranges. Additionally, exotic species like *Leucaena leucocephala* have spread from cultivated lands into Protected areas, exacerbating the invasion.

The presence of these invasive species not only disrupts ecological balance but also poses socio-economic challenges by reducing agricultural yields. To address this issue, strategies and guidelines for controlling invasive weeds in Biological Corridors and SRF land are essential. Proposed control measures include annual removal of invasive plants, mechanical methods using equipment like tractors and dozers and biological control through the introduction of natural predators or parasites of these invasive species. However, caution is advised against the use of herbicides due to potential ecological and environmental harm.

3.1.3. Impact of Developmental Activities

Developmental Activities and Biodiversity

Developmental activities, including road construction and infrastructure development, are crucial for socio-economic advancement in BC-03. However, they bring significant environmental challenges. These activities often result in habitat destruction, increased pollution and disturbances to local wildlife. This situation underscores the urgent need for careful planning and the adoption of sustainable development practices to mitigate the adverse effects on biodiversity conservation.

Agricultural Practices and Ecological Concerns

In BC-03, agricultural practices such as cardamom cultivation are causing notable ecological disturbances. This cultivation leads to deforestation, alters soil properties and disrupts the migratory routes of wildlife, affecting species like the Royal Bengal tiger. The expansion of cardamom plantations not only threatens regional biodiversity but also undermines efforts to maintain carbon sequestration. Additionally, land fragmentation due to human activities like agriculture and construction of farm roads is resulting in the loss of native plant species and the fragmentation of wildlife habitats. While not currently significant, this fragmentation could become a serious threat to the region's ecological integrity if it continues. Moreover, the increasing demands for irrigation and water pipelines are exerting pressure on BC-03's wetlands and their associated wildlife. The growing need for water for agricultural purposes is leading to wetland degradation, adversely affecting native wildlife and potentially leading to the extinction of certain species.

3.1.4. Grazing Pressures and Ecosystem Degradation

In Biological Corridor 03, livestock farming emerges as a primary income-generating activity, with a socio-economic survey indicating that 85% of the rural community within the Corridor boundaries owns cattle, followed by poultry (46%) and goats (28%). Approximately 13% of the community's income is derived from livestock rearing. The survey reveals that only 28.43% of the community possesses pastureland, while a significant majority (71.57%) lacks grazing areas for their cattle. Consequently, 34% of the cattle are grazed in Government reserved forests, 29% in abandoned agricultural fields, 17% are tethered or stall-fed, and 7% graze in privately improved pastures. This practice of livestock grazing, particularly in State Reserved Forest (SRF) land, leads to the depletion of palatable plant species, either through browsing or trampling. The forest resource assessment within BC-03 indicates a absence of valuable timber species like *Michelia doltsopa*, while less palatable species such as *Symplocus sp*. are found in abundance. Grazing within the Biological Corridor contributes to the scarcity of grass for wild animals, potentially leading to increased crop depredation in nearby settlements. Additionally, cattle grazing facilitates the spread of invasive weeds into the Biological Corridors, further impacting the ecological balance.

3.1.5. Drying Water Sources and Ecological Impact

Bhutan is endowed with enormous water resources, of which glacial lakes and wetlands are the most important. Combined with snow, ice, freshwater lakes, running streams, rivers, and groundwater. Bhutan has one of the highest per capita availabilities of water in the world with 94,500 m3/capita/annum (Wangdi, 2018 and NEC, 2016).

Despite being a water-rich country, issues with water accessibility continue to exist across the country. This is due to scattered settlement, management issues at water sources, inadequate and poor management of infrastructure, and issues in governance. With the rapid increase in socio-economic development and population, there is a greater demand for water than ever, but due to the country’s topography and seismic activity coupled with climate change effect (floods, glacial lake outburst floods (GLOFs), and droughts), Bhutan is gravely facing water-related issues right now. The following are some of the threats of drying water sources and waterholes thatwaterholes have been vividly noticed inside the BC3:

- Trapping of water sources for drinking and agricultural purposes due to increase in population without proper water budgeting and ecological flow
- Overgrazing in and around the catchment area
- Change in land use pattern (Cardamom plantation)
- No recharge area identified for those critical watershed areas
- Deforestation
- Rapid developmental activity- construction of approach/farm road
- Numerous landslides in the catchment area which leds to surface runoff and less infiltration

To address the above threats, it is essential to identify water sources that needs immediate interventions and monitoring of selected sites through detailed hydrological survey and biophysical analysis of the area are deemed essentials for sustainable management of water sources.

3.1.6. Wildlife Poaching and Biodiversity Loss

Wildlife poaching significantly contributes to the loss of biodiversity, particularly affecting Mammal and bird populations. This issue is 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.

Biological Corridor 03 (BC-03) in Bhutan is a crucial habitat for globally threatened species such as the Royal Bengal tiger *(Panthera tigris),* Asiatic elephants *(Elephas maximus),* Guar *(Bos guarus),* Golden Langur *(Trachypithecus geei)* and Himalayan black bear *(Ursus thibetanus laniger).* Additionally, species like Wild boar *(Sus scrofa*), Barking Deer *(Muntiacus muntjak),* and Sambar *(Rusa unicolor)* are frequently targeted for illegal hunting. Evidence of such activities was recorded during the Rapid Biodiversity Assessment (RBA), including specific instances of Tiger poaching in Simkharka under Jigmecholing Gewog in 2014. Consequently, wildlife poaching is recognized as a significant and ongoing threat to the management and conservation of the Biological Corridor.

Figure 19: Evidence of Illegal activities in the past

3.1.7. Illegal Fishing and River Ecosystems

The BC area is home to several perennial rivers, including Samurtungkhola, Sixtykhola, Sarpangkhola, Burkhola, Moukhola, Gongkhola, Simkharkhola, Rongkhola and Threwarkhola. This rich river ecosystem is increasingly threatened by illegal fishing practices such as electrocution, poisoning and the use of other harmful fishing gears.

3.1.8. Human-Wildlife Conflict and Its Ramifications

Human-wildlife conflict (HWC), as defined by IUCN in 2020, refers to "the negative interactions between humans and wild animals, leading to adverse outcomes for both human resources and wildlife habitats". The primary causes of HWC are habitat loss and fragmentation. As development activities increase, they result in habitat loss and fragmentation, pushing wildlife out of their natural habitats and leading to conflicts. These conflicts are prevalent, with 88% of survey respondents experiencing HWC in their area. Of these, 37% faced severe conflict, primarily due to crop damage caused by Wild Boars, deer and monkeys. This has significant implications for

livelihoods and food security, with some farmers losing entire crops overnight, fueling resentment towards wildlife conservation and sometimes leading to retaliatory killings.

The severity of conflict varies, with 23% experiencing it moderately and 29% mildly. Only 11% reported no conflict. Regarding crop damage trends, 51.8% of respondents noted no change, 38.5% saw an increase and 9.7% reported a decrease in recent years. This situation poses a threat to conservation efforts, as affected farmers may retaliate, thereby weakening support for wildlife conservation. Therefore, it is crucial to conduct studies to understand the causes of HWC and implement appropriate mitigation measures to prevent escalation of these conflicts.

2.2.Threat Ranking

The Miradi software was used to rank conservation threats based on three main criteria: Scope, Severity and Irreversibility. 'Scope' measures how much of the threat impacts the target within ten years under current conditions. 'Severity' evaluates the expected level of harm to the biodiversity target within the scope, considering ongoing trends. 'Irreversibility' assesses how reversible the effects of a threat are and the possibility of restoring affected targets if the threat ceases. Each criterion has four sub-levels: Low (affecting 1-10% of the target's population), Medium (11-30%), High (31-70%) and Very High (71-100%). For the specific conservation Corridor assessed, the overall threat was rated high, primarily due to impacts of developmental activities (plantation of cardamom, construction of roads etc.) followed by the impact of wildlife poaching on species conservation and ecological impact of drying water sources. The threat rank for all conservation targets was medium.

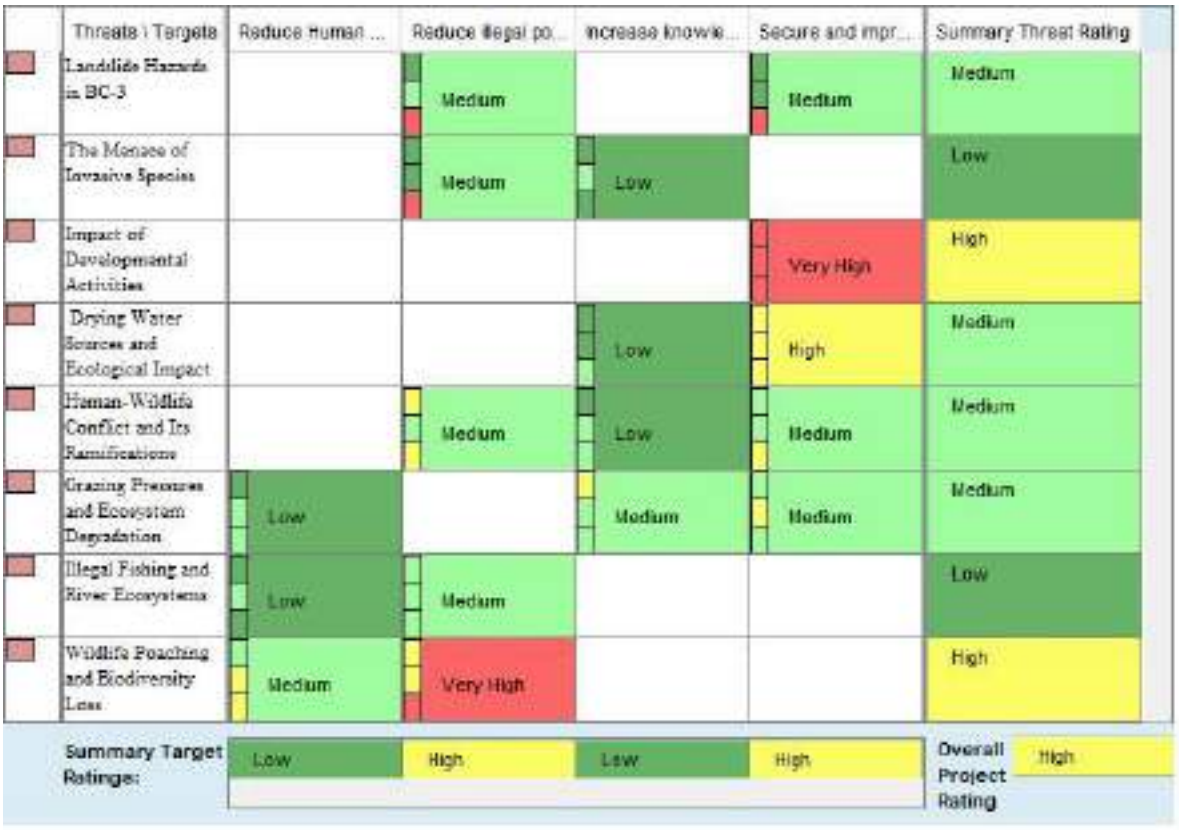


Figure 20: Assessment and Status of Conservation Threats

CHAPTER IV

MANAGEMENT INTERVENTIONS

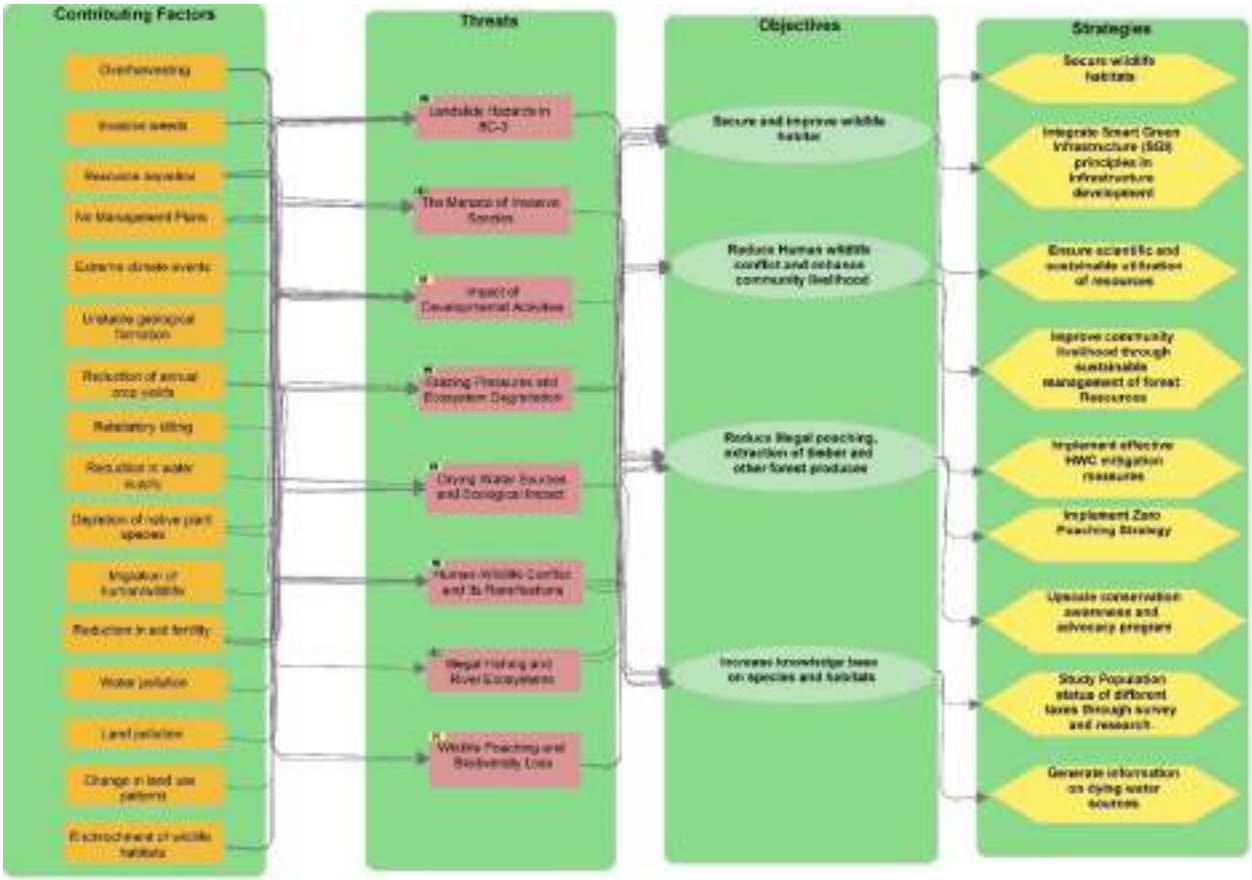


Figure 21: Conceptual model for the conservation Management of BC-03

This plan's strategies, actions and objectives were developed from an analysis of threats, contributing factors and opportunities related to biodiversity and community livelihood in the Corridor. The aim is to tackle problems and remove obstacles that impede the attainment of set objectives and goals. A conceptual model, created using Miradi software, encapsulates the management plan's conservation targets, goals, threats, strategies, and actions *(as shown in Figure 22)*. The conservation management plan outlines four key objectives and 9 strategies, encompassing various actions, intended to fulfill its aim over a decade.

Objectives, Strategies and Actions

Objective 1: Secure and Enhance Wildlife Habitats

Strategy 1.1: Secure wildlife habitats

1.1.1 Carry out mapping of salt licks and water holes
1.1.2 Implement invasive species control measures
1.1.3 Implement land management and soil conservation measures
1.1.4 Implement grassland management in selected sites inside the BC
1.1.5 Implement smart restorative plantation within the degraded landscapes of BC-03
1.1.6 Identify potential recharge area & interventions to secure perennial water flow

Strategy 1. 2: Integrate Smart Green Infrastructure (SGI) principles in infrastructure development

1.2.1 Initiate SGI principles in any developmental works such as Roads, Bridges, etc. impacting connectivity of landscape

Strategy 1.3: Ensure scientific and sustainable utilization of resources

1.3.1 Allocate resources sustainably through scientific measures
1.3.2 Monitor collection of NWFP
1.3.3 Prepare/ Revise Local Forest Management Plan
1.3.4 Prepare/ Revise Community Forest Management Plan

Objective 2: Mitigate Human-Wildlife Conflict and Improve Community Livelihoods

Strategy 2.1: **Implement effective HWC mitigation measures**

2.1.1 Update HWC hotspot map
2.1.2 Initiate citizen science group for HWC
2.1.3 Initiate formation of Geog Conservation Committee
2.1.3 Advocacy and awareness on HWC (educate students and local communities on natural heritage and Human-Wildlife Conflicts)
2.1.4. Develop framework for wildlife rescue and rehabilitation of problematic animals
2.1.5. Equip field staff and communities for effective HWC Management
2.1.6 Identify and promote enterprise development

Strategy 2.2: Improve community livelihood through sustainable management of forest Resources.

2.2.1 Initiate formation of forest resources management group
2.2.2 Explore and map out potential ecotourism sites
2.2.3 Develop potential ecotourism sites to generate income for local communities
2.2.4 Conduct ethnobotanical study in BC
2.2.5 Conduct market feasibility of products developed
2.2.6 Develop potential products based on findings of ethnobotanical study
2.2.7 Conduct capacity building of the forest resources management group based on above activities
2.2.8

Objective 3: Combat Poaching and Illegal Resource Extraction

Strategy 3.1: Implement Zero Poaching Strategy

3.1.1 Assess current poaching trends and enforcement operations in the Corridor
3.1.2 Upscale SMART patrolling equipment and technology
3.1.3 Capacity building of field staff in combating wild crimes

3.1.4 Conduct SMART patrolling and enforcement
3.1.5 Liaise, coordinate, and collaborate with relevant agencies for effective enforcement of rules and regulations and regulations through frequent advocacy programs

Strategy 3.2: Upscale conservation awareness and advocacy program

3.2.1 Conduct awareness on need for conservation of wildlife
3.2.2 Celebrate important days like Wildlife Day, Elephant Day, Tiger Day/Ranger Day, Social Forestry Day and World Environmental Day with communities, schools, and institutions to impart importance of conservation and information sharing.
3.2.3 Identify and support nature club in schools as ambassadors of conservation and promote the Corridor as living classroom.
3.2.4 Presentation and disseminating information on BC-03 Conservation Management plan to the public

Objective 4: Expand Knowledge Base on Species and Habitats

Strategy 4.1: Study Population status of different taxes through survey and research

4.1.1 conduct surveys and research on keystone species (Elephants, Guar, Tiger, Hornbill, Dhole, small cats) and lesser-known species within BC to determine their status
4.1.2 Conduct biodiversity survey on any least studied taxa
4.1.3 Conduct biodiversity survey on vegetation including NWFP within the BC
4.1.4 Conduct survey on Herpeto-fauna within the BC
4.1.5 Conduct survey on Butterflies and moths within the BC
4.1.6 Conduct survey on Fish diversity within the BC
4.1.7 Habitat modeling for keystone species within BC
4.1.8 Conduct study on the Impact of climate change on biodiversity within the BC
4.1.9 Develop strategies, protocols and control measures for invasive weeds within BC
4.1.10 Publication of reports, books, facts and figures on each taxon

Strategy 4.2: Generate information on dying water sources

4.2.1 Conduct wetland inventories including water sources (rivers, spring, streams, waterholes, ponds, lakes, marshes, peat bogs) within BC
4.2.2 Identify degraded wetlands and develop protocols for revival and mitigation

CHAPTER V

IMPLEMENTATION SCHEDULE & BUDGET

Work Plan and Budget

The Annual Work Plan (AWP) for the entire duration of the plan has been created. It includes all activities necessary to achieve the objectives along with their respective budgets. Yearly targets have been established to ensure timely results. Most of the budget is expected to come from Bhutan for Life (BFL), Royal Government of Bhutan, other conservation donor and partners. All the activities are scheduled for implementation as per the plan below.

Table 6: Implementation Schedule & Budget

Implementation Schedule & Budget(millions-Nu.) for BC-03 Conservation Plan										
Strategic action/Year	**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
Objective 1: Secure and Enhance Wildlife Habitats										
Strategy 1.1: Secure wildlife habitats										
Action 1.1.1. Carry out mapping of saltlicks and water holes	0.45									
Action 1.1.2. Implement invasive species control measures		0.3		0.3		0.3		0.3		0.3
Action 1.1.3. Implement land management and soil conservation measures	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Action 1.1.4. Implement grassland management in selected sites	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Action 1.1.5. Implement climate-smart restorative plantations within the degraded landscapes	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
Action 1.1.6. Identify potential recharge area & interventions to secure perennial water flow	0.2	0.5	0.5	0.5	0.5	0.5				
Strategy 1.2: Integrate Smart Green Infrastructure (SGI) principles in infrastructure development										
1.2.1. Initiate SGI principles in any developmental works such as Roads, Bridges, etc. impacting the connectivity of the landscape	1		1		1		1		1	
Strategy 1.3: Ensure scientific and sustainable utilization of resources										
Action 1.3.1. Allocate resources sustainably through scientific measures.	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Action 1.3.2. Monitor collection of NWFP	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Action 1.3.3. Prepare/ Revise Local Forest Management Plan	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Action 1.3.4. Prepare/ Revise the Community Forest Management plan			0.15	0.45	0.15	0.15				
Objective 2: Mitigate Human-Wildlife Conflict and Improve Community Livelihoods										

Strategy 2.1: Implement effective HWC mitigation measures										
Action 2.1.1. Update HWC hotspot map	0.5									
Action 2.1.2. Initiate SGI principles in any developmental works impacting the connectivity of the landscape.		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Action 2.1.3. Formation of citizen scientist group	0.4									
Action 2.1.4. Initiate formation of Geog Conservation Committee		1.5	1.5	1.5						
Action 2.1.5. Advocacy and awareness on HWC (educate students and local communities on natural heritage and human-wildlife conflicts)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Action 2.1.6. Carryout capacity building to field staff in managing HWC	0.45									
Action 2.1.7. Develop a framework for wildlife rescue and rehabilitation of problematic animals.	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Action 2.1.8. Equip field staff and communities for effective HWC and conservation management activities		0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Action 2.1.9. Promote enterprise development			0.2	0.2	0.2	0.2				
Strategy 2. 2: Improve community livelihood through sustainable management of forest Resources										
Action. 2.2.1. Initiate formation of forest resources management group.						0.3	0.5			
Action 2.2.2. Explore and map out potential ecotourism sites	0.3									
Action 2.2.3. Consultation with relevant stakeholders on the findings of the study		0.5								
Action 2.2.4. Develop potential ecotourism sites to generate income for local communities.			3	3						
Action 2.2.5. Conduct ethnobotanical study in BC	0.35									
Action 2.2.6. Develop potential products(prototype) based on findings of ethnobotanical study.		0.5								
Action 2.2.7. Conduct market feasibility of products developed.		2.5	2.5							
Action 2.2.8. Develop infrastructures, procure equipment, and conduct capacity building of the forest resources management group based on above activities				3	3					
Objective 3: Combat Poaching and Illegal Resource Extraction										
Strategy 3. 1: Implement Zero Poaching Strategy										
Action 3.1.1. Assess current poaching trends and enforcement operations in the Corridor	0.3								0.3	
Action 3.1.2. Upscale SMART patrolling equipment and technology	0.45		0.45		0.45		0.45		0.45	

Action 3.1.3. Capacity building of field staff in combating wildlife crimes	2		2		2		2		2	
Action 3.1.4. Conduct SMART patrolling and enforcement	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Action 3.1.5. Liaise, coordinate, and collaborate with relevant agencies for effective enforcement of rules and regulations through frequent advocacy program.	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Strategy 3.2: Upscale conservation awareness and advocacy program										
Action 3.2.1. Conduct awareness and waste campaigns among communities on wildlife poaching and need for conservation	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Action 3.2.2. Celebrate important days like Wildlife Day, Elephant Day, Tiger Day/Ranger Day, Social Forestry Day and World Environmental Day with communities, schools, and institutions to impart importance of conservation and information sharing	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Action 3.2.3. Identify and support nature club in schools as ambassador of conservation and promote the corridor as living classroom		0.75		0.75		0.75		0.75		0.75
Action 3.2.4 Presentation and disseminating information on BC-03 Conservation Management plan to the public	0.4									
Objective 4: Expand Knowledge Base on Species and Habitats										
Strategy 4. 1: Population status of different taxes through survey and research										
Action 4.1.1 Conduct survey and research on Mammals		0.45	0.45							
Action 4.1.2. Conduct a biodiversity survey on the least studied taxa		0.2								
Action 4.1.3. Conduct biodiversity survey on vegetation including NWFP within the BC		0.5	0.5							
Action 4.1.4. Conduct survey on Herpeto-fauna within the BC		0.45								
Action 4.1.5 Conduct survey on Butterflies and Moths within the BC		0.2								
Action 4.1.6. Conduct survey on Fish diversity within the BC		0.45								
Action 4.1.7. Habitat modeling for keystone species within BC		0.5								
Action 4.1.8. Conduct research on the Impact of climate change on biodiversity within the BC			0.35	0.35					0.35	
Action 4.1.9. Develop strategies, protocols, and control measures for invasive weeds within the BC			0.1	0.1						
Action 4.1.10. Publication of reports, books, facts and figures on each taxon				0.15						
Strategy 4.2: Generate information on dying water sources and wetlands										

Action 4.2.1. Conduct wetland inventories including water sources (rivers, spring, streams, waterholes, ponds, lakes, marshes, peat bogs) within the BC			0.35	0.35						
Action 4.2.2. Identify degraded wetlands and develop protocols for revival and mitigation			0.15	0.15						
4.2.3 Identify degraded wetlands and develop protocols for revival and mitigation						0.5	0.5	0.5		
Total Budget Yearly (Million-Nu.)	**11**	**14**	**18**	**15**	**12**	**7.5**	**9.3**	**6.4**	**8.9**	**5.9**

CHAPTER VI

MONITORING AND EVALUATION

The annual monitoring of the Conservation Management Plan, according to the Monitoring & Evaluation (M&E) results framework, should be mandated by the Forest Information and Monitoring Division (FMID) and the Nature Conservation Division. This should be done in consultation with the Divisional Forest Office in Sarpang, with records maintained for each year's achievements. The cumulative achievement results will be made available at the end of the plan period. Additionally, the Divisional Forest Office in Sarpang will submit an annual progress report on the plan's implementation. The plan evaluation will be conducted in the 5th year and at the end of the plan period by the Department of Forests and Park Services (DoFPS). The monitoring and evaluation of the plan will be carried out according to the Monitoring and Evaluation framework table provided below.

Table 7: Monitoring & Evaluation Framework

Objective	Action	Output indicator	Baseline	Unit	Yearly target									
1. Secure and Enhance Wildlife Habitats	**Strategy 1.1: Secure wildlife habitats**				**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
	Action 1.1.1. Carry out mapping of additional saltlicks and water holes	Maps of saltlicks and waterholes produced.	14 waterholes, 8 saltlicks	No	2	2	2	2	2	2	2	2	2	2
	Action 1.1.2. Implement invasive species control measures	Controlled 25 Ha area of invasive species	0	Ha	0	5	0	5	0	5	0	5	0	5
	Action 1.1.3. Implement land management and soil conservation measures	Hectare of degraded land managed	0	Ha	2	2	2	2	2	2	2	2	2	2
	Action 1.1.4. Implement grassland management in selected sites.	An area brought under grassland managed	0.2	ha	5	5	5	5	5	5	5	5	5	5
	Action 1.1.5. Implement smart climate	20 ha of grassland managed	0	ha	2	2	2	2	2	2	2	2	2	2

	restorative plantation within the degraded landscapes.													
	Action 1.1.7. Carryout water restoring interventions measures to revive drying water sources (lakes, ponds, spring, waterholes) inside BC-03.	Number of drying waters revived	5	No	3	3	3	3	3	3	3	3	3	3
	Strategy 1.2: Integrate Smart Green Infrastructure (SGI) principles in infrastructure development				**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
	Action 1.2.1. Initiate SGI principles in any developmental works impacting connectivity of landscape.	numbers of SGI initiated and implemented	0	No	1	0	1	0	1	0	1	0	1	0
	Strategy 1. 3: Ensure scientific and sustainable utilization of resources				**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
	Action 1.3.1. Ensure allocation of resources to be scientific and sustainable with effective service delivery	Allocation of resources scientifically and sustainably ensured. Suggested to put turnaround time for service delivery	0	M/days	333	333	333	333	333	333	333	333	333	333
	Action 1.3.2. Regulate sustainable collection of NWFP.	Sustainable collection of NWFP regulated	7	No.	7	7	7	7	7	7	7	7	7	
	Action 1.3.3. Local Forest Management Plan	Number of LFMP prepared/revise	3	No.	1	1	1	1	1	1	1	1	1	
	Action 1.3.4. Revision of	Number of CFs plan revised.	10	No.			1	3	1	1				

	Community Forest Management plan													
2. Mitigate Human-Wildlife Conflict and Improve Community Livelihoods	**Strategy 2.1: Implement effective HWC mitigation measures**				**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
	Action 2.1.1: Conduct baseline research on HWC	HWC study conducted	0	No	1	0	0	0	0	0	0	0	0	0
	Action 2.1.2: Initiate and implement SGI principles in any developmental work impacting connectivity of landscape.	SGI principles initiated and implemented	0		0	1	1	1	1	1	1	1	1	1
	Action 2.1.3. Formation of citizen scientist group.	4 groups of citizen scientist formed	0	no	4	0	0	0	0	0	0	0	0	0
	Action 2.1.4. Initiate formation of Geog Conservation Committee	Formed 3 groups	0	No	0	1	1	1	0	0	0	0	0	0
	Action 2.1.5: Advocacy and awareness on HWC (educate students and local communities on natural heritage and human-wildlife conflicts)	promotion and awareness carried out in 20 schools and 10 gewogs	0	No	3	3	3	3	3	3	3	3	3	3
	Action 2.1.6: Carryout capacity building to field staff in managing HWC	30 nos of field staff trained on HWC	0	No	30	0	0	0	0	0	0	0	0	0
	Action 2.1.7. Develop framework for	Injured and abandoned wildlife rescued	0	Man-days	50	50	50	50	50	50	50	50	50	50

	wildlife rescue and rehabilitation of problematic animals.													
	Action 2.1.8. Equip field staff and community for effective HWC and conservation management activities	Field staff and community equipped.	0	no	0	20	20	20	20	20	20	20	20	20
	Strategy 2.1: Improve community livelihood through sustainable management of forest Resources.				**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
	Action. 2.2.1. Initiate formation of forest resources management group.	No. of Management group established.	5 NWFPMGs & 4 CFMGs	No						2	2			
	Action 2.2.2. Explore and map out potential ecotourism sites	Map and Report produced	0	Nos	2									
	Action 2.2.3. Consultation with relevant stakeholders on the findings of the study	Consultation Report	0	Nos		1								
	Action 2.2.4. Develop potential ecotourism sites to generate income for local communities.	No. of sites established.	0	Nos		1	1	1						
	Action 2.2.5. Conduct ethnobotanical study in BC	Report produced.	0	Nos	1									
	Action 2.2.6. Develop potential products(prototy	New Products developed	0	Nos		2	2							

	pe) based on findings of ethnobotanical study and conduct market study.													
	Action 2.2.7. Develop infrastructures, procure equipment and conduct capacity building of the forest resources management group based on above activities	New products on sale	0	Noss				2	2					
3. Combat Poaching and Illegal Resource Extraction	**Strategy 3.1: Implement Zero Poaching Strategy**				**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
	Action 3.1.1. Assess current poaching trends and enforcement operations in the corridor	Number of assessment and enforcement report	0	No	0	1	0	0	0	0	0	0	1	0
	Action 3.1.2. Upscale SMART patrolling equipment and technology	Number of equipment procured	0	No.	6	0	6	0	6	0	6	0	6	0
	Action 3.1.3. Capacity building of field staffs	Number of field staff trained.	0	No.	10	0	10	0	10	0	10	0	10	0
	Action 3.1.4. Conduct SMART patrolling and enforcement	Number of reports generated in a year	0	No.	2	2	2	2	2	2	2	2	2	2
	Action 3.1.5. Liaise, coordinate, and collaborate with relevant agencies for effective enforcement of rules and regulation	Number of co-ordination meeting conducted	2	No.	1	1	1	1	1	1	1	1	1	1

	Strategy 3.2: Upscale conservation awareness and advocacy program				Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
	Action 3.2.1. Conduct awareness and waste campaigns among communities on wildlife poaching and need for conservation	Number of awareness conducted	1	No.	2	2	2	2	2	2	2	2	2	2
	Action 3.2.2. Celebrate important days like Wildlife Day, Elephant Day, Tiger Day/Ranger Day, Social Forestry Day and World Environmental Day with communities, schools and institutions to impart importance of conservation and information sharing	Number of celebrations	3	No.	4	4	4	4	4	4	4	4	4	4
	Action 3.2.3. Identify and support nature club in schools as ambassador of conservation and promote the corridor as living classroom	Number of schools supported	0	No.	0	2	0	2	0	2	0	2	0	2
	Action 3.2.4 Presentation and disseminating information on BC-03 Conservation Management plan to the public	Information disseminated in number of Gewogs	0	No.	4	0	0	0	0	0	0	0	0	0

					Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
4. Expand Knowledge Base on Species and Habitats	**Strategy 4.1: Study the Population status of different taxes through survey and research.**													
	Action 4.1.1 Conduct survey and research on keystone species (Elephants, Guar, Tiger, Hornbill, Dhole) and lesser-known species within BC to determine their status.	Number of surveys conducted	3	No.	0	2	2	0	0	0	0	0	0	0
	Action 4.1.2. Conduct biodiversity survey on Avian-fauna within the BC	Number of surveys conducted	1	No.	0	1	0	0	0	0	0	0	0	1
	Action 4.1.3. Conduct biodiversity survey on vegetation including NWFP within the BC	Number of surveys conducted	1	No.	0	1	1	0	0	0	0	0	0	0
	Action 4.1.4. Conduct survey on Herpeto-fauna within the BC	Number of surveys conducted	0	No.	0	1	0	0	0	0	0	0	0	0
	Action 4.1.5 Conduct survey on Butterflies and Moths within the BC	Number of surveys conducted	0	No.	0	1	0	0	0	0	0	0	0	0
	Action 4.1.6. Conduct survey on Fish diversity within the BC	Number of surveys conducted	0	No.	0	2	0	0	0	0	0	0	0	0
	Action 4.1.7. Habitat modeling for keystone species within BC	Map produced	0	No.	0	0	1	0	0	0	0	0	0	0
	Action 4.1.8. Conduct research	Number of reports	1	No.	0	0	1	0	0	0	0	0	1	0

	on the Impact of climate change on biodiversity within the BC													
	Action 4.1.9. Develop strategies, protocols, and control measures for invasive weeds within the BC	Number of strategies and protocol developed	0	No.	0	0	1	1	0	0	0	0	0	0
	Action 4.1.10. Publication of reports, books, Facts, and figure on each taxon	Number of publications	0	No.	0	0	0	1	0	0	0	0	0	0
	Strategy 4. 2: Generate information on dying water sources and wetlands				**Y1**	**Y2**	**Y3**	**Y4**	**Y5**	**Y6**	**Y7**	**Y8**	**Y9**	**Y10**
	Action 4.2.1. Conduct wetland inventories including water sources (rivers, spring, streams, waterholes, ponds, lakes, marshes, peat bogs) within the BC	Number of inventories conducted	0	No.	0	0	1	1	0	0	0	0	0	0
	Action 4.2.2. Identify degraded wetlands and develop protocols for revival and mitigation	No. of protocols developed	0	Nos	0	0	0	1	0	0	0	0	1	0

Annexures

1. List of trees/shrubs and herbs in Biological Corridor 03

Sl.no.	Species	Family	Life Form
1	*Acer campbellii*	Aceraceae	Tree
2	*Acer oblongum*	Aceraceae	Tree
3	*Ailanthus grandis*	Simaroubaceae	Tree
4	*Albizia spp*	Leguminosae	Tree
5	*Albizia lebbeck*	Melanthiaceae	Herb
6	*Alnus nepalensis*	Betulaceae	Tree
7	*Alstonia scholaris*	Gramineae	Grass
8	*Altingia excelsa*	Hamamelidaceae	Tree
9	*Amoora wallichii*	Zingiberaceae	Herb
10	*Baccaurea motleyana*	Gramineae	Grass
11	*Hovenia dulcis*	Gramineae	Shrub
12	*Bauhinia purpurea*	Leguminosae	Shrub/Tree
13	*Beilschemiedia sp*	Begoniaceae	Herb
14	*Betula alnoides*	Betulaceae	Tree
15	*Boehmeria glomerulifera*	Urticaceae	Shrub
16	*Bridelia retusa*	Euphorbiaceae	Tree
17	*Broapsis spp*	Gramineae	Grass
18	*Callicarpa arborea*	Verbenaceae	Tree
19	*Casearia graveolens*	Flacourtiaceae	Shrub/Tree
20	*Casearia glomerata*	Flacourtiaceae	Tree
21	*Castanopsis hystrix*	Fagaceae	Tree
22	*Castanopsis indica*	Fagaceae	Tree
23	*Castanopsis tribuloides*	Fagaceae	Tree
24	*Celtis tetrandra*	Ulmaceae	Tree
25	*Choerospondias axillaris*	Rosaceae	Shrub/Tree
26	*Chukrasia tabularis*	Meliaceae	Tree
27	*Cinnamomum bejolghota*	Lauraceae	Tree
28	*Cinnamomum cecidodaphne*	Lauraceae	Tree
29	*Cinnamomum glanduliferum*	Lauraceae	Shrub/Tree
30	*Cinnamomum spp*	Lauraceae	Tree
31	*Cordia myxa*	Boraginaceae	Tree
32	*Cordia obliqua*	Boraginaceae	Tree
33	*Croton caudatus*	Euphorbiaceae	Tree
34	*Dabanga grandiflora*	Gramineae	Grass
35	*Daphniphyllum chartaceum*	Gramineae	Grass
36	*Daphniphyllum himalayense*	Thymelaeaceae	Shrub
37	*Daubanga grandiflora*	Lythraceae	Tree
38	*Dillenia indica*	Dilleniaceae	Tree
39	*Diploknema butyracea*	Sapotaceae	Tree

40	*Elaeocarpus lanceifolius*	Elaeocarpaceae	Tree
41	*Endospermum chinense*	Compositae	Annual or perennial herb
42	*Engelhardia spicata*	Juglandaceae	Tree
43	*Erythrina arborescens*	Leguminosae	Tree
44	*Eurya acuminata*	Theaceae	Shrub/Tree
45	*Evodia meliaefolia*	Cruciferae	Herb
46	*Exbucklandia populnea*	Hamamelidaceae	Tree
47	*Ficus benghalensis*	Moraceae	Tree
48	*Ficus nemoralis*	Moraceae	Tree
49	*Ficus semicordata*	Moraceae	Tree
50	*Flueggea microcarpa*	Euphorbiaceae	Shrub
51	*Flueggea virosa*	Euphorbiaceae	Shrub
52	*Gmelina arborea*	Verbenaceae	Tree
53	*Abelmoschus esculentus*	Malvaceae	Herb
54	*Gynocardia odorata*	Flacourtiaceae	Tree
55	*Helicia erratica*	Compositae	Annual herb
56	*Helicia nilagirica*	Proteaceae	Tree
57	*Heynea Trijuga*	Meliaceae	Shrub/Tree
58	*Hydrangea heteromalla*	Hydrangeaceae	Bush/Tree
59	*Jambusa formosa*	Bignoniaceae	Tree
60	*Kalanchoe pinnata*	Crassulaceae	Herb
61	*Petroselinum crispum*	Umbelliferae	Herb
62	*Lagenaria siceraria*	Compositae	Biennial herb
63	*Lithocarpus spp.*	Fagaceae	Tree
64	*Litsea cubeba*	Lauraceae	Shrub/Tree
65	*Macaranga denticulata*	Euphorbiaceae	Tree
66	*Macropanax undulatus*	Araliaceae	Tree
67	*Magnolia pterocarpa*	Magnoliaceae	Tree
68	*Mangifera indica*	Anacardiaceae	Tree
69	*Mesa chiesa*	Araliaceae	Shrub
70	*Michelia cathcartii*	Rubiaceae	Tree
71	*Michelia spp.*	Magnoliaceae	Tree
72	*Miliusa macrocarpa*	Annonaceae	Tree
73	*Myrica esculenta*	Myricaceae	Tree
74	*Myrsine semiserrata*	Myrsinaceae	Tree
75	*Neolamarckia cadamba*	Rubiaceae	Tree
76	*Nyssa javanica*	Nyssaceae	Tree
77	*Oroxylum indicum*	Bignoniaceae	Tree
78	*Ostodes paniculata*	Euphorbiaceae	Shrub
79	*Persea fructifera*	Lauraceae	Tree
80	*Persea glaucescens*	Lauraceae	Tree
81	*Phoebe attenuata*	Lauraceae	Tree

82	*Prunus napaulensis*	Rosaceae	Tree
83	*Prunus undulate*	Rosaceae	Tree
84	*Pterospermum acerifolium*	Malvaceae	Tree
85	*Stercula villosa*	Sterculiaceae	Tree
86	*Pyrrhula edulis*	Pyrolaceae	Herb
87	*Quercus glauca*	Fagaceae	Tree
88	*Quercus lamellosa*	Fagaceae	Tree
89	*Quercus semecarpifolia*	Fagaceae	Shrub
90	*Quercus thomsoniana*	Fagaceae	Tree
91	*Baccaurea motleyana*	Phyllanthaceae	Tree
92	*Rhododendron kesangiae*	Ericaceae	Tree
93	*Rhus insignis*	Anacardiaceae	Tree
94	*Schima khasiana*	Theaceae	Tree
95	*Schima wallichii*	Theaceae	Tree
96	*Axonopus compressus*	Gramineae	Grass
97	*Cynodon dactylon*	Gramineae	Grass
98	*sigesbeckia orientalis*	Compositae	Annual herb
99	*Ageratum conyzoides*	Compositae	Annual herb
100	*Acmella uliginosa*	Compositae	Herb
101	*Symplocos lucida*	Symplocaceae	Tree
102	*Symplocos racemosa*	Symplocaceae	Shrub/Tree
103	*Symplocos spp.*	Symplocaceae	Tree
104	*Syzygium cumini*	Myrtaceae	Tree
105	*Syzygium operculatum*	Myrtaceae	Tree
106	*Terminalia myriocarpa*	Combretaceae	Tree
107	*Terminalia spp*	Combretaceae	Tree
108	*Terminalia tomentosa*	Combretaceae	Tree
109	*Tetradium fraxinifolium*	Rutaceae	Tree
110	*Tetrameles nudiflora*	Datiscaceae	Tree
111	*Toona ciliata*	Meliaceae	Tree
112	*Trevesia palmata*	Araliaceae	Tree
113	*Turpinia nepalensis*	Staphyleaceae	Tree
114	*Valiyakath*	Ericaceae	Shrub
115	*Viburnum erubescens*	Scrophulariaceae	Perennial herb
116	*Viburnum sp*	Scrophulariaceae	Perennial herb
117	*Wrightia arborea*	Apocynaceae	Tree
118	*Cymbidium aloifolium*	Orchidaceae	Orchid

2. List of mammal species of Biological Corridor 03

Sl.no	Scientific name	Species authority	Common name	Distribution	Family	IUCN	CITES
1	*Atherurus macrourus*	Linnaeus, 1758	Asiatic Brush-tailed porcupine	Ranibagantop, Tormey, Lampokharey	Hystricidae	LC	
2	*Hysterix bracyhura*	Linnaeus, 1758	Himalayan crestless porcupine	Jandadara, Labarbotrey	Hystricidae	LC	Appendix I
3	*Catopuma temmincki*	*Vigors and Horsfield, 1827*	Asiatic golden cat	Lompokharey, Tseshingpong	Felidae	NT	Appendix I
4	*Neofelis nebulosa*	Griffith, 1821	Clouded leopard	Galechu, Jorphokhari, Samtenling top, Dawralidara	Felidae	VU	Appendix I
5	*Panthera pardus*	Linnaeus, 1758	Common Leopard	Kutikeydara	Felidae	VU	
6	*Prionailurus bengalensis*	*Kerr ,1792*	Leopard cat	Labarbotrey, Lampokhoarey, Nilpokhari	Felidae	LC	Appendix II
7	*Parofelis marmorata*	*Martim, 1837*	Marbled cat	Tsishingpong, Dhapdara, Malidara, Jandaydara	Felidae	NT	
8	*Panthera tigris*	*Linnaeus, 1758*	Tiger	Gopidara, Jandedara, Dawnidhap, Labarbotrey, Chitridara	Felidae	EN	Appendix I
9	*Cuon alpinus primaevus*	*Pallas, 1811*	Wild dog	Jandeydara, Lampokhari, Ranidunga, Charadey, Paspaley, Rateykhar	Canidae	EN	Appendix II
10	*Ursus thibetanus laniger*	*Cuvier ,1823*	Himalayan black bear	Jandeydara, Lampokhari	Ursidae	VU	Appendix I
11	*Elephas maximus*	Linnaeus, 1756	Asian Elephant	Lampokhari, Labarbotrey	Proboscidea	EN	Appendix I
12	*Muntiacus mutjak*	*Zimmermann, 1780*	Barking deer	Lampokhari, Ranidunga, Bakutidrangra, Labarbotrey, Charadey, Melidara, Jandeydara, Tsishingpong	Cervidae	LC	
13	*Bos gaurus*	C.H.Smith, 1827	Guar	Rateykhar, Bakutidrangra	Cervidae	VU	Appendix I
14	*Nemorhaedus goral*	*Hardwicke, 1825*	Himalayan goral	Ranibagantop, Tormey,Charadey, Dhaptop, Melidara	Cervidae	NT	Appendix I
15	*Capricornis sumatraensis thar*	*Hodgson, 1831*	Himalayan serow	Ranibagantop, Tormey,Charadey, Dhaptop, Melidara	Cervidae	VU	Appendix I

16	*Cervus unicolor*	*Kerr, 1792*	Sambar	Jandadara, Labarbotrey, Dawnidhap, Charadey based, Melidara, Rateykhar	Cervidae	VU	
17	*Sus scrofa*	*Linnaeus, 1758*	Wild Boar	Jandaydara, Charadey, Lampokhari, Nilpokhari	Suidae	LC	
18	*Ratufa bicolor*		Malayan giant squirrel	Tsishingpong, Tormaphu	Pteromyidae	NT	Appendix II
19	*Dremomys lokriah*	*Hodgson, 1836*	Orange-bellied squirrel	Nilpokhari, Above Saundaley	Sciuridae	LC	
20	*Callosciurus pygerythrus*	*Geoffroy Saint-Hilaire, 1831*	Hoary-bellied squirrel	Dewnidhap, Nilpokhari	Sciuridae	LC	Appendix II
21	*Callosciurus erythraeus*	*Pallas, 1799*	Pallas squirrel	Nilpokhari, Charedey	Sciuridae	LC	
22	*Macaca assamensis*	*M'clelland, 1840*	Assamese macaque	Rateykhar, Ranidunga, Loringtop, Labarbotrey	Cercopithecidae	NT	Appendix II
23	*Macaca mulatta*	*Zimmermann, 1780*	Rhesus macaque	Labarbotrey, Laringtop, Rateykhar	Cercopithecidae	LC	Appendix II
24	*Trachypithecus geei*	*Khajuria, 1956*	Golden langur	Nilpokhari, Charadey, Melidara, Galechu	Cercopithecidae	EN	Appendix I
25	*Martes flavigula*	Bodaert, 1785	Yellow-throated marten	Tseshingpong, Dhapdara	Mustelidae	LC	
26	*Paguma larvata*	*C.E.H.Smith, 1827*	Himalayan Palm civet	Gophidara, Jandeydara,	Viverridae	LC	

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