CONSERVATION MANAGEMENT PLAN
BIOLOGICAL CORRIDOR 4
(*Connecting PNP-JSWNP-RMNP***)**

(January 2023 – December 2032)

Department of Forests and Park Services
Ministry of Energy and Natural Resources
Royal Government of Bhutan

CONSERVATION MANAGEMENT PLAN
BIOLOGICAL CORRIDOR 4
(*Connecting PNP-JSWNP-RMNP***)**

(January 2023 – December 2032)

Divisional Forest Office, Zhemgang
Department of Forests and Park Services
Ministry of Energy and Natural Resources

Plan prepared by:

1. Phub Dorji, Sr. Forestry Officer
2. Om Nath Raika, Sr. Forest Ranger III
3. Rita Bdr Powrel, Forest Ranger I

Critical inputs and edited by:

1. Sonam Wangdi, Chief Forestry Officer, NCD
2. Namgay Bidha, Deputy Chief Forestry Officer, NCD
3. Namgay Wangchuk, Senior Forestry Officer, NCD
4. Tshering Pem, Senior Forestry Officer, NCD
5. Letro, Senior Forestry Officer, NCD
6. Tandin, Senior Forestry Officer, NCD
7. Ngawang Gyeltshen, Deputy Chief Forestry Officer
8. Sonam Penjor, Senior Forestry Officer, NCD
9. Gem Tshering, Sr. Forest Ranger I
10. Kezang Wangmo, Sr.Forestry Officer, ZFD
11. Jangchu Wangdi, Sr. Forestry Officer, ZFD
12. Tendrel Zangpo, Sr. Forest Ranger III, ZFD
13. Sonam Phuntsho, Sr. Forest Ranger III, ZFD
14. Indra Kumar Darjee, Forest Ranger I, ZFD
15. Thinley Wangchuk, Forest Ranger II, ZFD
16. Thinley, Forest Ranger II, ZFD

Suggested citation:
Zhemgang Forest Division (2023), Conservation Management Plan of Biological Corridor 4 (January 2023 to December 2032). Department of Forests and Park Services, Ministry of Agriculture and Forests, Royal Government of Bhutan, Zhemgang.

Contact:
Zhemgang Forest Division, Department of Forest and Park Services, Ministry of Agriculture and Forests, Zhemgang.
Post Box: 394
Telephone: +975 3741205
Email: dfozhemgang@gmail.com

ISBN: 978-99980-776-1-4

Layout, design and printed @ Bhutan Printing Solution

གཞང་སྒེ་ནགས་ཚལ་ཡིག་ཚང་། གཞལམ་སྒང་།

ZHEMGANG FOREST DIVISION

DEPARTMENT OF FORESTS AND PARK SERVICES

ZHEMGANG

"Managing Bhutan's Natural Heritage"

ENDORSEMENT AND APPROVAL OF ROYAL GOVERNMENT OF BHUTAN

Conservation Management Plan of Biological Corridor 4 (2023-2032)

"In accordance with the provisions under Section 21 subsection (b) of Forest and Nature Conservation Act of Bhutan 1995"

Submitted for Approval:

(Tashi Wangchuk)
Offtg. Chief Forest Officer
Zhemgang Forest Division

Reviewed by:

(Sonam Wangdi)
Chief Forestry Officer
Nature Conservation Division

Recommended for Approval:

DIRECTOR
Department of Forests and Park Services

Approved by:

SECRETARY
Ministry of Energy and Natural Resources

Forward

Bhutan has one of the most extensive protected area networks in the world. More than 50% of the country is designated as national parks, wildlife sanctuaries, strict nature reserves and biological corridors. Learning from experiences of other countries, where most of the protected areas eventually became isolated spots for biodiversity conservation and reduction in the natural range of wildlife, the biological corridors linking the national parks and wildlife sanctuaries make protected areas in Bhutan more encompassing and holistic.

To ensure biological corridors maintain ecological balance by enhancing gene flow and wildlife movement between the protected areas, it is essential to have management plans to guide the biological corridors' management. Therefore, Zhemgang Forest Division (ZFD) has prepared the Conservation Management Plan for biological corridor 4 (BC4) for the next ten years to achieve these objectives.

BC4, a wide altitudinal variation from as low as 228 meters above sea level (masl) of the sub-tropical regions to as high as 4570 masl at Bridungla, is rich in floral and faunal diversity. The recent Rapid Biodiversity Assessment (RBA), other biological surveys and opportunistic records have confirmed the presence of 495 species of vascular plants, 40 species of mammals, and 305 species of birds; many of these are globally threatened. The current corridor management plan is a long-awaited document to foster further the needs of managing the critical wildlife habitat and ensuring co-existence between nature and people living inside the corridor.

The plan spans over ten years (January 2023 – December 2032). The majority of the funds for implementing the plan will be met by Bhutan for Life (BFL), supplemented by the Royal Government of Bhutan (RGoB) and other potential donors like the Bhutan Trust Fund for Environmental Conservation (BTEC), Global Environmental Facility of the United Nations Development Programme (GEF/UNDP), Royal Society for Protection of Nature (RSPN), and WWF Bhutan.

Lastly, on behalf of the Ministry of Agriculture and Forests (MoAF) and my behalf, I would like to express my profound appreciation to ZFD and the stakeholders involved for the commendable outputs, and I would like to urge the Division management to implement the conservation management plan with complete dedication and sincerity.

Tashi Delek

(Lobzang Dorji)
Director
Department of Forest and Park Services

Acknowledgment

The management of ZFD expresses our sincere and deep-felt gratitude to the DoFPS for assigning us to carry out the management planning for the BC4, which is an invaluable impetus for the division to gain experience in the BC plan development. Having gained such an opportunity to develop the BC plan, the division is confident to take further such plan in the future as per the Forest Management Code of Bhutan 2020 and Biodiversity Monitoring and Social Survey Protocol of Bhutan 2020 (BMSSPB).

We are greatly indebted to NCD for their valuable technical support in developing this conservation management. Gratitude is also due to the forestry officials from ZFD who contributed immensely in gathering, analyzing/interpreting the field data and writing the plan. Finally, we also thank our stakeholders for their valuable support, comments, and guidance while developing this plan.

Finally, we offer our undivided gratitude to every individual for their generous assistance, directly or indirectly, in developing the BC4 conservation management plan successfully. The plan is developed with funding support from GEF-LDCF NAPA III, for which we are very grateful.

Table of Contents

List of tables and figures

Tables

Figures

Acronyms and Abbreviations

BFL	Bhutan for Life
BTFEC	Bhutan Trust Fund for Environment Conservation
BMSSPB	Biodiversity Monitoring and Social Survey Protocol of Bhutan
BMG	Biodiversity Monitoring Grid
BC4	Biological Corridor 4
CVCA	Climate Vulnerability and Capacity Analysis
CF	Community Forest
CATS	Conservation Assured Tiger Standard
CITES	Convention on International Trade in Endangered Spices of Wild Flora and Fauna
CBL	Cool Broad Leaved
DoFPS	Department of Forest and Park Services
DBH	Diameter at Breast Height
EN	Endangered
FMCB	Forest Management Code of Bhutan
GC	Geog Centre
GEF	Global Environment Facility
GCF	Green Climate Fund
Ha	Hectare
HWC	Human Wildlife Conflict
IUCN	International Union for Conservation of Nature and Natural Resources
JSWNP	Jigme Singye Wangchuck National Park
km	Kilometre
LULC	Land Use Land Cover
LMFP	Local Forest Management Plan
METT+	Management Effectiveness Tracking Tools Plus
masl	Meters above sea level
M	Mode
NBC	National Biodiversity Centre
NCD	Nature Conservation Division
NT	Near Threatened
Nu	Ngultrum
NWFP	Non-Wood Forest Produce
n	Number
PNP	Phrumsengla National Park
PHCB	Population and Housing Census of Bhutan
PA	Protected Area
RBA	Rapid Biodiversity Assessment
RBA%	Relative Basal Area Percentage
RMNP	Royal Manas National Park
RSPN	Royal Society for Protection of Nature
SE	Sampling Error
SD4C	Social Development for Conservation

SES	Socio-Economic Survey
SMART	Spatial Monitoring and Reporting Tool
sqkm	square kilometre
SD	Standard Deviation
SRF	State Reserved Forest
TFD	Territorial Forest Division
T	Threatened
UWICER	Ugyen Wangchuk Institute for Conservation and Research
UNDP	United Nations Development Program
VU	Vulnerable
WBL	Warm Broad Leaved
WBH	White Bellied Heron
WWF	World Wildlife Fund
ZFD	Zhemgang Forest Division
LFMA	Local Forest Management Area

Executive Summary

The conservation of corridors forms an integral part of the Protected Area (PA) System as Biological Corridors (BC) connect PAs for their vitality through the movement/flow of biodiversity (plants and animals). Therefore, the development of the first corridor conservation management plan for BC4 is expected to provide a holistic framework for implementing activities toward the conservation and management of the corridor.

Biological corridor 4 (BC 4), with an area of 594.65 sq. km, is the largest among the eight biological corridors in Bhutan. BC4 is mainly designed to provide a wildlife corridor between three national protected areas of Royal Manas National Park in the south, Phrumsengla National Park to the north, and Jigme Singye Wangchuck National Park to the northwest. The corridor provides a breeding habitat and movement corridor for Royal Bengal Tiger. In addition, it also hosts many threaten flora and fauna. The lowest elevation is 228 masl, and the highest is 4570 masl. As per the land use and land cover in 2016, most of the corridor area is dominated by broad-leaved forest.

Preparation of the BC4 conservation management plan was first initiated in 2016, but the plan remained in draft form and never materialized. The current conservation management plan is prepared for ten years (2023 to 2032) which is based on the findings of a robust assessment of biodiversity and socio-economic status of local communities conducted in the year 2022, and it is supported by the findings of the first draft plan, and biodiversity assessment carried out by PNP in 2006.
BC4 recorded 485 flora species belonging to 301 genera and 128 families. Additionally, there are 37 species of mushrooms, 38 species of Ferns, and 129 species of orchids recorded in the BC4. Four species of plants and three species of orchids were discovered as new to the flora of Bhutan, and one species of *Begonia* as new to science from the corridor. The corridor is home to 40 mammals, which includes 18 species of threatened mammal species, including the charismatic Royal Bengal Tiger. A total of 305 species of birds belonging to 61 families were recorded in the BC4, of which nine species of birds are globally threatened, including the critically endangered White-bellied Heron. A total of 65 species are migratory birds. The corridor also recorded 15 species of damselflies, eight species of dragonflies, 23 species of snakes, 150 species of butterflies, 36 species of moths, and three species of frogs. The corridor has local communities living inside and in the buffer of the corridor. Itinerant herders also herd their cattle inside the corridor pastures.

Threat analyses were carried out using Miradi-4.5.0 in consultation with the field forestry staff, and we were able to identify10 significant threats. Human-wildlife conflict, wildlife poaching and illegal collection of forest resources are top-ranked threats. Therefore, goals, objectives, strategies and actions were incorporated to address threats and enhance conservation in the corridor. There are two goals with five objectives, 13 strategies and 49 actions for the better protection and conservation of the corridor under this conservation plan period.

Chapter I: Introduction

1.1. History of BC 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 Protected Area (National Parks, Wildlife Sanctuaries, and 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 within the Territorial Forest Divisions (TFD). Initially, the status of Biological Corridors was also set above State Reserved Forests (SRF) but below that of Protected Areas. However, recognizing the importance of Biological Corridors, the Forest and Nature Conservation Rules and Regulations of Bhutan (2017) now provide the Biological Corridors with equivalent legal protection status as the other protected areas. There are 8 BCs in the country, which connect the national parks, wildlife sanctuaries and strict nature reserve, forming the critical Bhutan Biodiversity Conservation Complex.

1.2. Brief functions of the BC

Biological Corridors are generally 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 mainly meant to connect habitats for the "effective conservation of populations, community and the 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 focus 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.

The Biological Corridor 4, which connects the Jigme Singye Wangchuck National Park, Royal Manas National Park and Phrumsengla National Park, provides a wildlife movement corridor to several threaten wildlife species, including Royal Bengal Tiger as the key species using the corridor. The corridor also provides a breeding habitat for Tigers and White Bellied Heron.

1.3. Basic information about the Biological Corridor

BC4 is the most significant biological corridor in Bhutan, covering an area of 594.65 sq. km and 40 km in length. The corridor connects Royal Manas National Park in the south, Phrumsengla National Park in the north, and Jigme Singye Wangchuck National Park in the west. The biological corridor covers three gewogs under Zhemgang Dzongkhag and a gewog under Trongsa Dzongkhag (Figure 1). The majority of the BC4 area falls under Zhemgang Forest Division, with 18.1% (107.98 sq. km) within Bumthang Forest Division. Human settlements inside the corridor are scattered in the corridor's eastern, southern, and north-western parts. Trongsa to Zhemgang national highway runs through the corridor from Dangdung bridge to Wangdigang bridge. The road connecting the middle and upper Kheng passes at the middle of the corridor.

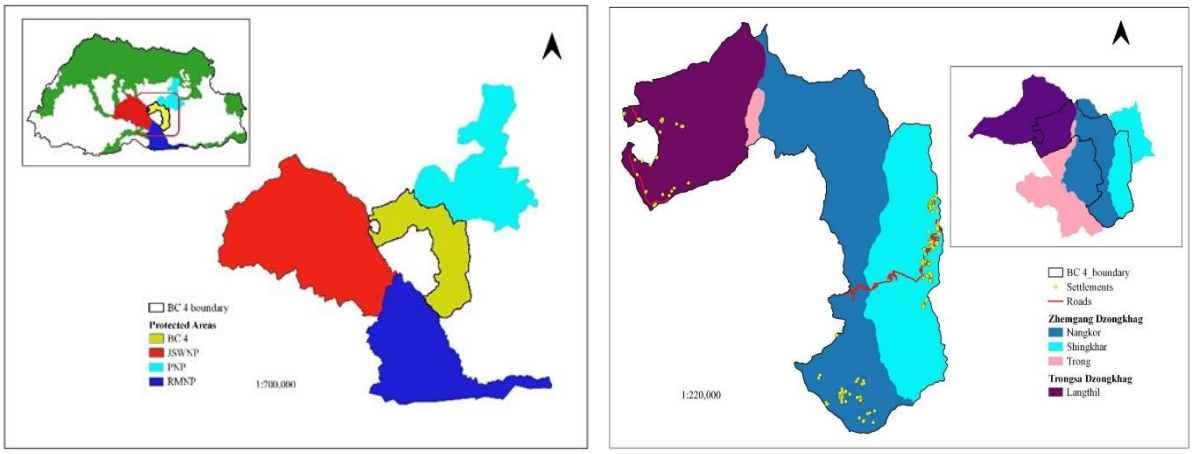


Figure 1.Administrative Map of BC4

1.4. Vision, mission, goals and objectives

Vision

Ensured structural and functional connectivity between protected areas for secured wildlife movement and gene flow.

Mission

To guarantee structural and functional connectivity between the three protected areas of PNP, JSWNP and RMNP through enhanced biodiversity conservation while ensuring human well-being via community stewardship conservation.

Goals

- To maintain and enhance ecological connectivity through the protection and conservation of biodiversity
- Support community well-being through community participation in conservation

Objectives

1. To secure and improve wildlife habitats for ensuring proper ecosystem functioning
2. To protect and conserve wildlife species.
3. To strengthen institutional capacity for effective management and protection of the corridor
4. To create climate-resilient local communities.
5. To reduce Human-wildlife conflict and enhance community livelihood.

Chapter II Current status

2.1.Physical features

2.1.1. BC4 boundary description.

The BC4 is located between the longitudes 90º35'22.14" E and 90º56'49.83" E and latitudes 27º23'5.66" N and 27º1'2.15" N.

The boundary begins at the river confluence of *Mangdechu* and *Chamkharchu* in the south at a latitude and longitude of 27°1'6.82 "N and 90°50'22.48 "E. Eastern part of the corridor follows along *Chamkharchu* till it meets with Phrumsengla National Park boundary at latitude and longitude of 27°17'34.47 "N and 90°55'47.80 "E at Shingkhar towards North. From that point, the corridor is aligned with the boundary of Phrumsengla National Park till it bifurcates with Phrumsengla National Park boundary at latitude and longitude of 27°23'5.91 "N and 90°45'2.84 "E at Bridingla top towards North West. The boundary then enters inside the jurisdiction of Bumthang Forest Division. It continues along *Brindingla* ridge till it reaches a latitude and longitude of 27°23'7.74 "N and 90°43'20.75 "E towards the North, and from there, the boundary proceeds down towards West along the *Moyamchu* in the upper part and *Thasachu* in the lower part till it reaches with 32 KB power transmission line A at *Dangdung*.

After connecting with 32 KB power transmission line A at a GPS location of 27°19'58.44 "N and 90°36'20.12 "E, the boundary runs south along 32 KB power transmission line A. Upon reaching a latitude and longitude of 27°18'46.55 "N and 90°36'35.68 "E at *Koshala*, it turns West till it meets *Mangdechu* River. After reaching *Mangdechu* river at 27°18'34.30 "N and 90°35'26.25 "E, it turns toward the south and proceeds along *Mangdechu* and upon covering 2.12 kilometres, the boundary forms zig at 27°17'34.76 "N and 90°35'47.19 "E, and it runs towards East along the gorge. The boundary follows this gorge, and upon meeting with the 32-power transmission line A at 27°18'0.87 "N and 90°37'5.78 "E, it turns south and follows till it reaches *Pangzur* ridge at 27°15'32.37 "N and 90°37'25.77 "E. Upon reaching *Pangzur* ridge it forms zig and proceeds towards West along *Pangzur* ridge and connects with *Mangdechu* River again. From this, the boundary runs along *the Mangdechu* river till it reaches *Mangdechu* and *Wangdigang* river confluence at 27°13'7.10 "N and 90°37'12.47 "E. On the other side of the *Mangdechu* river is Jigme Singye Wangchuck National Park. This stretch of the boundary from Dangdung to *Pangzur* ridge forms a bottleneck and lies close to the villages of Baling, *Pangzur* and *Khoshala*.

From the river confluence of *Mangdechu* and *Wangdigangchu*, the boundary follows *Wangdigangchu* river towards North East, and upon reaching the location of 27°16'26.68 "N and 90°43'38.26 "E, the boundary gets diversion towards East, and after making two zigs, it reaches *Tongkola* at 27°16'33.39 "N and 90°47'39.00 "E. From *Tongkola*, it turns towards the south and follows along *Tongkola* and *Nang* ridge. It makes zigs at 27°12'34.10 "N and 90°48'29.63 "E towards the South, and it passes through *the Pangbra* plateau and then transverses across *Burgoanchu* river and proceeds towards South East in proximity to *Buli* village. Upon reaching *Gonglathang* at 27° 8'47.09 "N and 90°50'23.80 "E, it turns towards South West and follows along a small stream. After reaching *Ngakhar* farm road at 27° 8'19.53 "N and 90°48'58.39 "E, it changes its direction towards South from South West, and after making one zig, the boundary reaches *Ngakhar* ridge at 27° 7'6.75 "N and 90°50'6.66 "E. From this point, the boundary changes its direction towards South West again along *Tsaidang* ridge, and it meets with *Mangdechu* river at 27° 4'53.13 "N and 90°46'46.33 "E. From

this point, the boundary changes towards South East following *Mangdechu* and ends its boundary at *Mangdechu* and *Chamkharchu* river confluence.

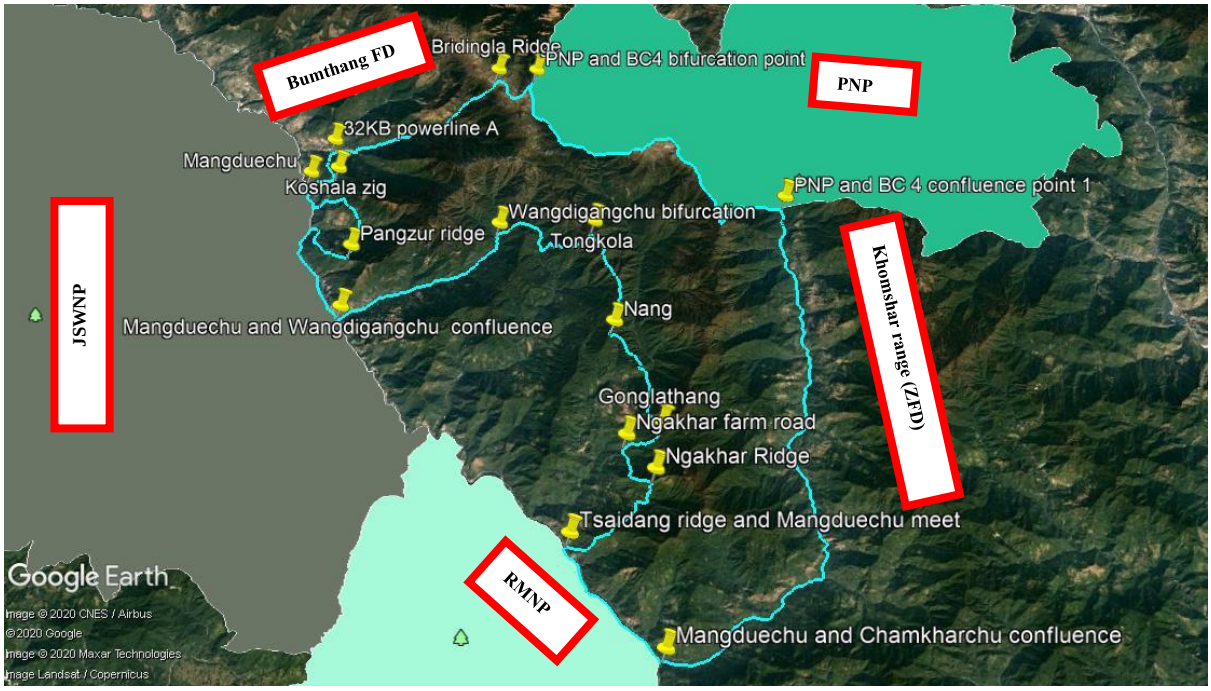


Figure 2. BC4 Boundary map

2.1.2. Topography and slope

The slope classification of the corridor is based on the standard adopted for developing Local Forest Management Plans (LFMP) in Bhutan. The slope is classified into three categories based on the steepness of the slope; 0-35 degrees as a gentle slope, 35-45 degrees as moderately steep, and more than 45 degrees as a steep slope (Figure 3). The biological corridor area is characterized by a 60% gentle slope, 28% moderately steep slope, and 12% steep slope.

The elevation of the corridor ranges from 228 masl to 4570 masl, and it is classified into four major categories (Figure 4). Most of the corridor area falls between the elevation range of 1000 to 2500 masl. A significant portion of the biological corridor area has south-facing slopes followed by north-facing slopes, west-facing slopes, and least with east-facing slopes (Figure 5).

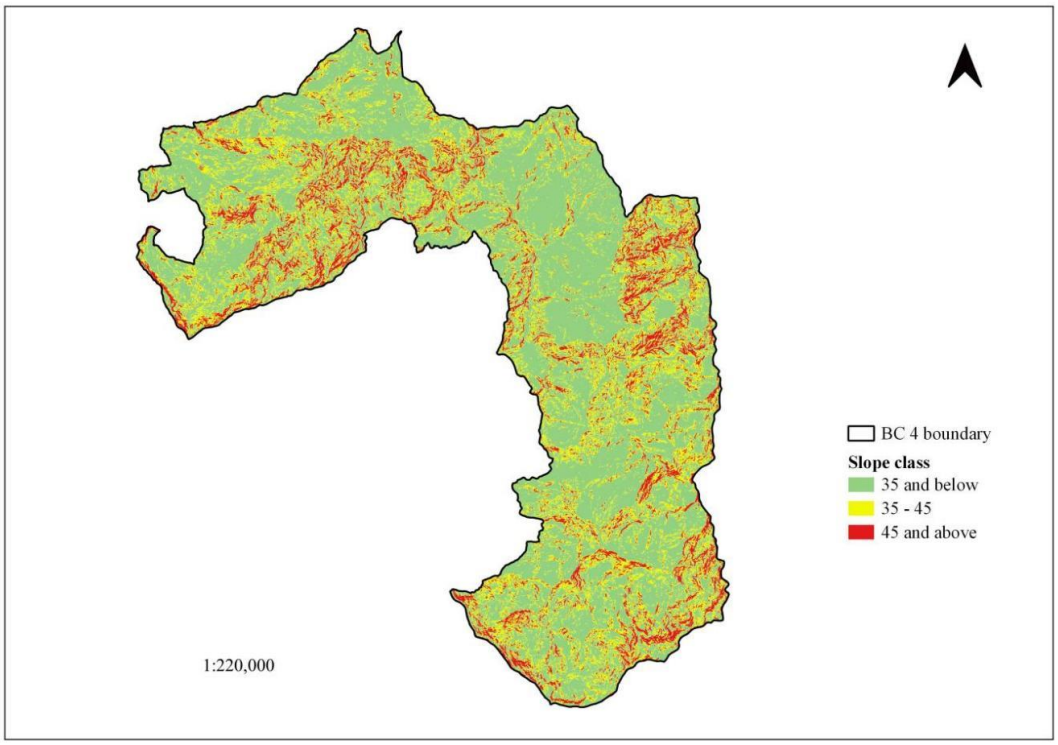


Figure 3. Slope classification of the corridor

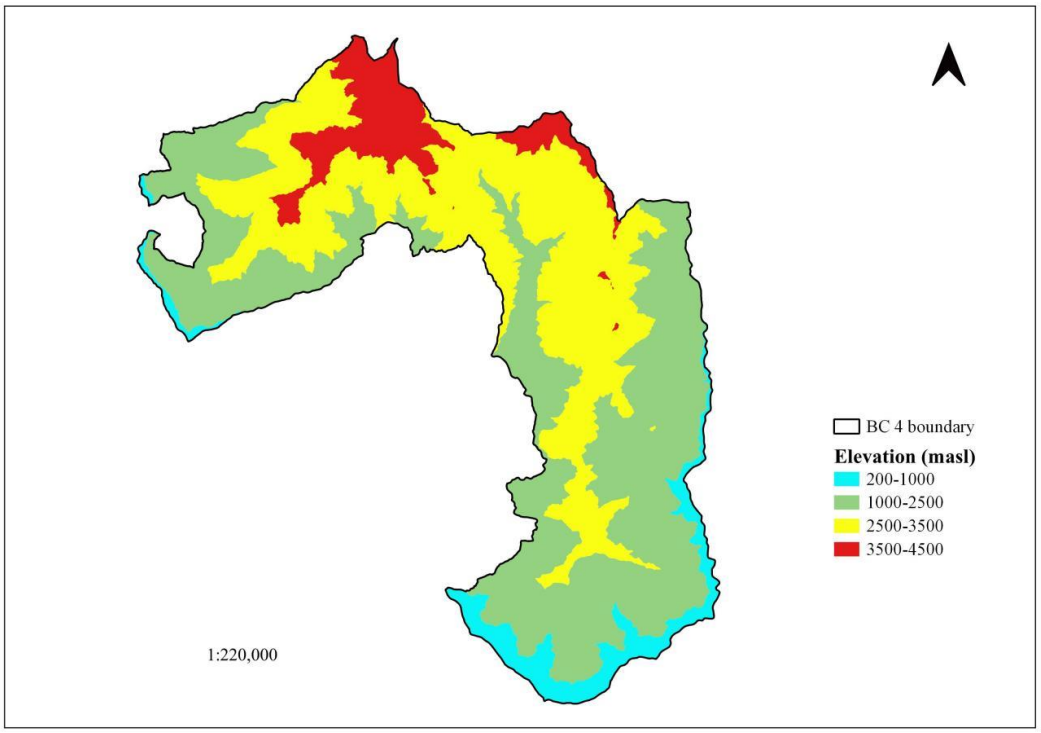


Figure 4. Elevation classification of the corridor

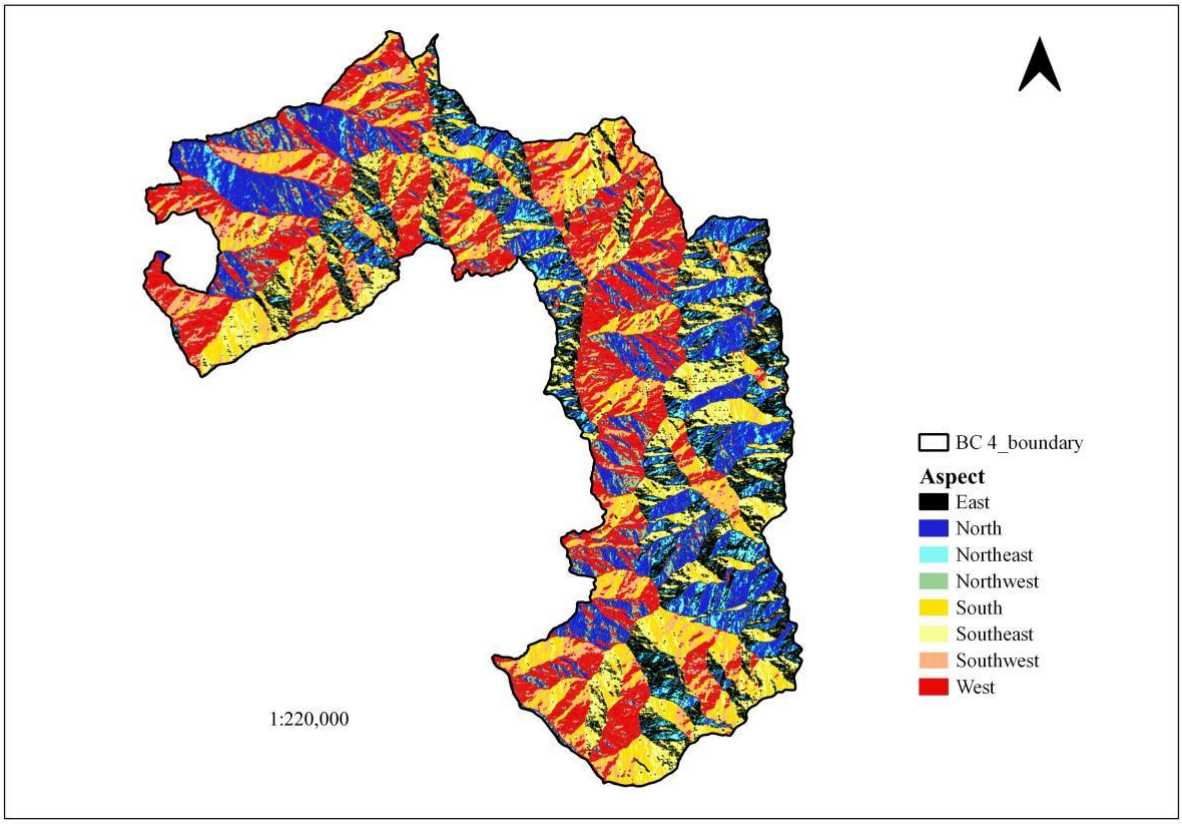


Figure 5. Aspect classification of the corridor

2.1.3. Drainage

There are major and minor rivers, as well as multiple seasonal streams flowing through the corridor catchment area. The corridor is prominently bordered by major rivers, *Mangduechu* and *Chamkharchu*. While the *Mangdechu* river basin borders the corridor with JSWNP in the north and RMNP in the south, the *Chamkharchhu* forms the eastern and southern boundary of the corridor.

The major rivers originate from beyond the corridor boundary, while the source of minor rivers (*Burgongchhu* and *Wangdigangchhu*) and all the seasonal streams emerge within the corridor. Further, there is an upcoming Hydro Project along the *Burgongchhu* basin (Between *Buli* and *Ngakhar* villages (Figure 6). The river source and upstream tributaries feed the river basin and emerge from within the corridor area. Hence, it is imperative to conserve upstream catchment for the sustainability of the hydropower plant and induce minimal impact on the biological corridor and the surrounding environment.

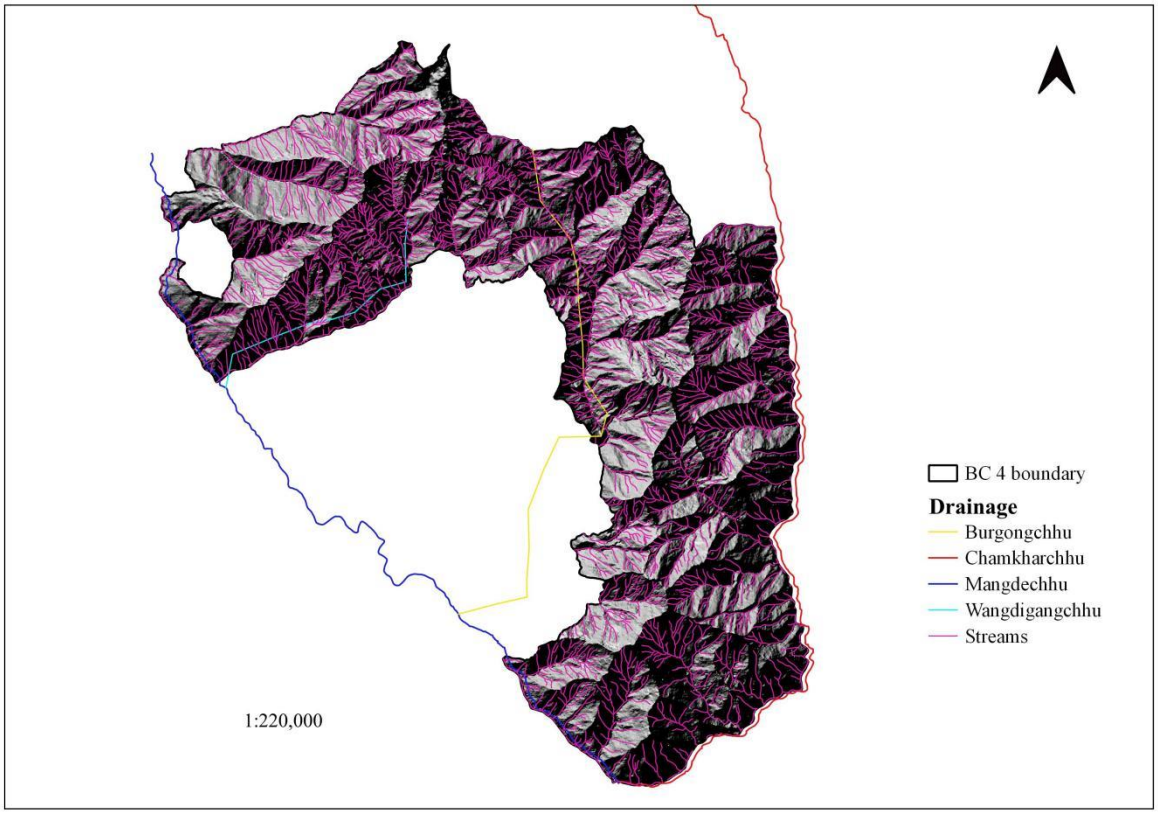


Figure 6. The drainage system of the corridor

2.2. Biological features.

2.2.1. Vegetation and Forest Types.

The corridor straddles two bio-geographic realms; the Indo-Malayan realm of Sub-tropical forest and the Palearctic realm of conifer forests and alpine meadows. Vegetation types of the corridor are classified into three major zones: the sub-tropical zone, temperate zone and alpine zone, based on the National Biodiversity Strategies and Action Plan, 2014. Three major vegetation types were determined in the corridor to determine the biodiversity status (Table 1). The forest type includes Warm Broad-Leaved Forest (WBL), Cool Broad-leaved Forest (CBL), Chirpine Forest (CF) and Fir Forest (FF)

Table 1: Vegetation type classification of the corridor

Eco-floristic zone (Ecological zone)	**Forest type (NBC 2014)**	**Vegetation type (Oshawa 1987)**	**Elevation range**
Sub-Tropical Zone Altitude – (150-2,000 masl)	**Warm broadleaved forest**	Warm temperate forest	less than 2000
Temperate Zone Altitude – (2,000-4,000 masl)	**Cool broadleaved forest**	Cool temperate	2000 to 3000
Alpine zone (>4000 masl)	**Fir Forest**	Subarctic	More than 3000

Forest types of the corridor are classified into four major types based on the Land Use Land Cover (LULC) 2016. A more significant portion of the area is dominated by broad-leaved forest followed by mixed conifer, Fir, and Chirpine (Figure 7). All the human settlements are in the broad-leaved forest, and the Chirpine forest is present only in a small patch at *Radhi, Nimshong, Reotala,*

Pangzur and *Koshala* chiwog. There is no settlement inside the mixed conifer and Fir Forest.

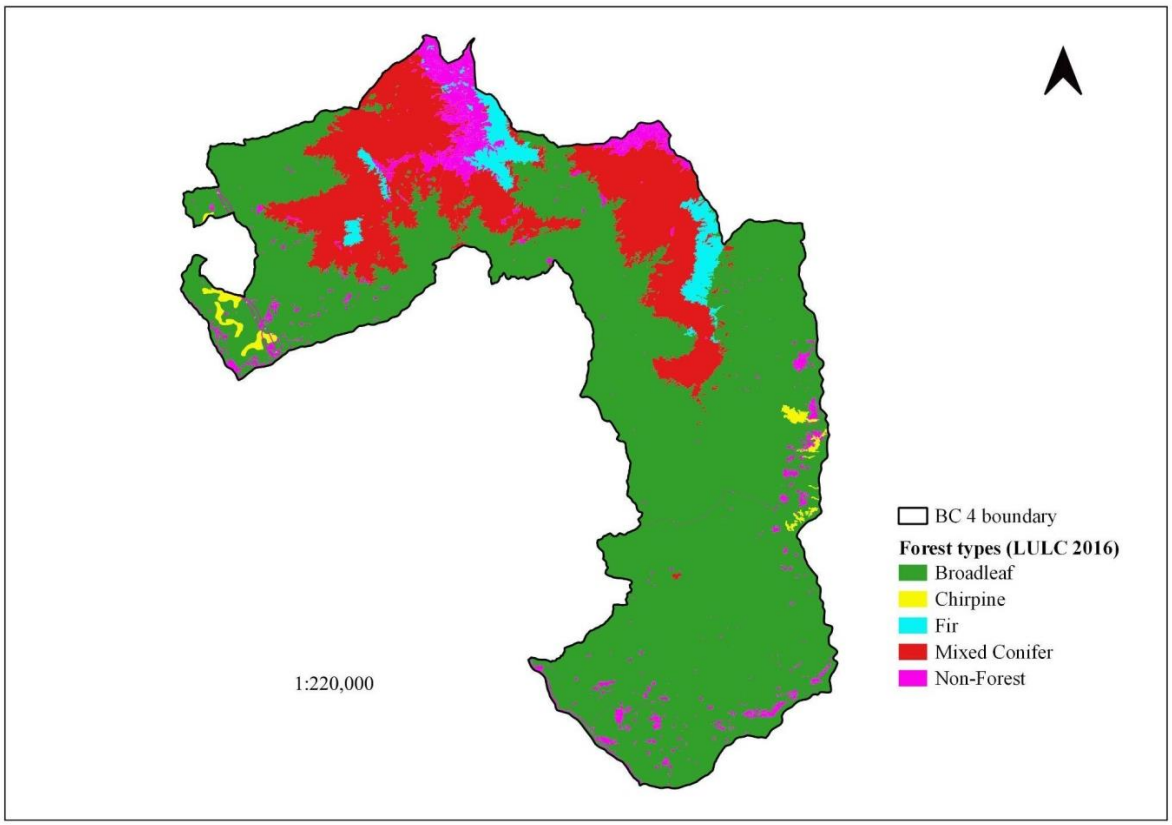


Figure 7. Forest types of the corridor

2.2.2. Flora Diversity.

The corridor recorded 485 flora species (excluding Orchids and Ferns) belonging to 128 families and 301 genera (Annexure 1). The five species are endemic to Bhutan, four species of plant and three species of orchid were discovered as new to the flora of Bhutan, and one Begonia species was discovered as new to science from the corridor (Table 7).

Table 7: New plant discoveries from the corridor

Habit	Year recorded	Scientific name	Remarks
Herb	2020	*Begonia flaviflora hara*	*New to Bhutan*
		Begonia gemmipara	*New to Bhutan*
		Impatiens sikkimensis	*New to Bhutan*
	2021	*Begonia bhutanensis*	*New to Science*
		Impatiens pseudolavigata	*New to Bhutan*
Orchid	2019	*Panisea panchaseensis*	*New to Bhutan*
		Plathanthera dunglonggenisis	*New to Bhutan*
	2020	*Bulbophyllum andersonii*	*New to Bhutan*

Based on the Rapid Biodiversity Assessment (RBA) survey following the prescribed survey protocol (DoFPS, 2020) by enumeration of 28 plots (20x20m) in 14 sample grids, the corridor is dominated by *Symplocos ramosissima* with IVI of 24.4, followed by *Rhododendron grande* (IVI=14.6) and *Castanopsis tribuloides* (IVI=11.9). Among the families, Symplocaceae recorded the highest

number (172) of trees/shrubs, followed by Fagaceae and Ericaceae. Based on the calculated relative basal area (RBA%), trees in the corridor are dominated by *Castanopsis tribuloides* (11.1%), followed by *Altingia excelsa* (7.7%) and *Michelia doltsopa* (7.3%). The RBA% of the family is dominated by Fagaceae (23.2%), followed by Magnoliaceae (13.9%) and Pinaceae (8.6%). The Shannon diversity index was highest for the CBL forest, which is similar to the diversity index of the WBL forest. Fir forest has the lowest diversity index (Table 2).

Table 2: Diversity indices for trees/shrubs in the corridor

Forest Type	S	N	Shannon wiener index(H)	Species richness	Evennes s index	Index of Dominance
WBL forest	54	2767	-3.10	15.40	-1.79	0.08
Fir forest	10	795	-1.46	3.10	-1.46	0.33
CBL forest	53	3885	-3.23	14.49	-1.87	0.07

WBL forest and CBL has 20 species in common and has a similarity index of 0.37, which indicates that CBL and WBL have a similar species composition. CBF and Fir Forest share six species in common and are 81% dissimilar. WBL and Fir Forest have the lowest similarity index with 0.06, with only two species in common.

Table 3: Index of similarity and dissimilarity

Forest type	No. of common species	Similarity index	Dissimilarity index
WBL -CBL	20	0.37	0.63
CBL-FF	6	0.19	0.81
WBL-FF	2	0.06	0.94

The physical conditions of trees and shrubs were assessed visually; the majority (71%) of trees and shrubs in the corridor are healthy, and 18% are leaning. A total of 119 regenerations were recorded from 35 species of trees. Regeneration was dominated by *Persea clarkeana* (17%), followed by *Symplocos sumuntia* (14%) and *Symplocos ramosissim*a (14%). Symplocaceae followed by Lauraceae and Fagaceae have the more significant portion of regenerations.

Cluster Analysis using PC-ORD 5 software grouped the homogenous plant communities into a cluster of forest zones by species similarity index value (%) in the dendrogram. The similarity index of 25% was performed for the species using the Relative Basal Area for the species gathered from 14 sample grids spread across the corridor. The cluster analysis at the 25% similarity index revealed four distinct clusters or zones of forest (Figure 8). Cluster I is located between the elevation range of 1370 to 1561 masl at the lower part of BC 4. This cluster is dominated by *Altingia excelsa*, *Casearia glomerata*, and *Boehmeria platyphylla*. Cluster II of the forest type is dominated by *Symplocos ramosissima* followed by *Pinus roxburghii* and *Quercus grifithii*, located between 1547 to 2241 masl. Grid 1505 was combined with the other two grids in the same cluster at a 52% similarity index, which was contributed by similar possession of *Quercus griffithii*. Cluster III is clustered between the elevation of 1218 to 3460 mals, which is contributed by the dominance of *Persea clarkeana, Symplocos ramossima, Rhododendron grande, Quercus lamellosa* and *Quercus oxyodon*. Cluster IV is dominated by *Symplocos sumentia* followed by *Myrsine semiserrata, Symplocos ramossissima* and *Liphocarpus elegans*, which is clustered between 1154 to 2992.

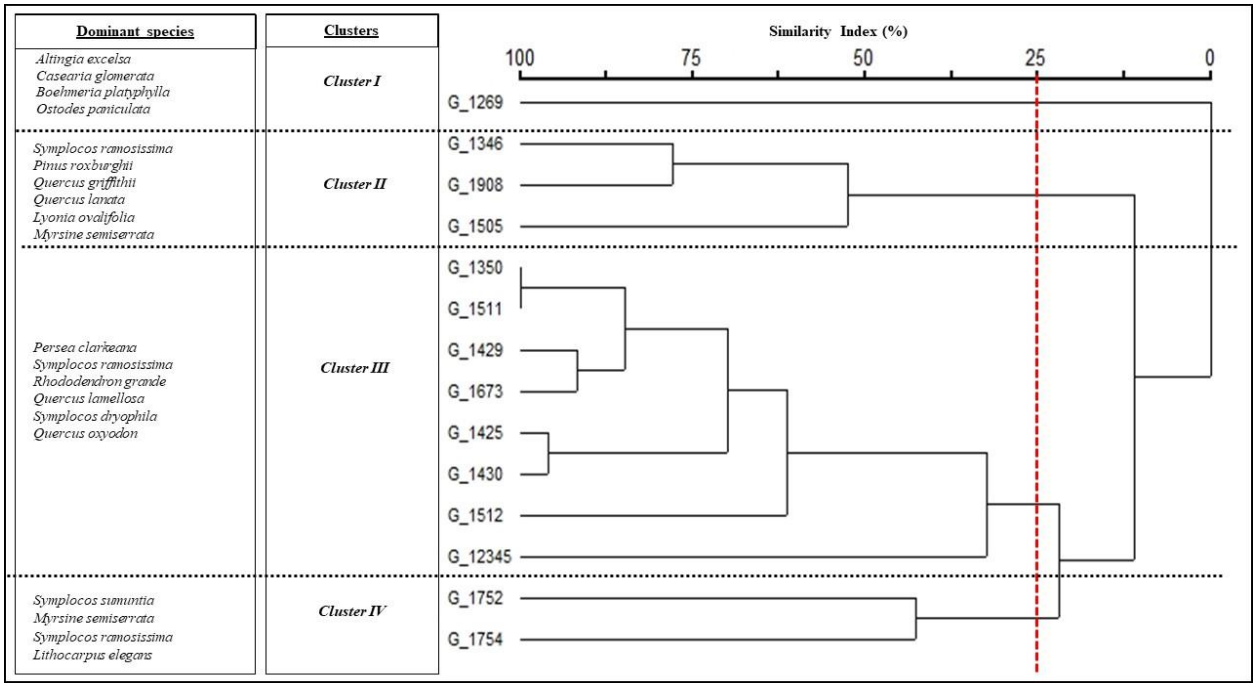


Figure 8. Cluster dendrogram of forest-type zones based on 25% similarity index

The largest Diameter at Breast Height (DBH) recorded was 128 cm with *Abies densa*, and the lowest was 1 cm for *Myrisine semiserrata*, a shrub or small tree-growing plant, and the majority of the DBH were distributed between 10 to 20 cm (Figure 9). The maximum tree height observed was 32 meters, and the majority of the heights were less than 10 meters (Figure 9)

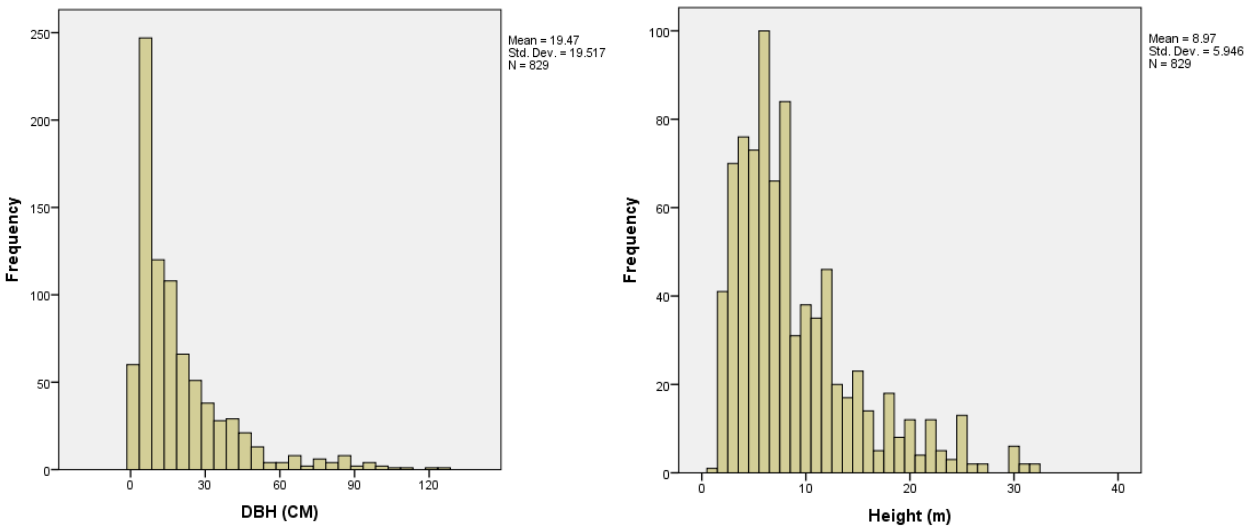


Figure 9. DBH and Height distribution histogram

The physical conditions of trees and shrubs were assessed visually; most (71%) of the trees and shrubs in the corridor are healthy, and 18% are leaning. In addition, there are fewer diseased, top-broken, dead and forked (Figure 10).

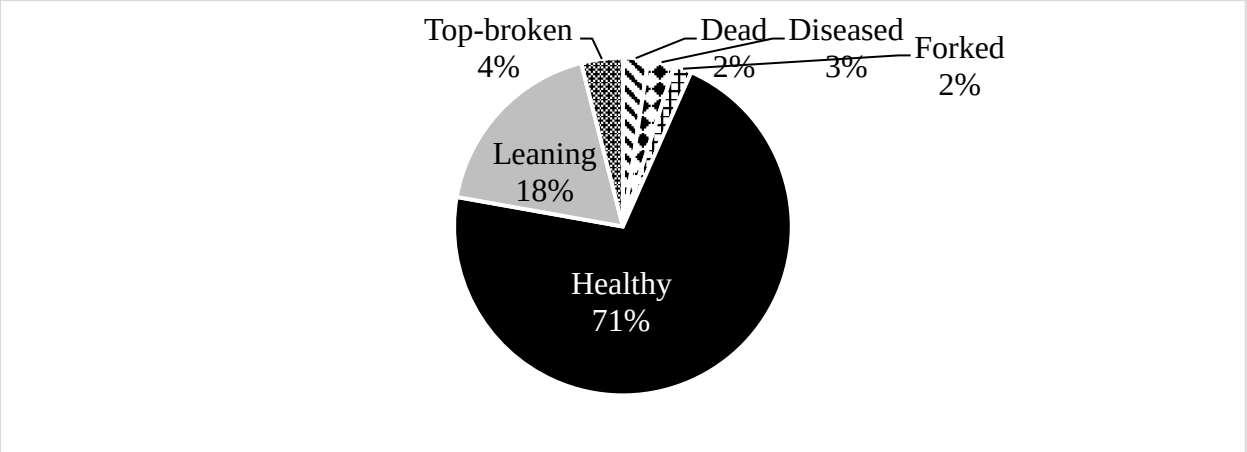


Figure 10. Composition of tree health condition

2.2.3. Faunal diversity.

a) Mammal Diversity

The BC 4 is critical for the movement of charismatic mammal species of conservation significance like the Tiger, Clouded Leopard, Asiatic Golden Cat, Marbled Cat, Golden Langur, Capped Langur, Red Panda, Himalayan Musk Deer, Spotted Linsang, etc... The corridor recorded 40 species of mammals to date (Annexure 2), of which five species are listed as Endangered, six species as Near Threatened and seven species as Vulnerable in the ICUN Red List of Threatened Species. In addition, 16 species are protected under Appendix I of CITES and three under Appendix II (Table 4). Ten species fall under Schedule I of Bhutan's Forest and Nature Conservation Act, 1995.

Table 4: Threatened mammals of BC4

Sl. No.	IUCN Status	Species
1.	Endangered (EN)	Dhole, Golden Langur, Himalayan Musk Deer, Red Panda, Royal Bengal Tiger
2.	Near Threatened (NT)	Asiatic Golden Cat, Assamese Macaque, Eurasian Otter, Himalayan Goral, Malayan Giant Squirrel, Marbled Cat
3.	Vulnerable (VU)	Asiatic Black Bear, Capped Langur, Clouded Leopard, Common Leopard, Gaur, Himalayan Serow, Sambar Deer

A camera trapping exercise was conducted from December 2019 to April 2021. A total of 35 camera traps were installed inside and in the buffer area of BC4 for an average of 116 days. The lowest camera trap night of a station was 58 days and the highest trap night for a camera trap station was 173 trap nights. A total of 55,612 pictures were processed from 3,822 trap efforts. For analysis of the relative abundance and occupancy of the species, 2,809 independent pictures were used, and for activity pattern calculation, 2691 pictures were processed. The independent event pictures of the species at a location were defined at 10 minutes intervals (Lahkar et al., 2018).

Based on the photographic captures, barking deer has the highest (n=457) independent capture rate, followed by Sambar deer (n=431), and the least captured species are Musk deer (n=1), Spotted linsang (n=1), Gaur (n=1), and capped langur (n=1). Herbivores (73%) are widely distributed and highly active wild animals, followed by small carnivores (17%) and large carnivores (9%). In contrast, omnivores are the least abundant because they primarily feed on the leaves and fruits on the trees. Thus, they are less available on the ground (Figure 11).

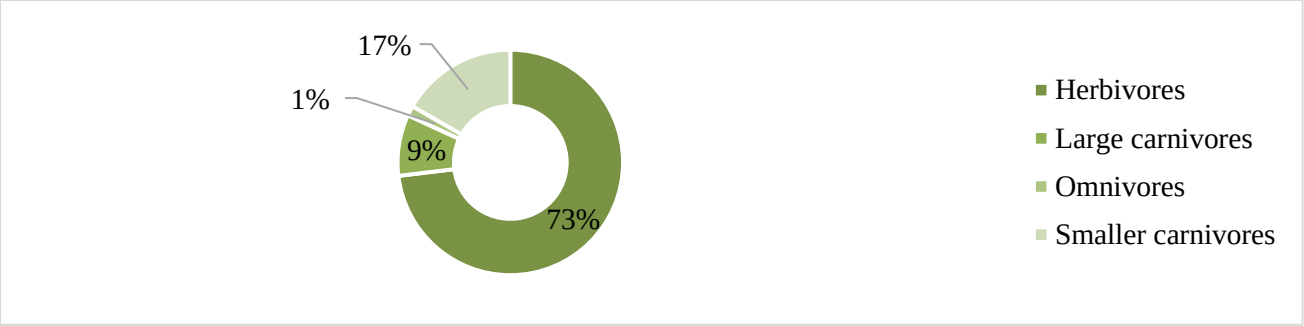


Figure 11: Mammal species compositions across different categories

Among the carnivore species, the photographic rate was highest for the tiger, followed by the Himalayan black bear, and least for the common leopard. This indicates that tigers in the corridor are the most active and abundant (Table 5). Among small wild cats, the leopard cat was most abundant (Independent Photo Capture (IPC) 101), followed by the marbled cat (IPC=63), Asiatic golden cat (IPC=14), and least with clouded leopard (IPC=14).

Table 5: Independent photographic of carnivore species

Carnivore species	IPC (n)
Common leopard	36
Dhole	40
Himalayan black bear	52
Tiger	68

The naïve occupancy was found highest for barking deer (0.89, n=24) and sambar deer (0.66, n=23), yellow-throated marten (0.66, n=23). Wild pig also has the highest occupancy, similar to leopard cat, and both are considered pests by the farmers. The Himalayan serow has the lowest (0.23, n=8) occupancy among the ungulates. Tiger (0.51, n=18) has the largest occupancy followed by Himalayan black bear (0.49, n=17), dhole (0.43, n=15) and common leopard (0.29, n=10) among the predators. This indicates that all these predators are widely distributed in the corridor. The gaur, the orange-bellied squirrel, musk deer, spotted linsang, and porcupine has the least occupancy (0.03) inside BC 4 (Figure 12).

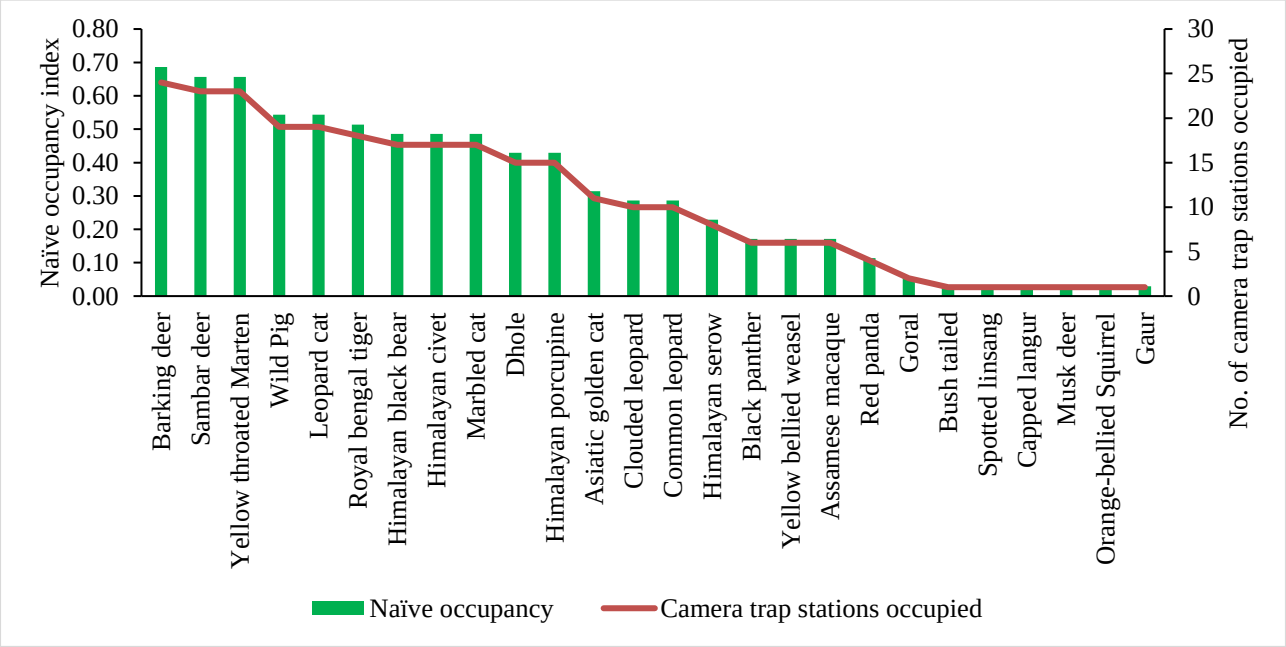


Figure 12: Mammal species naive occupancy proportion

The activity pattern of the Tiger is significantly (CI=95%) similar to its competing predators like the common leopard, dhole, and Himalayan black bear, and it is also similar to its primary prey species like sambar deer, barking seer, and Himalayan Serow. The activity pattern of the Tiger is similar to two small felids (Asiatic golden cat and marbled cat) among four small felids present in the corridor. The activity pattern of the Himalayan black bear is significantly similar to seven species of mammals, including carnivores like the Tiger, common leopard, dhole, marbled cat, Asiatic golden cat, yellow-throated marten, and herbivores including barking deer and wild pig. The activity pattern of the sambar deer, the main prey for tigers, is significantly similar to that of the Tiger, Asiatic golden cat, common leopard, Himalayan serow, and wild pig (Table 6).

Table 6: Chi-square analysis of paired activity patterns.

Species	Asiatic Golden Cat	Barking deer	Black Panther	Clouded leopard	Common leopard	Dhole	Gaur	Goral	Himalayan civet	Himalayan porcupine	Himalayan serow	Himalayan black bear	Leopard cat	Marbled cat	Musk deer	Orange-bellied squirrel	Reb panda	Sambar deer	Spotted linsang	Tiger	Wild pig	Yellow-bellied weasel	Yellow-throated marten
Asiatic golden cat		+	0	0	+	+	0	0	+	+	+	0	0	+	0	0	0	+	0	+	0	0	0
Barking deer	0		0	0	+	0	0	0	0	0	+	0	0	0	0	0	0	0	0	+	0	0	0
Black panther	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Common Leopard	0	0	0	0		+	0	0	0	0	+	+	0	+	0	0	0	+	0	+	+	0	0
Dhole	0	0	0	0	0		0	0	0	0	+	+	0	+	0	0	0	0	0	+	+	0	+
Himalayan civet	+	0	0	0	0	0	0	0		+	0	0	0	0	0	0	0	0	0	0	0	0	0
Himalayan porcupine	+	0	0	0	0	0	0	0	+		+	0	+	0	0	0	0	0	0	0	0	0	0
Himalayan serow	+	+	0	0	+	+	0	0	0	+		0	0	+	0	0	0	+	0	+	0	0	0
Himalayan black Bear	+	+	0	0	+	+	0	0	0	0	0		0	+	0	0	0	0	0	+	+	0	+
Leopard cat	0	0	0	0	0	0	0	0	0	+	0	0		0	0	0	0	0	0	0	0	0	0
Marbled cat	+	0	0	0	+	+	0	0	0	0	+	+	0		0	0	0	0	0	+	+	0	0
Sambar deer	+	0	0	0	+	0	0	0	0	0	+	0	0	0	0	0	0		0	+	0	0	0
Tiger	+	+	0	0	+	+	0	0	0	0	+	+	0	+	0	0	0	+	0		0	0	0
Wild pig	0	0	0	0	+	+	0	0	0	0	0	+	0	+	0	0	0	0	0	0		0	+
Hypothesis (H0): Species A and B have similar activity patterns at 95%, Significant = +, Not significant = 0																							

b) Bird diversity

The biological corridor recorded 305 species of birds under 61 families, and it hosts good numbers of significant conservation species (Annexure 3). The corridor currently recorded nine significant conservation species and 65 migratory bird species. In addition, the corridor is home to one critically endangered bird with its active nesting inside the corridor. Also, the corridor has the highest population of critically endangered bird (Table 7).

Table 7: IUCN Red list category of birds

IUCN Status	Common name
Critically Endangered (CR)	White Bellied Heron
Endangered (EN)	Steppe Eagle
Vulnerable (VU)	Greater Spotted Eagle, Rufous-necked Hornbill, Grey-crowned Prinia, Beautiful Nuthatch
Near Threatened (NT)	Mountain Hawk Eagle, Rufous-bellied Eagle, Himalayan Griffon, Great Hornbill, Yellow-rumped Honeyguide, Satyr Tragopan, Ward's Trogon

During the RBA, the survey team walked 23 transects covering a total transect length of 149.95 km and recorded data for 135 hours. Old trails and roads were used as transects, covering the lowest elevation of 1080 masl to 3600 masl at the highest. The highest number of bird species recorded are from Leiothrichidae and Muscicapidae families (16 species each). A total of 11 bird species were recorded in fir forest with 55 encounters, 63 species with 533 encounters in CBL forest and 112 species with 972 bird encounters WBL forest. Shannon-Wiener Diversity Index (H) indicates that the bird diversity is highest in WBL forest followed by CBL forest and fir forest has the least bird diversity (Table 8). This indicates that the WBL forest has a greater diversity and abundance of bird species.

Table 8: Bird diversity, richness, and evenness across forest types

Forest Type	Species Richness	Species Diversity (H)	Evenness (E)
CBL Forest	63	3.384	0.817
Fir Forest	11	1.904	0.794
WBL Forest	112	4.045	0.857

2.2.4. Other taxa diversity.

The corridor recorded 37 species of mushrooms under 27 genera, covering 20 families (Annexure 4), 38 species of ferns belonging to 16 families (Annexure 5), 15 species of damselflies belonging to seven families, and eight species of dragonflies belonging to three families (Annexure.6), 23 species of snakes belonging to five families (Annexure 7), three frog species belonging to three families, 129 species of orchids under 52 genera (Annexure 8), 150 species of butterflies belonging to 6 families (Annexure 9) and 36 species of moths belonging to 16 families (Annexure 10). The species listing is the cumulative listing of species recorded during the surveys and other opportunistic observation records. These lists will serve as the baseline database, and any further new observations will be recorded and listed.

2.3. Socio-Economic characteristics.

2.3.1. Demography and social structure.

The corridor covers seven chiwogs under four geogs. It has 525 households with a population of 3644 (National Statistics Bureau, 2018) (Table 9) with a male-to-female ratio of 53:47. The ethnic group in the corridor is Khengpa, and they speak Khengkha. Of the four geogs falling inside the corridor, Trong geog has no settlements.

The population density of the corridor is six people per square kilometre, the upper part of the corridor has the highest population, and Shingkhar gewog has the lowest population. Social data was collected from 161 households representing 30% of the total households in the corridor. Out of 161 respondents, 70.80% (n=114) were women and 29.20 (n=47) were male.

Table 9: The human population inside BC4.

Geog/Dzongkhag	Chiwog	Male	Female	Total
Nangkhor, Zhemgnag	Buli	629	539	1168
	Tshaidang	177	190	367
	Duenmang	126	153	279
Shingkhar, Zhemgang	Radi	55	59	114
	Nimshong	200	129	329
Langthel, Trongsa	Dangdung	525	461	986
	Baling	226	175	401
Total		**1938**	**1706**	**3644**

The population age group in the corridor is dominated by young people and children between 20 to 40 years of age followed by less than 20 years (Figure 13).

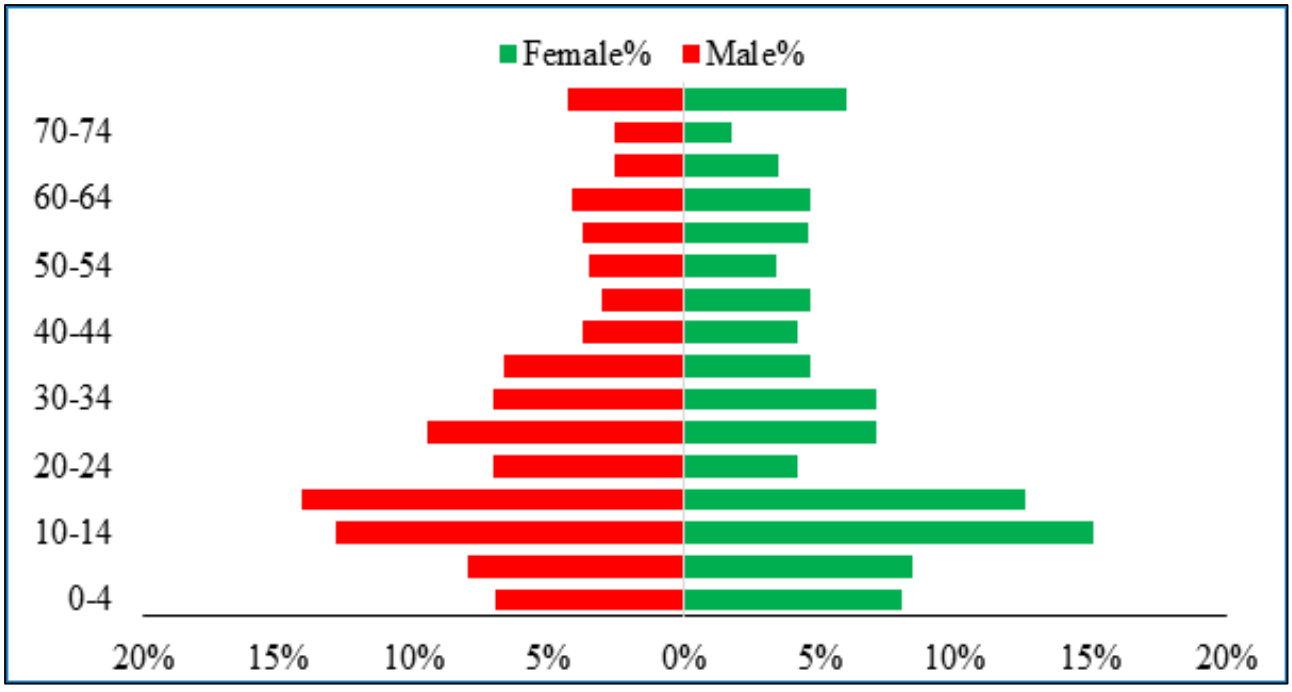


Figure 13. Population according to age group and gender

2.3.2. *Annual income and expenses of the communities*

The information generated from the socio-economic data revealed that the average annual income of the communities in the corridor is Nu. 39336.36 (± 72,793.00, SE= 5736.9). The majority of the communities depend upon agricultural farming (57%), followed by livestock tending (37%) and forest resources (6%). The income from agriculture is mainly from the sale of cabbage, chilly, and potato and the sale of cheese and butter in the case of livestock. Fern and mushrooms are the major forest products sold by the communities.

The annual expenditures of the communities were assessed and listed under 11 categories. The mean annual expenditure is calculated as Nu.195427.59 (± 278126). Amongst the 11 categories of expenditure, the community is spending the maximum on the construction and renovation (M=228622.00, ± 304551) of houses, followed by the purchase of vehicles and maintenance of farm machinery (Figure 14). Amongst the geogs, Langthel spends the highest (M=Nu. 42057) followed by Shingkhar (M=37190) and least with Nangkor (M=25290) geog.

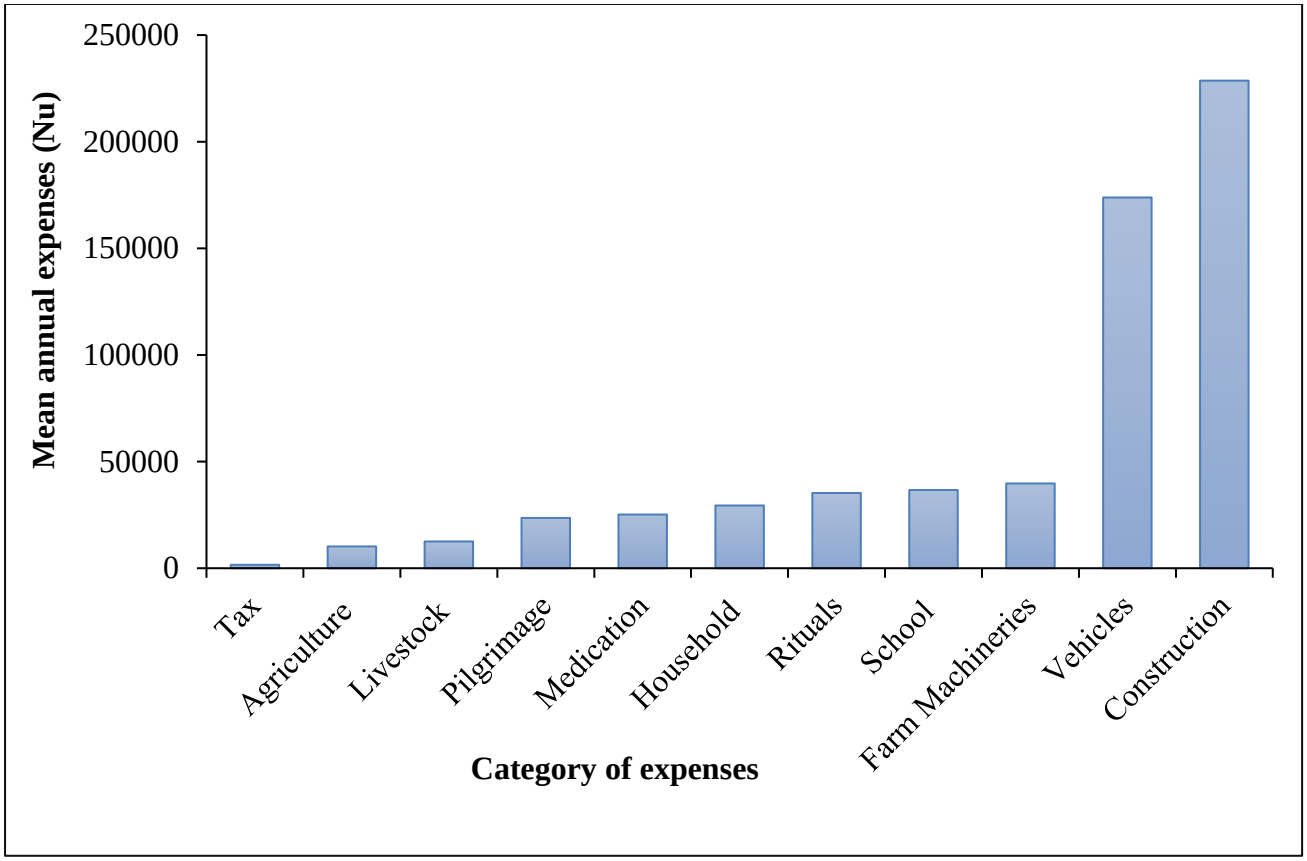


Figure 14. Category of expenses

2.3.3. *Agriculture*

Agriculture is the primary source of livelihood for the people residing in the corridor. The categories of landholding under registered land are *Chhuzhing* (Wetland), *Kamzhing* (Dry Land), *Tshoesa* (kitchen Garden), and *Ngultho Dumra* (Orchard). The most common types of land holdings are dry land (58.97%), wetland (21.97%), orchards, and kitchen gardens. Maize is abundantly grown among cereal crops (Figure 15). In addition, the communities of Nangkhor and Langthel have started to grow Quinoa, which is considered one of the most nutritious cereal crops.

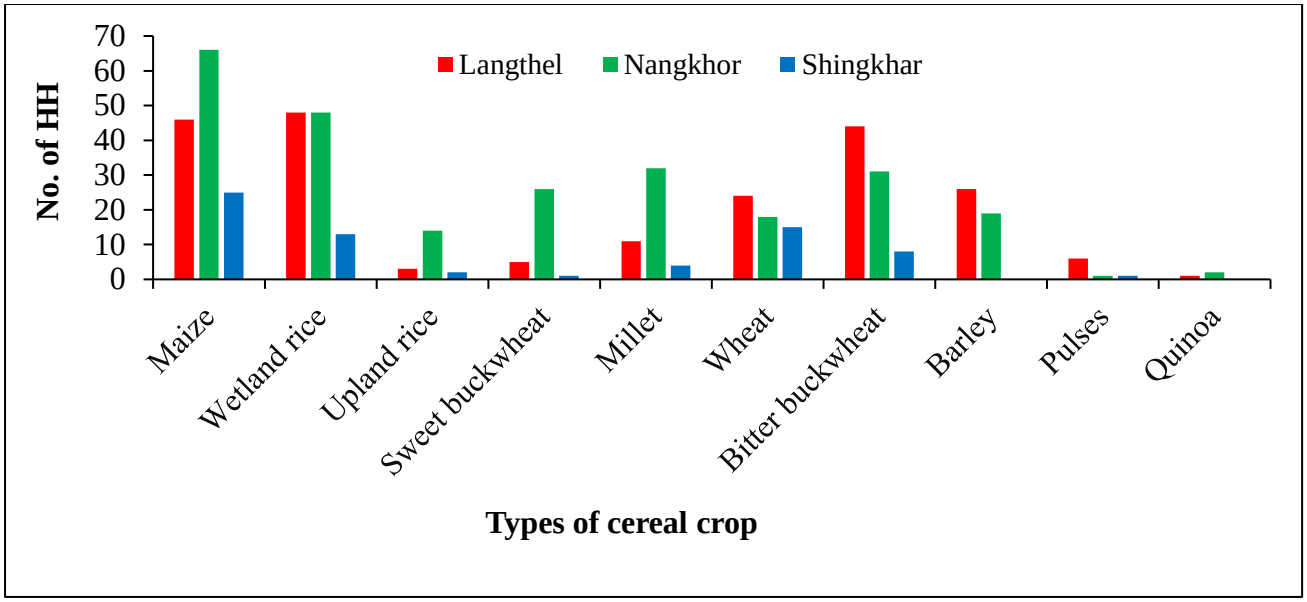


Figure 15. Varieties of crops grown

The local communities also grow varieties of other crops like Cardamom, Ground Apple, Sweet Potato, Guava, and Avocado to supplement the cash income for the family. Cardamom is widely cultivated and one of the main cash crops for the communities in the corridor (Figure 16).

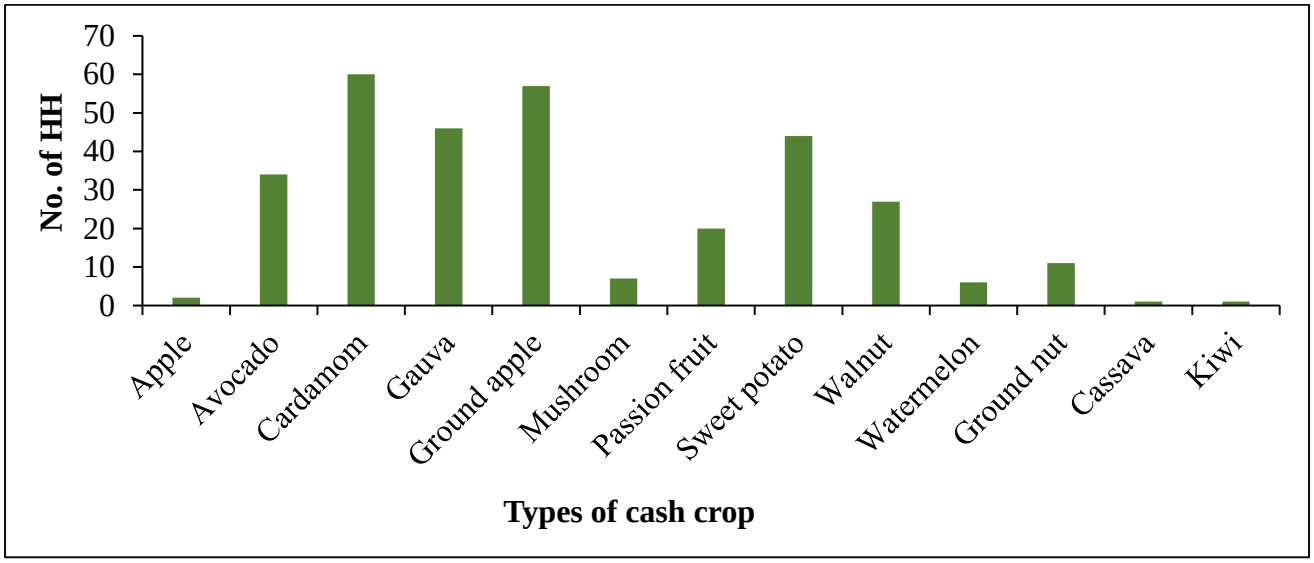


Figure 16. Types of cash crops grown

The SES data revealed that all the households within the corridor grow vegetables, and 20 varieties of vegetables are grown. Cabbage is mostly grown vegetables by the communities. Nangkhor gewog has the highest vegetable cultivation record with 45.3%, followed by Langthel and Shingkhar gewog with

38.3% and 16.4%, respectively (Figure 17).

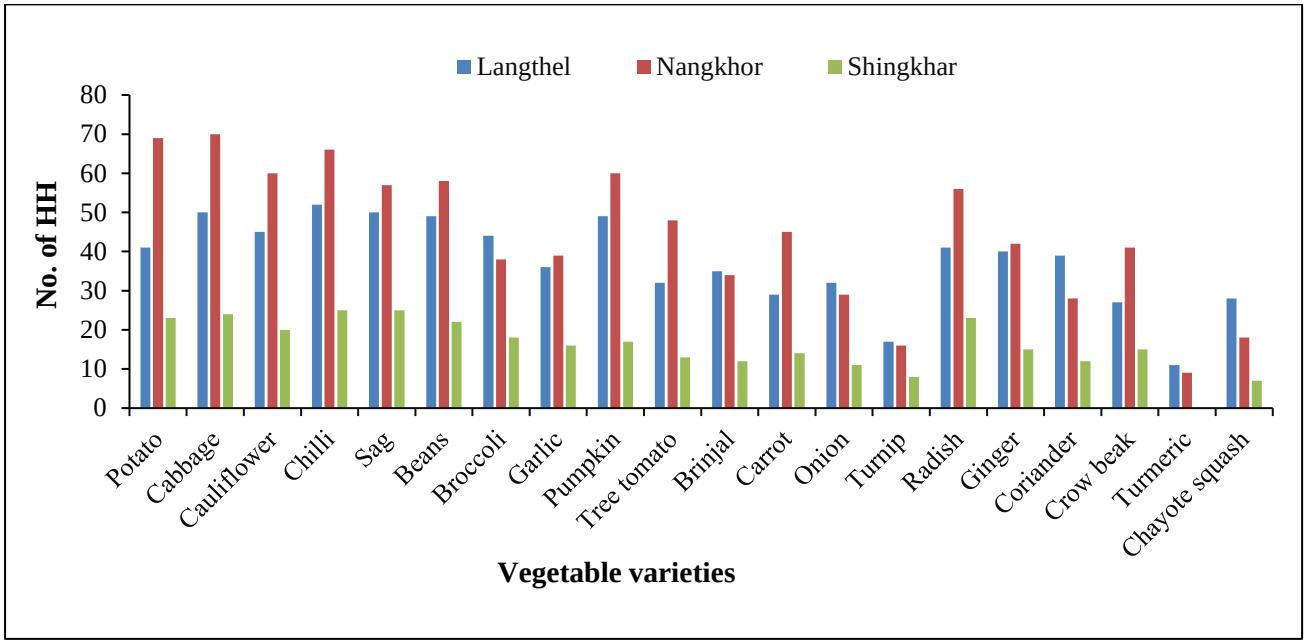


Figure 17. Varieties of vegetables grown

2.3.4. Livestock

Livestock is one of the essential components in farming systems other than agriculture practices. Livestock is reared by most of the farmers in the corridor with an average of 10 (± 15) livestock per household, where maximum (Mode=4) households rear four numbers of livestock. The community is rearing more local cattle than the improved breed (Table 10). It was reported that some households also practice beekeeping. The communities mostly tend their livestock in the agricultural field and forest. However, few practices tethering and stall feeding.

Table 10: Livestock held by communities

Livestock type	Mean	SD	Sum	HH
Local breed	5	10	798	108
Improved breed	1	3	173	50
Horse	-	2	64	29
Bee keeping	-	-	5	3
Goat	-	-	3	2
Cat	1	1	186	118
Dog	1	1	120	67
Sheep	-	-	5	1
Poultry	2	8	321	42
Piggery	-	-	3	1

Apart from the source of income, livestock rearing helps the communities to plough their agricultural field, farm yard manure production, and transportation and supplement their food source. However, at the same time, there are also challenges like lack of workforce, insufficient fodder, lack of grazing ground, and predation by wild predators (Figure 18).

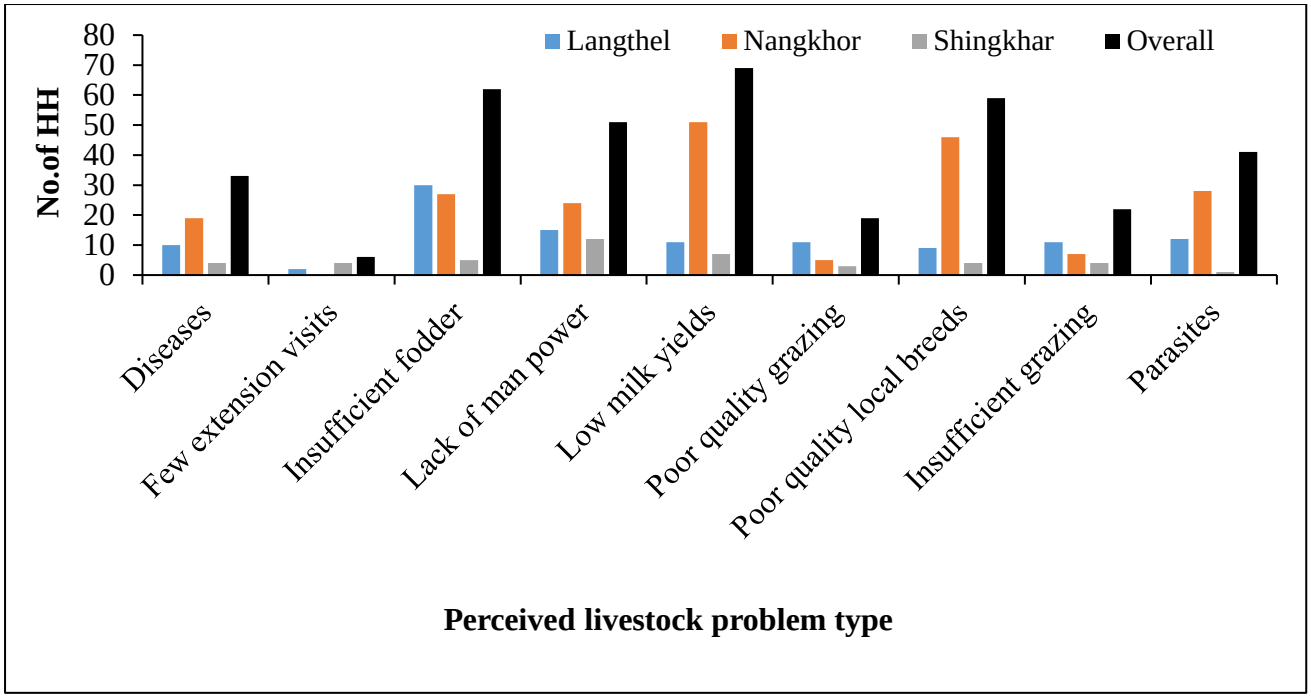


Figure 18. Problem faced in livestock rearing

2.4. Current Threats to the Corridor

2.4.1. Human-wildlife conflict

Similar to other PAs in the country, there are human settlements within the BC4. The livelihood of the communities is primarily dependent on agriculture and livestock farming. Forests surround most settlements, and there is constant interaction between wildlife and humans, leading to human-wildlife conflict.

2.4.2. Livestock Depredation

As per the SES report of BC4, 2022, it was recorded that 107 numbers of livestock encompassing six types of livestock belonging to 67 households were lost to wild predators in the last three years. The majority of the depredation was caused to local cattle breeds (71.06%) followed by horses (12.15%) (Table 11).

Table 11: Livestock lost to predators

Livestock type	Numbers	%
Dog	1	0.93
Horse	13	12.15
Improved breed	6	5.61
Local breed	76	71.03
Pig	3	2.80
Poultry	8	7.48

The highest depredation was caused by Royal Bengal Tiger followed by Dhole, Common Leopard and the rest are minimal (Figure 19).

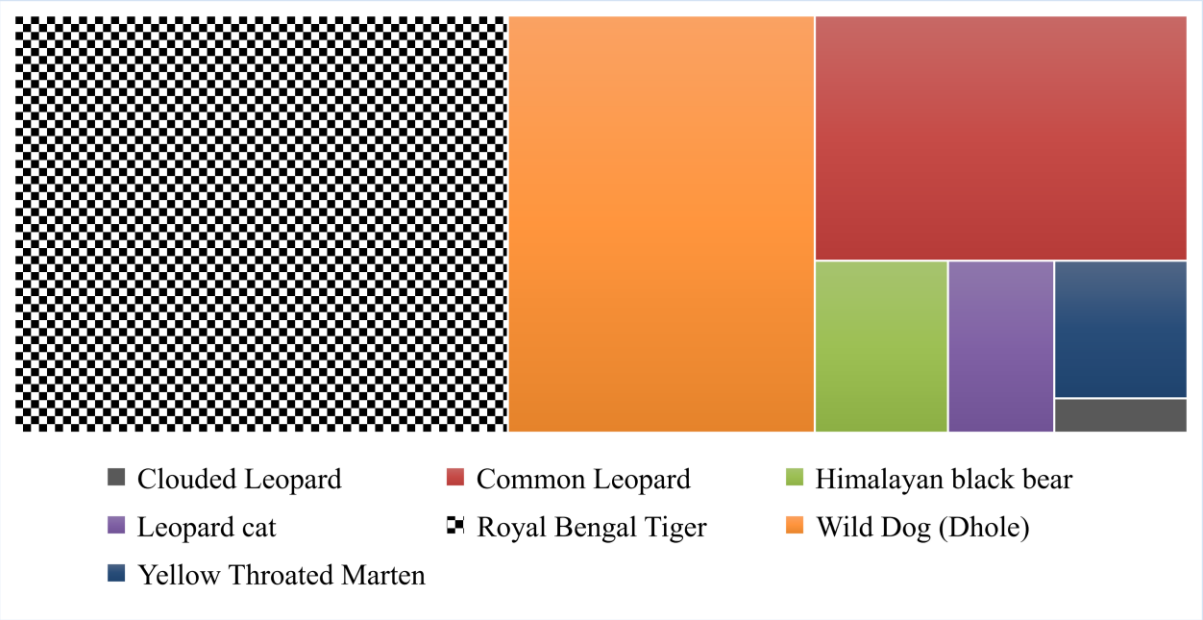


Figure 19. Wild predators and their proportion of livestock depredation

Amongst the wild predators, Common Leopard killed six types of livestock, Royal Bengal Tiger killed three types of livestock, and the maximum killed local breed cattle. Most livestock depredation is within a five km radius and is of concern for the communities living on the periphery of the forest. Local communities perceive that livestock depredation is mainly contributed by the free-ranging of livestock (23%), increase in forest cover (18%), increase in wildlife population (15%), lack of proper fencing (21%), and pasture land.

2.4.3. Crop damage by wildlife

The SES report revealed that 98% of the household reported incidences of crop damage by wild animals. The major types of crops damage are cereal crops (n=263), vegetables (n=106), and cash crop (n=66). Ten wild animals contributed to the damage, where Wild Pigs has damaged most, followed by Barking Deer and Porcupines (Figure 20).

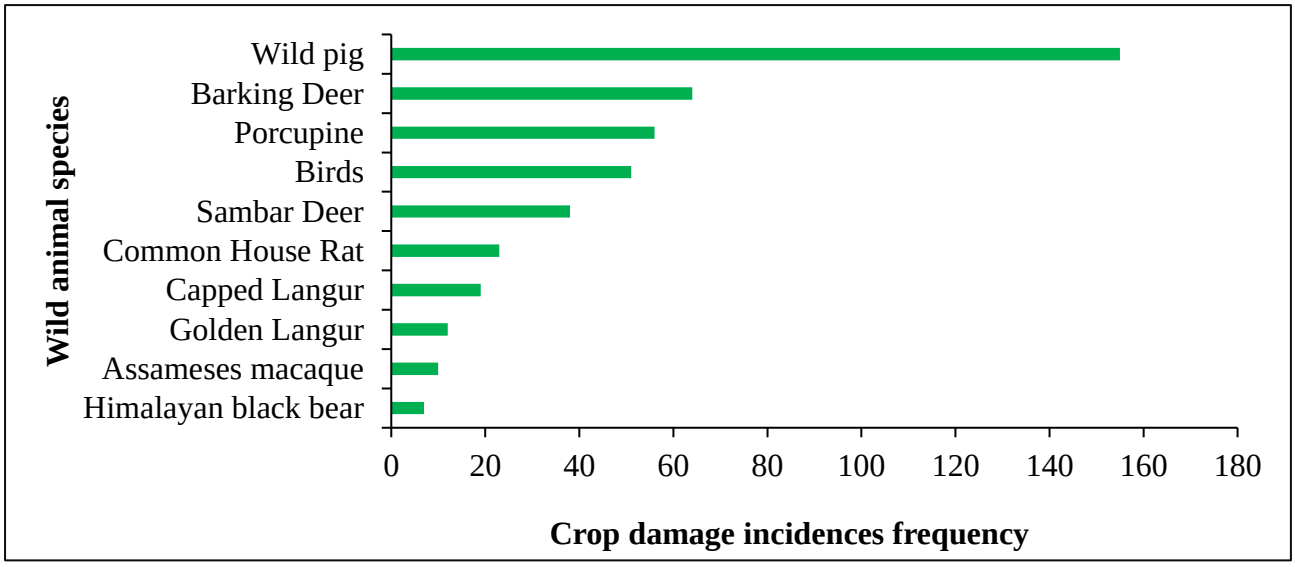


Figure 20. Crop damage frequency

During the last year, 163.48 acres of crops were damaged by wild animals. The communities of Nangkhor gewog recorded the highest crop damage (65.24 acres, M=0.47 acres) followed by Langthel (65.34 acres, M=0.31 acres) and the least (17.2 acres, M=0.3 acres) at Shingkhar. The crop damaged

by the wild animal resulted in substantial economic losses to farming, with an estimated monetary value of Nu.43, 98,125.00 in a year (Mode: Nu. 5000 per year).

2.5. Present land use category and resources use

2.5.1. Present land use category inside the corridor

The corridor has a total area of 594.65 sq. km, of which 1.88 sq. km is used for agriculture, 0.25 sq. km is covered by road, the power transmission line covers 0.88 sq. km, and four community forests cover 5.04 sq. km. The remaining area is State Reserved Forest land (Figure 21).

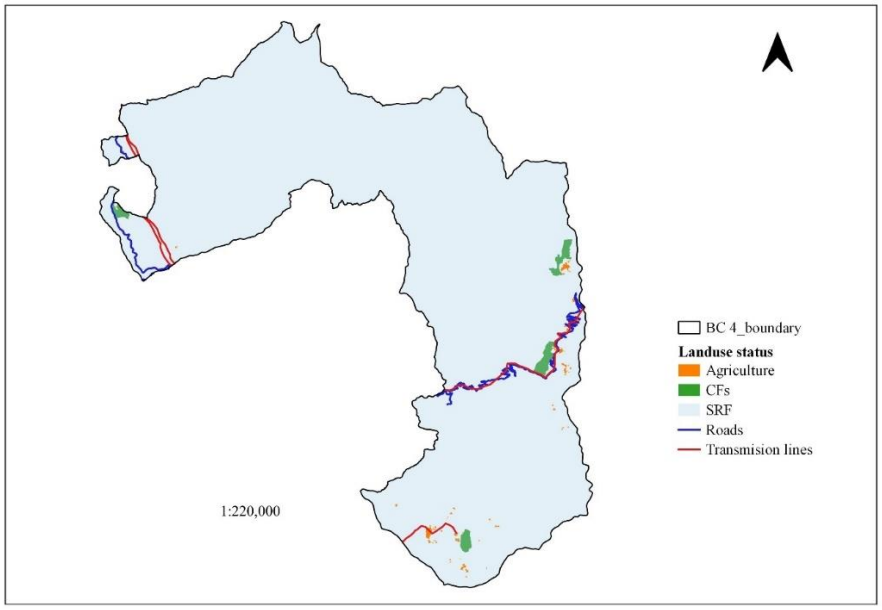


Figure 21. Land use category of the corridor

2.5.2. Forest resources use by communities

The SES report revealed that the communities inside the corridor collect 19 different types of forest products from the forest (Table 12). Fern and mushrooms are the most collected resources for commercial purposes and self-consumption, followed by fodder collection.

Table 12: Type of forest resources collected by each household

Product type	Geog			Total
	Langthel	Nangkhor	Shingkhar	
Fern	39	47	24	110
Mushrooms	35	53	21	109
Fodder	27	46	19	92
Canes	23	47	18	88
Elatostema	31	30	19	80
Agricultural tools	29	24	21	74
Bamboo	6	46	20	72
Wild yam	11	22	10	43
Orchid	18	10	12	40
Piper	30	4	2	36
Fern/leaves for bedding	10	10	9	29

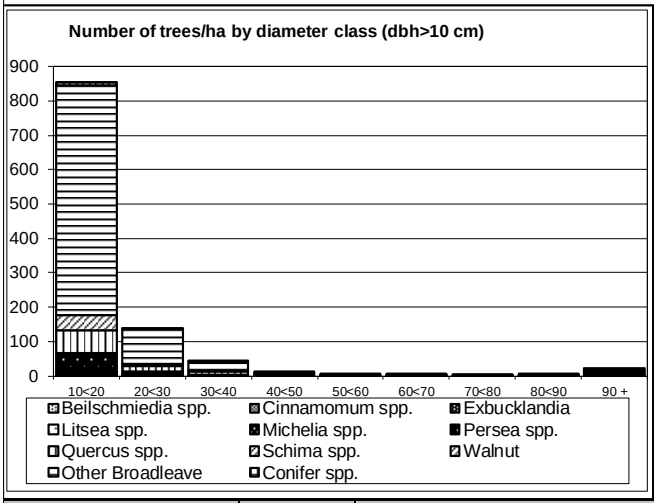
Top soil/leaf mould	10	6	1	17
Thatch grass	1	6	8	15
Medicinal plants	1	1	3	5
Paris	-	1	4	5
Religious drums	3	1	-	4
Daphne	1	3	-	4
Incense	1	1	1	3
Wood burr for Dhapa	-	1	-	1

2.6. Forest Resource Area

2.6.1. Forest stand stock condition of the corridor

The communities residing inside the corridor are dependent on natural resources. Most of the forest resources they depend on are timber, firewood, poles and non-wood forest products. There are four community forest management groups inside the corridor and no other sustainable management plans for utilizing natural resources. Most of the communities are guided by the community forest management regime, and three chiwogs are without sustainable forest resource utilization plans. These areas will now be cared for by the local forest management areas.

The corridor has a basal area of 32.5 cubic meters per hectare, and the overall tree stand volume of the corridor is 457.9 cubic meters per hectare, primarily contributed by broad-leaved species (76%) and 24% from the conifer species. The more significant portion of the trees is less than 20-centimeter DBH (Figure. 22).



Stand data	
Bas. Area (m2/ha)	32.5
Tot. Vol. (m3/ha)	457.9
Vconifer %	24%

Forest Type	%	Stand Type	%	NWFP+firew.	A	S
Hemlock		Plantation		Type	%	%
Fir	7	Natural	100	Firewood		31
Spruce		Coppice		Bamboo		10
Mixed Conifer		**Canopy**	**%**	Cane	3	
Blue Pine		Dense	62	Daphne	14	34
Chir Pine	7	Closed	21			
Hardwood	86	Open	17			
Mixed H/C		Unstocked		**Forest Use**	**I**	**E**
Age Class	**%**	**Condition**	**%**	Type	%	%
Young	34	Good	59	Grazing		34.48
Immature	45	Average	10	Shokshing		10.34
Mature	21	Poor	31	Lopping		13.79
Overmature		**Site Characteristics**				
Slope	**%**	**Erosiveness**	**%**	**Soil Cover**	**%**	
Gentle	28	Stable	72	High	83	
Moderate	45	Moderate	28	Moderate	17	
Steep	28	Unstable		Low		

Species	Height	N/ha per diameter class										Total (> 10cm)	
	0.3<1.3 m	<10	10<20	20<30	30<40	40<50	50<60	60<70	70<80	80<90	90+	N/ha	%
Beilschmiedia spp.		24			1	1	0					**2**	0
Cinnamomum spp.				1				0				**2**	0
Exbucklandia													
Litsea spp.		37	8									**8**	1
Michelia spp.			4	1	1					0	4	**10**	1
Persea spp.		49	55	10	4	1	1	0	0	0		**71**	7
Quercus spp.		220	66	17	8	4	1	1	1	0	6	**104**	10
Schima spp.		98	43	4	3	0		0		1		**51**	5
Walnut													
Other Broadleave		3903	671	101	24	3	0	0	0	1	5	**805**	74
Conifer spp.			8	6	4	4	0	1	0	0	8	**32**	3
Total		**4330**	**855**	**140**	**44**	**14**	**2**	**3**	**1**	**2**	**23**	**1085**	100

Figure 22. Tree stands stock condition of the corridor

2.6.2. Current Forest Resources Management Areas

The extraction of Timber and firewood resources inside the corridor are primarily guided by the community forest management plans. There is four community forest management inside the corridor, and most resource utilizations are guided by the community management plans (Figure. 13).

Table 13. Community forests inside the corridor

Sl No.	Name of CF	Geog	Village	Dzongkhag	Area (Ha)	No. of households
1	Tashicholing	Nangkhor	Duenmang	Zhemgang	102.19	23
2	Radhi	Shingkhar	Radhi	Zhemgang	148.30	25
3	Thukten Chholing	Shingkhar	Nimshong and Thajong	Zhemgang	174.00	44
4	Pangzur Phinsum Tshogpa Community Forest	Langthel	Pangzur	Trongsa	78.4	28

2.6.3. Local Forest Management Areas

Baling and Koshala under Langthel geog and Jamjong and Kamjong under Nangkhor geog are not managed by any forest utilization management plans until now. Therefore, four Local Forest

Management Areas (LFMA) are designated to manage the utilization of significant forest resources from these areas (Figure 23). All of these LFMA areas fall under the broad-leaved forest, and the highest LFMA area is in Dangdung, which has the significant household utilizing resources from the area (Table 14).

Table 14. Local Forest Management Areas inside BC4

Sl.No	LFMA	Forest type	Area(ha)	Dependent households
1	Dangdung LFMA	Broadleaf	381.31	Beyling: 50, Namther:54, Gnadhak:18, Dangdung:45, Koshala:22
2	Jemjong LFMA	Broadleaf	124.40	Jemjong: 4, Kamjong:39
3	Kamjong LFMA	Broadleaf	63.30	
4	Pangzur LFMA	Broadleaf	132.46	Baling:46

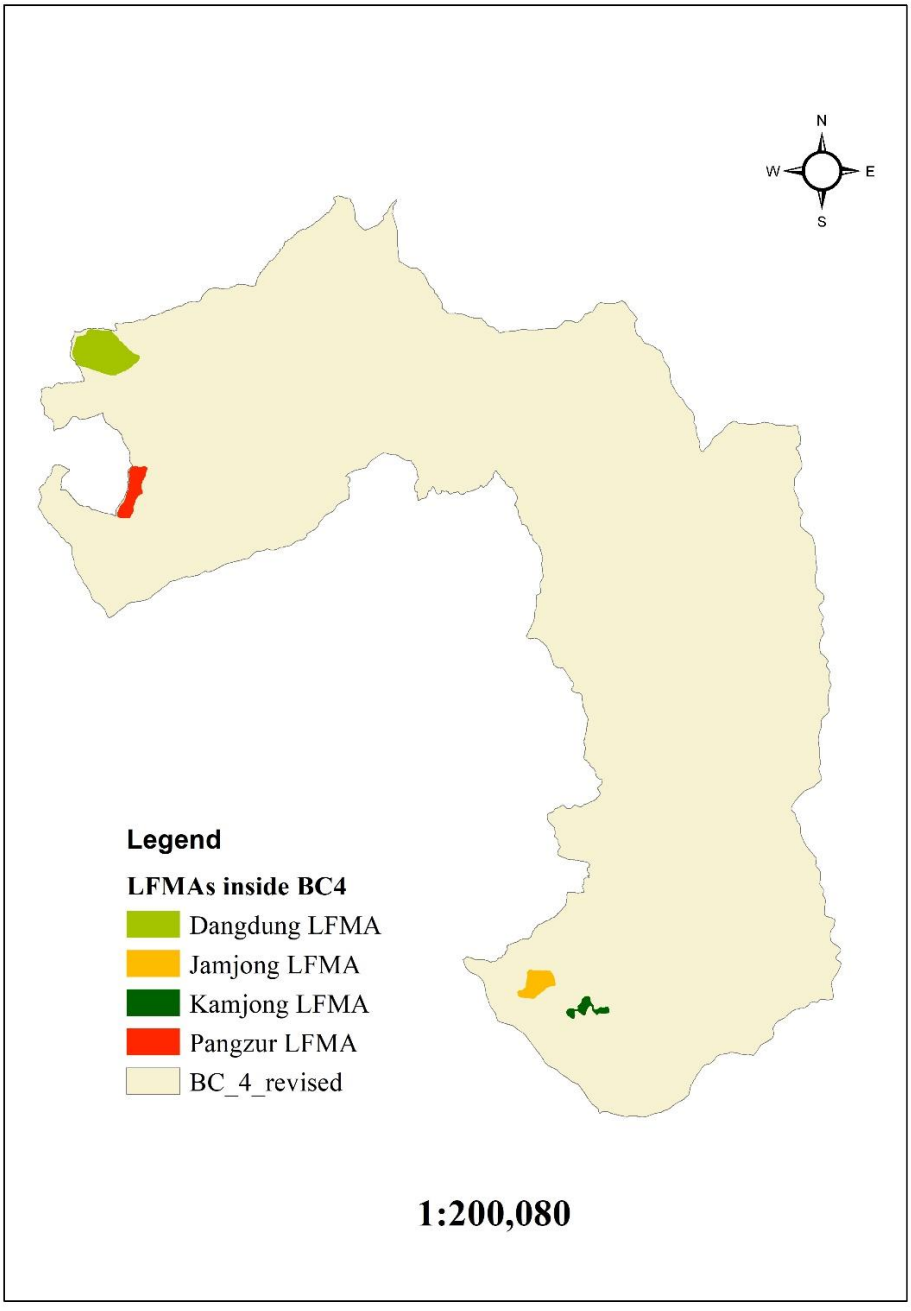


Figure 23. Location of LFMAs inside BC4

2.6.3.1.Dangdung Local Forest Management Area

The area of Dangdung LFMA measures 381.31 hectares, and four communities from Langthel geog depend on the forest resources, especially timber and firewood, from this LFMA. The Annual Allowable Cut is 7594 cubic meters.

Table 15. Dangdung LFMA summary sheet

Unit	Area Distribution			
	Non Production	Protection	Production	Total
ha	0.0	29.7	381.3	411.0
%	0%	7%	93%	100%

Average basal area (m2/ha)	Aver. Stand Volume (m3/ha)	No of accessible sample plots
26.9	2589	133

Unit	Forest Type Distribution								
	Hemlock	Fir	Spruce	Mix. Con.	Bluepine	Chirpine	Hardwood	Mixed HC	Total
%	0%	0%	0%	0%	0%	0%	100%	0%	**100%**
Unit	**Age distribution**					**Stand type distribution**			
	young	immature	mature	Overmature	Total	plantation	natural	coppice	Total
%	10%	9%	69%	12%	**100%**	0%	100%	0%	**100%**
Unit	**Canopy closure**					**Condition**			
	dense	closed	open	unstocked	Total	good	average	poor	Total
%	15%	77%	8%	0%	**100%**	68%	24%	8%	**100%**

Unit	Site Condition								
	Slope			Erosiveness			Soil Cover		
	gentle	moderate	steep	stable	moderate	unstable	high	moderate	low
%	77%	16%	8%	74%	29%	5%	34%	55%	8%

Unit	Forest Use					
	Intensive Side Uses			Extensive Side Uses		
	grazing	sokshing	lopping	grazing	sokshing	lopping
ha	106.9	0.0	123.3	6.2	0.0	0.0
%	26%	0%	30%	2%	0%	0%

Unit	NWFP Occurence and Firewood							
	NWFP abundant				NWFP sparse			
	Firewood	Bamboo	Cane	Daphne	Firewood	Bamboo	Cane	Daphne
ha	102.8	0.0	0.0	0.0	16.4	0.0	0.0	0.0
%	25%	0%	0%	0%	4%	0%	0%	0%

Unit	Potential Production				
	Timber				
	Drashing	Cham	Tsim	Poles,posts	Total
Ntot	80687	20132	11681	32123	**144623**
N/ha	212	53	31	84	**379**
m3	763111	17565	3412	2380	**786468**
m3/ha	2001.3	46.1	8.9	6.2	**2062.5**
Unit	**Firewood**				
	> 49cm	30-49cm	20-29 cm	10-19 cm	Total
Ntot	19921	5390	5140	7	**30458**
N/ha	52	14	13	0	**80**
m3	190235	6603	1565	198	**198601**
m3/ha	498.9	17.3	4.1	0.5	**520.8**

Unit	Sivicultural Measures				
	Planting	Thinning	Felling (firewood)	Felling (timber)	No Activity
ha	30.9	92.7	92.7	185.5	9.3
%	8	23	23	45	2

Yield Regulation		
AAC	**7594**	m3
	19.9	m3/ha
Prod. Potential / AAC	**130**	years

2.6.3.2.Pangzur Local Forest Management Area

Households from Baling are dependent on Pangzur LFMA for timber and firewood extraction. Pangzur LFMA is 132.46 hectares, and the forest type in the area is broad-leaved forest. The Annual Allowable Cut for the Pangzur LFMA is calculated at 616 cubic meters.

Unit	Area Distribution			
	Non Production	Protection	Production	Total
ha	0.0	11.6	132.5	144.1
%	0%	8%	92%	100%

Average basal area (m2/ha)	Aver. Stand Volume (m3/ha)	No of accessible sample plots
16.7	604	117

Unit	Forest Type Distribution								
	Hemlock	Fir	Spruce	Mix. Con.	Bluepine	Chirpine	Hardwood	Mixed HC	Total
%	0%	0%	0%	0%	0%	0%	100%	0%	**100%**
Unit	**Age distribution**					**Stand type distribution**			
	young	immature	mature	Overmature	Total	plantation	natural	coppice	Total
%	9%	27%	58%	6%	**100%**	0%	100%	0%	**100%**
Unit	**Canopy closure**					**Condition**			
	dense	closed	open	unstocked	Total	good	average	poor	Total
%	6%	84%	10%	0%	**100%**	80%	14%	6%	**100%**

Unit	Site Condition								
	Slope			Erosiveness			Soil Cover		
	gentle	moderate	steep	stable	moderate	unstable	high	moderate	low
%	38%	45%	8%	73%	64%	9%	27%	64%	9%

Unit	Forest Use					
	Intensive Side Uses			Extensive Side Uses		
	grazing	sokshing	lopping	grazing	sokshing	lopping
ha	25.9	0.0	0.0	20.9	0.0	0.0
%	18%	0%	0%	15%	0%	0%

Unit	NWFP Occurence and Firewood							
	NWFP abundant				NWFP sparse			
	Firewood	Bamboo	Cane	Daphne	Firewood	Bamboo	Cane	Daphne
ha	66.3	5.8	0.0	0.0	14.4	23.1	0.0	0.0
%	46%	4%	0%	0%	10%	16%	0%	0%

Unit	Potential Production				
	Timber				
	Drashing	Cham	Tsim	Poles,posts	Total
Ntot	6852	4356	2998	10251	**24457**
N/ha	52	33	23	77	**185**
m3	56250	3814	879	471	**61414**
m3/ha	424.5	28.8	6.6	3.6	**463.5**
Unit	**Firewood**				
	> 49cm	30-49cm	20-29 cm	10-19 cm	Total
Ntot	1773	2202	1568	0	**5543**
N/ha	13	17	12	0	**42**
m3	14616	2572	471	0	**17659**
m3/ha	110.3	19.4	3.6	0.0	**133.3**

Unit	Sivicultural Measures				
	Planting	Thinning	Felling (firewood)	Felling (timber)	No Activity
ha	2.5	9.9	41.9	89.9	0.0
%	2	7	29	62	0

Yield Regulation		
AAC	**616**	m3
	4.6	m3/ha
Prod. Potential / AAC	**128**	years

Figure 24. Pangzur LFMA summary sheet

2.6.3.3. Jemjong Local Forest Management Area

Four households from Jemjong are extracting timber and firewood from the current LFMA. The road from Jemjong will connect Kamjong soon, and households from Kamjong will also opt to extract timber from this site. The Annual Allowable Cut of Jemjong LFMA is set at a 147-meter cube.

Unit	Area Distribution			
	Non Production	Protection	Production	Total
ha	0.0	10.8	124.4	135.2
%	0%	8%	92%	100%

Average basal area (m2/ha)	Aver. Stand Volume (m3/ha)	No of accessible sample plots
9.9	154	103

Unit	Forest Type Distribution								
	Hemlock	Fir	Spruce	Mix. Con.	Bluepine	Chirpine	Hardwood	Mixed HC	Total
%	0%	0%	0%	0%	0%	0%	100%	0%	**100%**
Unit	**Age distribution**					**Stand type distribution**			
	young	immature	mature	Overmature	Total	plantation	natural	coppice	Total
%	17%	58%	24%	0%	**99%**	0%	100%	0%	**100%**
Unit	**Canopy closure**					**Condition**			
	dense	closed	open	unstocked	Total	good	average	poor	Total
%	5%	63%	32%	0%	**100%**	28%	68%	4%	**100%**

Unit	Site Condition								
	Slope			Erosiveness			Soil Cover		
	gentle	moderate	steep	stable	moderate	unstable	high	moderate	low
%	17%	66%	17%	30%	65%	5%	19%	71%	20%

Unit	Forest Use					
	Intensive Side Uses			Extensive Side Uses		
	grazing	sokshing	lopping	grazing	sokshing	lopping
ha	7.8	0.0	0.0	13.1	0.0	0.0
%	6%	0%	0%	10%	0%	0%

Unit	NWFP Occurence and Firewood							
	NWFP abundant				NWFP sparse			
	Firewood	Bamboo	Cane	Daphne	Firewood	Bamboo	Cane	Daphne
ha	14.9	2.7	0.0	0.0	52.7	20.3	10.8	0.0
%	11%	2%	0%	0%	39%	15%	8%	0%

Unit	Potential Production				
	Timber				
	Drashing	Cham	Tsim	Poles,posts	Total
Ntot	1603	2770	2706	20634	**27713**
N/ha	13	22	22	166	**223**
m3	12897	2213	795	1519	**17424**
m3/ha	103.7	17.8	6.4	12.2	**140.1**
Unit	**Firewood**				
	> 49cm	30-49cm	20-29 cm	10-19 cm	Total
Ntot	173	806	2214	0	**3193**
N/ha	1	6	18	0	**26**
m3	340	766	609	0	**1715**
m3/ha	2.7	6.2	4.9	0.0	**13.8**

Unit	Sivicultural Measures				
	Planting	Thinning	Felling (firewood)	Felling (timber)	No Activity
ha	10.5	34.1	34.1	53.1	0.0
%	8	25	25	39	0

Yield Regulation		
AAC	**147**	m3
	1.2	m3/ha
Prod. Potential / AAC	**130**	years

Figure 25. Jemjong LFMA summary sheet

2.6.3.4. Kamjong Local Forest Management Area

The timber availability in Kamjong is significantly less, and there are fewer people extracting timber but depending on firewood from the forest. In addition, no road exists, and people are not able to construct large houses.

Unit	Area Distribution			
	Non Production	Protection	Production	Total
ha	0.2	4.4	63.3	67.9
%	0%	6%	93%	100%

Average basal area (m2/ha)	Aver. Stand Volume (m3/ha)	No of accessible sample plots
4.7	105	80

Unit	Forest Type Distribution								
	Hemlock	Fir	Spruce	Mix. Con.	Bluepine	Chirpine	Hardwood	Mixed HC	Total
%	0%	0%	0%	0%	0%	0%	100%	0%	**100%**
Unit	**Age distribution**					**Stand type distribution**			
	young	immature	mature	Overmature	Total	plantation	natural	coppice	Total
%	38%	63%	0%	0%	**101%**	0%	100%	0%	**100%**
Unit	**Canopy closure**					**Condition**			
	dense	closed	open	unstocked	Total	good	average	poor	Total
%	0%	40%	60%	0%	**100%**	25%	68%	8%	**101%**

Unit	Site Condition								
	Slope			Erosiveness			Soil Cover		
	gentle	moderate	steep	stable	moderate	unstable	high	moderate	low
%	31%	64%	5%	44%	50%	6%	13%	74%	14%

Unit	Forest Use					
	Intensive Side Uses			Extensive Side Uses		
	grazing	sokshing	lopping	grazing	sokshing	lopping
ha	2.6	0.0	0.0	7.6	0.0	0.0
%	4%	0%	0%	11%	0%	0%

Unit	NWFP Occurence and Firewood							
	NWFP abundant				NWFP sparse			
	Firewood	Bamboo	Cane	Daphne	Firewood	Bamboo	Cane	Daphne
ha	19.0	0.0	0.0	0.0	9.5	0.0	0.0	0.0
%	28%	0%	0%	0%	14%	0%	0%	0%

Unit	Potential Production				
	Timber				
	Drashing	Cham	Tsim	Poles,posts	Total
Ntot	634	387	161	896	**2078**
N/ha	10	6	3	14	**33**
m3	5107	288	44	63	**5502**
m3/ha	80.7	4.5	0.7	1.0	**86.9**
Unit	**Firewood**				
	> 49cm	30-49cm	20-29 cm	10-19 cm	Total
Ntot	0	1385	0	0	**1385**
N/ha	0	22	0	0	**22**
m3	0	1201	0	0	**1201**
m3/ha	0.0	19.0	0.0	0.0	**19.0**

Unit	Sivicultural Measures				
	Planting	Thinning	Felling (firewood)	Felling (timber)	No Activity
ha	10.2	17.8	14.4	8.5	17.0
%	15	26	21	13	25

Yield Regulation		
AAC	**51**	m3
	0.8	m3/ha
Prod. Potential / AAC	**131**	years

Chapter III Threat Analysis

Threat assessment and analysis are integral to conservation planning and management for any protected area or species. Threat analysis encompasses determining the type of threats, the severity of the threats, and the drivers of the threats. Threats impeding the survival of nature and wildlife and the threats impacting human lives from nature and wildlife were identified from SES conducted in 2021 and RBA surveys conducted in 2006, 2016, and 2021, METT+ assessment of BC4 in 2021, and field experience knowledge from the field forestry staff. Threat analyses were conducted using Miradi-4.5.0 in consultation with the field forestry staff. As a result, we were able to identify and assess ten significant threats which hamper the conservation and protection of nature and wildlife and impact the livelihood of local communities (Figure 26). In addition, threats were assessed to derive relevant strategies and intervention actions for better corridor management and help improve the communities' livelihood. Details of each threat are discussed in the subsequent section.

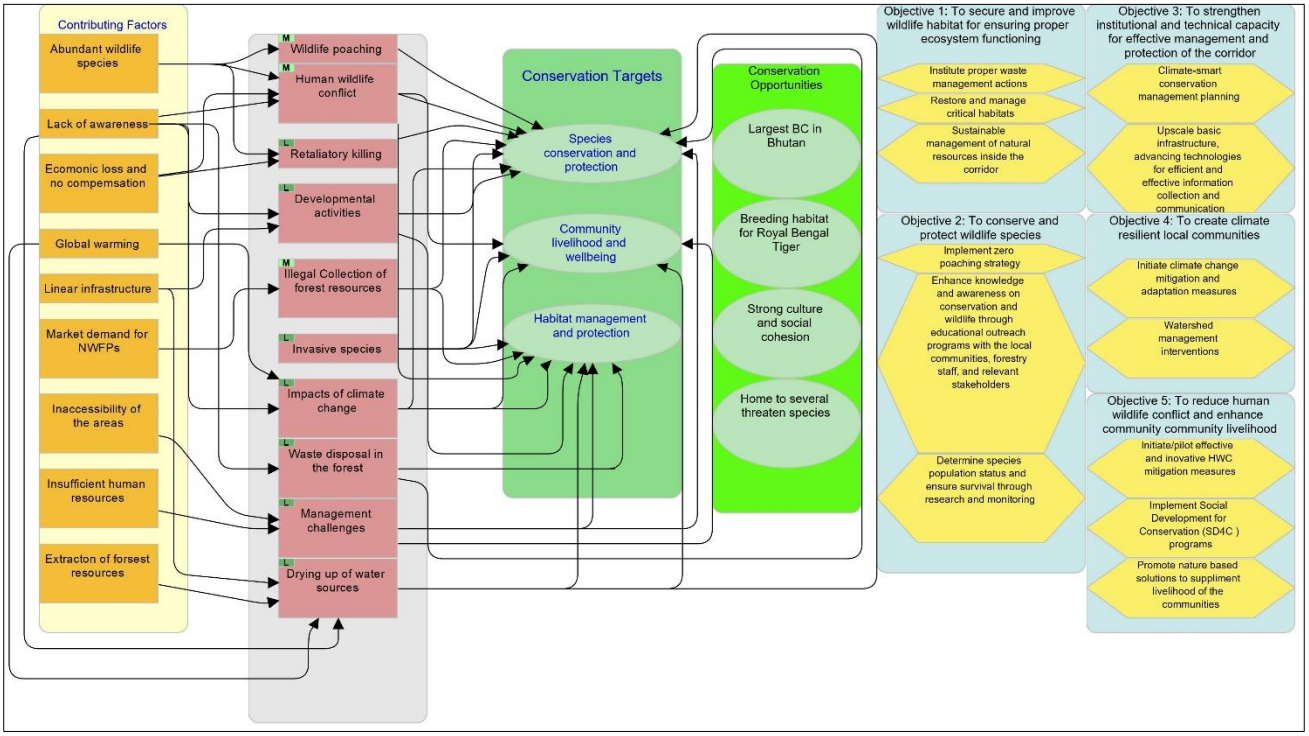


Figure 26. Threat analysis framework

3.1. Conservation threats

3.1.1. Wildlife poaching

Poaching is one of the main threats in the global scenario. Musk dear poaching shreds of evidence (Traps and snares) were detected along the northern Reotala ridges during the RBA conducted in 2016. In the year 2021, upon information received from the local informer, we have appended two poachers with poaching weapons and a small number of bush meats from Zangling forest inside the corridor. These people are the local people who are residing in proximity to the corridor (Figure 27). A foot trap suspected to be set for tigers was detected inside the corridor in the prime breeding habitat of the tiger during the RBA survey. These incidences indicate that wildlife poaching is prevalent in the corridor and it could be triggered by the abundant wildlife species present. With the increase in the number of wildlife species and exposure of the local communities to technologies, the poaching threats are

assumed to increase, if no proper mitigation measures are put in place.

Figure 27. Weapons and meats apprehended from the poachers

3.1.2. Human-wildlife conflict

Human-wildlife conflict is a critical issue for the conservation and livelihood of the communities. All the settlements surrounded by forests and abundant wildlife presence are the leading cause of human-wildlife conflict. 107 livestock belonging to 67 households were lost to wild predators in the last three years. The highest livestock depredation was by the Royal Bengal tiger, followed by a wild dog and a common leopard. In one incident, Ngakhar village lost 15 livestock to Tiger in one week.

Similarly, the loss of crops to wild herbivores has a devastating impact on people's livelihoods. Crop damage by wild herbivore and other species are typical in the corridor, where 98% of the household reported incidences of crop damage by wild animals. The majority of the crop damage incidences by the wild animal were reported for cereal crops (n=263) and vegetables (n=106) and least for cash crops (n=66). Crop damage by wild animals was mainly by wild pigs, barking deer and porcupines.

The human-wildlife conflict is one of the significant threats to the survival of wildlife and the livelihood of the local communities.

3.1.3. Retaliatory killing

Retaliatory killing is triggered by intense livestock depredation by predators and crop damage by herbivores. The human-wildlife conflict is prevalent in the corridor, and retaliation against the wildlife is inevitable. Most retaliatory killing is unnoticed or is not reported due to fines and penalties for the killing of wild animal. In 2021, a Common leopard was killed in retaliation by a community member when he lost many of his hens. Similarly, reports of two wild dog carcasses were recovered from one of the herder's pasture grounds at Nimshong in 2021. Upon investigation, it was suspected to have been poisoned by the cattle herders. Reports also indicate the presence of bush meats in the local communities, and this could probably be due to poaching or retaliatory killing.

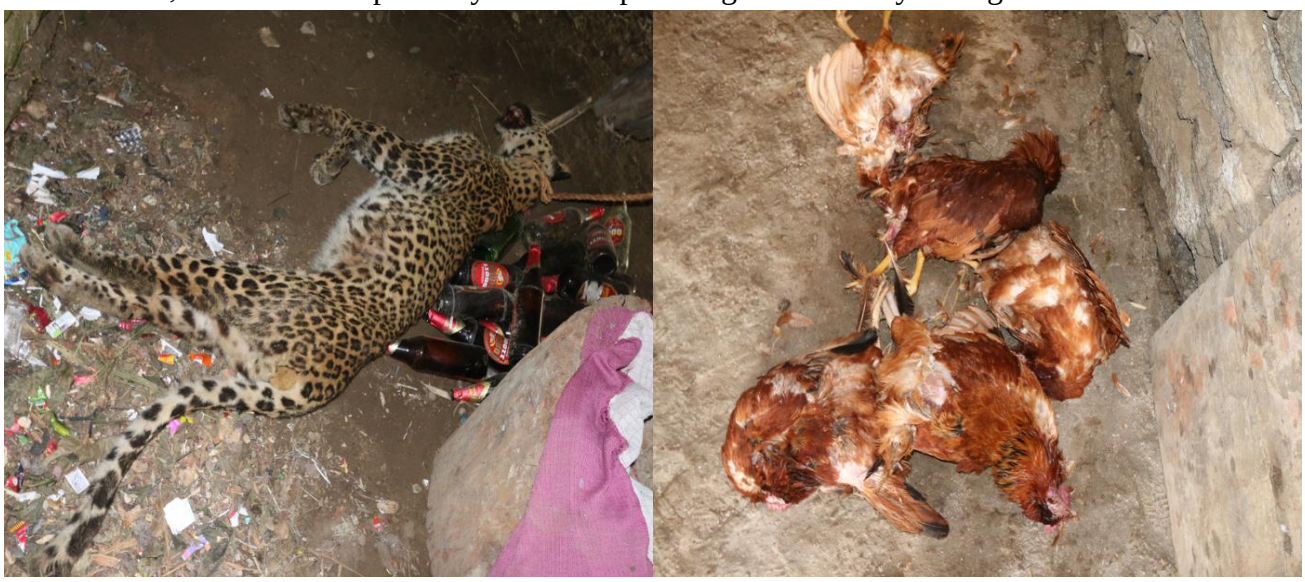


Figure 28. Common leopard predation of poultry and retaliation killing by the owner

3.1.4. Developmental activities

The developmental activities are increasing in the country and are similar in the corridor. The primary developmental activities that are causing threats to the environment and wildlife are infrastructures such as power transmission lines and road construction. These activities are accumulated in the northwestern part of the corridor, which is also a choke point for the wildlife movement. MangdechuThere are many reports of golden langur and other wildlife species being electrocuted by the powerlines. Close to 87.95 hectares of the corridor area are being used for Transmission lines. Roads are also a significant threat to wildlife movement, and many reports of wildlife casualties on the road. In 2021 alone, management recorded three golden langur causalities (road kill). The national highway connecting Trongsa with Zhemgang and Gelephu passes through the northern corridor, creating a choke point. The gewog centre road, connecting Shingkhar and Bardo, also passes through the corridor. These roads cover an area of 24.52 hectares of the corridor.

Figure 29. Endangered Golden Langur causality in the road

3.1.5. Illegal collection of forest resources

BC 4 is home to many commercially valuable and edible NWFPs, and there are increasing incidences of illegal collection of NWFPs. Rural communities illegally collect these resources for both commercials as well as self-consumption. One of the most market-demanded species is *Paris polyphylla* which is currently abundant. Local communities illegally collect this species and people from outside of the corridor also come to collect the species. In 2020, a *Paris polyphylla* dealer and 200 kg of dried *Paris polyphylla* species were appended. Similarly, such cases have also been recorded by Nimshong and Radhi in the year 2019. In addition, the collection of other resources like cane, fern, and mushrooms is rampant in the corridor.

3.1.6. Invasive species

Invasive species are a significant cause of the decline in native biodiversity in both terrestrial and aquatic ecosystems. BC 4 recorded five invasive species*: Ageratina adenophora, Chromolaena odorata, Mikania micrantha, Parthenium hysterophorus*, and *Lantana camara*. All these species are widely distributed across the corridor, and the severity is dominated by *Ageratina adenophora*, which is distributed across all the settlements. These species are found mainly in the disturbed areas around the human settlement. If these species are not managed and controlled, there is a risk of overtaking the native species.

The aquatic invasive species are also a cause of concern, and the corridor holds two major river systems (Chamkharchu and MangdechuMangdechu). Therefore, there could be a risk of invasive aquatic species, although no concrete data are available for the corridor.

3.1.7. Impact of climate change

Global warming is due to greenhouse gas accumulation, which human activities accelerate. The effect of global warming causes climate change, and the impact of climate change is higher on the fragile mountain ecosystem. Climate will have a range of direct and indirect impacts on both environment and the people.

People in the corridor have experienced extreme weather patterns, and it has also caused damage to their livelihoods. Most farmers experienced crop damage by pests and diseases, which they have not experienced in the past decades. The extreme weather pattern, like snowfalls in the lowlands of the corridor in the year 2021, has caused the drying of the cardamom plants. Due to extreme weather patterns, frequent landslides and soil erosions were rampant in the corridor.

3.1.8. Waste disposal in the forest

Wastes, particularly in the northern part of the corridor, are of significant concern to the functioning of the corridor. The presence of more prominent community residents and national highways in this area has increased the number of wastes through improper disposal of plastic and bottles along the highway by the communities and commuters. There are also several pastoralist cattle herders in the corridor who has a massive accumulation of waste in their cattle herds due to a lack of proper disposal and management.

3.1.9. Drying up of water resources

Drying up water sources is recorded as one of the serious issues in a mountainous country like Bhutan. Factors causing the drying up of water sources in our country are mainly contributed by deforestation, change in land use patterns, catchment degradation, and climate change. The drying up of water sources in the corridor has also been observed. During the water sources inventory and assessment conducted in the year 2019, the corridor recorded 27 water sources for communities inside the corridor and in the periphery areas. Water sources drying was mostly observed from the upper part settlements under Langthel gewog and till date 3 water sources have dried up in the gewog. People in these localities believe that developmental activities like the construction of the road for Hydro Power Project and the construction of the transmission line have triggered the dry-up of the water resources. Nangkhor gewog is also experiencing a high number of water sources drying (Figure 30)

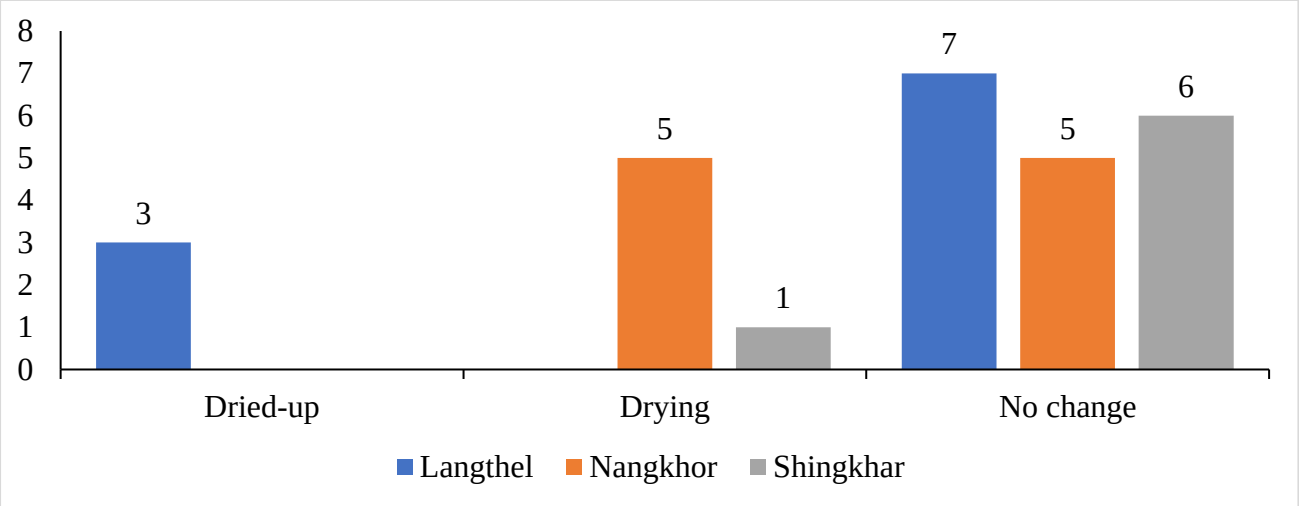


Figure 30. Water source status in BC4

3.2. Management challenges.

The elevation of the corridor ranges from 200 to 4500 masl, indicative of a vast ascend in elevation and the indication of rugged topography. Most of the corridor area is inaccessible to human settlement and has a central uninhabited area. Motorable roads are available only on the northern tip and in the middle of the corridor, but most fieldwork, including patrolling, must be conducted on foot.

The non-availability of data and information on the target species and the corridor impeded the science-based conservation and management of wildlife in the corridor. For example, the species abundance status and detailed study were not conducted for any species to date in the corridor. There is also a lack of information on the climate variables on the wildlife and the local communities.

Human resource management and capacity are pivotal in protecting a protected area. Unlike national parks with a full-time management system, the Territorial Forest Divisions manage biological corridors in Bhutan. The corridor boundary is shared between two forest divisions, and it is very

challenging to coordinate between two managements in implementing the conservation activities. There is also no particular office or building allocated for corridor management. Moreover, the technical knowledge of the field staff is also crucial in the effective management of the corridor, and the capacity of the field staff needs regular advocacy.

Communities inside the corridor are unaware that they are residing inside it, and their lack of knowledge of wildlife conservation significance and conservation laws hampers conservation efforts in the corridor. Therefore, the information gaps must be addressed for better management and conservation of the corridor.

3.3. Conservation opportunities

Biological corridor four also has several opportunities for conservation despite facing numerous challenges concerning biodiversity conservation. The primary conservation significance or the opportunities that the corridor holds are described below:

3.3.1. Largest biological corridor in Bhutan

There are eight biological corridors in Bhutan that provide connectivity between the country's other national parks, wildlife sanctuaries, and nature reserves. The corridor is even more significant than two wildlife sanctuaries (Jomotshangkha Wildlife Sanctuary and Phibsoo Wildlife sanctuary) in Bhutan. Moreover, it is the only corridor that connects the southern protected areas to the northern protected areas in central Bhutan.

3.3.2. Breeding habitat for threatened and iconic species

The corridor is home to Royal Bengal Tiger and provides safe passage for the movement of Tigers between southern and northern habitats. During our camera trapping exercise in 2020, we captured two active lactating breading female Tigris with three cubs each (Figure 31). It is incredible to see two active lactating mothers within 594 sq. km of the corridor. This capture indicates that the corridor is a breeding habitat for the Tigers, and it is paramount to protect such a critical habitat.

Figure 31. Tigris with three cubs

White-bellied Heron is a critically endangered bird species, and the two major rivers along the corridor have now become critical homes for this species. The highest number of WBH was recorded along

these rivers during Bhutan's 2021 WBH census survey. One active nest was discovered in 2021, and we still have an active nest of WBH in the corridor (Figure 32).

Figure 32. White Bellied Heron with an active nest

3.3.3. Strong culture and social cohesion

Buddhism's values and teachings are changing the local communities' attitudes. Buddhism, with its emphasis on the avoidance of killing, compassion towards all living beings, a meditation on the natural surroundings, and worship of trees, wildlife, natural landscape, rivers, and lakes, promotes the protection of the environment. Local communities inside the corridor were descendants of poachers, or their livelihood depended on bush meat in those days. However, with the advance of religious discourses and activities in the villages, people have discontinued killing wild animals and destroying the environment. Moreover, with the proper legislation and decentralization of the power to the local government, the livelihoods and social cohesion of the communities are harmonized and well organized in the corridor.

3.3.4. Home to several threaten species

Biological corridor 4 is also home to several threatened wildlife species, which are endemic and critically endangered. White Bellied Heron is a critically endangered bird with an endangered Steppe eagle, and other near-threatened bird species are found in the corridor. In addition, four plants and three orchids were discovered as new to the flora of Bhutan from the corridor within the past three years, and one Begonia species was discovered as new to science from the corridor in the year 2021. It also inhabits nine species of threatened plant species.

3.4. Threat ranking.

The conservation threat ranking was performed using the Miradi software, considering three primary criteria for ranking. These criteria include *1. Scope, 2. Severity, and 3. Irreversibility*. Scope refers to the proportion of the threat likely to affect the target within ten years under current circumstances. Severity is the level of damage to the biodiversity target expected within the scope, the level of damage to the target from the threat that can reasonably be expected given the continuation of current circumstances and trends. Irreversibility is the degree to which the effects of a given threat can be undone and the targets affected by the threat restored if the threat is stopped. Four sub-level criteria guide the nature of each threat ranking criteria: **1: Low** (The threat is likely to be very narrow in its

scope, affecting the target across a small proportion (1-10%) of its occurrence/population), **2: Medium** (The threat is likely to be restricted in its scope, affecting the target across some (11– 30%) of its occurrence/population), **3: High:** The threat is likely to be widespread in its scope, affecting the target across much (31– 70%) of its occurrence/population), **4: Very High** The threat is likely to be pervasive in its scope, affecting the target across all or most (71-100%) of its occurrence/population.
The overall threat ranking for the corridor's target conservation was **high**. It is contributed by the impact of human-wildlife conflict on the livelihood and well-being of the local communities, followed by wildlife poaching's impact on species conservation and protection. The threat rank for all the conservation targets is **medium**.

Threats/Target	Habitat Management and Protection	Species Conservation and Protection	Community Livelihood and welbeing	Summary Threat Rating
Human wildlife Conflict	Low	Medium	High	Medium
Wildlife Poaching		High		Medium
Impacts of Climate Change	Low	Low	Low	Low
Illegal collection of Forest Resources	Medium	Medium		Medium
Invasive Species	Low	Medium	Low	Low
Developmental Activities	Low	Low		Low
Waste Disposal in forest	Low	Low		Low
Retaliatory Killing		Medium		Low
Management Challenges	Medium	Low	Low	Low
Drying up of water sources	Low	Low	Low	Low
Summary Target Ratings:	Medium	Medium	Medium	Overall Progress Rating: High

Figure 33. Threat ranking score and status

Chapter IV: Management Interventions

The strategies and actions for this plan were derived based on the analysis of threats, conservation challenges, and conservation opportunities concerning biodiversity conservation and community livelihood in the corridor. It is designed to address the issues and overcome the barriers that hinder achieving the objectives and ultimate goal. The conceptual framework developed using the Miradi software summarizes the management plan's conservation targets, objectives, threats, strategies, and actions (Figure). This conservation management plan has five objectives and 15 strategies with 62 actions to achieve its goal for ten years (Table 16).

Table 16: Objectives and management actions for BC4 conservation management plan

Objective 1: To secure and improve wildlife habitats for ensuring proper ecosystem functioning
Strategy 1.1: Institute proper waste management actions
Action 1.1.1: Installation of signages and information boards at strategic illegal waste disposal risk areas
Action 1.1.2: Waste management awareness and sensitization to local communities, stakeholders, and school children
Strategy 1.2: Restore and manage critical habitats
Action 1.2.1: Conduct in-dept assessment of the critical habitats for enhanced and prioritized management.
Action 1.2.2: Restore degraded waterholes and saltlicks
Action 1.2.3: Mapping of salt licks, snag, and waterholes using remote sensing technologies
Action 1.2.4: Regular improvement of grasslands and pasture grounds
Action 1.2.5: Train and develop skills of rangers in management of wildlife and its' habitats.
Strategy 1.3: Sustainable management of natural resources inside the corridor
Action 1.3.1: Assessment of *Paris polyphylla* distribution status and enhance patrolling in the collection sites
Action 1.3.2: NWFPs group formation and marketing of the product
Action 1.3.3: Conduct regular refresher training on silviculture systems and sustainable management tools for the forestry staff.
Action 1.3.4: Resources allocation from Local Forest Management Areas and CFs
Action 1.3.5: Regular monitoring and revision of community forest
Objective 2: To protect and conserve wildlife species
Strategy 2.1: Implement zero poaching strategy
Action 2.1.1: Conduct regular anti-poaching patrolling to curb wildlife poaching through SMART patrolling.
Action 2.1.2: Enhance Ranger's knowledge on the SMART patrolling approach through refresher trainings and workshops.
Action 2.1.3: Equip forestry staff with anti-poaching gears and other equipment necessary for conducting anti-poaching activity
Action 2.1.4: Train forestry staff on law enforcement tactics, field safety and first aids.
Action 2.1.5: Strengthen River Rangers program (Refresher training on river rafting)
Strategy 2.2: Enhance knowledge and awareness on conservation and wildlife through educational outreach programs with the local communities, forestry staff, and relevant stakeholders
Action 2.2.1: Conduct awareness campaign with the cattle herders on the significance of wildlife to the ecosystem and the legal implications of retaliatory killing.
Action 2.2.2: Conduct awareness campaigns on wildlife conservation significance and goals and concepts of biological corridors to the local communities and school children
Action 2.2.3: Organize stakeholder coordination workshops/meetings to enhance better partnership in conservation.

Action 2.2.4: Identify and support nature and wildlife-based clubs in the schools
Action 2.2.5: Organize training and exposure trips for BC staff on PA management and wildlife conservation
Action 2.3.6: Strengthen citizen science group of BC4 cattle herders
Strategy 2.3: Determine species population status and ensure survival through research and monitoring
Action 2.3.1: Update biodiversity data of the BC4 on a periodic basis
Action 2.3.2: Conduct regular monitoring of wildlife species movement and status through camera traps as per the Biodiversity Monitoring Protocol of Bhutan 2020.
Action 2.3.3: Conduct wildlife distribution hot spot mapping
Objective 3: To strengthen institutional capacity for effective management and protection of the corridor
Strategy 3.1: Climate-smart conservation management planning
Action 3 .1.1: Mid-term review of BC4 conservation management plan
Action 3 .1.2: Revision of BC4 conservation management plan
Strategy 3.2: Upscale basic infrastructure, advancing technologies for efficient and effective information collection and communication
Action 3.1.1: Conduct regular in-house knowledge sharing and training on wildlife and protected area management
Action 3.1.2: Evaluate conservation management effectiveness of the corridor using Bhutan METT+
Action 3.1.3: Production of the poster and audio visuals on the corridor and its conservation significance
Objective 4: To create climate-resilient local communities
Strategy 4.1: Initiate climate change mitigation and adaptation measures
Action 4.1.1: Impart awareness and advocacy to local communities on climate change, global warming and scope for adaptation.
Action 4.1.2: Report climate change scenario by assessing people's knowledge on climate indicator variables.
Action 4.1.3: Conduct Climate Vulnerability and Capacity Analysis (CVCA) and propose sustainable adaptive interventions.
Action 4.1.4: Train forestry staff on climate data analysis and reporting.
Strategy 4.2: Watershed management interventions
Action 4.2.1: Monitoring of spring shed, watershed, water sources, and their classification.
Action 4.2.2: Hydrological mapping of the corridor area
Action 4.2.3: Revival of the drying water sources
Objective 5: To reduce Human-wildlife conflict and enhance community livelihood
Strategy 5.1: Initiate/Pilot effective and innovative HWC mitigation measures
Action 5.1.1: Update Human-wildlife conflict hot spot distribution mapping on a periodic interval.
Action 5.1.2: Establish wildlife rescue and rehabilitation enclosures.
Action 5.1.3: Initiate crop and livestock depredation compensation and insurance schemes
Action 5.1.4: Provide support to mitigate HWC like wire mesh fencing, predator corals, and electric fencing to the critical wildlife depredation hot spot villages
Action 5.1.5: Equip wildlife rescue through purchase of rescue equipment (drugs, first aids, cylinder, darts, etc…) and periodic courses
Strategy 5.2: Initiate Social Development for Conservation (SD4C) programs
Action 5.2.1: Enhance the community knowledge on mechanized agriculture and livestock tending.

Action 5.2.2: Support cold storage and carry equipment for livestock products for the itinerant herders
Action 5.2.3: Support solar lighting and mobile phone charging equipment to the cattle herders
Strategy 5.3: Promote nature-based solutions to supplement the livelihood of the local communities
Action 5.3.1: Support to enhance hot spring management at *Duenmang Tshachu*
Action 5.3.2: Enhance and support homestay management
Action 5.3.3: Train local youths in nature guiding and support formation of nature guiding group

Chapter V: Implementation schedule and Budget

Table 17: Implementation schedule and budget framework

Objectives	Strategies	Actions	Year along with budget (in Million Nu.)										Activity Total
			Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	
Objective 1: To secure and improve wildlife habitat for ensuring proper ecosystem functioning	Strategy 1.1: Institute proper waste management actions	Action 1.1.1: Installation of signages and information boards at strategic illegal waste disposal risk areas	0.2					0.2				0.2	0.6
		Action 1.1.2: Waste management awareness and sensitization to local communities, stakeholders, and school children	0.2			0.2			0.2			0.2	0.8
	Strategy 1.2: Restore and manage critical habitats	Action 1.2.1: Conduct in-dept assessment of the critical habitats for enhanced and prioritized management.		0.6									0.6
		Action 1.2.2: Restore degraded waterholes and saltlicks			0.3			0.3			0.3		0.9
		Action 1.2.3: Mapping of salt licks, snag, and waterholes using remote sensing technologies	0.5										0.5
		Action 1.2.4: Regular improvement of grasslands and pasture grounds		0.5				0.5			0.5		1.5
		Action 1.2.5: Train and develop skills of rangers in management of wildlife and its' habitats.		0.3			0.3			0.3			0.9
	Strategy 1.3: Sustainable management of natural resources inside corridor	Action 1.3.1: Assessment of *Paris polyphylla* distribution status and enhance patrolling in the collection sites	0.5										0.5
		Action 1.3.2: NWFPs group formation and marketing of the product		0.4					0.4				0.8
		Action 1.3.3: Conduct regular refresher training on silviculture systems and sustainable management tools to the forestry staff.	0.3				0.3				0.3		0.9

		Action 1.3.4: Resources allocation from Local Forest Management Areas and CFs												0
		Action 1.3.5: Regular monitoring and revision of community forest	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.3	0.1	1.4
Objective 2: To protect and conserve wildlife species	Strategy 2.1: Implement zero poaching strategy	Action 2.1.1: Conduct regular anti-poaching patrolling to curb wildlife poaching through SMART patrolling.	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	3
		Action 2.1.2: Enhance rangers' knowledge on SMART patrolling approach through training and workshops	0.4				0.4				0.4		1.2
		Action 2.1.3: Equip forestry staff with basic anti-poaching personal gears and other equipment necessary for conducting anti-poaching activity		1				1					2
		Action 2.1.4: Train forestry staff on law enforcement tactics, field safety and first aids	0.4				0.4					0.4	1.2
		Action 2.1.5: Strengthen River Rangers program (Refresher training on river rafting)		0.3					0.3				0.6
	Strategy 2.2: Enhancement of wildlife knowledge through educational outreach programs with the local communities, forestry staff and relevant stakeholders	Action 2.2.1: Conduct awareness campaign with the cattle herders on significance of wildlife to ecosystem and legal implications of retaliatory killing	0.3			0.3			0.3			0.3	1.2
		Action 2.2.2: Conduct awareness campaigns on wildlife conservation significance and goals and concepts of biological corridors to the local communities and school children		0.3			0.3			0.3			0.9
		Action 2.2.3: Organize stakeholder coordination workshops/meetings to enhance better partnership in conservation.			0.2				0.2				0.4

		Action 2.2.4: Identify and support nature and wildlife-based clubs in the schools	0.2					0.2					0.4
		Action 2.2.5: Organize trainings and exposure trips for BC staff on PA management and wildlife conservation						1					
		Action 2.3.6: Strengthen citizen science group of BC4 cattle herders		0.15		0.15		0.15		0.15		0.15	0.75
	Strategy 2.3: Determine species population status and ensure survival through research and monitoring	Action 2.3.1: Update biodiversity data of the BC4 on a periodic basis			0.4			0.4				0.4	1.2
		Action 2.3.2: Conduct regular monitoring of wildlife species movement and status through camera traps as per Biodiversity Monitoring Protocol of Bhutan 2020.	0.3				0.3				0.3		0.9
		Action 2.3.3: Conduct wildlife distribution hot spot mapping		0.4				0.4					0.8
Objective 3: To strengthen institutional capacity for effective management and protection of the corridor	Strategy 3.1: Climate smart conservation management plan development	Action 3 .1.1: Mid-term review of BC4 conservation management plan											0
		Action 3 .1.2: Revision of BC4 conservation management plan										1.4	1.4
	Strategy 3.2: Upscale basic infrastructure, advancing technologies for efficient and effective information collection and communication	Action 3.2.1: Conduct regular in-house knowledge sharing and training on wildlife and protected area management		0.2		0.2		0.2		0.2		0.2	1
		Action 3.2.2: Evaluate conservation management effectiveness of the corridor using Bhutan METT+					0.4					0.4	0.8
		Action 3.2.3: Production of poster and audio visuals on the corridor and its conservation significance							0.6				0.6
Objective 4: To create climate-	Strategy 4.1: Initiate climate change	Action 4.1.1: Impart awareness and advocacy to local communities on climate change, global warming and scope for adaptation.		0.2				0.2			0.2		0.6

resilient local communities	mitigation and adaptation measures	Action 4.1.2: Report climate change scenario by assessing people's knowledge on climate indicator variables.					0.5							0.5
		Action 4.1.3: Conduct Climate Vulnerability and Capacity Analysis (CVCA) and propose sustainable adaptive interventions.					0.4		0.6					1
		Action 4.1.4: Train forestry staff on climate data analysis and reporting.		0.4							0.4			0.8
	Strategy 4.2: Watershed management interventions	Action 4.2.1: Monitoring of spring shed, watershed, water sources, and their classification.			0.3					0.3				0.6
		Action 4.2.2: Hydrogeological mapping of the corridor area			0.8									0.8
		Action 4.2.3: Revival of the drying water sources				0.6					0.6			1.2
Objective 5: To reduce human wildlife conflict and enhance community livelihood	Strategy 5.1: Initiate effective and innovative HWC mitigation measures	Action 5.1.1: Update Human-wildlife conflict hot spot distribution mapping on a periodic interval.			0.3			0.3			0.3			0.9
		Action 5.1.2: Establish wildlife rescue and rehabilitation enclosures			0.7									0.7
		Action 5.1.3: Initiate crop and livestock depredation compensation and insurance schemes			0.8									0.8
		Action 5.1.4: Provide support to mitigate HWC like wire mesh fencing, predator corals, and electric fencing to the critical wildlife depredation hot spot villages			1				1			1		3
		Action 5.1.5: Equip wildlife rescue through purchase of rescue equipment (drugs, first aids, cylinder, darts, etc…) and periodic courses			0.4					0.4				0.8

	Strategy 5.2: Initiate Social Development for Conservation (SD4C) programs	Action 5.2.1: Enhance the community knowledge on mechanized agriculture and livestock tending		0.4					0.4					0.8
		Action 5.2.2: Support cold storage, carry equipment and advance milk churning machine to the itinerant herders	0.5					0.5						1
		Action 5.2.3: Support solar lighting and mobile phone charging equipment to the cattle herders		0.6						0.6				1.2
	Strategy 5.3: Promote nature-based solutions to supplement livelihood of the local communities	Action 5.3.1: Support to enhance hot spring management at *Duenmang Tshachu*			0.8					0.7				1.5
		Action 5.3.2: Enhance and support homestay management		1										1
		Action 5.3.3: Train local youths in nature guide and form nature guiding group		0.4					0.4					0.8
		Total budget	**0.5**	**3**	**5.1**	**0.6**	**0.9**	**1**	**2.4**	**2**	**1.5**	**1**		**45.75**

Chapter VI: Monitoring and Evaluation

Monitoring is a continuous assessment aiming at providing all stakeholders with detailed information on the progress or delay of the planned activities. Its purpose is to determine if the outputs, deliveries, and schedules planned have been reached so that action can be taken to correct the deficiencies as quickly as possible.

The monitoring at the field level shall be done by the Zhemgang Forest Division continuously and throughout the implementation phase. PA Monitoring Framework will monitor the corridor conservation management plan (Table 18). All progress in implementing planned activities and achieving the plan's strategies and objectives will be monitored and evaluated based on a comprehensive logical framework presented. The management effectiveness of the corridor while implementing the conservation management plan will be carried out using the Bhutan METT+ protocol as per Volume IV of the Forest Management Code of Bhutan 2020.

Table 18: PA monitoring framework

Data Sheet 1: Brief summary of Protected Area Sites	
Date of M&E Conducted (DD/MM/YY)	
Evaluators name & Office	
Name of protected area	
Size of protected area (ha)	
Number of technical staff	
Number of non-technical staff*	
Annual budget (Nu.) for both project and RGoB for the park	

** Non-technical staffs to include adm, accounts,*

Data Sheet 2: Assessment of the Output indicators for the Protected Area

Output Indicators as per the Management Plan	Baseline	Unit of Measure	Target for Plan Period	Yearly target	As Reported by Park Management	Reasons for non-fulfillment of the targets	Observation by M&E Team	Recommendation for each target, if any*
Indicator 1: e.g. Survey report for 3 floral species	*0*	*No*	*3*	*1*	*60% completed for 1 species*			
Indicator 2:								
Indicator 3:								
Indicator 4:								
Indicator 5:								

* Detailed recommendation in data sheet 4

Data sheet 3: Ad-hoc activities		

Datasheet 4: Detailed Recommendations		
Recommendations	**Responsibility**	**Deadline**
e.g. PA to send the expedite the completion of the survey report preparation	*Park Manager*	*Jun-20*

Table 19: Monitoring and evaluation framework

Objectives	Strategies	Actions	Output indicator	Baseline	Unit	Yearly target									
						Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Objective 1: To secure and improve wildlife habitat for ensuring proper ecosystem functioning	Strategy 1.1: Institute proper waste management actions	Action 1.1.1: Installation of signages and information boards at strategic illegal waste disposal risk areas	Number of signages installed	0	Nos.	3					3				3
		Action 1.1.2: Waste management awareness and sensitization to local communities, stakeholders, and school children	Number of local farmers, school children and stakeholders imparted with waste management awareness	100	Nos.	300			300			300			300
	Strategy 1.2: Restore and manage critical habitats	Action 1.2.1: Conduct in-dept assessment of the critical habitats for enhanced and prioritized management.	Number of surveys conducted and report produced	0	Nos.		1								
		Action 1.2.2: Restore degraded waterholes and saltlicks	Number of waterholes and saltlicks improved	5	Nos.			7			7			7	
		Action 1.2.3: Mapping of salt licks, snag, and waterholes using remote sensing technologies	Number of surveys conducted and report produced	0	Nos.	1									

		Action 1.2.4: Regular improvement of grasslands and pasture grounds	Acres of grassland improved	26	Acres		20				20			20	
		Action 1.2.5: Train and develop skills of rangers in management of wildlife and its' habitats.	Number of forestry staff trained	0	Nos.		20			20			15		
	Strategy 1.3: Sustainable management of natural resources inside corridor	Action 1.3.1: Assessment of *Paris polyphylla* distribution status and enhance patrolling in the collection sites	Number of surveys conducted and report produced	0	Nos.	1									
		Action 4.3.2: NWFPs group formation and marketing of the product	Number of surveys conducted, report produced and grouped formed	0	Nos.		1					1			
		Action 1.3.3: Conduct regular refresher training on silviculture systems and sustainable management tools to the forestry staff.	Number of forestry staff trained on silviculture system	5	Nos.	10				10				10	
		Action 1.3.4: Resources allocation from Local Forest Management Areas and CFs	Number of resource allocation report produced	0	Nos.	1	1	1	1	1	1	1	1	1	1
		Action 1.3.5: Regular monitoring and revision of community forest	Number of annual monitoring conducted for all CFs inside BC 4	4	Nos.	1	1	1	1	2	1	1	1	1	2

Objective 2: To protect and conserve wildlife species	Strategy 2.1: Implement zero poaching strategy	Action 2.1.1: Conduct regular anti-poaching patrolling to curb wildlife poaching through SMART patrolling.	Number of SMART patrols conducted and report produced	8	Nos.	2	2	2	2	2	2	2	2	2	2
		Action 2.1.2: Enhance rangers' knowledge on SMART patrolling approach through training and workshops	Number of trainings conducted	5	Nos.	1				1				1	
		Action 2.1.3: Equip forestry staff with basic anti-poaching personal gears and other equipment necessary for conducting anti-poaching activity	Number of anti-poaching equipment procured and supply	2	Nos.		2				2				
		Action 2.1.4: Train forestry staff on law enforcement tactics, field safety and first aids	Number of forestry staff trained	9	Nos.	15				15					15
		Action 2.1.5: Strengthen River Rangers program (Refresher training on river rafting)	River Rangers group formed and trained	0	report		1					1			
	Strategy 2.2: Enhancement of wildlife knowledge through educational outreach programs with the local communities, forestry staff	Action 2.2.1: Conduct awareness campaign with the cattle herders on significance of wildlife to ecosystem and legal implications of retaliatory killing	Number of cattle herders involved in awareness program	0	Nos.	16			16			16			16
		Action 2.2.2: Conduct awareness campaigns on wildlife conservation significance and goals and concepts of biological corridors	Number of communities and schools imparted with	3	Nos.		5			5			5		

	and relevant stakeholders	to the local communities and school children	awareness program												
		Action 2.2.3: Organize stakeholder coordination workshops/meetings to enhance better partnership in conservation.	Number of stakeholders involved in coordination workshops	0	Nos.			4				4			
		Action 2.2.4: Identify and support nature and wildlife-based clubs in the schools	Number of schools identified and supported	0	Nos.	3					3				
		Action 2.2.5: Organize trainings and exposure trips for BC staff on PA management and wildlife conservation	Number of staff trained in PA and wildlife management	0	Nos.						10				
		Action 2.3.6: Strengthen citizen science group of BC4 cattle herders	Number of cattle herders trained and group formed	0	Nos.		18		18		18		18		18
	Strategy 2.3: Determine species population status and ensure survival through research and monitoring	Action 2.3.1: Update biodiversity data of the BC4 on a periodic basis	Number of surveys conducted and report produced	1	Nos.			1			1				1
		Action 2.3.2: Conduct regular monitoring of wildlife species movement and status through camera traps as per Biodiversity Monitoring Protocol of Bhutan 2020.	Number of surveys conducted and report produced	0	Nos.	1				1				2	

		Action 2.3.3: Conduct wildlife distribution hot spot mapping	Number of surveys conducted and report produced	0	Nos.		1				1					
Objective 3: To strengthen institutional capacity for effective management and protection of the corridor	Strategy 3.1: Climate smart conservation management plan development	Action 3 .1.1: Mid-term review of BC4 conservation management plan	Number of assessments conducted and report produced	0	Nos.					1						
		Action 3 .1.2: Revision of BC4 conservation management plan	Number of surveys conducted and draft CMP	1	Nos.											1
	Strategy 3.2: Upscale basic infrastructure, advancing technologies for efficient and effective information collection and communication	Action 3.2.1: Conduct regular in-house knowledge sharing and training on wildlife and protected area management	Number of staff involved in the training	15	Nos.		10		10		10		10		10
		Action 3.2.2: Evaluate conservation management effectiveness of the corridor using Bhutan METT+	Number of METT+ assessments carried out and report produced	1	Nos.					1					1
		Action 3.2.3: Production of poster and audio visuals on the corridor and its conservation significance	Number of audio visual on BC4 produced and shared	0	Nos.							1			
Objective 4: To create climate resilient	Strategy 4.1: Initiate climate change mitigation and	Action 4.1.1: Impart awareness and advocacy to local communities on climate change,	Number of local communities imparted	5	Nos.		7				7			7		

local communities	adaptation measures	global warming and scope for adaptation.	with awareness program													
		Action 4.1.2: Report climate change scenario by assessing people's knowledge on climate indicator variables.	Number of surveys conducted and report produced	0	Nos.						1					
		Action 4.1.3: Conduct Climate Vulnerability and Capacity Analysis (CVCA) and propose sustainable adaptive interventions.	Number of surveys conducted and report produced	1	Nos.						1					
		Action 4.1.4: Train forestry staff on climate data analysis and reporting.	Number of staff trained	0	Nos.		15								15	
	Strategy 4.2: Watershed management interventions	Action 4.2.1: Monitoring of spring shed, watershed, water sources, and their classification.	Number of surveys conducted and report produced	0	Nos.			1						1		
		Action 4.2.2: Hydrogeological mapping of the corridor area	Number of surveys conducted and report produced	0	Nos.			1								
		Action 4.2.3: Revival of the drying water sources	Number of water sources revived	0	Nos.				2						2	
Objective 5: To reduce human	Strategy 5.1: Initiate effective and innovative	Action 5.1.1: Update Human-wildlife conflict hot spot distribution mapping on a periodic interval.	Number of surveys conducted	0	Nos.			1			1				1	

wildlife conflict and enhance community livelihood	HWC mitigation measures		and report produced												
		Action 5.1.2: Establish wildlife rescue and rehabilitation enclosures	Number of wildlife rescue enclosure established	0	Nos.			1							
		Action 5.1.3: Initiate crop and livestock depredation compensation and insurance schemes	Number of livestock compensation and insurance schemes formed	0	Nos.			1							
		Action 5.1.4: Provide support to mitigate HWC like wire mesh fencing, predator corals, and electric fencing to the critical wildlife depredation hot spot villages	Number of local communities provided with temporary HWC mitigation measures	0	Nos.			1				1			1
		Action 5.1.5: Equip wildlife rescue through purchase of rescue equipment (drugs, first aids, cylinder, darts, etc…) and periodic courses	Number of wildlife rescue equipment procured and used	4	Nos.			3					3		
	Strategy 5.2: Initiate Social Development for Conservation	Action 5.2.1: Enhance the community knowledge on mechanized agriculture and livestock tending	Number of farmers exposed to mechanized farming	0	Nos.		20					20			

	(SD4C) programs	Action 5.2.2: Support cold storage, carry equipment and advance milk churning machine to the itinerant herders	Number of cattle herders supported with cold storage and carry equipment for livestock products	0	Nos.	15					15					
		Action 5.2.3: Support solar lighting and mobile phone charging equipment to the cattle herders	Number of cattle herders supported with livelihood alternatives	28	Nos.		30						30			
	Strategy 5.3: Promote nature-based solutions to supplement livelihood of the local communities	Action 5.3.1: Support to enhance hot spring management at *Duenmang Tshachu*	Number of actions taken to enhance hot spring management	0	Nos.			2					2			
		Action 5.3.2: Enhance and support homestay management	Number of households supported with homestay management	0	Nos.		15									
		Action 5.3.3: Train local youths in nature guide and form nature guiding group	Number of nature-guide groups formed and trained	0	Nos.		1					1				

References

Bennett, A. F. (2003). Linkages in the landscape : the role of corridors and connectivity in wildlife conservation. In *Linkages in the landscape : the role of corridors and connectivity in wildlife conservation* (Issue September). https://doi.org/10.2305/iucn.ch.2004.fr.1.en

Division, Z. F., & Services, P. (2022). *BIODIVERSITY STATUS OF BIOLOGICAL CORRIDOR 4 A RAPID BIODIVERSITY ASSESSMENT Department of Forest and Park Services*.

DoFPS. (2020). *Biodiversity Monitoring and Social Survey Protocol of Bhutan*.

Lahkar, D., Ahmed, M. F., Begum, R. H., Das, S. K., Lahkar, B. P., Sarma, H. K., & Harihar, A. (2018). Camera-trapping survey to assess diversity, distribution and photographic capture rate of terrestrial mammals in the aftermath of the ethnopolitical conflict in Manas National Park, Assam, India. *Journal of Threatened Taxa*, *10*(8), 12008–12017. https://doi.org/10.11609/jott.4039.10.8.12008-12017

National Biodiversity Strategies and Aaction Plan. (2014). *National Biodiversity Strategies and Action Plan (NBSAP) Bhutan 2014.* 173pp.

National Statistics Bureau. (2018). *Population & Housing Census of Bhutan 2017*.

Ohsawa, M. (1987). Life zone ecology of the Bhutan Himalaya. *Laboratory of Ecology, Chiba University*, *6*(January 1987), 1–249. https://www.researchgate.net/publication/267415275_Life_Zone_Ecology_of_the_Bhutan_Himalaya

Annexures

Annexure 1. Dangdung LFMA Compartment Record
Annexure 2. Pangzur LFMA Compartment Record
Annexure 3. Jemjong LFMA Compartment Record
Annexure 4. Kamjong LFMA Compartment Record
Annexure 5. An annotated flora checklist for BC 4 from 2006 to 2021
Annexure 6. Mammals inventory of BC4 from 2006 to 2021
Annexure 7. An annotated bird checklist for BC 4 from 2006 to 2021
Annexure 8. Mushroom checklist of BC 4 2021
Annexure 9. Fern checklist of BC 4 2021
Annexure 10. Herpetofauna checklist of BC 4 2021
Annexure 11. Orchid checklist of BC 4 from 2006-2021
Annexure 12. Butterfly checklist of BC 4 2021
Annexure 13. Moths' checklist of BC 4 2021

Annexure 1. Dangdung LFMA Compartment Record

Compartment Record

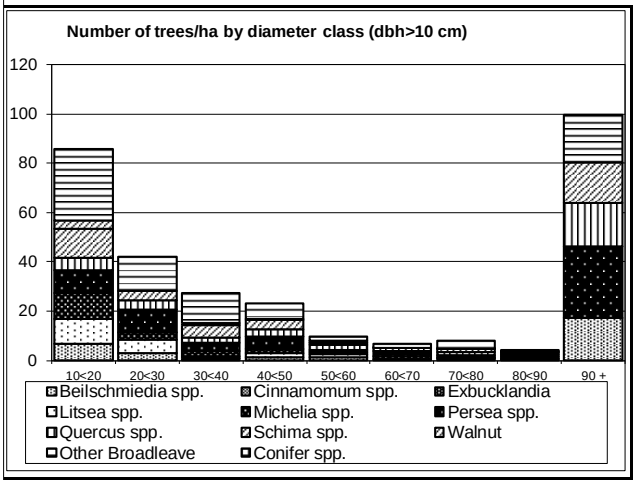
Geog	Langthel	Block	Dangdung	Block No	1	Comp.No	I

Areas in ha

Non Production		Protection	29.7	Production	381.3

Forest Composition and Description

Stand data	
Bas. Area (m2/ha)	21.1
Tot. Vol. (m3/ha)	1215.1
Vconifer %	



Forest Type	%	Stand Type	%	NWFP+firew.	A	S
Hemlock		Plantation		Type	%	%
Fir		Natural	100	Firewood	25	4
Spruce		Coppice		Bamboo		
Mixed Conifer		**Canopy**	**%**	Cane		
Blue Pine		Dense	15	Daphne		
Chir Pine		Closed	77			
Hardwood	100	Open	8			
Mixed H/C		Unstocked		**Forest Use**	**I**	**E**
Age Class	**%**	**Condition**	**%**	Type	%	%
Young	10	Good	68	Grazing	26	1.50
Immature	9	Average	24	Shokshing		
Mature	69	Poor	8	Lopping	30	
Overmature	12	**Site Characteristics**				
Slope	**%**	**Erosiveness**	**%**	**Soil Cover**	**%**	
Gentle	77	Stable	74	High	34	
Moderate	16	Moderate	29	Moderate	55	
Steep	8	Unstable	5	Low	8	

Species	Height	N/ha per diameter class										Total (> 10cm)	
	0.3<1.3 m	<10	10<20	20<30	30<40	40<50	50<60	60<70	70<80	80<90	90+	N/ha	%
Beilschmiedia spp.	27	40	7	3	1	1	1		1		17	**32**	10
Cinnamomum spp.													
Exbucklandia													
Litsea spp.			10	6	1	1	1	0	0	0		**20**	6
Michelia spp.	45	51	10	3	2	2	1	1		1		**20**	6
Persea spp.	120	43	9	9	3	5	1	2	1	1	29	**61**	20
Quercus spp.	90	72	5	4	2	3	2	2	1	1	17	**37**	12
Schima spp.	24	29	12	4	5	3	1		1	1	17	**44**	14
Walnut	19	8	3		1	0	1	0	0	0		**6**	2
Other Broadleave	909	1080	29	14	12	6	2	2	3	1	19	**88**	29
Conifer spp.													
Total	**1234**	**1322**	**86**	**42**	**28**	**23**	**10**	**7**	**8**	**4**	**100**	**307**	100

Future Management & Monitoring of Activities

Timber extraction and thinning

Production Potential (N, Volume)						No of trees removed each year										Total	%
Product size		N total	N/ha	%	(m3)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		
>50	Drashing	42783	112	94	391549	21	21	21	21	21	21	21	21	21		189	0
	Firewood	5957	16		44449	5	5	5	5	5	5	5	5	5		45	0
30-49	Cham	13644	36	4	11614												
	Firewood	5390	14		6603												
20-29	Tsim	10863	28	1	3226												
	Firewood	5140	13		1565												
10-19	Poles, etc.	30176	79	1	2243												
	Firewood	2596	7		198												

Silvicultural Measures			Area in ha implemented per year										Total	%
Measure	Area (ha)	in %	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		
Planting	30.9	8												
Thinning	92.7	23												
Felling (firewood)	92.7	23												
Felling (timber)	185.4	45												
No activity	9.3	2												

Assessment carried out by	Phub Dorji	**Year:**	2022

Annexure 2. Pangzur LFMA Compartment Record

Compartment Record

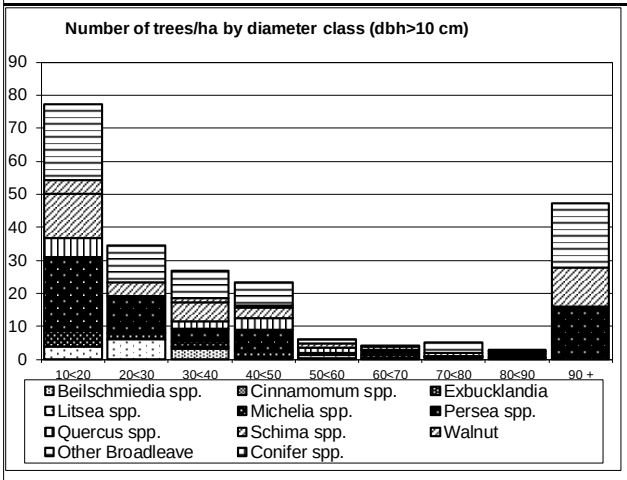
Geog	Langthel	Block	Pangzur	Block No	1	Comp.No	I

Areas in ha

Non Production		Protection	11.6	Production	132.5

Forest Composition and Description

Stand data	
Bas. Area (m2/ha)	16.7
Tot. Vol. (m3/ha)	604.3
Vconifer %	



Forest Type	%	Stand Type	%	NWFP+firew.	A	S
Hemlock		Plantation		Type	%	%
Fir		Natural	100	Firewood	46	10
Spruce		Coppice		Bamboo	4	16
Mixed Conifer		**Canopy**	**%**	Cane		
Blue Pine		Dense	6	Daphne		
Chir Pine		Closed	84			
Hardwood	100	Open	10			
Mixed H/C		Unstocked		**Forest Use**	**I**	**E**
Age Class	**%**	**Condition**	**%**	Type	%	%
Young	9	Good	80	Grazing	18	14.53
Immature	27	Average	14	Shokshing		
Mature	58	Poor	6	Lopping		
Overmature	6	**Site Characteristics**				
Slope	**%**	**Erosiveness**	**%**	**Soil Cover**	**%**	
Gentle	38	Stable	73	High	27	
Moderate	45	Moderate	23	Moderate	64	
Steep	8	Unstable	4	Low	9	

Species	Height	N/ha per diameter class										Total (> 10cm)	
	0.3<1.3 m	<10	10<20	20<30	30<40	40<50	50<60	60<70	70<80	80<90	90+	N/ha	%
Beilschmiedia spp.	45	63			3	1	0		1			**5**	2
Cinnamomum spp.													
Exbucklandia													
Litsea spp.	36	73	4	6	1		1	0	0	0		**13**	6
Michelia spp.	51	57	5	2	2	2	0	1		1		**12**	5
Persea spp.	311	130	22	11	4	6	0	1	0	1	16	**62**	27
Quercus spp.	103	82	6		2	3	2	1				**14**	6
Schima spp.	42	51	14	4	6	3	1		1	1	12	**41**	18
Walnut	15	24	4		1	1				0		**6**	3
Other Broadleave	955	877	23	11	8	7	2	0	3	1	19	**75**	33
Conifer spp.													
Total	**1560**	**1357**	**77**	**34**	**27**	**23**	**6**	**4**	**5**	**3**	**47**	**228**	100

Future Management & Monitoring of Activities

Timber extraction and thinning

Production Potential (N, Volume)						No of trees removed each year										Total	%
Product size		N total	N/ha	%	(m3)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		
>50	Drashing	6852	52	89	56250	21	21	21	21	21	21	21	21	21		189	0
	Firewood	1773	13		14616	5	5	5	5	5	5	5	5	5		45	0
30-49	Cham	4356	33	8	3814												
	Firewood	2202	17		2572												
20-29	Tsim	2998	23	2	879												
	Firewood	1568	12		471												
10-19	Poles, etc.	10251	77	1	739												
	Firewood																

Silvicultural Measures			Area in ha implemented per year										Total	%
Measure	Area (ha)	in %	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		
Planting	2.5	2												
Thinning	9.9	7												
Felling (firewood)	41.9	29												
Felling (timber)	89.9	62												
No activity														

Assessment carried out by	Phub Dorji	Year:	2022

Annexure 3. Jemjong LFMA Compartment Record

Compartment Record

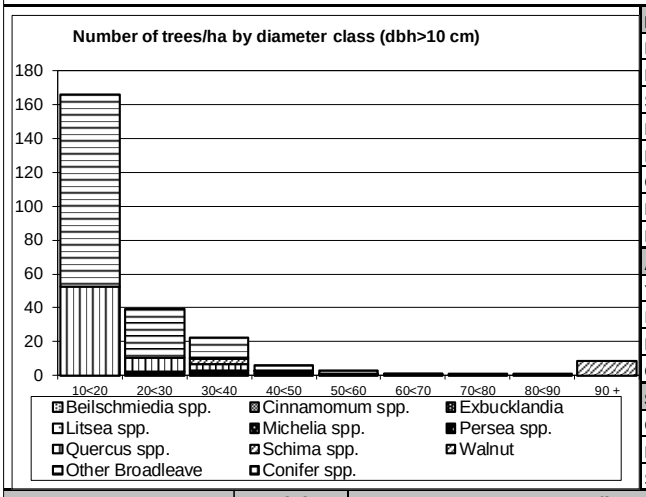
Geog	Nangkhor	Block	Jemjong	Block No	1	Comp.No	I

Areas in ha

Non Production	0.0	Protection	10.8	Production	124.4

Forest Composition and Description

Stand data	
Bas. Area (m2/ha)	9.9
Tot. Vol. (m3/ha)	153.9
Vconifer %	



Forest Type	%	Stand Type	%	NWFP+firew.	A	S
Hemlock		Plantation		Type	%	%
Fir		Natural	100	Firewood	11	39
Spruce		Coppice		Bamboo	2	15
Mixed Conifer		**Canopy**	**%**	Cane		8
Blue Pine		Dense	5	Daphne		
Chir Pine		Closed	63			
Hardwood	100	Open	32			
Mixed H/C		Unstocked		**Forest Use**	**I**	**E**
Age Class	**%**	**Condition**	**%**	Type	%	%
Young	17	Good	28	Grazing	5.8	9.71
Immature	58	Average	68	Shokshing		
Mature	24	Poor	4	Lopping		
Overmature		**Site Characteristics**				
Slope	**%**	**Erosiveness**	**%**	**Soil Cover**	**%**	
Gentle	17	Stable	30	High	19	
Moderate	66	Moderate	65	Moderate	71	
Steep	17	Unstable	5	Low	10	

Species	Height	N/ha per diameter class										Total (> 10cm)	
	0.3<1.3 m	<10	10<20	20<30	30<40	40<50	50<60	60<70	70<80	80<90	90+	N/ha	%
Beilschmiedia spp.													
Cinnamomum spp.													
Exbucklandia													
Litsea spp.													
Michelia spp.													
Persea spp.	230	155		2	3	1	0		0			**7**	3
Quercus spp.	244	79	53	8	4	1	0					**66**	27
Schima spp.	155	148			3	0	0	0		0	9	**14**	6
Walnut		48			0	0		0				**1**	0
Other Broadleave	1727	721	113	29	12	3	2	1	0	0		**161**	65
Conifer spp.													
Total	**2356**	**1150**	**166**	**40**	**22**	**6**	**3**	**1**	**1**	**1**	**9**	**249**	100

Future Management & Monitoring of Activities

Production Potential (N, Volume)						No of trees removed each year										Total	%
Product size		N total	N/ha	%	(m3)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		
>50	Drashing	1603	13	69	12897												
	Firewood	173	1		340												
30-49	Cham	2770	22	16	2213												
	Firewood	806	6		766												
20-29	Tsim	2706	22	7	795												
	Firewood	2214	18		609												
10-19	Poles, etc.	20634	166	8	1519												
	Firewood																

Silvicultural Measures			Area in ha implemented per year										Total	%
Measure	Area (ha)	in %	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		
Planting	10.5	8												
Thinning	34.1	25												
Felling (firewood)	38.1	28												
Felling (timber)	52.5	39												
No activity														

Assessment carried out by	Kinzang Thinley	**Year:**	2022

Annexure 4. Kamjong LFMA Compartment Record

Compartment Record

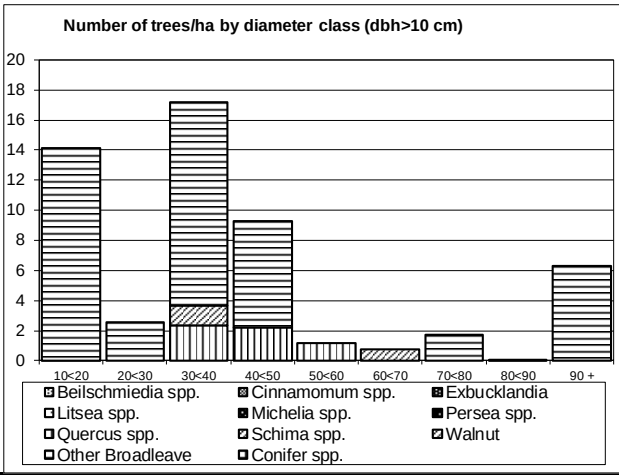
Geog	Nangkhor	Block	Kamjong	Block No	1	Comp.No	I

Areas in ha

Non Production	0.2	Protection	4.4	Production	63.3

Forest Composition and Description

Stand data	
Bas. Area (m2/ha)	4.9
Tot. Vol. (m3/ha)	105.9
Vconifer %	



Forest Type	%	Stand Type	%	NWFP+firew.	A	S
Hemlock		Plantation		Type	%	%
Fir		Natural	100	Firewood	28	14
Spruce		Coppice		Bamboo		
Mixed Conifer		**Canopy**	**%**	Cane		
Blue Pine		Dense		Daphne		
Chir Pine		Closed	40			
Hardwood	100	Open	60			
Mixed H/C		Unstocked		**Forest Use**	**I**	**E**
Age Class	**%**	**Condition**	**%**	Type	%	%
Young	38	Good	25	Grazing	3.8	11.25
Immature	63	Average	68	Shokshing		
Mature		Poor	8	Lopping		
Overmature		**Site Characteristics**				
Slope	**%**	**Erosiveness**	**%**	**Soil Cover**	**%**	
Gentle	31	Stable	44	High	13	
Moderate	64	Moderate	50	Moderate	74	
Steep	5	Unstable	6	Low	14	

Species	Height	N/ha per diameter class										Total (> 10cm)	
	0.3<1.3 m	<10	10<20	20<30	30<40	40<50	50<60	60<70	70<80	80<90	90+	N/ha	%
Beilschmiedia spp.													
Cinnamomum spp.													
Exbucklandia													
Litsea spp.													
Michelia spp.													
Persea spp.													
Quercus spp.	93	57			2	2	1					**6**	11
Schima spp.	186	199			1			1		0		**2**	4
Walnut													
Other Broadleave	1839	1021	14	3	14	7			2		6	**45**	85
Conifer spp.													
Total	**2118**	**1278**	**14**	**3**	**17**	**9**	**1**	**1**	**2**	**0**	**6**	**53**	100

Future Management & Monitoring of Activities

Production Potential (N, Volume)						No of trees removed each year										Total	%
Product size		N total	N/ha	%	(m3)	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		
>50	Drashing	634	10	76	5107												
	Firewood																
30-49	Cham	287	5	22	288												
	Firewood	1385	22		1201												
20-29	Tsim	161	3	1	44												
	Firewood																
10-19	Poles, etc.	896	14	1	63												
	Firewood																

Silvicultural Measures			Area in ha implemented per year										Total	%
Measure	Area (ha)	in %	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031		
Planting	10.2	15												
Thinning	17.8	26												
Felling (firewood)	14.4	21												
Felling (timber)	8.5	13												
No activity	17.0	25												

Assessment carried out by	Omnath Raika	Year:	2022

Annexure 5: An annotated flora checklist for BC 4 from 2006 to 2021

Sl.no	Scientific name	Family	Habit	IUCN status	CITES	Remarks	0 @2006, x @2016, X@2021
1	*Abies densa*	Pinaceae	Tree	LC			0 X
2	*Acanthocalyx nepalensis*	Caprifoliaceae	Herb	LC			X
3	*Acer campbellii*	Sapindaceae	Tree	LC			0 x X
4	*Acer hookeri*	Sapindaceae	Tree	DD			0 X
5	*Acer oblongum*	Sapindaceae	Tree	LC			X
6	*Acer sikkimense*	Sapindaceae	Tree	LC			X
7	*Acer sterculiaceum*	Sapindaceae	Tree	LC			X
8	*Acer thomsonii*	Sapindaceae	Tree	LC			X
9	*Actinodaphne obovata*	Lauraceae	Tree	LC			0
10	*Aeschynanthus hookeri*	Gesneriaceae	Herb	LC			X
11	*Aesculus indica*	Hippocastanaceae	Tree	LC			0
12	*Agapetes smithiana*	Ericaceae	Herb	LC			0
13	*Agapetes variegata*	Ericaceae	Shrub	LC			X
14	*Ageratina adenophora*	Asteraceae	Shrub	LC			0 x X
15	*Ageratum conyzoides*	Asteraceae	Herb	LC			x X
16	*Aglaia edulis*	Meliaceae	Tree	NT			X
17	*Ailanthus integrifolia*	Simaroubaceae	Tree	LC			X
18	*Ainsliaea latifolia*	Compositae	Grass	LC			X
19	*Albizia chinensis*	Leguminosae	Tree	LC			0 X
20	*Albizia julibrissin*	Leguminosae	Tree	LC			X
21	*Albizia lebbeck*	Leguminosae	Tree	LC			x X
22	*Albizia procera*	Leguminosae	Tree	LC			x X
23	*Alcimandra cathcartii*	Magnoliaceae	Tree	LC			X
24	*Alingium alpinum*	Cornaceae	Shrub	LC			X
25	*Alingium chinensis*	Cornaceae	Shrub	LC			X
26	*Allium caesium*	Alliaceae	Herb	LC			0
27	*Alnus nepalensis*	Betulaceae	Tree	LC			0 x X
28	*Altingia excelsa*	Altingiaceae	Tree	LC			X
29	*Anaphalis busua*	Asteraceae	Herb	LC			0 X
30	*Anaphalis margaritacea*	Compositae	Herb	LC			X
31	*Anaphalis triplenervus*	Asteraceae	Herb	LC			0
32	*Anisodus luridus*	Solanaceae	Shrub	LC			X
33	*Anisomeles indica*	Lamiaceae	Shrub	LC			X
34	*Aphanamixis polystachya*	Meliaceae	Tree	LC			X
35	*Aquilaria malaccensis*	Thymelaeaceae	Tree	CR	Appendix II		0
36	*Ardisia macrocarpa*	Primulaceae	Shrub	LC			0 X
37	*Ardisia thyrsiflora*	Primulaceae	Shrub	LC			0
38	*Arisaema consanguineum*	Araceae	Herb	LC			X
39	*Arisaema galeatum*	Araceae	Herb	LC			X
40	*Arisaema griffithii*	Araceae	Herb	LC			0
41	*Arisaema jacquemontii*	Araceae	Herb	LC			X

42	*Arisaema tortuosum*	Araceae	Herb	LC			X
43	*Arisaema triphyllum*	Araceae	Herb	LC			X
44	*Artemisia bhutanica*	Asteraceae	Shrub	LC		Endemic	X
45	*Artemisia maritima*	Asteraceae	Shrub	LC			x
46	*Artemisia roxburghii*	Asteraceae	Shrub	LC			0
47	*Artemisia vulgaris*	Asteraceae	Shrub	LC			X
48	*Asparagus racemosus*	Asparagaceae	Shrub	LC			X
49	*Astilbe rivularis*	Saxifragaceae	Shrub	LC			0 X
50	*Balanophora sp*	Balanophoraceae	Herb	LC			X
51	*Barleria cristata*	Acanthaceae	Shrub	LC			X
52	*Bauhinia variegata*	Fabaceae	Tree	LC			x X
53	*Begonia bhutanensis*	Begoniaceae	Herb	LC			X
54	*Begonia flaviflora hara*	Begoniaceae	Herb	LC			X
55	*Begonia gemmipara*	Begoniaceae	Herb	LC			X
56	*Begonia hatacoa*	Begoniaceae	Herb	LC			X
57	*Begonia megaptera*	Begoniaceae	Herb	LC			X
58	*Beilschmiedia gammieana*	Lauraceae	Tree	LC			X
59	*Benthamedia capitata*	Cornaceae	Tree	LC			X
60	*Berberis angulosa*	Berberidaceae	Shrub	LC			x
61	*Berberis asiatica*	Berberidaceae	Shrub	LC			0 x X
62	*Berberis hookeri*	Berberidaceae	Shrub	LC			X
63	*Berberis insignis*	Berberidaceae	Shrub	LC			X
64	*Berberis praecipua*	Berberidaceae	Shrub	LC			X
65	*Bergenia ciliata*	Saxifragaceae	Herb	LC			X
66	*Betula alnoides*	Betulaceae	Tree	LC			0 X
67	*Betula utilis*	Betulaceae	Tree	LC			0 X
68	*Bidens pilosa*	Asteraceae	Herb	LC			0 X
69	*Bischofia javanica*	Phyllanthaceae	Tree	LC			X
70	*Bistorta affinis*	Polygonaceae	Herb	LC			0 X
71	*Boehmeria macrophylla*	Urticaceae	Herb	LC			x
72	*Boehmeria platanifolia*	Urticaceae	Shrub	LC			X
73	*Boehmeria platyphylla*	Urticaceae	Shrub	LC			X
74	*Bombax ceiba*	Bombacaceae	Tree	LC			0 X
75	*Borinda grossa*	Poaceae	Bamboo	LC			X
76	*Boschniakia himalaica*	Orobanchaceae	Herb	LC			X
77	*Brassaiopsis hainla*	Araliaceae	Tree	LC			X
78	*Brassaiopsis mitis*	Araliaceae	Tree	LC			0 X
79	*Bridelia retusa*	Phyllanthaceae	Shrub	LC			0 X
80	*Buddleja asiatica*	Buddlejaceae	Shrub	LC			0
81	*Bupleurum candollei*	Apiaceae	Herb	LC			X
82	*Caesalpinia decapetala*	Leguminosae	Shrub	LC			0
83	*Callicarpa arborea*	Lamiaceae	Shrub	LC			0 X
84	*Canarium strictum*	Burseraceae	Tree	LC			0 X
85	*Cannabis sativa*	Cannabaceae	Shrub	LC			x X

86	*Canthium angustifolium*	Rubiaceae	Shrub	LC			X
87	*Cardamine impatiens*	Brassicaceae	Herb	LC			X
88	*Cardiocrinum giganteum*	Liliaceae	Herb	LC			X
89	*Caryota urens*	Arecaceae	Tree	LC			x
90	*Casearia glomerata*	Flacourtiaceae	Shrub	LC			X
91	*Cassiope fastigiata*	Ericaceae	Herb	LC			0
92	*Castanopsis hystrix*	Fagaceae	Tree	LC			0 X
93	*Castanopsis indica*	Fagaceae	Tree	LC			0 X
94	*Castanopsis tribuloides*	Fagaceae	Tree	LC			X
95	*Celtis tetrandra*	Ulmaceae	Tree	LC			0 X
96	*Chimonobambusa callosa*	Poaceae	Bamboo	LC			X
97	*Chirita urticifolia*	Urticaceae	Shrub	LC			0 x
98	*Chlorophytum nepalense*	Asparagaceae		LC			X
99	*Chromolaena odorata*	Asteraceae	Shrub	LC			0 x X
100	*Chukrasia tabularis*	Meliaceae	Tree	LC			x X
101	*Cinnamomum bejolghota*	Lauraceae	Tree	LC			x X
102	*Cinnamomum glaucescens*	Lauraceae	Tree	LC			X
103	*Cinnamomum impressinervium*	Lauraceae	Tree	LC			X
104	*Cinnamomum tamala*	Lauraceae	Tree	LC			0 x
105	*Cirsium falconeri*	Asteraceae	Herb	LC			0 X
106	*Cirsium verutum*	Asteraceae	Herb	LC			0 X
107	*Clematis acuminata*	Ranunculaceae	Climber	LC			X
108	*Clematis montana*	Ranunculaceae	Climber	LC			0 x X
109	*Clerodendrum colebrookianum*	Lamiaceae	Shrub	LC			X
110	*Clerodendrum infortunatum*	Lamiaceae	Shrub	LC			0 x
111	*Clerodendrum serratum*	Lamiaceae	Shrub	LC			X
112	*Clintonia udensis*	Liliaceae	Herb	LC			X
113	*Colocasia esculenta*	Araceae	Herb	LC			x
114	*Corydalis elatum*	Fumariaceae	Herb	LC			0
115	*Corylopsis himalayana*	Hamamelidaceae	Shrub	LC			X
116	*Cotoneaster intregrifolia*	Rosaceae	Herb	LC			0
117	*Cotoneaster microphylla*	Rosaceae	Shrub	LC			x
118	*Cotoneaster rotundifolius*	Rosaceae	Shrub	LC			X
119	*Crassocephalum crepidioides*	Asteraceae	Herb	LC			0 X
120	*Crawfurdia speciosa*	Gentianaceae	Climber	LC			X
121	*Cremanthodium reniforme*	Asteraceae	Herb	LC			0
122	*Crotolaria bracteata*	Leguminosae	Shrub	LC			X
123	*Cyanotis vaga*	Commelinaceae	Herb	LC			X
124	*Cyathula capitata*	Amaranthaceae	Herb	LC			X
125	*Cynoglossum amabile*	Boraginaceae	Shrub	LC			X
126	*Cynoglosum furcatum*	Asteraceae	Herb	LC			0
127	*Daphne bholua*	Thymelaeaceae	Shrub	LC			0 X

128	*Daphne sureil*	Thymelaeaceae	Shrub	LC			X
129	*Daphniphyllum himalense*	Daphniphyllaceae	Tree	LC			0 X
130	*Datura stramonium*	Solanaceae	Shrub	LC			X
131	*Debregeasia longifolia*	Urticaceae	Shrub	LC			0 X
132	*Dendrocalamus hamiltonii*	Poaceae	Bamboo	LC			X
133	*Dendrocnide sinuata*	Urticaceae	Shrub/Tree	LC			X
134	*Deutzia compacta*	Philadelphaceae	Shrub	LC			0
135	*Dichroa febrifuga*	Hydrangeaceae	Shrub	LC			0 x X
136	*Dioscora bulbifera*	Dioscoreaceae	Climber	LC			X
137	*Dioscorea deltoidea*	Dioscoreaceae	Climber	LC	Appendix II		0
138	*Dioscorea hamiltonii*	Dioscoreaceae	Climber	LC			x
139	*Diploknema butyracea*	Sapotaceae	Tree	LC			0 x X
140	*Dipsacus inermis*	Caprifoliaceae	Herb	LC			X
141	*Disporum cantoniense*	Liliaceae	Herb	LC			X
142	*Dobinia vulgaris*	Anacardiaceae	Shrub	LC			X
143	*Docynia indica*	Rosaceae	Tree	LC			0 X
144	*Dodecadenia grandiflora*	Lauraceae	Tree	LC			X
145	*Drepanostachyum intermedium*	Poaceae	Bamboo	LC			x
146	*Drimycarpus racemosus*	Anacardiaceae	Tree	LC			X
147	*Drymaria cordata*	Caryophyllaceae	Herb	LC			X
148	*Duabanga grandiflora*	Lythraceae	Tree	LC			0 x X
149	*Dufrenoya platyphylla*	Santalaceae	Herb	LC			X
150	*Duhaldea cappa*	Asteraceae	Herb	LC			0 X
151	*Edgeworthia gardneri*	Thymelaeaceae	Shrub	LC			X
152	*Ekianthus deflexus*	Ericaceae	Shrub	LC			X
153	*Elaeagnus parviflora*	Elaeagnaceae	Shrub	LC			X
154	*Elaeocarpus lanceifolius*	Elaeocarpaceae	Tree	LC			X
155	*Elaeocarpus sikkimensis*	Elaeocarpaceae	Tree	LC			X
156	*Elastostema lineolatum*	Urticaceae	Herb	LC			0
157	*Elatostema pusila*	Urticaceae	Herb	LC			0
158	*Elatostema sessile*	Urticaceae	Herb	LC			0 x X
159	*Elsholtzia ciliata*	Labiatae	Herb	LC			X
160	*Elsholtzia strobilifera*	Lamiaceae	Herb	LC			X
161	*Elsholzia flava*	Urticaceae	Herb	LC			0
162	*Elsholzia fruiticosa*	Urticaceae	Herb	LC			0
163	*Emblica officinalis*	Phyllanthaceae	Shrub	LC			0 X
164	*Engelhardia spicata*	Juglandaceae	Tree	LC			0 x X
165	*Eriobotyra hookeriana*	Rosaceae	Tree	LC			X
166	*Erythrina arborescens*	Fabaceae	Tree	LC			0 X
167	*Erythrina stricta*	Fabaceae	Tree	LC			X
168	*Euonymous tingens*	Celastraceae	Tree	LC			X
169	*Euphorbia pulcherrima*	Euphorbiaceae	Shrub	LC			X
170	*Eurya acuminata*	Pentaphylaceae	Tree	LC			0 x X

171	*Eurya cerasifolia*	Pentaphylaceae	Tree	LC			0 X
172	*Evodia fraxinifolia*	Rutaceae	Shrub	LC			X
173	*Exbucklandia populnea*	Hamamelidaceae	Tree	LC			0 x X
174	*Ficus auriculata*	Moraceae	Tree	LC			0 X
175	*Ficus elastica*	Moraceae	Tree	LC			0
176	*Ficus heterophylla*	Moraceae	Shrub	LC			X
177	*Ficus hispida*	Moraceae	Shrub	LC			X
178	*Ficus hookeriana*	Moraceae	Tree	LC			x
179	*Ficus oligodon*	Moraceae	Tree	LC			x
180	*Ficus semicordata*	Moraceae	Tree	LC			0 X
181	*Flemingia macrophylla*	Fabaceae	Shrub	LC			X
182	*Fluggea virosa*	Phyllanthaceae	Shrub	LC			0 X
183	*Fragaria nubicola*	Rosaceae	Herb	LC			0 x X
184	*Galinsoga parviflora*	Asteraceae	Herb	LC			X
185	*Galium elegans*	Rubiaceae	Herb	LC			X
186	*Gaultheria fragrantissima*	Ericaceae	Shrub	LC			0 x X
187	*Gaultheria griffithiana*	Ericaceae	Shrub	LC			X
188	*Gaultheria nummularioides*	Ericaceae	Shrub	LC			X
189	*Gaultheria semi-infera*	Ericaceae	Shrub	LC			0 X
190	*Geranium nepalense*	Geraniaceae	Herb	LC			X
191	*Geum elatum*	Rosaceae	Herb	LC			0
192	*Girardina diversifolia*	Urticacea	Herb	LC			0 X
193	*Glochidion heyneanum*	Euphorbiaceae	Tree	LC			X
194	*Gmelina arborea*	Verbenaceae	Tree	LC			x
195	*Gnaphalium affine*	Asteraceae	Herb	LC			0 X
196	*Gnaphalium hypoleucum*	Compositae	Herb	LC			X
197	*Gordonia excelsa*	Theaceae	Tree	LC			X
198	*Grewia optiva*	Tiliaceae	Tree	LC			0
199	*Hedera helix*	Araliaceae	Climber	LC			X
200	*Hedera nepalensis*	Araliaceae	Climber	LC			X
201	*Hedychium aruncullata*	Zingiberaceae	Herb	LC			0
202	*Hedychium densiflorum*	Zingiberaceae	Herb	LC			x
203	*Hedychium ellipticum*	Zingiberaceae	Herb	LC			X
204	*Hedyotis scandens*	Rubiaceae	Herb	LC			X
205	*Helicia nilagirica*	Proteaceae	Shrub	LC			X
206	*Helwingia himalaica*	Cornaceae	Shrub	LC			X
207	*Hemidesmus indicus*	Apocynaceae	Climber/ Shrub	LC			X
208	*Hemiphragma heterophyllum*	Scrophulariaceae	Herb	LC			X
209	*Heracleum lalli*	Apiaceae	Herb	LC			X
210	*Holmskioldia sanguinea*	Verbenaceae	Shrub	LC			X
211	*Hovenia acerba*	Rhamnaceae	Tree	LC			X
212	*Hoya lanceolata*	Apocynaceae	Herb	LC			X
213	*Hoya polyneura*	Apocynaceae	Herb	LC			X

214	*Hydrangea aspera*	Hydrangeaceae	Shrub	LC			X
215	*Hydrocotyle nepalensis*	Araliaceae	Herb	LC			X
216	*Hypericum hookerianum*	Hypericaceae	Shrub	LC			X
217	*Hypericum uralum*	Hypericaceae	Shrub	LC			X
218	*Ilex dipyrena*	Aquifoliaceae	Tree	LC			X
219	*Ilex intricata*	Aquifoliaceae	Tree	LC			X
220	*Ilex sikkimensis*	Aquifoliaceae	Tree	LC			X
221	*Illex fragilis*	Aquifoliaceae	Tree	LC			0 X
222	*Impatiens latiflora*	Balsaminaceae	Herb	LC			X
223	*Impatiens arguta*	Balsaminaceae	Herb	LC			X
224	*Impatiens jurpia*	Balsaminaceae	Herb	LC			X
225	*Impatiens pseudolavigata*	Balsaminaceae	Herb	LC			X
226	*Impatiens racemosa*	Balsaminaceae	Herb	LC			X
227	*Impatiens radiata*	Balsaminaceae	Herb	LC			X
228	*Impatiens sikkimensis*	Balsaminaceae	Herb	LC			X
229	*Impatiens spirifer*	Balsaminaceae	Herb	LC			X
230	*Impatiens stenanthe*	Balsaminaceae	Herb	LC			X
231	*Impatiens tripetala*	Balsaminaceae	Herb	LC			X
232	*Indigofera dosua*	Leguminosae	Shrub	LC			0 X
233	*Ipomea purpurea*	Convolvulaceae	Herb	LC			0
234	*Isodon lopanthoides*	Labiatae	Herb	LC			X
235	*Jasminum dispermum*	Jasminaceae	Climber	LC			X
236	*Juglans regia*	Juglandaceae	Tree	LC			0 x X
237	*Juniperus squamata*	Cupressaceae	Shrub	LC			0
238	*Justicia adhatoda*	Acanthaceae	Shrub	LC			0 x X
239	*Koenigia mollis*	Polygonaceae	Shrub	LC			0 x X
240	*Koenigia polystachya*	Polygonaceae	Shrub	LC			X
241	*Lagatis kunawarensis*	Asteraceae	Herb	LC			0
242	*Lagerstroemia sp.*	Lythraceae	Tree	LC			X
243	*Lagerstroemia speciosa*	Lythraceae	Tree	LC			x
244	*Laggera pterodonta*	Asteraceae	Herb	LC			X
245	*Lantana camara*	Verbenaceae	Shrub	LC			X
246	*Laportea bulbifera*	Urticaceae	Herb	LC			X
247	*Laportea terminalis*	Urticaceae	Herb	LC			X
248	*Leucas ciliata*	Labiatae	Herb	LC			X
249	*Leycester gracilis*	Caprifoliaceae	Shrub	LC			X
250	*Ligularia amplexicaulis*	Asteraceae	Herb	LC			0
251	*Ligularia przewalskii*	Asteraceae	Herb	LC			X
252	*Ligustrum compactum*	Oleaceae	Shrub	LC			X
253	*Lindenbergia muraria*	Scrophulariaceae	Herb	LC			X
254	*Lindera neesiana*	Lauraceae	Tree	LC			X
255	*Lindera pulcherrima*	Lauraceae	Tree	LC			0 X
256	*Lithocarpus elegans*	Fagaceae	Tree	LC			0 x X
257	*Lithocarpus fenestratus*	Fagaceae	Tree	LC			0
258	*Lithocarpus sp.*	Fagaceae	Tree	LC			X

259	*Litsea cubeba*	Lauraceae	Tree	LC			X
260	*Litsea monopetala*	Lauraceae	Tree	LC			X
261	*Litsea Sericea*	Lauraceae	Tree	LC			0
262	*Lobelia nubigena*	Campanulaceae	Herb	LC		Ende mic	0
263	*Lobelia pyramidalis*	Campanulaceae	Shrub	LC			X
264	*Lobelia senguinii*	Campanulaceae	Shrub	LC			X
265	*Loranthus elasticus*	Loranthaceae	Tree	LC			x
266	*Lucas aspera*	Lamiaceae	Herb	LC			X
267	*Lyonia ovalifolia*	Ericaceae	Shrub	LC			0 X
268	*Lysionotus serratus*	Gesneriaceae	Shrub	LC			X
269	*Macaranga denticulata*	Euphorbiaceae	Tree	LC			0 X
270	*Macaranga grandifolia*	Euphorbiaceae	Tree	VU			x
271	*Macaranga peltata*	Euphorbiaceae	Tree	LC			X
272	*Maddenia himalaica*	Rosaceae	Shrub	LC			X
273	*Maesa chisia*	Primulaceae	Shrub	LC			0 X
274	*Maesa rugosa*	Myrsinaceae	Shrub	LC			X
275	*Magnolia campbellii*	Magnoliaceae	Tree	LC			0
276	*Magnolia champaca*	Magnoliaceae	Tree	LC			x
277	*Mahonia nepaulensis*	Berberidaceae	Shrub	LC			0 X
278	*Mallotus philippensis*	Euphorbiaceae	Tree	LC			0 X
279	*Mangifera indica*	Anacardiaceae	Tree	LC			x
280	*Mangifera sylvatica*	Anacardiaceae	Tree	LC			X
281	*Maytenus hookeri*	Celastraceae	Shrub	LC			X
282	*Mazus scurrularia*	Mazaceae	Herb	LC			X
283	*Meconopsis grandis*	Papaveraceae	Herb	LC			0
284	*Meizotropis buteiformis*	Fabaceae	Shrub	LC			X
285	*Michelia doltsopa*	Magnoliaceae	Tree	LC			0 X
286	*Michelia kisopa*	Magnoliaceae	Tree	LC			0
287	*Michelia velutina*	Magnoliaceae	Tree	LC			X
288	*Microtropis discolor*	Celastraceae	Shrub	LC			X
289	*Mikania micrantha*	Asteraceae	Herb	LC			0 X
290	*Morus laevigata*	Moraceae	Tree	LC			X
291	*Murraya koenigii*	Rutaceae	Shrub	LC			X
292	*Musa sikkimensis*	Musaceae	Herb	LC			0
293	*Mussenda roxburghii*	Rubiaceae	Shrub	LC			X
294	*Myosotis scorpioides*	Boraginaceae	Herb	LC			X
295	*Myrica esculenta*	Myricaceae	Tree	LC			X
296	*Myrsine semiserrata*	Myrsinaceae	Shrub	LC			x X
297	*Nasturtium officinale*	Tropaeolaceae	Herb	LC			X
298	*Nicandra physalodes*	Solanaceae	Herb	LC			X
299	*Nicotiana tabacum*	Solanaceae	Shrub	LC			X
300	*Ophiopogon japonicus*	Asparagaceae	Grass	LC			X
301	*Oreoseris maxima*	Asteraceae	Herb	LC			X
302	*Oroxyllum indicum*	Bignoniaceae	Tree	LC			0 x X
303	*Osbeckia stellata*	Melastomataceae	Shrub	LC			x X

304	*Ostodes paniculata*	Euphorbiaceae	Tree	LC			0 x X
305	*Osyris lanceolata*	Santalaceae	Shrub	LC			X
306	*Oxyspora paniculata*	Melastomataceae	Shrub	LC			0 X
307	*Panax pseudoginseng*	Araliaceae	Herb	LC			X
308	*Pandanus furcatus*	Pandanaceae	Shrub	LC			x
309	*Pandanus nepalensis*	Pandanaceae	Shrub	LC			0
310	*Parasassafras confertiflora*	Lauraceae	Tree	LC			X
311	*Paris polyphylla*	Melanthiaceae	Herb	VU			X
312	*Peperomia tetraphylla*	Piperaceae	Herb	LC			X
313	*Persea bootanica*	Lauraceae	Tree	LC			0 x
314	*Persea clarkaena*	Lauraceae	Tree	LC			0 X
315	*Persea duthiei*	Lauraceae	Tree	LC			0 x
316	*Persea fructifera*	Lauraceae	Tree	LC			X
317	*Phlogocanthus pubinervius*	Acanthaceae	Shrub	LC			0
318	*Phoebe lanceolata*	Lauraceae	Tree	LC			X
319	*Phoenix humilis*	Arecaceae	Tree	LC			x
320	*Phoenix rupicola*	Arecaceae	Tree	NT			X
321	*Phytolacca acinosa*	Phytolaccaceae	Herb	LC			X
322	*Pieris formosa*	Ericaceae	Shrub	LC			X
323	*Pilea umbrosa*	Urticaceae	Herb	LC			x X
324	*Pinus roxburghii*	Pinaceae	Tree	LC			0 X
325	*Pinus wallichiana*	Pinaceae	Tree	LC			0 X
326	*Piper attenuatum*	Piperaceae	Climber	LC			x
327	*Piper betle*	Piperaceae	Climber	LC			x X
328	*Piper longum*	Piperaceae	Climber/ Shrub	LC			x
329	*Piper pedicilliatum*	Piperaceae	Shrub	LC			X
330	*Plantago erosa*	Plantaginaceae	Herb	LC			0
331	*Plectocomia himalayana*	Arecaceae	Climber	LC			0 X
332	*Polygonatum punctatum*	Asparagaceae	Herb	LC			X
333	*Polytrichum spp.*	Polytrichaceae	Herb	LC			x
334	*Potentilla atrosanguinea*	Rosaceae	Herb	LC			X
335	*Potentilla peduncularis*	Rosaceae	Herb	LC			x X
336	*Pothos cathcartii*	Araceae	Herb	LC			X
337	*Pouzolzia hirta*	Urticaceae	Shrub	LC			X
338	*Pouzolzia sanguinea*	Urticaceae	Shrub	LC			X
339	*Primula boothi*	Primulaceae	Herb	LC			0
340	*Primula capitata*	Primulaceae	Herb	LC			X
341	*Primula concinna*	Primulaceae	Herb	LC			X
342	*Primula gracilipes*	Primulaceae	Herb	LC			X
343	*Primula sikkimensis*	Primulaceae	Herb	LC			0
344	*Prunella vulgaris*	Lamiaceae	Herb	LC			X
345	*Prunus cerasoides*	Rosaceae	Tree	LC			0
346	*Prunus nepalensis*	Rosaceae	Tree	LC			X
347	*Pseudocaryopteris*	Lamiaceae	Shrub	LC			X

	paniculata						
348	*Pterospermum acerifolium*	Sterculiaceae	Tree	LC			x
349	*Quercus glauca*	Fagaceae	Tree	LC			0 X
350	*Quercus griffithii*	Fagaceae	Tree	LC			0 x X
351	*Quercus lamellosa*	Fagaceae	Tree	NT			0 X
352	*Quercus lanata*	Fagaceae	Tree	LC			0 X
353	*Quercus oxyodon*	Fagaceae	Tree	LC			X
354	*Quercus semecarpifolia*	Fagaceae	Tree	LC			0
355	*Rhaphidophora decursiva*	Araceae	Climber	LC			X
356	*Rhaphidophora grandiflora*	Araceae	Climber	LC			X
357	*Rheum acuminatum*	Polygonaceae	Herb	LC			0 X
358	*Rhodiola himalensis*	Crassulaceae	Herb	LC			0
359	*Rhododendron anthopogon*	Ericaceae	Herb	LC			0
360	*Rhododendron arboreum*	Ericaceae	Shrub	LC			0 x X
361	*Rhododendron barbatum*	Ericaceae	Shrub	LC			0 x X
362	*Rhododendron bhutanense*	Ericaceae	Shrub	LC		Endemic	0
363	*Rhododendron dalhousiae*	Ericaceae	Shrub	VU			X
364	*Rhododendron edgeworthii*	Ericaceae	Shrub	LC			0 X
365	*Rhododendron falconeri*	Ericaceae	Shrub	LC			0 x X
366	*Rhododendron flinkii*	Ericaceae	Shrub	LC			0
367	*Rhododendron grande*	Ericaceae	Shrub	LC			0 X
368	*Rhododendron hodgsonii*	Ericaceae	Tree	LC			0 x
369	*Rhododendron kendrickii*	Ericaceae	Shrub	LC			X
370	*Rhododendron kesangiae*	Ericaceae	Tree	LC		Endemic	x
371	*Rhododendron keysii*	Ericaceae	Shrub	LC			0 X
372	*Rhododendron maddenii*	Ericaceae	Shrub	LC			X
373	*Rhododendron setosum*	Ericaceae	Herb	LC			0
374	*Rhododendron thomsonii*	Ericaceae	Shrub	LC			0 X
375	*Rhus chinensis*	Anacardiaceae	Tree	LC			0 x X
376	*Rhus wallichi*	Anacardiaceae	Tree	LC			0
377	*Ribes griffithii*	Grossulariaceae	Shrub	LC			X
378	*Ribes laciniatum*	Grossulariaceae	Shrub	LC			X
379	*Ricinus communis*	Euphorbiaceae	Shrub	LC			0 X
380	*Rohdea nepalensis*	Asparagaceae	Herb	LC			X
381	*Rosa sericea*	Rosaceae	Shrub	LC			X
382	*Roscoea alpina*	Zingiberaceae	Herb	LC			X
383	*Rubia cordifolia*	Rubiaceae	Climber	LC			0 X
384	*Rubia sikkimensis*	Rubiaceae	Shrub	LC			X
385	*Rubus calycinoides*	Rosaceae	Shrub	LC			X
386	*Rubus calycinus*	Rosaceae	Shrub	LC			0 X
387	*Rubus ellipticus*	Rosaceae	Shrub	LC			0 x X
388	*Rubus lineatus*	Rosaceae	Shrub	LC			X

389	*Rubus nievus*	Rosaceae	Shrub	LC			X
390	*Rubus paniculatus*	Rosaceae	Shrub	LC			0 X
391	*Rubus pentagonus*	Rosaceae	Shrub	LC			X
392	*Rubus rugosus*	Rosaceae	Shrub	LC			X
393	*Rubus sengorensis*	Rosaceae	Shrub	LC		Endemic	X
394	*Rumex nepalensis*	Polygonaceae	Herb	LC			0 X
395	*Salix wallichiana*	Salicaceae	Tree	LC			X
396	*Sambucus adnata*	Adoxaceae	Shrub	LC			X
397	*Sapindus mukorossi*	Sapindaceae	Tree	LC			0 X
398	*Sapium insigne*	Euphorbiaceae	Tree	LC			0 X
399	*Sapria himalayana*	Rafflesiaceae	Herb	EN			X
400	*Sarccococa coriria*	Buxaceae	Herb	LC			0
401	*Sarcococca wallichii*	Buxaceae	Shrub	LC			0 X
402	*Saurauja nepaulensis*	Actinidiaceae	Tree	LC			X
403	*Sausauria gossypiphora*	Compositae	Herb	LC			0
404	*Sausauria nepalensis*	Compositae	Shrub	LC			0
405	*Schefflera impressa*	Araliaceae	Tree	LC			0 X
406	*Schefflera roxburghii*	Araliaceae	Shrub	LC			x
407	*Schefflera velutina*	Araliaceae	Tree	LC			X
408	*Schima khasiana*	Theaceae	Tree	LC			X
409	*Schima wallichii*	Theaceae	Tree	LC			0 x X
410	*Schisandra grandiflora*	Schisandraceae	Climber	LC			X
411	*Scurrula elata*	Loranthaceae	Shrub	LC			X
412	*Scurrula pulverulenta*	Loranthaceae	Shrub	LC			X
413	*Selinum tenuifolium*	Apiaceae	Herb	LC			X
414	*Senecio diversifolius*	Asteraceae	Herb	LC			0 X
415	*Senecio triligulatus*	Asteraceae	Herb	LC			0 X
416	*Sida acuta*	Malvaceae	Shrub	LC			X
417	*Skimmia laureola*	Lauraceae	Shrub	LC			X
418	*Skimmia laureola ssp. multinervia*	Lauraceae	Shrub	LC			X
419	*Smilax aspera*	Smilacaceae	Herb	LC			0
420	*Smilax ferox*	Smilacaceae	Herb	LC			0
421	*Smilax myrtillus*	Smilacaceae	Shrub	LC			X
422	*Smilax orthoptera*	Smilacaceae	Herb	LC			0
423	*Smilex regida*	Smilacaceae	Herb	LC			0
424	*Solanum khasianum*	Solanaceae	Shrub	LC			0 X
425	*Solanum mauritianum*	Solanaceae	Shrub	LC			X
426	*Solanum spirale*	Solanaceae	Shrub	LC			X
427	*Solena amplexicaulis*	Cucurbitaceae	Climber	LC			X
428	*Sophora velutina*	Leguminosae	Shrub	LC			X
429	*Sorbus cuspidata*	Rosaceae	Tree	LC			0 X
430	*Sorbus microphylla*	Rosaceae	Shrub	LC			X
431	*Sorbus rhamnoides*	Rosaceae	Tree	LC			0
432	*Spondias pinnata*	Anacardiaceae	Tree	LC			0

433	*Stephania glabra*	Menispermaceae	Climber	LC			X
434	*Sterculia lanceifolia*	Sterculiaceae	Shrub	LC			x
435	*Sterculia villosa*	Sterculiaceae	Tree	LC			0 x X
436	*Streptopus simplex*	Liliaceae	Herb	LC			X
437	*Strobilanthes maculata*	Acanthaceae	Shrub	LC			X
438	*Strobilanthes wallichii*	Acanthaceae	Shrub	LC			X
439	*Swertia bimauculata*	Gentianaceae	Shrub	LC			X
440	*Swertia petiolata*	Gentianaceae	Herb	LC			0
441	*Symplocos glomerata*	Symplocaceae	Shrub	LC			0 x X
442	*Symplocos racemosa*	Symplocaceae	Tree	LC			x X
443	*Symplocus ramosissima*	Symplocaceae	Tree	LC			X
444	*Synotis alata*	Compositae	Herb	LC			X
445	*Syzygium cumini*	Myrtaceae	Tree	LC			0
446	*Syzygium venosum*	Myrtaceae	Shrub	LC			X
447	*Taraxacum eriopodium*	Asteraceae	Herb	LC			X
448	*Taxus baccata*	Taxaceae	Tree	LC			0 X
449	*Terminalia myriocarpa*	Combretaceae	Tree	LC			0 x X
450	*Tetrastigma serrulatum*	Vitaceae	Climber	LC			X
451	*Thunbergia coccinea*	Acanthaceae	Climber	LC			0 X
452	*Thysanolaena latifolia*	Poaceae	Grass	LC			X
453	*Thysanolaena maxima*	Poaceae	Grass	LC			0 x X
454	*Toona ciliata*	Meliaceae	Tree	LC			0 x X
455	*Toxicodendron succedaneum*	Anacardiaceae	Tree	LC			0 X
456	*Trema sp.*	Cannabaceae	Shrub	LC			X
457	*Trichosanthes lepiniana*	Cucurbitaceae	Climber	LC			X
458	*Trifolium repens*	Leguminosae	Herb	LC			X
459	*Trillium tschonoskii*	Melanthiaceae	Herb	EN			X
460	*Tsuga dumosa*	Pinaceae	Tree	LC			0 X
461	*Tupistra nutans*	Asparagaceae	Herb	LC			X
462	*Tupistra wattii*	Asparagaceae	Herb	LC			X
463	*Ulmus lanceifolia*	Ulmaceae	Tree	LC			X
464	*Urtica ardens*	Urticaceae	Herb	LC			x
465	*Urtica dioica*	Urticaceae	Herb	LC			X
466	*Vaccinium gaultherifolium*	Ericaceae	Shrub	LC			X
467	*Vaccinium nummularia*	Ericaceae	Shrub	LC			X
468	*Vaccinium retusum*	Ericaceae	Shrub	LC			X
469	*Vaccinum nummularia*	Ericaceae	Shrub	LC			0
470	*Vernonia volkameriifolia*	Asteraceae	Shrub	LC			X
471	*Viburnum continifolium*	Ericaceae	Shrub	LC			0
472	*Viburnum cylindricum*	Adoxaceae	Shrub	LC			x X
473	*Viburnum erubescens*	Adoxaceae	Shrub	LC			X
474	*Viburnum nervosum*	Adoxaceae	Shrub	LC			X
475	*Viola betonicifolia*	Violaceae	Herb	LC			X
476	*Viola hookeri*	Violaceae	Herb	LC			X

477	*Viola palustris*	Violaceae	Herb	LC			X
478	*Vitex negundo*	Lamiaceae	Shrub	LC			x
479	*Wallichia densiflora*	Arecaceae		LC			X
480	*Wendlandia speciosa*	Rubiaceae	Shrub	LC			X
481	*Wrightia arborea*	Apocynaceae	Tree	LC			X
482	*Yushania microphylla*	Poaceae	Bamboo	LC			X
483	*Zanthoxyllum oxyphyllum*	Rutaceae	Shrub	LC			X
484	*Zanthoxylum armatum*	Rutaceae	Tree	LC			0 x

Annexure 6: Mammal inventory of BC 4 from 2006 to 2021

Sl.no	Common Name	Scientific Name	Family	IUCN status	CITES	0 @2006, x @2016, X @2021
1	Asiatic Black Bear	*Ursus thibetanus*	Ursidae	VU	Appendix I	0 x X
2	Asiatic Brush-tailed Porcupine	*Atherurus macrourus*	Hystricidae	LC		x X
3	Asiatic Golden Cat	*Catopuma temmincki*	Felidae	NT	Appendix I	x X
4	Assamese Macaque	*Macaca assamensis*	Cercopithecidae	NT		0 x X
5	Barking Deer	*Muntiacus muntjak*	Cervidae	LC		0 x X
6	Bengal Fox	*Vulpes bengalensis*	Canidae	LC		0
7	Capped Langur	*Trachypithecus pileatus*	Cercopithecidae	VU	Appendix I	0 X
8	Clouded Leopard	*Neofelis nebulosa*	Felidae	VU	Appendix I	x X
9	Common House Rat	*Rattus rattus*	Muridae	LC		x
10	Common Jackal	*Canis aureus*	Canidae	LC		0
11	Common Leopard	*Panthera pardus*	Felidae	VU	Appendix I	0 x X
12	Dhole	*Cuon alpinus*	Canidae	EN	Appendix II	0 x X
13	Eurasian Otter	*Lutra Lutra*	Mustelidae	NT	Appendix I	X
14	Five Striped Palm Squirrel	*Funambulus pennantii*	Sciuridae	LC		0
15	Gaur	*Bos gaurus*	Bovidae	VU	Appendix I	X
16	Golden Langur	*Trachypithecus geei*	Cercopithecidae	EN	Appendix I	0 x
17	Grey Langur	*Semnopithecus entellus*	Cercopithecidae	LC	Appendix I	x
18	Himalayan Goral	*Naemorhedus goral*	Bovidae	NT	Appendix I	x X
19	Himalayan Musk Deer	*Moschus leucogaster*	Moschidae	EN	Appendix I	0 x X
20	Himalayan Pika	*Ochotona himalayana*	Ochotonidae			0 x
21	Himalayan Serow	*Capricornis thar*	Bovidae	VU	Appendix I	0 x X
22	Hoary-bellied Squirrel	*Callosciurus pygerythrus*	Sciuridae	LC		0
23	Hodgson's Giant Flying Squirrel	*Petaurista magnificus*	Sciuridae	LC		x
24	Intermediate Horseshoe Bat	*Rhinolophus affinis*	Rhinolophidae	LC		0
25	Jungle Cat	*Felis chaus*	Felidae	LC		0
26	Leopard Cat	*Prionailurus bengalensis*	Felidae	LC	Appendix II	0 x X
27	Malayan Gaint	*Ratufa bicolor*	Sciuridae	NT	Appendix II	0 x X

	Squirrel					
28	Malayan Porcupine	*Hystrix bracyhura*	Hystricidae	LC		x X
29	Marbled Cat	*Pardofelis marmorata*	Felidae	NT	Appendix I	x X
30	Masked Palm Civet	*Paguma larvata*	Viverridae	LC		X
31	Orange-bellied Himalayan Squirrel	*Dremomys lokriah*	Sciuridae	LC		X
32	Particolored Flying Squirrel	*Hylopetes alboniger*	Sciuridae	LC		0
33	Red Fox	*Vulpes vulpes*	Canidae	LC		0
34	Red Panda	*Ailurus fulgens*	Ailuridae	EN	Appendix I	x X
35	Royal Bengal Tiger	*Panthera tigris tigris*	Felidae	EN	Appendix I	0 x X
36	Sambar Deer	*Rusa unicolor*	Cervidae	VU		0 x X
37	Spotted Linsang	*Prionodon pardicolor*	Prionodontidae	LC	Appendix I	X
38	Wild Pig	*Sus scrofa*	Suidae	LC		0 x X
39	Yellow-bellied Weasel	*Mustela kathiah*	Mustelidae	LC		X
40	Yellow-throated Marten	*Martes flavigula*	Mustelidae	LC		x

Annexure 7: An annotated bird checklist for BC 4 from 2006 to 2021

Sl.No	Common name	Scientific name	Family	0 @2006, x @2016, X @2021
1	Abberant Bush Warbler	*Horornis flavolivaceus*	Cettiidae	0
2	Alpine Accentor	*Prunella collaris*	Prunellidae	0 x
3	Ashy Bulbul	*Hemixos flavala*	Pycnonotidae	0
4	Ashy Drongo	*Dicrurus leucophaeus*	Dicruridae	0 x X
5	Ashy-throated Warbler	*Phylloscopus maculipennis*	Phylloscopidae	x X
6	Asian Barred Owlet	*Glaucidium cuculoides*	Strigidae	0 x X
7	Asian Emerald Cuckoo	*Chrysococcyx maculatus*	Cuculidae	x
8	Asian House Martin	*Delichon dasyous*	Hirundinidae	x
9	Bank Myna	*Acridotheres ginginianus*	Sturnidae	x
10	Barred Cuckoo Dove	*Macropygia unchall*	Columbidae	0 x X
11	Bar-throated Siva	*Siva strigula*	Leiothrichidae	0 X
12	Bar-winged Flycatcher-shrike	*Hemipus picatus*	Vangidae	0 X
13	Bar-winged Wren Babbler	*Spalaeornis troglodytoides*	Timaliidae	x
14	Bay Woodpecker	*Blythipicus pyrrhotis*	Picidae	0 x X
15	Beautiful Nuthatch	*Sitta formosa*	Sittidae	0 x
16	Beautiful Rosefinch	*Carpodacus pulcherrimus*	Fringillidae	0
17	Bhutan Laughingthrush	*Trochalopteron imbricatum*	Leiothrichidae	X
18	Black Bulbul	*Hypsipetes leucocephalus*	Pycnonotidae	0 x X
19	Black Drongo	*Dicrurus macrocerus*	Dicruridae	0 x
20	Black Eagle	*Ictinaetus malaiensis*	Accipitridae	0 x X
21	Black Redstart	*Phoenicurus ochruros*	Muscicapidae	0
22	Black throated sunbird	*Aethopyga saturata*	Nectariniidae	x
23	Black-chinned Yuhina	*Yuhina nigrimenta*	Zosteropidae	0 x X
24	Black-crested Bulbul	*Pycnonotus flaviventris*	Pycnonotidae	x X

25	Black-eared Shrike-babbler	*Pteruthius melanotis*	Vireonidae	0 X
26	Black-faced Laughingthrush	*Garrulax affinis*	Leiothrichidae	0 x X
27	Black-faced Warbler	*Abroscopus schisticeps*	Cettiidae	0 X
28	Black-headed Shrike-babbler	*Pteruthius rufiventer*	Vireonidae	0 X
29	Black-tailed Crake	*Porzana bicolor*	Rallidae	0
30	Black-throated Parrotbill	*Suthora nipalensis*	Sylviidae	X
31	Black-throated Prinia	*Prinia atrogularis*	Cisticolidae	X
32	Black-throated Sunbird	*Aethopyga saturata*	Nectariniidae	0 X
33	Black-throated Thrush	*Turdus atrogularis*	Turdidae	0 X
34	Black-throated Tit	*Aegithalos concinnus*	Aegithalidae	0 X
35	Black-winged Cuckooshrike	*Lalage melaschistos*	Campephagidae	0 X
36	Blood Pheasant	*Ithaginis cruentus*	Phasanidae	0 x X
37	Blue Rock Thrush	*Monticola solitarius*	Muscicapidae	0 x X
38	Blue Whistling Thrush	*Myophonus caeruleus*	Muscicapidae	0 x X
39	Blue-bearded Bee-eater	*Nyctyornis athertoni*	Meropidae	X
40	Blue-capped Rock Thrush	*Monticola cinclorhynchus*	Muscicapidae	x X
41	Blue-fronted Redstart	*Phoenicurus frontalis*	Muscicapidae	0 x X
42	Blue-throated Barbet	*Psilopogon asiaticus*	Megalaimidae	0 x X
43	Blue-throated Blue Flycather	*Cyornis rubeculoides*	Muscicapidae	0
44	Blue-winged Laughingthrush	*Trochalopteron squamatum*	Leiothrichidae	0 X
45	Blue-winged Siva	*Siva cyanouroptera*	Leiothrichidae	0 X
46	Blyth's Leaf Warbler	*Phylloscopus reguloides*	Phylloscopidae	0 X
47	Bronzed Drongo	*Dicrurus aeneus*	Dicruridae	0 X
48	Brown Bullfinch	*Pyrrhula nipalensis*	Fringillidae	X
49	Brown Dipper	*Cinclus pallasii*	Cinclidae	0 x X
50	Brown Wood Owl	*Strix leptogrammica*	Strigidae	0
51	Brown-flanked Bush Warbler	*Cettia fortipes*	Cettiidae	0 X
52	Buff-barred Warbler	*Phylloscopus pulcher*	Phylloscopidae	0
53	Chestnut-bellied Nuthatch	*Sitta cinnamoventris*	Sittidae	0 x
54	Chestnut-bellied Rock Thrush	*Monticola rufiventris*	Muscicapidae	X
55	Chestnut-crowned Laughingthrush	*Trochalopteron erythrocephalum*	Leiothrichidae	0 x X
56	Chestnut-crowned Warbler	*Phylloscopus castaniceps*	Phylloscopidae	0 X
57	Chestnut-headed Tesia	*Tesia castaneocoronata*	Cettiidae	0 X
58	Coal Tit	*Periparus ater*	Paridae	0 x
59	Collared Grosbeak	*Mycerobas affinis*	Fringillidae	0
60	Collared Owlet	*Glaucidium brodiei*	Strigidae	0 X
61	Collared Treepie	*Dendricitta frontalis*	Corvidae	x
62	Common Buzzard	*Buteo buteo*	Accipitridae	0
63	Common Emerald Dove	*Chalcophas indics*	Columbidae	x
64	Common Green Magpie	*Cissa chinensis*	Corvidae	0 X
65	Common Hoopoe	*Upupa epops*	Upupidae	x X
66	Common Kestrel	*Falco tinnunculus*	Falconidae	0 X
67	Common Myna	*Acridotheres tristis*	Sturnidae	0 x X
68	Common Rosefinch	*Carpodacus erythrinus*	Fringillidae	x X

69	Common Stonechat	*Saxicola torquatus*	Muscicapidae	X
70	Common Tailorbird	*Orthotomus sutorius*	Cisticolidae	0 X
71	Coppersmith Barbet	*Magalaima haemacephala*	Megalaimidae	x
72	Coral-billed Scimitar Babbler	*Pomatorhinus ferruginosus*	Timaliidae	0 X
73	Crested Bunting	*Melophus lathami*	Emberizidae	0 X
74	Crested Kingfisher	*Megaceryle lugubris*	Alcedinidae	x
75	Crested Serpent Eagle	*Spilornis cheela*	Accipitridae	0 X
76	Crimson Sunbird	*Aethopyga siparaja*	Nectariniidae	0 X
77	Crimson-breasted Woodpecker	*Dendrocopos cathpharius*	Picidae	0 X
78	Crow-billed Drongo	*Dicrurus annectans*	Dicruridae	0
79	Darjeeling Woodpecker	*Dendrocopos darjellensis*	Picidae	0 x X
80	Dark-breasted Rosefinch	*Procarduelis nipalensis*	Fringillidae	0 X
81	Dark-sided Flycatcher	*Muscicapa sibirica*	Muscicapidae	x
82	Dusky Warbler	*Phylloscopus fuscatus*	Phylloscopidae	x
83	Eurasian Cockoo	*Cuculus canorus*	Cuculidae	x
84	Eurasian Eagle Owl	*Bubo Bubo*	Strigidae	X
85	Eurasian Jay	*Garrulus grandarius*	Corvidae	0 X
86	Eurasian Tree Sparrow	*Passer montanus*	Passeridae	0 x X
87	Eurasian Woodcock	*Scolopax rusticola*	Scolopacidae	X
88	Eurasian Wren	*Troglodytes troglodytes*	Troglodytidae	0 X
89	Ferruginuous Flycatcher	*Muscicapa ferruginea*	Muscicapidae	X
90	Fire-breasted Flowerpecker	*Dicaeum ignipectus*	Dicaeidae	0 X
91	Fire-tailed Myzornis	*Myzornis pyrrhoura*	Sylviidae	0 X
92	Fire-tailed Sunbird	*Aethopyga ignicauda*	Nectariniidae	0 x
93	Gold Crest	*Regulus regulus*	Regulidae	0
94	Golden Babbler	*Stachyridopsis chrysaea*	Timaliidae	0
95	Golden Bush Robin	*Tarsiger chrysaeus*	Muscicapidae	X
96	Golden-breasted Fulvetta	*Lioparus chrysotis*	Sylviidae	0 X
97	Golden-throated Barbet	*Psilopogon franklinii*	Megalaimidae	0 x
98	Gould's Shortwing	*Heteroxenicus stellatus*	Muscicapidae	X
99	Great Barbet	*Psilopogon virens*	Megalaimidae	0 x X
100	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	0 X
101	Great Hornbill	*Buceros bicornis*	Bucerotidae	0 x
102	Great Parrotbill	*Paradoxornis aemodium*	Paradoxornithidae	0
103	Great Tit	*Parus major*	Paridae	x
104	Greater Flameback	*Chrysocolaptes guttacristatus*	Picidae	x
105	Greater Spotted Eagle	*Clanga clanga*	Accipitridae	x
106	Greater Yellownape	*Chrysophlegma flavinucha*	Picidae	0 x X
107	Green Shrike-babbler	*Pteruthius xanthochlorus*	Vireonidae	X
108	Green-backed Tit	*Parus monticolus*	Paridae	0 x X
109	Green-billed Malkoha	*Phaenicophaeus tristis*	Cuculidae	X
110	Greenish Warbler	*Phylloscopus trochiloides*	Phylloscopidae	0 x
111	Green-tailed Sunbird	*Aethopyga nipalensis*	Nectariniidae	0 x X
112	Grey Bushchat	*Saxicola ferreus*	Muscicapidae	0 x X
113	Grey Nightjar	*Caprimulgus jotaka*	Caprimulgidae	0 x X

114	Grey Treepie	*Dendrocitta formosae*	Corvidae	0 x X
115	Grey-backed Shrike	*Lanius tephronotus*	Laniidae	0 x X
116	Grey-bellied Tesia	*Tesia cyaniventer*	Cettiidae	0
117	Grey-capped Pygmy Woodpecker	*Yungipicus canicapillus*	Picidae	0 X
118	Grey-cheeked Warbler	*Phylloscopus poliogenys*	Phylloscopidae	0 x
119	Grey-chinned Minivet	*Pericrocotus solaris*	Campephagidae	0 x X
120	Grey-crested Tit	*Lophophanes dichrous*	Paridae	0 x X
121	Grey-crowned Prinia	*Prinia cinereocapilla*	Cisticolidae	x
122	Grey-headed Canary Flycatcher	*Culicicapa ceylonensis*	Stenostiridae	0 x X
123	Grey-headed Woodpecker	*Picus canus*	Picidae	0 X
124	Grey-hooded Warbler	*Phylloscopus xanthoschistos*	Phylloscopidae	0 X
125	Grey-sided Bush Warbler	*Cettia brunnifrons*	Cettiidae	0 X
126	Grey-sided Laughingthrush	*Garrulax caerulatus*	Leiothrichidae	0 X
127	Grey-throated Babbler	*Stachyris nigriceps*	Timaliidae	0 X
128	Grey-winged Blackbird	*Turdus boulboul*	Turdidae	0 x X
129	Hair-crested Drongo	*Dicrurus hottentottus*	Dicruridae	0 x
130	Hill Patridge	*Arborophila torqueola*	Phasanidae	0 x X
131	Hill Prinia	*Prinia atrogularis*	Cisticolidae	x
132	Himalayan Bluetail	*Tarsiger cyanurus*	Muscicapidae	0 X
133	Himalayan Bulbul	*Pycnonotus leucogenys*	Pycnonotidae	0
134	Himalayan Cuckoo	*Cuculus saturatus*	Cuculidae	X
135	Himalayan Cutia	*Cutia nipalensis*	Leiothrichidae	0 X
136	Himalayan Monal	*Lophophorus impejanus*	Phasanidae	0 x
137	Himalayan Owl	*Strix nivicolum*	Strigidae	X
138	Himalayan Shortwing	*Brachypteryx cruralis*	Muscicapidae	X
139	Himalayan Shrike-babbler	*Pteruthius ripleyi*	Vireonidae	0 x X
140	Hoary throated Barwing	*Actinodura nipalensis*	Leiothrichidae	0 x X
141	Hodgson's Redstart	*Phoenicurus hodgsoni*	Muscicapidae	0 X
142	House Sparrow	*Passer domestica*	Passeridae	x
143	Hume's Warbler	*Phylloscopus humei*	Phylloscopidae	x
144	Indian Cuckoo	*Cuculus micropterus*	Cuculidae	x
145	Indian White-eye	*Zosterops palpebrosus*	Zosteropidae	0 x
146	Kalij Pheasant	*Lophura leucomelanos*	Phasanidae	0 x X
147	Large Hawk-cuckoo	*Cuculus sparverioides*	Cuculidae	x
148	Large Niltava	*Niltava grandis*	Muscicapidae	0 x X
149	Large Woodshrike	*Tephrodornis virgatus*	Vangidae	0 x
150	Large-billed Crow	*Corvus macrorhynchos*	Corvidae	0 x X
151	Large-billed Leaf Warbler	*Phylloscopus magnirostris*	Phylloscopidae	0 X
152	Lemon-rumped Warbler	*Phylloscopus chloronotus*	Phylloscopidae	0 x
153	Lesser Cuckoo	*Cuculus poliocephalus*	Cuculidae	x X
154	Lesser Racket-tailed Drongo	*Dicrurus remifer*	Dicruridae	0 x X
155	Lesser Yellownape	*Picus chlorolophus*	Picidae	0 x
156	Lineated Barbet	*Megalaima lineate*	Megalaimidae	x
157	Little Bunting	*Emberiza pusilla*	Emberizidae	0 X
158	Little Forktail	*Enicurus scouleri*	Muscicapidae	0 X

159	Long-legged Buzzard	*Buteo rufinus*	Accipitridae	0
160	Long-tailed Broadbill	*Psarisomus dalhousiae*	Eurylaimidae	0 x
161	Long-tailed Minivet	*Pericrocotus ethologus*	Campephagidae	0 x
162	Long-tailed Shrike	*Lanius schach tricolor*	Laniidae	0 X
163	Long-tailed Sibia	*Heterophasia picaoides*	Leiothrichidae	0
164	Long-tailed Thrush	*Zoothera dixoni*	Turdidae	0
165	Maroon-backed Accentor	*Prunella immaculata*	Prunellidae	X
166	Mountain Bulbul	*Ixos mcclellandii*	Pycnonotidae	0 X
167	Mountain Hawk Eagle	*Nisaetus nipalensis*	Accipitridae	0 X
168	Mountain Imperial Pigeon	*Ducula badia*	Columbidae	0
169	Mountain Scops Owl	*Otus spilocephalus*	Strigidae	X
170	Mountain Tailorbird	*Phyllergates cucullatus*	Cettiidae	0 X
171	Mrs.Gould's sunbird	*Aethopyga gouldiae*	Nectariniidae	x
172	Nepal Fulvetta	*Alcippe nipalensis*	Pellorneidae	0 X
173	Nepal House Martin	*Delichon nipalense*	Hirundinidae	0 x X
174	Olive-backed Pipit	*Anthus hodgsoni*	Motacillidae	0 x X
175	Orange-bellied Leafbird	*Chloropsis hardwickii*	Chloropseidae	0 x X
176	Orange-headed Thrush	*Geokichla cirtrina*	Turdidae	x
177	Oriental Cuckoo	*Cuculus optatus*	Cuculidae	x
178	Oriental Magpie Robin	*Copsychus saularis*	Muscicapidae	0 x X
179	Oriental Skylark	*Alauda gulgula*	Alaudidae	0
180	Oriental Turtle Dove	*Streptopelia orientalis*	Columbidae	0 x X
181	Paddyfield Pipit	*Anthus rufulus*	Motacillidae	0
182	Pale Blue Flycatcher	*Cyornis unicolor*	Muscicapidae	0
183	Pale-headed Woodpecker	*Gecinulus grantia*	Picidae	0
184	Plain Mountain Finch	*Leucosticte nemoricola*	Fringillidae	0 x X
185	Plain-backed Thrush	*Zoothera mollissima*	Turdidae	0
186	Plumbeous Water Redstart	*Rhyacornis fuliginosa*	Muscicapidae	0 x X
187	Purple Sunbird	*Cinnyris asiaticus*	Nectariniidae	x
188	Red Crossbill	*Loxia curvirostra*	Fringillidae	X
189	Red Junglefowl	*Gallus gallus*	Phasanidae	x X
190	Red-billed Leiothrix	*Leiothrix lutea*	Leiothrichidae	0 X
191	Red-faced Liocichla	*Liocichla phoenicea*	Leiothrichidae	0 X
192	Red-fronted Rosefinch	*Carpodacus puniceus*	Fringillidae	0
193	Red-headed Trogon	*Harpactes erythrocephalus*	Trogonidae	0 X
194	Red-tailed Minla	*Minla ignotincta*	Leiothrichidae	0 X
195	Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	0 x X
196	Rock Pigeon	*Columba livia*	Columbidae	0 x
197	Rosy Pipit	*Anthus roseatus*	Motacillidae	0
198	Rufescent Prinia	*Prinia rufescens*	Cisticolidae	0
199	Rufous Sibia	*Heterophasia capistrata*	Leiothrichidae	0 x X
200	Rufous Treepie	*Dendrocitta vagabunda*	Corvidae	x
201	Rufous Woodpecker	*Micropternus brachyurus*	Picidae	X
202	Rufous-backed Sibia	*Leioptila annectens*	Leiothrichidae	0
203	Rufous-bellied Eagle	*Lophotriorchis kienerii*	Accipitridae	0 X

204	Rufous-bellied Niltava	*Niltava sundara*	Muscicapidae	X
205	Rufous-bellied Woodpecker	*Dendrocopos hyperythrus*	Picidae	0 x X
206	Rufous-breasted Accentor	*Prunella strophiata*	Prunellidae	0 X
207	Rufous-breasted Bush Robin	*Tarsiger hyperythrus*	Muscicapidae	0
208	Rufous-capped Babbler	*Stachyridopsis ruficeps*	Timaliidae	0 x
209	Rufous-chinned Laughingthrush	*Garrulax rufogularis*	Leiothrichidae	X
210	Rufous-faced Warbler	*Abroscopus albogularis*	Cettiidae	X
211	Rufous-fronted Tit	*Aegithalos iouschistos*	Aegithalidae	0
212	Rufous-gorgeted Flycatcher	*Ficedula strophiata*	Muscicapidae	0 x X
213	Rufous-necked Hornbill	*Aceros nipalensis*	Bucerotidae	0 x X
214	Rufous-necked Laughingthrush	*Garrulax ruficollis*	Leiothrichidae	0 x X
215	Rufous-throated Partridge	*Arborophila rufogularis*	Phasanidae	x X
216	Rufous-vented Tit	*Periparus rubidiventris*	Paridae	0 X
217	Rufous-vented Yuhina	*Yuhina occipitalis*	Zosteropidae	0 X
218	Rufous-winged Fulvetta	*Pseudominla castaneceps*	Pellorneidae	0 X
219	Russet Sparrow	*Passer cinnamomeus*	Passeridae	0 X
220	Rusty-cheeked Scimitar Babbler	*Pomatorhinus erythrogenys*	Timaliidae	0 X
221	Rusty-flanked Treecreeper	*Certhia nipalensis*	Certhiidae	0 X
222	Rusty-fronted Barwing	*Actinodura egertoni*	Leiothrichidae	0 x X
223	Salty-backed Forktail	*Enicurus schistaceus*	Muscicapidae	x
224	Sapphire Flycatcher	*Ficedula sapphira*	Muscicapidae	x
225	Satyr Tragopan	*Tragopan satyra*	Phasanidae	0 x X
226	Scaly Laughingthrush	*Trochalopteron subunicolor*	Leiothrichidae	0 X
227	Scaly Thrush	*Zoothera dauma*	Turdidae	X
228	Scaly-breasted Munia	*Lonchura punctulata*	Estrildidae	0
229	Scaly-breasted Wren Babbler	*Pnoepyga albiventer*	Pnoepygidae	0 X
230	Scarlet Finch	*Haematospiza sipahi*	Fringillidae	X
231	Scarlet Minivet	*Pericrocotus speciosus*	Campephagidae	0 x X
232	Short-billed Minivet	*Pericrocotus brevirostris*	Campephagidae	0 x
233	Short-eared Owl	*Asio flammeus*	Strigidae	X
234	Sikkim Treecreeper	*Certhia discolor*	Certhiidae	0 x X
235	Silver-eared Mesia	*Leiothrix argentauris*	Leiothrichidae	X
236	Slaty-backed Forktail	*Enicurus schistaceus*	Muscicapidae	0 X
237	Slaty-bellied Tesia	*Tesia olivea*	Cettiidae	0 X
238	Slaty-blue Flycatcher	*Ficedula tricolor*	Muscicapidae	0
239	Small Niltava	*Niltava macgrigoriae*	Muscicapidae	x X
240	Snow Pigeon	*Columba leuconota*	Columbidae	0 x
241	Snowy-browed Flycatcher	*Ficedula hyperythra*	Muscicapidae	X
242	Speckled Piculet	*Picumnus innominatus*	Picidae	0 X
243	Speckled Wood Pigeon	*Columba hodgsonii*	Columbidae	0 x
244	Spotted Dove	*Spilopelia chinensis*	Columbidae	0 x X
245	Spotted Forktail	*Enicurus maculatus*	Muscicapidae	0 X
246	Spotted Laughingthrush	*Garrulax ocellatus*	Leiothrichidae	x X
247	Spotted Nutcracker	*Nucifraga caryocatactes*	Corvidae	0 x X
248	Spotted Owlet	*Athene brama*	Strigidae	0

249	Spotted Wren Babbler	*Elachura formosa*	Pnoepygidae	0
250	Spot-winged Grosbeak	*Mycerobas melanozanthos*	Fringillidae	X
251	Steppe Eagle	*Aquila nipalensis*	Accipitridae	x X
252	Straited Laughingthrush	*Garrulax striatus*	Leiothrichidae	0
253	Straited Prinia	*Prinia crinigera*	Cisticolidae	0
254	Streak-breasted Scimitar Babbler	*Pomatorhinus ruficollis*	Timaliidae	0 X
255	Streaked Laughingthrush	*Trochalopteron lineatum*	Leiothrichidae	0
256	Streaked Spiderhunter	*Arachnothera magna*	Nectariniidae	0 x X
257	Striated Bulbul	*Pycnonotus striatus*	Pycnonotidae	0 x X
258	Striated Laughingthrush	*Garrulax striatus*	Leiothrichidae	x X
259	Striated Yuhina	*Yuhina castaniceps*	Zosteropidae	0 X
260	Stripe-throated Yuhina	*Yuhina gularis*	Zosteropidae	0 x X
261	Sultan Tit	*Melanochlora sultanea*	Paridae	0 X
262	Tawny Fish Owl	*Ketupa flavipes*	Strigidae	X
263	Tawny Wood Owl	*Strix aluco*	Strigidae	0
264	Tickell's Leaf Warbler	*Phylloscopus affinis*	Phylloscopidae	x X
265	Ultramarine Flycatcher	*Ficedula superciliarius*	Muscicapidae	x
266	Upland Buzzard	*Buteo hemilasius*	Accipitridae	0
267	Verditer Flycatcher	*Eumyias thalassinus*	Muscicapidae	x X
268	Wallcreeper	*Tichodroma muraria*	Tichodromidae	X
269	Ward's Trogon	*Harpactes wardi*	Trogonidae	0 x X
270	Wedge-tailed Green Pigeon	*Treron sphenurus*	Columbidae	0 x X
271	Whiskered Yuhina	*Yuhina flavicollis*	Zosteropidae	0 x X
272	Whistler's Warbler	*Seicercus whistleri*	Phylloscopidae	0 X
273	White Wagtail	*Motacilla alba*	Motacillidae	0 x
274	White-bellied Erpornis	*Erpornis zantholeuca*	Zosteropidae	0 x
275	White-bellied Heron	*Ardea insignis*	Ardeidae	X
276	White-breasted Parrotbill	*Psittiparus ruficeps*	Paradoxornithidae	X
277	White-browed Fulvetta	*Fulvetta vinipectus*	Sylviidae	0 X
278	White-browed Piculet	*Sasia ochracea*	Picidae	X
279	White-browed Rosefinch	*Carpodacus thura*	Fringillidae	0
280	White-browed Scimitar Babbler	*Pomatorhinus schisticeps*	Timaliidae	x
281	White-capped Water Redstart	*Phoenicurus leucocephalus*	Muscicapidae	0 x X
282	White-collared Blackbird	*Turdus albocinctus*	Turdidae	0 x X
283	White-crested Laughingthrush	*Garrulax leucolophus*	Leiothrichidae	0 x X
284	White-gorgeted Flycatcher	*Anthipes monileger*	Muscicapidae	X
285	White-naped Yuhina	*Yuhina bakeri*	Zosteropidae	0 x
286	White-rumped Munia	*Lonchura striata*	Estrildidae	0 X
287	White-spectacled Warbler	*Seicercus affinis*	Phylloscopidae	0
288	White-tailed Nuthatch	*Sitta himalayensis*	Sittidae	0 X
289	White-throated Bulbul	*Alophoixus flaveolus*	Pycnonotidae	0 x X
290	White-throated Dipper	*Cinclus cinclus*	Cinclidae	x
291	White-throated Fantail	*Rhipidura albicollis*	Rhipiduridae	0 x X
292	White-throated Kingfisher	*Halcyon smyrnensis*	Alcedinidae	X
293	White-throated Laughingthrush	*Garrulax albogularis*	Leiothrichidae	0 x X

294	White-throated Redstart	*Phoenicurus schisticeps*	Muscicapidae	0 X
295	White-winged Grosbeak	*Mycerobas carnipes*	Fringillidae	0
296	White-winged Redstart	*Phoenicurus erythrogastrus*	Muscicapidae	0 x
297	Yellow-bellied Fantail	*Chelidorhynx hypoxanthus*	Stenostiridae	0 x X
298	Yellow-bellied Flowerpecker	*Dicaeum melanozanthum*	Dicaeidae	X
299	Yellow-bellied Warbler	*Abroscopus superciliaris*	Cettiidae	0 x
300	Yellow-billed Blue Magpie	*Urocissa flavirostris*	Corvidae	0 x X
301	Yellow-breasted Greenfinch	*Chloris spinoides*	Fringillidae	0 X
302	Yellow-browed Tit	*Sylviparus modestus*	Paridae	0 X
303	Yellow-cheeked Tit	*Parus spilonotus*	Paridae	0 x
304	Yellowish-bellied Bush Warbler	*Horornis acanthizoides*	Cettiidae	0
305	Yellow-rumped Honeyguide	*Indicator xanthonotus*	Indicatoridae	x X

Annexure 8: Mushroom checklist of BC 4 2021

Sl.No	Common name	Scientific name	Family
1		*Oudemensells sp*	Physalacriaceae
2		*Parasola media*	Psathyrellaceae
3	The price	*Agaricus augustus*	Agaricaceae
4	Spiny puff ball	*Lycoperdon echinatum*	Agaricaceae
5	Common puff ball	*Lycoperdon perlatum*	Agaricaceae
6	Wood ear	*Auricularia auricila-judae*	Auriculariaceae
7	Orange Jelly fungus	*Dacrymyces palmatus*	Dacrymycetaceae
8	White-pored chicken of the woods	*Laetiporus cincinnatus*	Fomitopsidaceae
9	White-pored chicken of the woods	*Laetiporus sulphureus*	Fomitopsidaceae
10	Bracket fungus	*Ganoderma applanatum*	Ganodermataceae
11	Reishi mushroom	*Ganoderma lucidum*	Ganodermataceae
12	Earth Star	*Geastrum saccatum*	Geastraceae
13	Old mans beard/lions mane	*Hericium erinaceus*	Hericiaceae
14		*lyophyllum aggregatum*	Lyophyllaceae
15		*lyophyllum shimeji*	Lyophyllaceae
16		*Xeromphalina campanella*	Marasmiaceae
17		*mycena haematopus*	Mycenaceae
18	Clustered bonnet	*Mycena inclinata*	Mycenaceae
19	Lilca bonnet	*Mycena pura*	Mycenaceae
20	Dog stinkhorn	*Mutinus caninus*	Phallaceae
21	Enokitake	*Flammulina velutipes*	Physalacriaceae
22		*Pleurotus citrinopileatus*	Pleurotaceae
23	Hoof fungus	*fomes fomentarius*	Polyporaceae
24		*Microporus affinis*	Polyporaceae
25		*microporus xanthopus*	Polyporaceae
26	Spring polypore	*Polyporus arcularius*	Polyporaceae
27		*Trametes pubescens*	Polyporaceae
28		*Trametes Versicolor*	Polyporaceae
29	Voilet-Pored Bracket Fungus	*Trichaptum abietinum*	Polyporaceae
30		*Trichaptum biforme*	Polyporaceae
31	Orange Peel Fungus	*Aleuria aurantia*	Pyronemataceae
32	Eyelash Pixie Cup	*Scutellinia scutellata*	Pyronemataceae

33	Common Split Gill	*Schizophyllum commune*	Schizophyllaceae
34	False turkey tail	*Stereum ostrea*	Stereaceae
35	Clustered wood lover	*Hypholoma fasciculare*	Strophariaceae
36		*Pholiota nameko*	Strophariaceae
37		*Pholiota squarrosa*	Strophariaceae

Annexure 9: Fern checklist of BC 4 2021

Sl.No	Common name	Scientific name	Family
1		*Hymenophyllum bivalve*	Hymenophyllaceae
2		*Tectaria harlandii*	Tectariaceae
3		*Asplenium delavayi*	Aspleniaceae
4	Bird's Nest Fern	*Asplenium nidus*	Aspleniaceae
5		*Diplazium donianum*	Athyriaceae
6		*Diplazium esculentum*	Athyriaceae
7	Tree fern	*Alsophila spinulosa*	Cyatheaceae
8		*Monachosorum henryi*	Dennstaedtiaceae
9	eagle fern	*Pteridium aquilinum*	Dennstaedtiaceae
10	Spreading Wood Fern	*Dryopteris expansa*	Dryopteridaceae
11	Mountain Male-Fern	*Dryopteris oreades*	Dryopteridaceae
12	common horsetail	*Equisetum arvense*	Equisetidae
13	False staghorn fern	*Dicranopteris linearis*	Gleicheniaceae
14	Forked Ferns	*Diplopterygium giganteum*	Gleicheniaceae
15		*Trichomanes elegans*	Hymenophyllaceae
16	Veined Bristle-Fern	*Trichomanes venosum*	Hymenophyllaceae
17	Fairy Fern	*Odontosoria chinensis*	Lindsaeaceae
18	Chinese Clubmoss	*Huperzia miyoshiana*	Lycopodiaceae
19	Northern Firmoss	*Huperzia selago*	Lycopodiaceae
20	common club moss	*Lycopodium clavatum*	Lycopodiaceae
21		*Lycopodium japonicum*	Lycopodiaceae
22	Fishbone Fern	*Nephrolepis cordifolia*	Nephrolepidaceae
23	Rock-ginger Fern	*Drynaria coronans*	Polypodiaceae
24	Oakleaf Fern	*Drynaria quercifolia*	Polypodiaceae
25	Basket fern	*Drynaria roosii*	Polypodiaceae
26		*Lepisorus excavatus*	Polypodiaceae
27		*Lepisorus heterolepis*	Polypodiaceae
28		*Lepisorus kawakamii*	Polypodiaceae
29	Needle Fern	*Lepisorus mucronatus*	Polypodiaceae
30	Weeping Fern	*Lepisorus thunbergianus*	Polypodiaceae
31	Kangaroo Fern	*Microsorum pustulatum*	Polypodiaceae
32	Golden Polypody	*Phlebodium aureum*	Polypodiaceae
33	Leather-leaf Fern	*Pyrrosia eleagnifolia*	Polypodiaceae
34		*Pyrrosia linearifolia*	Polypodiaceae
35		*Pyrrosia matsudai*	Polypodiaceae
36	Cretan Brake	*Pteris cretica*	Pteridaceae
37	Doederlein's Spikemoss	*Selaginella doederleinii*	Selaginellaceae
38	Willdenow's Spikemoss	*Selaginella willdenowii*	Selaginellaceae

Annexure 10: Herpetofauna checklist of BC 4 2021

Sl. No.	Common name	Scientifice name	Family	IUCN status	CITES
1	Short-nosed Vine Snake	*Ahaetulla prasina*	Colubridae		
2	Orange-collared Keelback	*Rhabdophis himalayanus*	Colubridae		
3	Copper-headed Trinket Snake	*Coelognathus radiatus*	Colubridae		
4	Eastern Trinket Snake	*Orthriophis cantoris*	Colubridae		
5	Banded Trinket Snake	*Oreocrytophis porphyraceus*	Colubridae		
6	Green Rat Snake	*Ptyas nigromarginata*	Colubridae		
7	White-barred Kukri Snake	*Oligodon albocinctus*	Colubridae		
8	Chinese Kukri Snake	*Oligodon chinensis*	Colubridae		
9	Collared Black-headed Snake	*Sibynophis collaris*	Colubridae		
10	Himalayan Keelback	*Herpetoreas platyceps*	Colubridae		
11	Tawny Cat Snake	*Boiga ochracea*	Colubridae		
12	Assamese Slender Snake	*Trachischium Monticola*	Colubridae		
13	Clerk's Keelback	*Hebius clerki*	Colubridae		
14	Striped Trinket Snake	*Orthriophis taeniurus*	Colubridae	VU	
15	Iridescent Snake	*Blythia reticulata*	Colubridae		
16	Large-eyed False Cobra	*Pseudoxenodon macrops*	Colubridae		
17	Macclelland's Coral Snake	*Sinomicrurus macclellandi*	Elapidae		
18	Monocled Cobra	*Naja Kaouthia*	Elapidae		Appendix II
19	King Cobra	*Ophiophagus hannah*	Elapidae	VU	Appendix II
20	Greater Black Krait	*Bungarus niger*	Elapidae		
21	Himalayan Krait	*Bungarus bungaroides*	Elapidae		
22	Short-legged Horned Toad	*Megophrys brachykolos*	Megophryidae	EN	
23	Montane Slug-eating Snake	*Pareas monticola*	Pareidae		
24	Giant Tree Frog	*Rhacophorus maximus*	Rhacophoridae		
25	Bubble-nest Frog	*Raorchestes andersoni*	Rhacophoridae		
26	Mountain Pit Viper	*Ovophis monticola*	Viperidae		

Annexure 11: Orchid checklist of BC 4 from 2006-2021

Sl.no	Scientific name	0 @2006, x @2016, X @2021
1	*Anoectochilus brevilabris*	X
2	*Anthogonium gracile*	X
3	*Arachnanthe clarkei*	X
4	*Arundina graminifolia*	X
5	*Bulbophyllum affine*	X
6	*Bulbophyllum andersonii*	X
7	*Bulbophyllum emarginatum*	X
8	*Bulbophyllum gymnopus*	X
9	*Bulbophyllum hirtum*	X
10	*Bulbophyllum obrienianum*	X
11	*Bulbophyllum odoratissimum*	X
12	*Bulbophyllum parviflorum*	X

13	*Bulbophyllum raskotii*	X
14	*Bulbophyllum reptans*	X
15	*Bulbophyllum retusiusculum*	X
16	*Bulbophyllum sterile*	X
17	*Bulbophylum secundum*	X
18	*Calanthe alismifolia*	X
19	*Calanthe biloba*	X
20	*Calanthe griffithii*	X
21	*Calanthe herbacea*	X
22	*Calanthe mannii*	X
23	*Calanthe plantaginea*	0 X
24	*Calanthe puberula*	X
25	*Calanthe tricarinata*	X
26	*Calanthe triplicata*	X
27	*Calanthe yuksomnensis*	X
28	*Callostylis rigida*	X
29	*Cephalanthera damasonium*	X
30	*Ceratostylis himalaica*	X
31	*Cheirostylis yunnanensis*	X
32	*Chilochista usenoides*	x X
33	*Chrysoglosum ornatum*	X
34	*Cleisostoma paniculatum*	X
35	*Cleisostoma williamsonii*	X
36	*Coelogyne barbata*	X
37	*Coelogyne corymbosa*	X
38	*Coelogyne fimbriata*	X
39	*Coelogyne nitida*	X
40	*Coelogyne occultata*	X
41	*Coelogyne prolifera*	X
42	*Coelogyne schultesii*	X
43	*Coelogyne stricta*	X
44	*Conchidium muscicola*	X
45	*Cremastra appendiculata*	X
46	*Crepidium aphyllum*	X
47	*Cryptochilus lutea*	X
48	*Cryptochilus sanguinea*	X
49	*Cymbidium aloifolium*	X
50	*Cymbidium cyperifolium*	X
51	*Cymbidium erythraeum*	X
52	*Cymbidium iridioides*	X
53	*Dendrobium chrysanthum*	X
54	*Dendrobium densiflorum*	X
55	*Dendrobium denudans*	X
56	*Dendrobium devonianum*	X
57	*Dendrobium fuscescens*	X

58	*Dendrobium heterocarpum*	X
59	*Dendrobium hookerianum*	X
60	*Dendrobium jenkinsii*	X
61	*Dendrobium longicornu*	X
62	*Dendrobium moniliforme*	X
63	*Dendrobium nobile*	X
64	*Dendrobium spatella*	X
65	*Dendrolirium ferrugineum*	X
66	*Epigenium navicularis*	X
67	*Epipogium japonicum*	X
68	*Epipogium roseum*	X
69	*Eria coronaria*	X
70	*Eriodes barbata*	X
71	*Eulophia graminea*	X
72	*Galeola lindleyana*	0 X
73	*Gastrochilus acutifolius*	X
74	*Gastrochilus calceolaris*	X
75	*Gastrochilus disticus*	X
76	*Goodyera procera*	X
77	*Goodyera schlechtendaliana*	X
78	*Herminium lanceum*	X
79	*Herpysma longicaulis*	X
80	*Ione candida*	X
81	*Liparis bootanensis*	X
82	*Liparis cespitosa*	X
83	*Liparis elliptica*	X
84	*Liparis resupinata*	X
85	*Liparis viridiflora*	X
86	*Malaxis acuminata*	X
87	*Malaxis purpurea*	X
88	*Oberonia acaulis*	X
89	*Oberonia falcata*	X
90	*Oberonia maxima*	X
91	*Oberonia mucronata*	x X
92	*Oberonia obcordata*	X
93	*Odontochilus crispus*	X
94	*Odontochilus elwesii*	X
95	*Odontochilus lanceolatus*	X
96	*Odontochilus poilanei*	X
97	*Ornithochilus difformis*	X
98	*Otochilus fuscus*	X
99	*Otochilus lancilabius*	X
100	*Panisea panchaseensis*	X
101	*Panisea tricallosa*	X
102	*Panisea uniflora*	X

103	*Panisea yunnanensis*	X
104	*Papiliolanthe vandarum*	X
105	*Phaius flavus*	X
106	*Phalaenopsis diffformis*	X
107	*Phalaenopsis taenialis*	X
108	*Pholidota articulata*	x X
109	*Pinalia acervata*	X
110	*Pinalia amica*	X
111	*Pinalia spicata*	X
112	*Platanthera aristatus*	X
113	*Plathanthera dunglonggenisis*	X
114	*Pleione hookeriana*	X
115	*Pleione humilis*	X
116	*Pleione maculata*	X
117	*Pleione praecox*	0 X
118	*Satyrium nepalense*	X
119	*Schoenorchis gemmata*	X
120	*Spiranthes hongkongensis*	X
121	*Sunipia bicolor*	X
122	*Sunipia cirrhata*	X
123	*Thunia alba*	X
124	*Vanda alpina*	X
125	*Vanda bicolor*	X
126	*Vanda cristata*	x X
127	*Vanda griffithii*	X
128	*Zeuxine goodyeroides*	X
129	*Zeuxine reflexa*	X

Annexure 12: Butterfly checklist of BC 4 2021

Sl.No.	Common Name	Scientific Name	Family
1	Veined Scrub Hopper	*Aeromachus stigmatus*	Hesperiidae
2	Lucas' Ace	*Sovia lucasii magna*	Hesperiidae
3	Yellow Spot Swift	*Polytremis eltola*	Hesperiidae
4	Tawny Angle	*Ctenoptilum vasava vasava*	Hesperiidae
5	Plain Banded Awl	*Hasora vita indica*	Hesperiidae
6	Tytier's Multispotted flat	*Celaenorrhinius ratna tytleri*	Hesperiidae
7	Bevan's Swift	*Borbo bevani*	Hesperiidae
8	Spotted Demon	*Notocrypta feisthamelii*	Hesperiidae
9	Large-spot Plain Ace	*Thoressa sitala*	Hesperiidae
10	Tyler's White Flat	*Satarupa zulla zulla*	Hesperiidae
11	Common Dartlet	*Oriens gola*	Hesperiidae
12	Green Awlet	*Burara vasutana*	Hesperiidae
13	Common Lineblue	*Prosotas nori*	Lycaenidae
14	Common Cerulean	*Jamides celeno*	Lycaenidae
15	Pale Grass Blue	*Pseudozizeeria maha*	Lycaenidae

16	Common Hedge Blue	*Acytolepis puspa*	Lycaenidae
17	Golden Sapphire	*Heliophorus brahma*	Lycaenidae
18	Dark Grass Blue	*Zizeeria karsandra*	Lycaenidae
19	Swinhoe's Hedge Blue	*Monodontides musina*	Lycaenidae
20	Dark Himalayan Oakblue	*Arhopala rama*	Lycaenidae
21	Blue Tit	*Chliaria kina*	Lycaenidae
22	Common Flash	*Rapla iarbus*	Lycaenidae
23	Bi-spot Royal	*Ancema ctesia*	Lycaenidae
24	Indian Sunbeam	*Curetis thetis*	Lycaenidae
25	Chocolate Royal	*Remelana jangala*	Lycaenidae
26	Angled Sunbeam	*Curetis acuta*	Lycaenidae
27	Himalayan Wonderful Hairstreak	*Thermozephyrus ataxux*	Lycaenidae
28	Euasapa	*Euaspa pavo*	Lycaenidae
29	Forest Quacker	*Pithecops corvus*	Lycaenidae
30	Common Imperial	*Cheritra freja*	Lycaenidae
31	Bright Sunbeam	*Curetis bulis*	Nymphalidae
32	Silver-grey Silverline	*Spindasis nipalicus*	Nymphalidae
33	Green Sapphire	*Heliphorus androcles*	Nymphalidae
34	Powdery Green Sapphire	*Heliphorus tamu*	Nymphalidae
35	Common Beak	*Libythea lepita*	Nymphalidae
36	Glassy Tiger	*Parantica aglea*	Nymphalidae
37	Chestnut Tiger	*Parantica sita*	Nymphalidae
38	Chocolate Tiger	*Parantica melaneus*	Nymphalidae
39	Common Crow	*Euploea core*	Nymphalidae
40	Striped Blue Crow	*Euploea mulciber*	Nymphalidae
41	Common Nawab	*Polyura anthamas*	Nymphalidae
42	Tiger Brown	*Orinona damaris*	Nymphalidae
43	Common Fivering	*Ypthima baldus*	Nymphalidae
44	Himalayan Fivering	*Ypthima sakra*	Nymphalidae
45	Yellow Coster	*Acraea issoria*	Nymphalidae
46	Large Silverstripe	*Argynnis childreni*	Nymphalidae
47	Common Sergeant	*Athyma perius*	Nymphalidae
48	Common Sailor	*Neptis hylas*	Nymphalidae
49	Popinjay	*Stibochiona nicea*	Nymphalidae
50	Common Map	*Cyrestis thyodamas*	Nymphalidae
51	Common Maplet	*Chersonisia risa*	Nymphalidae
52	Tabby	*Pseudergolis wedah*	Nymphalidae
53	Common Jester	*Symbrenthia lilaea*	Nymphalidae
54	Indian Red Admiral	*Vanessa indica*	Nymphalidae
55	Indian Tortoisehell	*Aglais caschmirensis*	Nymphalidae
56	Blue Admiral	*Kaniska canace*	Nymphalidae
57	Blue Pansy	*Junonia orithia*	Nymphalidae
58	Yellow Pansy	*Junonia hiertha*	Nymphalidae
59	Chocolate Pansy	*Junonia iphita*	Nymphalidae
60	Lemon Pansy	*Junonia lemonias*	Nymphalidae

61	Orange Oak Leaf	*Kallima inchus*	Nymphalidae
62	Blue Duchess	*Euthalia duda*	Nymphalidae
63	Red Lacewing	*Cethosia cyana*	Nymphalidae
64	Common Commodore	*Auzakia danava*	Nymphalidae
65	Bicolor Commodore	*Parasarpa zayla*	Nymphalidae
66	Blue-tailed Jester	*Symbrenthia niphanda*	Nymphalidae
67	Indian Fritillary	*Argyreus hyperbius*	Nymphalidae
68	Large Threering	*Ypthima nareda*	Nymphalidae
69	Tamil Yeoman	*Cirrochroa thais*	Nymphalidae
70	Great Yellow Sailer	*Neptis radha*	Nymphalidae
71	Straight-banded Treebrown	*Lethe verma*	Nymphalidae
72	Blackvein Sergeant	*Athyma ranga*	Nymphalidae
73	Blue Duke	*Bassarona durga*	Nymphalidae
74	Bronze Duke	*Euthalia nara*	Nymphalidae
75	Common Bushbrown	*Mycalesis perseus*	Nymphalidae
76	Spotted Palmfly	*Elymnias malelas*	Nymphalidae
77	Great Nawab	*Polyura eudamippus*	Nymphalidae
78	Dark Blue Tiger	*Tirumala septentrionis*	Nymphalidae
79	Green Duke	*Euthalia sahadeva*	Nymphalidae
80	Circe	*Hestina nama*	Nymphalidae
81	Autumn Leaf	*Doleschallia bisaltide*	Nymphalidae
82	Orange Staft Sergeant	*Athyma cama*	Nymphalidae
83	Dark-Branded Bush Brown	*Mycalesis minus*	Nymphalidae
84	Himalayan Sergeant	*Athyma opalina*	Nymphalidae
85	Green Commodore	*Sumalia daraxa*	Nymphalidae
86	Moore’s Bushbrown	*Mycalesis heri*	Nymphalidae
87	Grand Duchess	*Euthalia patala*	Nymphalidae
88	Indian Purple Emperor	*Mimathyma ambica*	Nymphalidae
89	Painted Lady	*Vanessa cardui*	Nymphalidae
90	Club Beak	*Libythea myrrha*	Nymphalidae
91	Black Prince	*Rohana parisatis*	Nymphalidae
92	Common Nawab	*Polyura athamas*	Nymphalidae
93	Blue Oakleaf	*Kallima horsfieldii*	Nymphalidae
94	White-edged Blue Baron	*Euthalia phemius*	Nymphalidae
95	Pallid Argus	*Callerebia scanda*	Nymphalidae
96	Common Woodbrown	*Lethe sidonis*	Nymphalidae
97	Lilack Fork	*Lethe dura*	Nymphalidae
98	Common Red Forester	*Lethe mekara*	Nymphalidae
99	Small Woodbrown	*Lethe nicetella*	Nymphalidae
100	Pasha	*Herona marathus*	Nymphalidae
101	Jewel Five-ring	*Ypthima avanta*	Nymphalidae
102	Tailed Red Forester	*Lethe sinorix*	Nymphalidae
103	Chocolate Jungle Queen	*Stichophthalma nourmahal*	Nymphalidae
104	Scarce Evening Brown	*Cyllogenes janetae*	Nymphalidae
105	White Commodore	*Parasarpa dudu*	Nymphalidae

106	Jungle Glory	*Thaumantis diores*	Nymphalidae
107	Common Mormon	*Papilio polytes*	Papilionidae
108	Golden Birdwing	*Troides aeacus*	Papilionidae
109	Common Windmill	*Atrophaneura polyeucts*	Papilionidae
110	Rose Windmill	*Atrophaneura latreillei*	Papilionidae
111	Great Windmill	*Atrophaneura dasarata*	Papilionidae
112	Common Rose	*Atrophaneura aristolochiae*	Papilionidae
113	Red Helen	*Papilio helenus*	Papilionidae
114	Common Bluebottle	*Graphium serpedon*	Papilionidae
115	Glassy Bluebottle	*Graphium cloanthus*	Papilionidae
116	Common Peacock	*Papilio polyctor*	Papilionidae
117	Paris Peacock	*Papilio paris*	Papilionidae
118	Six-bar Swordtail	*Graphium euros*	Papilionidae
119	Spangle	*Papilio protenor*	Papilionidae
120	Krishna Peacock	*Papilio krishna*	Papilionidae
121	Spot Swordtail	*Graphium nomius*	Papilionidae
122	Veined Jay	*Graphium chironides*	Papilionidae
123	Fourbar Swordtail	*Graphium agetes*	Papilionidae
124	Lesser Zebra	*Graphium macareus*	Papilionidae
125	Yellow Helen	*Papilio nephelus*	Papilionidae
126	Tawny Mime	*Papilio agestor*	Papilionidae
127	Brown Gorgon	*Meandrusa sciron*	Papilionidae
128	Tailed Jay	*Graphium agamemnon*	Papilionidae
129	Common Raven	*Papilio castor*	Papilionidae
130	Spectacled Swordtail	*Graphium paphus*	Papilionidae
131	Indian Cabbage White	*Pieris canidia*	Pieridae
132	Large Cabbage White	*Pieris brassicae*	Pieridae
133	Yellow Orange Tip	*Ixias pyrena*	Pieridae
134	White Orange Tip	*Ixias marianne*	Pieridae
135	Red-spot Jezebel	*Delias descombesi*	Pieridae
136	Pale Jezebel	*Delias sanaca*	Pieridae
137	Red-base Jezebel	*Delias pasithoe*	Pieridae
138	Common Grass Yellow	*Eurema hecabe*	Pieridae
139	Spotted Sawtooth	*Prioneris thestylis*	Pieridae
140	Hill Jezebel	*Delias belladonna*	Pieridae
141	Dark Jezebel	*Delias berinda*	Pieridae
142	Plain Surphur	*Dercas lycorias*	Pieridae
143	Dark Clouded Yellow	*Colias fieldii*	Pieridae
144	Dark Judy	*Abisara fylla*	Riodinidae
145	Punchinello	*Zemeros flegyas*	Riodinidae
146	Lesser Punch	*Dodona dipoea*	Riodinidae
147	Tailed Punch	*Dodona eugenes*	Riodinidae
148	Common Punch	*Dodona durga*	Riodinidae
149	Mixed Punch	*Dodona ouida*	Riodinidae
150	Orange Punch	*Dodona egeon*	Riodinidae

Annexure 13: Moths checklist of BC 4 2021

Sl.No.	Common Name	Scientific Name	Family
1	Bob Butterfly Moth	*Callidula attenuata*	Callidulidae
2	Glad-eye Butterfly Moth	*Pterodecta anchora*	Callidulidae
3	Cossid Moth	*Zeuzera multistrigata*	Cossidae
4	Coral Tree Moth	*Agathodes ostentalis*	Crambidae
5	Thunbergia Tear Sucker	*Filodes fulvidorsalis*	Crambidae
6		*Oreta vatama*	Drepanidae
7	Large Bird-dropping Hooktip	*Macrocilix maia*	Drepanidae
8		*Barsine orientalis*	Erebidae
9		*Lygniodes endoleucs*	Erebidae
10		*Palirisa lineosa*	Eupterotidae
11		*Osteosema sp.*	Geometridae
12	Yellow-border Plutodes	*Plutodes costatus*	Geometridae
13	False Tiger Month	*Dysphania militaris*	Geometridae
14		*Percnia ductaria*	Geometridae
15	Iridicolor Emerald	*Iotaphora iridicolor*	Geometridae
16		*Thallasodes* sp.	Geometridae
17		*Limacodidae sp.*	Limacodidae
18		*Tarsolepis fulgida*	Notodontidae
19		*Syntypistis sp.*	Notodontidae
20		*Salassa sp.*	Saturniidae
21	Edward's Atlas Moth	*Archaeoattacus edwardsii*	Saturniidae
22	Rosy Tasar Silk Moth	*Antheraea rubicunda*	Saturniidae
23	Indian Moon Moth	*Actias selene*	Saturniidae
24	Orange-legged Clearwing	*Melittia hampsoni*	Sesiidae
25		*Marumba sp.*	Sphingidae
26	Ochreous Gliding Hawkmoth	*Ambulyx ochracea*	Sphingidae
27		*Sataspes infernalis*	Sphingidae
28	Green-striped Hawkmoth	*Cechetra lineosa*	Sphingidae
29	Broad-bordered Bee Hawk Moth	*Hemaris fuciformis*	Sphingidae
30		*Cerace cyanopyga*	Tortricidae
31	Harlequin Tiger Moth	*Campylotes histrionicus*	Zygaenidae
32		*Sacada sp.*	Pyralidae
33		*Numenes sp.*	Erebidae
34		*Daddala sp.*	Erebidae
35		*Arcte polygrapha*	Noctuidae
36	Hill Fern Moth	*Callopistria repleta*	Noctuidae