Biological Corridor (BC) 9 Conservation Management Plan

(July 2025 - June 2035)

Connecting Sakteng Wildlife Sanctuary & Bumdeling Wildlife Sanctuary

Data collection:

- Staff of Divisional Forest Office, Trashigang

Management Plan prepared by:

1. Karma Leki, Chief Forestry Officer
2. Sonam Tobgay, Dy.CFO
3. Lam Norbu, Sr.FO
4. Sonam Wangmo, Sr.FO
5. Kelzang Jigme, FO
6. Pema Tshewang, Sr.FR III
7. Tandin Wangchuk, FR I
8. Jambay Wangchuk, Asst. Forester
9. Tenzin Wangdi, Dy.CFO
10. Ngagyel Dema, FO

Critical input and edited by: Nature Conservation Divisional Officials

1. Sonam Wangdi, CFO
2. Samten Wangchuk, PFO
3. Tshering Zam, Dy.CFO
4. Tshering Pem, Dy.CFO
5. Lungten Dorji,Sr.FO
6. Chimi Dorji,Sr.FO
7. Phub Dorji,Sr.FO
8. Choney Yangzom, Sr.FO
9. Rinchen Dorji,Sr.FO

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1. Dawa Tshering, FR I, Wamrong Range
2. Pema Tshewaing, Sr.FR II, Jamkhar Beat Office
3. NTS camera trap and Drone

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

Endorsement and Approval of the Royal Government of Bhutan

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

Submitted for Approval:

(Karma Leki)
Chief Forestry Officer
Divisional Forest Office, Trashigang

Reviewed by:

(Sonam Wangdi)
Chief Forestry Officer
Nature Conservation Division, Thimphu

Recommended for Approval:

DIRECTOR
Department of Forests and Park Services

Approved by:

SECRETARY
Ministry of Energy and Natural Resource

FOREWORD

The conservation of biodiversity is a cornerstone of sustainable development and ecological resilience. Biological corridors play a critical role in maintaining landscape connectivity, allowing wildlife to move freely between protected areas, ensuring genetic diversity, and fostering ecosystem stability. Biological Corridor 9 (BC 9) is a crucial link within Bhutan's protected area network, strategically connecting Sakteng Wildlife Sanctuary (SWS) and Bumdeling Wildlife Sanctuary (BWS). This corridor serves as a vital passage for species, allowing them to migrate, adapt, and survive amid the challenges posed by habitat loss and climate change.

The landscape harbors a remarkable diversity of flora and fauna, many of which hold both national and global conservation significance. Despite its ecological importance characterized by a rich array of habitats and species, there was previously no designated biological corridor ensuring seamless connectivity between SWS and BWS. Recognizing this gap, the Biological Corridor 9 Bill was proposed, thoroughly assessed through a feasibility report, and subsequently approved and adopted in 2023 by the National Assembly and National Council of Bhutan. This milestone marked a significant advancement in Bhutan's conservation framework, making BC 9 the only designated biological corridor in the extreme eastern region of the country. Given its crucial role in preserving the region's ecological balance, a structured Management Plan is essential to strengthen conservation initiatives.

For this, a conservation management plan is an essential document that establishes a comprehensive roadmap for sustainable land and resource

management, habitat restoration, and the active participation of local communities. By integrating conservation efforts with community engagement, the plan ensures the long-term protection and ecological integrity of BC 9. Furthermore, it aligns with Bhutan's broader protected area management objectives, reinforcing national and global commitments to biodiversity conservation.

This management plan is the result of dedicated efforts from the Divisional Forest Office (DFO), Trashigang. Its development is timely, featuring a well-defined vision and strategic objectives while incorporating appropriate management prescriptions in line with the overall goals of protected area management in Bhutan. As we implement this plan, it is imperative that all stakeholders remain committed to upholding its goals. By working together, we can ensure that BC 9 continues to serve as a resilient ecosystem, supporting both biodiversity and the livelihoods of the communities that depend on it.

Tashi Delek!

DIRECTOR

Department of Forests and Park Services

ACKNOWLEDGEMENT

The management of the Divisional Forests Office, Trashigang, is deeply indebted to the Department of Forests and Park Services for entrusting us with the responsibility of managing BC 9.

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

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

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

(Karma Leki)

Chief Forestry Officer

ACRONYMS

B2C2	Bhutan Biological Corridor Complex
BC	Biological Corridor
BFL	Bhutan for Life
BTFEC	Bhutan Trust Fund for Environmental Conservation
BWS	Bumdeling Wildlife Sanctuary
CCVA	Climate Change Vulnerability Assessment
CDV	Canine Distemper Virus
CF	Community Forest
DFO	Divisional Forest Office
DoFPS	Department of Forests and Park Service
EBA	Evidence-Based Approaches
FMU	Forest Management Unit
FYP	Five Year Plan
H'	Shannon Wiener Diversity Index
HWC	Human Wildlife Conflict
IAS	Invasive Alien Species
IUCN	International Union for Conservation of Nature
LFMA	Local Forest Management Area
LULC	Land Use Land Cover
M.a.s. l	Meter Above Sea Level
METT +	Monitoring Effectiveness Tracking Tool Plus
NCD	Nature Conservation Division
NCHM	National Centre for Hydrology and Metrology
NWFP	Non-Wood Forest Product
RSPN	Royal Society for Protection of Nature
SMART	Spatial Monitoring Reporting Tool
SRFL	State Reserve Forest Land
SWS	Sakteng Wildlife Sanctuary
TDFO	Trashigang Divisional Forest Office
WBI	Wood-Based Industry

EXECUTIVE SUMMARY

Biological Corridor 9 (BC 9) was officially designated in June 2023 to establish ecological connectivity between Sakteng Wildlife Sanctuary (SWS) and Bumdeling Wildlife Sanctuary (BWS) in eastern Bhutan. Spanning an area of 216 km², it encompasses parts of Phongmay gewog under Trashigang Dzongkhag and Yallang, Toetsho, Khamdang, Yangtse, and Bumdeling gewogs under Trashi Yangtse Dzongkhag. The settlements within BC 9 include Dukti, Melongkhar-Chema, and Namthi-Yerphel chewogs from Yallang Gewog; Jangphutse, Manam-Chemkhar, and a portion of Omba-Meldung Chiwog from Toetsho Gewog; and Womanang Chiwog from Bundeling Gewog.

With the elevation ranging from 925 m.a.s.l to 4511 m.a.s.l, the dominant forest type in BC 9 is cool broadleaved forest. The biodiversity assessment survey recorded 913 plant species across 154 families, including three endemic species (*Isodon atroruber*, *Corallodiscus cooperi*, and *Bulbophyllum trongsaense*) and five of the newly plant species recorded in Bhutan (*Panisea panchaseensis*, *Eurycorymbus cavaleriei*, *Chiloschista densiflora*, *Sisyrinchium rosulatum*, and *Herminium longilobatum)*. The survey also recorded the presence of a monotypic genus, *Tetracentron sinense*.

BC 9 is home to 39 mammal species, among which five are listed as Endangered, nine as Vulnerable, four as Near Threatened, and 21 as Least Concern on the IUCN Red List of Threatened Species. The Royal Bengal tiger, clouded leopard, and musk deer protected under Schedule I of the Forest and Nature Conservation Act of Bhutan, 2023 are also found in BC.

The corridor also supports rich avian diversity, with 200 bird species documented. The occurrence of Bhutan glory (*Bhutanitis lidderdalii*), a butterfly emblematic of Bhutan indicates relatively undisturbed and ecologically rich habitat of the landscape.

Subsistence agriculture and livestock rearing form the primary livelihoods for communities in the landscape. However, the area faces multiple threats, including human-wildlife conflict, habitat fragmentation and degradation, unsustainable resource use, forest fires, socio-economic and demographic pressures, and the impacts of climate change. These threats often pose serious challenges to species conservation, ecological connectivity, and community wellbeing.

To address these challenges,13 strategies having 42 actions have been identified which are aligned with six overarching objectives to realize the vision of a thriving and interconnected network of protected areas where wildlife and humans coexist harmoniously.

This management plan will be implemented over a period of ten years from July 2025 to June 2035, aligning with Bhutan's 13th and 14th Five Year Plans. A total budget of Nu. 43.62 million is proposed to support species conservation, maintain ecological connectivity and improve community livelihoods through human wildlife conflict mitigation, habitat management, climate-resilient and sustainable initiatives.

The primary funding to implement this plan is expected from the Royal Government of Bhutan and other potential conservation partners.

TABLE OF CONTENTS

EXECUTIVE SUMMARY V

Chapter 1

Introduction 1

1.1 Background and function of BC in Bhutan 1

1.2 Basic information of BC9 2

1.3 Vision, Mission, Goal and Objectives 3

1.4 Scope of the plan 5

Chapter 2

Current status 6

2.1 Physical features 6

2.1.1 BC9 boundary description 6

2.1.2 Topography and climate 7

2.1.3 Waterbodies 9

2.1.4 Chokepoints 10

2.2 Biological features 10

2.2.1 Vegetations and Forest types 10

2.2.2 Floral diversity 12

2.2.3 Faunal diversity 15

2.3 Important habitats 22

2.4 Socio-economic characteristics 25

2.4.1 Social -economic status 25

2.4.2 Livelihood 26

2.4.3 People's perception on climate change and its impact on their livelihood 34

2.4.4 Climate change adaptation measures in practice 37

2.5 Resource use 39
2.6 Ecotourism opportunities 42
2.7 Present threats 42
2.8 Future plans of development activities in the BC 44
2.9 Cross cutting forest management regime 44
2.7.1. Community Forest 45
2.7.2. Non-wood Forest Management 47
2.7.3. Local Forest Management Area 47
Chapter 3
Threat Analysis 49
3.1. Habitat loss & degradation 51
3.2. Human Wildlife Conflict 52
3.3. Socio-Economic & Demographic Challenges 57
3.4. Unsustainable Resource Use & Exploitation 59
3.5. Forest fire 61
3.6. Pest and disease outbreak 63
3.7. Climate Change 66
Chapter 4
Management Intervention 69
Chapter 5
Implementation Schedule and Budget 74
Chapter 6
Monitoring and Evaluation 81
4. References 88
5. Annexures 90

LIST OF TABLE

Table 1 Village and population information inside BC9 4

Table 2: Mammal order and families..... 16

Table 3: Shows the average income from agriculture farming system..... 29

Table 4 Average income per house from livestock..... 31

Table 5: List of CFs overlapped within with BC 9..... 46

Table 6: List of NWFP management overlapped within BC9 landscape 48

Table 7: List of LFMA partly overlapped with BC9 boundary 48

Table 8 Implementation framework and budget outlay..... 75

Table 9 Monitoring and evaluation framework 82

LIST OF FIGURES

Figure 1: The network of nine BCs connecting the ten protected areas of Bhutan..... 2

Figure 2: The location of BC9 connecting BWS and SWS..... 7

Figure 3: Monthly climatology showing of temperature (minimum, maximum and mean), precipitation and relative humidity for the year 2022-2024. (Data source: NCHM) 8

Figure 4: Stream and river network inside BC9 10

Figure 5: The different forest tyeps in BC 9 (Forest Types of Bhutan 2022)..... 11

Figure 6: Tree and shrub species composition..... 12

Figure 7: Herb species composition 13

Figure 8:. Species diversity, richness and evenness 14

Figure 9: Mammalian order with representation of species and families. 17

Figure 10: Musk deer and red panda inside BC 9 17

Figure 11: Healthy male and female common leopard inside BC9..... 18

Figure 12: Satyr tragopan in the BC9 captured by camera trap 19

Figure 13: Scutiger sikkimensis and Sylvirana spp., recorded from the BC9 landscapes..... 20

Figure 14: Jerdon's Pit Viper recorded from the BC9 landscapes during the survey..... 21

Figure 15: Bhutan glory (Bhutanitis lidderdalii) inisde BC9 22

Figure 16: The potential habitat for some of the threatened mammal species..... 24

Figure 17: The ranking of households income from different sources in the order of low to high (eg: agriculture is the highest rank while the Other sources is lowest rank. "Others" income sources comprises of family support, cross border religious services and handicraft)..... 25

Figure 18: Average landholding per household..... 27

Figure 19: Paddy cultivation in Melongkhar village inside BC9 28

Figure 20: Problems and constraints faced by communities during the agriculture farming practices..... 29

Figure 21: Horese being used as primary mode of transportation in the BC 9 30

Figure 22: Shows the importance of livestock rearing..... 32

Figure 23: The various types of livestock grazing practices 32

Figure 24: Livestock grazing practice 33

Figure 25: Perceived change in weather parameter 34

Figure 26: Perceived impact of climate change in plant phenology 35

Figure 27: Perceived change in climate change vulnerability 36

Figure 28: Impact of climate change in the landscape 37

Figure 29: Map showing the resource allocation area in BC 9 from different cross cutting regimes 40

Figure 30: Resource utilization trend through PRA 41

Figure 31: Aerial view of burnt forest area in December, 2024. 43

Figure 32: Threat ranking 49

Figure 33: Conceptual framework to address the threat inside BC 9. 50

Figure 34: Fallow land covered by Ageratina adenophora in Dukti 52

Figure 35: Carcass of horse killed by wild predator in the BC 9 53

Figure 36: Severity of impact of HWC 53

Figure 37: Crop raiding wildlife species 54

Figure 38: Reason for the cause of crop damage by wildlife 54

Figure 39: Livestock depredation cases by various predators 55

Figure 40: Demographic structure of the sample household 57

Figure 41: An abondoned house caused by Gungtong in the BC 9 58

Figure 42: The illegally sawn timber (Photo 1 & 2) and unauthorized tapping of water source (photo 3 & 4) from the BC 9 area 60

Figure 43: The people carrying finished bamboo product (photo 1), carrying raw materials (photo 2), trap laid for birds (photo 3), and trap laid for ungulate species (photo 4). 61

Figure 44: Forest fire outbreak in Chemkhar in BC 9 in December 2024..62

Figure 45: Outbreak of goral scabies in and around the BC 9 landscape in 2018.(Figure A-Figure showing Male Photo from Ugyen Dechen's report 64

Figure 46: Projected precipitation change under different climate scenario in Trashi Yangtse Dzongkhag 67

Figure 47: Projected temperature change under different climate scenario in Trashi Yangtse Dzongkhag (Source : World Bank Group's Climate Change Knowledge Portal)..... 67

Chapter 1

Introduction

1.1 Background and function of BC in Bhutan

Biological corridors (hereafter referred to as BCs) connect protected areas, facilitating wildlife movement and contributing to species survival. By connecting habitats, BCs are expected to facilitate uninterrupted wildlife movement to access essential resources, promote gene flow, support recolonization, and aid in species recovery from extinction. Additionally, BCs play an important role in helping species adapt to climate change by allowing them to adjust to shifting geographic ranges (Rudnick et al., 2012; Damschen et al., 2019). Therefore, BCs forms an important form of climate refugia.

In Bhutan, BCs were established in 1999 as a *"Gift to the Earth from the people of Bhutan"* by Her Majesty Ashi Dorji Wangmo Wangchuck (DoFPS, 2021). Initially consisting of twelve corridors designed to connect the country's the then nine protected areas, this network was modified in 2008 with the creation of tenth protected area (Wangchuck Centennial National Park), which subsumed three northern BCs and merged into one (BC7), reducing the total to eight (WCD, 2010).

In 2023, a new biological corridor (BC 9) was declared to connect Bumdeling Wildlife Sanctuary (BWS) and Sakteng Wildlife Sanctuary (SWS). The declaration of this BC 9 completes the Bhutan Biological Corridor Complex (B2C2) circuit in eastern Bhutan, significantly enhancing the region's ecological integrity. Currently, there are total of nine biological corridors, covering 8.28 % of the country's land area, playing a vital role in maintaining landscape connectivity and supporting the nation's network of ten protected areas.

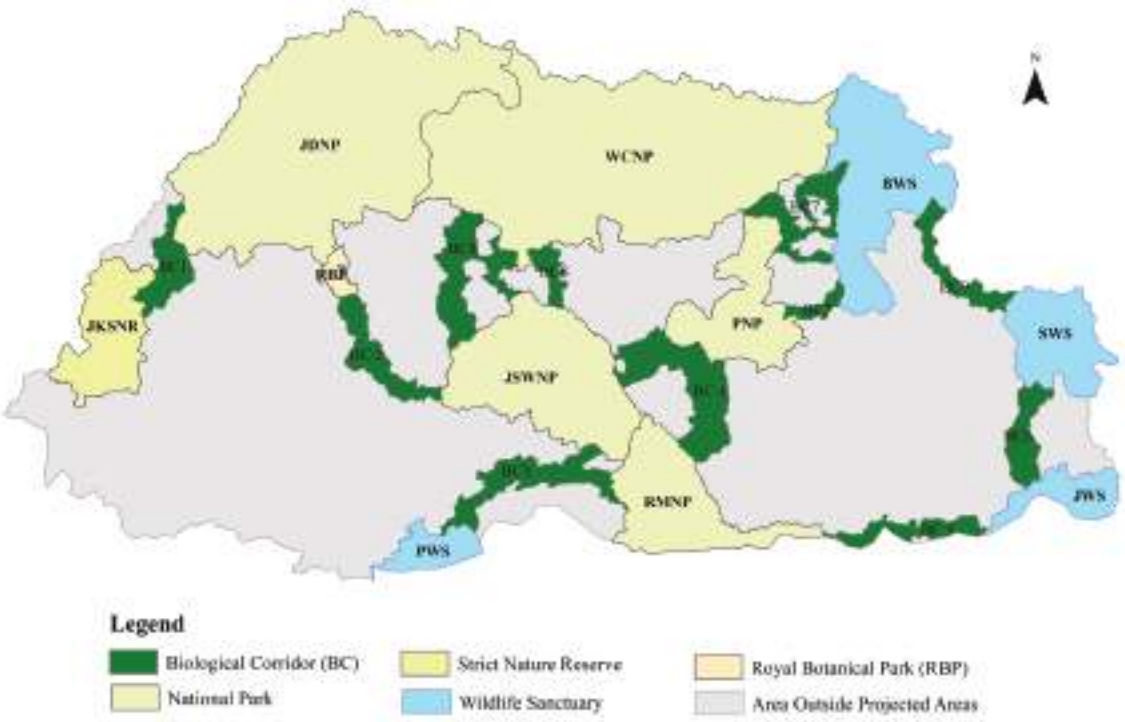

Figure 1: The network of nine BCs connecting the ten protected areas of Bhutan.

1.2 Basic information of BC9

In June 2023, during the 10th session of Bhutan's Third Parliament, BC 9 was officially declared, connecting BWS and SWS.

The corridor stretches approximately 60.2 km (as measured along the polygon map centreline) and covers an area of 216 km². This include the parts of Bumdeling, Yangtse, Khamdang, Toetsho and Yallang gewogs under Trashiyangtse Dzongkhag and the part of Phongmay gewog under Trashigang Dzongkhag. However, only Toetsho, Yallang, and Bumdeling consist of settlements within BC 9.

The household density within BC 9 is roughly 2 households per km², with settlements clustered in three gewogs. The BC occupy 8.09 km² of registered private land (seven chewogs), which may serve as potential choke points.

According to LULC 2020 the land cover is predominantly forest (91.6 %), followed by shrubs (5 %), cultivated agriculture (1.6 %), and other land types (<1 %). The habitat fragmentation of the BC caused by road is minimal as only 4.46km of road are within the corridor area.

1.3 Vision, Mission, Goal and Objectives

Vision

- A thriving and interconnected network of protected areas where wildlife and humans coexist harmoniously

Mission

- To maintain an ecologically resilient and functional corridor between BWS and SWS, enhancing landscape connectivity through climate smart conservation practices and community engagement

Goal

- To establish BC9 as a secure and well-managed corridor enabling unimpeded wildlife movement between SWS and BWS by 2035

Objective

1. To enhance landscape connectivity by maintaining and restoring habitats that faciliate wildlife movement.
2. To improve wildlife monitoring by generating baseline data and tracking population trends for targeted conservation planning
3. To adopt and implement climate smart conservation practices that promote resilience to climate change
4. To foster conservation partnerships with local communities through sustainable livelihood initiatives.
5. To enhance community wellbeing through the adoption of innovative mechanisms to address human wildlife conflict
6. To improve institutional capacity development for effective service delivery.

Table 1 Village and population information inside BC9

Dzongkhag	Gewog	Village	HH	Number of Household		Population		Private land (km²)	Area inside BC (km²)
				Active	Gungtong	Male	Female		
Trashi Yangtse	Yallang	Namthi	27	19	8	89	109	4.10	54.03
		Yerphel	55	31	24	178	211		
		Chema	42	29	13	164	156		
		Melongkhar	29	18	11	93	109		
		Dukti	38	16	22	148	118		
	Toetsho	Chemkhar	20	18	2	78	66	2.75	31.22
		Manam	16	13	3	50	46		
		Thangdrang	13	10	3	38	32		
		Omba	19	15	4	65	65		
		Jangphutse	74	62	12	255	258		
	Bumdeling	Womanang	41	35	6	50	55	1.13	50.26
	Yangtse								41.86
	Khamdang								3.90
Trashigang	Phongmay							0.11	34.72
Total			**374**	**267**	**108**	**1158**	**1170**	**8.09**	***216.00***

**The above information is based on gewog profile provided by respective Tshogpa for 2025*

1.4 Scope of the plan

This plan is based on the findings from comprehensive surveys and assessments. It has been designed to provide a structured, science-based approach for the conservation and management of BC 9, ensuring that all actions address the identified threats. The plan seeks to balance ecological priorities with community needs by integrating data-driven conservation strategies, habitat restoration, livelihood improvement, and climate-adaptive management practices.

By adhering to this plan, BC 9 will be managed scientifically and sustainably, with the ultimate vision of creating a thriving, interconnected network of protected areas where wildlife and humans coexist harmoniously.

The plan will be implemented from July 1, 2025, and remain valid until June 30, 2035, for a period of 10 years. The execution of the detailed strategies and actions outlined in this plan is contingent upon securing adequate funding, which the Trashigang Forest Division, DoFPS will seek from potential conservation partners and will be implemented in collaboration with line agencies and stakeholders.

Chapter 2

Current status

2.1 Physical features

2.1.1 BC9 boundary description

The BC9 extends from 27.413208ºN to 27.727414ºN and 91.505903ºE to 91.824898ºE. It connects Bumdeling Wildlife Sanctuary (BWS) in the north with Sakteng Wildlife Sanctuary (SWS) in the southeast. The boundary with SWS begins at Thongphu Tse/Khegpa Phu peak and then follows the Kurong downstream till 91.7862ºE, 27.4132ºN. It then ascends the ridge passing Wampangdung Chorten, continuing to Wangleng, Thongjey Goth, Wangphu, Mebrungla, Wamphu, Circila Pangthang, Korphu, Pangchula, Rimsho, the ridge near Gongja Ney. The boundary further, follows gorge of Ngalakang Ri, Maidung Chhu, Kapashing, horizontally crosses Dakpadung Chhu, Chumdu Chhu, Banay Chhu, Banay Goenpa peak, Thulashing Chhu, Dribla Chhu, Tsangnga, Berzam Chhu, Zhabaymo, Serkang Chhu, Tshoneyma, Talikang Chhu, Rapting. It then follows Womanang Chhu upstream, till Dechenphodrang stream confluence. The boundary with BWS begins at the confluence of Womanang Chu and streams from Dechenphodrang and runs upstream till the international border under Bumdeling gewog. On the right side, BC9 follows the international border with the Indian state of Arunachal Pradesh.

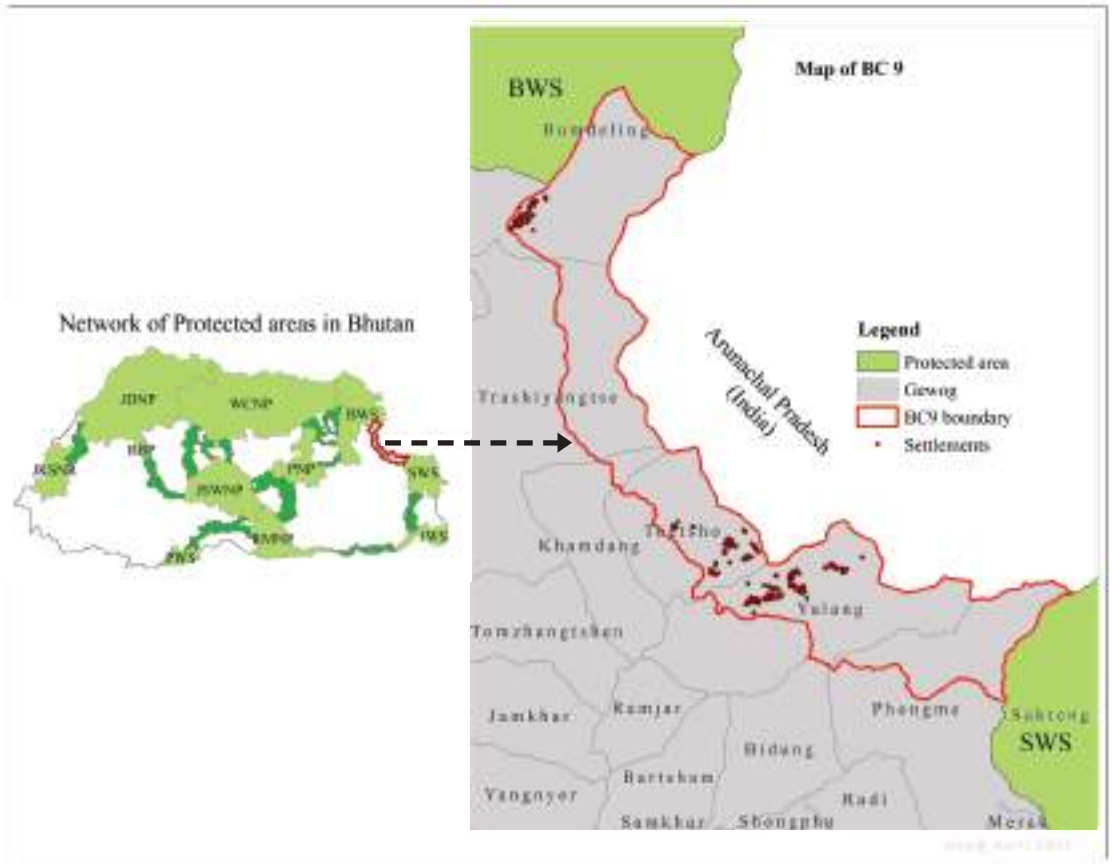

Figure 2: The location of BC9 connecting BWS and SWS

2.1.2 Topography and climate

According to Forest and Nature Conservation code of best management practices of Bhutan volume III: sustainable forest management (2021), slopes are categorized as gentle (below 25 %), moderate (25-50 %), steep (50-100 %), and very steep or inoperable (above 100 %). In the BC 9 landscape, steep slopes are most prevalent, comprising 45 % of the area. Moderate slopes account for 34 %, followed by gentle slopes at 12 % and very steep areas at 9 %. The majority of slopes in BC 9 face west (35 %), followed by south and north (26 % each), east (13 %), and the flat areas comprises of less than 1 %.

BC 9 exhibits wide variability in elevation ranging from 925 m.a.s.l to 4511 m.a.s.l. Close to 85% of the landscape is located above 2000m which experiences temperate climate while the remaining 15 % is located below 2000 m.a.s.l with subtropical climate.

Based on the Köppen-Geiger climate classification map for Bhutan (1980-2016), the majority of the BC 9 landscape experiences a temperate climate with dry winters and warm summers (Cwa). This is followed by areas with cold, dry winters and warm summers (Dwb), while certain locations in the deep valleys of Gongri chhu exhibit a temperate climate with dry winters and hot summers (Cwa).

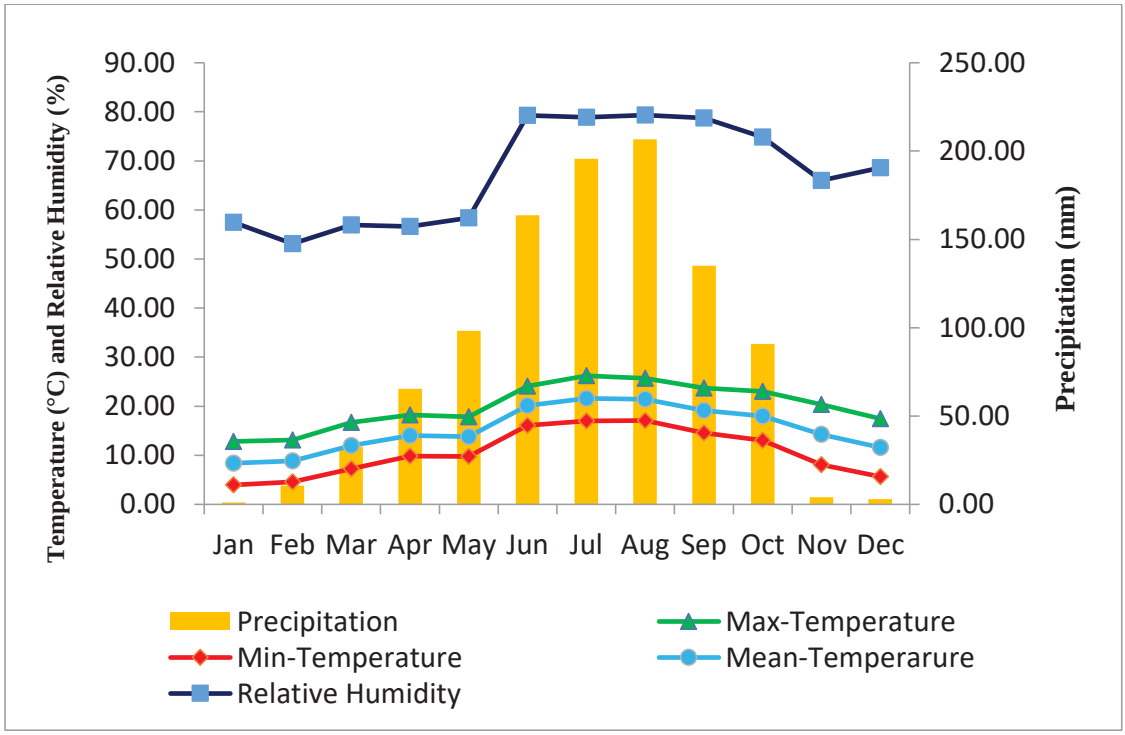

Figure 3: Monthly climatology showing of temperature (minimum, maximum and mean), precipitation and relative humidity for the year 2022-2024. (Data source: NCHM)

The data from the nearby weather station (Bidung, Bumdleing, Radhi and Sakteng) indicates that, BC 9 is likely to exhibits a monthly mean temperature ranging from 8.4°C in January (winter) to 21.6°C in July (summer), with summer months (June–August) exhibiting the highest maximum temperatures (24.1–26.2°C). Winter months (December–February) are noticeably cooler, with January recording the lowest minimum temperature (3.96°C), suggesting occasional frost events. Precipitation records shows that winter and early spring (January–April) are relatively dry (1.1–65.5 mm/month), while summer (June–August) accounts for the majority of annual rainfall, peaking in August (206.6 mm). A sharp transition occured between May (98.3 mm) and June (163.7 mm), aligning with monsoon-like conditions, followed by a rapid decline post-October (90.8 mm in October to 4.0 mm in November). Relative humidity correlates strongly with precipitation, reaching peak values in summer (78.9–79.3 %) and remaining elevated through autumn (September–October: 74.8–78.7 %), likely due to residual moisture from rainfall.

2.1.3 Waterbodies

Multiple streams originate from within the BC 9 landscape forming a network of tributaries for important river comprising of Kholong chu, Drangme chu and Gamri chu as shown in the Figure 4.

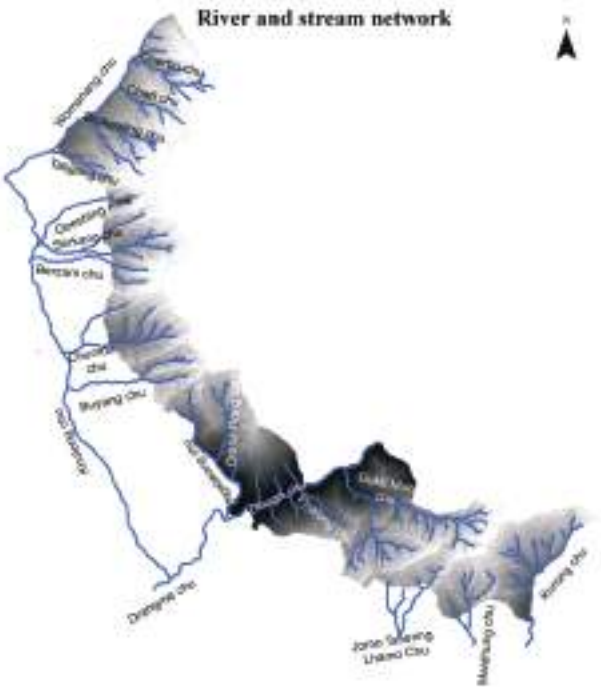

Figure 4: Stream and river network inside BC9

2.1.4 Chokepoints

Settlement of Yallang and Teotsho gewog located in the BC 9 are likely to create potential choke points for the movement of the wildlife. This is visible from the availability of only a narrow stretch of forested area to be safely used by the wildlife. Further the same region is dissected by the Gongri chu river further creating the natural barrier for wildlife movement.

2.2 Biological features

2.2.1 Vegetations and Forest types

The reference to the Forest Types of Bhutan 2022 indicates cool broadleaved forest as dominant forest types covering 26.43 % of the area followed by fir forest (22.21 %), hemlock forest (20.14 %), evergreen oak forest (15.52 %), warm broadleaved forest (2.55 %), chirpine forest (1.86

%), juniper rhododendron scrub (1.46 %), blue pine forest (0.66 %), and trace of dry alpine scrub forest (0.06 %). The remaining 8.24 % of the area is classified as non-forested areas including agricultural land. The detail are as shown in Figure 5.

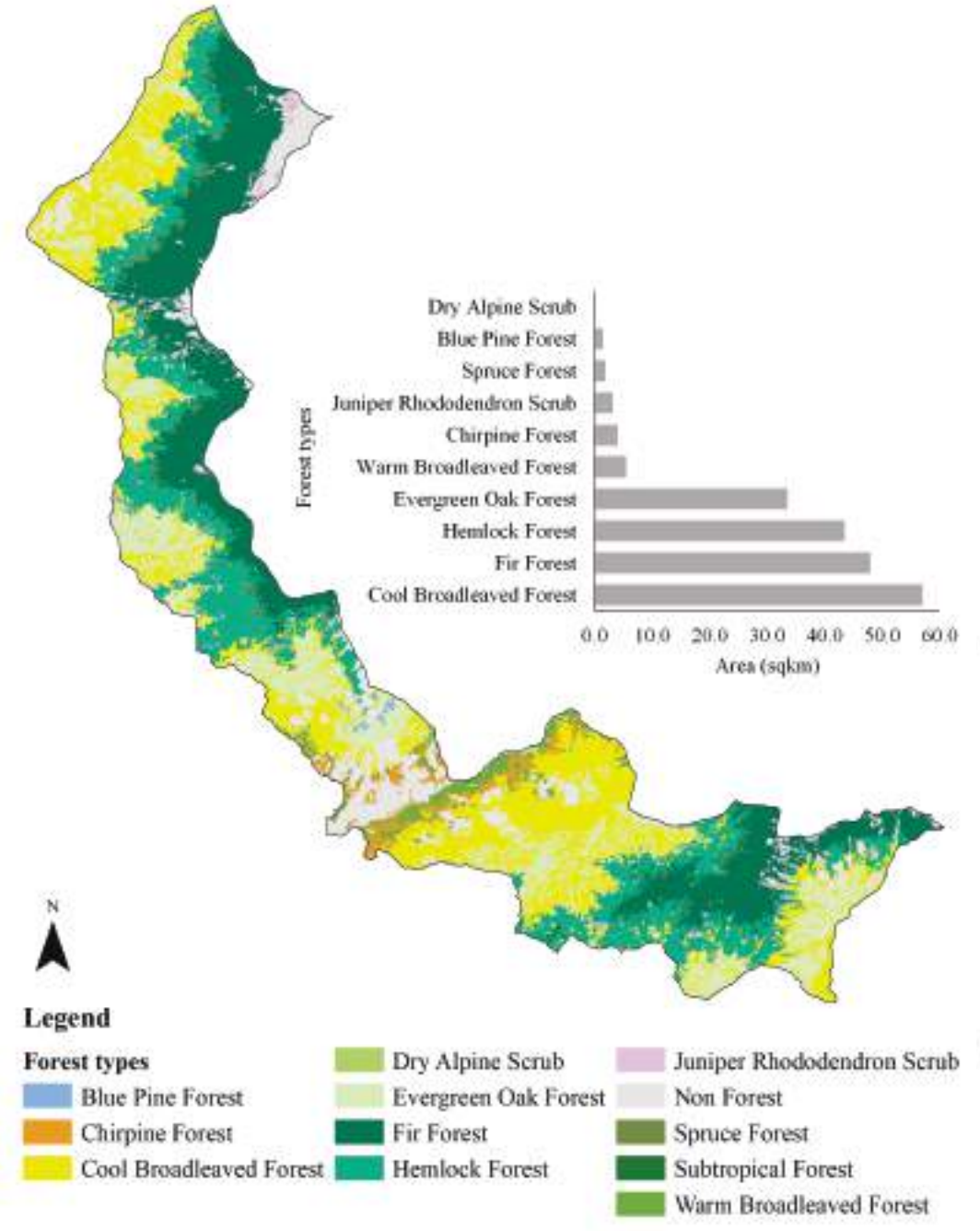

Figure 5: The different forest types in BC 9 (Forest Types of Bhutan 2022)

2.2.2 Floral diversity

The vegetation survey from the plotted sampling points was unable to gather all the species present inside the entire BC area. Therefore, free listing of every plant species was conducted. This effort has recorded 913 species of flora belonging to 154 families. Of 154 families, Orchidaceae *(n=95)* followed by Asteraceae *(n=70)* and Rosaceae (n=49) were found to be dominant while the Hymenophyllaceae *(n=1),* Hypoxidaceae *(n=1),* Acoraceae *(n=1)* were the least recorded families.

However, biodiversity assessment from 54 sampling points resulted in 338 plant species of 84 families, out of which 86 were tree species, 109 shrubs and 143 herbs and 4 unknown species.

The biological corridor is also home to three endemic plant species *(Isodon atroruber, Corallodiscus cooperi, Bulbophyllum trongsaense),* recently reported five plant species to Bhutan *(Panisea panchaseensis, Eurycorymbus cavaleriei, Chiloschista densiflora, Sisyrinchium rosulatum* and *Herminium longilobatum* and a monotypic genus *(Tetracentron sinense).*

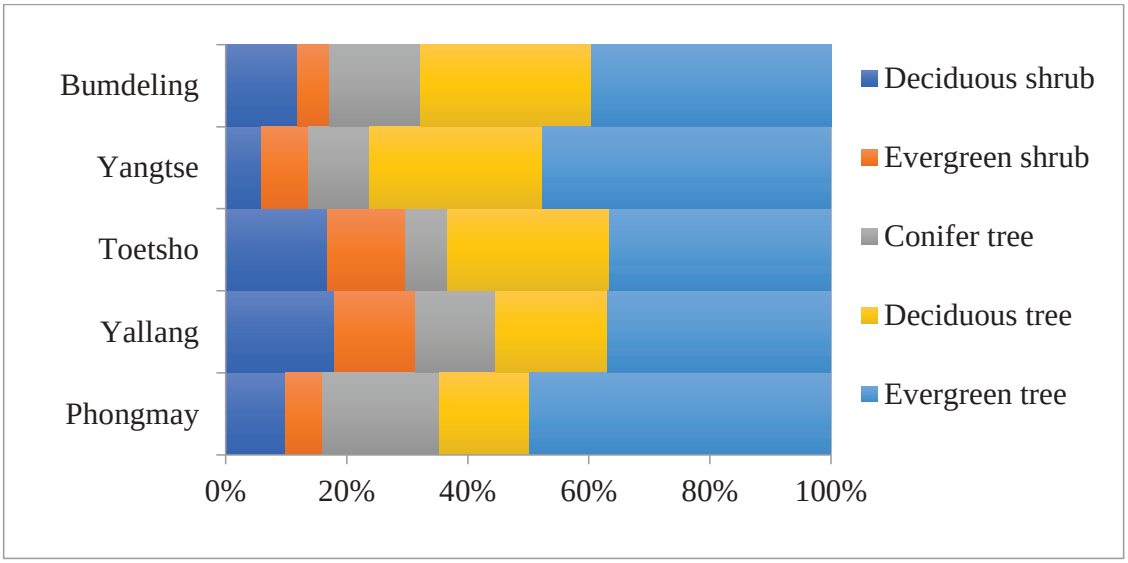

Figure 6: Tree and shrub species composition

Analysis of shrub and tree composition revealed five distinct vegetation types. Evergreen trees dominated the vegetation structure, constituting 42% *(n=393)* of the total composition. Deciduous trees formed the second-largest proportion at 23.3% *(n=218),* followed by conifer trees 13.5%, *(n=126).* Shrub communities were less prevalent, with deciduous shrubs accounting for 12.5% *(n=117)* and evergreen shrubs representing the smallest fraction at 8.8% *(n=82*) indicated in Figure 6. These findings highlight the predominance of evergreen tree species in the study area, with woody vegetation structured hierarchically across tree and shrub functional types.

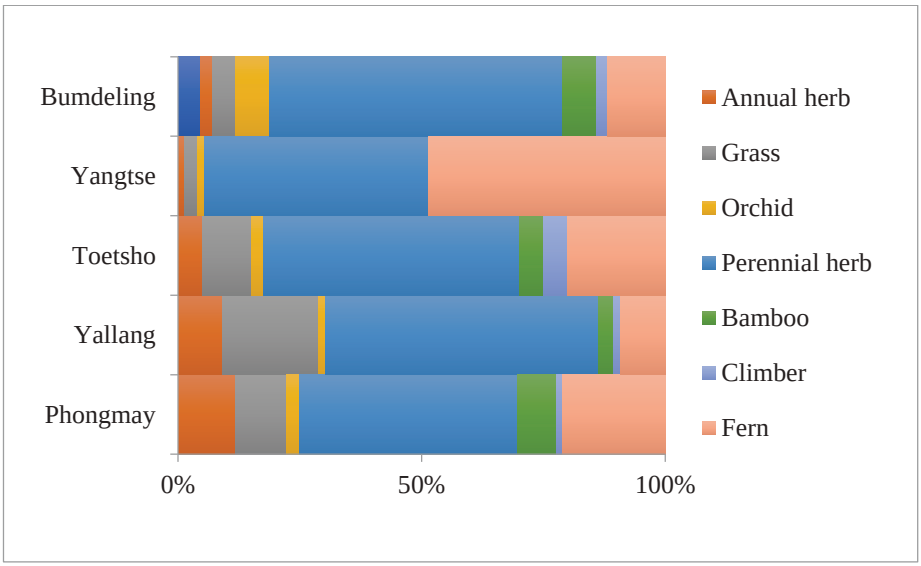

Figure 7: Herb species composition

The herbs were classified into seven categories of annual, perennial, grass, orchid, bamboo, climber and fern. Based on the relative abundance perennial herb forms the major life form with 51.91% *(n=177),* followed by fern 22.29% *(n=76),* grass 9.09% (n=31) and annual herb 5.87% *(n=20).* The bamboo, orchid and climber contribute only 4.69% *(n=16),* 3.23% *(n=11),* 1.76% *(n=6)* while 1.17% *(n=4)* were unknown species. The detail are as shown in Figure 7.

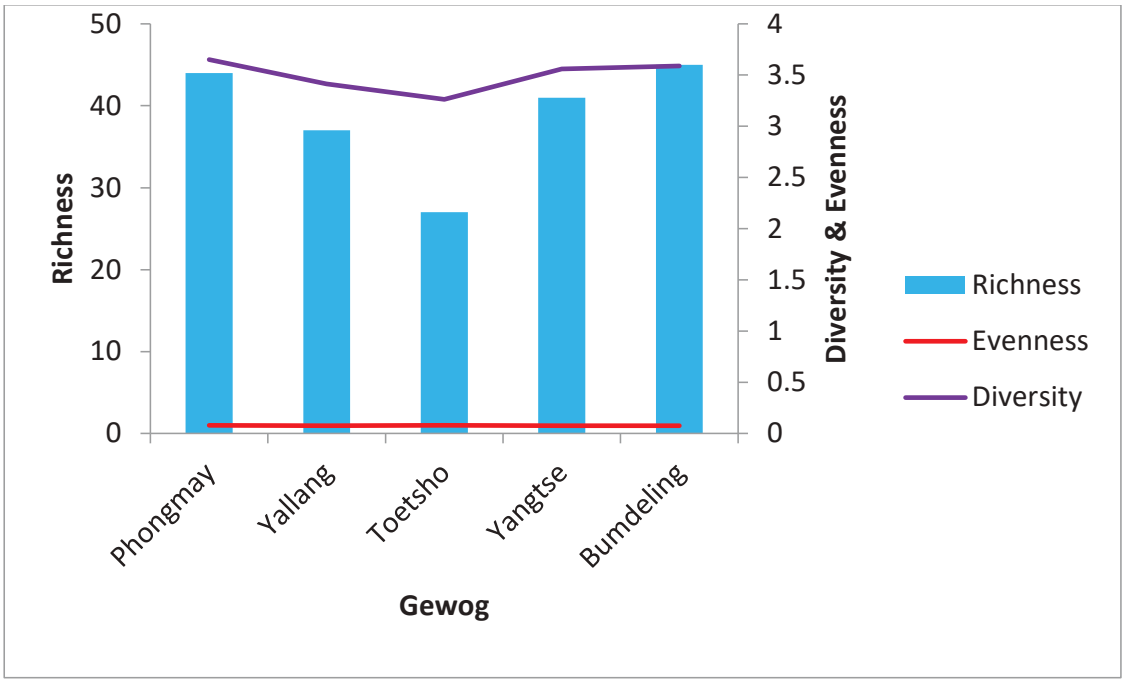

Figure 8:. Species diversity, richness and evenness

Based on Shannon Diversity Index, the highest herb species diversity was recorded from Phongmay gewog (H'=3.65) followed by Bumdeling (H'=3.58), and Yangtse (H'=3.56). Overall, BC 9 consist of high diversity of herb species (H'=4.62), followed by shrub (H'=4.29), and tree (H'=3.74). The species were evenly distributed among the five gewogs while Bumdeling has the highest species richness with 45 species followed by Phongmay (S=44), Yangtse (S=41), Yallang (S=27) and Toetsho (S=27). This is shown in Figure 8.

A total of 35 regenerating species were recorded from the 54 plots along BC 9 with *Abies densa* being the most dominant (*n=34*) followed by *Illicium griffithii (n=22),* and *Rhododendron grande* (*n=18*). The least dominant species were *Quercus semecarpifolia (n=1), Sapium insigne (n=1), Schima khasiana (n=1), Euonymus frigidus (n=1), Lindera*

heterophylla (n=1), Osmanthus suavis (n=1), Persea odoratissima (n=1), and *Phyllanthus emblica (n=1).*

The total of 77 sapling species were recorded among 54 plots and based on relative abundance, *Symplocos ramosissima (n=327)* was the most dominant species followed by *Lyonia ovalifolia (n=99), Rhododendron keysii (n=85), Rhododendron kesangiae (n=63)* and *Rhododendron arboreum (n=48).*

2.2.3 Faunal diversity

2.2.3.1 Mammal

The mammal diversity of BC 9 is remarkable with species from both the Palearctic and Indo-Malayan biogeographic realm. It holds many charismatic and conservation significance species as listed in Annexure 1. The wildlife camera trap studies, Sherman live trapping and field surveys have revealed the presence of 39 species of mammals belonging to 19 families and 8 orders (Annexure 1). Of these, five are endangered, nine are Vulnerable, four are Near Threatened and 21 are Least Concerned as per the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species. In total, 16 species of the recorded mammals, are globally threatened. Tiger, Clouded leopard and Musk deer were also recorded in BC 9 which are protected under Schedule I of the Forest and Nature Conservation Act of Bhutan, 2023.

Among the eight mammalian orders recorded (Figure 9), Carnivore depicts the highest family and species representation respectively with 28% (n= 5) and 38% (n= 15) and least by Feliformia, Lagamorpha and Chiroptera with 6% (n= 1 each) respectively. The detail is shown in table 2.

Table 2: Mammal order and families

Sl.no	Mammalian Order	No. of Families (n)	No. of Species (n)
1	Carnivora	5	15
2	Artiodactyla	4	6
3	Rodentia	4	9
4	Primates	1	3
5	Insectivora	1	3
6	Feliformia	1	1
7	Lagomorpha	1	1
8	Chiroptera	1	1

The biodiversity assessment survey was conducted within the BC landscape in the year 2024. The survey indicated that the majority of animal signs were recorded from the cool broadleaf forest (69 %) followed by conifer forest (15 %), mixed conifer forest (8 %), bamboo forest (7 %), warm-broadleaf forest and open grassland (1 % each) respectively. This could be attributed to the fact that most of the BC 9 landscape consist of the cool broadleaved forest.

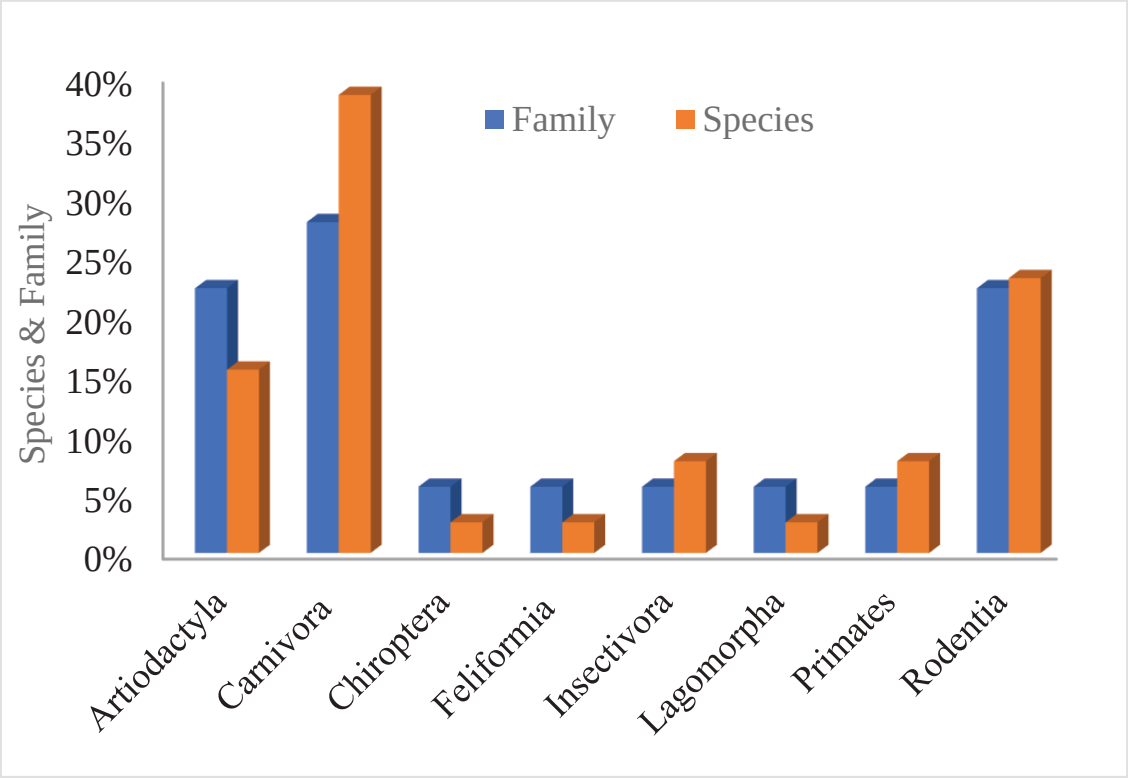

Figure 9: Mammalian order with representation of species and families

Figure 10: Musk deer and red panda inside BC 9

Figure 11: Healthy male and female common leopard inside BC9

2.2.3.2 Avifauna

A total of 1133 individuals were recorded adopting McKinnon bird listing method belonging to 174 species during the year 2024 survey, while an additional of 26 species were identified during the feasibility study of BC9 in year 2021. In total, 200 species of birds were recorded and are categorized under 48 families and 12 orders. Of these, 3 are near threatened (Chestnut-breasted Partridge, Green-imperial Pigeon, Himalayan Griffon) and other species are of least concern as per the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species (IUCN 2014). The bird survey covered a transect of 289.94 km across the entire corridor.

Figure 12: Satyr tragopan in the BC9 captured by camera trap

The Shannon Wiener Diversity Index (H'), shows that BC 9 harbors high bird diversity (H'= 4.50) with highest Margalef species richness index and individual record in White-throated Laughingthrush (n=81, R'=11.38), followed by Rufous Sibia (n=44, R'=6.11), Whiskered Yuhina & Nepal House Martin (n=33, R'=4.55), Hill Partridge & Green- backed tit (n=32, R'=4.41), and some other species such as Alpine accentor, Alpine Thrush and Asian Barred Owlet had the lowest species richness index and individual record (n=1, R'=0.00).

Muscicapidae family was dominant (30 nos. of Species), followed by Leiothrichidae (18 nos. of Species), Phylloscopidae (13 nos. of Species) and Columbidae (9 nos. of Species) and Passeriformes as most dominant order in the survey area.

2.2.3.3 Herpetofauna

The composition of amphibian diversity in BC 9 comprises of 11 species belonging to four families under a single order (Annexure 2). All recorded species are currently classified as Least Concern under the IUCN Red List, indicating no immediate conservation threats. Among the four families documented, Megophyridae represents the highest species representation by 36% (*n*=4) of the total species recorded. Ranidae and Rhacophoridae each contribute 27% (*n*= 3 species each) and the Dicroglossidae is the least represented, comprising only 3% (*n*=1 species). Further research through standardized amphibian surveys will enhance better understanding of species diversity in the BC 9 landscape.

Figure 13: Scutiger sikkimensis and Sylvirana spp., recorded from the BC9 landscapes

During the year 2024 biodiversity assessment survey, snake species were recorded opportunistically. A total of three species were documented such as *Pseudoxenodon macrops* (False Cobra), *Protobothrops jerdonii* (Jerdon's Pit Viper), and *Ovophis monticola* (Mountain Pit Viper). These observations provide a preliminary baseline for snake diversity in the BC9

landscape. The recorded species represent a mix of both non-venomous and venomous taxa, indicative of the habitat heterogeneity in the corridor.

Figure 14: Jerdon's Pit Viper recorded from the BC9 landscapes during the survey

2.2.3.4. Other taxa diversity

BC9 landscapes host a high diversity of Lepidoptera species, as observed during field assessments. However, no systematic documentation or species inventory was conducted during the year 2024 biodiversity assessment. Through the opportunistic listing since the year 2022, Trashigang Forest Division recorded and documented 68 species of butterflies and 48 species of hawk moths, some of which were recorded from the BC9 landscape. These records highlight that further targeted studies may reveal a more species assemblage.

Figure 15: Bhutan glory (Bhutanitis lidderdalii) inisde BC9

Similarly, no comprehensive surveys have been conducted for other lesser-known taxa, including fish and invertebrates. While anecdotal observations indicate the presence of rich aquatic and terrestrial invertebrate diversity, the lack of data limits the assessment of their species composition within the corridor.

2.3 Important habitats

The red panda shows high to medium habitat suitability across several forested areas inside BC 9 landscape, including Markangla Jug, Cherbu, Dungden, and Kedung forests in Womanang Chiwog, Tongbrak, Gaybhu, Dribla, and the Mirgola forest ridge in Yangtse, the Gorpatati locality in Khamdang and Toetsho, and around the Tshongtshongma base in Yallang and Phongmay gewog. These area support well developed bamboo forests, which are critical component of red panda habitat. In contrast, areas with low suitability include rocky, snow-capped peaks of Markangla in

Womanang, lower elevation with no bamboo forest, and the regions with dense human settlements in Toetsho and Yallang.

Interestingly, for the musk deer, high-suitability habitats are concentrated in upper-elevation ridges, particularly, in Markangla (Womanang), Tongbrak, Gaybhu, Dribla and Mirgola ridge in Yangtse, as well as portions of the Gorpatati forest in Khamdang-Toetsho, and areas surrounding Tshongtshongma in Yallang and Phongmay. These high-suitability zones (alpine scrub, fir and hemlock forest) are surrounded by moderately suitable habitats at mid-elevations, with habitat potential decreasing significantly towards lower elevations and area near human settlements.

The dhole exhibits a much wider distribution of high to medium suitability habitats through the horizontal landscape. However, the species shows reduced habitat potential in the Markangla ridge and in proximity to human habitation in Toetsho and Yallang.

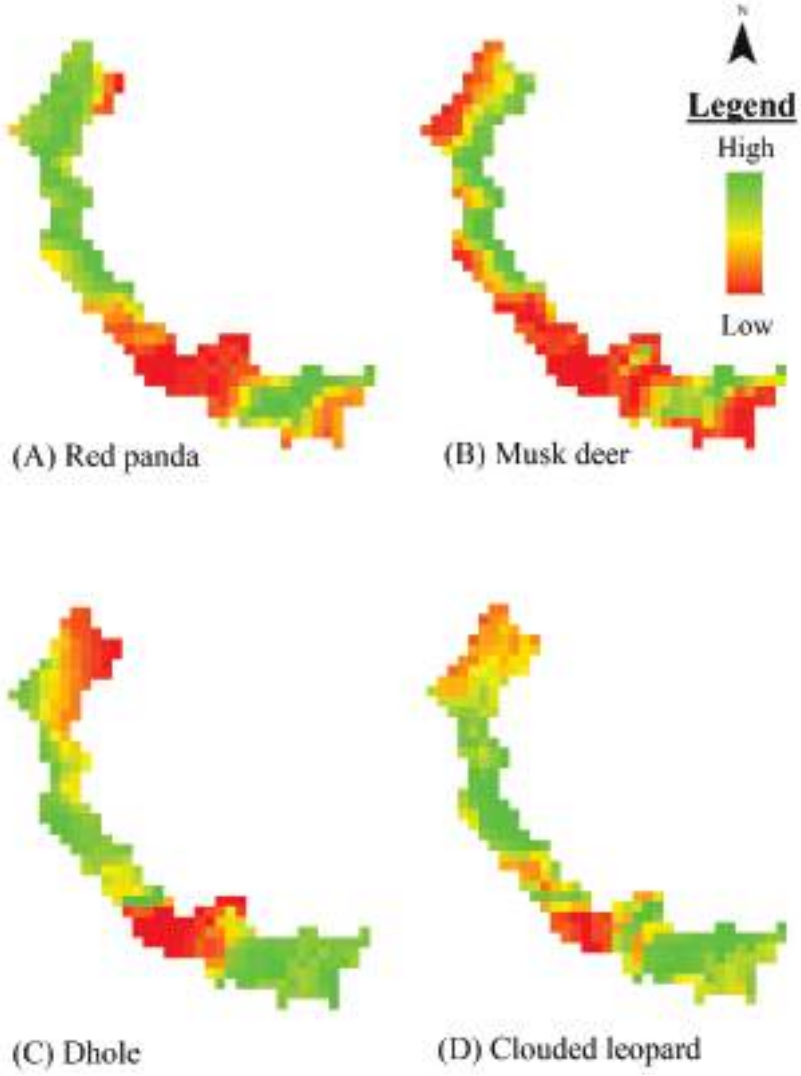

Figure 16: The potential habitat for some of the threatened mammal species

Similarly, the Clouded leopard occupies a broad range of high to medium suitability habitat across the landscape. Nevertheless, the Markangla mountain ridge and the settlement zones of Toetsho and Yallang exhibit lower habitat suitability of the species. In overall, the spatial distribution of habitat suitability reveals that each species shows distinct habitat preferences, largely influenced by elevation, vegetation type, and proximity to human activities.

2.4 Socio-economic characteristics

2.4.1 Social -economic status

Approximately 374 households reside in BC 9, of which 108 are reported as *gungtong* (abandoned household). The socio-economic survey (2025) interviewed 48 % of the active households consisting of 52 % female and 48 % male respondents.

The primary sources of income for the sampled households are agriculture followed by livestock rearing, and wage labour, supplemented by multiple other minor income sources.

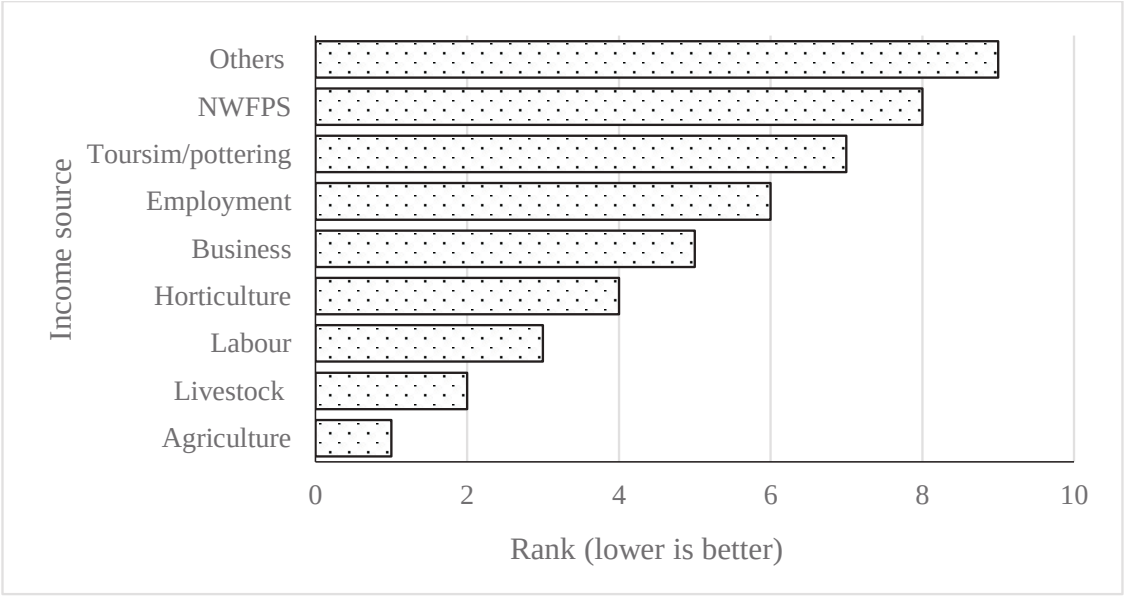

Figure 17: The ranking of households income from different sources in the order of low to high (eg: agriculture is the highest rank while the Other sources is lowest rank. "Others" income sources comprises of family support, cross border religious services and handicraft)

The average landholding per household is 1.9 acres, including both *Chuzhing* (agricultural wetland) and *kamzhing* (agricultural dryland), though approximately 53 % of the land is left fallow. Subsistence

agriculture, combined with small-scale livestock rearing, is a common livelihood practice. Cash crop cultivation is limited to *Zanthoxylum* (Sichuan pepper), cardamom, and chili.

Cattle and horses are the dominant livestock, primarily used for backyard manure production for agriculture use and transportation. Horses are primary mode of transportation for Yerphel-Namthi, Melongkhar-Chema, and Dukti under Yallang gewog, and Manam-Chemkhar, Omba, and Jangphutse under Toetsho gewog which lack road connectivity. Additionally, informal trade and religious service in nearby settlements in the Indian state of Arunachal Pradesh is a prevalent economic activity in the area.

2.4.2 Livelihood

The settlement primarily rely on agriculture and livestock, as detailed in the following section.

2.4.2.1 Agriculture

The communities are dependent on various sustenance agricultural farming practices for their livelihood, utilizing different types of land for cultivation. The land categories owned by the people include Chuzhing (agricultural wetland), Kamzhing (agricultural dry land), Khemsa (land designated for construction), and orchard land.

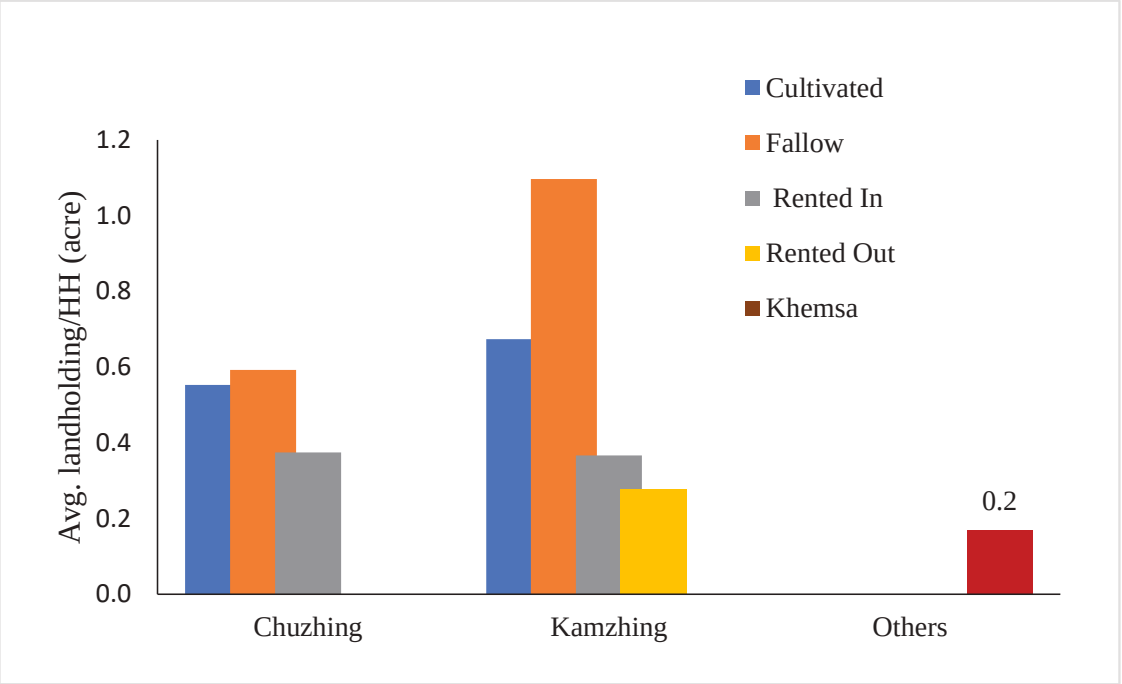

Figure 18: Average landholding per household

The Figure 18 illustrates the average land ownership per household across different land use patterns. Due to demographic changes within the community, only half of the registered land is cultivated, while the remaining portion is left fallow. On average, households cultivated 0.55 acres of Chuzhing, with 0.59 acres left fallow. Similarly, 0.67 acres of Kamzhing were cultivated, whereas 1 acre remained fallow.

Paddy is the most preferred cereal crop cultivated, followed by maize and millet. Many communities are isolated without farm road access and therefore, growing various vegetables primarily for self-consumption.

Figure 19: Paddy cultivation in Melongkhar village inside BC9

2.4.2.1.1 Average income from Agriculture Farming

The average household income generated by farmers was Nu. 23,827, ranging from a maximum of Nu. 160,000 to no income at all. The Womanang community sell vegetables, potatoes, paddy, maize, and chilies at the Trashiyangtse market. The Jangphutse and Omba communities under Toetsho gewog primarily trade chilies, potatoes, paddy, and horticultural crops. Meanwhile, the Namthi and Yerphel communities trade Zanthoxylum and small quantities of cardamom.

2.4.2.1.2 Problems with Agriculture Farming

The communities face several constraints during the agriculture farming. As depicted in the Figure 20, human-wildlife conflict is the most severe constraint, followed by poor accessibility, inadequate market access, pests and diseases, labour shortages, erratic climatic conditions, insufficient investment funds, and poor soil fertility.

Table 3: Shows the average income from agriculture farming system

Agriculture produces	Income (Nu)		
	Minimum	Maximum	Average
Cardamom	4200	133000	26776
Chilli	300	160000	31982
Horticultural crop	1000	90000	19750
Maize	450	40000	12170
Other Vegetables	120	60000	6067
Paddy	2000	39000	15862
Potato	250	102100	27604
Zanthoxylum	1000	100000	32933

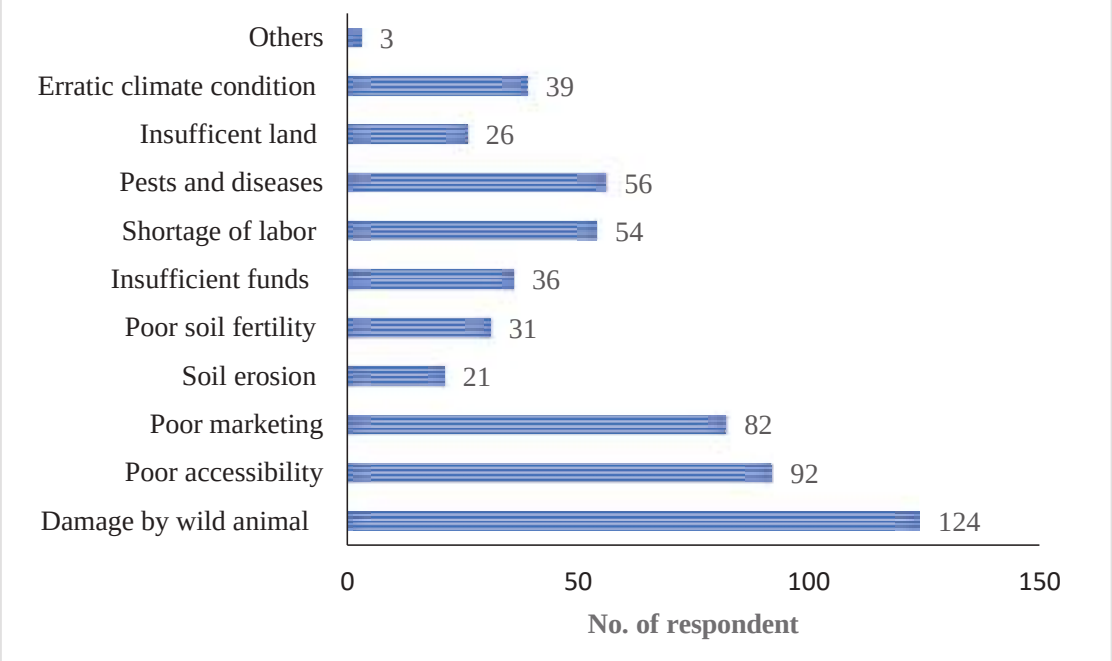

Figure 20: Problems and constraints faced by communities during the agriculture farming practices

Human-wildlife conflict is considered as major challenge for agriculture farming. The communities attribute this to increasing forest/vegetation cover encroachment into farmland, driven by ban in shifting cultivation and increasing fallow land. Labor shortages further constrain farming activities

due to rural-urban migration where majority of the working age group move out to seek better opportunities in urban areas, leaving behind mostly elderly residents, further resulting in more abandoned farmland. This situation is further aggravated by frequent pest infestations, erratic climatic conditions, poor soil fertility, and soil erosion further weakening agricultural productivity in the community.

Figure 21: Horse being used as primary mode of transportation in the BC 9

2.4.2.2 Livestock

Livestock plays a vital role in farming, contributing to both diet and income. Most community members prefer rearing cattle (local breed and Jersey cow), with an average of three cattle per household. Communities such as Dukti, Melongkhar, Chema, Namthi, and Yarphel under Yallang Gewog, along with Jangphutse, Manam, Chemkhar, and Omba under Toetsho Gewog, traditionally rear horses for transportation. Socio-economic survey

data indicate an average of two horses per household. Additionally, with support from the livestock sector, communities have established poultry farming at the local level for both self-consumption and commercial purposes.

2.4.2.2.1 Average Income from Livestock farming

The livestock are primarily raised as a source of backyard manure (75.97 %) and food for family sustenance (61.24 %). The horses are commonly reared for transportation, making it third rank at 60.47 % in terms of livestock rearing reason. Sales of livestock products also help in income generation (54.26 %). The importance of livestock as draught power is ranked least (18.6 %) which could be attributed access to farm machineries (Figure 22). Households that own livestock earn an average of Nu. 69,489 per year from the sale of livestock products and transportation services as shown in Table 4.

Table 4 Average income per house from livestock

Livestock Types	**Income (Nu)**		
	Maximum	**Minimum**	**Average**
Cattles	200,000	0	28279
Horse	150,000	400	33144
Poultry	30,000	0	8066
Total	**380,000**	**400**	**69489**

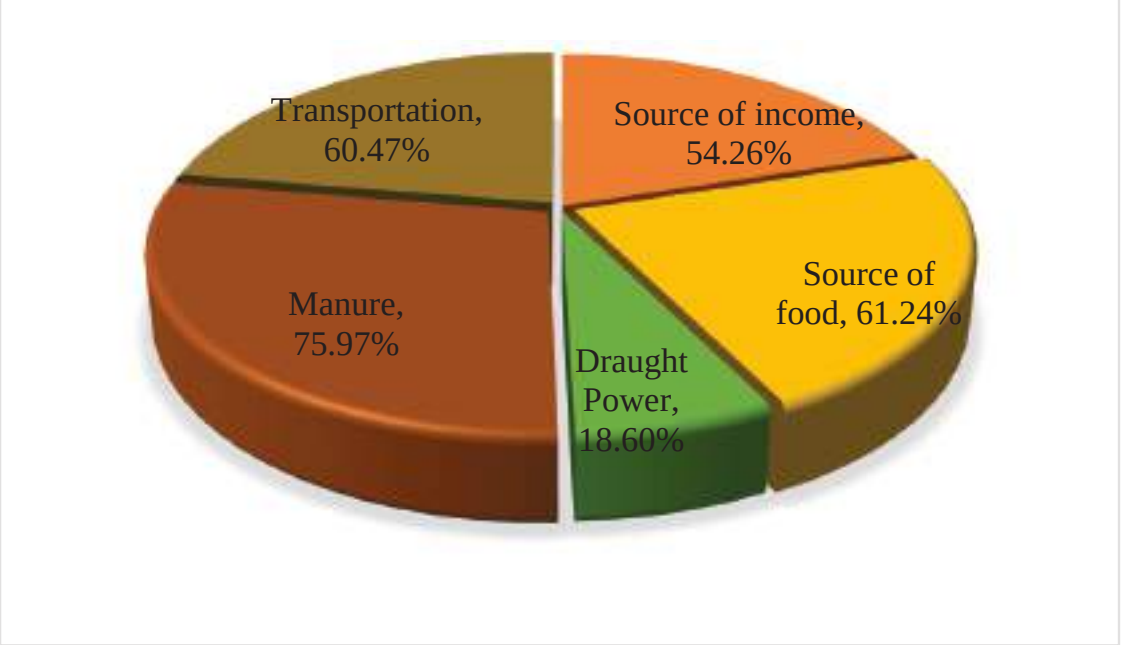

Figure 22: Shows the importance of livestock rearing

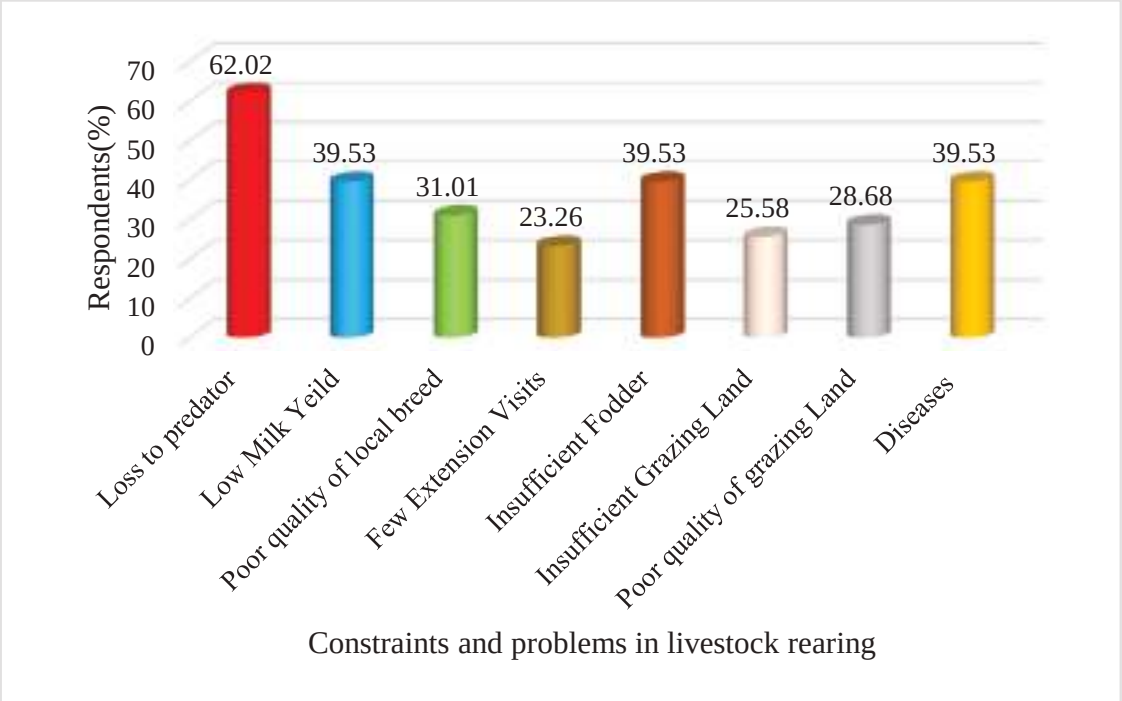

Figure 23:The various types of livestock grazing practices

2.4.2.2.2 Problems and constraints for livestock rearing

The livestock loss to predators is the most frequently reported issue accounting to 62.02 % (n=80) followed by low milk yield production, insufficient fodder, and livestock diseases. The detail is depicted in the Figure 23.

2.4.2.2.3 Livestock grazing pattern

The majority of villagers graze their cattles on fallow agriculture land and stall feeding than utilizing Tsamdro and improved pastureland. The more than half of the total surveyed households rely on stall feeding of their livestock. Besides grazing in fallow land and stall feeding, open grazing in neary by forest is also reported (Figure 24). This is common with horses which are left in forest for free grazing while not in use for transporation.

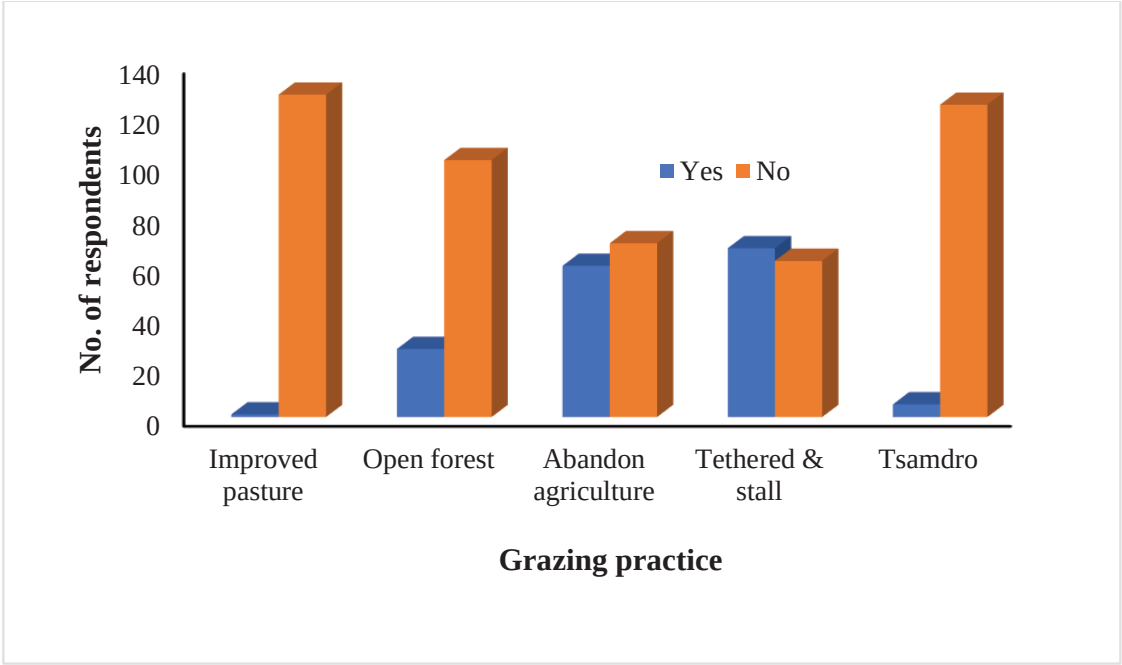

Figure 24: Livestock grazing practice

2.4.3 People's perception on climate change and its impact on their livelihood

Of the total respondents, 58.6 % were aware of the term "Climate Change," while 38.3 % were unaware, and 3.1 % were uncertain. Similarly, 63.3 % noticed the impacts of climate change in their surroundings, whereas 28.1 % haven't noticed, and 8.6 % were uncertain. The analysis revealed that gender did not significantly impact either awareness of climate change (χ^2 (2, N = 128) = 0.229, p = 0.892) or the perception of its impacts (χ^2 (2) = 0.077, p = 0.962) in the sample population.

Respondents identified a diverse range of factors contributing to climate change, including environmental issues such as air pollution, deforestation, and human activities such as improper waste disposal, development activities, and forest fires. The communities also linked it to socio-cultural changes like rural electrification and the perceived neglect of traditional rituals.

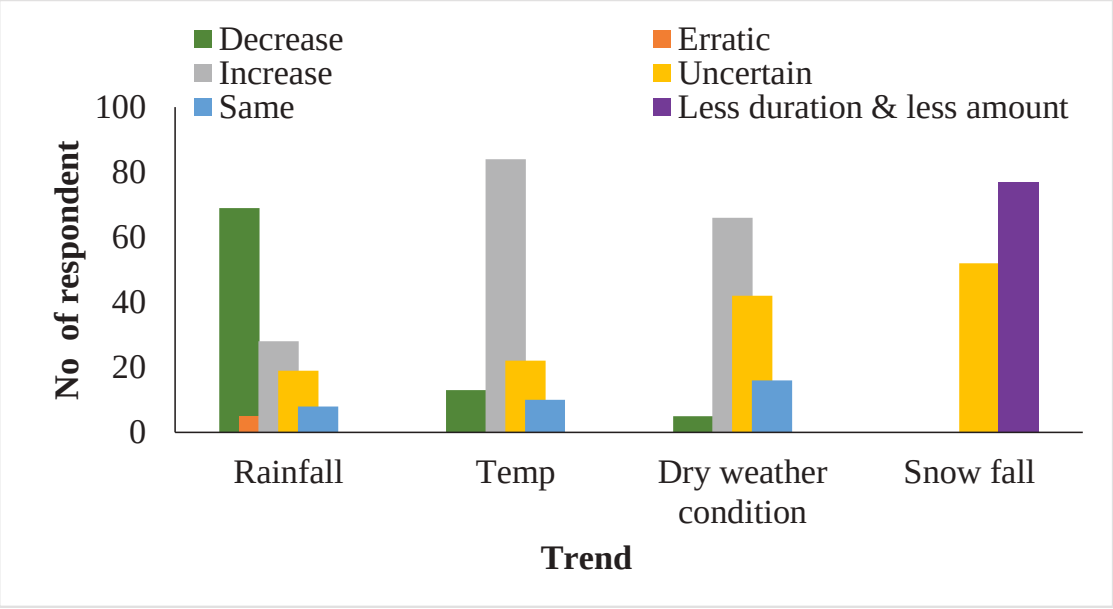

Figure 25: Perceived change in weather parameter

Respondents observed significant changes in their local weather patterns over the past decade. The majority of the respondents reported a decline in rainfall (53.5 %), rise in temperatures (65.1 %), more frequent dry spells (51.2 %), and a reduction in frequency, quantity and duration of snowfall (59.7 %). This is depicted in Figure 25.

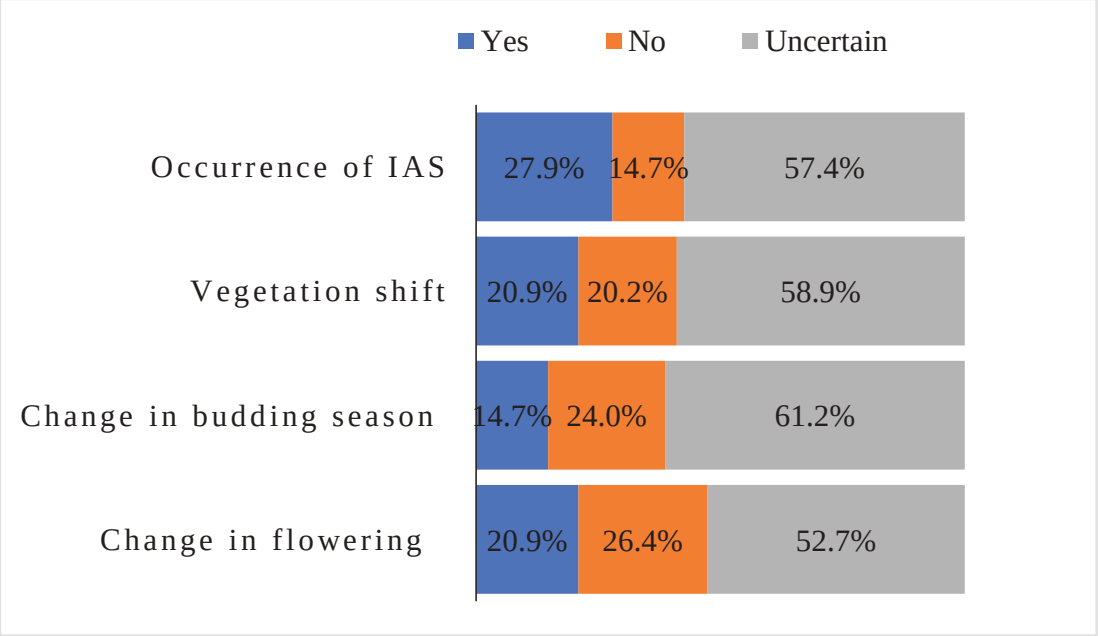

Figure 26: Perceived impact of climate change in plant phenology

While most respondents were uncertain about changes in plant phenology, approximately 21 % reported observing the change in flowering and vegetation shift and budding seasons (14.7 %). Another 27.9 % reported occurrence of invasive alien species (IAS) as depicted in Figure 26 . These observations included earlier flowering and budding of fruit trees, the successful cultivation of warm-climate plants in cooler regions, and the occurrence of new plant and pest species, notably *Ageratina adenophora* and armyworms. Some respondents also noted the disappearance of local flora and fauna, such as leeches, gorals, tigers, and specific plants known locally as 'Khey-Cherang Ngon' and 'Banynidro Ngon'.

The drying of water sources are reported during the survey. Of the 71 respondents reporting this issue, the highest percentage was in Toetsho gewog (56.3 %), followed by Bumdeling (31 %), and the lowest in Yallang (12.7 %). This suggests a potential future water scarcity risk in Jangphutse, Omba, and Manam-Chemkhar chewogs if timely mitigation measures are not implemented.

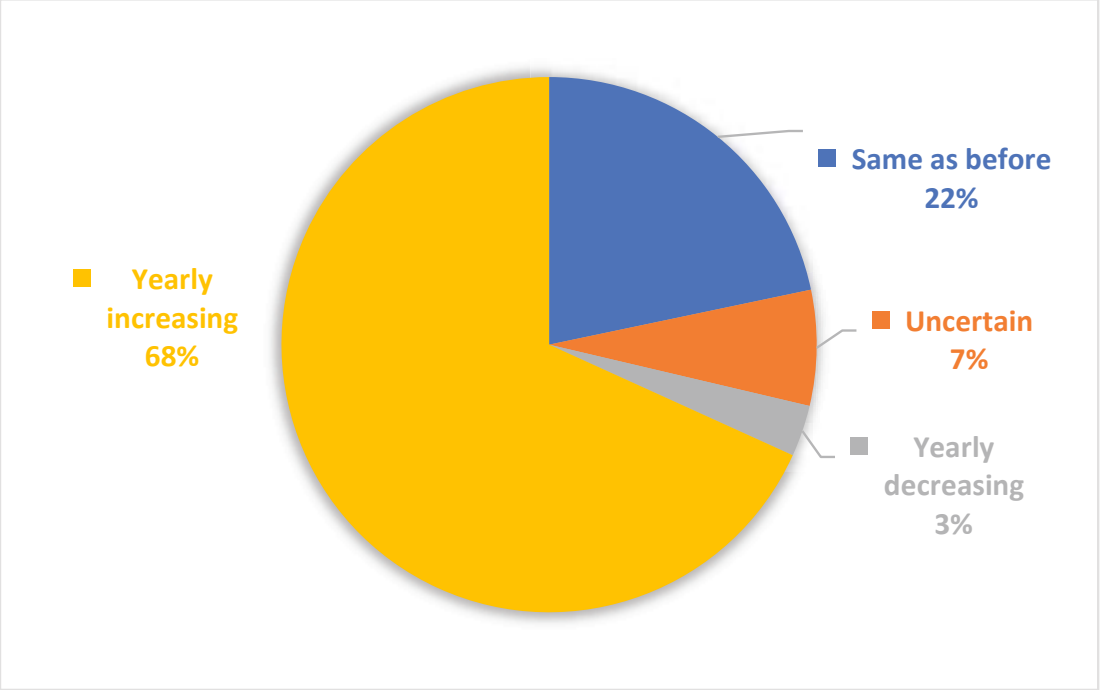

Figure 27: Perceived change in climate change vulnerability

The majority of respondents (68 %) says there is increasing vulnerability to the impacts of climate change, driven by multiple factors (Figure 27). Subsequently, 41.1 % of the respondents reported being affected by extreme weather patterns, while 32.6 % were uncertain, and 26.4 % experienced no impact in the last 10 years.

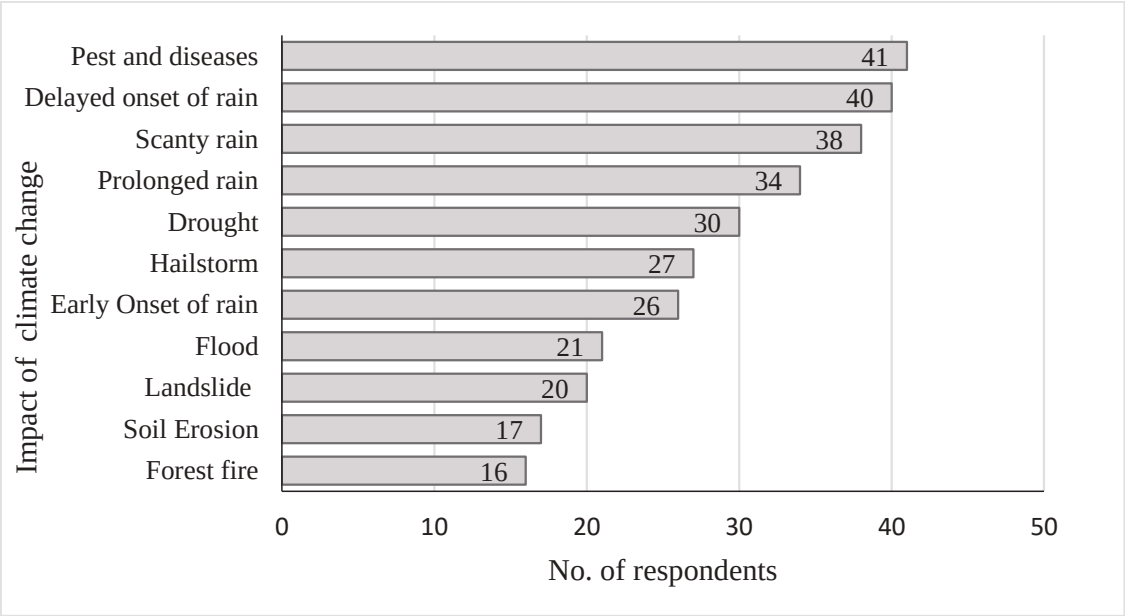

Figure 28: Impact of climate change in the landscape

Pest and disease outbreaks, delayed onset of rain, scanty rainfall, and prolonged rainfall were ranked as the most significant climate change impacts affecting communities (Figure 28).

Beside major destruction of crops by armyworm, there is an increasing number of horse mortality suspected to be caused by pneumonia from consuming *Ageratina adenophora.* Since, horses are the primary mode of transportation in the landscape, raising mortality of horses directly impact the household's livelihood.

2.4.4 Climate change adaptation measures in practice

The impact of climate change is evident in the landscape, where agricultural production has been directly affected by pest and disease outbreaks triggered by untimely rainfall and rising temperatures.

In response, approximately 30.2 % of respondents have adopted climate-resilient, disease-resistant crops with high nutritional and commercial value to minimize the effects of climate change. Cardamom, quinoa, and hybrid horticultural crops are among the new crops being adopted by communities, with support from the Department of Agriculture. These efforts not only enhance resilience to climate change but also improve food security and farmers' livelihoods. However, similar adaptation measures need to be scaled up, as 69.8 % of respondents have not yet adopted these strategies, rendering them vulnerable.

When asked about the necessity of adaptation strategies to cope with the effects of climate change on livelihoods and society, 40 % of respondents acknowledged the need, 32 % were uncertain, and 28 % did not see the need. Some of the adaptation strategies suggested by respondents include:

- Avoiding waste burning and indiscriminate waste disposal
- Conducting advocacy and awareness campaigns on climate change
- Increasing plantation efforts and maintaining forest health
- Providing improved seeds and planting high-value, climate-resilient crops
- Supplying water sprinklers to adapt to increasing erratic rainfall patterns
- Reducing the risk of forest fire outbreaks
- Enhancing irrigation and drainage systems, and constructing retention walls
- Performing timely rituals and strictly implementing "La-dam and Re-dam."

2.5 Resource use

Given the proximity of locals to forest, most households rely on forests for timber, fuelwood, manure, livestock bedding and collects limited variety of non-wood forest products (NWFPs) to supplement their income. However, due to road access and market limitations, earnings from NWFP sales remain low.

Forest resources are primarily collected from community forests (51 %), followed by area outside CF (30 %) and around 19 % utilize both sources. These resources are mainly gathered for household use, with only 3 % of respondents selling these forest products. Among the most commonly used resources is leaf litter collected at an average of 21 m^3 per household annually, followed by firewood at 5 m^3. As an agrarian society, leaf litter is primarily used for livestock bedding, which contributes to backyard manure production for agriculture.

All residents from Dukti, Chema-Melongkhar, and Namthi-Yerphel chewogs under Yallang Gewog; Womanang chewog under Bumdeling Gewog; and Manam-Chemkhar chewog under Toetsho Gewog, who live in BC 9, are members of their respective community forests. Their resource needs are met through these community forests.

However, 62 households from Omba, Phakti and Jangphutse villages are not currently members of any community forest. Therefore, they rely on nearby state reserve forest land to meet their resource needs. Thongrong chiwog under Phongmey Gewog, although located outside BC9, has 40 households that depend on bamboo resources found within the corridor.They extract bamboo from Wangling and Shukpateng area.

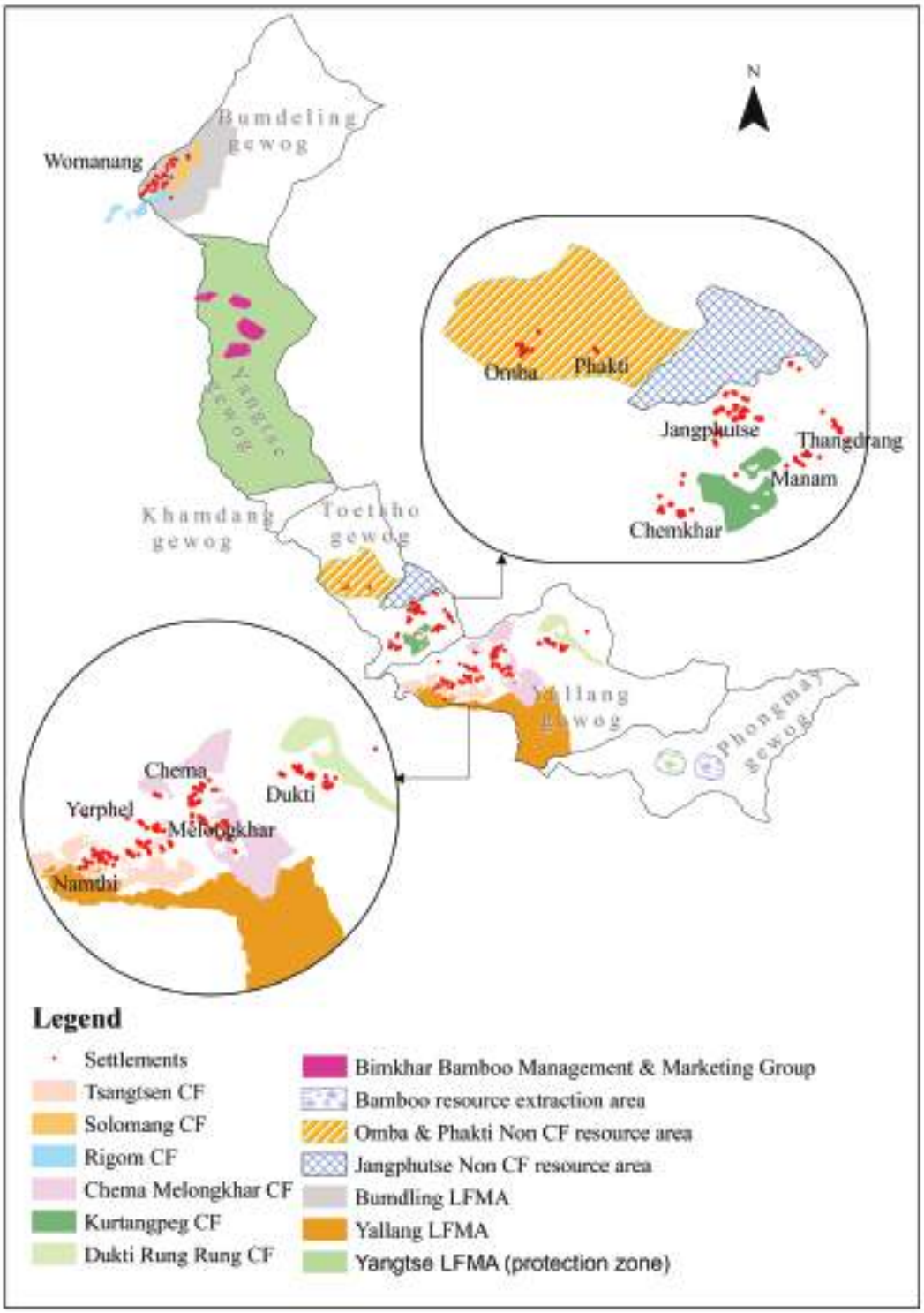

Figure 29:Map showing the resource allocation area in BC 9 from different cross cutting regimes

Figure 30: Resource utilization trend through PRA

Except for construction timber, 60 % of respondents reported a decline in the use of other forest products compared to the past 10 years, while 10.5 % noted an increase and 29.5 % observed no change. The reduced dependency on forest resources, particularly firewood, is largely attributed to the growing use of electric appliances for heating and cooking, as well as a decline in livestock numbers, which has reduced the need for firewood for feed preparation.

During the PRA exercise, the Dukti community expressed concerns that forest health and resource availability have declined over time. However, they also noted that overall forest cover has increased. Other communities similarly reported a decline in forest resource use but an improvement in forest health and coverage.

2.6 Ecotourism opportunities

The BC 9 landscape is of immense cultural, religious, and ecological significance. Sacred sites like Omba Nye, Gungja Nye, and Tshongtshongma Nye attract thousands of pilgrims, with Omba Ney revered as the “Taktsang of the East.” Beyond its spiritual heritage, BC 9 offers outstanding ecotourism opportunities. The proposed Yallang eco-trail inside BC 9 has potential to become a premier destination for hiking and bird watching, while sites such as Shangphola, Dribla, and Tongbrak provide excellent spots for camping, biodiversity exploration, and conservation education. Panoramic viewpoints extend as far as Tawang (India) and the China border, adding to the region’s appeal. Additionally, the community-based tourism, including homestays in Omba and nearby villages, can enhance visitor experiences while supporting local livelihoods.

2.7 Present threats

The land use and cover map indicate that 1.86 % is covered by chirpine forests, which are highly prone to forest fires. These forests are primarily found in Manam-Chemkhar, Jangphutse, Duki, Chemkhar-Melongkhar, and Yerphel-Namthi chewogs. This stretch of chirpine forest forms a critical choke point due to the corridor’s narrow width, which is constrained by multiple settlements. The frequent outbreak of forest fires in this narrow landscape often leaves the area burnt and barren, resulting in fragmented forest cover that could disrupt wildlife movement and habitat connectivity.

Approximately 1091 acres of forest were burnt during the December 2024 fire incident leaving narrow forest cover for wildlife movement as depicted in the figure 31.

Figure 31: Aerial view of burnt forest area in December, 2024.

BC 9 shares a border of over 60 km with the Indian state of Arunachal Pradesh. Due to its porous border and geographical setup, cross-border illegal resource extraction and wildlife poaching are common, posing significant threats to biodiversity and ecosystem.

Subsistence agriculture and livestock rearing is further challenged by escalating human-wildlife conflict indicated by increasing incidents of livestock predation and crop damage incidences.

Considering the above scenarios, forest fires, illegal resource extraction, poaching, and human-wildlife conflict are some of the prominent current threats experienced in BC 9. These threats are further elaborated in the threat section

2.8 Future plans of development activities in the BC

Projecting future development in the BC 9 landscape is challenging, as plans depend on the Five-Year Plans (FYP) and long-term strategies. Based on the 13th FYP of the Dzongkhag and gewogs, key projects include irrigation channels, foot trails, bridge maintenance, infrastructure development, and chain-link and electric fencing.

Omba and Jangphutse villages in Toetsho gewog remain inaccessible by road, prompting the gewog Administration to propose an aerial cable car to benefit rural communities. In Yallang gewog, farm road expansion and eco trails towards Sakteng are anticipated. Efforts to improve cultural sites in Omba aim to enhance visitor experiences and boost rural economies are also being considered.

Despite these plans, out-migration remains a concern, particularly from remote villages where limited infrastructure and economic opportunities drive younger populations to urban areas. This trend calls for strategic planning to balance development with conservation while addressing rural depopulation.

2.9 Cross cutting forest management regime

The local communities residing within and periphery of the BC 9 landscape rely on natural resources such as timber for construction, firewood, poles,

and non-wood forest products for their daily livelihoods and supplementary income, in addition to subsistence farming. To ensure a sustainable supply of these resources, various scientific management regimes have been established. These regimes aim to balance rural needs with sustainable forest resource utilization while enhancing local socio-economic benefits. Currently, three cross-cutting management regimes operate within the BC 9 landscape such as Community Forests, Non-Wood Forest Management, and Local Forest Management Areas. These management systems were established before the formal designation of BC 9 and are guided by scientific management practices and prescriptions designed to ensure the long-term sustainability of forest resources.

2.9.1. Community Forest

Currently, a total of six Community Forests (CFs) are spread across the BC landscape. The two CFs in Womanang Chiwog, Bumdeling Gewog, TrashiYangtse, fall under the service delivery jurisdiction of the Bumdeling Wildlife Sanctuary (BWS), although the administrative boundary is mapped under the Trashigang Forest Division. The remaining CFs are under the administrative control of the Trashigang Forest Division. Each CF operates under its own management plan, further guided by the By-laws and managed by Community Forest Management Groups (CFMGs) to ensure the sustainable management of natural resource. The summary of CFs are provided in Table 5.

Table 5: List of CFs overlapped within with BC 9

SL. No.	CF Name	Location	Estb.	1st Plan Period	Plan revision year	Basal area (m^2/ha)	AHL (m^3)	No. of Member (HH)	Area (ha)	Dominant forest types
1	Kurtengpeg CF	Manam Chemkhar, Toetsho gewog	13 June 2023	2023-2033	2033	3.083	23.194	31	77.709	Chirpine
2	Duti RungRung CF	Dukti in Yallang gewog	2022	2022-2031	2031	23.2	395.54	25	148.74	Chirpine and cool broadleaved
3	Chema-Melongkhar CF	Chema Melongkhar in Yallang gewog	2022	2022-2031	2031	8.05	42.278	47	292.04	Chirpine and cool broadleaved
4	Solomang CF	Solomang in Bumdeling gewog	2020	2020-2030	2030	52.17	140.9	23	115.6	Mixed broadleaved forest
5	Rigom Kuenphen CF (Block I falls inside BC9)	Rigom, Shiling & Zamadung in Bumdeling gewog	2019	2019-2029	2029	9.85	2510.89	28	140 (56.11 falls inside BC9)	Mixed broadleaved forest
6	Tsangtsen CF	Yerphel and Namthi in Yallang gewog	2015	2015-2025 & 2nd plan (2025-2035)	2035	12.7	232.89	45	211.70	Cool broadleaved and conifer forest

Note: *Please refer the respective CF management plan for details*

2.9.2. Non-wood Forest Management

Non-Wood Forest Products (NWFP) management is another cross-cutting management regime in the BC 9 landscape. Currently, two NWFP management regimes are in place such as bamboo management and marketing in Bimkhar, Yangtse Gewog and Zanthoxylum management group in Yallang Gewog, TrashiYangtse. These regimes fall under the administrative control of the Trashigang Forest Division. Each regime has its own management plan and Standard Operating Procedures (SOP), guided by by-laws and managed by local groups, with the primary goal of ensuring the sustainable utilization of resources. Additionally, these regimes aim to generate income and improve the living standards of local communities through the revenue generated from these products. The table 6 provides a brief overview of the NWFP management regimes within BC 9.

2.9.3. Local Forest Management Area

Local Forest Management Area (LFMA) is another cross-cutting management regime. Currently, there are three LFMA management regime partly overlapped with BC 9 boundary. Yangtse gewog and Yallang gewog LFMA under the administrative control of the Trashigang Forest Division and Bumdeling gewog LFMA managed by Bumdeling Wildlife Sanctuary. Each of these regimes has their own management plan whose summary is given in table 7.

Table 6: List of NWFP management overlapped within BC9 landscape

SL No	Name	Product	Location	Year of Estab.	Area (ha)	No. of member (HH)	1st Mgt. Plan Period	2nd Plan Period
1	Bimkhar Bamboo Management & Marketing Group	Bamboo	Bimkhar in Yangtse gewog	2020	234.9	48	2020-2024	2025-2034
2	Phuntsho Thinye Management	Zanthoxylum	Namthi Yerphel in Yallang gewog	2011	Privately cultivated	10	2019-2023	SOP Developed in 2024

Table 7: List of LFMA partly overlapped with BC9 boundary

SL. No.	Gewogs	Dzongkhag	LFMP Prepared	AAC (m3)	Plan Period	Next Plan Revision
1	Yangtse	TrashiYangtse	2019	13079	2019-2028	2029
2	Yallang	TrashiYangtse	2019	3982	2019-2028	2029
3	Bumdeling	TrashiYangtse	2023	16503	2023-2033	2034

Chapter 3

Threat Analysis

Analysing threats in a conservation management plan is to identify the key factors that negatively impact biodiversity, habitats, ecosystem and social welling of the communities inside BC 9. Threats were assessed to derive relevant strategies and intervention actions for better management of the corridor through holistic approach. The threats were ranked based on their scope (spatial extent), severity (impact), and irreversibility (permanence of impact) using Miradi software version 4.6.0.

Threats\Targets	Community Livelihood &	Species Conservation	Habitat Connectivity	Summary Threat Rating
Human Wildlife Conflict(HWC)	High	Low		Medium
Habitat Loss & Degradation		Low	Low	Low
Unsustainable Resource Use & Expliotation	Medium	Medium	Low	Medium
Forest Fire	Medium	Medium	Medium	Medium
Socio-Economic & Demographic Challenges	High	Low		Medium
Pest & Disease Outbreak	Medium	Low	Low	Low
Climate Change	Medium	Low	Low	Low
Summary Target Ratings:	High	Medium	Low	**Overall Rating** Medium

Figure 32: Threat ranking

The overall threat rating was “medium”, with threats impacting Community Livelihood & Wellbeing (High), Species Conservation (Medium), and Habitat Connectivity (Low). This indicates that the threats in BC 9 is of moderate level. However, if left unmonitored and unaddressed, it could escalate and cause severe conservation and socio-economic issues

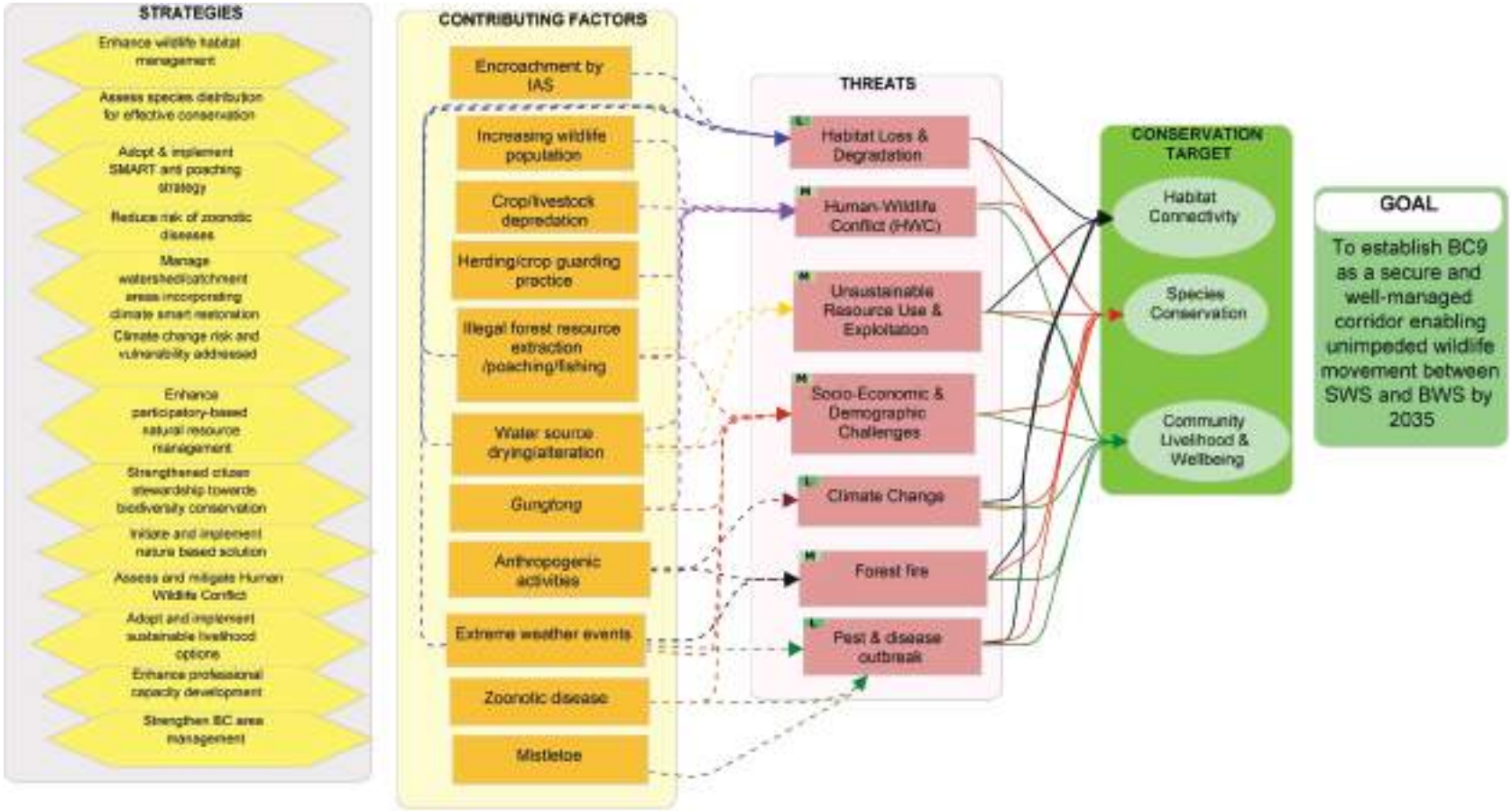

Figure 33: Conceptual framework to address the threat inside BC 9.

3.1.Habitat loss & degradation

Chromolaena odorata, Ageratina adenophora, and Parthenium hysterophorus are among the invasive plant species recorded within the landscape. During the biodiversity survey, *A. adenophora* was found in two survey plots (17 and 3), while *C. odorata* was detected in three plots (23, 19, and 20). Their presence deep inside the landscape poses a risk of further encroachment into open areas, gradually leading to wildlife habitat degradation.

A. adenophora was found to be widespread in all the settlements, whereas *C. odorata* was observed in the Manam-Chemkhar chewog, along with *Parthenium hysterophorus*. Local communities have reported that these invasive species negatively impact agricultural ecosystems and livestock health by altering habitats. The increasing number of unexplained horse deaths, suspected to be caused by pneumonia, is believed to result from excessive consumption of *A. adenophora*. Similar cases could have occurred in wildlife which remains unnoticed.

The dense biomass of *C. odorata* during the winter season in Manam-Chemkhar chewog exacerbates the risk of forest fires, further contributing to habitat loss and degradation. Climate change and extreme weather with extended dry period aggravates the dispersal of invasive species and risk of forest fire outbreak. Additionally, illegal timber felling and resource extraction also drive habitat destruction, which is discussed further in the section 3.4.

Figure 34: Fallow land covered by Ageratina adenophora in Dukti

During the 2024 social survey, 61 % of respondents reported observing the drying up of water sources, resulting in water shortages. Additionally, natural stream courses have been altered to meet the growing demand for rural water supply and irrigation. Consequently, this alters the water availability for wildlife, contributing to habitat degradation and loss.

3.2.Human Wildlife Conflict

Human-wildlife conflict (HWC) is a significant challenge for residents of the landscape. The survey found that 89.9 % of respondents experienced HWC in the past three years, primarily in the form of crop and livestock loss, property damage, disease transmission, and psychological distress. Crop damage was the most prevalent type of conflict, followed by livestock depredation and social harassment (Figure 36).

The most common crop-raiding wildlife in the area includes ungulates, primates, rodents, and birds such as the Kalij pheasant and grey treepie. Among these, wild pigs, monkeys, and porcupines were identified as the

Figure 35: Carcass of horse killed by wild predator in the BC 9

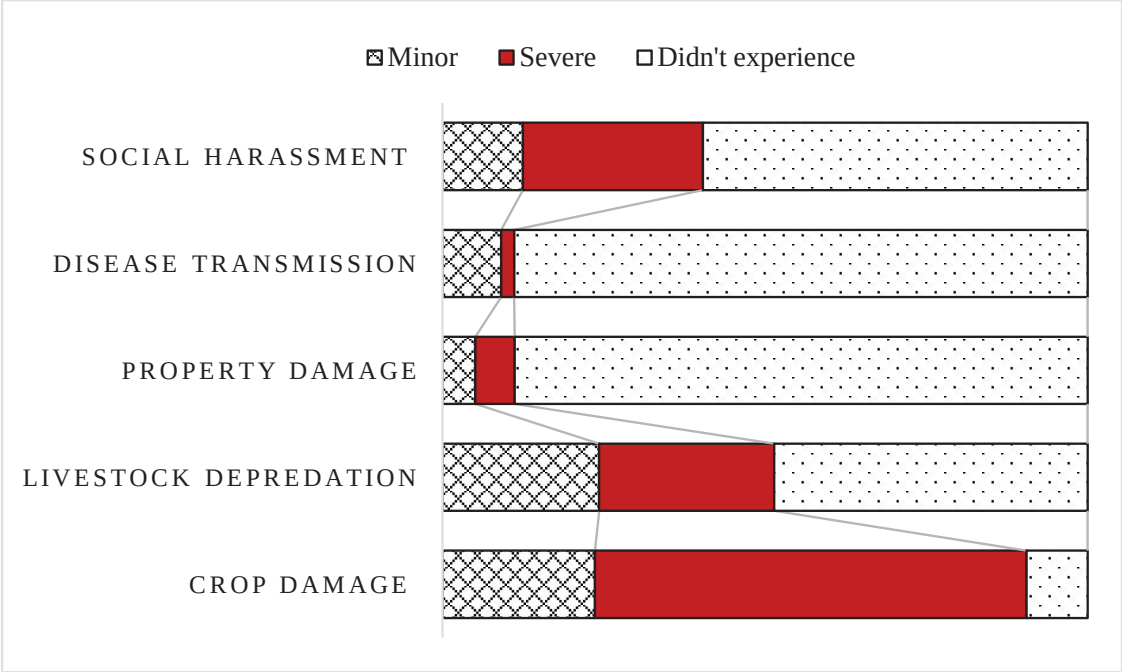

Figure 36: Severity of impact of HWC

most problematic species, damaging a variety of crops (Figure 37). Additionally, an unusual phenomenon of langurs feeding on Zanthoxylum flowers was reported in Yerphel, where Zanthoxylum cultivation is a key source of household income.

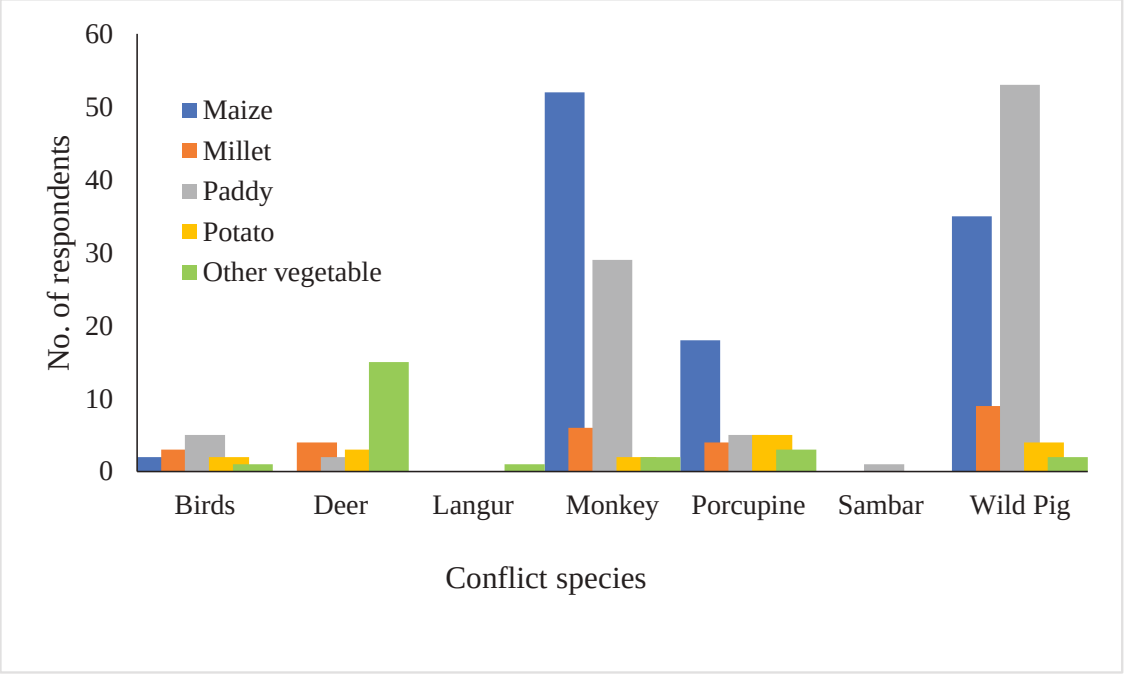

Figure 37: Crop raiding wildlife species

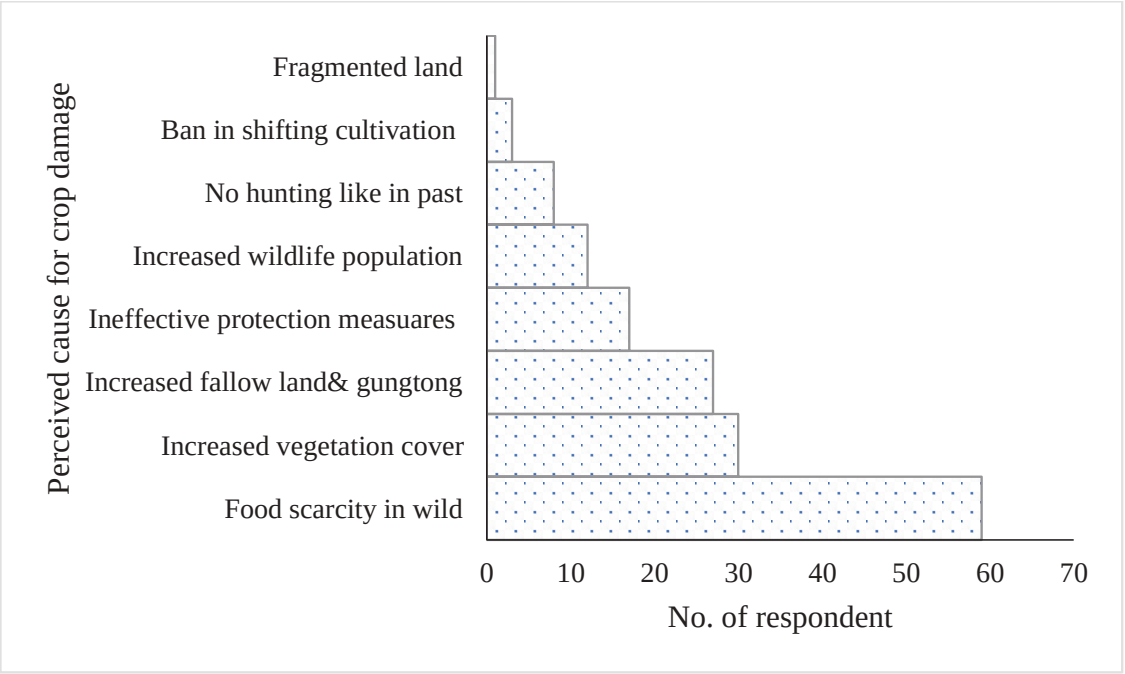

Figure 38: Reason for the cause of crop damage by wildlife

Over the past three years, sampled households reported a total of 73 livestock killings by predators, including 46 cattle, 26 horses, and one dog. According to respondents, common leopards and dholes are the primary predators behind livestock depredation (Figure 39). The highest number of common leopard attacks on livestock were recorded in Manam-Chemkhar chewog; however, many cases go unreported due to the absence of compensation or concrete action from relevant agencies.

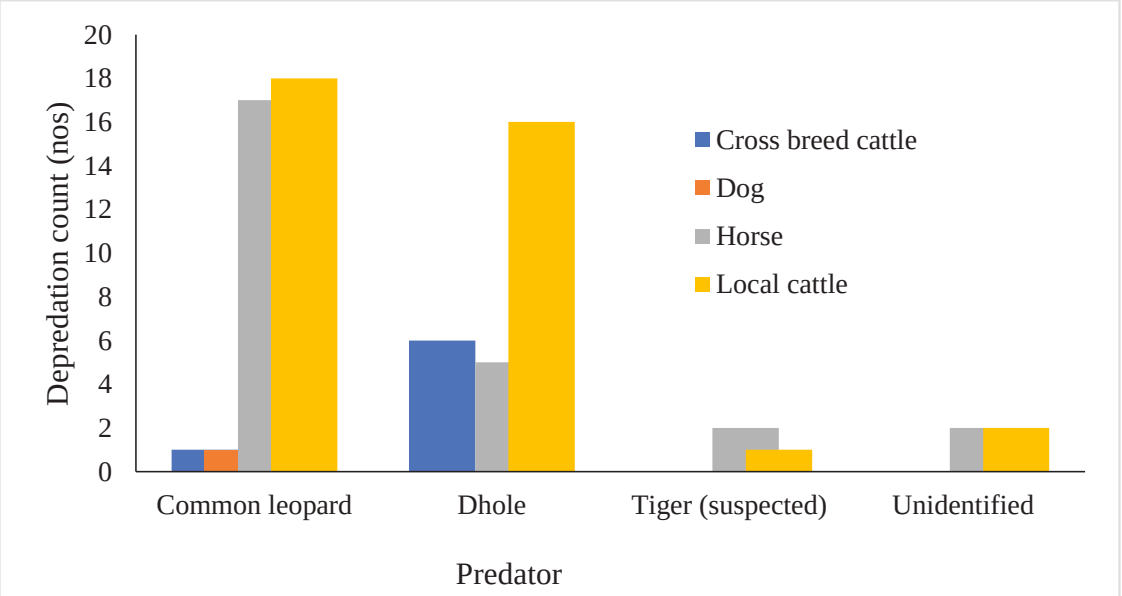

Figure 39: Livestock depredation cases by various predators

Respondents who experienced HWC identified several key factors contributing to livestock and crop loss, including the food scarcity in the wild, growing population of problem species, ineffective guarding practices, sluggish nature of livestock compared to wild prey, a declining prey population in the wild, unguarded grazing in forested areas, expanding fallow land due to guntong, a growing predator population, reduced hunting by local communities and increased vegetation cover. They attribute the increase in vegetation cover to the ban on shifting cultivation, the effective implementation of forest policies, and the expansion of fallow land due to outmigration.

Frequent habitat disturbances and resource depletion caused by illegal forest extraction, poaching, and the alteration of water sources are driving wildlife closer to human settlements, thereby increasing the risk of HWC. During the 2025 social survey, communities expressed that the high incidence of livestock depredation in Manam-Chemkhar Chewog was largely due to hunting pressure in nearby Indian settlements. This pressure is believed to be displacing predators into BC 9, where they increasingly prey on livestock. Similarly, communities also attributed the rising primate populations which is identified as a major cause of crop damage to cross-border disturbances, suggesting that such pressures are altering wildlife distribution across the landscape.

To mitigate HWC, respondents suggested various measures such as installing chain-link and coral fencing, developing pasturelands, trapping and relocating problematic species, discouraging unguarded or free grazing, controlling predator populations, using acoustic deterrence devices, and installing street lighting near huts and agricultural fields.

Similarly, during the BC 9 feasibility public consultation meetings in 2022, HWC was strongly highlighted by local communities as a major issue across the landscape. In response to the seriousness of the concern, the Bhutan Trust Fund for Environmental Conservation (BTFEC) provided support worth Nu. 5.26 million to install approximately 24 km of polywire electric and solar fencing in isolated households where community-based chain-link fencing was not feasible. Additionally, the project supplied fodder saplings worth Nu. 0.75 million to help reduce livestock depredation by wildlife and Nu. 1 million worth bamboo plantations to diversity the livelihood. Despite these efforts, there remains a significant need for

additional mitigation measures to comprehensively address HWC across the entire BC 9 landscape.

3.3.Socio-Economic & Demographic Challenges

Of the 806 individuals from 129 sampled households, only 411 (51 %) currently reside in the community, while the remaining 49 % have migrated. Among those staying in the village, a significant portion (45.7 %) consists of dependents, including minors and the elderly.

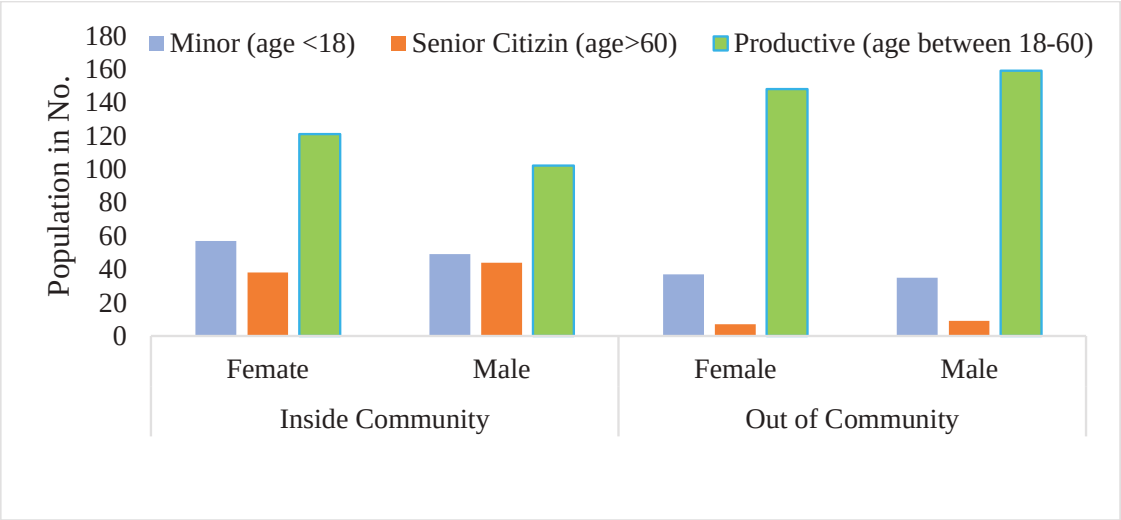

Figure 40: Demographic structure of the sample household

The demographic structure reflects a decline in the working-age population, as many have left for employment or education. Limited economic opportunities and accessibility challenges have driven this outmigration, with 395 individuals (49 %) moved out for jobs in the civil service, private sector, armed forces, or overseas, as well as for educational pursuits.

Figure 41: An abondoned house caused by Gungtong in the BC 9

This trend has resulted in a community largely composed of dependents, leading to increasing numbers of gungtong and fallow land, which negatively impact local livelihoods and social structures. Out of 374 households residing inside, alarmingly 108 households were reported to be gungtong. The expansion of fallow land has further facilitated the spread of invasive plant species and other vegetation, exacerbating HWC. This has further threatened the livelihood of those staying in the village from HWC and subsequently wildlife and their habitat from retaliatory responses.

Illegal forest resource extraction, drying/alteration of water source, and extreme weather events further intensify socio-economic and demographic challenges by degrading natural resources, reducing agricultural productivity, and increasing poverty. Such events frequently manifest as outbreaks of pest and disease, reduced yield and often crop failure. These impacts lead to livelihood loss, health risks, social conflicts, and

outmigration, especially affecting marginalized groups. Outbreak of army worn and crop wilting from extended dry periods are some of the common phenomenon reported from in the landscape.

Cross-border outbreaks of zoonotic diseases are frequently reported in the landscape, primarily due to illegal transboundary livestock trade. Highly contagious diseases such as Foot-and-Mouth Disease (FMD), which primarily affects cloven-hoofed animals like cattle, pigs, sheep, and goats, are often observed in Toetsho and Yallang gewogs, posing a serious threat to community livelihoods.

3.4.Unsustainable Resource Use & Exploitation

The biological corridor boundary is in close proximity to the Indian state of Arunachal Pradesh, which makes the natural resources highly vulnerable to exploitation by non-nationals. In 2023, several incidents of illegal activities were reported in the Dukti area, located under Yallang gewog. These included rampant illegal logging and unauthorized water tapping. It was discovered that over 2000 cubic feet of sawn timber had been found at multiple locations within the biological corridor area. However, in the following year, the surveillance team did not encounter any new illegal activities in that area.

In 2024, two separate incidences of poaching evidences were reported i.e. from Yangtse and Breng area under Phongmay. The forest partrolling team dismantled over 20 traps deliberately laid for wild ungulates and birds.

Figure 42: The illegally sawn timber (Photo 1 & 2) and unauthorized tapping of water source (photo 3 & 4) from the BC 9 area

In Thongrong area, camera trap images detected the people harvesting small bamboos from the BC area for commercial purposes to support their livelihoods. This evidence confirms that the collection is unmanaged, with resources being shared between humans and wildlife which is one of the contributing factors for never ending human wildlife conflict. While bamboo is considered a sustainable material due to its fast growth, improper and unmanaged harvesting can lead to habitat deterioration, exacerbating environmental impacts such as landslides and erosion. This, in turn, poses a significant threat to various wildlife species, including endangered ones. Through all these incidences, it is evident that unsustainable practice of resource use is prevalent in the BC area.

Figure 43: The people carrying finished bamboo product (photo 1), carrying raw materials (photo 2), trap laid for birds (photo 3), and trap laid for ungulate species (photo 4).

3.5.Forest fire

Forest fire is a major challenge to conservation especially in Toetsho and Yallang Gewog, Trashiyangtse and experience cases of forest fire incidence mainly during dry winter season. This is due to its dominance of highly flammable chirpine forests with a dry lemon grass understory, serve as a readily ignitable fuel source which makes vulnerable and risk. The forest fire prone assessment report by the Trashigang Forest Division, indicated the fire within the landscape of the BC 9. Recurrent forest fires in the area, pose a significant threat to biodiversity and ecosystem stability, further, direct consequences for wildlife species, which rely on BC 9 landscape as an ecological corridor. The frequent forest fires in the area also threaten

Figure 44: Forest fire outbreak in Chemkhar in BC 9 in December 2024

nearby human settlements, agricultural lands, and infrastructures, leading to potential socio-economic consequences.

Forest fire in the area is mainly caused from anthropogenic activities. Majority of them are intentionally ignited to promote profuse growth of green grass for the livestock, and highly price wild asparagus and to deter wildlife from nearby settlement. Further, forest fires area also prominent along the international border caused by the intentional setting of fires by the border intruders. A significant fire incident in December 2024 at Manam Chemkhar, Toetsho Gewog, TrashiYangtse within BC 9, resulted in massive destruction of approximately 1,091 acres of State Reserved Forest (SRF) land. The fire also caused extensive damage to rural infrastructure (farm

electric fence poles and pipes worth Nu. 10,500/-) and optic fiber connections to Jangphutse and Dukti primary schools, which were completely destroyed.

Given the high susceptibility to wildfires, it is crucial to enhance early detection and response mechanisms using community-based monitoring. Additionally, strengthening community engagement and recurrent awareness programs prior to onset of fire season is crucial to reduce fire risks.

3.6.Pest and disease outbreak

Forest pests and diseases poses significant impact on biodiversity. Among them, mistletoe species (Loranthaceae and Santalaceae families) are major concerns due to their parasitic nature. These plants grows on the branches of host species penetrating the vascular system and competing for essential resources.

In Bhutan, mistletoe can pose notable impacts on forests, particularly in temperate and subtropical regions where it commonly infests trees such as pine, oak, and other hardwood species. While mistletoe does not typically cause the widespread destruction like other forest pests, its long-term presence can negatively impact forest health, especially in densely infected areas. This could reduce the tree vitality, loss of forest regeneration and overall biodiversity.

The biodiversity survey teams came across with some species of mistletoe such as, *Scurrula elata, Scurrula parasitica* and *Dufrenoya granulata* in the BC 9 area but not significant impact was observed.

Wildlife epidemics, particularly in rare and isolated populations, can lead to mass mortality and local extinctions, especially when combined with stressors like habitat loss, genetic bottlenecks, and poor land management (Glassock et al. 2021). In 2018, Capripox (goat pox) was first reported in Himalayan gorals in Arunachal Pradesh, India, particularly in border areas, raising concerns about disease spill over from domestic livestock to wildlife (Bora et al. 2021, Goswami, 2018).

Figure 1: A. figure showing Male adult Goral rescued from Khetsang town planning & KHPL colony construction with injury to both eyes. B. female adult, pregnant rescued from Thergoom, Nekhang near Sand Extraction site. C. premature Goral delivered from infected Goral. D. status of Goral after translocation to Bomdeling Wildlife Sanctuary.

Figure 45: Outbreak of goral scabies in and around the BC 9 landscape in 2018. Photo from Ugyen Dechen's report

In Bhutan, a similar outbreak emerged in January 2018. A female goral was found injured in Tshergom, Jamkhar gewog in TrashiYangtse Dzongkhag, and was rescued and translocated to Bumdeling Wildlife Sanctuary. A detailed investigation revealed goat pox outbreak among gorals, with several cases showing symptoms like weak bodies, skin rapture and lesions,

eye rashes, and body hair loss (Bora et al. 2021). This marked the first recorded mass die-off of gorals in the region. Capripox severely impacted goral and Himalayan serow populations in the BC 9 landscape and its buffer area. Forestry personnel from Doksum and Yangtse Forest Range confirmed the deaths of 19 gorals and one serow, with more deaths suspected (Dechen, 2018). Further, carcasses were recovered in a decomposed state inside jungles, making it difficult to ascertain the exact number of deaths in outbreaks.

During the 2024 social survey, several respondents reported a significant decline in the goral population within the landscape, attributing it to the disease outbreak that occurred in 2018.

The corridor's proximity to the international border enchances the risk of zoonotic disease transmission from livestock to wildlife, including diseases like Foot-and-Mouth Disease (FMD), Black Quarter, Canine Distemper Virus (CDV), and rabies. Seasonal livestock migrations from Sakteng to pasture land in BC 9, which include yaks, sheep, goats, horses, and herder's dogs, further increase the risk of disease transmission.

To mitigate future threats, regular field assessments, disease surveillance, and community awareness are critical. Educating local herders about disease risks, implementing livestock vaccination programs, and establishing a Quick Response Team (QRT) with early warning systems will be essential for effective wildlife disease management in BC 9.

3.7.Climate Change

Climate change is a pressing global crisis with far-reaching consequences for both human societies and ecosystems. Local communities living within and near forested areas relying on natural resources for their livelihood are most vulnerable to these changes. The communities in BC 9 expressed their concern regarding climate change and its detrimental effects on their income and livelihood which is intensifying each year. The repeated occurrence of extreme weather patterns and damages it fetched to crops through pest and disease outbreak, erratic rainfall, wind, and hailstorm are elaborated in previous section 2.2.3.

The Figure 46 and 47 depicts the projected change in precipitations and temperature pattern in Trashiyangtse Dzongkhag. The precipitation and temperature are projected to increase in all climate scenarios in coming decades, thus anticipating potential impact to livelihood and biodiversity in the region.

The projected climate change in the landscape is expected to significantly affect both forest ecosystems and agricultural livelihoods, increasing conservation and livelihood challenges. Rising temperatures, shifting precipitation patterns, and increased frequency of forest fires and pest and disease outbreaks could alter forest structure and species composition, potentially encouraging upslope migration of subtropical species and threatening alpine biodiversity. These changes, along with increased incidence of invasive species and diseases, will likely affect the ecological integrity of BC 9. Simultaneously, agriculture, vital for local livelihoods is

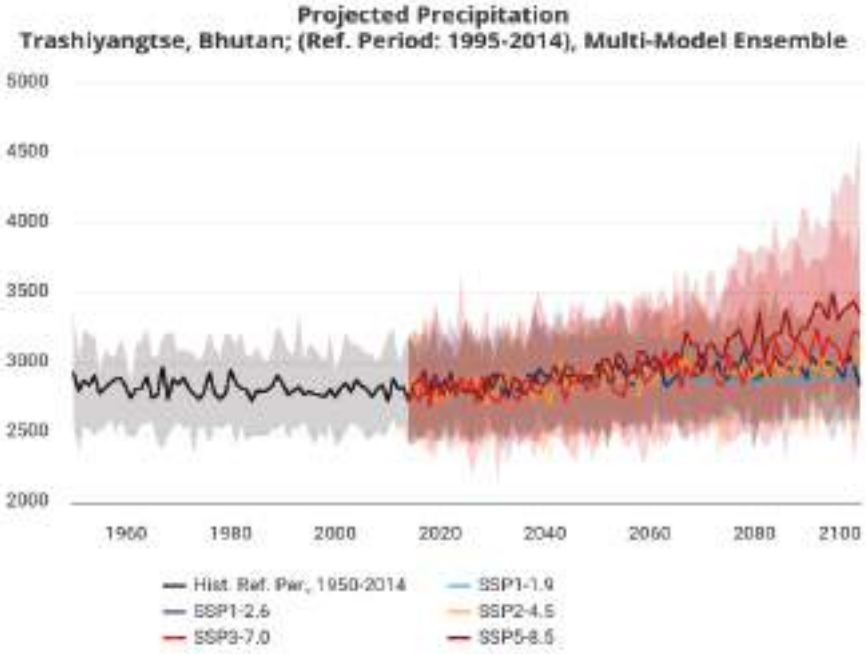

Figure 46: Projected precipitation change under different climate scenario in Trashi Yangtse Dzongkhag

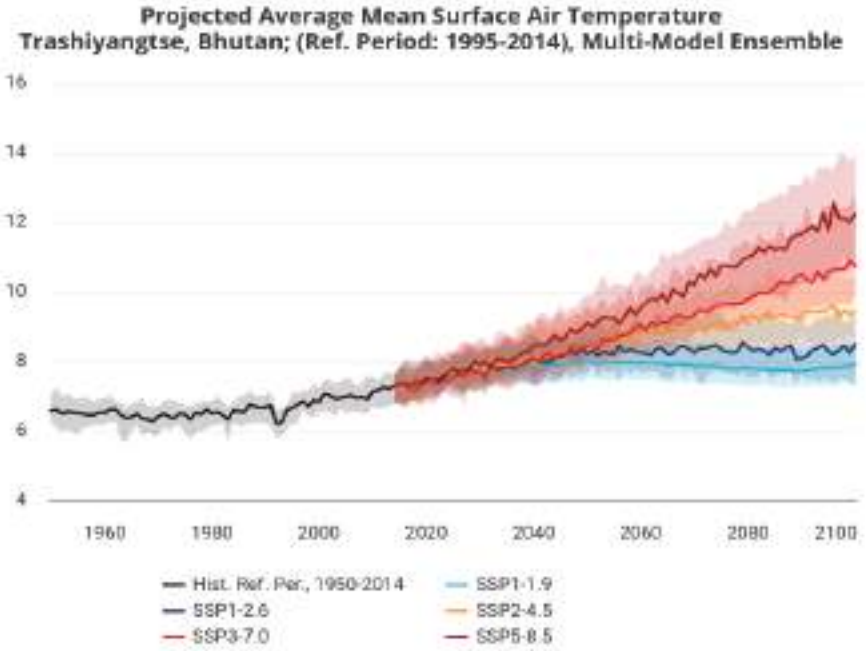

Figure 47: Projected temperature change under different climate scenario in Trashi Yangtse Dzongkhag (Source : World Bank Group's Climate Change Knowledge Portal)

highly vulnerable due to the corridor's steep terrain, land degradation, and reliance on monsoon rains. Climate change is expected to shift optimal crop-growing zones, strain water availability, and increase risks of soil erosion and landslides, especially on sloped farmlands.

As BC 9 lies in the climate-sensitive eastern region, the compounded effects of forest degradation and agricultural stress could intensify human-wildlife conflict, food insecurity, and community vulnerability.

Chapter 4

Management Intervention

The strategies and actions were developed based on the threat ranking analysis. Accordingly, 13 strategies and 42 actions, that aims to achieve six objectives have been developed to support the conservation goal of BC9.

Objective 1: To enhance landscape connectivity by maintaining and restoring habitats that facilitate wildlife movement

Strategy 1.1. Enhance wildlife habitat management

Action: 1.1.1. Mapping of degraded wildlife habitat and implementing needs based appropriate wildlife habitat management works

Action: 1.1.2. Assessment and mapping of invasive alien plant species

Action: 1.1.3. Implement management activities for invasive alien plant species

Action: 1.1.4. Conduct public advocacy and awareness on invasive species

Action: 1.1.5. Conduct survey to identify potential/critical waterhole and mineral licks

Action: 1.1.6. Create and improve identified waterhole and mineral licks

Action: 1.1.7. Support plantation in degraded areas

Objective 2: To improve wildlife monitoring by generating baseline data and tracking population trends for targeted conservation planning

Strategy 2.1. Assess species distribution for effective conservation

Action: 2.1.1. Conduct macro invertebrates, reptiles, amphibian, butterfly and fishes survey

Action: 2.1.2. Conduct periodic monitoring of Musk deer

Action: 2.1.3. Document medicinal and aromatic plant diversity in BC 9

Action: 2.1.4. Carry out camera trapping for annual monitoring of wildlife

Strategy 2.2. Adopt and implement SMART anti-poaching strategy

Action: 2.2.1. Enhance surveillance and conduct periodic SMART patrolling

Action: 2.2.2. Conduct anti-poaching activities

Strategy 2.3. Reduce risk of zoonotic diseases

Action: 2.3.1. Conducting advocacy and awareness on prevention of zoonotic disease outbreak

Objective 3: To adopt and implement climate smart conservation practices that promote resilience to climate change

Strategy 3.1. Manage watershed/catchment areas incorporating climate smart restoration

Action: 3.1.1. Asses the condition of springshed and implement appropriate intervention measures

Strategy 3.2. Climate change risk and vulnerability addressed

Action: 3.2.1. Implement adaptation measures based on Climate Change perception study and their impact on livilihood

Action: 3.2.2. Conduct advocacy and awareness on climate change

Action: 3.2.3. Conduct advocacy and awareness on forest fire prevention and control

Action: 3.2.4. Strengthen inter-agency forest fire coordination group

Objective 4: To foster conservation partnerships with local communities through sustainable livelihood initiatives

Strategy 4.1. Enhance participatory-based natural resource management

Action: 4.1.1. Revise three CF management plan

Action: 4.1.2. Revise bamboo management and marketing group management plan

Action: 4.1.3. Conduct training on record and book keeping to strengthen CF and bamboo group management

Action:4.2.4. Revise/amend three LFMA management plans

Strategy 4.2. Strengthen citizen stewardship towards biodiversity conservation

Action: 4.2.1. Strengthen and educate nature club in the schools inside BC 9

Action: 4.2.2. Conduct public advocacy and awareness on waste management

Action: 4.2.3. Install waste management signage in strategic locations

Strategy 4.3. Initiate and implement nature based solution

Action: 4.3.1. Facilitate the development of ecotourism products

Action: 4.3.2. Facilitate Omba Ney and Gongza ney infrastructure improvement

Action: 4.3.3. Support capacity builing in product development to strengthen Bimkhar bamboo management and marketing group

Objective 5: To enhance community wellbeing by reducing human wildlife conflict and livelihood improvement

Strategy 5.1. Assess and mitigate Human Wildlife Conflict

Action: 5.1.1. Implement appropriate HWC management intervention like physical barriers

Action: 5.1.2. Facilitate the improvement of pasture/grazing land

Action: 5.1.3. Conduct advocacy and awareness on the causes of HWC

Strategy 5.2. Adopt and implement sustainable livelihood options

Action: 5.2.1. Support solar lighting and mobile phone charging equipment to the nomadic herders

Action: 5.2.2. Support product value addition of *zanthoxylum* and chilli products

Objective 6. To improve institutional capacity development for effective service delivery

Strategy 6.1. Enhance professional capacity development

Action: 6.1.1. Conduct refresher course on SMART patrolling tool and forest fire fighting techniques

Action: 6.1.2. Need based capacity development to use latest tools and technology in the field of conservation

Strategy 6.2. Strengthen BC area management

Action: 6.2.1. Demarcate and fix BC9 boundary pillar

Action: 6.2.2. Procure necessary office equipment

Action: 6.2.3. Construct Yangtse Range Office

Action: 6.2.4. Monitor and evaluate BC management plan as per Bhutan METT+

Action: 6.2.5. Conduct midterm review of conservation management plan

Action: 6.2.6. Conduct final evaluation of Conservation Management Plan

Chapter 5

Implementation Schedule and Budget

The implementation plan and financial outlay to implement the management actions are detailed in the action plan, specifying locations and timeframes to ensure effective conservation measures. The conservation strategies for BC 9 are framed around six key objectives, which are further supported by 42 targeted actions under 13 strategies. This management plan will be valid for 10 years effective from July 2025 to June 2035 covering 13th and 14th Five Year Plan (FYP) of the Royal Government of Bhutan.

To facilitate the effective execution of management actions, the conservation operation plan will be prepared annually and it will guide the effective implementation of the actions framed under each strategy.

A financial estimate of Nu. 43.62 million has been proposed to support activities aimed at the protection of wild flora and fauna, enhancement of socio-economic conditions for local communities through mitigation of Human Wildlife Conflict (HWC) and other sustainable green infrastructure in the locality.

The primary funding sources for these conservation activities are expected to be secured from Royal Government of Bhutan (RGoB) and other potential conservation partners. The allocation and utilization of financial resources will strictly adhere to government financial regulations, norms, and circulars in accordance with the RGoB's financial year (July to June). Furthermore, efforts will be made to explore additional funding opportunities from conservation partners and will be implemented in collaboration with the line agencies and stakeholders. Diversifying funding sources will enhance financial sustainability and ensure the long-term success of conservation interventions within BC 9.

Table 1 Implementation framework and budget outlay

Objective	Strategy	Action	Year along with budget (in Nu. m)										Sub total	Lead Agency	Remarks
			1	2	3	4	5	6	7	8	9	10			
1.To enhance landscape connectivity by maintaining and restoring habitats that support wildlife movement	1.1. Enhance wildlife habitat management	1.1.1. Mapping of degraded wildlife habitat and implementing need based appropriate wildlife habitat management works	0.4	-	-	0.6	-	-	0.8	-	-	-	**1.8**	DoFPS	Entire BC9 area
		1.1.2. Assessment and mapping of invasive alien plant species	-	0.2	-	-	-	-	-	-	-	-	**0.2**	DoFPS	Entire BC9 area
		1.1.3. Implement management activities for invasive alien plant species	-	-	-	0.15	-	0.15	-	0.15	-	-	**0.45**	DoFPS	Places identified after assessment & mapping
		1.1.4. Conduct public advocacy and awareness on invasive species	-	-	0.1	-	-	-	0.15	-	-	-	**0.25**	DoFPS	Settlements inside BC9
		1.1.5. Conduct survey to identify potential/critical waterhole, mineral licks and any critical habitats	-	0.1	-	-	-	-	-	-	-	-	**0.1**	DoFPS	Entire BC9 area
		1.1.6. Create and improve identified waterhole / mineral licks/critical habitat	-	-	0.2	-	0.25	-	-	0.3	-	-	**0.75**	DoFPS	Based on survey recommendation
		1.17. Support plantation in degraded areas	0.3	-	-	-	-	-	0.5	-	-	-	**0.8**	DoFPS	Khamdang and entire BC area

2. To improve wildlife monitoring by generating baseline data and tracking population trends for targeted conservation planning						
2.1. Assess species distribution for effective conservation				2.2. Adopt & implement SMART anti-poaching strategy		2.3. Reduce risk of zoonotic diseases
2.1.1. Conduct macro invertebrates, reptiles, amphibian, butterfly and fishes survey	2.1.2. Conduct periodic monitoring of Musk deer	2.1. 3. Document medicinal and aromatic plant diversity in BC9.	2.1.4. Carry out camera trapping for annual monitoring of wildlife	2.2.1. Enhance surveillance and conduct periodic SMART patrolling	2.2.2. Conduct anti-poaching activities	2.3.1. Conducting advocacy and awareness on prevention of zoonotic disease outbreak
-	0.1	-	0.15	0.2	0.1	0.8
0.4	0.1	0.5	0.15	0.2	-	-
-	0.1	-	0.15	0.2	0.1	-
-	0.1	-	0.15	0.2	-	-
-	0.1	-	0.15	0.3	0.1	-
-	0.1	-	0.15	0.3	-	1
-	0.1	-	0.15	0.3	0.1	-
-	0.1	-	0.15	0.3	-	-
0.5	0.1	-	0.15	0.3	0.1	-
-	-	-	0.15	0.3	-	-
0.9	**0.9**	**0.5**	**1.5**	**2.6**	**0.5**	**1.8**
DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS
Entire BC9, Ngalakang(kheni) and Dukti stream	Tshongtshong ma (Phongmay), Dripla, Gaybu, Tongbrak & Manamla	Entire BC9 area	Entire BC9 area	Entire BC9 area	Tshongtshong ma (Phongmay), Dripla, Gaybu, Tongbrak & Manamla	Settlements inside BC9

3. To adopt and implement climate smart conservation practices that promote resilience to climate change				
3.2. Climate change risk and vulnerability addressed				3.1. Manage watershed/catchment areas incorporating climate smart restoration
3.2.4. Strengthen inter-agency forest fire coordination group	3.2.3. Conduct advocacy and awareness on forest fire prevention and control	3.2.2. Conduct advocacy and awareness on climate change	3.2.1.. Implement adaptation measures based on Climate Change perception study and their impact on livelihood	3.1.1. Asses the condition of springshed and implement appropriate intervention measures
0.2	0.1	0.1	-	-
-	0.1	-	0.5	-
-	0.1	-	-	-
-	0.1	0.1	-	0.5
-	0.1	-	0.5	-
0.25	0.1	-	-	-
-	0.1	0.1	-	-
-	0.1	-	-	0.5
-	0.1	-	0.5	-
-	0.1	-	-	-
0.45	**1**	**0.3**	**1.5**	**1**
DoFPS	DoFPS	DoFPS	DoFPS	DoFPS
Toetsho and Yallang gewog	Jangphutse, Manan-Chemkhar, Chema and Dukti	Settlements inside BC9	Entire BC9 area	Manam-Chemkhar

4. To foster conservation partnerships with local communities through sustainable livelihood initiatives									
4.1. Enhance participatory-based natural resource management				4.2. Strengthen citizen stewardship towards biodiversity conservation			4.3. Initiate and implement nature-based solution		
4.1.1. Revise three CF management plan	4.1.2. Revise bamboo management and marketing group management plan	4.1.3. Conduct training on record and book keeping to strengthen CF and bamboo group management	4.1.4. Revise/amend three LFMA plans	4.2.1. Strengthen and educate nature club in the schools inside BC9	4.2.2. Conduct public advocacy and awareness on waste management	4.2.3. Install waste management signage in strategic locations	4.3.1. Facilitate development of ecotourism products	4.3.2. Facilitate Omba Ney and Gongza ney infrastructure improvement	Action: 4.3.3. Support capacity builing in product development to strengthen Bimkhar bamboo management and marketing group
-	-	-		-	0.1	-	0.2	1	-
-	-	0.1		-	-	0.05	-	-	-
-	-	-		0.1	-	-	-	-	0.25
0.12	-	-	0.3	-	0.1	-	-	-	-
-	-	-		0.15	-	-	-	-	-
-	-	-		-	-	-	0.3	-	-
-	-	0.2		-	0.1	-	-	1	-
0.6	-	-		-	-	-	-	-	-
-	-	-		-	-	0.1	-	-	-
-	0.8	-		-	-	-	-	-	-
0.72	**0.8**	**0.3**	**0.3**	**0.25**	**0.3**	**0.15**	**0.5**	**2**	**0.25**
DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS
Dukti, Melongkhar, Kurtangpeg CF	Bimkhar	Dukti, Melongkhar, Kurtangpeg CF & Bimkhar Bamboo group	Yangtse, Bumdeling & Yallang (remove LFMA area for BC)	Melongkhar & Thragom, Jangphutse & Womanang school	Setlements inside BC9	Enroute to Omba and Gongza Ney	Omba and Jangphutse	Omba and Gongza Ney	Bimkhar

5. To enhance community wellbeing by reducing human wildlife conflict and livelihood improvement					
5.2. Adopt and implement sustainable livelihood options					5.1. Assess and mitigate Human Wildlife Conflict
5.2.2. Support product value addition of zanthoxylum and chilli products	5.2.1. Support solar lighting and mobile phone charging equipment to the nomadic herders	5.1.3. Conduct advocacy and awareness on the causes of HWC	5.1.2. Facilitate improvement of pasture/rangeland management	5.1.1. Implement appropriate HWC management intervention like physical barriers	
-	-	-	-	-	
-	-	0.1	0.15	-	
-	0.3	-	-	1.5	
-	-	-	-	-	
0.5	-	-	0.2	-	
-	-	-	-	2	
-	-	-	-	-	
-	-	0.15	-	-	
-	-	-	0.3	-	
-	-	-	-	-	
0.5	**0.3**	**0.25**	**0.65**	**3.5**	
DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	
Yerphel and Jangphutse village	Brokpa & Yangtse herders inside BC9	Settlements inside BC9	Yangtse and Phongmay	Jangphutse, Manan-Chemkhar, Chema, Omba, Melongkhar and Dukti,	

64

Total	6. To improve institutional capacity development for effective service delivery							
	6.2. Strengthen BC area management						6.1 Enhance professional capacity development	
	6.2.6. Conduct final evaluation of Conservation Management Plan	6.2.5. Conduct midterm review of conservation management plan	6.2.4. Assess the Management Effectiveness of the BC Management based on Bhutan METT+tool	6.2.3. Construct Yangtse range office	6.2.2. Procure necessary office equipment	6.2.1. Demarcate and fix BC9 boundary pillar	6.1.2. Need based capacity development to use latest tools and technology in the field of conservation (e.g AI camera trap)	6.1.1. Conduct refresher course of SMART patrolling tool and forest fire fighting techniques
3.8	-	-	0.05	-	-	-	-	-
14.2	-	-	0.05	10	0.8	0.5	-	0.2
3.65	-	-	0.05	-	-	-	0.5	-
2.47	-	-	0.05	-	-	-	-	-
2.75	-	0.15	0.05	-	-	-	-	0.2
4.9	-	-	0.05	-	-	-	0.5	-
4.65	-	-	0.05	-	1	-	-	-
2.7	-	-	0.05	-	-	-	-	0.3
2.9	-	-	0.05	-	-	-	0.7	-
1.6	0.2	-	0.05	-	-	-	-	-
43.62	**0.2**	**0.15**	**0.5**	**10**	**1.8**	**0.5**	**1.7**	**0.7**
	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS	DoFPS
	10th year	5th year	Entire BC9 area	Yangtse	Yangtse and Doksum range office	Entire BC9 area	Yangtse and Doksum range office	Yangtse and Doksum range office

Chapter 6

Monitoring and Evaluation

Monitoring is a continuous process designed to evaluate the progress of planned activities, ensuring that objectives, deliverables, and timelines are met while promptly identifying and resolving any challenges.

The Divisional Forest Office, Trashigang, will conduct annual monitoring throughout the implementation phase, like any other forest management regimes, utilizing the PA Monitoring Framework outlined in Volume IV of the Forest Management Code of Bhutan 2020. Additionally, the Bhutan METT+ protocol will assess both the management effectiveness of the BC and the successful execution of the conservation management plan.

The entire monitoring and evaluation process will be governed by the Monitoring and Evaluation framework detailed in Table 9, ensuring a structured and transparent approach to achieving conservation goals

Table 2 Monitoring and evaluation framework

Objective	Strategy	Action	Output Indicator	Baseline	Unit	Year along with budget (in Nu. m)									
						1	2	3	4	5	6	7	8	9	10
1.To enhance landscape connectivity by maintaining and restoring habitats that facilitate wildlife movement	1.1. Enhance wildlife habitat management	1.1.1. Mapping of degraded wildlife habitat and implementing need based appropriate wildlife habitat management works	Hectares of area managed	2.5	Ha	5	-	-	5	-	-	5	-	-	-
		1.1.2. Assessment and mapping of invasive alien plant species	Assessment report	Nil	Nos	-	1	-	-	-	-	-	-	-	-
		1.1.3. Implement management activities for invasive alien plant species	Report	Nil		-	-	-	1	-	1	-	1	-	-
		1.1.4. Conduct public advocacy and awareness on invasive species	Awareness report	Nil	Nos	-	-	1	-	-	-	1	-	-	-
		1.1.5. Conduct survey to identify potential/critical waterhole, mineral licks and any critical habitats	Assessment report	Nil	Nos	-	1	-	-	-	-	-	-	-	-
		1.1.6. Create and improve identified waterhole / mineral licks/critical habitat	No of waterhole/saltlicks improved	2	Nos	-	-	2	-	2	-	-	2	-	-
		1.17. Support plantation in degraded areas	Hectares of area managed	Nil	Ha	1	-	-	-	-	-	1	-	-	-

2.To implement effective wildlife monitoring to track population trends and identify critical habitat areas							
2.3. Reduce risk of zoonotic diseases	2.2. Adopt and implement SMART anti-poaching strategy			2.1. Assess species distribution for effective conservation			
2.3.1. Conducting advocacy and awareness on prevention of zoonotic disease outbreak	2.2.2. Conduct anti-poaching activities	2.2.1. Enhance surveillance and conduct periodic SMART patrolling	2.1.4. Carry out camera trapping for annual monitoring of wildlife	2. 1. 3. Document medicinal and aromatic plant diversity in BC9.	2.1.2. Conduct periodic monitoring of Musk deer	2.1.1. Conduct macro invertebrates, reptiles, amphibian, butterfly and fishes survey	
Awareness report	Anti-poaching report	SMART report	Assessment report	Assessment report	Assessment report	Assessment report	
Nil	Nil	Nil	Nil	Nil	Nil	Nil	
Nos	Nos	Nos	Nos	Nos	Nos	Nos	
1	1	1	-	-	1	-	
-	-	1	-	1	1	1	
-	1	1	-	-	1	-	
-	-	1	-	-	1	-	
-	1	1	1	-	1	-	
1	-	1	-	-	1	-	
-	1	1	-	-	1	-	
-	-	1	-	-	1	-	
-	1	1	-	-	1	1	
-	-	1	1	-	-	-	

3. To adopt and implement climate smart conservation practices that promote resilience to climate change					
3.1. Manage watershed/ catchment areas incorporating climate smart restoration	3.2. Climate change risk and vulnerability addressed				
3.1.1. Asses the condition of springshed and implement appropriate intervention measures	3.2.1.. Implement adaptation measures based on Climate Change perception study and their impact on livelihood	3.2.2. Conduct advocacy and awareness on climate change	3.2.3. Conduct advocacy and awareness on forest fire prevention and control	3.2.4. Strengthen inter-agency forest fire coordination group	
Implementation report and site visit	Implementation report and site visit	Awareness report	Awareness report	Report	
Nil	Nil	Nil	Nil	Nil	
Nos	Nos	Nos	Nos	Nos	
-	-	1	1	1	
-	1	-	1	-	
-	-	-	1	-	
-	-	-	1	-	
1	-	1	1	-	
-	1	-	1	-	
-	-	-	1	-	
-	1	-	1	-	
-	-	1	1	-	
1	-	-	1	-	
-	-	-	1	-	

4. To foster conservation partnerships with local communities through sustainable livelihood initiatives												
4.1. Enhance participatory-based natural resource management	4.1.1. Revise three CF management plan	No of revised plan	5	Nil	Nos	-	-	-	-	-	-	-
	4.1.2. Revise bamboo management and marketing group management plan	No of revised plan	1	Nil	Nos	-	-	-	-	-	-	1
	4.1.3. Conduct training on record and book keeping to strengthen CF and bamboo group management	Training report	Nil	Nil	Nos	-	1	-	-	-	-	-
	4.1.4. Revise/amend three LFMA plans	Report	Nil	Nil	Nos	-	-	3	-	-	-	2
4.2. Strengthen citizen stewardship towards biodiversity conservation	4.2.1. Strengthen and educate nature club in the schools inside BC9	No. of schools supported	Nil	Nil	Nos	-	-	2	-	-	-	-
	4.2.2. Conduct public advocacy and awareness on waste management	Awareness report	Nil	Nil	Nos	-	-	-	1	-	-	-
	4.2.3. Install waste management signage in strategic locations	Awareness report	Nil	Nil	Nos	-	1	-	-	-	-	-
4.3. Initiate and implement nature-based solution	4.3.1. Facilitate development of ecotourism products	No. of homestay supported	3	Nil	Nos	1	-	-	-	1	-	-
	4.3.2. Facilitate Omba Ney and Gongza ney infrastructure improvement	Implementation report and site visit	1	Nil	Nos	1	-	-	-	-	1	-
	Action: 4.3.3. Support capacity builing in product development to strengthen Bimkhar bamboo management and marketing group	Product development training report	Nil	Nil	Nos	-	1	-	-	-	-	-

5. To enhance community wellbeing by reducing human wildlife conflict and livelihood improvement				
5.1. Assess and mitigate Human Wildlife Conflict			5.2. Adopt and implement sustainable livelihood options	
5.1.1. Implement appropriate HWC management intervention like physical barriers	5.1.2. Facilitate improvement of pasture/rangeland management	5.1.3. Conduct advocacy and awareness on the causes of HWC	5.2.1. Support solar lighting and mobile phone charging equipment to the nomadic herders	5.2.2. Support product value addition of zanthoxylum and chilli products
Area under intervention	Area under intervention	Awareness report	No of herders benefited	No. of household benefited
50	Nil	Nil	Nil	Nil
Ha	Ha	Nos	Nos	Nos
-	-	-	-	-
-	3	1	-	-
1	-	-	9	-
-	-	-	-	-
-	3	-	-	10
2	-	-	-	-
-	-	-	-	-
-	-	1	-	-
-	3	-	-	-
-	-	-	-	-

6. To improve institutional capacity development for effective service delivery	6.1 Enhance professional capacity development	6.1.1. Conduct refresher course of SMART patrolling tool and forest fire fighting techniques	No. of staff trained along with training report	Nil	Nos	-	50	-	-	50	-	-	50	-	-
		6.1.2. Need based capacity development to use latest tools and technology in the field of conservation (e.g AI camera trap)	No. of staff trained along with training report	Nil	Nos	-	-	20	-	-	20	-	-	20	-
	6.2. Strengthen BC area management	6.2.1. Demarcate and fix BC9 boundary pillar	Implementation report and site visit	Nil	Nos	-	1	-	-	-	-	-	-	-	-
		6.2.2. Procure necessary office equipment	Equipment procured	Nil	Nos	-	1	-	-	-	-	1	-	-	-
		6.2.3. Construct Yangtse range office	Completion report and site visit	Nil	Nos	-	1	-	-	-	-	-	-	-	-
		6.2.4. Assess the Management Effectiveness of the BC Management based on Bhutan METT+tool	METT+ report	Nil	Nos	-	-	-	-	1	-	-	-	-	1
		6.2.5. Conduct midterm review of conservation management plan	Report	Nil	Nos	-	-	-	-	1	-	-	-	-	-
		6.2.6. Conduct final evaluation of Conservation Management Plan	Report			-	-	-	-	-	-	-	-	-	1

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5. Annexures

Annexure 1. List of Mammal

Sl. No	Order	Family	Scientific Name	Common Name	IUCN Status
1	Artiodactyla	Bovidae	*Naemorhedus goral*	Himalayan goral	NT
2	Artiodactyla	Bovidae	*Capricornis sumatraensis*	Himalayan serow	VU
3	Artiodactyla	Ceruidae	*Moschus* spp.	Black musk deer	EN
4	Artiodactyla	Cervidae	*Muntiacus muntjak*	Barking deer	LC
5	Artiodactyla	Cervidae	*Rusa unicolor*	Sambar deer	VU
6	Artiodactyla	Suidae	*Sus scrofa*	Wild pig	LC
7	Carnivora	Aluridae	*Ailurus fulgens*	Red panda	EN
8	Carnivora	Canidae	*Cuon alpinus*	Dhole	EN
9	Carnivora	Felidae	*Panthera tigris*	Tiger	EN
10	Carnivora	Felidae	*Catopuma temminxkii*	Asiatic golden cat	VU
11	Carnivora	Felidae	*Neofelis nebulosa*	Clouded Leopard	VU
12	Carnivora	Felidae	*Panthera pardus*	Common leopard	VU
13	Carnivora	Felidae	*Felis chaus*	Jungle cat	LC
14	Carnivora	Felidae	*Prionailurus bengalensis*	Leopard cat	LC

15	Carnivora	Felidae	*Pardofelis marmorata*	Marbled cat	NT
16	Carnivora	Ursidae	*Ursus thibetanus*	Himalayan Black Bear	VU
17	Carnivora	Mustelidae	*Mustela* spp.,	Weasel species	LC
18	Carnivora	Mustelidae	*Martes flavigual*	Yellow throated marten	LC
19	Carnivora	Mustelidae	*Lutrogale perspicillata*	Smooth-coated otter	VU
20	Carnivora	Mustelidae	*Aonyx cinereus*	Small-clawed otter	VU
21	Carnivora	Mustelidae	*Lutra lutra*	Eurasian otter	NT
22	Chiroptera	Vespertilionidae	*Vespertilionidae spp*	Bat	LC
23	Feliformia	Viverridae	*Paguma larvata*	Masked Palm Civet	LC
24	Insectivora	Soricidae	*Soriculus nigrescens*	Himalayan shrew	LC
25	Insectivora	Soricidae	*Soriculus caudatus*	Hodgson's brown toothed shrew	LC
26	Insectivora	Soricidae	*Sorex minutus*	Pygmy shrew	LC
27	Lagomorpha	Ochotonidae	*Ochotona macrotis*	Large- eared Pika	LC
28	Primates	Cercopithecidae	*Trachypithecus pileatus*	Capped languar	VU
29	Primates	Cercopithecidae	*Macaca munzula*	Arunachal macaque	EN
30	Primates	Cercopithecidae	*Macaca* spp.	Macaque species	LC
31	Rodentia	Hystricidae	*Hystrix bracyhura*	Himalayan crestless porcupine	LC
32	Rodentia	Muridae	*Rattus* spp.	Rat	LC

33	Rodentia	Muridae	*Niviventer niviventer*	White- bellied rat	LC
34	Rodentia	Sciuridae	*Callosciurus pygerythrus*	Hoary-bellied squirrel	LC
35	Rodentia	Sciuridae	*Dremomys lokriah*	Orange bellied squirrel	LC
36	Rodentia	Sciuridae	*Tamiops macclellandi*	Himalayan Stripped Squirrel	LC
37	Rodentia	Sciuridae	*Funambulus palmarum*	Three-striped Squirrel	LC
38	Rodentia	Muridae	*Niviventer eha*	Smoke bellied rat	LC
39	Rodentia	Cricetidae	*Neodon sikkimensis*	Sikkim vole	LC

Annexure 2. List of Amphibian

Sl. No.	Order	Family	Scientific Name	Common Name	IUCN Status
1	Anura	Ranidae	*Amolops formasa*	Assam sucker/cascade frog	LC
2	Anura	Ranidae	*Amolops himalayanus*	Himalayan sucker/cascade frog	LC
3	Anura	Rhacophoridae	*Roarchestes longchuanensis*	Bush tree frog	LC
4	Anura	Rhacophoridae	*Polypedates himalayensis*	Himalayan tree frog	LC
5	Anura	Megophyridae	*Scutiger sikkimmensis*	Sikkim snow toad/Sikkim high altitude toad	LC

6	Anura	Ranidae	*Sylvirana* spp.	Long-toad frog	LC
7	Anura	Dicroglossidae	*Euphylctis cyanphlyctis*	Indian skittering/skipper frog	LC
8	Anura	Rhacophoridae	*Philautus* spp.	Shrub frog	LC
9	Anura	Megophyridae	*Megophrys* minor	Drawft horned toed	
10	Anura	Megophyridae	*Megophrys major*	White-lipped horned toad	LC
11	Anura	Megophyridae	*Megophrys parva*	Concave-Crowned horned toad	LC

Annexure 2. List of Birds

Sl. No.	Common Name	Scientific Name	Family	IUCN status
1	Alpine Accentor	*Prunella collaris*	Prunellidae	LC
2	Alpine Thrush	*Zoothera mollissima*	Turdidae	LC
3	Ashy Drongo	*Dicrurus leucophaeus*	Dicruridae	LC
4	Ashy-throated Warbler	*Phylloscopus maculipennis*	Phylloscopidae	LC
5	Ashy-wood Pigeon	*Columba pulchricollis*	Columbidae	LC
6	Asian Barred Owlet	*Glaucidium cuculoides*	Strigidae	LC
7	Asian Brown Flycatcher	*Muscicapa dauurica*	Muscicapidae	LC
8	Asian emerald dove	*Chalcophaps indica*	Columbidae	LC
9	Asian House Martin	*Delichon dasypus*	Hirundinidae	LC

10	Barred cuckoo-dove	*Macropygia unchall*	Columbidae	LC
11	Bay Woodpecker	*Blythipicus pyrrhotis*	Picidae	LC
12	Bhutan Laughingthrush	*Trochalopteron imbricatum*	Leiothrichidae	LC
13	Black Bulbul	*Hypsipetes leucocephalus*	Pycnonotidae	LC
14	Black Drongo	*Dicrurus macrocercus*	Dicruridae	LC
15	Black Eagle	*Ictinaetus malaiensis*	Accipitridae	LC
16	Black Redstart	*Phoenicurus ochruros*	Muscicapidae	LC
17	Black-throated Sunbird	*Aethopyga saturata*	Nectariniidae	LC
18	Black-throated Tit	*Aegithalos concinnus*	Aegithalidae	LC
19	Black-browed Tit	*Aegithalos iouschistos*	Aegithalidae	LC
20	Black-faced Laughingthrush	*Trochalopteron affine*	Leiothrichidae	LC
21	Black-faced Warbler	*Abroscopus schisticeps*	Scotocercidae	LC
22	Black-hooded Oriole	*Oriolus xanthornus*	Oriolidae	LC
23	Black-tailed Crake	*Zapornia bicolor*	Rallidae	LC
24	Blood Pheasant	*Ithaginis cruentus*	Phasianidae	LC
25	Blue-throated Barbet	*Psilopogon asiaticus*	Megalaimidae	LC
26	Blue Whistling-Thrush	*Myophonus caeruleus*	Muscicapidae	LC
27	Blue-winged Minla	*Actinodura cyanouroptera*	Leiothrichidae	LC
28	Blue-capped Redstart	*Phoenicurus coeruleocephala*	Muscicapidae	LC

29	Blue-capped Rock-Thrush	*Monticola cinclorhyncha*	Muscicapidae	LC
30	Blue-fronted Redstart	*Phoenicurus frontalis*	Muscicapidae	LC
31	Blue-winged laughingthrush	*Trochalopteron squamatum*	Leiothrichidae	LC
32	Blyth's Leaf warbler	*Phylloscopus reguloides*	Phylloscopidae	LC
33	Brown Parrotbill	*Paradoxornis unicolor*	Paradoxornithidae	LC
34	Brownish-flanked Bush Warbler	*Horornis fortipes*	Scotocercidae	LC
35	Brown-throated Fulvetta	*Fulvetta ludlowi*	Paradoxornithidae	LC
36	Chestnut-crowned Bush Warbler	*Cettia major*	Scotocercidae	LC
37	Chestnut-bellied Nuthatch	*Sitta cinnamoventris*	Sittidae	LC
38	Chestnut-bellied Rock Thrush	*Monticola rufiventris*	Muscicapidae	LC
39	Chestnut-breasted Partridge	*Arborophila mandellii*	Phasianidae	NT
40	Chestnut-crowned Laughingthrush	*Trochalopteron erythrocephalum*	Leiothrichidae	LC
41	Chestnut-crowned Warbler	*Phylloscopus castaniceps*	Phylloscopidae	LC
42	Chestnut-headed Tesia	*Cettia castaneocoronata*	Scotocercidae	LC

43	Chestnut-tailed minla	*Actinodura strigula*	Leiothrichidae	LC
44	Coal Tit	*Periparus ater*	Paridae	LC
45	Collared Owlet	*Taenioptynx brodiei*	Strigidae	LC
46	Common Tailorbird	*Orthotomus sutorius*	Cisticolidae	LC
47	Common Buzzard	*Buteo buteo*	Accipitridae	LC
48	Crested Bunting	*Emberiza lathami*	Emberizidae	LC
49	Crested Serpent-Eagle	*Spilornis cheela*	Accipitridae	LC
50	Crimson Sunbird	*Aethopyga siparaja*	Nectariniidae	LC
51	Crimson-naped Woodpecker	*Dryobates cathpharius*	Picidae	LC
52	Darjeeling Woodpecker	*Dendrocopos darjellensis*	Picidae	LC
53	Dark-breasted Rosefinch	*Procarduelis nipalensis*	Fringillidae	LC
54	Dark-rumped Rosefinch	*Carpodacus edwardsii*	Fringillidae	LC
55	Dark-sided Flycatcher	*Muscicapa sibirica*	Muscicapidae	LC
56	Dusky Warbler	*Phylloscopus fuscatus*	Phylloscopidae	LC
57	Eurasian Hoopoe	*Upupa epops*	Upupidae	LC
58	Eurasian Jay	*Garrulus glandarius*	Corvidae	LC
59	Eurasian Kestrel	*Falco tinnunculus*	Falconidae	LC
60	Eurasian Sparrowhawk	*Accipiter nisus*	Accipitridae	LC
61	Eurasian Treecreeper	*Certhia familiaris*	Certhiidae	LC

62	Eurasian Wren	*Troglodytes troglodytes*	Troglodytidae	LC
63	Eurasion Tree Sparrow	*Passer montanus*	Passeridae	LC
64	Fire-breasted Flowerpecker	*Dicaeum ignipectus*	Dicaeidae	LC
65	Fire-tailed Myzornis	*Myzornis pyrrhoura*	Paradoxornithidae	LC
66	Golden Bush-Robin	*Tarsiger chrysaeus*	Muscicapidae	LC
67	Golden-naped Finch	*Pyrrhoplectes epauletta*	Fringillidae	LC
68	Golden-throated Barbet	*Psilopogon franklinii*	Megalaimidae	LC
69	Gray Bushchat	*Saxicola ferreus*	Muscicapidae	LC
70	Gray-crested Tit	*Lophophanes dichrous*	Paridae	LC
71	Gray Treepie	*Dendrocitta formosae*	Corvidae	LC
72	Gray-backed Shrike	*Lanius tephronotus*	Laniidae	LC
73	Gray-bellied Tesia	*Tesia cyaniventer*	Scotocercidae	LC
74	Gray-cheeked Warbler	*Phylloscopus poliogenys*	Phylloscopidae	LC
75	Gray-headed Canary-flycatcher	*Culicicapa ceylonensis*	Stenostiridae	LC
76	Gray-headed Woodpecker	*Picus canus*	Picidae	LC
77	Gray-hooded Warbler	*Phylloscopus xanthoschistos*	Phylloscopidae	LC
78	Gray-sided Bush Warbler	*Cettia brunnifrons*	Scotocercidae	LC

79	Gray-sided laughingthrush	*Pterorhinus caerulatus*	Leiothrichidae	LC
80	Gray-winged Blackbird	*Turdus boulboul*	Turdidae	LC
81	Great Barbet	*Psilopogon virens*	Megalaimidae	LC
82	Great Tit	*Parus major*	Paridae	LC
83	Green- backed Tit	*Parus monticolus*	Paridae	LC
84	Green-imperial Pigeon	*Ducula aenea*	Columbidae	NT
85	Greenish Warbler	*Phylloscopus trochiloides*	Phylloscopidae	LC
86	Green-tailed Sunbird	*Aethopyga nipalensis*	Nectariniidae	LC
87	Hill Partridge	*Arborophila torqueola*	Phasianidae	LC
88	Himalayan Bluetail	*Tarsiger rufilatus*	Muscicapidae	LC
89	Himalayan Bulbul	*Pycnonotus leucogenys*	Pycnonotidae	LC
90	Himalayan Buzzard	*Buteo refectus*	Accipitridae	LC
91	Himalayan Cutia	*Cutia nipalensis*	Leiothrichidae	LC
92	Himalayan Griffon	*Gyps himalayensis*	Accipitridae	NT
93	Himalayan Monal	*Lophophorus impejanus*	Phasianidae	LC
94	Himalayan Owl	*Strix nivicolum*	Strigidae	LC
95	Himalayan Prinia	*Prinia crinigera*	Cisticolidae	LC
96	Himalayan White-browed Rosefinch	*Carpodacus thura*	Fringillidae	LC
97	Hoary-throated Barwing	*Actinodura nipalensis*	Leiothrichidae	LC

98	Hodgson's Redstart	*Phoenicurus hodgsoni*	Muscicapidae	LC
99	House Sparrow	*Passer domesticus*	Passeridae	LC
100	House Swift	*Apus nipalensis*	Apodidae	LC
101	Indian Blue Robin	*Larvivora brunnea*	Muscicapidae	LC
102	Indian Cuckoo	*Cuculus micropterus*	Cuculidae	LC
103	Indian White-eye	*Zosterops palpebrosus*	Zosteropidae	LC
104	Kalij Pheasant	*Lophura leucomelanos*	Phasianidae	LC
105	Large Hawk-Cuckoo	*Hierococcyx sparverioides*	Cuculidae	LC
106	Large Niltava	*Niltava grandis*	Muscicapidae	LC
107	Large-billed Crow	*Corvus macrorhynchos*	Corvidae	LC
108	Large-billed Leaf Warbler	*Phylloscopus magnirostris*	Phylloscopidae	LC
109	Lemon-rumped Warbler	*Phylloscopus chloronotus*	Phylloscopidae	LC
110	Lesser Coucal	*Centropus bengalensis*	Cuculidae	LC
111	Lesser Cuckoo	*Cuculus poliocephalus*	Cuculidae	LC
112	Little Forktail	*Enicurus scouleri*	Muscicapidae	LC
113	Little Pied Flycatcher	*Ficedula westermanni*	Muscicapidae	LC
114	Long-tailed Minivet	*Pericrocotus ethologus*	Campephagidae	LC
115	Long-tailed Shrike	*Lanius schach*	Laniidae	LC
116	Maroon Oriole	*Oriolus traillii*	Oriolidae	LC
117	Mountain Bulbul	*Ixos mcclellandii*	Pycnonotidae	LC

118	Mountain Tailorbird	*Phyllergates cucullatus*	Scotocercidae	LC
119	Mrs. Gould's sunbird	*Aethopyga gouldiae*	Nectariniidae	LC
120	Nepal House-Martin	*Delichon nipalense*	Hirundinidae	LC
121	Northern Nutcracker	*Nucifraga caryocatactes*	Corvidae	LC
122	Olive-backed Pipit	*Anthus hodgsoni*	Motacillidae	LC
123	Orange-bellied Leafbird	*Chloropsis hardwickii*	Chloropseidae	LC
124	Oriental Magpie-Robin	*Copsychus saularis*	Muscicapidae	LC
125	Oriental Skylark	*Alauda gulgula*	Alaudidae	LC
126	Oriental Turtle-Dove	*Streptopelia orientalis*	Columbidae	LC
127	Plumbeous Redstart	*Phoenicurus fuliginosus*	Muscicapidae	LC
128	Pygmy Cupwing	*Pnoepyga pusilla*	Pnoepygidae	LC
129	Red Crossbill	*Loxia curvirostra*	Fringillidae	LC
130	Red-billed Leiothrix	*Leiothrix lutea*	Leiothrichidae	LC
131	Red-headed Trogon	*Harpactes erythrocephalus*	Trogonidae	LC
132	Red-tailed Minla	*Minla ignotincta*	Leiothrichidae	LC
133	Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	LC
134	Rosy Pipit	*Anthus roseatus*	Motacillidae	LC
135	Rufous Sibia	*Heterophasia capistrata*	Leiothrichidae	LC
136	Rufous-bellied Niltava	*Niltava sundara*	Muscicapidae	LC

137	Rufous-bellied Woodpecker	*Dendrocopos hyperythrus*	Picidae	LC
138	Rufous-breasted Accentor	*Prunella strophiata*	Prunellidae	LC
139	Rufous-breasted Bush Robin	*Tarsiger hyperythrus Muscicapidae*	Muscicapidae	LC
140	Rufous-capped Babbler	*Cyanoderma ruficeps*	Timaliidae	LC
141	Rufous-chinned Laughingthrush	*Lanthocincla rufogularis*	Leiothrichidae	LC
142	Rufous-gorgeted Flycatcher	*Ficedula strophiata*	Muscicapidae	LC
143	Rufous-throated Partridge	*Arborophila rufogularis*	Phasianidae	LC
144	Rufous-throated Wren-Babbler	*Spelaeornis caudatus*	Timaliidae	LC
145	Rufous-vented Tit	*Periparus rubidiventris*	Paridae	LC
146	Rufous-vented Yuhina	*Yuhina occipitalis*	Zosteropidae	LC
147	Rufous-winged Fulvetta	*Schoeniparus castaneceps*	Pellorneidae	LC
148	Russet Sparrow	*Passer cinnamomeus*	Passeridae	LC
149	Rusty-cheeked Scimitar-Babbler	*Erythrogenys erythrogenys*	Timaliidae	LC
150	Rusty-flanked Treecreeper	*Certhia nipalensis*	Certhiidae	LC
151	Rusty-fronted Barwing	*Actinodura egertoni*	Leiothrichidae	LC

152	Satyr Tragopan	*Tragopan satyra*	Phasianidae	LC
153	Scaly Thrush	*Zoothera dauma*	Turdidae	LC
154	Scaly-breasted Munia	*Lonchura punctulata*	Estrildidae	LC
155	Scarlet Minivet	*Pericrocotus speciosus*	Campephagidae	LC
156	Sikkim Treecreeper	*Certhia discolor*	Certhiidae	LC
157	Slaty-backed Forktail	*Enicurus schistaceus*	Muscicapidae	LC
158	Slender-billed Scimitar-Babbler	*Pomatorhinus superciliaris*	Timaliidae	LC
159	Small Niltiva	*Niltava macgrigoriae*	Muscicapidae	LC
160	Snow Pigeon	*Columba leuconota*	Columbidae	LC
161	Snowy-browed Flycatcher	*Ficedula hyperythra*	Muscicapidae	LC
162	Speckled Piculet	*Picumnus innominatus*	Picidae	LC
163	Speckled Wood-Pigeon	*Columba hodgsonii*	Columbidae	LC
164	Spot bellied Eagle-Owl	*Ketupa nipalensis*	Strigidae	LC
165	Spotted Dove	*Spilopelia chinensis*	Columbidae	LC
166	Spotted Forktail	*Enicurus maculatus*	Muscicapidae	LC
167	Spotted Laughingthrush	*Lanthocincla ocellata*	Leiothrichidae	LC
168	Square-tailed Drongo-Cuckoo	*Surniculus lugubris*	Cuculidae	LC

169	Streak-breasted Scimitar-Babbler	*Pomatorhinus ruficollis*	Timaliidae	LC
170	Striated Bulbul	*Alcurus striatus*	Pycnonotidae	LC
171	Striated Laughingthrush	*Grammatoptila striata*	Leiothrichidae	LC
172	Stripe-throated Yuhina	*Yuhina gularis*	Zosteropidae	LC
173	Tickell's Leaf Warbler	*Phylloscopus affinis*	Phylloscopidae	LC
174	Ultramarine Flycatcher	*Ficedula superciliaris*	Muscicapidae	LC
175	Verditer Flycatcher	*Eumyias thalassinus*	Muscicapidae	LC
176	Ward's Trogon	*Harpactes wardi*	Trogonidae	LC
177	Wedge-tailed Green Pigeon	*Treron sphenurus*	Columbidae	LC
178	Western Yellow Wagtail	*Motacilla flava*	Motacillidae	LC
179	Whiskered Yuhina	*Yuhina flavicollis*	Zosteropidae	LC
180	Whistler Warbler	*Phylloscopus whistleri*	Phylloscopidae	LC
181	White Wagtail	*Motacilla alba*	Motacillidae	LC
182	White-browed Fulvetta	*Fulvetta vinipectus*	Paradoxornithidae	LC
183	White-browed Shrike-Babbler	*Pteruthius aeralatus*	Vireonidae	LC
184	White-capped Redstart	*Phoenicurus leucocephalus*	Muscicapidae	LC
185	White-collared Blackbird	*Turdus albocinctus*	Turdidae	LC

186	White-crested Laughingthrush	*Garrulax leucolophus*	Leiothrichidae	LC
187	White-spectacled Warbler	*Phylloscopus intermedius*	Phylloscopidae	LC
188	White-tailed Nuthatch	*Sitta himalayensis*	Sittidae	LC
189	White-throated Fantail	*Rhipidura albicollis*	Rhipiduridae	LC
190	White-throated Laughingthrush	*Pterorhinus albogularis*	Leiothrichidae	LC
191	White-throated Redstart	*Phoenicurus schisticeps*	Muscicapidae	LC
192	White-winged Grosbeak	*Mycerobas carnipes*	Fringillidae	LC
193	White-winged Redstart	*Phoenicurus erythrogastrus*	Muscicapidae	LC
194	Yellow-throated Fulveta	*Schoeniparus cinereus*	Pellorneidae	LC
195	Yellow-bellied Fairy-Fantail	*Chelidorhynx hypoxanthus*	Stenostiridae	LC
196	Yellow-bellied Warbler	*Abroscopus superciliaris*	Scotocercidae	LC
197	Yellow-billed Blue-Magpie	*Urocissa flavirostris*	Corvidae	LC
198	Yellow-breasted Greenfinch	*Chloris spinoides*	Fringillidae	LC
199	Yellow-browed Tit	*Sylviparus modestus*	Paridae	LC
200	Yellow-vented warbler	*Phylloscopus cantator*	Phylloscopidae	LC

Annexure 4: Tree list

Sl.No	Species	Family
1	*Abies densa*	Pinaceae
2	*Acer campbellii*	Aceraceae
3	*Acer cappadocicum*	Aceraceae
4	*Acer hookeri*	Aceraceae
5	*Acer oblongum*	Aceraceae
6	*Acer pectinatum*	Aceraceae
7	*Acer sikkimensis*	Aceraceae
8	*Acer sterculiaceum*	Aceraceae
9	*Alangium chinense*	Alangiaceae
10	*Albizia julibrissin*	Leguminosae
11	*Albizia lucidior*	Leguminosae
12	*Albizia odoratissima*	Leguminosae
13	*Alnus nepalensis*	Betulaceae
14	*Antidesma acuminatum*	Euphorbiaceae
15	*Bauhinia purpurea*	Leguminosae
16	*Betula alnoides*	Betulaceae
17	*Betula utilis*	Betulaceae
18	*Bischofia javanica*	Bischofiaceae
19	*Bombax ceiba*	Bombacaceae
20	*Brassaiopsis glomerulata*	Araliaceae
21	*Brassaiopsis hainla*	Araliaceae
22	*Brassaiopsis hispida*	Araliaceae
23	*Brassaiopsis mitis*	Araliaceae
24	*Buddleja colveili*	Buddlejaceae
25	*Buddleja forrestii*	Buddlejaceae
26	*Buddleja paniculata*	Buddlejaceae
27	*Carpinus viminea*	Betulaceae
28	*Casearia glomerata*	Flacourtiaceae
29	*Cassia fistula*	Leguminosae
30	*Castanopsis tribuloides*	Fagaceae
31	*Cinnamomum glanduliferum*	Lauraceae

32	*Cinnamomum impressinervium*	Lauraceae
33	*Citrus medica*	Rutaceae
34	*Clerodendrum colebrookianum*	Verbenaceae
35	*Cornus capitata*	Cornaceae
36	*Corylopsis himalayana*	Hamamelidaceae
37	*Corylus ferox*	Betulaceae
38	*Croton caudatus*	Euphorbiaceae
39	*Cupressus corneyana*	Cupressaceae
40	*Dalbergia sericea*	Leguminosae
41	*Dalbergia stipulacea*	Leguminosae
42	*Daphniphyllum chartaceum*	Daphniphyllaceae
43	*Daphniphyllum himalayense*	Daphniphyllaceae
44	*Diospyros lotus*	Ebenaceae
45	*Diploknema butyracea*	Sapotaceae
46	*Docynia indica*	Rosaceae
47	*Dodecadenia grandiflora var. grandiflora*	Lauraceae
48	*Dodecadenia grandiflora var. griffithii*	Lauraceae
49	*Ehretia macrophylla*	Boraginaceae
50	*Elaeocarpus lanceifolius*	Elaeocarpaceae
51	*Engelhardia spicata var. spicata*	Juglandaceae
52	*Eriobotrya hookeriana*	Rosaceae
53	*Eriolaena spectabilis*	Sterculiaceae
54	*Erythrina arborescens*	Leguminosae
55	*Euonymus frigidus var. elongatus*	Celastraceae
56	*Euonymus grandiflorus*	Celastraceae
57	*Euonymus tingens*	Celastraceae
58	*Eurya cerasifolia*	Theaceae
59	*Eurycorymbus cavaleriei*	Sapindaceae
60	*Exbucklandia populnea*	Hamamelidaceae
61	*Falconeria insignis*	Euphorbiaceae
62	*Ficus concinna*	Moraceae
63	*Ficus glaberrima*	Moraceae
64	*Ficus oligodon*	Moraceae

65	*Ficus semicordata*	Moraceae
66	*Ficus subincisa*	Moraceae
67	*Fraxinus floribunda*	Oleaceae
68	*Gamblea ciliata*	Araliaceae
69	*Glochidion velutinum*	Euphorbiaceae
70	*Grewia eriocarpa*	Tiliaceae
71	*Hymenodictyon flaccidum*	Rubiaceae
72	*Ilex excelsa*	Aquifoliaceae
73	*Ilex fragilis*	Aquifoliaceae
74	*Ilex hookeri*	Aquifoliaceae
75	*Illicium griffithii*	Illiciaceae
76	*Juglans regia*	Juglandaceae
77	*Juniperus recurva*	Cupressaceae
78	*Kydia calycina*	Malvaceae
79	*Lannea coromandelica*	Anacardiaceae
80	*Ligustrum compactum*	Oleaceae
81	*Lindera melastomacea*	Lauraceae
82	*Lindera neesiana*	Lauraceae
83	*Lindera obtusiloba var. heterophylla*	Lauraceae
84	*Lindera pulcherrima*	Lauraceae
85	*Lithocarpus fenestratus*	Fagaceae
86	*Litsea cubeba*	Lauraceae
87	*Litsea elongata*	Lauraceae
88	*Litsea glutinosa*	Lauraceae
89	*Litsea monopetala*	Lauraceae
90	*Lyonia ovalifolia*	Ericaceae
91	*Lyonia villosa*	Ericaceae
92	*Macaranga pustulata*	Euphorbiaceae
93	*Macropanax dispermus*	Araliaceae
94	*Magnolia campbellii*	Magnoliaceae
95	*Mallotus nepalensis*	Euphorbiaceae
96	*Mallotus philippensis*	Euphorbiaceae
97	*Malus baccata*	Rosaceae

98	*Meliosma dilleniifolia*	Sabiaceae
99	*Meliosma pinnata*	Sabiaceae
100	*Merrilliopanax alpinus*	Araliaceae
101	*Michelia velutina*	Magnoliaceae
102	*Microtropis discolor*	Celastraceae
103	*Morus australis*	Moraceae
104	*Morus macroura*	Moraceae
105	*Murraya paniculata*	Rutaceae
106	*Myrica esculenta*	Myricaceae
107	*Myrsine seguinii*	Myrsinaceae
108	*Neocinnamomum caudatum*	Lauraceae
109	*Neolitsea foliosa*	Lauraceae
110	*Osmanthus suavis*	Oleaceae
111	*Parasassafras confertiflora*	Lauraceae
112	*Pentapanax fragrans*	Araliaceae
113	*Persea clarkeana*	Lauraceae
114	*Persea duthiei*	Lauraceae
115	*Persea odoratissima*	Lauraceae
116	*Photinia integrifolia*	Rosaceae
117	*Phyllanthus emblica*	Euphorbiaceae
118	*Pinus bhutanica*	Pinaceae
119	*Pinus roxburghii*	Pinaceae
120	*Populus glauca*	Salicaceae
121	*Premna bengalensis*	Verbenaceae
122	*Prunus carmesina*	Rosaceae
123	*Prunus cerasioides*	Rosaceae
124	*Prunus napaulensis*	Rosaceae
125	*Pyrus pashia*	Rosaceae
126	*Quercus glauca*	Fagaceae
127	*Quercus griffithii*	Fagaceae
128	*Quercus lamellosa*	Fagaceae
129	*Quercus lanata*	Fagaceae
130	*Quercus oxyodon*	Fagaceae

131	*Quercus semecarpifolia*	Fagaceae
132	*Radermachera sinica*	Bignoniaceae
133	*Rhododendron arboreum*	Ericaceae
134	*Rhododendron barbatum*	Ericaceae
135	*Rhododendron dalhousiae var. rhabtodum*	Ericaceae
136	*Rhododendron falconeri*	Ericaceae
137	*Rhododendron grande*	Ericaceae
138	*Rhododendron griffithianum*	Ericaceae
139	*Rhododendron hodgsonii*	Ericaceae
140	*Rhododendron kesangiae*	Ericaceae
141	*Rhododendron keysii*	Ericaceae
142	*Rhus hookeri*	Anacardiaceae
143	*Rhus succedanea*	Anacardiaceae
144	*Salix wallichiana*	Salicaceae
145	*Saurauia napaulensis*	Actinidiaceae
146	*Schefflera impressa*	Araliaceae
147	*Schima khasiana*	Theaceae
148	*Schima wallichii*	Theaceae
149	*Schoepfia griffithii*	Olacaceae
150	*Skimmia laureola var. multinervia*	Rutaceae
151	*Sloanea tomentosa*	Elaeocarpaceae
152	*Solanum erianthum*	Solanaceae
153	*Sorbus rufopilosa*	Rosaceae
154	*Sorbus thebetica*	Rosaceae
155	*Sorbus vestita*	Rosaceae
156	*Sterculia villosa*	Sterculiaceae
157	*Styrax serrulatus*	Styracaceae
158	*Symplocos glomerata*	Symplocaceae
159	*Symplocos ramosissima*	Symplocaceae
160	*Symplocos sumuntia*	Symplocaceae
161	*Syzygium cumini*	Myrtaceae
162	*Taxus baccata*	Taxaceae
163	*Terminalia bellirica*	Combretaceae

164	*Tetracentron sinense*	Tetracentraceae
165	*Tetradium fraxinifolium*	Rutaceae
166	*Toona ciliata*	Meliaceae
167	*Toricellia tiliifolia*	Cornaceae
168	*Trema politoria*	Ulmaceae
169	*Trema tomentosa*	Ulmaceae
170	*Tsuga dumosa*	Pinaceae
171	*Ulmus lanceifolia*	Ulmaceae
172	*Vitex negundo*	Verbenaceae
173	*Wendlandia grandis*	Rubiaceae
174	*Wightia speciosissima*	Scrophulariaceae
175	*Wrightia arborea*	Apocynaceae
176	*Zanthoxylum acanthopodium*	Rutaceae
177	*Zanthoxylum armatum*	Rutaceae
178	*Ziziphus incurva*	Rhamnaceae
179	*Ziziphus mauritiana*	Rhamnaceae
180	*Oreopanax sp*	Araliaceae
181	*Decaisnea insignis*	Lardizabalaceae
182	*Prunus spp*	Rosaceae
183	*Albizia sp*	Leguminosae
184	*Beilschmiedia sp*	Lauraceae
185	*Ficus sp*	Moraceae
186	*Glochidion sp*	Euphorbiaceae
187	*Meliosma pinnata*	Sabiaceae
188	*Michelia doltsopa*	Magnoliaceae
189	*Prunus sp*	Rosaceae
190	*Prunus undulata*	Rosaceae
191	*Sorbus microphylla*	Rosaceae
192	*Castanopsis indica*	Fagaceae
193	*Euonymus lucidus*	Celastraceae
194	*Prunus himalaica*	Rosaceae
195	*Viburnum nervosum*	Caprifoliaceae

Annexure 4: Shrub list

Sl.No	Species	Family
1	*Abelmoschus manihot*	Malvaceae
2	*Abrus precatorius*	Leguminosae
3	*Aconogonon molle*	Polygonaceae
4	*Actinidia strigosa*	Actinidiaceae
5	*Aechmanthera gossypina*	Acanthaceae
6	*Agapetes incurvata*	Ericaceae
7	*Agapetes serpens*	Ericaceae
8	*Ardisia macrocarpa*	Myrsinaceae
9	*Aristolochia griffithii*	Aristolochiaceae
10	*Aristolochia platanifolia*	Aristolochiaceae
11	*Artimesia myriantha*	Compositae
12	*Asparagus racemosus*	Asparagaceae
13	*Astilbe rivularis*	Saxifragaceae
14	*Astragalus sp*	Leguminosae
15	*Barleria cristata*	Acanthaceae
16	*Berberis aristata*	Berberidaceae
17	*Berberis griffithiana*	Berberidaceae
18	*Berberis napaulensis*	Berberidaceae
19	*Berberis wallichiana*	Berberidaceae
20	*Bistorta vacciniifolia*	Polygonaceae
21	*Boehmeria hamiltoniana*	Urticaceae
22	*Boehmeria macrophylla*	Urticaceae
23	*Boehmeria sp*	Urticaceae
24	*Boehmeria ternifolia*	Urticaceae
25	*Borinda grossa*	Gramineae
26	*Bridelia sikkimensis*	Euphorbiaceae
27	*Buddleja asiatica*	Buddlejaceae
28	*Butea buteiformis*	Leguminosae
29	*Cadiocrinum giganteum*	Liliaceae
30	*Caesalpinia decapetala*	Leguminosae
31	*Cajanus molle*	Leguminosae

32	*Campylotropis speciosa*	Leguminosae
33	*Canabis sativa*	Canabaceae
34	*Carpesium abrontanoides*	Compositae
35	*Casearia graveolens*	Flacourtiaceae
36	*Chimonobambusa callosa*	Gramineae
37	*Clematis acuminata*	Ranunculaceae
38	*Clematis buchananiana*	Ranunculaceae
39	*Clematis connata*	Ranunculaceae
40	*Clematis ranunculoides*	Ranunculaceae
41	*Clematis smilacifolia*	Ranunculaceae
42	*Coix lacryma-jobi*	Poaceae
43	*Coriaria nepalensis*	Coriariaceae
44	*Cotoneaster acuminatus*	Rosaceae
45	*Cotoneaster microphyllus*	Rosaceae
46	*Crotalaria capitata*	Leguminosae
47	*Crotalaria tetragona*	Leguminosae
48	*Cyathula capitata*	Amaranthaceae
49	*Daphne bholua*	Thymelaeaceae
50	*Debregeasia longifolia*	Urticaceae
51	*Dendrocalamus hamiltonii*	Gramineae
52	*Desmodium confertum*	Leguminosae
53	*Desmodium elegans*	Leguminosae
54	*Dicentra scandens*	Fumariaceae
55	*Dioscorea bulbifera*	Dioscoreaceae
56	*Dioscorea deltoidea*	Dioscoreaceae
57	*Dioscorea pentaphylla*	Dioscoreaceae
58	*Dischidia benghalensis*	Asclepiadaceae
59	*Dufrenoya granulata*	Santalaceae
60	*Eclipta prostrata*	Compositae
61	*Elaeagnus parvifolia*	Elaeagnaceae
62	*Elaeagnus pyriformis*	Elaeagnaceae
63	*Elatostema lineolatum*	Urticaceae
64	*Elsholtzia flava*	Labiatae

65	*Elsholtzia fruticosa*	Labiatae
66	*Embelia floribunda*	Myrsinaceae
67	*Enkianthus deflexus*	Ericaceae
68	*Entada rheedii*	Leguminosae
69	*Euonymus echinatus*	Celastraceae
70	*Euonymus frigidus*	Celastraceae
71	*Euphorbia pulcherrima*	Euphorbiaceae
72	*Eurya acuminata*	Theaceae
73	*Ficus hederacea*	Moraceae
74	*Ficus sarmentosa*	Moraceae
75	*Flemingia macrophylla*	Leguminosae
76	*Flemingia strobilifera*	Leguminosae
77	*Flueggea virosa*	Euphorbiaceae
78	*Gaultheria fragrantissima*	Ericaceae
79	*Gaultheria griffithianum*	Ericaceae
80	*Gaultheria hookeri*	Ericaceae
81	*Gaultheria nummularioides*	Ericaceae
82	*Gaultheria semi-infera*	Ericaceae
83	*Girardinia diversifolia*	Urticaceae
84	*Gouania leptostachya*	Rhamnaceae
85	*Hedera nepalensis*	Araliaceae
86	*Hedychium sp*	Zingiberaceae
87	*Hedyotis scandens*	Rubiaceae
88	*Hemidesmus indicus*	Apocynaceae
89	*Holboellia latifolia*	Lardizabalaceae
90	*Holmskioldia sanguinea*	Labiatae
91	*Hoya globulosa*	Asclepiadaceae
92	*Hoya linearis*	Asclepiadaceae
93	*Hoya polyneura*	Asclepiadaceae
94	*Hydrangea anomala*	Hydrangeaceae
95	*Hydrangea heteromalla*	Hydrangeaceae
96	*Hydrangea sp*	Hydrangeaceae
97	*Hypericum choisianum*	Hypericaceae

98	*Hypericum griffithii*	Hypericaceae
99	*Hypericum sp*	Hypericaceae
100	*Ichnocarpus frutescens*	Apocynaceae
101	*Indigofera cassioides*	Leguminosae
102	*Indigofera dosua*	Leguminosae
103	*Isodon coetsa*	Labiatae
104	*Jasminum dispermum*	Oleaceae
105	*Jasminum grandiflorum*	Oleaceae
106	*Justicia adhatoda*	Acanthaceae
107	*Lagera crispata*	Compositae
108	*Leptodermis lanceolata*	Rubiaceae
109	*Leycesteria formosa*	Caprifoliaceae
110	*Ligularia amplexicaulis*	Compositae
111	*Ligularia mortonii*	Compositae
112	*Ligustrum confusum*	Oleaceae
113	*Lindenbergia grandiflora*	Scrophulariaceae
114	*Lindenbergia griffithii*	Scrophulariaceae
115	*Lobelia montana*	Campanulaceae
116	*Lonicera acuminata*	Caprifoliaceae
117	*Luculia gratissima*	Rubiaceae
118	*Maesa montana*	Myrsinaceae
119	*Maytenus kurzii*	Celastraceae
120	*Melastoma normale*	Melastomataceae
121	*Millettia pachycarpa*	Leguminosae
122	*Mucuna imbricata*	Leguminosae
123	*Murraya koenigii*	Rutaceae
124	*Myrsine semiserrata*	Myrsinaceae
125	*Neillia rubiflora*	Rosaceae
126	*Neillia thyrsiflora*	Rosaceae
127	*Neohymenopogon parasiticus*	Rubiaceae
128	*Osbeckia nutans*	Melastomataceae
129	*Osyris lanceolata*	Santalaceae
130	*Oxyspora paniculata*	Melastomataceae

131	*Paederia foetida*	Rubiaceae
132	*Parthenium hysterophorus*	Compositae
133	*Parthenocissus semicordata*	Vitaceae
134	*Pegia nitida*	Anacardiaceae
135	*Pentapanax parasiticus*	Araliaceae
136	*Periploca calophylla*	Asclepiadaceae
137	*Persicaria chinensis*	Polygonaceae
138	*Philadelphus tomentosus*	Philadelphaceae
139	*Piptanthus nepalensis*	Leguminosae
140	*Pouzolzia sanguinea*	Urticaceae
141	*Prinsepia utilis*	Rosaceae
142	*Pseudocaryopteris bicolor*	Labiatae
143	*Pseudocaryopteris paniculata*	Labiatae
144	*Rhaphidophora decursiva*	Araceae
145	*Rhamnus nepalensis*	Rhamnaceae
146	*Rhododendron camelliiflorum*	Ericaceae
147	*Rhododendron cinnabarinum*	Ericaceae
148	*Rhododendron edgeworthii*	Ericaceae
149	*Rhododendron glaucophyllum*	Ericaceae
150	*Rhododendron kendrickii*	Ericaceae
151	*Rhododendron lanatum*	Ericaceae
152	*Rhododendron lindleyi*	Ericaceae
153	*Rhododendron maddenii*	Ericaceae
154	*Rhododendron pendulum*	Ericaceae
155	*Rhododendron setosum*	Ericaceae
156	*Rhus chinensis*	Anacardiaceae
157	*Rhus paniculata*	Anacardiaceae
158	*Ribes griffithii*	Grossulariaceae
159	*Ribes laciniatum*	Grossulariaceae
160	*Rosa brunonii*	Rosaceae
161	*Rubia cordifolia*	Rubiaceae
162	*Rubus acuminatus*	Rosaceae
163	*Rubus biflorus*	Rosaceae

164	*Rubus ellipticus*	Rosaceae
165	*Rubus indotibetanus*	Rosaceae
166	*Rubus lineatus*	Rosaceae
167	*Rubus macilentus*	Rosaceae
168	*Rubus niveus*	Rosaceae
169	*Rubus pentagonus*	Rosaceae
170	*Rubus splendidissimus*	Rosaceae
171	*Rubus treutleri*	Rosaceae
172	*Sabia campanulata*	Sabiaceae
173	*Salix sikkimensis*	Salicaceae
174	*Sambucus adnata*	Caprifoliaceae
175	*Sambucus nigra*	Adoxaceae
176	*Sarcococca hookeriana*	Buxaceae
177	*Schefflera bengalensis*	Araliaceae
178	*Schisandra grandiflora*	Schisandraceae
179	*Scurrula elata*	Loranthaceae
180	*Skimmia laureola*	Rutaceae
181	*Smilax elegans*	Smilacaceae
182	*Smilax menispermoidea*	Smilacaceae
183	*Smilax ferox*	Smilacaceae
184	*Solanum viarum*	Solanaceae
185	*Sorbus insignis*	Rosaceae
186	*Sorbus wallichii*	Rosaceae
187	*Spermadictyon suaveolens*	Rubiaceae
188	*Spiraea arcuata*	Rosaceae
189	*Spiraea bella*	Rosaceae
190	*Spiraea micrantha*	Rosaceae
191	*Stachyurus himalaicus*	Stachyuraceae
192	*Streptolirion volubile*	Commelinaceae
193	*Strobilanthes hamiltoniana*	Acanthaceae
194	*Strobilanthes tomentosa*	Acanthaceae
195	*Swertia bimaculata*	Gentianaceae
196	*Swida macrophylla*	Cornaceae

197	*Symplocos dryophila*	Symplocaceae
198	*Synotis trilligulata*	Compositae
199	*Tetrastigma rumicispermum*	Vitaceae
200	*Thladiantha cordifolia*	Cucurbitaceae
201	*Tinospora sinensis*	Menispermaceae
202	*Toddalia asiatica*	Rutaceae
203	*Tricholepis furcata*	Compositae
204	*Trichosanthes lepiniana*	Cucurbitaceae
205	*Tricyrtis maculata*	Uvulariaceae
206	*Triumfetta annua*	Malvaceae
207	*Urtica dioica*	Urticaceae
208	*Vaccinium dunalianum*	Ericaceae
209	*Vaccinium nummularia*	Ericaceae
210	*Vaccinium retusum*	Ericaceae
211	*Vaccinium vacciniaceum*	Ericaceae
212	*Ventilago denticulata*	Rhamnaceae
213	*Verbascum thapsus*	Scrophulariaceae
214	*Vernonia volkameriifolia*	Compositae
215	*Viburbum erubescens*	Caprifoliaceae
216	*Viburnum cylindricum*	Caprifoliaceae
217	*Viburnum foetidum*	Caprifoliaceae
218	*Viburnum mullaha*	Caprifoliaceae
219	*Viburnum nervosum*	Caprifoliaceae
220	*Vincetoxicum hirundinaria*	Asclepiadaceae
221	*Wallichia densiflora*	Arecaceae(Palmae)
222	*Woodfordia fruticosa*	Lythraceae
223	*Xanthium indicum*	Compositae
224	*Yushania sp*	Gramineae
225	*Zanthoxylum oxyphyllum*	Rutaceae
226	*Panax pseudoginseng*	Araliaceae
227	*Actinidia callosa*	Actinidiaceae
228	*Ribes spp*	Rosaceae
229	*Aconogonon polystachyum*	Polygonaceae

230	*Artemisia vulgaris*	Compositae
231	*Clematis montana*	Ranunculaceae
232	*Hypericum hookerianum*	Hypericaceae
233	*Maesa chisia*	Myrsinaceae
234	*Pieris formosa*	Ericaceae
235	*Piper pedicellatum*	Piperaceae
236	*Premna sp*	Lamiaceae
237	*Rosa sericea*	Rosaceae
238	*Rubus hypargyrus*	Rosaceae
239	*Skimmia arborescens*	Rutaceae
240	*Strobilanthes helicta*	Acanthaceae
241	*Vernonia saligna*	Compositae
242	*Viburnum cotinifolium*	Caprifoliaceae
243	*Rhododendron triflorum*	Ericaceae

Annexure 5: Herb list

Sl.No	Species	Family
1	*Acanthospermum hispidum*	Compositae
2	*Achyranthes aspera*	Amaranthaceae
3	*Achyranthes bidentata*	Amaranthaceae
4	*Acmella uliginosa*	Compositae
5	*Acorus calamus*	Acoraceae
6	*Adenophora khasiana*	Campanulaceae
7	*Adenostemma lavenia*	Compositae
8	*Aeschynanthus sp*	Gesneriaceae
9	*Ageratina adenophora*	Compositae
10	*Ageratum conyzoides*	Compositae
11	*Agrimonia pilosa*	Rosaceae
12	*Ainsliaea aptera*	Compositae
13	*Ainsliaea latifolia*	Compositae
14	*Ajuga macrosperma*	Labiatae
15	*Aletris pauciflora var. pauciflora*	Liliaceae
16	*Allium wallichii*	Alliaceae

17	*Alternanthera pungens*	Amaranthaceae
18	*Alternanthera sessilis*	Amaranthaceae
19	*Ammannia baccifera*	Lythraceae
20	*Anaphalis busua*	Compositae
21	*Anaphalis margaritacea*	Compositae
22	*Anaphalis nepalensis*	Compositae
23	*Anaphalis triplinervis*	Compositae
24	*Anemone rivularis*	Ranunculaceae
25	*Anisadenia pubescens*	Linaceae
26	*Anisadenia saxatilis*	Linaceae
27	*Argyreia venusta*	Convolvulaceae
28	*Arisaema echinatum*	Araceae
29	*Arisaema tortuosum*	Araceae
30	*Arthraxon hispidus*	Gramineae
31	*Asparagus sp*	Asparagaceae
32	*Aster albescens*	Compositae
33	*Aster sp*	Compositae
34	*Astragalus stipulatus*	Leguminosae
35	*Axonopus compressus*	Gramineae
36	*Balanophora involucrata*	Balanophoraceae
37	*Begonia josephii*	Begoniaceae
38	*Bidens pilosa*	Compositae
39	*Bidens tripartita*	Compositae
40	*Bistorta vivipara*	Polygonaceae
41	*Blumea aromatica*	Compositae,
42	*Blumea japonica*	Asteraceae
43	*Boerhavia diffusa*	Onagraceae
44	*Boschniakia himalaica*	Orobanchaceae
45	*Bryocarpum himalaicum*	Primulaceae
46	*Bupleurum candollei*	Umbelliferae
47	*Cajanus scarabaeoides*	Leguminosae
48	*Campanula pallida*	Campanulaceae
49	*Cardamine hirsuta*	Cruciferae

50	*Cardamine macrophylla*	Cruciferae
51	*Cardamine sp*	Cruciferae
52	*Carex baccans*	Cyperaceae
53	*Carpesium nepelense*	Compositae
54	*Cassia lechenaultiana*	Leguminosae
55	*Cautleya gracilis*	Zingiberaceae
56	*Cautleya spicata*	Zingiberaceae
57	*Centella asiatica*	Umbelliferae
58	*Ceropegia ludlowii*	Asclepiadaceae
59	*Chaetoseris cyanea*	Compositae
60	*Chenopodium ambrosioides*	Amaranthaceae
61	*Chrysosplenium nepalensis*	Saxifragaceae
62	*Circaea alpina*	Onagraceae
63	*Cissampelopsis corifolia*	Compositae
64	*Cleome viscosa*	Capparaceae
65	*Clinopodium umbrosum*	Labiatae
66	*Clintonia udensis*	Uvulariaceae
67	*Codonopsis gracilis*	Convolvulaceae
68	*Codonopsis viridis*	Campanulaceae
69	*Commelina palludosa*	Commelinaceae
70	*Conyza bonariensis*	Compositae
71	*Corallodiscus cooperi*	Gesneriaceae
72	*Corydalis leptocarpa*	Fumariaceae
73	*Cosmos bipinnatus*	Compositae
74	*Craniotome furcatus*	Labiatae
75	*Crassocephalum crepidioides*	Compositae
76	*Crawfurdia speciosa*	Gentianaceae
77	*Crotalaria sessiliflora*	Leguminosae
78	*Croton bonplandianum*	Euphorbiaceae
79	*Cuscuta reflexa*	Cuscutaceae
80	*Cyanotis vaga*	Commelinaceae
81	*Cymbopogon flexuosus*	Gramineae
82	*Cynoglossum furcatum*	Boraginaceae

83	*Cynthillium cinereum*	Compositae
84	*Cyperus cyperoides*	Cyperaceae
85	*Cyperus sp*	Cyperaceae
86	*Delphinium cooperi*	Ranunculaceae
87	*Desmodium sp*	Leguminosae
88	*Desmodium triflorum*	Leguminosae
89	*Dichrocephala integrifolia*	Compositae
90	*Dicliptera bupleuroides*	Acanthaceae
91	*Didymocarpus sp*	Gesneriaceae
92	*Dinetus racemosus*	Convolvulaceae
93	*Dipsacus inermis*	Dipsacaceae
94	*Disporum calcaratum*	Uvulariaceae
95	*Disporum cantoniense*	Uvulariaceae
96	*Drosera lunata*	Droseraceae
97	*Drymaria cordata*	Caryophyllaceae
98	*Duhaldea cappa*	Compositae
99	*Dumasia villosa*	Lpeguminosae
100	*Elatostema obtusum*	Urticaceae
101	*Elatostema sp*	Urticaceae
102	*Ellisiophyllum pinnatum*	Scrophulariaceae
103	*Elsholtzia ciliata*	Labiatae
104	*Elsholtzia strobilifera*	Labiatae
105	*Emilia sonchifolia*	Compositae
106	*Epilobium royleanum*	Onagraceae
107	*Equisetum diffusum*	Equisetaceae
108	*Erigeron multiradiatus*	Compositae
109	*Eriocapitella vitifolia*	Ranunculaceae
110	*Eupatorium mairei*	Compositae
111	*Euphorbia heterophylla*	Euphorbiaceae
112	*Euphorbia hirta*	Euphorbiaceae
113	*Euploca strigosa*	Boraginaceae
114	*Fagopyrum dibotrys*	Polygonaceae
115	*Fallopia convolvulus*	Polygonaceae

116	*Fimbristylis sp*	Cyperaceae
117	*Fragaria nubicola*	Rosaceae
118	*Galinsoga parviflora*	Compositae
119	*Galium aparine*	Rubiaceae
120	*Galium elegans*	Rubiaceae
121	*Gamochaeta pensylvanica*	Compositae
122	*Gentiana capitata*	Gentianaceae
123	*Gentiana cephalodes*	Gentianaceae
124	*Gentiana pedicellata*	Gentianaceae
125	*Geranium nepalense*	Geraniaceae
126	*Geranium polyanthes*	Geraniaceae
127	*Geranium procurrens*	Geraniaceae
128	*Gerbera maxima*	Compositae
129	*Geum aleppicum*	Rosaceae
130	*Globba sp*	Zingiberaceae
131	*Gomphrena celasioides*	Amaranthaceae
132	*Gynura nepalensis*	Compositae
133	*Hackelia uncinata*	Boraginaceae
134	*Halenia elliptica*	Gentianaceae
135	*Hedychium aurantiacum*	Zingiberaceae
136	*Hedychium spicatum*	Zingiberaceae
137	*Hemiphragma heterophyllum*	Scrophulariaceae
138	*Henckelia bifolia*	Gesneriaceae
139	*Heracleum nepalense*	Umbelliferae
140	*Hibiscus lobatus*	Malvaceae
141	*Houttuynia cordata*	Saururaceae
142	*Hydrocotyle himalaica*	Umbelliferae
143	*Hydrocotyle nepalensis*	Umbelliferae
144	*Hydrocotyle sipthorpioides*	Umbelliferae
145	*Hypericum elodeioides*	Hypericaceae
146	*Hypericum japonicum*	Hypericaceae
147	*Hyptis suaveolens*	Labiatae
148	*Impatiens arguta*	Balsaminaceae

149	*Impatiens cristata*	Balsaminaceae
150	*Impatiens racemosa*	Balsaminaceae
151	*Impatiens stenantha*	Balsaminaceae
152	*Indigofera linifolia*	Leguminosae
153	*Inula hookeri*	Compositae
154	*Isodon atroruber*	Labiatae
155	*Isodon lophanthoides*	Labiatae
156	*Jacobaea analoga*	Compositae
157	*Juncus sp*	Juncaceae
158	*Juncus thomsonii*	Juncaceae
159	*Kalanchoe integra*	Crassulaceae
160	*Koenigia campanulata*	Polygonaceae
161	*Kyllinga brevisfolia*	Cyperaceae
162	*Laportea bulbifera*	Urticaceae
163	*Laportea terminalis*	Urticaceae
164	*Lecanthus peduncularis*	Urticaceae
165	*Lepidium virginicum*	Cruciferae
166	*Lespedeza juncea*	Leguminosae
167	*Leucas aspera*	Labiatae
168	*Leucas ciliata*	Labiatae
169	*Lindenbergia indica*	Scrophulariaceae
170	*Lindernia sp*	Scrophulariaceae
171	*Lobelia nummularia*	Campanulaceae
172	*Lobelia seguinii*	Campanulaceae
173	*Lysimachia congestiflora*	Primulaceae
174	*Lysionotus serratus*	Gesneriaceae
175	*Maianthemum fuscum*	Convallariaceae
176	*Maianthemum oleraceum*	Convallariaceae
177	*Maianthemum purpureum*	Convallariaceae
178	*Mazus pumilus*	Scrophulariaceae
179	*Mazus surculosus*	Scrophulariaceae
180	*Meconopsis sinuata*	Papaveraceae
181	*Melanoseris bracteata*	Compositae

182	*Melanoseris macrorhiza*	Compositae
183	*Melissa axillaris*	Labiatae
184	*Mentha spicata*	Labiatae
185	*Mikania micrantha*	Compositae
186	*Mimosa pudica*	Leguminosae
187	*Mimulus nepalensis*	Scrophulariaceae
188	*Miscanthus nepalensis*	Gramineae
189	*Molineria capitulata*	Hypoxidaceae
190	*Monotropa hypopitys*	Monotropaceae
191	*Monotropa uniflora*	Monotropaceae
192	*Myriactis nepalensis*	Compositae
193	*Myriactis wallichii*	Compositae
194	*Notochaeta hamosa*	Labiatae
195	*Oenanthe javanica*	Umbelliferae
196	*Ophiopogon clarkei*	Convallariaceae
197	*Ophiorhiza sp*	Rubiaceae
198	*Oplismenus compositus*	Poaceae
199	*Oxalis corniculata*	Oxalidaceae
200	*Oxalis griffithii*	Oxalidaceae
201	*Paris polyphylla*	Trilliaceae
202	*Parochetus communis*	Leguminosae
203	*Pedicularis bifida*	Scrophulariaceae
204	*Pedicularis gracilis*	Scrophulariaceae
205	*Peperomia tetraphylla*	Piperaceae
206	*Peracarpa carnosa*	Campanulaceae
207	*Persicaria capitata*	Polygonaceae
208	*Persicaria nepalensis*	Polygonaceae
209	*Persicaria runcinata*	Polygonaceae
210	*Persicaria sp*	Polygonaceae
211	*Picris hieracioides*	Compositae
212	*Pilea scripta*	Urticaceae
213	*Pilea symmeria*	Urticaceae
214	*Piloselloides hirsuta*	Compositae

215	*Plantago erosa*	Plantaginaceae
216	*Pogostemon linearis*	Labiatae
217	*Polygonatum punctatum*	Convallariaceae
218	*Potentilla indica*	Rosaceae
219	*Potentilla lineata*	Rosaceae
220	*Pouzolzia hirta*	Urticaceae
221	*Primula capitata*	Primulaceae
222	*Primula denticulata*	Primulaceae
223	*Primula filipes*	Primulaceae
224	*Primula gracilipes*	Primulaceae
225	*Prunella vulgaris*	Labiatae
226	*Pseudognaphalium affine*	Compositae
227	*Pseudognaphalium hypoleucum*	Compositae
228	*Pueraria peduncularis*	Leguminosae
229	*Pyrola corbieri*	Pyrolaceae
230	*Ranunculus chinensis*	Ranunculaceae
231	*Ranunculus diffusus*	Ranunculaceae
232	*Rorripa palustris*	Cruciferae
233	*Roscoea megalantha*	Zingiberaceae
234	*Rubus calycinus*	Rosaceae
235	*Rubus nepalensis*	Rosaceae
236	*Rubus paniculatus*	Rosaceae
237	*Rumex nepalensis*	Polygonaceae
238	*Saccharum rufipilum*	Gramineae
239	*Sagina japonica*	Caryophyllaceae
240	*Sagittaria sagitata*	Alismataceae
241	*Salvia plectranthoides*	Labiatae
242	*Sanicula alata*	Umbelliferae
243	*Sarcopyramis napalensis*	Melastomataceae
244	*Saussurea deltoidea*	Compositae
245	*Saxifraga stenophylla*	Saxifragaceae
246	*Saxifraga strigosa*	Saxifragaceae
247	*Scutellaria discolor*	Labiatae

248	*Sedum sp*	Cruciferae
249	*Selinum wallichianum*	Umbelliferae
250	*Senecio scandens*	Compositae
251	*Shuteria involucrata*	Leguminosae
252	*Sida acuta*	Malvaceae
253	*Sida cordifolia*	Malvaceae
254	*Sigesbeckia orientalis*	Compositae
255	*Silene baccifera*	Caryophyllaceae
256	*Siphocranion macranthum*	Labiatae
257	*Sisyrinchium rosulatum*	Iridaceae
258	*Smilax munita*	Smilacaeae
259	*Solena amplexicaulis*	Cucurbitaceae
260	*Sonchus asper*	Compositae
261	*Sonchus oleraceus*	Compositae
262	*Sonchus wightianus*	Compositae
263	*Spergula arvensis*	Caryophyllaceae
264	*Spermacoce latifolia*	Labiatae
265	*Stellaria monosperma*	Caryophyllaceae
266	*Stellaria vestita*	Caryophyllaceae
267	*Stephania glabra*	Menispermaceae
268	*Streptopus simplex*	Uvulariaceae
269	*Strobilanthes nutans*	Acanthaceae
270	*Strobilanthes wallichii*	Acanthaceae
271	*Swertia cordata*	Gentianaceae
272	*Swertia paniculata*	Gentianaceae
273	*Synotis alata*	Compositae
274	*Synotis cappa*	Compositae
275	*Synotis wallichii*	Compositae
276	*Tiarella polyphylla*	Saxifragaceae
277	*Taraxacum eriopodum*	Compositae
278	*Tetrastigma serrulatum*	Vitaceae
279	*Thalictrum foliolosum*	Ranunculaceae
280	*Thlaspi arvense*	Cruciferae

281	*Torenia cordifolia*	Scrophulariaceae
282	*Torilis japonica*	Umbelliferae
283	*Tridax procumbens*	Compositae
284	*Trifolium repens*	Leguminosae
285	*Tripterospermum volubile*	Gentianaceae
286	*Tupistra wattii*	Convallariaceae
287	*Utricularia striatula*	Lentibulariaceae
288	*Valeriana hardwickii*	Caprifoliaceae
289	*Valeriana jatamansii*	Caprifoliaceae
290	*Verbena officinalis*	Verbenaceae
291	*Veronica himalensis*	Scrophulariaceae
292	*Viola betonicifolia*	Violaceae
293	*Viola hookeri*	Violaceae
294	*Viola pilosa*	Violaceae
295	*Viscum nepalensis*	Santalaceae
296	*Zehneria japonica*	Cucurbitaceae
297	*Chlorophytum nepalense*	Anthericaceae
298	*Desmodium laxum*	Leguminosae
299	*Didymocarpus cinereus*	Gesneriaceae
300	*Androsace spp*	Saxifragaceae
301	*Sedum triactina*	Cruciferae
302	*Asparagus filicinus*	Asparagaceae
303	*Boenninghausenia albiflora*	Rutaceae
304	*Carex sp*	Cyperaceae
305	*Chamabainia cuspidata*	Urticaceae
306	*Chimaphila japonica*	Pyrolaceae
307	*Circaea alpina subsp. imaicola*	Onagraceae
308	*Commelina benghalensis*	Commelinaceae
309	*Heteropogon contortus*	Gramineae
310	*Impatiens sp*	Balsaminaceae
311	*Impatiens spirifer*	Balsaminaceae
312	*Leucas indica*	Labiatae
313	*Lysimachia alternifolia*	Primulaceae

314	*Ophiopogon intermedius*	Convallariaceae
315	*Ophiorrhiza spp*	Rubiaceae
316	*Oplismenus sp*	Gramineae
317	*Pilea sp*	Urticaceae
318	*Potentilla anserina*	Rosaceae
319	*Scleria terrestris*	Cyperaceae
320	*Setaria pumila*	Gramineae
321	*Strobilanthes sp*	Acanthaceae
322	*Viola biflora*	Violaceae

Annexure 6:Fern list

Sl.No	Species	Family
1	*Cheilanthes sp*	Polypodiaceae
2	*Drynaria propinqua*	Polypodiaceae
3	*Gleichenia gigantea*	Glecheniaceae
4	*Lepisorus sp*	Polypodiaceae
5	*Lycopodium clavatum*	Lycopodiaceae
6	*Lycopodium serratum*	Lycopodiaceae
7	*Monachosorum henryi*	Dennstaedtiaceae
8	*Nephrolepis cordifolia*	Nephrolepidaceae
9	*Onychium japonicum*	Pteridaceae
10	*Osmunda cinnamomea*	Osmundaceae
11	*Polystichum squarrosum*	Dryopteridaceae
12	*Pteridium aquilinum*	Pteridaceae
13	*Pteris cretica*	Pteridaceae
14	*Selaginella sp*	Selaginellaceae
15	*Woodwardia unigemmata*	Blechnaceae
16	*Oleandra wallichii*	Polypodiaceae
17	*Arachniodes superba*	Dryopteridaceae
18	*Asplenium ensiforme*	Aspleniaceae
19	*Athyrium eburneum*	Athyriaceae
20	*Athyrium fimbriatum*	Athyriaceae
21	*Athyrium vermae*	Athyriaceae

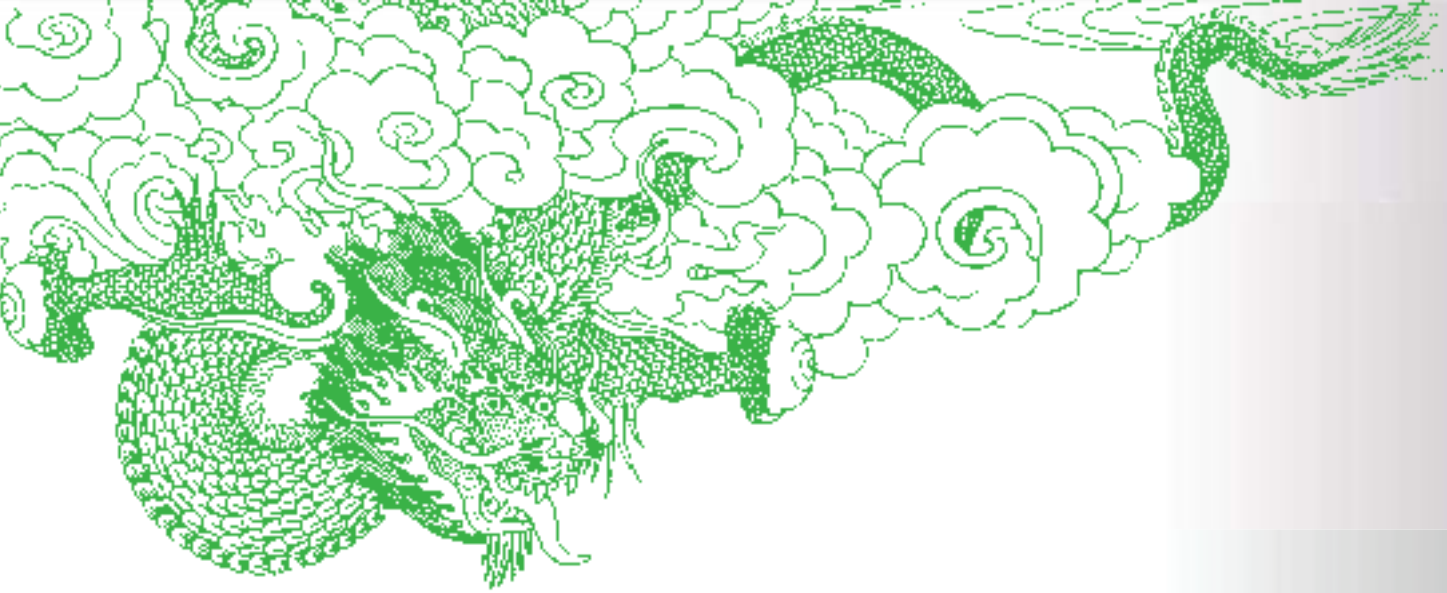
22	*Davallodes pulchra*	Davalliaceae
23	*Drynaria delavayi*	Polypodiaceae
24	*Dryopsis apiciflora*	Dryopteridaceae
25	*Dryopsis clarkei*	Dryopteridaceae
26	*Dryopteris fructosa*	Dryopteridaceae
27	*Dynaria mollis*	Polypodiaceae
28	*Goniophlebium argutum*	Polypodiaceae
29	*Hymenophyllum tenellum*	Hymenophyllaceae
30	*Hypolepis polypodiodes*	Dennstaedtiaceae
31	*Lemaphyllum rostratum*	Polypodiaceae
32	*Lepisorus loriformis*	Polypodiaceae
33	*Lepisorus scolopendrium*	Polypodiaceae
34	*Loxogramme chinensis*	Polypodiaceae
35	*Micropolypodium sikkimense*	Polypodiaceae
36	*Neocheiropteris zipelli*	Polypodiaceae
37	*Peranema aspidioides*	Dryopteridaceae
38	*Polypodiodes hendersonii*	Polypodiaceae
39	*Polypodiodes lachnopus*	Polypodiaceae
40	*Polystichum longipaleatum*	Dryopteridaceae
41	*Polystichum piceopaleaceum*	Dryopteridaceae
42	*Selaginella monospora*	Selaginellaceae
43	*Selliguea griffithiana*	Polypodiaceae
44	*Coniogramme pubescens*	Pteridaceae
45	*Diplazium spectabile*	Athyriaceae
46	*Diplazium stoliczkae*	Athyriaceae
47	*Dryopteris wallichiana*	Dryopteridaceae
48	*Plagiogyria pycnophylla*	Plagiogyriaceae
49	*Polystichum punctiferum*	Dryopteridaceae
50	*Pteridium revolutum*	Pteridaceae
51	*Pteris wallichiana*	Pteridaceae

Annexure 7: Orchid list

Sl.No	Species	Family
1	*Acampe ochracea*	Orchidaceae
2	*Acampe rigida*	Orchidaceae
3	*Agrostophyllum callosum*	Orchidaceae
4	*Anoectochilus brevilabris*	Orchidaceae
5	*Anthogonium gracile*	Orchidaceae
6	*Brachycorythis obcordata*	Orchidaceae
7	*Bulbophyllum emarginatum*	Orchidaceae
8	*Bulbophyllum reptans*	Orchidaceae
9	*Bulbophyllum retusiusculum*	Orchidaceae
10	*Bulbophyllum roseopictum*	Orchidaceae
11	*Bulbophyllum trongsaense*	Orchidaceae
12	*Bulbophyllum umbellatum*	Orchidaceae
13	*Calanthe mannii*	Orchidaceae
14	*Calanthe plantaginea*	Orchidaceae
15	*Calanthe tricarinata*	Orchidaceae
16	*Calanthe triplicata*	Orchidaceae
17	*Calanthe yuksomnensis*	Orchidaceae
18	*Cephalanthera damasonium*	Orchidaceae
19	*Cephalanthera erecta*	Orchidaceae
20	*Cerastostylis himalaica*	Orchidaceae
21	*Cheirostylis moniliformis*	Orchidaceae
22	*Chiloschista densiflora*	Orchidaceae
23	*Cleisostoma racemiferum*	Orchidaceae
24	*Cleisostoma williamsonii*	Orchidaceae
25	*Coelogyne corymbosa*	Orchidaceae
26	*Coelogyne fimbriata*	Orchidaceae
27	*Coelogyne nitida*	Orchidaceae
28	*Coelogyne prolifera*	Orchidaceae
29	*Coelogyne schultesii*	Orchidaceae
30	*Coelogyne stricta*	Orchidaceae
31	*Corybas himalaica*	Orchidaceae
32	*Cryptochilus luteus*	Orchidaceae
33	*Cryptochilus sanguineus*	Orchidaceae

34	*Cymbidium bicolor*	Orchidaceae
35	*Cymbidium erythraeum*	Orchidaceae
36	*Cymbidium hookerianum*	Orchidaceae
37	*Dendrobium aphyllum*	Orchidaceae
38	*Dendrobium chrysanthum*	Orchidaceae
39	*Dendrobium densiflorum*	Orchidaceae
40	*Dendrobium falconeri*	Orchidaceae
41	*Dendrobium fimbriatum*	Orchidaceae
42	*Dendrobium fuscescens*	Orchidaceae
43	*Dendrobium hookerianum*	Orchidaceae
44	*Dendrobium jenkinsii*	Orchidaceae
45	*Dendrobium longicornu*	Orchidaceae
46	*Dendrobium nobile*	Orchidaceae
47	*Diena ophrydis*	Orchidaceae
48	*Eria coronaria*	Orchidaceae
49	*Gastrochilus pseudodistichus*	Orchidaceae
50	*Goodyera biflora*	Orchidaceae
51	*Goodyera foliosa*	Orchidaceae
52	*Goodyera hemsleyana*	Orchidaceae
53	*Goodyera repens*	Orchidaceae
54	*Goodyera schlechtendaliana*	Orchidaceae
55	*Goodyera vittata*	Orchidaceae
56	*Gymnadenia orchidis var. orchidis*	Orchidaceae
57	*Herminium josephi*	Orchidaceae
58	*Herminium longilobatum*	Orchidaceae
59	*Holcoglossum himalaicum*	Orchidaceae
60	*Liparis elliptica*	Orchidaceae
61	*Liparis resupinata*	Orchidaceae
62	*Liparis viridiflora*	Orchidaceae
63	*Malaxis muscifera*	Orchidaceae
64	*Myrmechis pumila*	Orchidaceae
65	*Nervilia falcata*	Orchidaceae
66	*Oberonia acaulis*	Orchidaceae

67	*Oberonia caulescens*	Orchidaceae
68	*Oberonia falcata*	Orchidaceae
69	*Odontochilus lanceolatus*	Orchidaceae
70	*Oreorchis foliosa*	Orchidaceae
71	*Otochilus fuscus*	Orchidaceae
72	*Otochilus lancilabius*	Orchidaceae
73	*Panisea panchaseensis*	Orchidaceae
74	*Peristylus elisabethae*	Orchidaceae
75	*Phalaenopsis taenialis*	Orchidaceae
76	*Pholidota articulata*	Orchidaceae
77	*Pinalia amica*	Orchidaceae
78	*Pinalia leucantha*	Orchidaceae
79	*Pinalia spicata*	Orchidaceae
80	*Platanthera leptocaulon*	Orchidaceae
81	*Platanthera sikkimensis*	Orchidaceae
82	*Platanthera urceolata*	Orchidaceae
83	*Pleione praecox*	Orchidaceae
84	*Ponerorchis chusua*	Orchidaceae
85	*Satyrium nepalense*	Olacaceae
86	*Spiranthes sinensis*	Olacaceae
87	*Vanda bicolor*	Orchidaceae
88	*Vanda cristata*	Orchidaceae
89	*Vanda testacea*	Orchidaceae
90	*Vandopsis undulata*	Orchidaceae
91	*Zeuzine goodyeroides*	Orchidaceae
92	*Galeola lindleyana*	Orchidaceae
93	*Platanthera stenantha*	Orchidaceae
94	*Nervilia plicata*	Orchidaceae
95	*Pleione sp*	Orchidaceae



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