



CONSERVATION MANAGEMENT PLAN

(January 2023 - December 2032)

WANGCHUCK CENTENNIAL NATIONAL PARK

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



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Department of Forests and Park Services
Ministry of Energy and Natural Resources
Choekhor: Bumthang
Bhutan

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The landscape view of the valley in the north. Contributed by Sonam Wangmo, WCNP

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Wangchuck Centennial National Park, HQ. Contributed by Prakash Rai, WCNP

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ROYAL GOVERNMENT’S ENDORSEMENT AND APPROVAL

Conservation Management Plan for Wangchuck Centennial National Park (January 2023 - December 2032)

“In accordance with and as per the Forest and Nature Conservation Act of Bhutan, 1995”

Submitted for Approval

Chief Forestry Officer
Wangchuck Centennial National Park

Forwarded for Approval

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Ministry of Energy and Natural Resources





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SECRETARY

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Ministry of Energy and Natural Resources
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Thimphu

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FOREWORD

Wangchuck Centennial National Park was declared in 2008 as a tribute by the Government and people of Bhutan to the visionary and selfless leadership of the Wangchuck Dynasty. The establishment of this national park further fulfils the Royal Government of Bhutan's commitment of maintaining at least 60% of the total geographical area under forest cover for all time, as mandated by the Constitution of the Kingdom of Bhutan. This national park connects Jigme Dorji National Park in the west to the Bumdeling Wildlife Sanctuary in the east ensuring biological connectivity in the northern highlands of Bhutan. It is further connected to southern conservation landscapes by biological corridors, BC-7 and BC-8 forming an integral part of the protected area network of the country.

The national park spans over an area of 4914 sq.km across five Dzongkhags covering nine gewogs. The altitude of the park ranges from 1350-7500 m.a.s.l with vegetation types ranging from warm broadleaf forest to alpine meadows. The wide altitudinal range confers the park with diverse flora and fauna, with several charismatic species. The water towers, rivers and supporting watersheds in the park that feed the four river systems are vital for hydropower generation and thus, for Bhutan's economic development.

This management plan is developed as per the science-based technical guideline, Forest and Nature Conservation Code of Best Management Practices of Bhutan (Volume IV: Protected area management). Implementation of this management plan will ensure the conservation of biodiversity of the park in harmony with people's values and aspirations.

I applaud Wangchuck Centennial National Park for all the efforts put in for the development of this plan which will guide biodiversity conservation of the park for the next ten years.

Tashi Delek!



(Karma Tshering)



དཔལ་ལྷན་འབྲུག་གཞུང་། རྒྱལ་ཁྲིམས་དང་རང་བཞིན་ཐོན་སྐྱེད་ལྷན་ཁག་།

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Royal Government of Bhutan
Ministry of Energy and Natural Resources

Department of Forests and Park Services



PREFACE

The first conservation management plan of Wangchuck Centennial National Park oversaw the conservation of natural biodiversity of park through 2012 to 2017 for the period of five years. During the implementation of first management plan, notable progress has been made in fulfilling the treble demands of conservation, infrastructure development and enhancing livelihood of park residents through Integrated Conservation and Development Programs.

Development of this management plan followed technical guidelines prescribed by Forest and Nature Conservation Code of Best Management Practices of Bhutan (Volume IV: Protected area management). Therefore, the implementation of this plan will ensure that the protected area is managed through the integration of good science, research, technology and past management experiences. This conservation management plan has its footing on the foundation of biodiversity survey, socio-economic survey, local forest management planning, and stakeholder and community consultation.

This new plan comes with a clear vision, mission and goals with realistic, reckonable, and timebound objectives that are all geared towards accomplishing the goal of conserving the rich biodiversity of the park and ensuring continuous benefits from the ecosystem services.

I would like to congratulate and express my appreciation to the entire staff who were involved in the intensive field surveys and plan preparation.

With best wishes and Tashi Delek.

(Lebzang Dorji)

Director



ACKNOWLEDGEMENT

Wangchuck Centennial National Park is pleased to bring forward the second conservation management plan of the park. The conservation management plan will be implemented for ten years (2023 to 2033) and will form the main basis for implementation of conservation activities in the park. The park management would like to convey sincere acknowledgement to the following for the timely development of the management plan.

The park management would like to congratulate and extend sincere gratitude to all the field staff who have been actively involved in various field surveys. The management highly values their contributions and appreciates everyone for demonstrating unwavering commitment, dedication, and support on this historic endeavor.

The Nature Conservation Division (NCD) has been of great support in providing technical support and guidance throughout the plan preparation. Therefore, the park management would like to sincerely thank NCD for their timely support and guidance.

Management planning is a budget-intensive process, hence the management of WCNP attaches great importance to the continued financial support and assistance bestowed by the Royal Government of Bhutan (RGoB) and Bhutan for Life (BFL) project for providing financial support to carry out major portions of the plan revision expenses like rapid biodiversity survey, socio-economic survey, local forest management planning and community consultation for which we are immensely grateful.

Thank you,

(Tshering Dhendup)

Chief Forestry Officer

(Wangchuck Centennial National Park)



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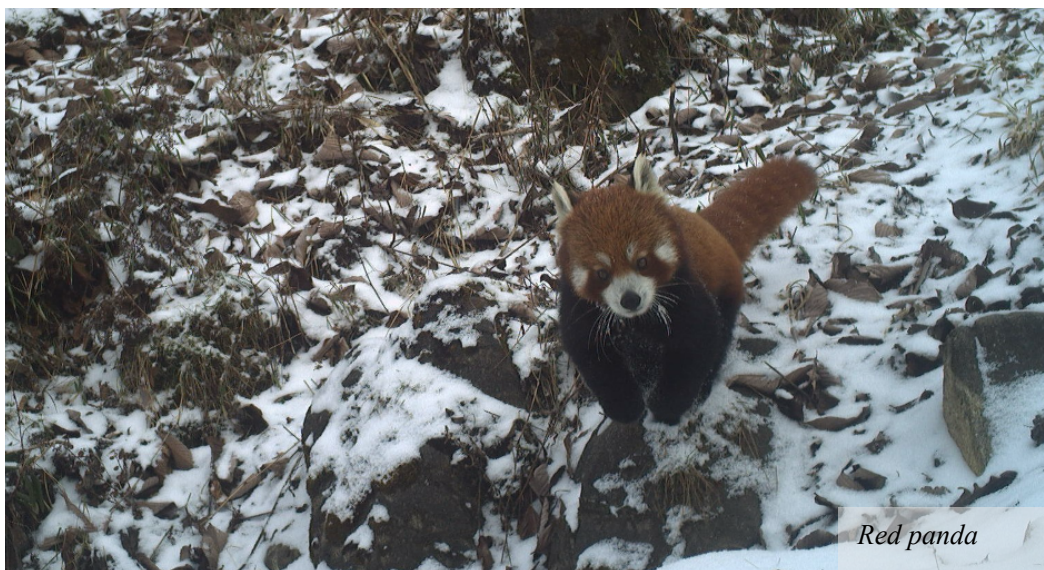
LIST OF ACRONYMS

ABTO:	Association of Bhutanese Tour Operators
BFL:	Bhutan for Life
CFMG:	Community Forest Management Group
CFO:	Chief Forestry Officer
DoFPS:	Department of Forests and Park Services
DoL:	Department of Livestock
FNCRR:	Forest and Nature Conservation Rules and Regulations
FYP:	Five Year Plan
FIRMS:	Forest Information Reporting & Monitoring System
FRMD:	Forest Resource and Management Division
GIGO:	Garbage in Garbage Out
GIS:	Geographical Information System
GPS:	Global Positioning Satellite
GT:	Geog Tshogde (Block Development Committee)
HH:	Households
HQ:	Head Quarter
HRD:	Human Resource Development
HRM:	Human Resource Management
ICDP:	Integrated Conservation and Development Program
ITMS:	Instituted of Traditional Medicine Services
LFMA:	Local Forest Management Area
MAP:	Medicinal and Aromatic Plants
METT:	Management Effectiveness Tracking Tool
MoAF:	Ministry of Agriculture and Forests
NCD:	Nature Conservation Division
NWFP:	Non-Wood Forest Products
PA:	Protected Area
PES:	Payment to Ecosystem Services
RGoB:	Royal Government of Bhutan
RNR-RDC:	Renewable Natural Resource Research & Development Center
SES:	SocioEconomic Survey
SMART :	Spatial Monitoring and Reporting Tools
DoTr:	Department of Tourism
WCNP:	Wangchuck Centennial National Park
WWF:	World Wildlife Fund



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EXECUTIVE SUMMARY

Wangchuck Centennial National Park (WCNP) is the largest and the newest protected area among the ten protected areas in Bhutan. The park falls within the political jurisdictions of the five Dzongkhags covering over nine gewogs. WCNP was formally gazetted on June 10, 2008 as a tribute to the Wangchuck dynasty for selflessly leading the country for 100 years.

The conservation management plan is the backbone for the functioning of the park. With the expiration of the first management plan in 2017, the work on the inception of the new management plan began in 2019. The plan preparation began with the rapid biodiversity assessment of the park and socio-economic survey in 2019 and field work on local forest management area was carried out in 2021.

The plan begins with the brief background on the conservation significance of Bhutan with a brief history and significance of WCNP. The vision, mission and goals of the park are also enlisted. The zonation of the park was completed in 2022, wherein the core zone, transition zone, multiple use zone and buffer comprise of 40.20%, 53.11%, 4.49% and 2.20% respectively.

Based on the rapid biodiversity assessment and previous record, the park has recorded 44 species of mammals, 693 species of vascular plants, 251 species of birds, 246 species of butterflies and 5 species of fish. As part of the socio-economic survey 783 households were interviewed based on strategic random sampling.

Chapter IV describes the threats and challenges. The threat analysis was done using the Miradi. The overall threat ranking as per the analysis was medium for WCNP. Keeping the threats and management challenges in mind, conservation goals, objectives and management prescriptions were designed.

Management prescription is divided into six broad objectives, 16 strategies and 75 strategic actions. For the implementation of the proposed activities, the total budget forecast for the entire plan period is Ngultrum 212.18 millions.



CHAPTER I

BACKGROUND

1.1. Bhutan in context

1.1.1. Bhutan's conservation history and approach

Buddhism plays a central, significant role in the lives of the Bhutanese and has shaped how people view nature. The Buddhist philosophy of respecting all forms has helped to conserve biodiversity through the centuries and has been integrated into Bhutanese culture. The Buddhist ethos, a conservation-minded leadership, and the small population that has not placed much demand on the natural ecosystems have enabled Bhutan to conserve its natural resources and beauty over the years.

A 'formal' protected areas system was established in the 1960s, with the vast Jigme Dorji National Park covering the entire northern region of the country established in 1974 (Nature Conservation Division, n.d.). Several smaller protected areas lay scattered along the southern border, but the important temperate broadleaf forests in the middle hills were largely excluded from this system. In 1995, the protected areas were revised to rectify this gap by adding several new protected areas in the mid-hills, and through boundary revisions to existing parks. In 1999 a system of corridors was designated to link the protected areas and transition to a landscape approach to conservation. The Wangchuck Centennial National Park (WCNP) was subsequently added to the protected areas system in 2008. The park included additional habitat for some of Bhutan's charismatic species, such as tiger, snow leopard, takin, Tibetan wolf, red panda, and also several glaciers and other water towers in the mountains.

1.2. History and significance of WCNP

Wangchuck Centennial National Park (WCNP) is the largest and newest protected area among the ten protected areas in Bhutan. The park falls within the political jurisdictions of five Dzongkhags covering over nine gewogs. It shares a boundary with Jigme Dorji National Park in the west and with Bumdeling Wildlife Sanctuary in the east, thus, forming an integral part of the protected area complex of the country. WCNP was formally gazetted on June 10, 2008 as a tribute to the Wangchuck dynasty for selflessly leading the country for 100 years. The park is one of the most important water towers in the country, feeding four major river systems,



namely Punatsangchhu, Mangdechhu, Chamkharchhu and Kurichhu, which are vital for the hydropower generation in the country. Located in the north-central part of the country, it harbors the candidate for the highest unclimbed mountain in the world, Mt. Gangkar Phuensum, and several other mountains like Rinchen Zoegila and Jazayla. The park also has the largest growing area for the Cordyceps the Gold of the Himalayas.

The altitude ranges from 1350 to 7500 m.a.s.l. (5100 m in old plan) with vegetation of the warm broadleaf forest to the alpine meadows. Almost 85% of the park area remains under snow cover during winter. Over 693 species of vascular plants, 44 species of mammals, 251 species of birds, and 246 species of butterflies (Wangchuck Centennial National Park, 2019) have been recorded so far in the park.

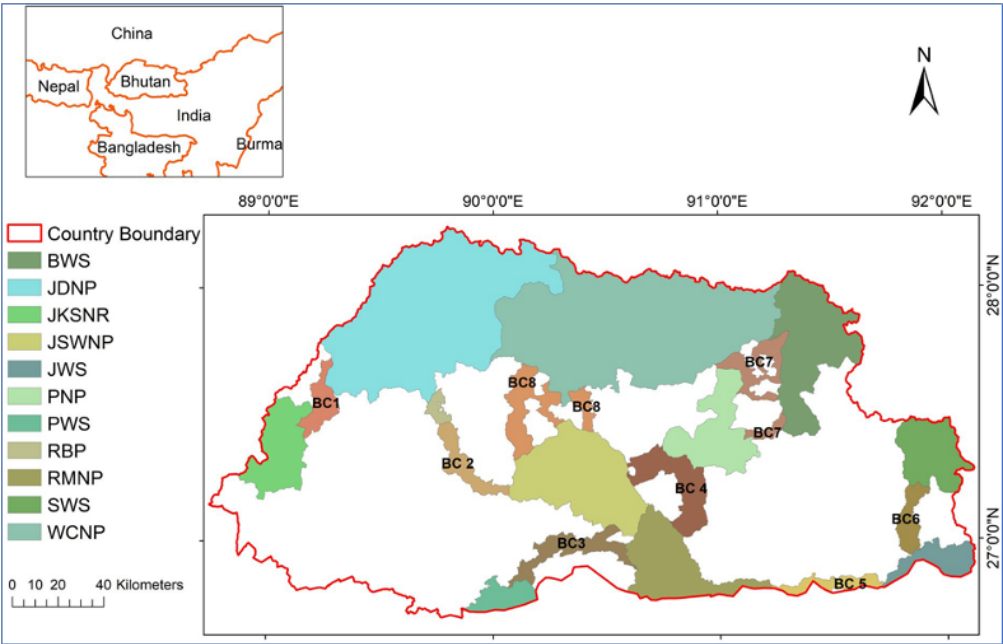


Figure 1: Protected area network of Bhutan

Some of mammals species found in the park includes Stoliczka’s mountain vole, Bengal tiger (*Panthera tigris*), snow leopard (*Panthera uncia*), common leopard (*Panthera pardus*), clouded leopard (*Neofelis nebulosa*), pallas cat (*Otocolobus manul*), himalayan black bear (*Ursus thibetanus*), himalayan musk deer (*Moschus sp.*), red panda (*Ailurus fulgens*), blue



sheep (*Pseudois nayur*), himalayan serow (*Capricornis thar*), sambar deer (*Rusa unicolor*), primates and small mammals.

WCNP is the only protected area in the country, wherein the Tibetan wolf (*Canis lupus*) presence was confirmed through camera trap during the nationwide snow leopard survey in 2016. Above all, the park is a treasure trove for the highly-priced and sought-after, the Chinese caterpillar *Opiocordyceps sinensis* widely known as Cordyceps. This mystic fungus is regarded as mountain gold, and thus, every year thousands of locals comb the alpine meadows for the Cordyceps hunt. Other important medicinal herbs include *Fritillaria delavayi*, *Veronica ciliata*, *Delphinium graciale*, *Nardostachys grandiflora*, *Neopicrorhiza scrophulariiflora*, *Meconopsis simplicifolia*, *Meconopsis hurridula*, *Aconitum hicksii*, *Corydalis dubia* and many more.

The park in itself contributes towards fulfilling the constitutional mandate of maintaining 60% of the country under forest cover in perpetuity, and it pursues one of the pillars of the Gross National Happiness, the conservation of the environment. Apart from its status as the largest protected area of the country, it hugely contributes to the national economy through the generation of hydropower energy, as the park is a reservoir of snowcapped mountains, glaciers, and glacial lakes, which feeds the river system necessary for the generation of hydropower electricity. Symbolically, the park has three national symbols, Takin the national animal, Raven the national bird; and Cypress the national tree.

The Himalayan wolf Canis lupus, an iconic canid of WCNP





1.3. Vision, Mission and Goals

1.3.1. Vision

“A healthy and thriving natural landscape where its resources and values are managed sustainably for perpetuity.”

1.3.2. Mission

Conserve and manage the national park through inclusive and integrated approaches for maximization of ecosystem services and sustainable utilization of natural resources.

1.3.3. Goals

The park’s mission is supported by the following goals:

- ☐ Conservation and protection of key species and their habitat.
- ☐ To ensure continuous ecological benefit from the major ecosystem of the park.
- ☐ To support the socio-economic well-being of the park residents.
- ☐ Sustainable management of natural resources in the park.

1.4. Salient features of the plan

The conservation management plan of the park has been broadly described in 7 major chapters. The plan begins with a brief description of Bhutan and its biodiversity and conservation significance, followed by a description of the history and significance of WCNP. The driving mantra of the park, the vision, mission, goals, and conservation objectives are stated in Chapter I. The area of WCNP constitutes 12.9% of the total land area in Bhutan, making it the largest protected area in the country. WCNP is further divided into four zones, namely the core zone, transition zone, multiple-use zone, and buffer zone.

Chapter II describes the current status of WCNP. The park falls within the administrative boundaries of five Dzongkhag across nine gewogs. The human occupies the low-lying valleys of the park, and around 783 households are situated across six different gewogs with 6640 residents. The information on the other three gewogs is missing because they were not included in the socio-economic survey, as other divisions provide the services in these places due to the proximity and convenience. The elevation in the park ranges from 1350 m.a.s.l. to 7500 m.a.s.l. The land is mostly covered by forest towards the south and with snow, glaciers, and rocky scree towards the north. The park is also home to valuable ethnobotanical plants. The elusive predators such as Tibetan wolf, Tiger, and Snow leopard roam the park area. This chapter also



describes the resource use area for the park residents under the local forest management area section.

Chapter III mainly summarizes the review of the past management plan. The past management plan was for a period of 5 years, starting from 2012 to 2017. It consisted of eight strategic goals and 67 strategic actions. Out of the 67 strategic actions, 53 were achieved. The 14 unachieved actions can be attributed to insufficient funds and staff and other unforeseen reasons. Of the 14 unachieved actions, some were carried over to the new management plan, while others were omitted due to their irrelevancy in the current scenario. The assessment report of Bhutan METT+, the lessons learned through the implementation of the programs, and the challenges and issues are also discussed in this chapter.

Chapter IV list the various threats under two broad headings; the conservation threats and the management threats. It follows with analyzing the threats to identify management prescriptions in Chapter 5. The threats were analyzed using the Mirada 4.5.0 software, and the result chain and the threat ranking were generated using the software. As per the analysis, the overall threat for WCNP was classified as medium.

Chapter V describes the various management prescriptions to be implemented in the park over the period of ten years. Management prescriptions are broadly divided into six objectives, with 16 strategies and 75 actions.

Chapter VI outlays the implementation plan, and the budget outlay for the various activities mentioned in Chapter V. The final Chapter VII of the management plan is the monitoring and the evaluation of the management prescriptions. It will allow for the monitoring of the activities and evaluate the successful implementation of the activities.

1.5. Zonation of WCNP

For the effective and ground-based management of the protected areas, it is paramount that the protected area is zoned into different management zones. The zoning is done as prescribed and guided by the Protected Area Zonation Guidelines of Bhutan 2020, framed by the Nature Conservation Division. As per this guideline, there are four distinctive zones: core zone, transition zone, buffer zone and multiple-use zone. All these zones have their own criteria and different management prescriptions. The degree of protection implies based on the functionality of the zones. Therefore, proper zonation is key to the effective and successful park management.



1.5.1. Zoning decision

As prescribed in the Protected Area (PA) Zonation Guidelines of Bhutan 2020, WCNP has four main functional zones viz. core zone, transition zone, multiple-use zone, and buffer zone. The Cordyceps collection area, temporary herder's camp, and grazing area for the herders are included in the transition zone. Under the multiple-use zone, two army outposts at Tsampa and Gomthang, a permanent herders camp in the Gomthang area, and religious institutions/Lhakhangs are included. 500m radius buffer has been taken from the edge of the fields and around settlements or traditionally used areas in which the communities have individual or communal rights.

1.5.2. Designation and description of the zones

The overall zonation of WCNP is carried out using MaxEnt, Zonation Software (Version 4) and ArcGIS 10.8 based on the available 11,900-point data of important flora and fauna. The area of different zones under WCNP is as follows:

1.5.2.1. Core zone

As set criteria in the zonation guidelines, landscapes with high conservation values that are indispensable for the integrity of ecosystems are set aside as a core zone. This zone is also known as the zone for no negotiation. Except for research and patrolling, any form of anthropogenic disturbance is strictly prohibited in this zone. Around 40.2% of the park area falls under the core zone.

Table 1: Zone, area and percentage cover of different zones under WCNP

Zone	Area (sq. km)	Coverage in Percentage
1. Core Zone	1975.827	40.20 %
2. Transition Zone	2609.941	53.11 %
3. Multiple Use Zone	220.745	4.49 %
4. Buffer Zone	108.121	2.20 %



1.5.2.2. Transition zone

The park area has human settlements and many religious and culturally significant places. These sites are veined with a network of routes and trails (eco-trails and traditional migratory routes). There are nomadic communities in the park who practice transhumance and have lived in these mountains for centuries, and have customary right over the distinct grassland (*tsamdro*). Moreover, there are many patches of alpine meadows wherein the highly sought-after medicinal fungi, the Cordyceps, is found. There are also *tsamdro* land and other trails located in the park. All of these areas having human activities for a certain duration of the year or throughout the year are clubbed as transition zone of the park. Around 53.11 % of the park area falls under the transition zone.

1.5.2.3. Multiple use zone

The multiple-use zone includes settlements, build-up areas, private registered lands and resource allocation areas for the protected area residents. In this zone, the park management and the stakeholders work together to manage and use the area in a sustainable manner to benefit both people and wildlife. Around 4.49% of the park area falls under the multiple-use zone.





1.5.2.4. *Buffer one*

A buffer zone is a certain scaled area around core and transition zones, which would give cushioning function to these zones from the anthropogenic interferences. The trails that pass through the transition zone will also be part of the buffer zone after assigning a minimum buffer width on either side (DoFPS, 2019). In the buffer zone, human intervention is less compared to the multiple-use zone. Around 2.2% of the park area falls under the buffer zone.

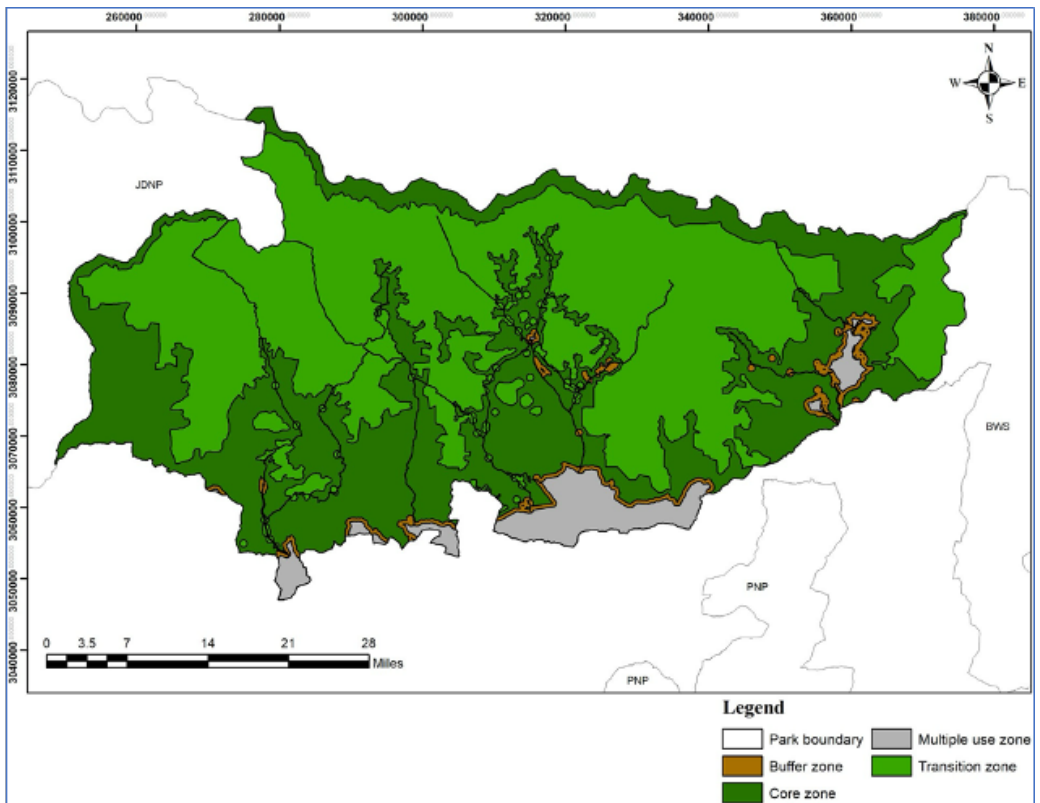


Figure 2: Zonation of WCNP



CHAPTER II

CURRENT STATUS OF WCNP

2.1. Landscape characteristics

2.1.1. Location

Located between 27°32'6" N 28°10'12" N latitudes and 89°59'09" E 91°17'6" E longitudes, WCNP falls within the administrative boundaries of five Dzongkhags across nine Gewogs. It shares its boundary with Jigme Dorji National Park (JDNP) in the west and with Bumdeling Wildlife Sanctuary (BWS) in the east. The whole of the park's northern boundary runs along the international border. In the southern belt, it shares its boundary with BC-07 in the southeast, BC-08 in the southwest, and with Bumthang Forest Division in the south-central belts.

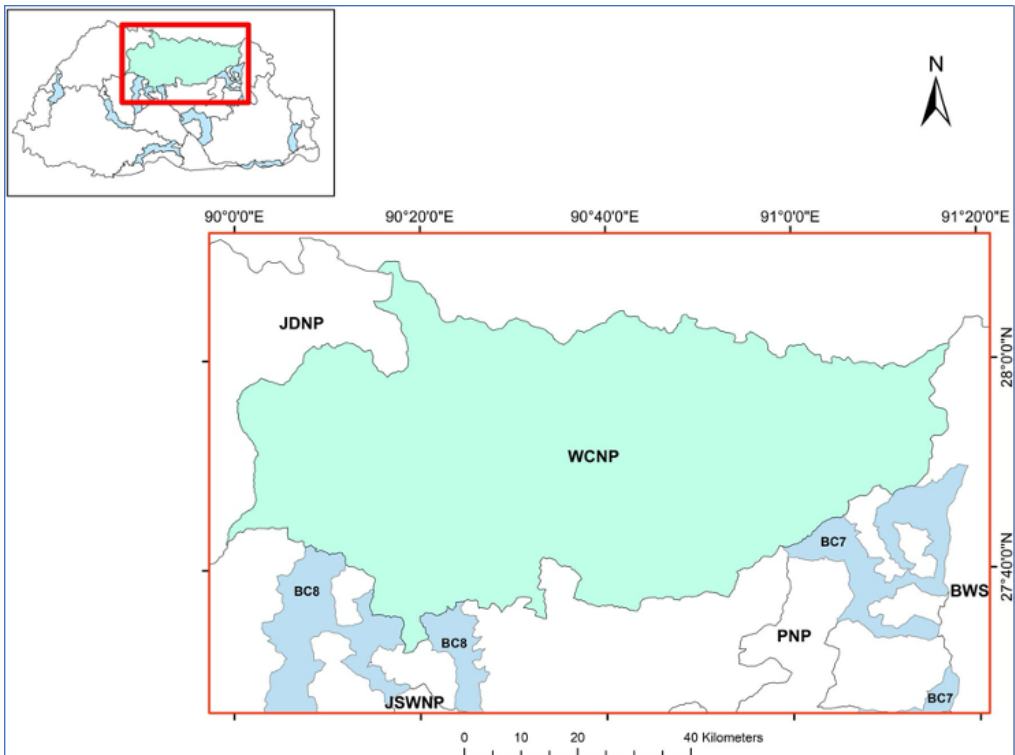


Figure 3: Map of WCNP and the periphery area



2.1.2. Elevation and aspect

From the sub-tropical low-lying valleys to the snowcapped mountain peaks, the altitude ranges from 1500-7500 m. Almost 85% of the park remains under snow cover for about four months.

2.1.3. Geography, geology, and land use type

With its altitudinal range of 1500-7500m, the soil types are podzols, brown forest soil, and some yellow forest soil (Okazaki, 1987). Sandy loam soil dominates the alpine meadows and scrubland, whereas, in the southern part of the park, soil types vary from clay to sandy loam. In the northern part of the park, the landform is all rugged, with steep terrains and rocky ridges with deposits of rocks. Above 4500 meters, geologically, it is the alpine rocky zones, and the area is covered with moraine, exposed sedimentary and granitic rocks. The park contains several permanently snowcapped mountain peaks like Gangkar Phuensum, Rinchen Zoegila, and Jazayla. Mount Gangkar Phuensum is one of the candidates for the highest unclimbed mountain in the world.

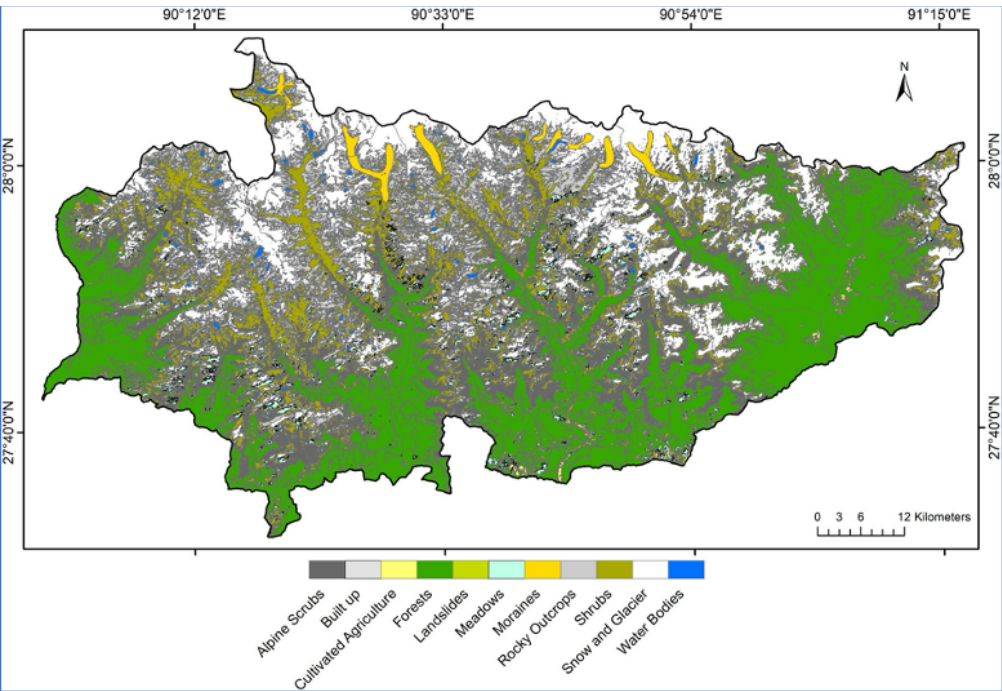


Figure 4: Land cover map of WCNP

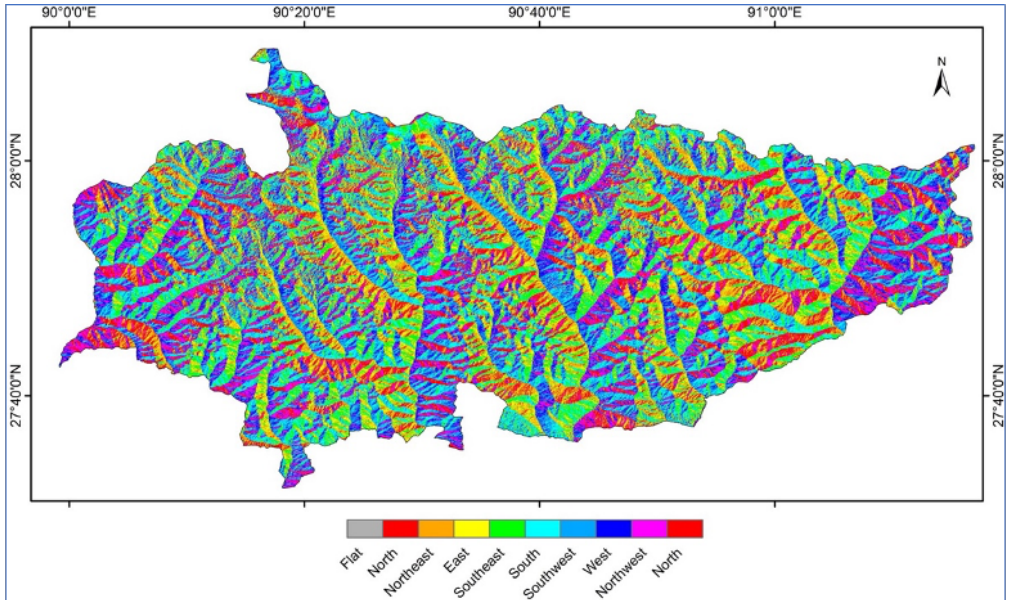


Figure 5: Aspect of WCNP

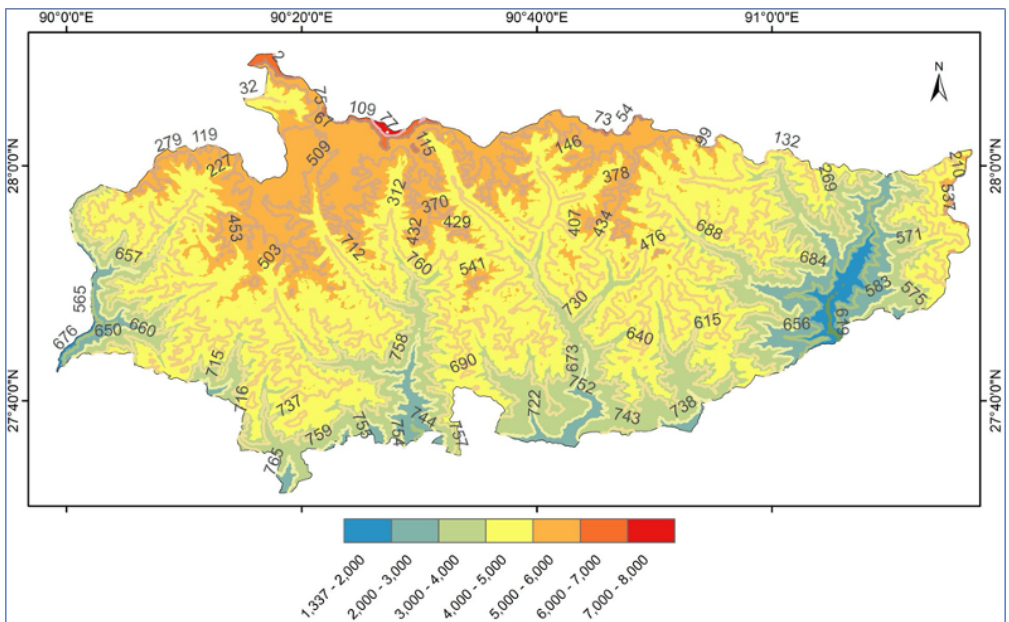


Figure 6: Elevation map of WCNP



2.1.4. Climate and hydrology

WCNP spreads across three climatic zones: sub-tropical, temperate, and alpine. In WCNP, the climate in the southeast and southwest becomes hot during summer and warm to cool in the inner valleys of central Dzongkhag such as Bumthang. Most of the northern portion receives snowfall round the year and it has an alpine climate. During summer and monsoons, there is continuous rain for several days, which swells the streams and rivers, thus carrying a huge load of forest debris. It sometimes brings flash floods and landslides. The winter months experience cold winds, very low nighttime temperatures, and moderate daytime temperature. In some occasions, the park receives light showers and snow. The majority of the park area is alpine region followed by temperate region and then sub-tropical. Due to its topographic setting, the park has almost 200 glaciers, which are the source of freshwater that is indispensable for all life forms. In these vast stretches of the alpine valleys, there lie around 483 lakes, which include glacial as well as alpine lakes. Apart from its ecological services, these lakes are strongly rooted in the cultural, spiritual, and social well-being of the communities residing around these lakes. The lakes are mostly revered and protected and some of the lakes have a very strong historical background associated with them. These beliefs ingrained in people have indeed helped the land to protect and conserve the rich biodiversity in the park. Having more than 200 glaciers and almost 483 glacial lakes, the park serves as a water tower for some of the major river systems in the country like Punatsangchhu, Mangdechhu, Chamkharchhu and Kurichhu. Thus, the park greatly contributes to the revenue generation for the country

2.2. Floral description

2.2.1. Floristic composition

The rapid biodiversity assessment (RBA) recorded 342 plant species across 232 vegetation survey plots. Central Park Range (CPR) recorded the highest number of plant species with 225 species followed by Dungkhar Park Range (DPR) with 151 plant species and Sephu Park Range (SPR) with 94 plant species. Owing to a greater number of alpine plant communities, CPR recorded the highest number of plant species in it.

2.2.2. Forest types

Out of the six climatic zones identified (Wangda & Ohsawa, 2006), three zones prevails in the park: the Cool Temperate zone (2500-3000m), Sub-alpine zone (3000-4000m), and alpine zone



above 4000m. Nested within these ecological zones are the following forest types described by (Grierson & Long, 1983). The different forest types found in WCNP are as follows:

2.2.2.1. Cool broadleaved forest:

Between 2700-2850m, these forests are the transitional zones between broadleaf forests of lower elevations and the temperate conifers of higher elevations. Some part of the Chokhor area is dominated by such forest type. Along river valleys, *Quercus semicarpifolia* dominate the top canopy with *Acer campbelli*, *Rhododendron arboreum*, *Rhododendron hodgsonii*, *Enkianthus deflexus*, *Pieris formosa*, and *Sorbus cuspidate* in the mid canopy. Bamboo thickets comprising chiefly of *Yushania microphylla* are found in the lower parts of the valley and tall growth of *Borinda grossa* and *Dendrocalamus* sp. occupy the higher elevations. A few pockets of blue pine (*Pinus wallichiana*) form mono-species stand along the ridges.

2.2.2.2. Mixed conifer forest:

Between 2700 to 3200m, these forests consist of mono-species stands of spruce (*Picea spinulosa*) or hemlock (*Tsuga dumosa*), or intermix with blue pine in the lower elevations of Tang and Chokhor and with larch (*Larix griffithii*) in the higher elevations. The drier, south-facing slopes along the Chamkharchhu valley starting from Khagtang have pure stands of blue pine while the north and east-facing slopes, which are shaded and wetter, support a mixture of hemlock and spruce. The undergrowth consists of shrubby species such as *Lindera heterophylla*, *Elaeagnus parviflora*, *Rosa sericea*, *Berberis aristata*, *Daphne bhoola*. Climber species include *Clematis montana* and *Holbolia latifolia*. Intensive grazing over time has created dwarf bamboo thickets of *Yushania microphylla* that dominate open areas.

2.2.2.3. Fir forest:

Like in other parts of Bhutan, fir forests characterize the park's highest forested ridges between 3200 and 4000m. This forest type can be observed at the upper hills of Sephu and Dhur. A large portion of the area is dominated by fir, with some junipers (*J. recurva* and *J. pseudosabina*) in the higher elevations. Hemlock occasionally grows into the top canopy. The mid canopy can consist of *Betula utilis*, *Sorbus micorphylla*,



S. foliolosa, *Prunus* sp. and a variety of Rhododendrons; *R. hodgsonii*, *R. wightii*, *R. campylocarpum*, *R. barbaratum*, *R. cinnabarinum*, *R. lanatum*, *Lonicera* sp., *Enkianthus deflexus*, *Ribes glaciale*, and *R. orientalis*. In the drier slopes with a closed canopy there is virtually no ground flora except for a few scattered *Rubus* sp. and Sphagnum moss, but the moist slopes support a variety of herbaceous plants such as *Oxalis* sp., *Thalictrum reiniforme*, *Imaptien* ssp, *Primula* sp. *Aconogonum* sp., Sphagnum moss, and bamboo thickets (*Yushania* and *Arundinaria*). *Usnea longissima* lichens hang from the branches of fir.

An undergrowth with abundant bamboo and *Sorbus* sp. provides important habitat for the endangered red panda (*Ailurus fulgens*) and Himalayan musk deer (*Moschus chrysogaster leucogaster*), as well as the Himalayan serow (*Capricornis sumatraensis thar*) which is reported to be an important prey species for tigers in the high-altitude areas.

2.2.2.4. *Juniper/Rhododendron scrub:*

This forest type is mainly of *J. recurva* and *J. pseudosabina*, which forms the transitional zone between the tree line and alpine meadows around the elevation range of 3800-4000m, especially on slopes with high humidity. A variety of herbaceous plants of Genus *Morina*, *Pedicularis*, *Phlomis*, *Potentilla*, *Primula*, *Heracleum*, *Allium*, *Juncus*, *Poa*, *Fescuta*, forms a dense undergrowth. The south-facing drier slopes have more communities of dwarf rhododendrons that form a dense mat-like structure (*R. nivale*, *R. setosum*, *R. campylocarpum*, *R. lepidotum*, *R. thomsonii*) which are sometimes found mixed with *Salix* spp. In this Park, the Juniper Forest provides important refuge for migratory takin (*Budorcas taxicolor whitei*) and Himalayan musk deer. The highlanders and the seasonal migrators like Cordyceps collectors and tourist exploit this forest for fuelwood collection.

2.2.2.5. *Alpine meadows and scrub:*

The alpine meadows and scrub range from 4000m to about 4800m. The land consists of numerous herbaceous plants with grasses (Gramineae and Poaceae) forming a dense mat. In the late spring and summer, the alpine habitats are a rich tapestry of colour from the diverse flowers that include *Potentilla*, *Pedicularis*, *Aconitum*,



Sassurea, *Meconopsis*, *Anemone*, *Epilobium*, *Swertia*, *Rheum*, *Gernaium*, *Festuca*, *Juncus*, *Poa*, etc, with many plants of medicinal value. On the drier slopes, *Rhododendron* and *Salix*, occasionally mixed with *Juniperus* sp., characterize scrubby vegetation. The ground vegetation consists of herbaceous plants like *Aconogonum alpinum*, *Swertia* sp., *Cotoneaster* sp., *Primula* sp. The alpine meadows are important grazing grounds for many wild ungulates, especially blue sheep (*Pseudois nayur*) and takin. These patches are the main grazing ground for the yaks. Moreover, this is ground where the *Cordyceps* grows. Some portions of these lands fall under the Transition zone as here we allow human activities for the stipulated time.

2.2.2.6. Dry alpine scrub:

Between 4800 5100m is alpine scree. These areas are close to the high passes and snowline; thus, very scanty and hardy vegetation thrives here. The characteristic species of this habitat include *Draba*, *Corydalis*, *Saxifraga*, *Androsace*, *Arenaria*, *Lagotis*, etc. In a few areas (e.g.; high ridge of Methachhutha and Zulela) scrubby aromatic *Rhododendrons* are found at about 4900m. This type of habitat is the main habitat for snow leopard (*Uncia uncia*) and occasionally for the Tibetan wolf (*Canis lupus chanco*).

2.2.3. Species of ethno-botanical value

Known by the name “*Druk Lho Menjong*”, in ancient times, meaning the ‘Land of medical herbs’, this park is bestowed with high diversity of medicinal plants. About 33 species of medicinal plants have been documented in the areas covered by the survey. This includes the highly-priced and rare Yartsa Goenbup (*Ophiocordyceps sinensis*) and the Himalayan Yew (*Taxus baccata wallichiana*).

The national tree of Bhutan *Cupressus corneyana*, is not only a valuable timber species but its leaves are used as incense during special religious occasions. Amongst the herbaceous plants, *Salvia nubicola*, which is known to be used widely in Lingshi for chewing is also found in the park. The lady’s slipper orchid *Cypripedium himalaicum*, which is used for making vegetable curry in Laya, is found in many of the transitional zones of sub-alpine to alpine area of the park.

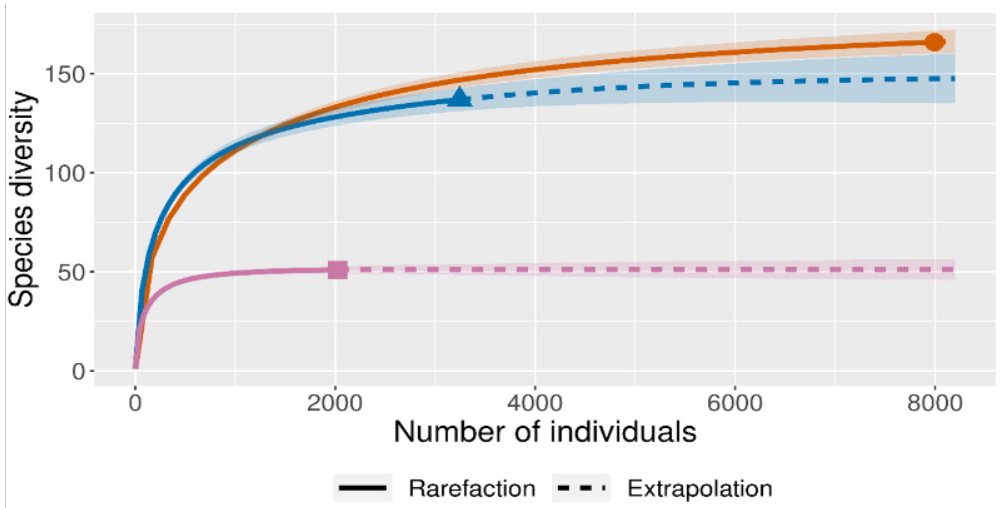


Figure 8: Graph showing species diversity

Chokhor Park Range recorded 1679 (31 species) trees with dbh ≥ 10 cm, Sephu Park Range 1603 trees (41 species), and Dungkar Park Range 871 trees (62 species). From the sampled data, it is understandable that the Dungkar Park Range's forest is more diverse than that of Sephu and Chokhor Park Range forests. The greater diversity in tree species of the Dungkar Park Range is due to the great variation in its altitudinal range.

Stand density (trees ≥ 10 cm dbh) for each range are 239, 142 and 109 trees per hectare for Chokhor, Sephu and Dungkar respectively. Higher stand density in Chokhor qualifies for the vast area of blue pine and mixed conifer forests in its jurisdiction than the other two ranges.

2.2.6. Relative basal area (RBA %)

Sephu Park Range has a maximum RBA for the trees in diameter class (≥ 50 cm dbh) that attributes to 1317 trees compared to the 171 and 221 trees for Dungkar and Chokhor Park Range respectively. For the diameter class (40-50cm dbh), the maximum RBA is for Chokhor Park Range. Total basal area (m^2) of trees (≥ 10 cm) for Sephu (plots=49), Chokhor (plots=126), and Dungkar (plots=56) are 277.799, 114.083, and 74.047 respectively (Figure 9).

2.2.7. Relative value index (IVI)

The importance value index (IVI) for ten tree species based on their importance for the rural communities was calculated using relative density, relative frequency, and relative abundance.



Through IVI value, we could determine the dominance of particular tree species in the ecosystem. For Chokhor Range, *Pinus wallichiana* was the most dominant species with IVI 107.188, while *Tsuga dumosa* was dominant in both Sephu and Dungkar Range, with IVI 76.314 and IVI 66.056 respectively.

Quantitative structure of the top 10 tree (dbh>10cm) species and their respective importance value index in the respective park range are given in Table 2, Table 3, and Table 4.

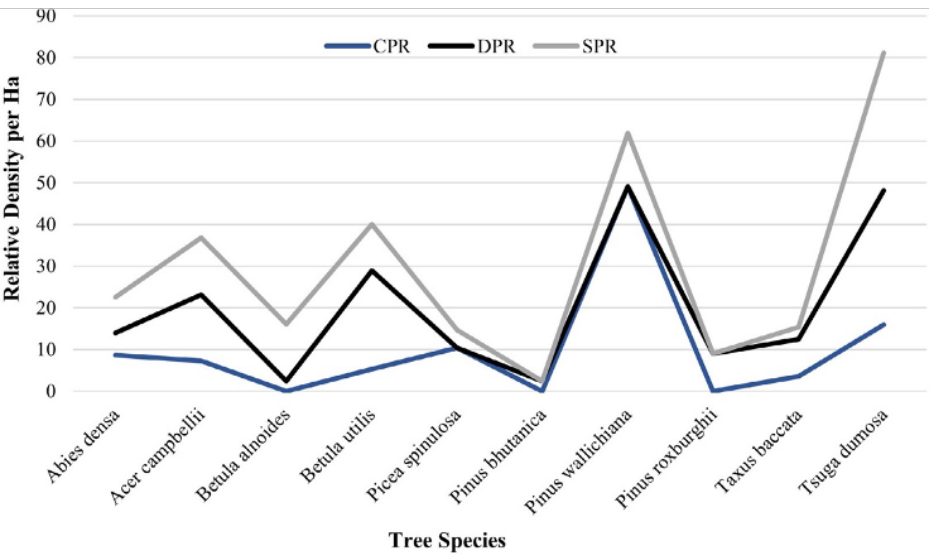


Figure 9: Graph showing the relative density of the tree species in three ranges

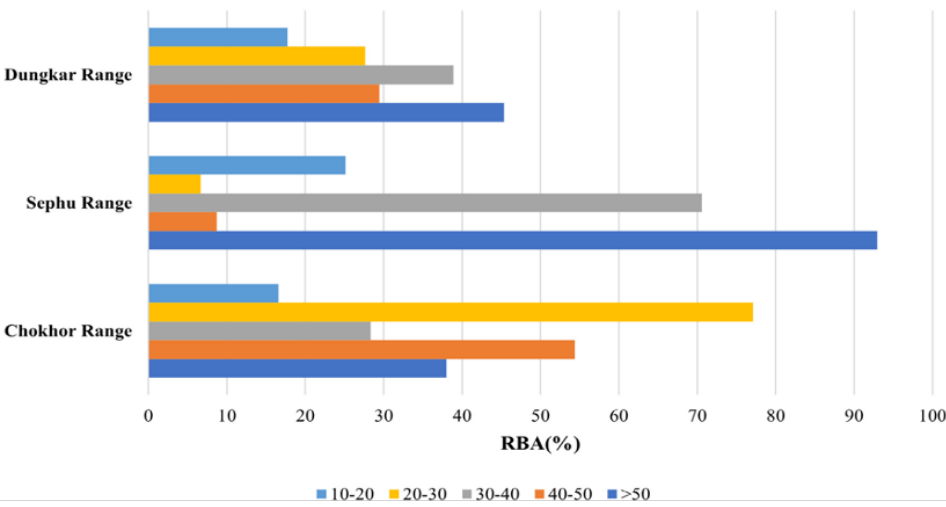


Figure 10: RBA of tree in three ranges



Table 2: IVI of tree species found in Chokhor Park Range

Scientific name	NI*	RDe*	RF*	RA*	IVI*
<i>Abies densa</i>	105	8.649	13.242	10.405	32.296
<i>Acer campbellii</i>	88	7.249	12.329	9.366	28.944
<i>Betula alnoides</i>	0	0.000	0.000	0.000	0.000
<i>Betula utilis</i>	64	5.272	11.416	7.357	24.044
<i>Picea spinulosa</i>	126	10.379	15.525	10.650	36.554
<i>Pinus bhutanica</i>	0	0.000	0.000	0.000	0.000
<i>Pinus wallichiana</i>	595	49.012	21.005	37.172	107.188
<i>Pinus roxburghii</i>	0	0.000	0.000	0.000	0.000
<i>Taxus wallichiana</i>	43	3.542	4.110	13.730	21.382
<i>Tsuga dumosa</i>	193	15.898	22.374	11.319	49.592
Total	1214	100	100	100	300

Table 3: IVI of tree species found in Sephu Park Range

Scientific name	NI	RDe	RF	RA	IVI
<i>Abies densa</i>	24	8.602	12.245	8.989	29.836
<i>Acer campbellii</i>	38	13.620	12.245	14.232	40.097
<i>Betula alnoides</i>	38	13.620	14.286	12.199	40.105
<i>Betula utilis</i>	31	11.111	12.245	11.610	34.966
<i>Picea spinulosa</i>	12	4.301	4.082	13.483	21.866
<i>Pinus bhutanica</i>	0	0.000	0.000	0.000	0.000
<i>Pinus wallichiana</i>	36	12.903	8.163	20.225	41.291
<i>Pinus roxburghii</i>	0	0.000	0.000	0.000	0.000
<i>Taxus wallichiana</i>	8	2.867	8.163	4.494	15.525
<i>Tsuga dumosa</i>	92	32.975	28.571	14.767	76.314
Total	279	100	100	100	300

The quantitative structure of top 10 tree (dbh>10cm) species and their respective importance value index in SPR. Quantitative structure of top 10 tree (dbh>10cm) species and their respective importance value index in DPR.



Table 4: IVI of tree species found in Dungkar Park Range

Scientific name	NI	RDe	RF	RA	IVI
<i>Abies densa</i>	13	5.306	6.000	7.816	19.122
<i>Acer campbellii</i>	39	15.918	34.000	4.138	54.056
<i>Betula alnoides</i>	6	2.449	6.000	3.607	12.056
<i>Betula utilis</i>	58	23.673	22.000	9.510	55.184
<i>Picea spinulosa</i>	0	0.000	0.000	0.000	0.000
<i>Pinus bhutanica</i>	6	2.449	2.000	10.822	15.271
<i>Pinus wallichiana</i>	0	0.000	0.000	0.000	0.000
<i>Pinus roxburghi</i>	22	8.980	2.000	39.681	50.661
<i>Taxus wallichiana</i>	22	8.980	12.000	6.614	27.593
<i>Tsuga dumosa</i>	79	32.245	16.000	17.811	66.056
Total	245	100	100	100	300

* NI = Number of Individuals; RDe: Relative Density; RF: Relative Frequency; RA: Relative Abundance; IVI: Importance Value Index

2.2.8. Endemic plants

WCNP is home to many endemic plant species. The list of endemic plants found in WCNP is presented in Table 5.

Table 5: Endemic plants found in WCNP

Sl. No.	Family	Botanical name of endemic plants
1.	Amaryllidaceae	<i>Allium rhabdotum</i>
2.	Orchidaceae	<i>Bhutanthera himalayana</i>
3.	Asteraceae	<i>Anaphalis cooperi</i>
4.	Caryophyllaceae	<i>Arenaria ludlowii</i>
		<i>Silene birgittae</i>
5.	Ericaceae	<i>Rhododendron kesangiae</i>
6.	Primulaceae	<i>Androsace hemisphaerica</i>
		<i>Androsace ludlowiana</i>
		<i>Primula umbratilis</i>
		<i>Primula umbratilis</i> var. <i>alba</i>
7.	Gesneriaceae	<i>Corallodiscus cooperi</i>
8.	Orobanchaceae	<i>Pedicularis dhurensis</i>
		<i>Pedicularis imbricata</i>
		<i>Pedicularis inconspicua</i>



		<i>Pedicularis longipedicellata</i>
9.	Plantaginaceae	<i>Neopicrorhiza minima</i>
10.	Thymelaeaceae	<i>Daphne ludlowii</i>
11.	Papaveraceae	<i>Corydalis aurantiaca</i>
12.	Ranunculaceae	<i>Delphinium muscosum</i>
13.	Rosaceae	<i>Cotoneaster bumthangensis</i>
		<i>Potentilla bhutanica</i>
14.	Saxifragaceae	<i>Saxifraga thiantha</i>
		<i>Saxifraga thiantha</i> var. <i>citrina</i>
15.	Polygonaceae	<i>Bistorta griersonii</i>

2.2.9. Threatened plant species

WCNP is home to many of the plant species that are listed under the IUCN Red List of threatened species. Conservation of such plant species is one of the important goals of the park. The exploitation of these plants by humans for various uses is a major threat. *Nardostachys jatamansi*, a critically endangered species is used by the local people for making incense. The roots of this plant are used in making incense and hence collection by humans results in killing the whole plant. Other threatened plant species found in the park are *Cypripedium cordigeru*, *Cypripedium himalaicum*, *Cypripedium elegans*, *Malaxis muscifera*, *Bistorta griersonii*, *Androsace hemisphaerica*, *Neopicrorhiza minima* and *Corallodiscus cooper*.



Figure 11: Left: *Corydalis aurantiaca* & Right: *Daphne ludlowii*



2.3. Faunal description

2.3.1. Mammals

In the previous management plan, the park recorded 41 species of mammals, which is now updated to 44 species. The three new records were updated based on the Rapid Biodiversity Assessment in 2019. Of the 44 species of mammals recorded, 18 fall under IUCN red list (Table 6). Through the evidence of camera traps, there are records of tiger dwelling above 4000 meters, which indicates the overlap of the habitat of tigers and snow leopards. In Bhutan, the snow leopard is considered a mountain deity and together with the tiger, it is the most feared and the most revered animal for their magnificence. The elusive predator like the Tibetan wolf (*Canis lupus chanco*) was also reported for the first time in the park through the camera trapping exercise of the first nationwide snow leopard survey in 2016.

The rapid biodiversity assessment of mammals was carried out using both a mammal transects survey and a camera trap survey. For the transect survey, 63 grids were enumerated across the park, and for the camera trap survey, 56 camera stations were installed. Figure 11 shows the distribution of different mammal species in the park along the varied elevation range (maximum, minimum, and mean) as ascertained from the rapid biodiversity assessment in 2022. As per the transect survey, 339 mammalian observations were made based on different types of evidence, which are represented in Figure 12. As per the data, droppings were the highest evidence recorded. The Shannon-Weiner diversity index (H') and evenness index (J') was calculated based on the habitat of the species recorded (Table 7). The highest H' was for conifer forest while the lowest was for bamboo, indicating that the conifer forest in WCNP has the most diverse mammalian species. This high diversity can also be attributed to the fact that most of the park area is covered by conifer forest.

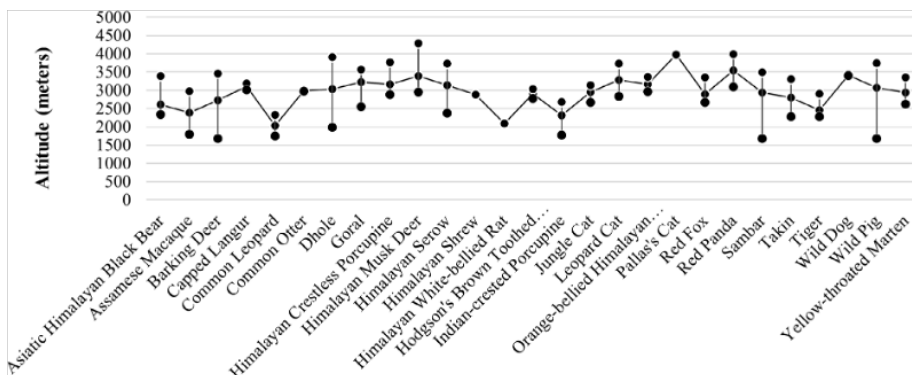


Figure 12: Elevation wise distribution of mammals in WCNP



Table 6: IUCN Red List mammals in WCNP

Sl. No.	Common Name	Scientific Name	IUCN Status	CITES	FNCA 1995 Status
1	Assamese Macaque	<i>Macaca assamensis</i>	NT	Appendix II	NA
2	Bhutan Takin	<i>Budorcas taxicolor whitei</i>	VU	NA	Schedule I
3	Capped Langur	<i>Trachypithecus pileatus</i>	EN	Appendix I	NA
4	Clouded Leopard	<i>Neofelis nebulosa</i>	VU	Appendix I	Schedule I
5	Common Leopard	<i>Panthera pardus</i>	VU	Appendix I	Schedule I
6	Gaur	<i>Bos gaurus</i>	VU	Appendix I	Schedule I
7	Goral	<i>Naemorhedus goral</i>	NT	Appendix I	NA
8	Asiatic Black Bear	<i>Ursus thibetanus</i>	VU	Appendix I	Schedule I
9	Himalayan Musk Deer	<i>Moschus chrysogaster</i>	EN	Appendix I	Schedule I
10	Himalayan Serow	<i>Capricornis thar</i>	VU	Appendix I	Schedule I
11	Malayan Giant squirrel	<i>Ratufa bicolor</i>	NT	Appendix II	NA
12	Red Panda	<i>Ailurus fulgens</i>	EN	Appendix I	Schedule I
13	Royal Bengal Tiger	<i>Panthera tigris</i>	EN	Appendix I	Schedule I
14	Sambar	<i>Rusa unicolor</i>	VU	NA	NA
15	Snow Leopard	<i>Uncia uncia</i>	EN	Appendix I	Schedule I
16	Dhole	<i>Cuon alpinus</i>	EN	Appendix I	NA
17	Asiatic Golden cat	<i>Catopuma temminckii</i>	NT	NA	NA
18	Marbled Cat	<i>Pardofelis marmorata</i>	NT	NA	NA

Table 7: Shanon-Weiner and evenness index of mammals recorded from RBA

Sl. No.	Habitat type	No. of Species	Richness	H'	J'
1	Bamboo	6	3	0.87	0.79
2	Broadleaf	8	6	1.73	0.97
3	Conifer	235	20	2.37	0.79
4	Cool Broadleaf	37	9	1.75	0.79
5	Grassland	57	14	1.76	0.67
6	River/stream	5	0.67	0.67	0.97
7	Wetland	6	3	1.01	0.92



2.3.2. Birds

About 251 species of birds have been recorded from the park and about 130 species of the bird are confirmed to breed in the park, including Bhutan’s national bird, the Raven. Raven and Himalayan Monal are two of Bhutan’s totally protected bird species, listed in Schedule I of the Forest and Nature Conservation Act, 1995. The park also has IUCN Red listed bird species viz Satryr’s tragopan, Black-necked crane and recently Pallas’s fish eagle was reported from the park for the first time in 2019.

Shanon-Weiner diversity index (H') and the evenness index were calculated from the data collected from RBA based on their habitats and the cool broadleaf habitat was most diverse when it comes to birds and the evenness was highest for river/stream habitat.

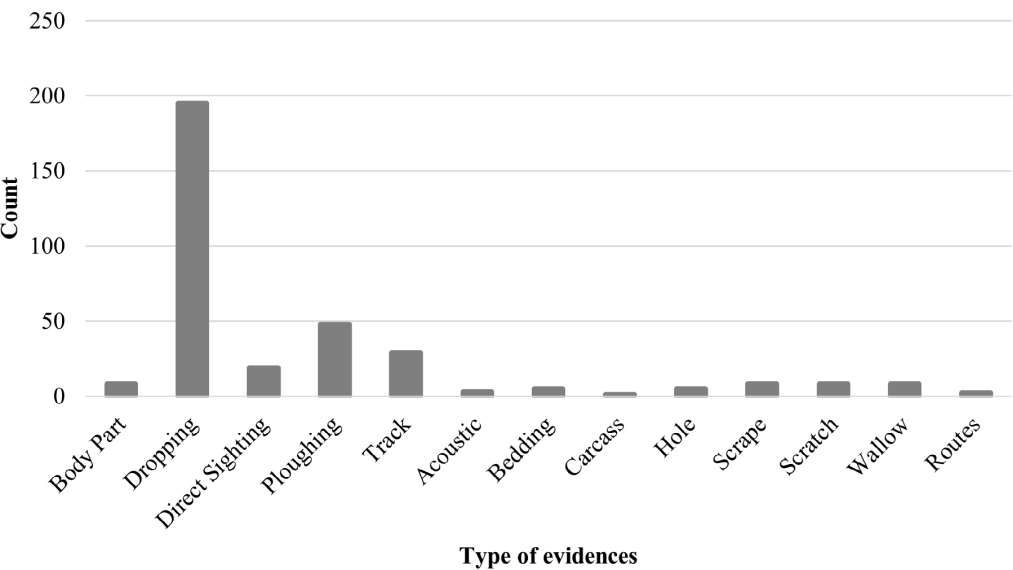


Figure 13: Animal records based on different evidences

Table 8: Shanon-Weiner and evenness index of birds recorded from RBA

Sl. No.	Habitat type	No. of Species	Richness	H'	J'
1	Bamboo	5	3	0.95	0.86
2	Conifer	3426	75	2.31	0.53
3	Cool Broadleaf	577	70	3.51	0.83
4	Grassland	251	29	2.83	0.84
5	River/stream	55	14	2.42	0.92



2.3.3. Fish

As per the fish survey conducted in May – June of 2016, five species of fish were recorded in the park viz. brown trout, point-nosed snow trout, stone cat, sucatus catfish and torrent catfish. However, pre and post-monsoon surveys are deemed important to determine and to see the visitation of a few other migratory species (Wangchuck Centennial National Park, 2016).

2.3.4. Butterfly

A recent butterfly survey has recorded about 246 species across the park. The butterflies found under the park can be categorized into six major families namely Hesperidae, Lycaenidae, Nymphalidae, Papilionidae, Pieridae and Riodinidae. In the field guide for Butterflies of Wangchuck Centennial National Park, the most abundant species is found under Nymphalidae family (Figure 13).

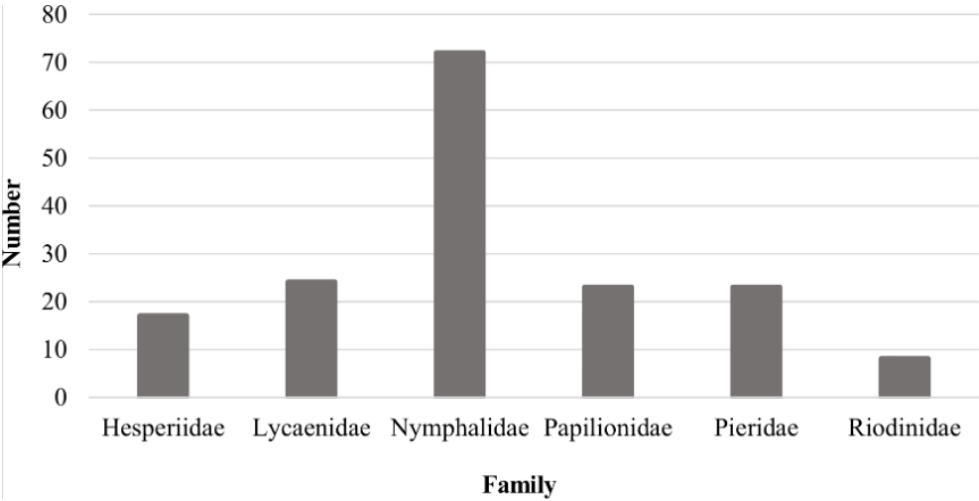


Figure 14: Family wise distribution of butterflies in WCNP

2.4. People and livelihood

Except for highlanders who practice transhumance, most of the human settlements occupy the low-lying valleys of the park. As of 2021, there are 783 households living across the park under six different gewogs, with a total population of 6640. Of nine gewogs falling under WCNP, only six gewogs have permanent settlements. Chokhor gewog and Gangzur gewog have the highest population density (Table 9).



Table 9: Number of households and population under each gewog under WCNP

Gewog	No. of HH	Population			Population density (per sq.km)
		Male	Female	Total	
Chokhor	294	1167	1213	2380	1.8
Tang	41	243	216	459	1.74
Sephu	117	215	266	481	0.5
Nubi	6	28	30	58	0.22
Gangzur	90	650	400	1050	4.72
Kurtoe	235	1149	1063	2212	2.3
Total	783	3452	3188	6640	11.28

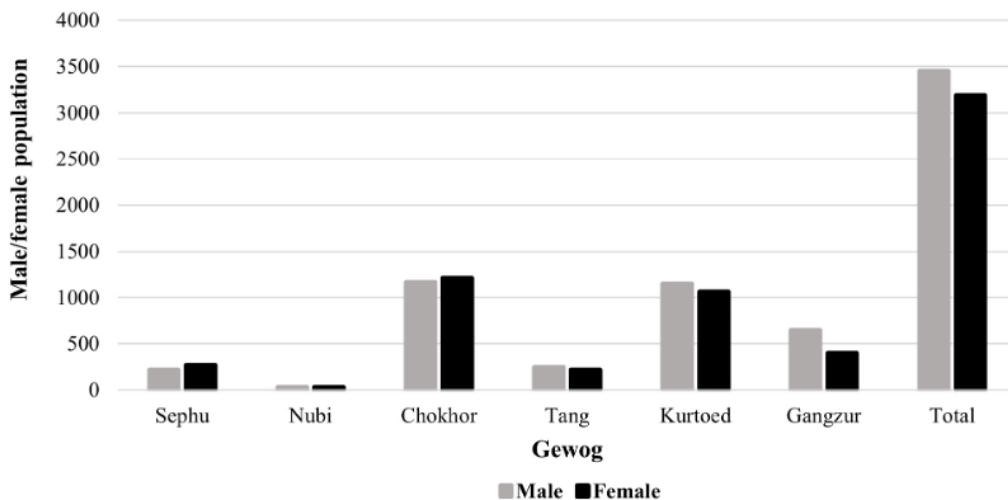


Figure 15: Gender distribution of park residents in different gewog

2.4.1. Yak herding communities

For generations, the transhumance pastoralists of Bhutan have practiced yak rearing as a means of their livelihood. In WCNP, there are around 130 yak herders. Of the nine gewogs falling within the park jurisdiction, four gewogs have yak-herding communities. Of 130 yak-herding households, 56 yak herding households graze their yaks inside the park for the entire duration of the year while 76 households graze their yaks during the summer months only. With 57 yak-rearing households, (Figure 15) Sephu Gewog has the highest yak herding households. Most of these herders do not possess sufficient agricultural lands and they rely on yak products and *Cordyceps* for their livelihood. These herders have certain designated pieces of land demarcated by natural features like ridges, streams, and other natural land features over which



they have practiced customary rights for grazing their cattle. These semi-nomadic communities have their own local dialect and these people are often referred to as *Bjob*.

In recent years, it has been noted that there is a decrease in the yak herding communities. With the rapid development and better livelihood opportunities, the children belonging to the herding communities prefer to settle in cities rather than continue with the herding tradition. The drop in herders' numbers is also due to better livelihood opportunities provided by the Cordyceps business.

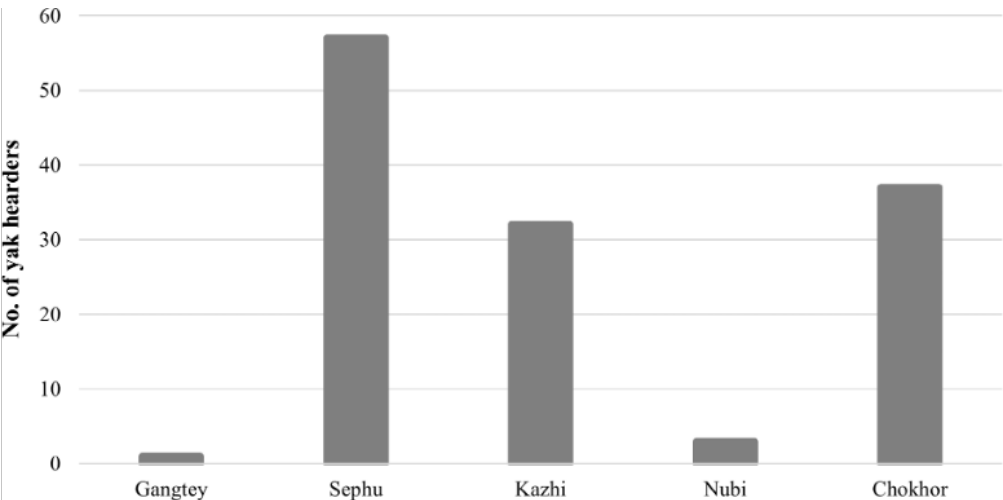


Figure 16: Number of yak herders in different gewogs under WCNP

2.4.2. Socio-economic conditions

With the human communities present inside the park from time immemorial, incorporation of the community's aspirations and trying to address the issues faced by the communities is of paramount importance to implementing the conservation activities inside the park. To understand the community's aspirations and constraints, the management of WCNP has conducted a socio-economic survey in 2019 during which 251 households were interviewed with a set of semi-structured questionnaires. Of the 251 respondents, 140 were females and 111 were males.



2.4.2.1. Livelihood

Being an agrarian nation, most of the communities inside the park depend on agriculture and livestock for their livelihood. For the semi-nomadic communities, the main sources of income are from yak products and Non-Wood Forest Products (NWFP), especially Cordyceps. Other sources of income for the people include government employees, contract works, sale of cash crops, pottering, and guiding services for the tourists (Figure 17).

With the legalization of the Cordyceps harvest in 2004, the livelihood of the highlanders has improved manifolds. The Cordyceps harvest benefits three gewogs (Chokhor, Sephu and Tang) out of the nine gewogs falling inside the park. With the boom in the Cordyceps business in recent times, the semi-nomadic communities have been earning good cash from the sale of the Cordyceps. Now every highlander could afford a decent house for their family and a majority of the households own a motor vehicle.

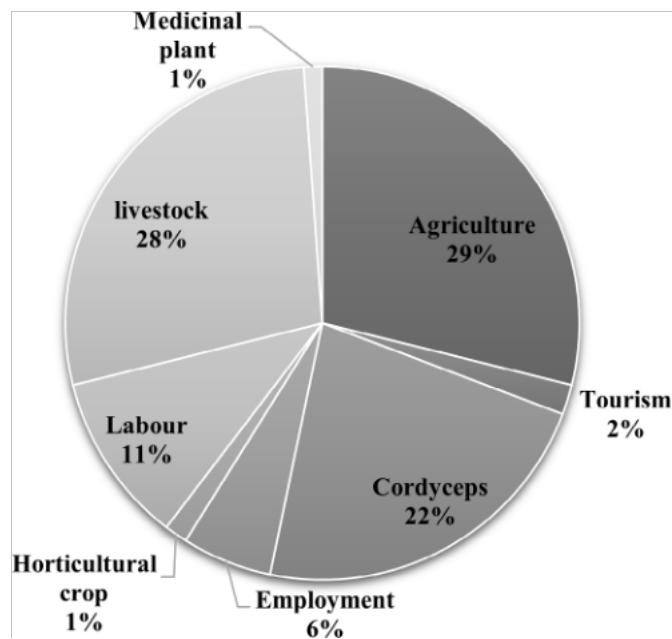


Figure 17: Source of income for the resident of the park

Agriculture: As per the socio-economic survey (N=251), 26% of the households do agricultural work for their livelihood. People cultivate cereal crops like maize, rice, buckwheat, wheat, and barley, and cash crops like mustard and potatoes besides the horticultural crops. Given the geographic setting and the favorability of climatic conditions, the majority of farming activities occur in the eastern part of the park. People in the west and central part of the park, do cultivate potatoes as a cash crop and vegetables for household consumption.



Despite agriculture being the backbone of the farmer’s livelihood, there are several limiting factors, which affect the growth of agriculture. Of the many difficulties faced by the farmers (Figure 18), crop damage by the wild animals was the major constraint. This proves that there is a pertaining and growing issue of human-wildlife conflict in the park area.

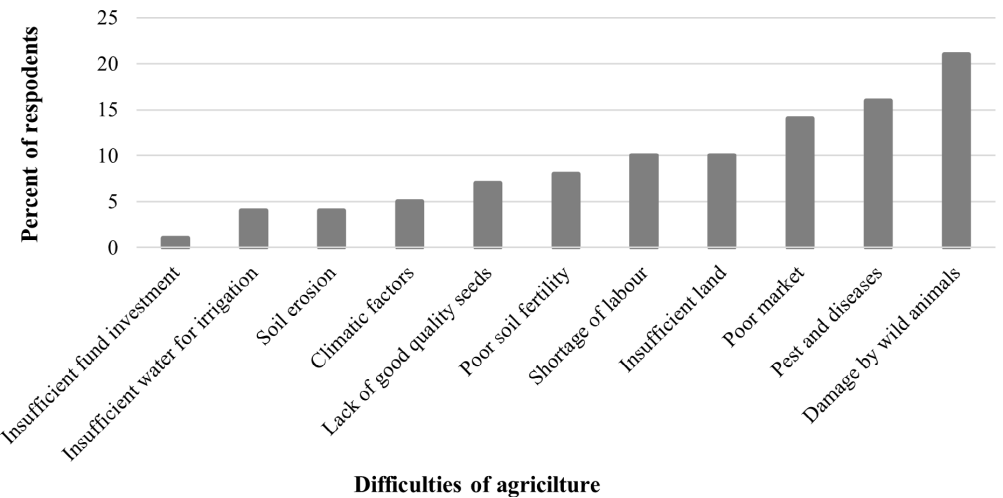


Figure 18: Challenges in farming faced by the people

Crop damage trend: Of 251 respondents, 55% of them feel that crop damage incidences have increased over time. 20% of the respondents feel, that it has remained the same and 13% of them feel that the crop damage incidences have decreased over time (Figure 19). Some of the reasons that people give for the increased crop damage trend were the rise in the number of herbivores populations and a decrease in the immediate predators. Some even feel that it might have resulted due to strict law enforcement wherein people refrained from killing wild animals as compared to the free hunting in the olden days.

As reported, crop damage by wild animals is a major problem for farmers. Hundreds of (n=155) crop damage incidences were said to be caused by different wild animals. Most damage incidences were on crops like maize (n=50), followed by paddy (n=48) and potato (n=25) (Figure 20).

Different wild animals are responsible for crop damage. From the 205 crop damage incidences by the wild animal as reported by the respondents at the time of the survey, 70% (n=144) of



the incidences were caused by the wild pig, followed by 11% (n=24) by barking deer, 8% (n=16) by monkeys and 7 % (n=14) by sambar. Few incidences of crop damage by Himalayan black bears (n=4) and porcupines (n=3) were also reported.

Given the crop damage incidences from the wild animals, the farmers have been guarding their crops. 49% of the respondents said that they have to guard their crops, especially during the night. Most of the crop raids occur during harvest season.

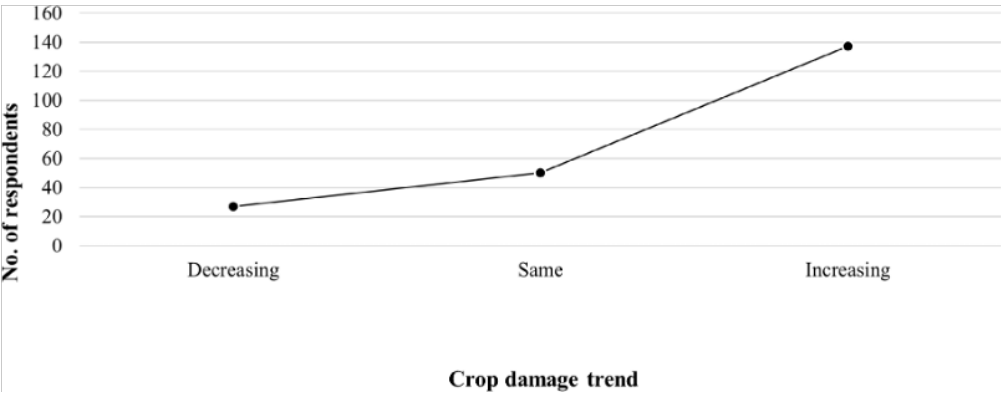


Figure 19: Crop damage trend under WCNP

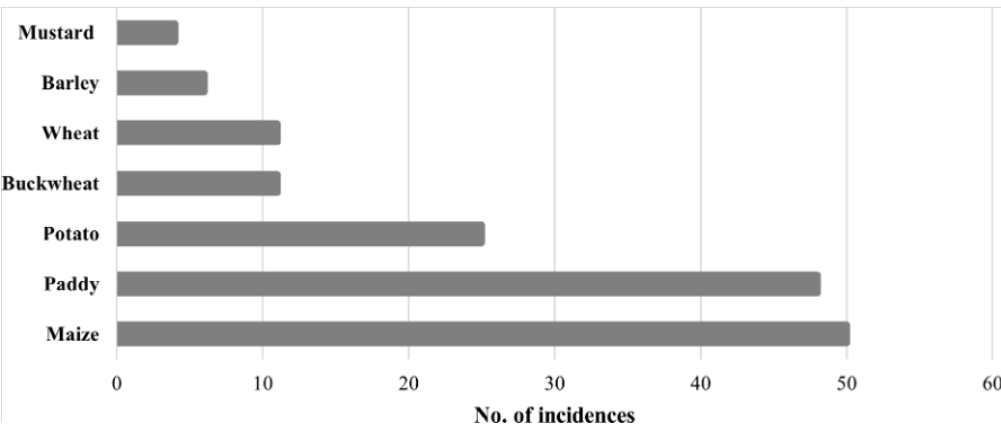


Figure 20: Crop damage incidences for different cash crops

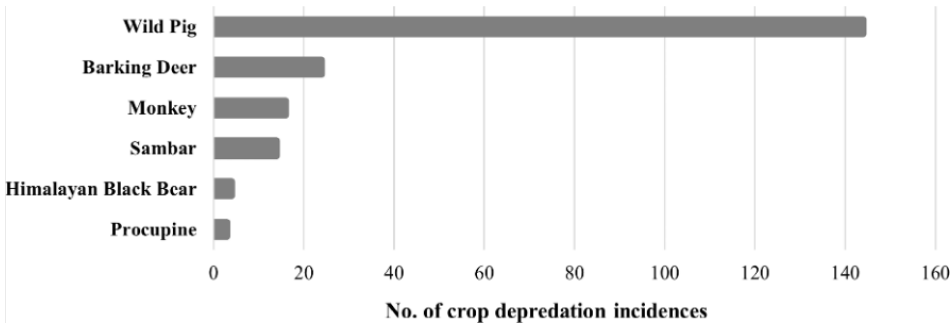


Figure 21: Number of crop depredation incidences by different wild animals

Livestock: Livestock is an integral part of the farming communities of the park. Almost every household rear one of the livestock; cattle, horse, yak, goat, sheep, and poultry. Animal husbandry is mainly for food (animal products), income (sale of animal products), transportation (horses and yaks), and manures. Most of the respondents said that they rear livestock as a source of income, source of food, and manure. Only 2% of the respondents said they rear the livestock for means of transportation and draught power (Figure 22).

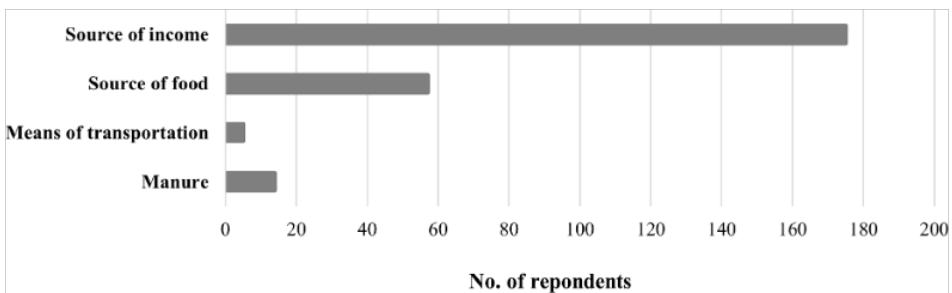


Figure 22: Uses of the livestock

Livestock depredation incidences: Over the years, there is an upsurge in depredation incidences. The park harbors a good number of predator species like tiger, snow leopard, common leopard, Himalayan black bear, dhole, Tibetan wolf, and many other small predators like yellow-throated marten, red fox, and small cats. Through the survey, different predators involved in the killing of livestock were identified. Dhole, tiger, common leopard, Himalayan black bear, and snow leopard (Figure 23). The majority of respondents (n=62) reported dholes as the top predator and they say that the dhole population has grown over the years. The actual kill of the livestock reported at the time of the survey for two years (2018-2019) was compiled as follows:

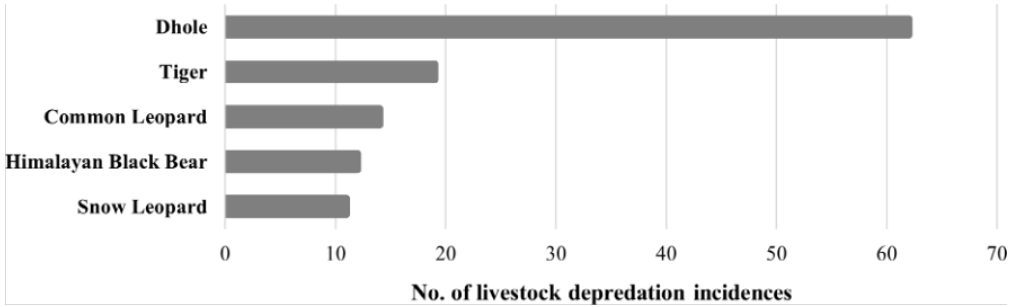


Figure 23: Number of livestock depredation incidences under WCNP

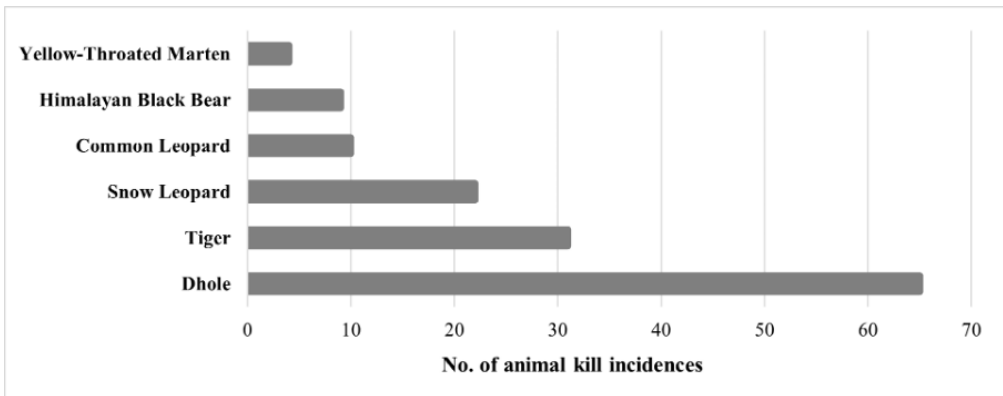


Figure 24: Number of livestock killed by different predators under WCNP

2.4.2.2. *Human-wildlife conflict (HWC) scenarios and mitigation*

Given the fact that 60% of Bhutan’s population depends on livestock and crop production for livelihood, HWC is and will be a critical issue for the park and forestry department. Bhutan is widely known for its conservation success stories due to the strong conservation laws, regulations, policies and ingrained religious sentiments of Bhutanese people. On the other side, the farmers often suffer economic losses caused due to the negative interaction with the wild animals. Crop damages, livestock depredation, property damage and attacks on humans are different types of conflicts that are prevalent in the park. More than 90% of the conflicts are associated with crop damage (55%) and livestock depredation (37%). Despite the growing HWC incidences, the park has not encountered any retaliatory killings in response to the conflicts. It is assumed that the people have developed some degree of tolerance level due to the livelihood diversification programs. Credit also goes to the strict conservation laws and better awareness programs on the importance of biodiversity conservation for better ecosystems and ecosystem services.

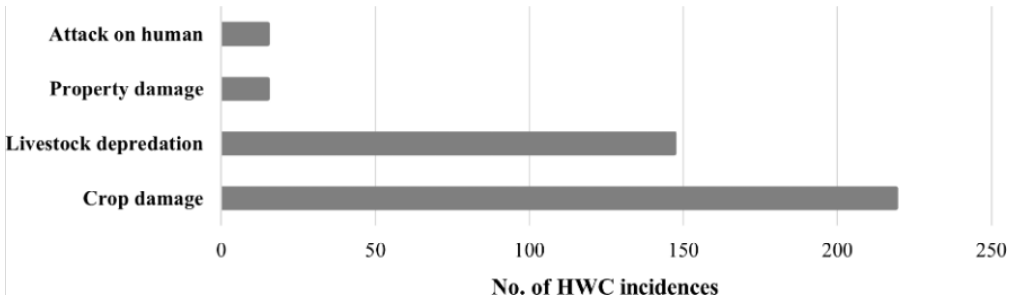


Figure 25: Different HWC incidences under WCNP

Given the upsurge in the HWC incidences in the park, the management of WCNP has conducted a study to determine the attitude of the park residents towards the wild animals in their localities. People responded differently to different wild animal species in the locality. People mostly disliked Wild pig, due to its widespread involvement in crop damage while Himalayan black bears and dholes are the most disliked carnivores in the park. Sambar and barking deer are the occasional pests to the farmers, so these two are the most disliked herbivores.

Knowing the farmer's/local stakeholder's attitudes and values toward wildlife is important for the successful implementation of the wildlife conservation initiatives. People have a better understanding of the population dynamics in reality. So, seeking their opinion is very important, as they are ones living among the animals and who have better as well as bitter experiences with these animals. Analysis of the conflict incidences, conflict animals, and the frequency of the animals sighted showed a positive correlation. For instance, the wild pig is the most frequently sighted animal; it is also the most disliked animal since it has the most conflict incidences with the people.

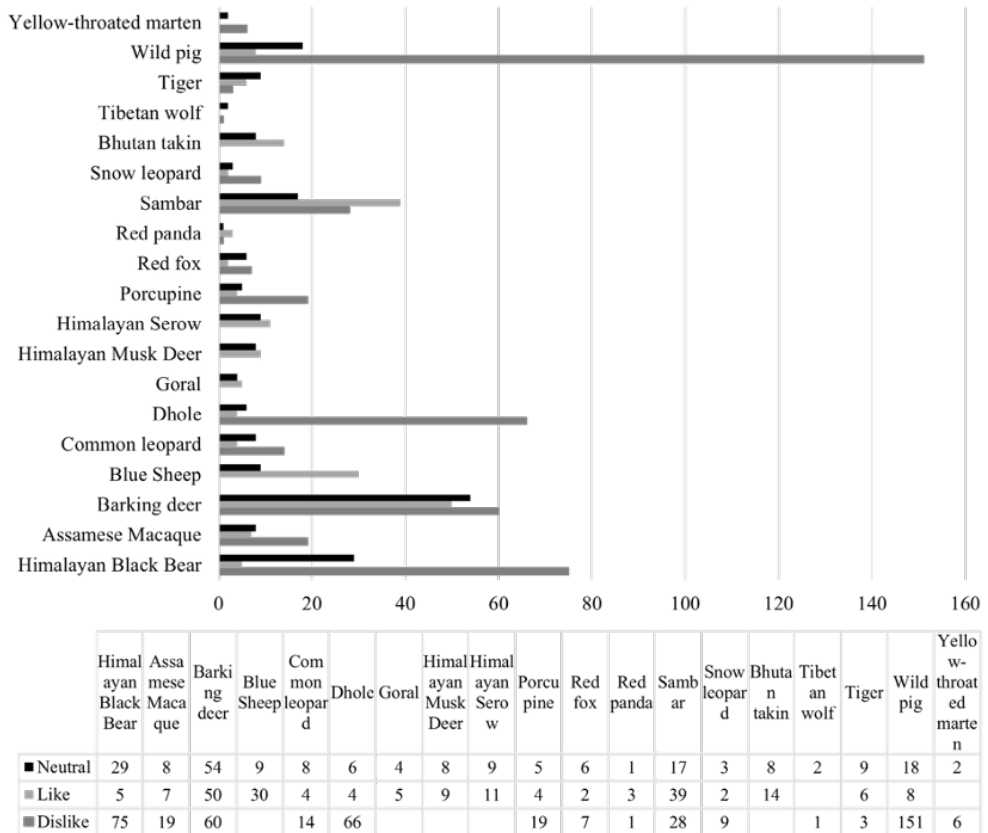


Figure 26: People's perception towards wild animals

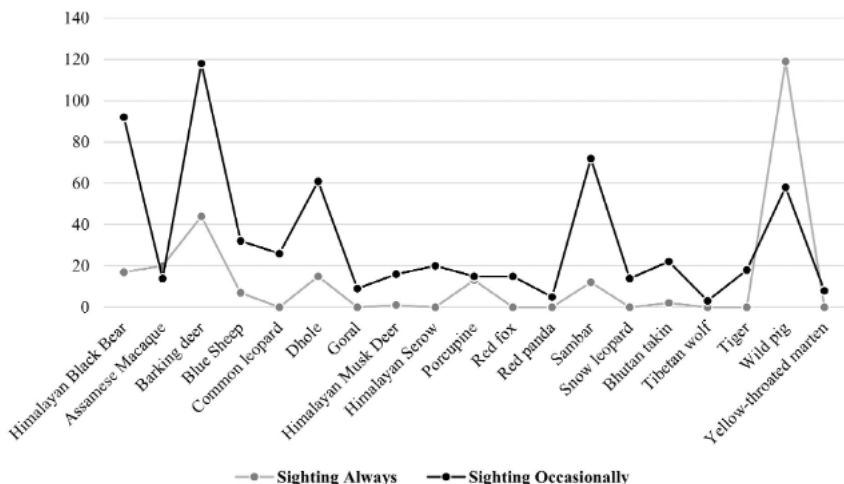


Figure 27: Wildlife sighting incidences by local people



2.4.2.3. *Human-wildlife conflict hotspot*

Mapping of HWC hotspots in the park gives a very good idea of the distribution of the conflicts, which in turn will help the park management in coming up with better mitigation measures. The HWC hotspot map (Figure 28) was developed with the HWC data compiled in the last four years. There were 311 data points, which included human attack, property damage, and crop damage among others. The environmental data used for the analysis is given in Table 10. Land Use Land Cover data was reclassified and three different layers of meadow, forest, and agricultural land were generated. All the environmental data were resampled to 30 m x 30 m spatial resolution for the analysis. The model was developed in MaxEnt. As per the result generated, most of the HWC incidences were concentrated near the settlement area. The detailed probability of occurrence of HWC is given in figure 28.

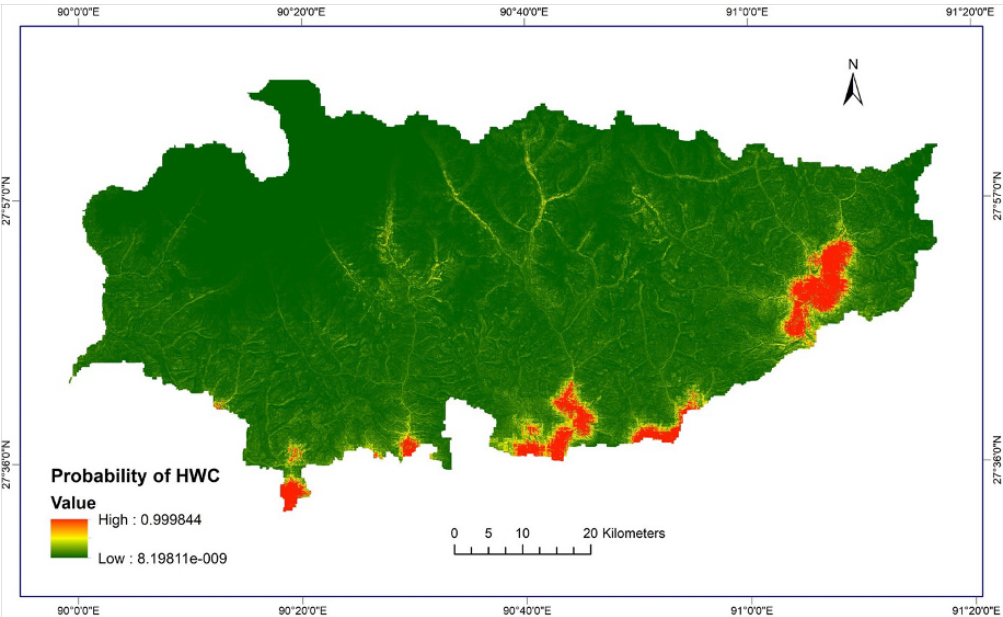


Figure 28: HWC hotspot map of WCNP

Table 10: Environmental variables used for the analysis

Factors	Environmental Variable	Spatial Resolution	Source
Topography	Elevation	30 x 30 m	www.usgs.gov
	Slope	30 x 30 m	
	Aspect	30 x 30 m	
Climate	Total annual precipitation	800 x 800 m	WorldClim
	Mean annual temperature	800 x 800 m	
Land cover	LULC 2016	30 x 30 m	DoFPS
Anthropogenic	Distance from settlement	1 x 1 km	NSB



2.5. Forest resource area

2.5.1. Local forest management area (Resource allocation to residents)

The park caters to public service of around 783 households with an estimated population of around 7300 people via the multiple-use zone which accounts for around 293.09 sq. km of the total area of 4914 sq. km. The public demand for natural resources is mainly for house-building timber, firewood, posts, and poles which happen to be in the proximity of the settlements and motorable roads within the multiple-use zone. For the projection of the resource stock in the multiple-use zone of the park, the Local Forest Management Area (LFMA) method and template developed by Forest Resources and Management Division was used and data were collected from the representative sample plots. The grids for data collection were laid over the multiple-use zones only and data was collected from the representative plots from every compartment.

For field data collection and also the resource allotment modalities, every range jurisdiction under the park was treated as one block; namely Chokhor block, Dungkhar block, and Sephu block. This was done as the allocation of blocks as per the LFMA method was not possible due to the unavailability of the funds and as well as due to the constrain in time for the field survey. In the future, if there is budget allocation, the park management intends to produce LFMA for every gewog as per the guidelines. The resulting Annual Allowable Cut (AAC) as per the analysis is given in Table 11.

Table 11: AAC as per LFMA inventory

Sl. No.	Block	AAC (m³)
1.	Chokhor block	96,520
2.	Dungkar block	16,408
3.	Sephu block	7,194

2.5.2. Community forests

Community forests (CF) caters to the timber demand of the villagers. The CFs are managed by the CF members based on the community forest management plan. The details of all the CFs established WCNP are given in Table 12.



Table 12: Community forest inside WCNP

Sl. No	Name of CF	Village	Gewog	Dzongkhag	No of H/H	Area (Ha)	Establishment year	1 st Mgt plan period	2 nd MP reviewed Plan period	MP next review period
1	Dhur Dhendupling	Dhur	Chokhor	Bumthang	60	566	26/04/2012	May 2012 – Apr-22	NA	Jun-23
2	Gorchen	Na-shiphel	Chokhor		14	139.4	19/05/2015	19/05/2015 – 20/06/2025	NA	June 20/2025
3	Lusibe	Lusibe	Chokhor		16	127	31/08/2015	31/8/2015	NA	31/9/2025
4	Singye	Kharsa	Chokhor		44	299.49	23/05/2011	May 2011 – Jun-21	Jun-23 – June 2033	Jun-33
5	Chutoe	Chutoe	Tang		15	95.56	2020	12/3/20	March 2030	12/3/30
6	Namkha	Nam-ha&Khoeyor	Tang		10	85.61	2020	12/3/20	Mar-30	12/3/30
7	Tangrung	Tangrung	Kurtoed	Lhuentse	9	111.76	2013	4/4/23	Apr-23	
8	Mangkong	Tabi	Kurtoed		15	192.41	2008	2008 to 21/07/2017	20/4/2019	20/4/2029

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## 2.6. Administrative, service delivery, and park infrastructure

WCNP is spread over five Dzongkhags i.e., Bumthang, Wangdue Phordang, Lhuentse, Trongsa, and Gasa. The majority of the area is covered under Bumthang Dzongkhag. The park headquarters is located at Nasiphel, Chokhor Gewog, Bumthang, and is headed by the Chief Forestry Officer. There are four functional sections at the head office followed by four range offices and three guard posts in the field offices (Figure 29).

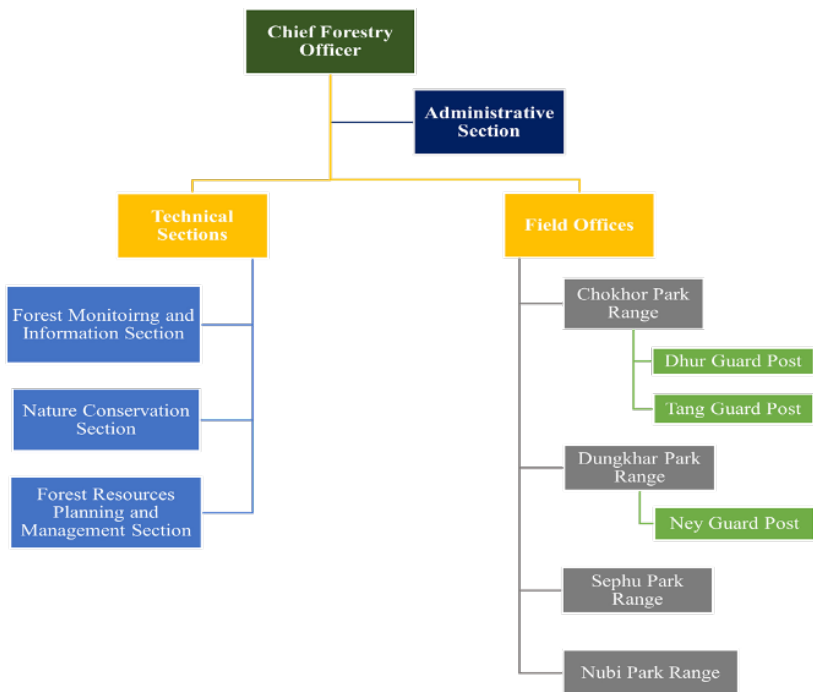


Figure 29: The organogram of WCNP

Chokhor Park Range (CPR) office is located at Thangbi, Chokhor. It caters to the public of Dhur-Lusibe, Goling-Kharsa, Nasiphel, and Zhabithang. Tandigang and Khangrab chiwog under Tang Gewog are looked after by the Tang Guard Post located at Mitsethang. Dungkahr Park Range (DPR) is located at Rabung, under Kurtoed gewog and provides public service to Gangzur and Kurtoed Gewog. Under Gangzur gewog only Ney chiwog is catered by DPR and under Kurtoed gewog; Chagdzom-Chussa, Dungkhar, Jasabi-Ugyenphu, Tabi and Tangroong-Wawel chiwogs are catered by DPR. Sephu Park Range (SPR) is located at Drupsiding, under Sephu gewog. Public service to Nakha and Busa-Zeri chiwog is provided by SPR. Nubi gewog also falls under the jurisdiction of SPR but the public services are provided by the Bumthang Division.



Table 13: Details on number of approved staff as per OD to the existing staff strength

| Sl. no           | Name of the office                               | As per approved Organizational Development Exercise |                       | Existing no. of staff |
|------------------|--------------------------------------------------|-----------------------------------------------------|-----------------------|-----------------------|
|                  |                                                  | Position/Rank                                       | No. of approved staff |                       |
| Park Headquarter |                                                  |                                                     |                       |                       |
| 1.               | Administration section                           | Chief Forestry Officer                              | 1                     | 1                     |
|                  |                                                  | ADM                                                 | 1                     | 1                     |
|                  |                                                  | ESP                                                 | 1                     | 1                     |
|                  |                                                  | Driver                                              | 1                     | 1                     |
| 2.               | Forest Monitoirng and Information Section        | Forestry Officer                                    | 2                     | 1                     |
|                  |                                                  | Ranger                                              | 1                     | 1                     |
| 3.               | Nature Conservation Section                      | Forestry Officer                                    | 2                     | 1                     |
|                  |                                                  | Ranger                                              | 1                     | 0                     |
| 4.               | Forest Resources Planning and Management Section | Forestry Officer                                    | 2                     | 1                     |
|                  |                                                  | Ranger                                              | 1                     | 1                     |
| Field Offices    |                                                  |                                                     |                       |                       |
| 1.               | Chokhor Park Range                               | Park Range Officer                                  | 1                     | 1                     |
|                  |                                                  | Forester                                            | 7                     | 7                     |
|                  |                                                  | ESP                                                 | 1                     | 1                     |
| 2.               | Dungkar Park Range                               | Park Range Officer                                  | 1                     | 1                     |
|                  |                                                  | Forester                                            | 7                     | 3                     |
|                  |                                                  | ESP                                                 | 1                     | 1                     |
| 3.               | Sephu Park Range                                 | Park Range Officer                                  | 1                     | 1                     |
|                  |                                                  | Forester                                            | 7                     | 7                     |
|                  |                                                  | ESP                                                 | 1                     | 1                     |
| 4.               | Nubi Park Range                                  | Park Range Officer                                  | 1                     | 1                     |
|                  |                                                  | Forester                                            | 7                     | 1                     |
|                  |                                                  | ESP                                                 | 1                     | 0                     |
| 5.               | Dhur Guard Post                                  | Forester                                            | 4                     | 3                     |
| 6.               | Ney Guard Post                                   | Forester                                            | 4                     | 3                     |
| 7.               | Tang Guard Post                                  | Forester                                            | 4                     | 2                     |
|                  |                                                  | Total                                               | 61                    | 42                    |



## CHAPTER III

### SUMMARY REVIEW OF THE PAST MANAGEMENT PLAN

#### 3.1. Assessment of the previous conservation management plan

The strategic goals and the strategic actions of previous conservation management plans have guided the activities carried out by the park management since 2012. The most recent plan had eight strategic goals and 68 strategic actions, of which 55 strategic actions were achieved. Some unachieved strategic actions are being carried over to the new plan based on their relevancy to the current scenario. The major activities that were implemented in the previous years are summarized below:

##### 3.1.1. Forest protection and enforcement

###### 3.1.1.1. *SMART Patrolling*

Spatial Monitoring and Reporting Tool (SMART) patrolling is an anti-poaching tool used worldwide. After implementing SMART in WCNP, the park rangers dismantled about 487 musk deer traps, and 562 old traps and apprehended seven poachers. Apart from curbing illegal activities, SMART has also helped the park maintain a data repository of wild flora and fauna found in the park. Considering its effectiveness in addressing wildlife crime and its significant impact on rangers' service delivery, the park will continue to implement and further enhance SMART patrolling efforts.

##### 3.1.2. Forest Resource management

###### 3.1.2.1. *Community forests*

There are currently eight Community Forests (CF), out of which three were established from July 2012 till June 2018. The first CF was established at Kurtoed Gewog in 2013 and is called Tangrung CF in Tangrung village. Another two CFs were established in Chokhor Gewog in 2015: Gorchen CF at Dhur village and Lusibe CF at Lusibe village. Mangkhog CF is due for its first management plan review on April 2023 and Gorchen CF and Lusibe CF are due in June 2025. Two more CFs were established in 2020: Chutoe CF and Namkha CF at Tang Gewog. Regular record-keeping training was also imparted to the CF members.



### **3.1.2.2. *Alternative sources of energy***

To reduce forest fires and illegal collection of firewood, alternative sources of energy were provided by the park. Around 70 solar lamps were distributed to the park residents. Bio-briquette production machines were provided to the highlanders in 2015 to reduce the use of firewood. Using alternative energy sources such as biogas was also promoted at Dungkhar and Sephu Park Range.

A community-based group was also formed in Dungkhar Park Range to combat forest fires. Two other forest fire groups were formed at Chazam-Chusa Chiwog and one at Jasibi village in 2019. Jasibi forest fire members were recently involved in extinguishing a forest fire at Jasibi.

### **3.1.3. Waste management**

The park has conducted various cleaning campaigns and advocacy programs related to waste management. The park has provided waste bins to different institutions as a measure to manage the waste generated in the workplace. As a direct measure to handle the waste, the park staff, carry out waste collection activities within the vicinity of the respective offices on the 9<sup>th</sup> day of every month.

Waste has also been a major issue at the cordyceps collection sites. Most of the cordyceps collectors are found to dump their waste at the collection area rather than taking them back for proper disposal. The waste left in the cordyceps collection area will drastically deteriorate the alpine ecosystem. To combat this issue, the park started implementing a strategy called Garbage In and Garbage Out (GIGO). With this strategy, the people moving to the collection area has to declare the plastic items that they are carrying at an entry point, and upon return from the collection area, they need to re-declare the waste they brought back. If the waste is less than what they have taken, the individual is fined a certain amount. This initiative helps deter the public, especially the cordyceps collectors from dumping the waste in the pristine alpine area.

### **3.1.4. Human-wildlife conflict management**

HWC has always been a major issue in the park. To combat this issue, some of the initiatives taken by the park are:



#### **3.1.4.1. *Electric fencing***

Electric fencing is one of the most common and effective ways to combat HWC. Our park has provided and supported the public with electric fencing to mitigate HWC. As per the data from 2014 to 2019, around 25.13 kilometers of electric fencing has been provided to Chokhor, Tang, Sephu, and Kurtoed Gewogs covering about 64 hectares of area, benefitting about 185 households.

#### **3.1.4.2. *Livestock insurance groups***

Community-based livestock insurance scheme was initiated with financial support from various donor-supported projects with the aims of reducing retaliatory killing and to compensate communities for the loss of their livestock to wildlife depredation. Park management, in consultation with local government and communities has formed six livestock insurance groups engaging 159 members. Three groups of 70 households were formed in Chokhor Gewog in 2010 and 2011. Two insurance groups were formed in Dungkhar Park Range. One group was initiated and formed for Ney Chiwog under Gangzur Gewog with 53 members in 2017, and one group was formed in Dungkar village with 17 members in 2016. In Sephu, with funding support from the Laya-Sephu project, the insurance group was formed in 2014. The group has 19 members including some highlanders.

The groups were functioning satisfactorily and some have started to compensate their members. However, the groups were dissolved after the Ministry's order in June 2018 to collect the seed money of all GECC/Livestock Insurance groups and deposit it in the centralized account of the Endowment Fund for Crop & Livestock Conservation in Bhutan to be established at the national level.

#### **3.1.4.3. *Supplied yak breeding bulls***

To support the highlanders, the park with support from Asia High Mountain and Landscape Project, supplied 17 breeding bulls at Chokhor and eight breeding bulls at Sephu in 2015-2016. The main aims and objectives of supplying the yak bulls were to maintain the quality of breeds, improve the breeds of the offspring and enhance the production of milk, butter, and cheese.

### **3.1.5. *Preservation of Cultural and Religious Sites***

WCNP is a hotspot for numerous cultural, religious, and historical sites (Figure 30). Protection and promotion of religious, cultural, and historical sites and practices was one of the key goals of the park conservation management plan. For promoting and preserving cultural practices in the communities, the park management has supported activities promoting religious and



cultural practices. Maintenance of Murti Zam under Tang Gewog was supported in 2012. Murti Zam is located on the way to Tang Thowadrak, one of the most visited pilgrimage sites in Bumthang. People of Namkhai and Chojam annually conduct festivals and people requested the park management for support to procure mask dance costumes as the old costumes needed to be replaced. Along with the mask dance costumes, the park has supported the construction of toilets for Namkhai and Chojam Lhakhang and water supply for Thay Lhakhang at Bebzur. For the safety of sacred statues and relics, one fireproof iron box was given to Thay Lhakhang. The park also supported the renovation of Bebzur Chukpo's mansion. Bebzur Chukpo's mansion is a gigantic structure in the village, and it is said to be the house of the richest family in the village. The purpose of supporting the renovation of three storied structure with numerous rooms was to promote it as a heritage house and ultimately convert it into a museum. Bhutanese people have the practice of visiting hot springs for treatment of various ailments, and the park has several famous hot springs like the Dhur Tshachu under Bumthang and Khampalung Tshachu under Lhuentse. The park management supported the construction of guest houses and trail improvement for the two hot springs.

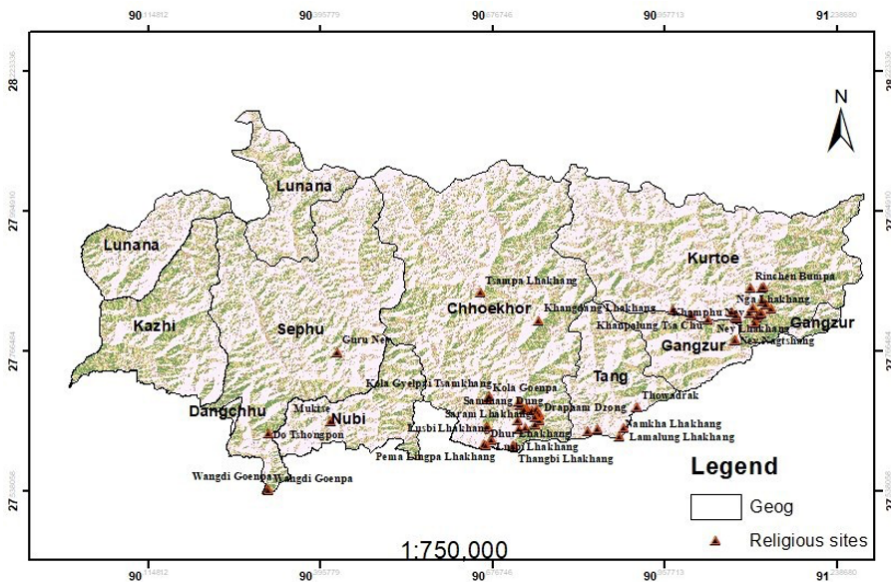


Figure 30: Religious and cultural significant sites in WCNP

### 3.1.6. Research and publications

Research and field works are one of the primary mandates of the park. During the previous plan, various research and field works were done. Some of the major research works carried out by the park are as follows:



#### ☐ **Medicinal Plants of Wangchuck Centennial National Park**

The publication recorded 128 species of medicinal plants under 48 different families (Wangchuck Centennial National Park, 2014). The study was conducted as a part of the project funded by WWF Bhutan, and it was carried out as a step towards conserving the bio-cultural heritage of Bhutan.

#### ☐ **A Field Study on Asiatic Black Bear in Wangchuck Centennial National Park**

The report published in 2014 highlighted the various aspects of biology, ecology, status, and distribution of the Asiatic black bear in WCNP. The distribution of black bears ranges from an elevation of 2500 to 4500 masl. The area extends from Kazhi and Dangchu in the west and Kurtoed and Gangzur in the east, and as far as Tshampa and Khekhri in the north to Sephu and Tang in the south of the park (Wangchuck Centennial Park, 2014).

#### ☐ **Report on Fish Diversity in Wangchuck Centennial National Park**

The study on fish was deemed necessary as the data on fish found in WCNP was lacking. The study identified five different species of fish under three different families found across the park. The survey was conducted during the month of May and June 2016.

#### ☐ **Distribution and Conservation Threats of Bhutan Takin**

Identifying the habitat of the Bhutan Takin in WCNP was a necessary management intervention to ensure that conservation and protection efforts for the National Animal are further enhanced. As per the report, the potential habitat of the species covers an area of 1579.40 km<sup>2</sup> (Wangchuck Centennial National Park, 2016).

#### ☐ **Population Status and Distribution of Snow Leopards in Wangchuck Centennial National Park**

To secure the future of the elusive cat, the study on snow leopards was undertaken to determine the population size, density and distribution, and their prey species. The survey was conducted from autumn 2011 till spring 2014. As per the survey, it has been determined that the abundance of snow leopards varies between 9 and 11 (mean: 9 individuals) in the Chokhor Park Range area and 5 and 17 (mean: 6 individuals) in the Sephu Park Range area (WCNP & WWF, 2016).





#### □ **Field Guide for Butterflies**

The field guide for butterflies was developed from the information gathered by park management during the biodiversity survey and butterfly survey. The publication includes the butterfly diversity of WCNP and its distribution in different administrative ranges of the park. The book described 167 species of butterflies under six major families found in WCNP (Wangchuck Centennial National Park, 2017).

#### □ **Field Study on Musk Deer and its Conservation Strategy in Wangchuck Centennial National Park**

The conservation of musk deer is challenged by the threats from poaching and habitat degradation. For strategic patrolling and monitoring of musk deer and their habitat, the park management studied distribution and habitat use by the species. As per the findings, the potential habitat of the musk deer in the park was found to be 1185 km<sup>2</sup> (Dhendup, Nado, & Dorji, 2018).

### **3.1.7. Strengthening of institutional capacity**

#### **3.1.7.1. Infrastructures**

- **Park Head Office, Nasiphel**
  - ✓ Construction of CFO Residence completed in 2013
  - ✓ Construction of Office Building completed in 2014
  - ✓ Construction of 2-unit staff Quarter completed in 2016
  - ✓ Construction of Information Centre completed in 2016
- **Chokhor Park Range, Thangbi**
  - ✓ Construction of Range Office completed in 2014
  - ✓ Construction of 2-Unit staff Quarter completed in 2019
- **Sephu Park Range, Sephu**
  - ✓ Construction of Range Office Completed in 2013
  - ✓ Construction of 2-unit staff Quarter completed in 2015
- **Dungkhar Park Range, Kurtoed**
  - ✓ Construction of 2 Unit staff Quarter Completed in 2016
  - ✓ Construction of Range Office completed in 2017
- **Beat office at Tang**
  - ✓ Construction of Beat Office at Tang completed in 2022



### **3.1.7.2. Capacity development**

Training details of WCNP staff (2012 – till date):

- ☐ In 2012-2013, one staff attended Certificate Course in Wildlife Management in India for 9 months
- ☐ In 2012, two staff were sent on an exchange program for nine days in Bangkok
- ☐ In 2012, one staff sent to Bangalore, India for Dietary analysis training on scats for eight days
- ☐ In 2013, one staff sent for Training in Environmental Management systems in the Philippines for two weeks
- ☐ In 2013, eight staff sent to Nepal for a Human Wildlife Conflict management study tour for 10 days
- ☐ In 2014, one staff attended a short course on Introduction to Geo-informatics

### **3.1.8. Water source mapping**

The park management, in collaboration with the Watershed Management Division (WMD), conducted an inventory of water sources across the park to establish baseline data on various water sources used for drinking, irrigation, and other purposes. The exercise was also carried out to study the trends of drying water sources and their causes. A water source classification survey was conducted in 2021. The park management has recorded 138 water sources in five Dzongkhags and nine gewogs, benefiting 783 households. All these water sources are used for drinking and irrigation purposes. The assessment result indicated about 1.45% ( $n = 02$ ) of the water sources are in pristine condition, 65.21% ( $n = 90$ ) in normal condition, 29.71% ( $n = 41$ ) in degraded condition, and 3.62% ( $n = 05$ ) in critical condition. The reasons behind the drying up of water sources are attributed to an increase in population, increased development activities, deforestation, intensive grazing, and disturbance of water sources by domestic animals.

As a part of the water source management program to revive and manage the critical watershed areas, a water intervention management program was carried out in Thangbi Chiwog under Chokhor Gewog, Bumthang. A detailed water intervention management plan has been submitted to Watershed Management Division, DoFPS, Thimphu.



### **3.1.9. Bhutan METT+ assessment**

Bhutan Management Effectiveness Tracking Tool (METT) + assessment was introduced in all protected areas to strengthen the protected area management through regular assessments. The outcomes of the Bhutan METT+ assessment will be applied to improve the systems for managing all the protected areas of Bhutan.

Assessment for WCNP was first conducted in 2016 (2010 to 2016 assessment) with an overall score of 61%. The major threats identified during the assessments were human-wildlife conflict, housing and settlement, waste management, livestock farming, and grazing. The second round of internal assessment for Bhutan METT+ was completed in July 2022 with a score of 67%. Commercial poaching, waste management, and human-wildlife conflict were the major threats identified.

## **3.2. Lessons learnt**

While implementing the strategies of the past management plan, there were lots of lessons learnt which are as follows:

### **3.2.1. Inaccessibility of the areas**

The majority of the park area falls in the northern part of the country with rugged terrain in areas above 5000 masl which remains under the snow throughout the year, rendering it inaccessible. Areas falling above 3500 masl become inaccessible during winter and early spring months. The park management can implement its activities in the yak herding community for hardly six months from early May to early November. Knowledge of the inaccessibility of the areas under the park at different periods helps the management in strategic planning of SMART patrolling.

### **3.2.2. Partnership and Collaboration**

The implementation of the activities would not have been successful without the collaboration with other relevant stakeholders and partners. For example, WCNP supplied breeding bulls in collaboration with the Department of Livestock. Similarly, the personnel of the Royal Bhutan Army stationed at the higher elevation areas is very helpful, especially in terms of providing food and lodge for the park staff while on monitoring visits to these areas. Further, they also support the park staff with their communication facilities during emergencies.



### 3.2.3. Effective planning and implementation

Proper planning of activities for the park management and annual work plan for the staff are carried out at the start of the financial year. The annual work plan is aligned with the mandates of the park and in line with the conservation management plan. Further, activities are prioritized based on the availability of funds. An effective monitoring and evaluation program is also developed to ensure the successful and effective implementation of plans and programs.

### 3.2.4. Lack of technical Expertise

With the digitalization era, the department has launched most of the public service delivery programs online and therefore it has become very important for the staff to enhance their capacities to cater to online public services. As most of the staff have limited knowledge of the use of computers and other technology, it becomes difficult to provide prompt services. Considering the need for enhancement of capacities of the staff especially on basic computer knowledge and other related applications, the management of WCNP has planned strategic in-house training for staff of every range office. Further, every range in the park now has one individual who knows SMART, ArcGIS, GPS, and basic computer applications such as MS Office and G Suite.

### 3.2.5. Resource allocation

Reliable field equipment is essential in providing efficient public services apart from carrying out field surveys and research. Therefore, equipment such as GPS, smartphones, motorcycles, cameras, binoculars, and other field gear was procured and distributed to the field offices.

## 3.3. Gaps and carry-over actions from the previous plan

The WCNP management has been able to achieve only 80% of its targets and the activities from the previous management plan due to limited staff, and limited access along the international border areas coupled with harsh terrain and financial constraints. Therefore, some of the activities are being carried over to the new management plan, while some of the activities are dropped since it was found to be irrelevant in the current scenario. The following are the activities carried over from the previous management plan:

- ☐ Field study on small mammals and reptiles.
- ☐ Develop sustainable harvesting regimes and techniques for medicinal plants in coordination with the Institute of Traditional Medicine Services (ITMS).
- ☐ Construction of field offices and other required infrastructures.



### 3.4. Delay in inception of current management plan

The first conservation management plan expired in July 2017 and preparation of a new conservation plan was initiated but there was no assured funding for the planning process and related field surveys. While most of the activities of the first conservation plan were implemented and achieved, some activities especially infrastructure development could not be fully implemented. Further, the adoption of the Annual Performance Agreement (APA) by the government and its implementation at the agency level in 2015 has guided the park management in preparing and implementing the annual work plan for every financial year. APA system has guided the management in proposing activities in line with the outputs approved by the department. With the implementation of Bhutan for Life (BFL) project, most of the park activities are implemented with BFL funding support. The park management has been rendering mandatory forestry services and allotment of forest resources to the park residents, irrespective of the expiration of the management plan.





## CHAPTER IV

### THREAT ANALYSIS

Identifying threats, challenges, and their analysis is integral for conservation planning and management. After the threats and challenges have been identified and ranked, a management prescription has to be coined and implemented to address the urgent and severe threats and challenges immediately. Following are the conservation threats and management challenges identified for WCNP:

#### **4.1. Conservation threats**

Besides providing provisioning services, regulating services, cultural services, and supporting services, the protected areas remain a cornerstone of global conservation efforts. Some of the threats remain dormant as of now, and some are already showing their detrimental impacts and signs. Identifying and analyzing the threats is of paramount importance to assess the risk associated with emerging threats. With proper threat analysis, the park will devise proper mitigation and adaptation action plans to minimize threats and challenges. Following are the threats identified for WCNP.

##### **4.1.1. Poaching and illegal trade of wildlife products**

###### **4.1.1.1. *Poaching and illegal trade of faunal species***

The remoteness, inaccessibility, and vastness of the park area favor the poachers to carry out illegal activities. In the past four years, park rangers have dismantled about 487 live musk deer traps, and 562 old traps and apprehended seven poachers. On average, every forester has around 153 sq. km of area to cover. Being home to some of the highly poached species like musk deer and snow leopards, the park encounters many poaching cases every year. Although the poaching case of snow leopards is rarely apprehended, but this does not negate the poaching of snow leopards. Due to the porous northern transboundary, there is also a possibility of poaching from across the border.

###### **4.1.1.2. *Illegal harvest of medicinal plants***

Covering the maximum part of the alpine ecosystems, the park is a treasure trove of some of the highly valued and sought-after medicinal plants. One such example is Cordyceps, which is now a highly prized medicinal plant found naturally in the Himalayan region (Boesi, 2003).



Although there is a sustainable harvesting guideline for the ‘Cordyceps’ and a strict monitoring mechanism in place, especially during the harvesting season, there are many illegal activities such as untimely collection and intrusion of ineligible collectors from both within and across the border. Some other illegal collections are associated with species like *Nardostachys grandiflora* and *Neopicrorhiza scrophulariiflora*. The illegal harvesting of these species puts a huge strain on the survival and sustainability of these high-value medicinal plant species.

### **4.1.2. Degradation of alpine ecosystem**

#### **4.1.2.1. *Range shifting of alpine shrubs and scrubs into meadowlands***

About 127 sq. km of the park area is under alpine meadows, which is one of the important habitats for both wild fauna and flora. The meadows are also grazing land for the yaks in the park. With the restriction of burning in the mountains, the park residents said that the shrubs and scrubs are invading the grassland. There are other factors behind this dynamism, like the warming of the earth's surface, upward movement of plants, decline in the number of yak herders over time, and trampling of the grassland by the seasonal cordyceps collectors. All these lead to slow and steady deterioration and degradation of the grassland. The most effective way of restoring these alpine meadows is through the conventional practice of transhumance. The alpine meadows are the main forging land for the blue sheep, which is also the primary prey of the snow leopard.

#### **4.1.2.2. *Livestock overgrazing***

Yak husbandry has been there from time immemorial and the practice of transhumance is still prevalent in the park. During the summer months, the nomads take their yaks and horses to higher altitudes, where they reside for months. People of Chokhor and Sephu Gewogs, consisting of about 143 yak herders, graze their yak inside the park. Although the threat to the alpine meadows from livestock grazing is minimal, we still can't ignore it altogether.

#### **4.1.2.3. *Solid waste accumulation***

Every year, around 2000 people set for the harvest of the cordyceps from the mountains. These people carry rations and other food with them, and after the collection season, they leave behind plastic bottles, used batteries, rags, cans, torn boots, and other non-degradable wastes. On top of that, occasional trekkers, armed forces, highlanders, pilgrims, and tourists also add to the waste accumulation in the park. Most of the waste is thrown at camping sites, resting sites, along the trails, and lunch points. Waste management programs like advocacies, cleaning





campaigns, and the GIGO system are instituted. The GIGO system is mainly for cordyceps collectors, who are mandated to bring back their waste. In recent years (from 2020), the gewog administration has initiated the deposition of security fees for waste management for the cordyceps collectors, and upon declaration of wastes by the collectors on their return, the money is refunded.

**4.1.3. Climate change**

Climate change has always been a constant threat to the ecosystem and the livelihood of people around the world (Adhikari, 2020). Bhutan is no exception to the harsh consequences of climate change. Bhutan being a mountainous country, is vulnerable to the impacts of climate change. There are 567 glacial lakes in Bhutan covering an area of  $55.04 \pm 0.055 \text{ km}^2$  within the four river basins (Karma, et al., 2021), and of these, 17 are Potentially Dangerous (PD) out of which 8 are found in WCNP (Cryosphere Services Division, NCHM, 2019). Feeding the Pho Chhu sub-basin, there are 3 PD lakes, 3 lakes feeding the Mangdechhu sub-basin and 2 lakes feeding the Chamkhar Chhu sub-basin (Figure 31). Although these water reservoirs are the main contributor to hydropower generation, their presence also poses a great risk to the lives and property downstream. As per records, in 2016, Glacial Lakes Outburst Floods (GLOF) killed 20 people and livestock, and damaged several houses, watermills, and pasture lands along its path (Seldon, 2016).

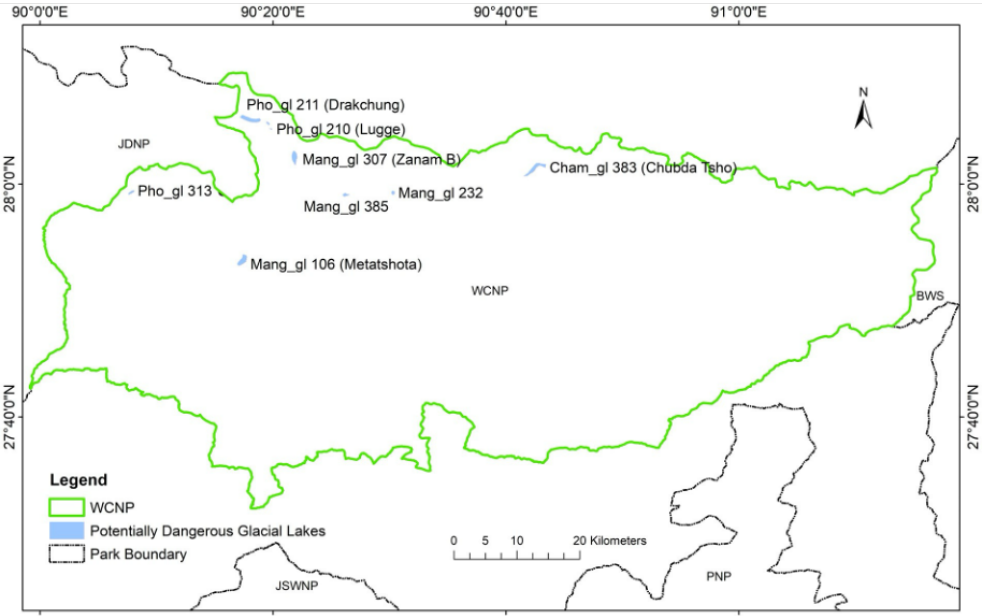


Figure 31: Potentially dangerous glacial lakes of WCNP



There is an impending danger of GLOF in the park in the near future. Climate change threatens the survival of biodiversity and the integrity of the ecosystems. The park’s mountain ecoregions harbor a diversity of alpine and temperate habitats that contains numerous endangered and endemic species. As a result, the park is an integral part of the protected area complex of the country.

**4.1.4. Habitat fragmentation and loss**

**4.1.4.1. Developmental activities**

With inhabitants inside the park, developmental activities are inevitable. Every year, many development projects, such as farm road constructions, installation of electric transmission lines, and construction of irrigation channels and trails, happen in the park. As per the record maintained in Forest Information Reporting & Monitoring System (FIRMS), the area lost to developmental activities in the last 5 years is 102.4 acres (Table 14). Out of many developmental activities, the abovementioned activities are the major factors behind wildlife habitat fragmentation.

Table 14: Developmental activities recorded for past 5 years

| Sl. No. | Developmental Activities       | Area (acre) |
|---------|--------------------------------|-------------|
| 1       | Surface collection             | 12.7        |
| 2       | Land exchange                  | 8.81        |
| 3       | Transmission line/mobile tower | 8.73        |
| 4       | Road                           | 33.78       |
| 5       | Other constructions            | 38.38       |

**4.1.4.2. Forest fire**

Fire can be used as a forest management tool; however, uncontrolled fires can destroy and fragment wildlife habitats and even kill many biodiversity therein. No major forest fire incidences occurred in the park in recent times, except for the recent forest fire that occurred at Jasebi, Lhuentse, which burned about 31 acres of forest. This could be attributed to the proper advocacy by the Department and the park management to the general public. With the



wildlife habitat management guidelines in place, fires will be prescribed as a management tool to control the invasive weeds and other unhealthy growth of the alpine shrubs. This could also lead to the destruction of habitats if proper mitigation measures are unplanned. Careless fires from buffer areas of the park could also lead to major habitat loss in the park.

#### **4.1.4.3. *Illegal extraction of forest resources***

With most of the places being connected by farm roads, there is a drastic increase in the illegal extraction of forest produce. Illegal extraction of timber and firewood from the forest are common cases that forestry officials face. As per the record maintained in FIRMS, about 9866 cft (Cubic Feet) of illegal timber was apprehended in the last four years. The unscientific and unsustainable extraction of such resources harms the forest, which otherwise has taken many years to get established. Hence, higher illegal extraction of resources will lead to the deterioration of forest health.

#### **4.1.5. Pest and diseases**

Recently, there have been several incidences of wildlife mortality in the park. In 2020, the park reported the death of more than 17 takins at Dhur, two at Gomthang and about 6 at Tshokarla. The cause of disease and death is still unknown; however, livestock official doubt that the death could have resulted due to transmission of the diseases from the yaks and feral dogs. Since mountain ungulates and the yaks share a common grazing area, there might be a possibility of disease transmission to the wildlife and vice-versa. It will then be safe to say that those takins succumbed to death due to some diseases that we are unknown of.

Bark beetle infection has always been a major pest in the forest ecosystem. They mostly infect conifer species and spread very quickly if not managed and eradicated early. As most of the park area consists of conifer species, such infection is a major concern for the management. Apart from bark beetle, there is infectious pest such as adelgid, which mainly infect hemlock and spruce trees and weakens the tree by sucking the sap from it.

Plants can also be considered as pests when they destroy the native vegetation and replace it with their own species. The fast-spreading alien invasive species can also be considered a major pest or threat to the native ecosystem. Invasive species can spread faster and replace native vegetation, creating an imbalance in the ecosystem. Some common invasive species are



*Ageratina adenophora*, *Lantana camara*, and *Parthenium hysterophorus*. (Thinley, Banterng, Gonkhamdee, & Katawatin, 2019). In-depth research on invasive species found in the park is required to ascertain further the threats and implications to the native vegetation and ecosystem at large.

**4.1.6. Human-wildlife conflict**

Human-wildlife conflict has always been a major threat to the wellbeing of the people and animals. This issue mainly occurs in rural areas where wild animals invade the crops and, in some cases, encroach on the people's dwellings in search of food. The most common conflict occurs between humans and wild pigs. Wild Pigs frequently invade farmers' fields and destroy their crops. *Highlanders*, who constantly shift from one place to another with varying seasons, come into conflict with Himalayan Asiatic black bears. When they migrate to another area, their dwellings in the previous areas are vandalized by bears, and in the process, all the stocked-up rations are lost. Another species that come into conflict is the Tibetan wolf. People with horses and yaks often complain to the forestry officials about their livestock being attacked by Tibetan wolfs. Details on HWC scenarios have been explained in Chapter 2.

**4.2. Management challenges**

**4.2.1. Porous international border**

The northern boundary of WCNP is shared with China (Tibet). Traditionally, people crossed the international boundary for trade and other purposes. Even today, there are many routes through which people can travel across borders. Due to the porous nature of the international boundary, there are many cases of illegal trade of NWFP, poaching, the illegal harvest of cordyceps, and wildlife trafficking. These activities pose great challenges to forestry officials, especially regarding monitoring and apprehending.

**4.2.2. Remoteness and Inaccessibility of the Area**

WCNP is the largest protected area in the country. The vast landscape, along with difficult terrain, makes it virtually impossible to access and monitor all the areas inside the park. In the northern area, the ice and rocky terrains make it very difficult to navigate, while in the southern area, the thick vegetation and cliff create problems. Most places in the park area are also devoid of cellular networks. This makes it extremely dangerous for the park staff while conducting



surveys and patrolling as there are no other means to contact for help in case of any emergencies.

#### **4.2.3. Limited baseline data**

WCNP is a new protected area in the country, with inadequate data on the park's biodiversity. Some of the important surveys carried out by the park are the musk deer survey, snow leopard survey, tiger survey, and National Forest Inventory. There are still many species that are yet to be studied. For effective conservation and management of the species, it is important that we have the baseline data of the lesser-known species in the park. Therefore, it is very essential for the park management to address this lack of data and work towards gathering the data.

#### **4.2.4. Lack of conservation awareness**

People living inside the park are important for the successful achievement of the park's objectives and goals. Most of the people residing in the park are unaware of the rules and regulations in place for the conservation and protection of biodiversity. With constant amendments being made to Forest and Nature Conservation Rules and Regulations (2017), it's the responsibility of the park officials to make the general public aware of such changes and keep the public updated. If the people are well aware of the rules and related penalties, especially for illegal activities, then it would go a long way towards fulfilling the mandates of conservation and protection of biodiversity in the park.

#### **4.2.5. Socio-economic status of inhabitants**

Being an agrarian society, people's livelihood heavily depends on the forest and its natural resources. Due to the lack of alternative income sources, the people living inside the park resort to exploiting natural resources for their livelihood. With little understanding of the ecosystem and its importance, the protection and conservation policies in place for the protected areas is seen as a restrictive and biased measure to the local people.

### **4.3. Threat analysis**

Threat analysis encompasses the assessment of threats in conservation planning and management. It forms an integral part of conservation planning and management. Once the threat has been identified, threat ranking is necessary to prioritize interventions to mitigate the threat. Threat analysis and ranking has been done using Miradi 4.5.0. Only the broad threats



included under conservation and management were used for the analysis. Six threats under conservation threats and five threats under management threats were analyzed on seven broad targets of the park. The result chain analysis on targets, threats, and its contributing factors was developed in Miradi 4.5.0 software. The threats were ranked on scope, severity, and irreversibility. Each threat component is ranked as low, medium, high or very high. After all the components were ranked, then the overall rating was generated. The overall threat ranking of the park as per the software was Medium (Table 15).

Table 15: Threat ranking of WCNP

|                         | Threats \ Targets                               | Conservation and protection ... | To ensure continuo... | To support the s... | Sustainable man... | Summary Threat Rating          |
|-------------------------|-------------------------------------------------|---------------------------------|-----------------------|---------------------|--------------------|--------------------------------|
|                         | Poaching and illegal trade of wildlife products | Medium                          |                       |                     | Medium             | Medium                         |
|                         | Pest and diseases                               | Medium                          |                       | Medium              | Low                | Medium                         |
|                         | Human wildlife conflict                         | Low                             |                       | Medium              |                    | Low                            |
|                         | Habitat fragmentation and loss                  | Low                             | Low                   |                     |                    | Low                            |
|                         | Degradation of alpine ecosystem                 | Low                             | Medium                |                     |                    | Low                            |
|                         | Climate change                                  | Medium                          | Medium                | Low                 |                    | Medium                         |
| Summary Target Ratings: |                                                 | Medium                          | Medium                | Medium              | Low                | Overall Project Rating: Medium |

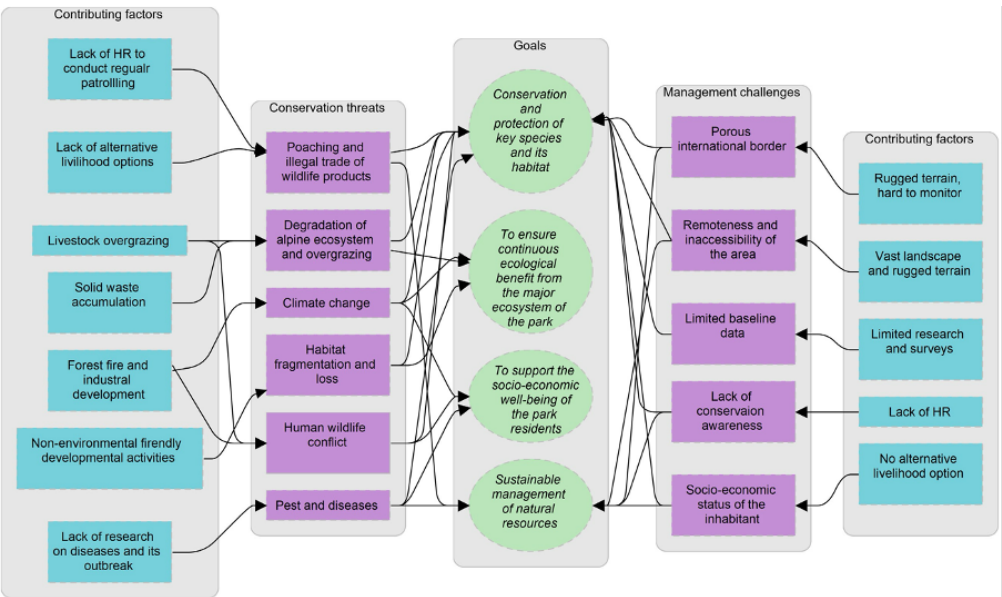


Figure 32: Result chain of threats and their contributing factors to the conservation targets



Figure 33: Conceptual model of strategies formulated to address the threats in WCNP





## CHAPTER V

# MANAGEMENT PRESCRIPTIONS

The management prescriptions of the plan are formulated to address the threats and challenges identified in Chapter IV. Figure 33 shows the conceptual model of strategies prescribed for addressing conservation threats and management challenges. There are six conservation objectives, 16 strategies, and 75 strategic actions.

### **Objective 1: Protection and conservation of nature and biodiversity**

#### ***Strategy 1.1: Implement zero poaching strategy and strengthen law enforcement***

- 1.1.1 Conduct regular SMART patrolling.
- 1.1.2 Establish an intelligence-sharing network with communities and relevant stakeholders and explore opportunities to provide incentives and other benefits to the informant.
- 1.1.3 Procure field equipment and gears to strengthen patrolling efforts.
- 1.1.4 Coordinate refresher training on the use of Fire Arms for the field staff.
- 1.1.5 Conduct regular awareness of forestry rules and regulations to the park resident.
- 1.1.6 Train all the new recruits on the operation of SMART.
- 1.1.7 Conduct specific and specialized law enforcement training for Rangers in collaboration with Royal Bhutan Police, Courts, OAG, and other relevant stakeholders.

#### ***Strategy 1.2: Uphold biodiversity conservation through research and monitoring.***

- 1.2.1 Conduct tiger survey as part of the National Tiger Survey.
- 1.2.2 Conduct snow leopard survey as part of the National Snow Leopard Survey.
- 1.2.3 Conduct research on aquatic biodiversity.
- 1.2.4 Conduct studies on dragonflies and damselflies.
- 1.2.5 Conduct studies on herpeto-fauna diversity and distribution.
- 1.2.6 Conduct studies on important plant species such as *Neopicorrhiza* sp. and *Paris polyphylla*.

### **Figure 33 Conceptual model of strategies formulated to address the threats in WCNP**

- 1.2.7 Conduct timely forest inventory as part of the National Forest Inventory.
- 1.2.8 Conduct out a survey on the red panda to determine its distribution and ecology.
- 1.2.9 Conduct studies on dhole to determine its distribution.



- 1.2.10 Carry out studies on small mammals to determine its diversity and distribution.
- 1.2.11 Carry out a survey on endemic plants of park (*Daphne ludowlii*, *Cotoneaster bumthangensis*).
- 1.2.12 Conduct studies on orchid diversity and distribution.
- 1.2.13 Implement citizen science programs by providing necessary training to the community.

**Objective 2: To promote wildlife habitat management and restoration.**

***Strategy 2.1: Enhance wildlife habitat management interventions.***

- 2.1.1 Improve and monitor water holes and salt lick as per the wildlife habitat management guidelines.
- 2.1.2 Identify and manage wildlife (takin, tiger, and snow leopard) trails/movement corridors to improve wildlife habitat connectivity.
- 2.1.3 Restore alpine meadows by clearing invading shrubs in the area.

***Strategy 2.2 Solid Waste Management***

- 2.2.1 Strict implementation of garbage in garbage out (GIGO) across the park in collaboration with gewog administration during cordyceps collection season.
- 2.2.2 Strengthen advocacy and awareness of solid waste management to the stakeholders and public at large.
- 2.2.3 Construct and install signages and information boards at strategic locations along the eco-trails and campsite found within the park.
- 2.2.4 Coordinate with the Department of Tourism and ABTO on the implementation of GIGO approach for tourists visiting the park.

***Strategy 2.3: Strengthen surveillance and prevention of pest and diseases***

- 2.3.1 Contain and manage bark beetle infection in the park through sanitation operations.
- 2.3.2 Conduct studies on adelgid in collaboration with UWIFoRT.
- 2.3.3 Manage invasive species as per the intervention plan developed by National Biodiversity Center.
- 2.3.4 Provide awareness to the local communities on the various pest and diseases in the park.

**Objective 3: Sustainable management of natural resources**

***Strategy 3.1: Strengthen Community Forest (CF) Management***



- 3.1.1 Revise six Community Forest management plans.
- 3.1.2 Build capacity of the CFMG on record keeping, good governance, and silviculture system.
- 3.1.3 Facilitate the formation of a new CFMG.
- 3.1.4 Promote product development (value addition) of the CF produce.
- 3.1.5 Conduct regular monitoring of the CFs.

***Strategy 3.2: Enhance Local Forest Management Area (LFMA)***

- 3.2.1 Provide training to field staff on carrying out LFMA field surveys.
- 3.2.2 Carry out survey and development of management plan for LFMA.
- 3.2.3 Train field offices on LFMA implementation and record keeping.

***Strategy 3.3: Promote community-based Non-Wood Forest Product (NWFP) Management***

- 3.3.1 Monitor the existing NWFP group.
- 3.3.2 Revision of one NWFP management plan.
- 3.3.3 Facilitate the formation of new NWFP groups.
- 3.3.4 Facilitate the marketing for the sale of NWFP (*Paris polyphylla*, *Exidia* sp., *Neopicrorhiza* sp.).
- 3.3.5 Enhance coordination between the park and the Institute of Traditional Medicine Services (ITMS) and improve sustainable harvest regimes and techniques.

***Strategy 3.4: Enhance Public Service Delivery***

- 3.4.1 Train all the field staff on using online public service delivery platforms such as OFS, G2C, and FIRMS.
- 3.4.2 Provide awareness to the public on using online services for availing public services.

**Objective 4: To improve the livelihood of the people residing in the park**

***Strategy 4.1: Explore and promote ecotourism activities***

- 4.1.1 Revive at least five of the existing homestays in the park.
- 4.1.2 Renovate Dhur Tsa-chu trails.
- 4.1.3 Construct steel truss bridges along the snowman trail.

***Strategy 4.2: Mitigate Human-Wildlife Conflict***

- 4.2.1 Provide solar fence and chain link fence to the community in the HWC hotspot area.



- 4.2.2 Institute compensation and insurance scheme for livestock killed by snow leopard and tiger Sephu and Chokhor gewog.
- 4.2.3 Provide material to construct a corral (iron cage) for the highlander to protect the yak calf from predators.
- 4.2.4 Provide material support for the construction of ration store for highlanders.

**Objective 5: To strengthen the institutional and technical capacity of the park**

***Strategy 5.1: Enhance Park infrastructure and equipment.***

- 5.1.1 Construct Nubi Park Rang Office and Ney Guard Post.
- 5.1.2 Construct staff quarter at park Head Quarter (HQ).
- 5.1.3 Maintenance of the existing office and staff quarters.
- 5.1.4 Improve visitor information center at HQ.
- 5.1.5 Maintain and upgrade communication facilities (maintenance of repeater station and procurement of handsets).
- 5.1.6 Procure field gear such as a tent, GPS, binoculars, camera, and diameter tape and distribute to all the field offices.
- 5.1.7 Procure office supplies such as computers, printers, furniture, and other necessary equipment.

***Strategy 5.2: Develop the capacity of the field staff***

- 5.2.1 Provide regular refresher training on using SMART, uniform code of conduct and drill.
- 5.2.2 Provide training to the staff on the use of GIS and Remote Sensing.
- 5.2.3 Provide training on the use of basic computer applications to the field staff based on need-based assessment.
- 5.2.4 Train staff on species identification and taxonomy.
- 5.2.5 Conduct exchange programs among the protected areas.
- 5.2.6 Train staff on the use of unmanned aerial vehicle.

***Strategy 5.3: Ensure effective protected area management***

- 5.3.1 Evaluate protected area management effectiveness using Bhutan METT+.
- 5.3.2 Carry out a mid-year review of the management plan.
- 5.3.3 Plan for revising the management plan in the final year of this management plan (Rapid biodiversity survey, socio-economic survey and LFMA).
- 5.3.4 Preparation of Annual Operation Plan



**Objective 6: To enhance the resilience of communities from climate change-induced threats**

***Strategy 6.1: Community capacity development to combat climate change threat***

- 6.1.1 Raise awareness among the local community groups on the causes of climate change and its impact, and build the capacity of local leaders to monitor climate change indicators and plan for appropriate adaptation strategies.

***Strategy 6.2: Enhance monitoring and analysis of climate change impacts***

- 6.2.1 Conduct a climate vulnerability and capacity assessment (CVCA) survey.
- 6.2.2 Organize awareness and advocacy for the local stakeholders based on the findings of the CVCA.
- 6.2.3 Monitor permanent biological grid every year to detect changes in flora and faunal composition.
- 6.2.4 Promote bioengineering practices for disaster-prone/affected areas.

*Snow Leopard, Panthera uncia*





## CHAPTER VI

### IMPLEMENTATION PLAN AND FINANCIAL OUTLAY

The objectives and strategic actions stated in Chapter V will be implemented over a 10 years period. For each strategic actions, we have estimated the budget of Nu. 212.18 million and stated in Table 16. The budget has been estimated based on the budget utilization for similar activity in the past. The majority of the financial support will be rendered from Bhutan for Life Project, RGoB funding and other donor funded projects of the department.

Table 16: Implementation Plan & Financial Outlay

| Objectives                                                                  | Strategies                                                                                  | Actions                                                                                                                                                                 | Plan Year and Budget (in millions) |     |     |     |     |     |     |     |     |     |            |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------|
|                                                                             |                                                                                             |                                                                                                                                                                         | Y1                                 | Y2  | Y3  | Y4  | Y5  | Y6  | Y7  | Y8  | Y9  | Y10 | Total      |
| <b>Objective 1: Protection and conservation of nature and biodiversity.</b> | <b><i>Strategy 1.1: Implement zero poaching strategy and strengthen law enforcement</i></b> | 1.1.1. Conduct regular SMART patrolling.                                                                                                                                | 5.5                                | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | 5.5 | <b>55</b>  |
|                                                                             |                                                                                             | 1.1.2 Establish intelligence sharing network with communities and relevant stakeholders and explore opportunities to provide incentives and other benefitsto informant. |                                    | 0.5 | 0.1 | 0.1 | 0.1 | 0.5 | 0.1 | 0.1 | 0.1 | 0.1 | <b>1.7</b> |



|                                                                                            |                                                                                                                                                                     |      |      |      |      |      |      |      |      |      |      |     |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|-----|
|                                                                                            | 1.1.3 Procure field equipment and gears to strengthen patrolling efforts.                                                                                           | 1    |      |      |      | 0.7  |      |      |      | 0.8  |      | 2.5 |
|                                                                                            | 1.1.4 Coordinate refresher training on the use of FireArms for the field staff.                                                                                     | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 1   |
|                                                                                            | 1.1.5 Conduct regular awareness on forestry rules and regulations to the park resident.                                                                             |      | 0.5  |      |      | 0.5  |      |      | 0.5  |      | 0.5  | 2   |
|                                                                                            | 1.1.6 Train all the new recruits on the operation of SMART.                                                                                                         | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.4 |
|                                                                                            | 1.1.7 Conduct specific and specialized law enforcement training for Rangers in collaboration with Royal Bhutan Police, Courts, OAG and other relevant stakeholders. | 0.4  |      |      |      | 0.4  |      |      |      |      | 0.4  | 1.2 |
| <b>Strategy 1.2:<br/>Uphold biodiversity conservation through research and monitoring.</b> | 1.2.1 Conduct tiger survey as part of the National Tiger Survey.                                                                                                    |      |      |      |      | 3    |      |      |      |      |      | 3   |
|                                                                                            | 1.2.2 Conduct snow leopard survey as part of the National Snow                                                                                                      |      |      |      |      |      |      | 3.5  |      |      |      | 3.5 |







|  |  |                                                                                                                 |     |     |     |     |   |  |     |     |   |     |
|--|--|-----------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|---|--|-----|-----|---|-----|
|  |  | Leopard Survey.                                                                                                 |     |     |     |     |   |  |     |     |   |     |
|  |  | 1.2.3 Conduct research on aquatic biodiversity.                                                                 |     |     | 1   |     |   |  |     |     |   | 1   |
|  |  | 1.2.4 Conduct studies on dragonflies and damselflies.                                                           |     |     | 0.5 | 0.5 |   |  |     |     |   | 1   |
|  |  | 1.2.5 Conduct studies on herpetofauna diversity and distribution.                                               | 0.6 |     |     |     |   |  |     | 0.5 |   | 1.1 |
|  |  | 1.2.6 Conduct studies on important plant species such as <i>Neopicrorhiza</i> sp. and <i>Paris polyphylla</i> . | 0.6 | 0.7 |     | 0.3 |   |  | 0.5 |     |   | 2.1 |
|  |  | 1.2.7 Conduct timely forest inventory as part of the National Forest Inventory.                                 |     |     |     |     |   |  |     | 7   | 7 | 14  |
|  |  | 1.2.8 Conduct survey on red panda to determine its distribution and ecology.                                    |     |     | 1   |     |   |  |     |     |   | 1   |
|  |  | 1.2.9 Conduct studies on dhole to determine its distribution.                                                   |     |     |     |     | 1 |  |     |     |   | 1   |
|  |  | 1.2.10 Carry out studies on small mammals to                                                                    |     |     |     | 1.5 |   |  |     |     |   | 1.5 |



|                                                                             |                                                                         |                                                                                                                  |  |     |     |  |     |     |     |     |  |     |
|-----------------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|--|-----|-----|--|-----|-----|-----|-----|--|-----|
|                                                                             |                                                                         | determine its diversity and distribution.                                                                        |  |     |     |  |     |     |     |     |  |     |
|                                                                             |                                                                         | 1.2.11 Carry out survey on endemic plants of park ( <i>Daphne ludowlii</i> , <i>Cotoneaster bumthangensis</i> ). |  | 0.5 |     |  |     |     |     |     |  | 0.5 |
|                                                                             |                                                                         | 1.2.12 Conduct studies on orchid diversity and distribution.                                                     |  | 0.7 |     |  |     |     |     |     |  | 0.7 |
|                                                                             |                                                                         | 1.2.13 Implement citizen science programs by providing necessary trainings to the community.                     |  | 0.3 |     |  | 0.3 |     |     | 0.4 |  | 1   |
| <b>Objective 2: To promote wildlife habitat management and restoration.</b> | <b>Strategy 2.1: Enhance wildlife habitat management interventions.</b> | 2.1.1 Improve and monitor water holes and salt lick as per the wildlife habitat management guidelines.           |  |     | 0.4 |  |     | 0.4 |     | 0.5 |  | 1.3 |
|                                                                             |                                                                         | 2.1.2 Identify and manage wildlife (taken, tiger, and snow leopard) trails/ movement corridors                   |  | 0.5 |     |  | 0.5 |     | 0.5 |     |  | 1.5 |





|  |                                             |                                                                                                                                                             |      |     |     |     |      |     |     |     |     |      |      |
|--|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----|-----|-----|------|-----|-----|-----|-----|------|------|
|  |                                             | of to improve wildlife habitat connectivity.                                                                                                                |      |     |     |     |      |     |     |     |     |      |      |
|  |                                             | 2.1.3 Restore alpine meadow by clearing invading shrubs in the area.                                                                                        |      |     | 0.9 |     |      |     |     | 0.7 |     |      | 1.6  |
|  | <b>Strategy 2.2 Solid Waste Management.</b> | 2.2.1 Strict implementation of garbage in garbage out (GIGO) across the park in collaboration with gewog administration during cordyceps collection season. | 0.2  | 0.2 | 0.2 | 0.2 | 0.2  | 0.2 | 0.2 | 0.2 | 0.2 | 0.2  | 2    |
|  |                                             | 2.2.2 Strengthen advocacy and awareness on solid waste management to the stakeholders and public at large.                                                  | 0.05 |     |     |     | 0.05 |     |     |     |     | 0.05 | 0.15 |
|  |                                             | 2.2.3 Construct and install signages and information board at strategic locations along the eco-trails and campsite found within the park.                  |      |     |     | 0.8 |      |     |     | 0.8 |     |      | 1.6  |
|  |                                             | 2.2.4 Coordinate with                                                                                                                                       |      |     |     |     |      |     |     |     |     |      |      |



|                                                                  |                                                                                   |                                                                                                       |      |      |      |      |      |      |      |      |      |      |      |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|------|
|                                                                  |                                                                                   | the Department of Tourism and ABTO on implementation of GIGO approach for tourist visiting the park   | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.5  |
|                                                                  | <b>Strategy 2.3: Strengthen surveillance and prevention of pest and diseases.</b> | 2.3.1 Contain and manage bark beetle infection in the park by carrying out sanitation operation.      | 0.5  | 0.5  | 0.5  |      |      |      |      |      |      |      | 1.5  |
|                                                                  |                                                                                   | 2.3.2 Conduct studies on adelgid in collaboration with UWIFoRT.                                       |      |      |      |      |      | 1    |      |      |      |      | 1.5  |
|                                                                  |                                                                                   | 2.3.3 Manage invasive species as per the intervention plan developed by National Biodiversity Center. |      | 0.5  |      |      |      |      |      | 0.9  |      |      | 1.4  |
|                                                                  |                                                                                   | 2.3.4 Provide awareness to the local communities on the various pest and diseases in the park.        |      | 0.2  |      |      |      | 0.2  |      |      |      |      | 0.4  |
| <b>Objective 3: Sustainable management of natural resources.</b> | <b>Strategy 3.1: Strengthen Community Forest (CF) Management.</b>                 | 3.1.1 Revision of six Community Forest Management Plan (CFMP).                                        | 0.08 |      | 0.16 |      |      |      | 0.08 |      | 0.16 |      | 0.48 |
|                                                                  |                                                                                   | 3.1.2 Build capacity of the CFMG on record                                                            | 0.3  |      | 0.1  |      |      |      | 0.1  |      | 0.1  |      | 0.6  |





|  |                                                                             |                                                                          |      |      |      |      |      |      |      |      |      |      |     |
|--|-----------------------------------------------------------------------------|--------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|-----|
|  |                                                                             | keeping, good governance and silviculture system.                        |      |      |      |      |      |      |      |      |      |      |     |
|  |                                                                             | 3.1.3 Facilitate the formation of new CFMG.                              |      |      | 0.2  |      |      |      |      | 0.3  |      |      | 0.5 |
|  |                                                                             | 3.1.4 Promote product development (value addition) of the CF produce.    |      |      |      |      |      | 0.5  |      |      |      |      | 0.5 |
|  |                                                                             | 3.1.5 Conduct regular monitoring of the CFs.                             | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 0.1  | 1   |
|  | <b>Strategy 3.2: Enhance Local Forest Management Area (LFMA).</b>           | 3.2.1 Provide training to field staff on carrying out LFMA field survey. |      | 1    |      |      |      |      |      |      |      |      | 1   |
|  |                                                                             | 3.2.2 Carry out survey and develop management plan for LFMA.             |      |      | 0.9  |      |      |      |      |      |      |      | 0.9 |
|  |                                                                             | 3.2.3 Train field offices on LFMA implementation and record keeping.     |      |      | 0.5  |      |      |      |      |      |      |      | 0.5 |
|  | <b>Strategy 3.3: Promote community-based Non-Wood Forest Product (NWFP)</b> | 3.3.1 Monitor the existing NWFP group.                                   | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.3 |
|  |                                                                             | 3.3.2 Revision of the one NWFP management plan.                          |      |      |      |      |      |      |      |      |      | 0.3  | 0.3 |
|  |                                                                             | 3.3.3 Facilitate the                                                     |      | 0.2  |      |      |      |      |      | 0.3  |      |      | 0.5 |



|                                                                                   |                                                                 |                                                                                                                                                               |      |      |      |      |      |      |      |      |      |      |             |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|------|-------------|
|                                                                                   | <b>Management.</b>                                              | formation of new NWFP groups.                                                                                                                                 |      |      |      |      |      |      |      |      |      |      |             |
|                                                                                   |                                                                 | 3.3.4 Facilitate the marketing of the sale of NWFP (Cordyceps, <i>Paris polyphylla</i> , <i>Exidia</i> sp., <i>Neopicrorhiza</i> sp.).                        | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | 0.08 | <b>0.8</b>  |
|                                                                                   |                                                                 | 3.3.5 Enhance coordination between the park and the Institute of Traditional Medicine Services (ITMS) and improve sustainable harvest regimes and techniques. |      | 0.15 |      |      |      |      |      |      |      |      | <b>0.15</b> |
|                                                                                   | <b>Strategy 3.4: Enhance Public Service Delivery.</b>           | 3.4.1 Train all the field staff on the use of online public service delivery platforms such as OFS, G2C and FIRMS.                                            | 0.15 |      |      |      |      | 0.2  |      |      |      |      | <b>0.35</b> |
|                                                                                   |                                                                 | 3.4.2 Provide awareness to the public on the use of online services for availing public services.                                                             |      | 0.05 |      |      |      |      |      |      |      |      | <b>0.05</b> |
| <b>Objective 4: To improve the livelihood of the people residing in the park.</b> | <b>Strategy 4.1: Explore and promote ecotourism activities.</b> | 4.1.1 Revive at least five of the existing homestay in the park.                                                                                              |      |      |      |      | 1    |      |      |      | 1    |      | <b>2</b>    |
|                                                                                   |                                                                 | 4.1.2 Renovate Dhur Tsachu trail.                                                                                                                             | 3    | 15   | 15   | 12   |      |      |      |      |      |      | <b>45</b>   |





|                                                                               |                                                                        |                                                                                                                              |     |     |     |   |     |     |  |  |  |     |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|---|-----|-----|--|--|--|-----|
|                                                                               |                                                                        | 4.1.3 Construct steel truss bridges along the snow mantrail.                                                                 |     | 3   | 3   |   |     |     |  |  |  | 6   |
|                                                                               | <b>Strategy 4.2:<br/>Mitigate<br/>Human<br/>Wildlife<br/>Conflict.</b> | 4.2.1 Provide solar fence and chain link fence to the community in the HWC hotspot area.                                     |     | 1   | 1   | 1 | 1   | 1   |  |  |  | 5   |
|                                                                               |                                                                        | 4.2.2 Institute compensation and insurance scheme for livestock killed by snow leopard and tiger in Sephu and Chokhor gewog. | 0.6 | 0.6 |     |   |     |     |  |  |  | 1.2 |
|                                                                               |                                                                        | 4.2.3 Provide material to construct corral (iron cage) to the highlander to protect yak calf from predators.                 |     |     | 0.3 |   |     | 0.3 |  |  |  | 0.6 |
|                                                                               |                                                                        | 4.2.4 Provide material support for construction of ration store for highlanders.                                             |     | 0.5 |     |   | 0.5 |     |  |  |  | 1   |
| <b>Objective 5: To strengthen institutional and technical capacity of the</b> | <b>Strategy 5.1:<br/>Enhance park infrastructure and equipment.</b>    | 5.1.1 Construct Nubi Park Rang Office and Ney Guard Post.                                                                    |     |     | 6   |   | 4   |     |  |  |  | 10  |
|                                                                               |                                                                        | 5.1.2 Construct staff quarter at park HQ.                                                                                    |     |     |     | 4 |     |     |  |  |  | 4   |





|       |                                                               |                                                                                                                           |     |     |     |     |     |     |     |     |     |     |     |
|-------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| park. |                                                               | 5.1.3 Timely maintain the existing offices and staff quarters.                                                            |     | 0.7 |     |     | 0.5 |     |     | 0.5 |     | 0.5 | 2.2 |
|       |                                                               | 5.1.4 Improve visitor information center at HQ.                                                                           |     | 1   |     |     |     |     |     | 0.8 |     |     | 1.8 |
|       |                                                               | 5.1.5 Maintain and upgrade communication facilities (Maintenance of repeater station and procurement of handsets).        |     | 0.5 |     |     |     | 0.5 |     |     |     | 0.5 | 1.5 |
|       |                                                               | 5.1.6 Procure field gears such as tent, GPS, binocular, camera and diameter tape and distribute to all the field offices. |     | 0.8 |     |     |     |     |     | 0.6 |     |     | 1.4 |
|       |                                                               | 5.1.7 Procure office supplies such as computer, printer, furniture and other necessary equipment.                         | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.2 | 1.3 |
|       | <b>Strategy 5.2:<br/>Develop capacity of the field staff.</b> | 5.2.1 Provide regular refresher training on use of SMART, uniform code of conduct and drill.                              | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 1   |

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		5.2.2 Provide training to the staff on use of GIS and RS.	0.6						0.9				1.5
		5.2.3 Provide training on the use of basic computer applications to the field staff based on need-based assessment.			0.7								0.7
		5.2.4 Train staff on species identification and taxonomy.		0.6						0.6			1.2
		5.2.5 Conduct exchange program among the protected areas.			0.5		0.5		0.5		0.5		2
		5.2.6 Train staff on use of un-manned aerial vehicle.		0.2		0.2		0.2		0.2		0.2	1
	Strategy 5.3: Ensure effective protected area management.	5.3.1 Evaluate protected area management effectiveness using Bhutan METT+.				0.05						0.05	0.1
		5.3.2 Carry out mid-year review of the management plan.					0.2						0.2
		5.3.3 Plan for the revision of the management plan in										2	2



		the final year of this management plan (Rapid biodiversity assessment, socio economic survey and LFMA).											
		5.3.4 Preparation of Annual Operation Plan.											0
Objective 6: To enhance resilience of communities from climate change induced threats.	Strategy 6.1: Community capacity development to combat climate change threat.	6.1.1 Raise awareness among the local community groups on the causes of climate change and its impact, and build capacity of local leaders to monitor climate		0.4				0.4				0.4	1.2
		change indicators and plan for appropriate adaptation strategies.		0.4				0.4				0.4	1.2
	Strategy 6.2: Enhance monitoring and analysis of climate change impacts	6.2.1 Conduct timely climate vulnerability and capacity assessment (CVCA) survey.										0.7	0.7
		6.2.2 Organize awareness and advocacy to the local stakeholders based on the findings of the CVCA.		0.3								0.3	0.6
		6.2.3 Monitor permanent biological grid every	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.6





	year to detect changes in flora and faunal composition.											
	6.2.4 Promote bioengineering practices for disaster prone/affected areas.					0.3						0.3
	Total	14.24	37.26	39.22	26.81	16.41	15.86	11.84	12.96	18.12	19.46	212.18





CHAPTER VII

MONITORING AND EVALUATION

In order to ensure that the conservation goals and strategic actions of the conservation plan is achieved and implemented effectively, monitoring of each conservation activities during the time of activity implementation and evaluation after the completion of each activity is the main step towards effective fulfillment of the conservation goals and objectives. A realistic monitoring and evaluation plan for this management plan is prepared as per the Forest and Nature Conservation Code of Best Management Practices (Vol. IV). WCNP as the lead implementor of the activities will be responsible for yearly monitoring and evaluation. Further the park will prepare an annual Conservation Operational Plan to ensure that activities are implemented based on the plan projections over the 10 years period. The following table describes the various monitoring and evaluation strategy for each strategic goals and strategic actions stated .

Table 17: Monitoring & Evaluation

Strategic Actions	Output Indicator	Baseline	Units	Monitoring Framework									
				Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
Objective 1: Protection and conservation of nature and biodiversity													
Strategy 1.1: To implement zero poaching strategy and strengthen law enforcement													
1.1.1 Conduct regular SMART patrolling.	Patrolling effort increased	7000	KM	8000	8000	8000	8000	8000	8000	8000	8000	8000	8000





1.1.2 Establish intelligence sharing network with communities and relevant stakeholders and explore opportunities to provide incentives and other benefits to informant.	Intelligence sharing network formed	10	Number		2	2	2	2	2	2	2	2	2
1.1.3 Procure field equipment and gears to strengthen patrolling efforts.	Necessary equipment procured and distributed	N A	Timeline	2023				2027				2031	
1.1.4 Coordinate refresher training on the use of Fire Arms for the field staff.	Training conducted	1	Number	1	1	1	1	1	1	1	1	1	1
1.1.5 Conduct regular awareness on forestry rules and regulations to the park resident.	Awareness conducted	3	Number		3			3			3		
1.1.6 Train all the new recruits on the operation of SMART.	Training imparted	N A	Number	1	1	1	1	1	1	1	1	1	1
1.1.7 Conduct specific and specialized law enforcement training for Rangers in collaboration with Royal Bhutan Police, Courts, OAG and other relevant stakeholders.	Training organized and given	1	Number	2				2					2
Strategy 1.2: Upholding biodiversity conservation through research and monitoring													
1.2.1 Conduct tiger survey as part of the National Tiger Survey.	Tiger survey completed	48	Grid						48				



1.2.2 Conduct snow leopard survey as part of the National Snow Leopard Survey.	Snow leopard survey conducted	87	Grid							87			
1.2.3 Conduct research on aquatic biodiversity.	Research conducted	1	Report			1							
1.2.4 Conduct studies on dragonflies and damselflies.	Research conducted	0	Report			1	1						
1.2.5 Conduct studies on herpato-fauna diversity and distribution.	Herpato-fauna diversity and distribution determined	0	Report	1									
1.2.6 Conduct studies on important plant species such as <i>Neopicrorhiza</i> sp. and <i>Paris polyphylla</i> .	Reports produced	0	Report	1	1		1				1		
1.2.7 Conduct timely forest inventory as part of the National Forest Inventory.	NFI conducted	308	Grid									154	154
1.2.8 Conduct survey on red panda to determine its distribution and ecology.	Survey conducted and report produced	0	Report			1							
1.2.9 Conduct studies on dhole to determine its distribution.	Survey conducted and report produced	0	Report						1				
1.2.10 Carry out studies on small mammals to determine its diversity and distribution.	Survey conducted and report produced	0	Report				1						

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|                                                                                                 |                                      |   |        |  |   |  |  |   |  |  |  |   |  |
|-------------------------------------------------------------------------------------------------|--------------------------------------|---|--------|--|---|--|--|---|--|--|--|---|--|
| 1.2.11 Carry out survey on endemic plants of park (Daphne ludowlii, Cotoneaster bumthangensis). | Survey conducted and report produced | 0 | Report |  | 1 |  |  |   |  |  |  |   |  |
| 1.2.12 Conduct studies on orchid diversity and distribution.                                    | Survey conducted and report produced | 0 | Report |  | 4 |  |  |   |  |  |  |   |  |
| 1.2.13 Implement citizen science programs by providing necessary trainings to the community.    | Trainings imparted                   | 0 | Number |  | 3 |  |  | 3 |  |  |  | 4 |  |

## Objective 2: To promote wildlife habitat management and restoration

### Strategy 2.1: Enhance wildlife habitat management interventions

|                                                                                                       |                                                 |    |         |  |   |    |  |   |    |  |   |    |  |
|-------------------------------------------------------------------------------------------------------|-------------------------------------------------|----|---------|--|---|----|--|---|----|--|---|----|--|
| 2.1.1 Improve and monitor water holes and saltlick as per the wildlife habitat management guidelines. | Water holed and salt lick improved andmonitored | 15 | Number  |  |   | 20 |  |   | 20 |  |   | 20 |  |
| 2.1.2 Identify and manage wildlife (taken, tiger, and snow leopard) trails/ movement corridors of to  | Wildlife corridors identifiedand managed        | 0  | KM      |  | 1 |    |  | 1 |    |  | 1 |    |  |
| improve wildlife habitat connectivity.                                                                |                                                 |    |         |  |   |    |  |   |    |  |   |    |  |
| 2.1.3 Restore alpine meadow by clearing invading shrubs in the area.                                  | Alpine meadow improved                          | 0  | Hectare |  |   | 40 |  |   |    |  |   | 30 |  |





| Strategy 2.2: Solid Waste Management                                                                                                                       |                                             |    |                 |   |   |   |    |   |   |   |    |   |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----|-----------------|---|---|---|----|---|---|---|----|---|---|
| 2.2.1 Strict implementation of garbage in garbageout (GIGO) across the park in collaboration with gewog administration during cordyceps collection season. | GIGO implemented                            | 1  | No. of location | 4 | 4 | 4 | 4  | 4 | 4 | 4 | 4  | 4 | 4 |
| 2.2.2 Strengthen advocacy and awareness on solidwaste management to the stakeholders and public atlarge.                                                   | Advocacy and awareness imparted             | 3  | Number          | 6 |   |   |    | 6 |   |   |    |   | 6 |
| 2.2.3 Construct and installsignages and information board at strategic locations along the eco-trails and campsite found within the park.                  | Signage and informationboards installed     | NA | Number          |   |   |   | 15 |   |   |   | 15 |   |   |
| 2.2.4 Coordinate with the Department of Tourism and ABTO on implementation of GIGO approachfor tourist visiting the park                                   | GIGO for tourist implemented                | 0  | No. of location | 2 | 2 | 2 | 2  | 2 | 2 | 2 | 2  | 2 | 2 |
| Strategy 2.3: Strengthen surveillance and prevention of pest and diseases                                                                                  |                                             |    |                 |   |   |   |    |   |   |   |    |   |   |
| 2.3.1 Contain and manage bark beetle infection in the park by                                                                                              | Bark beetle infection contained and managed | NA | Hectare         | 3 | 3 | 3 |    |   |   |   |    |   |   |

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carrying out sanitation operation.													
2.3.2 Conduct studies on adelgid in collaboration with UWIFoRT.	Study conducted	0	Report						1				
2.3.3 Manage invasive species as per the intervention plan developed by National Biodiversity Center.	Spread of invasive species controlled	NA	Intervention activity		5						9		
2.3.4 Provide awareness to the local communities on the various pest and diseases in the park.	Awareness imparted	0	Number		4				4				
Objective 3: Sustainable management of natural resources													
Strategy 3.1: Strengthen Community Forest (CF) Management													
3.1.1 Revision of six Community Forest Management Plan (CFMP).	CF Revised	1	Number	1		2				1		2	
3.1.2 Build capacity of the CFMG on record keeping, good governance and silviculture system.	Trainings imparted	2	Number	3		3				3		3	
3.1.3 Facilitate the formation of new CFMG.	CFMG formed	8	Number			1					1		
3.1.4 Promote product development (value addition) of the CF	CF product developed	0	CF						5				



produce.													
3.1.5 Conduct regular monitoring of the CFs.	Monitoring of CF conducted	8	Number	8	8	8	8	8	8	8	8	8	8
Strategy 3.2: Enhance Local Forest Management Area (LFMA)													
3.2.1 Provide training to field staff on carrying out LFMA field survey.	Training imparted	0	Number		3								
3.2.2 Carry out survey and develop management plan for LFMA.	Survey carried out and plan produced	0	Plan			3							
3.2.3 Train field offices on LFMA implementation and record keeping.	Field staff trained	0	Number			3							
Strategy 3.3: Promote community-based Non-Wood Forest Product (NWFP) Management													
3.3.1 Monitor the existing NWFP group.	NWFP group monitored	1	Number	1	1	1	1	1	1	1	1	1	1
3.3.2 Revision of the one NWFP management plan.	NWF management plan revised	0	Number										1
3.3.3 Facilitate the formation of new NWFP groups.	NWFP group formed	1	Number		2						2		
3.3.4 Facilitate the marketing of the sale of NWFP (Cordyceps, <i>Parispolyphylla</i> , <i>Exidia</i> sp., <i>Neopicrorhiza</i> sp.).	Cordyceps auction monitored	4	Number	4	4	4	4	4	4	4	4	4	4

~~~~~



|                                                                                                                    |                                               |   |          |  |      |      |      |     |     |     |  |   |  |
|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|---|----------|--|------|------|------|-----|-----|-----|--|---|--|
| 3.3.5 Enhance coordination between the park and the Institute of Traditional Med-                                  | Reported generated                            | 0 | Number   |  | 1    |      |      |     |     |     |  |   |  |
| <b>Strategy 3.4: Enhance Public Service Delivery</b>                                                               |                                               |   |          |  |      |      |      |     |     |     |  |   |  |
| 3.4.1 Train all the field staff on the use of online public service delivery platforms such as OFS, G2C and FIRMS. | Trainings imparted                            | 0 | Number   |  | 3    |      |      |     |     |     |  |   |  |
| 3.4.2 Provide awareness to the public on the use of online services for availing public services.                  | Awareness provided                            | 3 | Number   |  | 3    |      |      |     |     |     |  |   |  |
| <b>Objective 4: To improve the livelihood of the people residing in the park</b>                                   |                                               |   |          |  |      |      |      |     |     |     |  |   |  |
| <b>Strategy 4.1: Explore and promote ecotourism activities</b>                                                     |                                               |   |          |  |      |      |      |     |     |     |  |   |  |
| 4.1.1 Revive at least five of the existing homestay in the park.                                                   | Homestay revived                              | 0 | Number   |  |      |      |      | 3   |     |     |  | 2 |  |
| 4.1.2 Renovate Dhur Tsachu trail.                                                                                  | Dhur Tsa-chu trail renovated                  | 0 | Timeline |  | 2023 | 2024 | 2025 |     |     |     |  |   |  |
| 4.1.3 Construct steel truss bridges along the snow man trail.                                                      | Steel truss bridge constructed                | 0 | Number   |  |      | 2    | 1    |     |     |     |  |   |  |
| <b>Strategy 4.2: Mitigate Human Wildlife Conflict</b>                                                              |                                               |   |          |  |      |      |      |     |     |     |  |   |  |
| 4.2.1 Provide solar fence and chain link fence to the community in the HWC hotspot area.                           | Solar fencing and chain link fencing provided | 0 | Meter    |  |      | 500  | 500  | 500 | 500 | 500 |  |   |  |



|                                                                                                                              |                                              |    |          |   |      |      |   |      |    |    |   |  |   |
|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|----|----------|---|------|------|---|------|----|----|---|--|---|
| 4.2.2 Institute compensation and insurance scheme for livestock killed by snow leopard and tiger in Sephu and Chokhor gewog. | Compensation and insurance scheme instituted | 1  | Number   | 6 | 6    |      |   |      |    |    |   |  |   |
| 4.2.3 Provide material to construct corral (iron cage) to the highlander to protect yak calf from predators.                 | Materials provided                           | 0  | Number   |   |      | 10   |   |      |    | 10 |   |  |   |
| 4.2.4 Provide material support for construction of ration store for highlanders.                                             | Ration storage constructed                   | 0  | Number   |   | 10   |      |   |      | 10 |    |   |  |   |
| <b>Objective 5: To strengthen institutional and technical capacity</b>                                                       |                                              |    |          |   |      |      |   |      |    |    |   |  |   |
| <i>Strategy 5.1: Enhance park infrastructure and equipment</i>                                                               |                                              |    |          |   |      |      |   |      |    |    |   |  |   |
| 5.1.1 Construct Nubi Park Rang Office and Ney Guard Post.                                                                    | Nubi Range and GP constructed                | NA | Timeline |   |      | 2025 |   | 2027 |    |    |   |  |   |
| 5.1.2 Construct staff quarter at park HQ.                                                                                    | Staff quarter constructed                    | 4  | Unit     |   |      |      | 2 |      |    |    |   |  |   |
| 5.1.3 Timely maintain the existing offices and staff quarters.                                                               | Maintenance carried out                      | 2  | Number   |   | 2    |      |   | 1    |    |    | 1 |  | 1 |
| 5.1.4 Improve visitor information center at HQ.                                                                              | Visitor information center improved          | NA | Timeline |   | 2024 |      |   |      |    |    |   |  |   |
| 5.1.5 Maintain and upgrade communication facilities (Maintenance of                                                          | Repeater station maintained                  | 3  | Number   |   | 3    |      |   |      | 3  |    |   |  | 3 |

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repeater station and procurement of handsets).													
5.1.6 Procure field gears such as tent, GPS, binocular, camera and diametertape and distribute to all the field offices.	Field gears procured	NA	Timeline		2024								
5.1.7 Procure office supplies such as computer, printer, furniture and other necessary equipment.	Office supplies procured	NA	No. of office	5	5	5	5	5	5	5	5	5	5
Strategy 5.2: Develop capacity of the field staff													
5.2.1 Provide regular refresher training on use of SMART, uniform code of conduct and drill.	Training imparted	2	Number	2	2	2	2	2	2	2	2	2	2
5.2.2 Provide training to the staff on use of GIS and RS.	Training imparted	0	Number	3						4			
5.2.3 Provide training on the use of basic computer applications to the field staff based on need-based assessment.	Training imparted	0	Number			3							
5.2.4 Train staff on species identification and taxonomy.	Training imparted	0	Number		3						3		
5.2.5 Conduct exchange program among the protected areas.	Exchange program conducted	0	Number		1						1		



5.2.6 Train staff on use of un-maned aerial vehicle	Staff trained	0	No. of staff	15	15	15							
Strategy 5.3: Ensure effective management of protected area													
5.3.1 Evaluate protected area management effectiveness using Bhutan METT+.	Evaluation done and report produced	1	Report				1						1
5.3.2 Carry out mid-year review of the management plan.	Mid-review done	NA	Timeline					2026					
5.3.3 Plan for the revision of the management plan in the final year of this management plan (Rapid biodiversity assessment, socio economic survey and LFMA).	RBA and socio economic assessment done	NA	Timeline										2032
5.3.4 Preparation of Annual Operation Plan (OP).	Annual OP submitted	NA	Number	1	1	1	1	1	1	1	1	1	1
Objective 6: To enhance resilience of communities from climate change induced threats													
Strategy 6.1: Community capacity development to combat climate change threat													
6.1.1 Raise awareness among the local community groups on the causes of climate change and its impact, and build capacity of local leaders to monitor climate change indicators and	Awareness carried out	0	Number		4				4				4

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|                                                                                                      |                                     |   |          |   |   |   |   |   |   |   |   |   |      |
|------------------------------------------------------------------------------------------------------|-------------------------------------|---|----------|---|---|---|---|---|---|---|---|---|------|
| plan for appropriate adaptation strategies.                                                          |                                     |   |          |   |   |   |   |   |   |   |   |   |      |
| <i>Strategy 6.2: Enhance monitoring and analysis of climate change</i>                               |                                     |   |          |   |   |   |   |   |   |   |   |   |      |
| 6.2.1 Conduct timely climate vulnerability and capacity assessment (CVCA)survey.                     | CVCA Survey carried out             | 1 | Timeline |   |   |   |   |   |   |   |   |   | 2032 |
| 6.2.2 Organize awareness and advocacy to the local stakeholders based on the findings of the CVCA.   | Stakeholder consultationcarried out | 4 | Number   |   |   |   |   |   |   |   |   |   | 4    |
| 6.2.3 Monitor permanent biological gird every year todetect changes in flora and faunal composition. | Monitoring done                     | 6 | Grid     | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6    |
| 6.2.4 Promote bioengineering practices for disaster prone/affected areas.                            | Bioengineering carried out          | 2 | Number   |   |   |   |   | 2 |   |   |   |   |      |





## REFERENCES

- Adhikari, I. P. (2020). Climate Change Impact in Bhutan. *The Bhutan Journal*, 1(1), 36-51.
- Boesi, A. (2003). dByar rtswa dgun 'bu (Cordyceps sinensis Berk): An Important Trade Item for the Tibetan Population of Li thang County, Sichuan Province, China. *The Tibet Journal*, 28(3), 29-42.
- Cryosphere Services Division, NCHM. (2019). *Reassessment of Potentially Dangerous Glacial lakes in Bhutan*. Thimphu: National Center for Hydrology and Meteorology.
- Dhendup, T., Nado, & Dorji, L. (2018). *Field Study on Musk Deer and its Conservation Strategy in Wangchuck Centennial National Park*. Thimphu: KUENSEL Corporation Ltd.
- DoFPS. (2019). *Protected Area Zonation Guidelines of Bhutan*.
- Grierson, A. C., & Long, D. G. (1983). *Flora of Bhutan: Including a record of plants from Sikkim*. Edinburgh: Royal Botanic Garden.
- Karma, Yangzom, D., Duba, T., Namgay, W., Lhamo, S., Tsering, P., . . . Namgay, T. (2021). *Bhutan Glacial Lake Inventory*. CSD, NCHM.
- Nature Conservation Division. (n.d.). *Bhutan Biodiversity*. Retrieved from Protected areas and Biological corridors of Bhutan: <https://bt.chm-cbd.net/protected-areas/protected-areas-and-biological-corridors-bhutan#:~:text=In%201993%20Royal%20Government%20of,and%20one%20Strict%20Nature%20Reserve.&text=Gazetted%20in%201974%20as%20a,oldest%20protected%20areas%20in%20Bhutan>.
- Seldon, C. (2016). *Surveying Bhutan's most dangerous glacial lakes*. Retrieved from The Third Pole: [https://www.thethirdpole.net/en/climate/surveying-bhutans-most-dangerous-glacial-lakes/?gclid=Cj0KCQjw6pOTBhCTARIsAHF23fKd6M5k-jzaxMt452upq99PDPU0vdO8HhWsiqc5Mt590\\_Xeb\\_kvbgAsU3EALw\\_wcB](https://www.thethirdpole.net/en/climate/surveying-bhutans-most-dangerous-glacial-lakes/?gclid=Cj0KCQjw6pOTBhCTARIsAHF23fKd6M5k-jzaxMt452upq99PDPU0vdO8HhWsiqc5Mt590_Xeb_kvbgAsU3EALw_wcB)
- Thinley, U., Banterng, P., Gonkhamdee, S., & Katawatin, R. (2019). Distributions of Alien Invasive Weeds under Climate Change Scenarios in Mountainous Bhutan. *Agronomy*, 9(8), 442.
- Wangchuck Centennial National Park. (2014). *Medicinal Plants of Wangchuck Centennial Park*. Thimphu: KUENSEL Corporation Ltd.



- Wangchuck Centennial National Park. (2016). *Distribution and Conservation Threats of Bhutan Takin in Wangchuck Centennial National Park*. Bumthang: Wangchuck Centennial National Park.
- Wangchuck Centennial National Park. (2016). *Report on Fish Diversity in Wangchuck Centennial National Park*. Nashiphel: WCNP.
- Wangchuck Centennial National Park. (2017). Conservation Management Plan Wangchuck Park, July 2012 - June 2017. Thimphu: Kuensel.
- Wangchuck Centennial National Park. (2017). *Field guide for butterflies; Wangchuck Centennial National Park*. Thimphu: KUESNSEL Corporation Ltd.
- Wangchuck Centennial National Park. (2019). *Field Guide for Butterflies: Wangchuck Centennial National Park*. Thimphu: Kuensel.
- Wangchuck Centennial Park. (2014). *A Field Study on Asiatic Black Bear in Wangchuck Centennial Park*. Nasiphel: WCNP, DoFPS.
- Wangda, P., & Ohsawa, M. (2006). Structure and regeneratino dynamics of dominant tree species along altitudinal gradinet in a dry valley slopes of the Bhutan Himalaya. *Forest Ecology and management*, 230(2006), 136-150.
- WCNP & WWF. (2016). *Pupulation Status and Distribution of Snow Leopards in Wangchuck Centennial National Park, Bhutan*. Thimphu: Wangchuck Centennial National Park and World Wildlife Fund.

*Bluesheep, primary prey species of Snow leopard*





## APPENDICES

### APPENDIX 1: Local Forest Management Area (LFMA)

The park caters public service to around 783 households with an estimated population of around 7300 via the multiple use zone which accounts around 293.09 sq.km of the total area of 4914 sq.km. The public demand for the natural resources are mainly in terms of allotment for house building timber, firewood, posts and poles which happens to be in the proximity of the settlements and motorable roads within the multiple use zone.

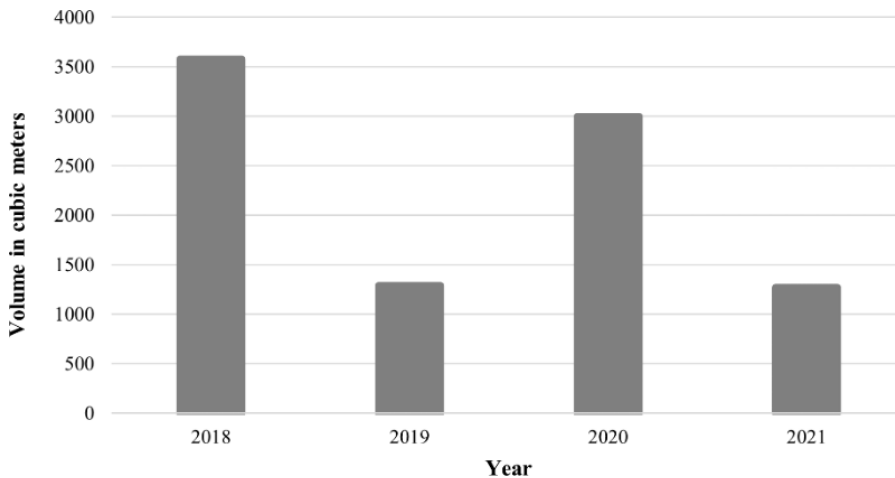


Figure 34: Timber allotment to the public at CPR

For projection of the resource stock in the multiple use zone of the park, the LFMA method and template developed by FRMD was used and data were collected from the representative sample plots. The grids for data collection were laid over the multiple use zones only and data collected from the representative plots from every compartments.

For field data collection and resource allotment modalities, every range under the park is treated as one block; namely Chokhor block, Dungkhar block and Sephu block. This was done as the allocation of blocks as per the LFMA method was not possible due to the unavailability of the funds and due to time constrain for the field survey. In the future, if there are budget allocation, WCNP will produce LFMA for every gewog as per the guidelines.



#### □ **Chokhor Park Range**

Chokhor range covers three chiwogs of upper Chokhor gewog and two chiwogs of upper Tang gewog. Forest types in the range vary from blue pine forest, mixed conifer, fir and rhododendron shrubs. Over the last four years, the range office has allotted a total of 9139.07 cubic meter inclusive of timber, firewood, fencing posts and poles. On average, the demand of timber and other non-timber produce in the range is approximately 2284.77m<sup>3</sup> annually.

Timber allotment are mainly done for new house construction, renovation, annual firewood allotment, fencing posts, flag poles for deceased and other religious purposes. Besides rural allotment, the resources are allotted for other developmental activities and renovation of religious structures within the park area

Table 16 shows the summary of the field resource assessment carried out in 112 representative plots in a total area of 9148.0 ha of multiple use zones of the range.

#### □ **Dungkhar Park Range**

During the resource inventory for local forest management to determine the growing stock in the range, a total of 31 representative plots were laid in 1640 ha (16.4 sq.km) in five compartments (Ney, Tethapang, Chagzam, Wavel & Ugyenphu). The abstract of field work is presented in the table 17 below. The range has mostly matured broadleaf forest with average basal area of 78.5 m<sup>2</sup>/ha and production potentiality of 10 cubic meter per ha. The calculation of Annual Allowable Cut (AAC) is also determined on the concept of sustainable yield.

Allotment of resources to the park residents for domestic use and other developmental activities is being done through a single tree selection system. Currently the range is having good forest coverage and adequate growing stock to meet the demand. The figure 35 represents the quantity of resource allotted by the range in last two years. The range cater services to whole Kurtoed gewog and one chiwog of Gangzur gewog. There are community forest and the requirements of the Community Forest Member Groups are met from their



community forests as per the management plan. The comparison of the annual requirement of the communities and the AAC show comfortable position in meeting the requirements. Summary of the local forest management area assessment is shown at Table 17.

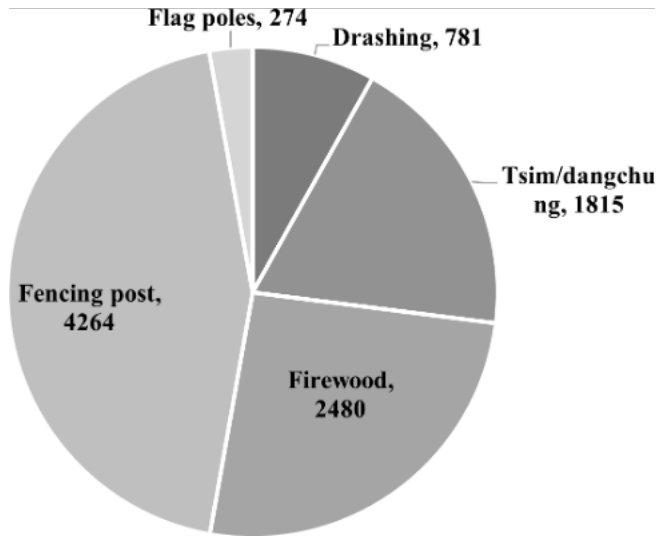


Figure 35: Summary of local forest resources at DPR

□ **Sephu Park Range**

The range has 2018.9 ha of multiple use zones to meet the resources demand of the residents for domestic use. The range caters services to Busa-zeri chiwog of Sephu gewog and the communities are dependent on nearby forests for timber, firewood, fencing posts and flagpoles. Allotment of rural timber and other forest produce are done as per the provisions of the FNCA, 1995 and FNCRR, 2017 and will continue to do so. The quantity of forest products allotted to the Park residents in the past four years is depicted in the graph below and the figures are from the records

For the estimation of growing stock and annual allowable cut (AAC) data collection was done in 24 plots in two compartments namely Zeri and Busa-lambji. The range has mostly matured mixed conifer forest and scattered patches of Blue pine forest in vicinity of the settlements. In the higher altitudes forest comprise of fir, hemlock, broadleaf and juniper patches.



The condition of the forest is moderate with average basal area of 11.3 m<sup>2</sup>/ha and annual allowable cut (AAC) 7194 m<sup>3</sup> over rotation period of 114 years. Summary of growing stock, forest condition and utilization is provide in Table 18

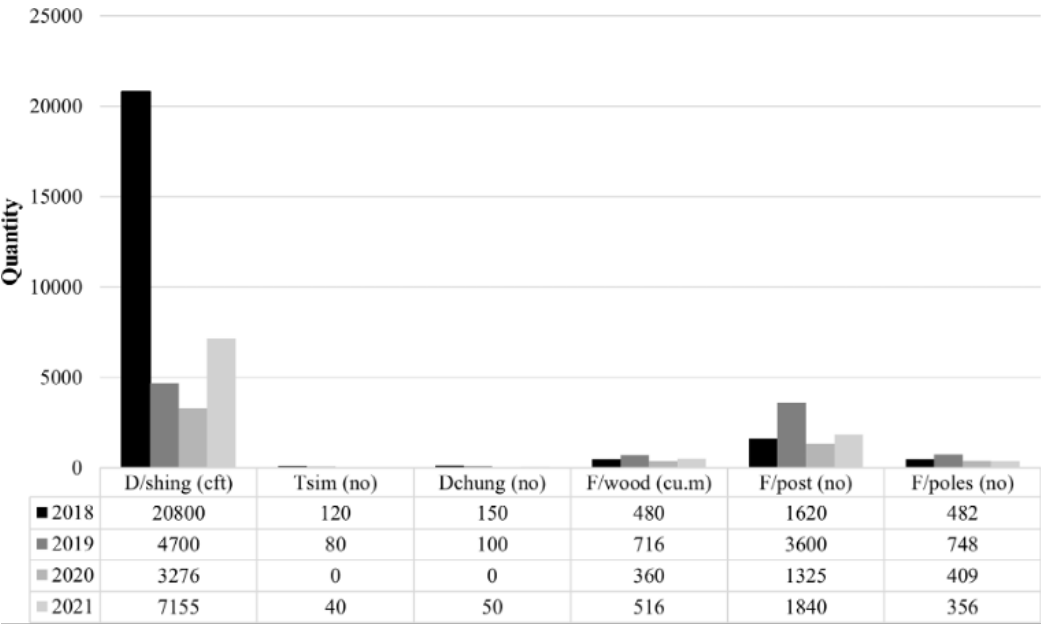


Figure 36: Forest products allotted to the park residents in the past four years at SPR



*Vulture, a common raptor in WCNP*



Table 18: LFMA data for CPR

| Unit | Area Distribution |            |            |       |
|------|-------------------|------------|------------|-------|
|      | Non Production    | Protection | Production | Total |
| ha   | 0                 | 0          | 9148       | 9148  |
| %    | 0%                | 0%         | 100%       | 100%  |

| Average basal area (m <sup>2</sup> /ha) | Average stand volume (m <sup>3</sup> /ha) | No. of accessible plots |
|-----------------------------------------|-------------------------------------------|-------------------------|
| 28.9                                    | 1262                                      | 112                     |

|      | Hemlock          | Fir      | Spruce | Mix. Con.  | Blue pine | Chir pine               | Hardwood | Mixed HC | Total |
|------|------------------|----------|--------|------------|-----------|-------------------------|----------|----------|-------|
| %    | 26%              | 0%       | 1%     | 63%        | 8%        | 0%                      | 1%       | 1%       | 99%   |
| Unit | Age Distribution |          |        |            |           | Stand Type Distribution |          |          |       |
|      | Young            | Immature | Mature | Overmature | Total     | Plantation              | Natural  | Coppice  | Total |
| %    | 8%               | 15%      | 67%    | 10%        | 100%      | 0%                      | 100%     | 0%       | 100%  |
| Unit | Canopy Closure   |          |        |            |           | Condition               |          |          |       |
|      | Dense            | Closed   | Open   | Unstocked  | Total     | Good                    | Average  | Poor     | Total |
| %    | 8%               | 71%      | 16%    | 5%         | 101%      | 23%                     | 69%      | 8%       | 100%  |

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Site Condition									
Unit	Slope			Erosiveness			Soil Cover		
	Gentle	Moderate	Seep	Stable	Moderate	Unstable	High	Moderate	Low
%	25%	70%	6%	48%	52%	0%	17%	80%	3%

Forest Use					
Intensive Side Uses			Extensive Side Uses		
Grazing	Sokshing	Lopping	Grazing	Sokshing	Lopping
0	0	0	5859.6	0	0
0%	0%	0%	64%	0%	0%

NWFP Occurrence and Firewood								
Unit	NWFP Abundant				NWFP Sparse			
	Firewood	Bamboo	Cane	Daphne	Firewood	Bamboo	Cane	Daphne
ha	969	2074.9	0	0	985.9	940.6	0	688.3
%	11%	23%	0%	0%	11%	10%	0%	8%



Potential Production					
Unit	Timber				
	Drashing	Cham	Tsim	Poles/posts	Total
N. tot	383257	573669	629905	894811	2481642
N/ha	42	63	69	98	271
m3	3702993	555091	207810	236779	4702673
m ³ /ha	404.8	60.7	22.7	25.9	514.1

Unit	Firewood				
	> 49cm	30-49cm	20-29 cm	10-19 cm	Total
N. tot	319948	99322	30034	0	449304
N/ha	35	11	3	0	49
m3	3851879	86738	9931	0	3948548
m ³ /ha	421.1	9.5	1.1	0	431.6

Yield Regulation		
AAC	96520	m3
	10.6	m ³ /ha
Prod. Potential/AAC	90	years

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Table 19: LFMA data for DPR

| Unit | Area Distribution |            |            |        |
|------|-------------------|------------|------------|--------|
|      | Non-production    | Protection | Production | Total  |
| Ha   | 0                 | 0          | 1640.2     | 1640.2 |
| %    | 0                 | 0          | 100        | 100    |

| Average basal area (m2/ha) | Average stand volume (m3/ha) | No. of accessible plots |
|----------------------------|------------------------------|-------------------------|
| 78.5                       | 1300                         | 31                      |



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

