PARO

Divisional Forest Office Management Plan

(January 2026 – December 2035)

Divisional Forest Office, Paro

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

WWF

Supported by:

Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

based on a decision of the German Bundestag

IKI INTERNATIONAL CLIMATE INITIATIVE

Plan prepared by:

1. Sonam Phuntsho, Deputy Chief Forestry Officer
2. Namgay, Chief Forestry Officer
3. Sonam Tobgay, Principal Forestry Officer
4. Thinley Tshering, Deputy Chief Forestry Officer
5. Pema Rinzin, Deputy Chief Forestry Officer
6. Choden, Senior Forest Ranger
7. Sonam Wangdi, Senior Forest Ranger
8. Namgay Dechen, Forestry Officer

Review and endorsement:

Reviewed and endorsed by the 77th session of the Departmental TAC meeting held on 30th January, 2026.

Suggested Citation:

Divisional Forest Office, Paro (2026). Holistic and Nature-based Solutions Driven Divisional Forest Office Management Plan (January 2026 - December 2035), Department of Forests and Park Services, Ministry of Energy and Natural Resources, Royal Government of Bhutan.

Photo contributed by:

1. Namgay, Chief Forestry Officer
2. Sonam Phuntsho, Deputy Chief Forestry Officer
3. Lham Dorji, Forestry Officer

Approval Sheet

Period of the Plan
This plan is valid for the period of 10 years from January, 2026 to December, 2035

Submitted for approval:

Chief Forestry Officer
Divisional Forest Office, Paro

Technically reviewed & recommended for approval:

Chief Forestry Officer
Forest Resources Planning and Management Division

Recommended for approval:

Director
Department of Forests and Park Services

APPROVED

Secretary
Ministry of Energy and Natural Resources

Foreword

Forests have long been central to the livelihoods of the Bhutanese people and are deeply interwoven with the country's social, cultural, and traditional values. Beyond their contribution to socio-economic development, forests play a critical role in climate regulation and the provision of essential ecosystem services. Recognizing this importance, Bhutan is among the few countries to enshrine environmental conservation in its Constitution. Article 5 of the Constitution mandates that at least 60 percent of the country's land area be maintained under forest cover for all time. Bhutan has further reinforced its global environmental leadership by committing to remain carbon neutral at the 15th Conference of Parties to the UNFCCC in 2009, a pledge reaffirmed through its Intended Nationally Determined Contribution submitted in 2015 under the Paris Agreement.

Currently, forests cover over 69.7 percent of Bhutan's total land area, making them an indispensable national asset. These forests sequester an estimated 8.5 million tonnes of carbon annually, sustain reliable water flows critical for hydropower generation, and provide essential resources such as timber and firewood to citizens. In light of Bhutan's national and international commitments, as well as the social, cultural, economic, and ecological benefits derived from forests, sustainable forest resource management remains imperative, particularly through targeted and effective interventions at the Divisional level.

Accordingly, this Divisional Forest Management Plan has been developed as a comprehensive framework for sustainable forest management within the Divisional Forest Office. The plan takes stock of existing management initiatives and presents the current status of forest area, biodiversity conservation, growing stock, resource allocation, local socio-economic conditions, and human–wildlife conflict. It prescribes strengthened conservation measures, sustainable resource utilization, climate change adaptation and mitigation actions, and human–wildlife conflict management, supported by a phased implementation plan, financing framework, and monitoring system. Developed through broad stakeholder consultation, the plan ensures shared ownership and institutional endorsement. The Divisional Forest Office is commended for this important milestone toward advancing sustainable forest management and biodiversity conservation.

Director

Acknowledgement

The Divisional Forest Office Management Plan is the result of a collective and dedicated effort by the staff of the Divisional Forest Office, Paro. The Division sincerely acknowledges the commitment, professionalism, and teamwork demonstrated by all officers and staff who contributed their time, experience, and technical inputs toward the successful formulation of this plan. Their sustained engagement throughout the planning process ensured that the document is comprehensive, practical, and grounded in field realities.

The formulation of this Management Plan was made possible through the unwavering support and guidance of the IKI Task Force Members under the IKI Project. The Division is deeply grateful for their strategic direction, technical advice, and continuous encouragement throughout the planning process. The Division further expresses its sincere gratitude to the IKI Project, "*Living Landscapes: Securing High Conservation Values in South-Western Bhutan*," for its generous financial support, which enabled the conduct of comprehensive socio-economic and field surveys. The data generated through these assessments formed a critical foundation for evidence-based planning and significantly informed the management prescriptions contained in this plan. WWF-Bhutan, together with the Project Coordination Unit, played a pivotal role in facilitating the timely procurement of essential equipment and field gear, and in delivering capacity-building programs both within and outside the country. These interventions greatly strengthened the technical capacity of the field teams involved in the assessment.

The Division would like to extend special appreciation to Mr. Sonam Phuntsho, Dy. Chief Forestry Officer of DFO, Paro who played a crucial leadership role in guiding and coordinating the formulation of this Management Plan. His dedication, technical oversight, and leadership were instrumental in bringing the planning process to completion. Finally, the Division extends its heartfelt thanks to all individuals, institutions, and stakeholders who, in various capacities, contributed to the development of this Management Plan. Their collective efforts have resulted in a key milestone that will guide sustainable forest management and biodiversity conservation in the Division in the years to come.

Abbreviations

% .....Percent
° .....Degree
°C .....Degree Celsius
AAC.....Annual Allowable Cut
ABS.....Access and Benefit-Sharing
ACC.....Anti-Corruption Commission
AGB.....Above Ground Biomass
BA .....Basal Area
BAB.....Biodiversity Act of Bhutan
BC .....Biological Corridor
BFA.....Bhutan Forest Act
BGB .....Below Ground Biomass
BMG.....Biodiversity Monitoring Grid
C2C.....Conflict to Co-existence
CBD.....Convention on Biological Diversity
CF .....Community Forest
CFMG .....Community Forest Management Group
CMP .....Conservation Measures Partnership
CO_2 .....Carbon Dioxide
CS .....Conservation Standards
CVCA .....Climate Vulnerability and Capacity Assessment
CWD .....Coarse Woody Debris
DFO .....Divisional Forest Office
DFOMP .....Divisional Forest Office Management Plan
DGM .....Department of Geology and Mines
DoFPS .....Department of Forests and Park Services
eDATS .....*electronic* Daily Allowance and Travel System
EMR .....Existing Management Regime
EoL .....Extraordinary Leave
ESP .....Elementary Services Personnel
FIRMS.....Forest Information and Resources Monitoring System
FMIS.....Forest Monitoring and Information Section
FMP .....Forest Management Plan
FMU .....Forest Management Unit
FNCA .....Forest and Nature Conservation Act
FNCRR.....Forest and Nature Conservation Rules and Regulations
FRPMS.....Forest Resources Planning and Management Section
FTM .....Forest Type Map
FWF .....Forest Welfare Fund
G2C .....Government to Citizen
GIMS.....Government Inventory Management System
GIS.....Geographic Information System
GLOFs.....Glacial Lake Outburst Floods
ha.....Hectare
$ha^{-1}yr^{-1}$ .....per hectare per year
HCV .....High Conservation Value
HCVA.....High Conservation Value Area
HCVRN.....High Conservation Value Resource Network
HWC .....Human-Wildlife Conflict
IFFCG .....Inter-agency Forest Fire Coordination Group
IFL .....Intact Forest Landscapes

IKI .....International Climate Initiative
IUCN .....International Union for Conservation of Nature
IWBI.....Integrated Wood-Based Industry
JDNP.....Jigme Dorji National Park
JKSNR .....Jigme Khesar Strict Nature Reserve
KBA .....Key Biodiversity Area
km .....Kilometer
km^2 .....Square Kilometer
LAB .....Land Act of Bhutan
LEDS.....Low Emission Development Strategies
LFMA.....Local Forest Management Area
LFMP .....Local Forest Management Plan
LSD.....Legal Services Division
LULC.....Land Use Land Cover
m .....meter
m^2 .....square meter
m^3 .....cubic meter
METT+ .....Management Effectiveness Tracking Tool plus
mm .....Millimeter
NCD .....Nature Conservation Division
NCS .....Nature Conservation Section
NDC .....Nationally Determined Contribution
NEC .....National Environment Commission
NEPA.....National Environment Protection Act
NFI.....National Forest Inventory
NFP .....National Forest Policy
NSB.....National Statistics Bureau
NSLS .....Nationwide Snow Leopard Survey
NTFP.....Non-Timber Forest Product
NTS .....National Tiger Survey
NWFP.....Non-Wood Forest Product
NWFPMG Non-Wood Forest Product Management Group
OEMCA .....Other Effective Management Conservation Area
OFS.....Online Forestry Services
OP.....Operational Plan
PA .....Protected Area
PES .....Payment for Ecosystem Services
PF.....Private Forest
PHCB .....Population and Housing Census of Bhutan
RBA .....Rapid Biodiversity Assessment
REDD+.....Reducing Emissions from Deforestation and Forest Degradation plus
RGoB .....Royal Government of Bhutan
RHBT .....Rural House Building Timber
RTE .....Rare Threatened or Endangered
SDSS.....Spatial Decision and Support System
SDG.....Sustainable Development Goal
SES.....Socio-Economic Survey
SFM .....Sustainable Forest Management
SMART .....Spatial Monitoring and Reporting Tool
SOC .....Soil Organic Carbon
SRFL.....State Reserved Forest Land
UNFCCC ..United Nations Framework Convention on Climate Change
WBI .....Wood-Based Industry
WPMA .....Waste Prevention and Management Act

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Executive Summary

Forests are central to Bhutan's environmental, economic, and social framework, with the Constitution mandating 60% forest cover. As a carbon-negative nation, Bhutan prioritizes Sustainable Forest Management through laws and policies that integrate biodiversity conservation, community-based approaches, and sustainable resource use, balancing ecological integrity with economic growth and equitable benefits.

Established in 1991, DFO Paro manages 1,630.84 km^2 across Paro, Haa, Chhukha and Thimphu districts, including diverse forest types and critical biodiversity. Despite infrastructure and resource constraints, the office addresses human-wildlife conflicts, illegal activities and promotes Sustainable Forest Management, biodiversity conservation and climate mitigation, supported by an 78-member technical and administrative team.

The landscape supports eight forest types and diverse wildlife, including 30 mammals (five endangered), 235 birds and nine herpetofauna. Apex predators like tigers, snow leopards and Tibetan wolves coexist with key prey species. Sustainable management, including PES and scientific thinning, balances conservation, resource use and timber and NWFP allocation.

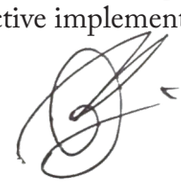
Forest cover is 59.01%, dominated by Fir forests contributing substantially to biomass, carbon stock and tree density. While occasional threats such as forest fires and pest outbreaks affect over 1,650 hectares, ongoing reforestation, sanitation, and support to over 107 registered Wood-Based Industries ensure sustainable resource use and ecosystem resilience.

A socio-economic survey of 1,308 out of 4,832 households across Paro and Haa Dzongkhags revealed that agriculture, livestock and NWFPs are primary livelihood sources. Gender dynamics show that 64% of households are female-headed, emphasizing the need for gender-inclusive approaches in conservation. HWC remains a challenge, affecting 96% of the households.

The 7,217.45 ha Taktshang-Bumdrak-Dragay Pangtsho, a High Conservation Value Area (HCV 6) in DFO, Paro, combines sacred sites, diverse forests and endangered wildlife. Supporting cultural heritage, ecotourism and water resources, it sustains ecological integrity and community well-being. Designated Priority 2, its preservation aligns with Bhutan's forest and biodiversity commitments.

The region faces significant climate variability, with rising temperatures and erratic rainfall affecting ecosystems and water sources. Vulnerable Gewogs, such as Shaba and Naja, face heightened risks, and local communities are adapting through crop diversification and water management. To address these challenges, the DFO's management plan outlines 84 strategic actions with 14 strategies under four broad objectives with a forecasted budget of Nu. 202.81 million focused on biodiversity conservation, HWC mitigation, and capacity-building for sustainable development over the next decade.

By integrating gender considerations, strengthening institutional capacities, and fostering community engagement, the management plan ensures long-term ecological and socio-economic resilience. Monitoring and evaluation will play a key role in assessing progress and ensuring effective implementation of these strategies.



Key facts of the Divisional Forest Office, Paro

Sl.No.	Forest statistics		
1	Total Forest Area	ha	96236.64
2	Forest Cover Percent	%	59.01
3	Conifer Forest	ha	82968.21
		%	50.87
4	Broadleaved Forest	ha	13268.44
		%	8.14
5	Non-Forest	ha	66847.34
		%	40.99
6	Basal area per hectare	m2/ha	34.25
7	Growing stock per hectare	m3	322.39
Biodiversity statistics			
1	Trees and Shrubs	No.	61
2	Ground vegetation	No.	272
3	Mammal	No.	30
4	Bird	No.	235
5	Herpetofauna	No.	9
Protected and Conservation Area			
1	Biological Corridor	ha	25555
2	High Conservation Value Area	ha	7217.45
Sustainable Forest Management Regime			
1	Forest Management Unit	No.	5
2	Community Forest Management Group	No.	47
3	Local Forest Management Area	No.	8
4	Non-Wood Forest Product Management Group	No.	2
Wood-based Industries			
1	Primary Wood-Based Industries	No.	62
2	Secondary Wood-Based Industries	No.	45
Field Offices			
1	Divisional Forest Head Office	No.	1
2	Forest Range Office	No.	2
3	Forest Beat Office	No.	2
4	Forest Management Unit Office	No.	5
5	Forest Check Post	No.	2

Chapter 1: Background

1.1. Rationale

Bhutan though a small country is widely recognized across the world for its environmental conservation initiatives and as a carbon negative country in the 21st century. The intact natural resource that we have today is a testimony to the farsighted conservative visions of our successive monarchs and the sound environment conservation policies of the country. However, over the years the forest management policies have undergone significant changes from that of more conservation focused to sustainable utilization of forest resources. Though scientific management of forest resources based on the principles of sustainability has long been practiced, it has become even more imperative than ever before in light of the changing climate and its impacts. Today climate change and its impacts have widely affected many countries. Bhutan by virtue of being located in a most fragile mountainous ecosystem is even more poised to the impacts of climate change. Thus, Bhutan is one of the few countries in the world that enshrines forest and environmental conservation aspects in its Constitution. Article 5 of the Constitution of the Kingdom of Bhutan reflects commitment to ensure that, in order to conserve the country's natural resources and to prevent degradation of the ecosystem, a minimum of sixty percent of Bhutan's total land shall be maintained under forest cover for all time.

The Divisional Forest Office (DFO) as the custodian of our forest resources in the Dzongkhag plays an integral role in conserving and protecting our natural forest resources besides catering forestry services to the people of the country. It is one of the main players in implementing our sound environmental conservation policies and ensuring our commitment to remain carbon neutral and maintain 60% forest cover for all times to come. Though management of forest resources within the divisional jurisdiction is guided by the noble principles of sustainability, it is even more important to be scientific along with long term divisional goals and objectives. It is also equally important to review and evaluate such goals and objectives on a periodic basis. Therefore, in order to do so a comprehensive and holistic Divisional Forest Management Plan (DFMP) with time bound vision, mission, objectives and goals is imperative. It shall serve as an overarching scientific Forest Management Plan (FMP) in scientifically managing the forest resources within the jurisdiction of DFO, Paro.

1.2. History and Significance

1.2.1. Importance of Forests

The Article 5 of the Constitution of the kingdom of Bhutan states that: "*Every Bhutanese is a trustee of the kingdom's natural resources and environment*". The Royal Government is enjoined in the Constitution to conserve and improve the environment and safeguard the country's biodiversity. It is further directed to secure sustainable development while promoting economic and social development. The Constitution has enshrined the Government to ensure that a minimum of 60% of the country's land should be maintained under forest cover for all times to come. Bhutan is the only carbon neutral country in the world, absorbing carbon more than it emits. The RGoB has made an international commitment to remain carbon neutral for all times to come.

1.2.2. Overview of the Sustainable Forest Management

Sustainable Forest Management in Bhutan is guided by the constitutional mandate to maintain at least 60% of the country's total land under forest cover for all time. This commitment underlines Bhutan's dedication to environmental conservation, ensuring the sustainable utilization of biodiversity resources, balancing economic needs with ecological integrity, and enhancing forest governance systems. Key national policies, such as the FNCA 2023 and NFP 2011, provide the legal and strategic framework for managing forests, conserving biodiversity, and ensuring equitable benefit-sharing among communities. Bhutan's unique position as a carbon-negative country underscores the importance of forest management in mitigating climate change, preserving ecological balance, and supporting sustainable livelihoods. Within this framework, individual DFOs, including the DFO, Paro plays an essential role in implementing national policies at the local level, managing resources sustainably, and addressing region-specific challenges.

Established in 1991 under the Department of Forests and Park Services, the Divisional Forest Office, Paro was established to fulfill Bhutan's constitutional mandates. The DFO is also tasked with delivering public services to the people of Paro, Haa and Chhukha Dzongkhags (districts), ensuring that the needs of local communities are met apart from the conservation and protection of rich biodiversity including the pristine ecosystem.

Over the years, DFO, Paro has evolved significantly, both administratively and technically. Initially focused on resource protection and enforcement, the division has expanded its scope to include modern multi-faceted management systems and community-based sustainable approaches. Major achievements include the successful implementation of Forest Management Units (FMUs), Community Forests (CFs), Local Forest Management (LFM) and NWFP management areas, which have collectively contributed to sustainable resource use, biodiversity conservation and local economic development.

DFO, Paro plays a critical role in resource management and service delivery. It ensures the sustainable harvest of forest resources, promotes community participation through initiatives like CFs and strengthens local livelihoods. Its effort in biodiversity conservation supports Bhutan's broader environmental objectives, contributing to the country's status as a global leader in biodiversity conservation.

Moreover, DFO, Paro's jurisdictional significance extends to its strategic location near protected areas and international borders, which presents opportunities for transboundary conservation and challenges in managing HWC and illegal activities. Through adaptive management and collaboration with stakeholders, the division continues to address these issues effectively.

By integrating traditional knowledge with scientific approaches, DFO at Paro exemplifies Bhutan's holistic vision for forest management, emphasizing environmental sustainability, economic viability and social equity.

1.3. Policies and legislations

1.3.1. National Forest Policy 2011

The National Forest Policy 2011 was formulated to keep up with changing times and the evolution of forest management concept of the SRF. Since 1957, Forest governance has transitioned from providing "free access" to "almost no access" to "managed access". The Forest Policy 2011 broadly stipulates to apply scientific management approaches to all of Bhutan's forest and biodiversity resources for the benefit of people without compromising the conservation values and the constitutional mandate of maintaining a minimum of 60 % forest cover for all time.

The Policy while stating about different management regimes also has provisions on the forest-based industries and need of proper utilization and marketing in developing private sector and rural communities. Some of the main features of the Policy include a science-based participatory approach to forest governance and sustainable forest management with emphasis on efficient and environment friendly technologies for value-addition and waste minimization.

1.3.2. Forest and Nature Conservation Act of Bhutan (1969, 1995, 2023)

The Bhutan Forest Act (BFA) 1969 is one of the first Acts passed by the RGoB. The Act nationalized "all land under which no person has acquired a permanent heritable and transferable right of use and occupancy" as forests. It further identified and provided directives regarding the forest rights, uses, royalties and penalties. The Act stipulated that at least 60% of the country should remain forested at all times.

The Bhutan Forest Act 1969 was repealed and ratified in 1995. The FNCA of Bhutan 1995 identified and outlined the requirement of management plan for production and protection of forest and wildlife. Emphasis was given to community and social forestry and encouraged the participation of community and private individuals in managing the forestry resources. The Act also provided the legal basis for defining management restrictions in the process of forest planning and function mapping.

The FNCA of Bhutan 1995 was revised in the year 2023 to cope with emerging conservation issues without compromising the development needs of the Country and its people. Besides harmonizing obsolete sections and subsections of the previous Act, the FNCA of Bhutan 2023 formulated a mechanism for PES.

1.3.3. Forest and Nature Conservation Rules (FNCR 2000, 2003, 2006, 2017, 2023, 2024)

The FNCR 2000 was revised in 2003 and again in 2006 to mainly accommodate a broader scope of the power and duties vested by the FNCA 1995 which were not covered by earlier FNCR. The FNCA 1995 mandated the Department to manage SRF including CF, protect and conserve wildlife, soil, water and other related natural resources of Bhutan. The FNCR 2006 issued authority and provisions for the preparation of management plans for Protected Area (PA), FMU, CF, NWFP Soil and Water conservation. Various amendments to the FNCR 2006 have been done over the years due to changing time

but keeping in line with the provisions of the NFP 2011. Further, a separate amendment to the FNCR 2006 was carried out due to the adoption of the revised rule for the rural timber allotment as part of the implementation of the Government to Citizen (G2C) services Programme. The FNCR 2006 was again revised in 2017 which was an amalgam of all the different amendments made to the FNCR 2006 and the provision on the Rules on Biological Corridors (BC) 2007, which defined the protection status and prescription of the BC plan.

The Forest and Nature Conservation Rules and Regulations 2017 was revised in 2023 to accommodate all the requirements vested in FNCA of Bhutan 2023. Major changes in the FNCRR 2023 includes the deletion of Chapter on Surface Collection of Sand and Stone as the mandate is transferred to the Department of Geology and Mines (DGM). In addition to fine tuning the provisions of the FNCRR 2017 the FNCRR 2023 underscores expediting public service delivery through online platforms. The amended FNCRR 2024 introduced targeted refinements to the FNCRR 2023 to address implementation challenges, clarify procedures, and simplify processes, enhancing practicality and efficiency without altering the core conservation objectives.

1.3.4. Land Lease Rules and Regulations of Bhutan 2018

The Land Lease Rules and Regulations of Bhutan 2018 implement the provision of the Land Act of Bhutan 2007 and necessitates the requirement of forestry clearance for issuance of SRF Land on lease. Further, it strongly discourages and forbids lease of land registered under Government institutions and areas which are under different management regime or (system/or practice) namely designated Parks, Nature Reserve, PA, BC, Buffer Zones, CF, Critical Watershed, Wetland, High Risk Zones, Nyes, Sacred Grooves (religious sites), monuments and Restricted Zones. However, the Secretariat can make exemptions for only those critical infrastructures of national importance and public need under special circumstances as deemed relevant by it.

1.3.5. Biodiversity Act of Bhutan 2003

The Biodiversity Act of Bhutan 2003 provides for the conservation and sustainable utilization of biological resources and associated traditional knowledge and ensures Sui Generis protection of plant varieties. It also authorizes the implementation of the Access and Benefit-sharing (ABS) regime to derive additional benefits in a fair and equitable manner.

1.3.6. Land Act of Bhutan 2007

The Land Act of Bhutan (LAB) 2007 provides for the leasing of state land for economic and various other activities. All Tsamdro (grazing) and Sokshing (forest land for collection of leaf litter) rights shall revert back to the State and convert to leasehold uses with management plan giving preference to previous right holders.

1.3.7. National Environment Protection Act 2007

The National Environment Protection Act (NEPA) 2007 provides for the establishment of an effective system to conserve and protect the environment through the National Environment Commission (NEC) or its successors, designation of competent authorities and constitution of other advisory committees, so as to independently regulate and promote

sustainable development in an equitable manner. The Act also calls for conservation and protection of wetlands, alpine regions, watersheds, and other vulnerable ecosystems in addition to the existing protected areas.

1.3.8. Waste Prevention and Management Act of Bhutan 2009

The Waste Prevention and Management Act (WPMA) of Bhutan 2009 promote minimization and sound management of waste in the country through the 3 Rs (Reduce, Reuse and Recycle). The Act further identifies different agencies for regulation of waste in the country wherein it empowers the then Ministry of Agriculture and Forests to ensure prevention and management of waste with respect to the agricultural sector, including livestock and forestry.

1.3.9. Climate Change Policy of the Kingdom Bhutan, 2020

Bhutan, a landlocked country in the Eastern Himalayas, is highly vulnerable to the impacts of climate change due to its fragile mountain ecosystems, dependence on climate-sensitive sectors (like agriculture, hydropower, and forestry), and limited adaptive capacity. Despite being a net carbon sink, it absorbs more greenhouse gases than it emits. Bhutan faces increasing risks from climate induced disasters such as glacial lake outburst floods (GLOFs), erratic rainfall, landslides and droughts.

To address these challenges and align with its international commitments under the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, Bhutan adopted the Climate Change Policy of Bhutan 2020. This policy provides a strategic framework for coordinated action on climate change mitigation and adaptation, while ensuring that development remains sustainable and resilient. It also provides strategic guidance to ensure that Bhutan remains carbon neutral and protects the well-being of the people by adapting to climate change efficiently and effectively. The policy also aims to address challenges and opportunities such as international support in the form of finance, technology, capacity building, research and awareness arising from recent developments in the national and international arena of climate change, which will be critical in implementing climate actions. This policy also ensures meaningful participation of all relevant stakeholders in climate change actions in a coordinated and coherent manner with clear roles and responsibilities.

1.3.10. Nationally Determined Contribution, 2021

Bhutan's 2nd NDC was officially launched on 5th June 2021 coinciding with World Environment Day and ahead of COP26. It reaffirms Bhutan's pledge to remain carbon neutral and outlines enhanced mitigation measures via sector-specific Low Emission Development Strategies (LEDS) and updates to the National REDD+ Strategy and Action Plan. Bhutan's 2nd NDC advances LEDS across multiple sectors to decouple development from emissions. It also highlights key sector specific adaptation and mitigation measures and initiatives that will be taken by Bhutan. In presenting the second NDC, Bhutan maintains the commitment to remain carbon-neutral where emission of greenhouse gases will not exceed carbon sequestration by the forests and sinks as first pledged in 2009 and reaffirmed in the first NDC. At the same time, Bhutan calls on the international community to continue and enhance the support for Bhutan's efforts to mitigate and adapt to climate change. While Bhutan's first NDC covered broad

priority action areas, the 2nd NDC further enhanced our actions by elaborating priority mitigation actions in the form of LEDS, roadmaps and strategies.

1.3.11. National Adaption Plan of the Kingdom of Bhutan, 2023

The National Adaptation Plan (NAP) process was initiated by Bhutan in line with the UNFCCC Cancun Adaptation Framework (2010), which called on countries to formulate medium and long-term strategies to address climate change impacts. While Bhutan had earlier prepared two National Adaptation Programme of Action (NAPAs) focused on urgent and immediate needs, the NAP aims to provide a comprehensive, long-term framework for integrating climate change adaptation into national planning and development.

Bhutan began developing its NAP with support from the Green Climate Fund (GCF), the UNDP, and other partners around 2019. The objective is to identify, prioritize and mainstream adaptation needs across key sectors such as agriculture, forestry, water resources, health, energy and infrastructure, ensuring that climate resilience is embedded within the country's socio-economic development guided by the philosophy of Gross National Happiness (GNH). The NAP process also emphasizes strengthening institutional coordination, scientific data and climate information systems and financing mechanisms to support sectoral adaptation. Importantly, it helps Bhutan align national adaptation planning with its Climate Change Policy (2020) and the 2nd Nationally Determined Contribution (2021).

1.3.12. Water Act of Bhutan, 2011

The Water Act of Bhutan, 2011 provides the legal framework for the protection, conservation, development, and sustainable management of water resources in Bhutan. The Act recognizes water as a public trust and a vital national resource, ensuring its equitable and sustainable use for present and future generations. The Act establishes principles for integrated water resources management, regulates water abstraction and pollution, and sets out institutional roles for water governance at national and local levels. It also provides for the protection of watersheds, water sources, and water quality, while promoting efficient water use, conflict resolution, and environmental sustainability in line with Bhutan's development and conservation priorities.

1.3.13. Mines and Mineral Act of Bhutan 1995 and Regulation

The Mines and Minerals Act of 1995 provide the legal framework for the exploration, extraction, management, and conservation of mineral resources in Bhutan. It recognizes minerals as a state-owned resource and aims to ensure their sustainable utilization while safeguarding the environment and supporting national development. The Act establishes licensing and permit systems for prospecting, mining, and processing of minerals, defines the roles and responsibilities of regulatory authorities, and sets out procedures for revenue collection, royalty payments, and enforcement of compliance. The Mines and Minerals Regulations operationalize the Act by detailing application procedures, safety and environmental standards, reporting requirements, and penalties for violations. Together, the Act and its Regulations aim to balance economic development, environmental protection, and responsible resource management in Bhutan.

1.3.14. Economic Development Policy of Bhutan 2016

The Economic Development Policy of Bhutan outlines the nation's strategy to achieve sustainable, inclusive, and equitable economic growth while maintaining the country's unique cultural heritage and environmental conservation priorities. Rooted in the philosophy of Gross National Happiness (GNH), the policy emphasizes that economic development must contribute not only to income generation but also to social well-being and ecological balance. Key objectives include diversifying the economy, promoting private sector development and entrepreneurship, fostering rural development, enhancing human capital and skills, and ensuring sustainable use of natural resources. The policy also encourages investment in infrastructure, innovation, and trade, while prioritizing environmental stewardship and social equity. Overall, it provides a roadmap for Bhutan to achieve balanced economic growth that aligns with its development philosophy and long-term national goals.

1.3.15. National Biodiversity Strategy and Action Plan of Bhutan, 2025

The National Biodiversity Strategy and Action Plan (NBSAP) of Bhutan is a strategic framework aimed at conserving biodiversity, promoting sustainable use of biological resources, and ensuring equitable benefit-sharing. Aligned with the Convention on Biological Diversity (CBD), the NBSAP integrates Bhutan's development priorities, traditional knowledge, and conservation commitments into a coherent national plan.

The strategy focuses on ecosystem and species conservation, habitat restoration, and protection of genetic resources, while emphasizing community participation and mainstreaming biodiversity into sectoral policies such as agriculture, forestry, and tourism. The Action Plan outlines priority activities, targets, and institutional responsibilities to achieve these goals, ensuring that biodiversity contributes to both environmental sustainability and socio-economic development in Bhutan.

1.4. Purpose and Objectives

1.4.1. Vision

Contribute to a sustainable Forest Ecosystems for the People, Nature and Economy.

1.4.2. Mission

Contribute to conserve and manage Bhutan's forest resources and biodiversity to ensure social, economic and environmental well-being, and to maintain a minimum of 60% of the land under forest cover for all times to come.

1.4.3. Purpose

To sustainably conserve and manage the forest resources and biodiversity under the jurisdiction of the Divisional Forest Office, Paro in order to support social, economic and environmental well-being for present and future generations, while contributing to the national mandate of maintaining at least 60% of the country's land area under forest cover.

1.5. Objectives

The objectives of this management plan are:

1.5.1 To improve forest health, enhance habitat conditions and foster biodiversity conservation through nature-based solutions and sustainable forest management practices, while generating economic benefits and supporting long-term ecological and economic resilience.

1.5.2 To reduce and mitigate human-wildlife conflict through conflict to co-existence (C2C) approaches.

1.5.3 To strengthen infrastructure and Human Resource capacity building for conservation.

1.5.4 To preserve and manage the conservation of cultural and historical sites through High Conservation Value Area (HCV6) designation.

Chapter 2: Current Status

2.1. Boundary and Area

The Divisional Forest Office, Paro (DFO) is located in the western part of Bhutan between longitudes 89^{0}00'E-89^{0}35'E and latitude 27^{0}10'N-27^{0}50'N. Geographically, the DFO, Paro shares boundaries with Jigme Dorji National Park (JDNP) in the north, Jigme Khesar Strict Nature Reserve (JKSNR) in the West and DFO, Gedu and Thimphu in the South and East respectively. The Division covers 16 Gewogs in four Dzongkhags - 10 Gewogs in Paro dzongkhag, four Gewogs in Haa Dzongkhag, One Gewog each in Chhukha and Thimphu Dzongkhag.

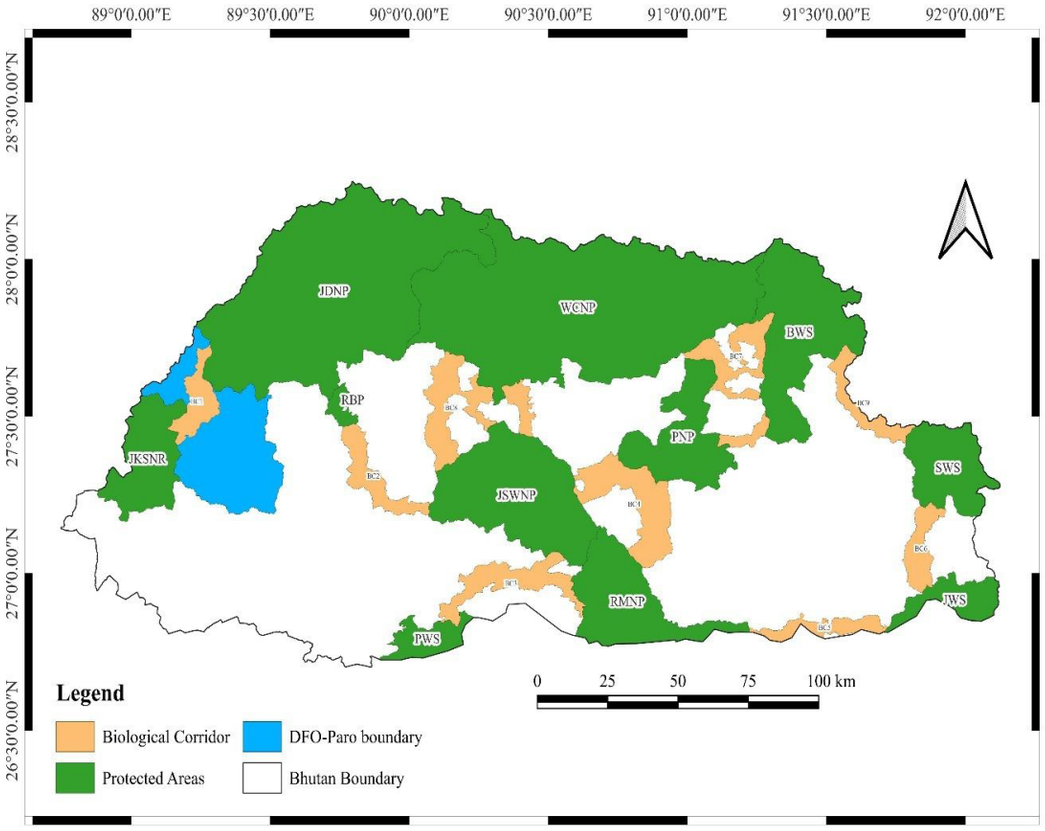


Figure 1: Divisional Forest Office, Paro

Table 1: Land Use Land Cover (LULC 2016) status of DFO, Paro

Land use Landcover	Area(sq.km)	Percentage (%)
Alpine Scrubs	42.69	2.62
Built up	8.32	0.51
Cultivated Agriculture	65.82	4.04
Forests	962.37	59.01
Meadows	119.99	7.36
Non-Built up	0.39	0.02
Rocky Outcrops	97.87	6.00
Shrubs	320.33	19.64
Snow and Glacier	5.92	0.36
Water Bodies	7.14	0.44
Grand Total	**1630.84**	**100.00**

The DFO covers approximately 1,630.84 km^2, with elevations ranging from 1,900m in the south to 5,600m in the north. Slope analysis indicates that 80.2% of the area has slopes under 35˚, 15.4% between 35˚ and 45˚, and 6% above 45˚. As per land Use Land Cover (LULC) data 2016 of Bhutan, land cover shows forests (59.01%) as the largest category, followed by shrubs (19.64%) and non-built-up area (0.02%) has the lowest category.

For the purpose of harmonizing spatial datasets, the Land Use Land Cover (LULC) map of 2016 was overlaid with the Forest Type Map (FTM) of 2022 to delineate and quantify discrepancies in non-forest areas. The comparative analysis revealed a net difference of 1132.427ha. To standardize area estimates, the non-forest extent derived from the FTM, 2022 was normalized against the corresponding non-forest area of the LULC, 2016 resulting in an adjustment coefficient of 0.9833. The coefficient was subsequently applied proportionately across all non-forested categories of the LULC, 2016 dataset to ensure consistency and alignment in area (Table 1).

2.2. Administration

2.2.1. Administrative Set up

The Division operates through a coordinated network of offices dedicated to effective forest resource management, conservation efforts and public service delivery. The Division Headquarter, strategically located at Tshongdue in Paro, serves as the central administrative and coordination hub. Supporting the Headquarter are two key Range Offices namely Forest Range Office, Paro and the Forest Range Office, Haa which oversee field operations within their respective jurisdictions. There are two Beat Offices namely Dawakha and Tsento under the Forest Range Office, Paro to cater services and oversee field operations. In addition, the DFO's management framework is reinforced by

five Forest Management Unit (FMU) offices namely Bitekha, Haa-East, Lonchu, Selela and Zonglela (Figure 2). These FMUs play a critical role in implementing scientific and sustainable forest management practices, ensuring protection and facilitating the sustainable harvesting and allotment of timber for commercial and rural purposes.

The Division office is structured into different sections that aligns with the functional Divisions under the DoFPS, enabling effective implementation of forestry policies and programs at the field level. The technical sections of the Division include the Forest Resources Planning and Management Section (FRPMS), which oversees sustainable forest management planning, resource utilization and silvicultural operations. Likewise, the Forest Monitoring and Information Section (FMIS) is tasked with monitoring forestry activity in different management regimes including patrol planning and data management for the Division and the Nature Conservation Section (NCS) which leads biodiversity conservation, habitat protection and community engagement in conservation efforts.

These technical sections are further supported by the Administrative Section, responsible for office management, human resources and logistics. Financial operations and accounting services are managed by the Finance Section, which functions under the Cluster Service Center of Paro Dzongkhag, ensuring streamlined financial oversight and support for the Division's activities.

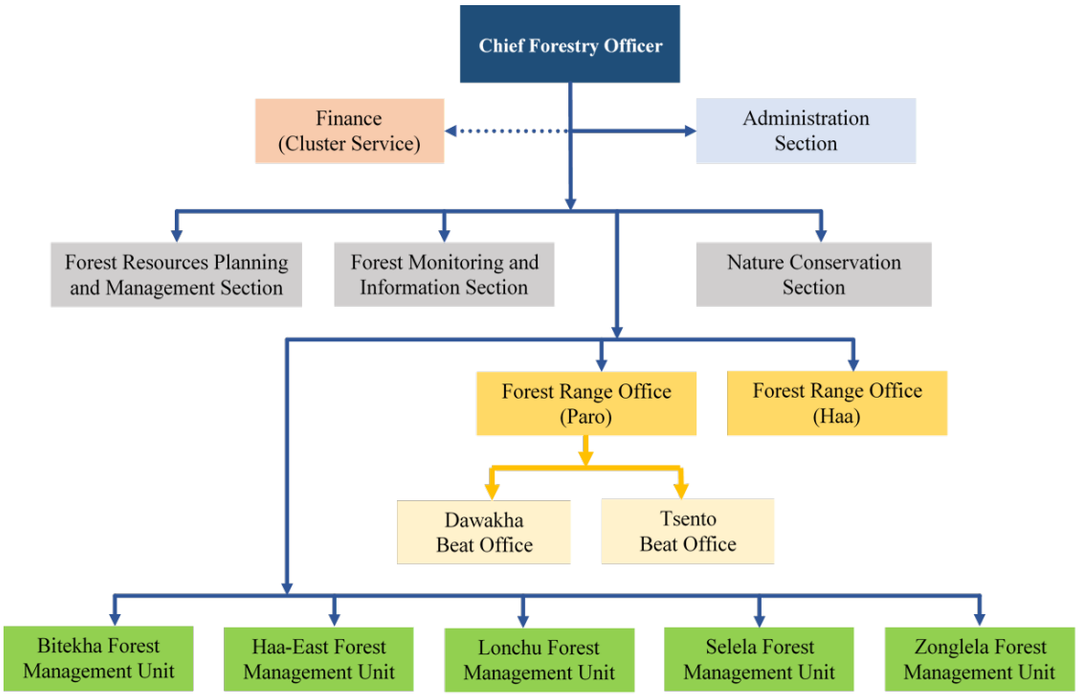


Figure 2: Organogram of DFO, Paro

2.2.2. Mandates

The Division is responsible for performing various routine tasks, including service delivery, planning and implementing silvicultural operations, as well as patrolling and conservation efforts. These activities are managed by respective sections under the management.

2.2.2.1. Forest Resources Planning and Management Section (FRPMS)

- Scientific forest management through planning, implementation, and extraction of forest resources from forest management units, local forest management areas, Nation-wide thinning areas and working schemes.
- Community-based Forest Resource Management through planning and implementation of activities including the revision of Community Forestry and Non-Wood Forest Product management areas, community-based forest enterprise.
- Processing for approval of allotment of timbers, firewood, and NWFP only for commercial purposes.
- Processing for approval of export and import of all forest products.
- Timber Allocation and Utilization including facilitation activities with Wood-based Industries, natural resources pricing, timber disposal, and utilization.
- Non-Wood Forest Product Allocation and Utilization.
- Planning and implementation of afforestation and reforestation plantation under Divisional Forest Office.
- Planning, coordination, and Open auction of timber from ad-hoc areas under DFO as per Third-party modality and other relevant modalities.
- Maintain record and Registration of Integrated Wood Based Industry (IWBI), Primary and Secondary wood-based Industry, under DFO.
- Inventory of FMU, CF, NWFP, LFMP, NFI, Plantation and Nursery.
- Assessment of watersheds & wetlands and design & implementation of interventions for their protection and management.
- Identify recharge areas and implement revival measures for drying water sources.
- Planning, and coordination of any ecotourism-related activities under DFO.

2.2.2.2. Forest Monitoring and Information Section (FMIS)

Enforcement of FNCA 2023, FNCRR 2023, and any other rules and amendments that may be endorsed by the higher authority through coordination with Ranges, FMUs and Beat Offices.

- Awareness of FNCA 2023, FNCRR 2023, and any other rules and amendments that may be endorsed by the higher authority through coordination with Range and Beat Offices.
- Monitoring the implementation of terms and conditions of forestry clearances, and forest produce clearances.
- Monitoring of FMU, LFMP, BC, CF, Plantation and NWFP management

prescriptions as per M&E framework including Bhutan METT+ (Monitoring Effectiveness Tracking Tool).

- Provide feedback and recommendations to the Division and the Range/ Beat/ FMU staff based on the monitoring and evaluation.
- Provide legal advice to the field staff and legal backstopping to Range Offices in coordination with the Department and Legal Services Division (LSD), Ministry.
- Focal for G2C services, OFS, SMART, GIMS, Forest Fire and Drone.
- Coordinate and planning for all forest fire and forest pest-related programs under Divisional Forest Office.
- Open Auction of the illegal timber/NWFP.
- Process Forestry clearance from SRFL for developmental activities (OFS and G2C).
- Data Compilation and Management in FIRMS and maintain the record of spatial data of all the Spatial Data (Forest cover, SDSS & remote sensing, Drone data) under DFO
- Monitoring of revenue collection and deposit by Range/beat offices and FMU. (Data Manager).
- Monitor the forestry offenses and settlement of cases.
- Advocate on waste management.
- Focal for Uniform code of conduct.
- Inventory and issuance of arms and ammunitions and processing of related legal documents with relevant authority.
- Coordinate maintenance of arms and ammunition.

2.2.2.3. Nature Conservation Section (NCS)

- Identifying, Planning, & Monitoring HCV (High Conservation Values), KBA (Key Biodiversity Areas), and Other Conservation Areas under DFO
- Protection and conservation of natural habitats of flora and fauna under DFO.
- Species conservations and surveys.
- Planning and conducting an annual survey of BMG (Biodiversity Monitoring Grid) under DFO.
- Fishing license monitoring.
- Research on flora and fauna under DFO in consultation with the Department.
- Process and review clearance and research permit for any research conducted within DFO.
- Management of wildlife rescue facilities.
- Coordinate and lead HWC mitigation including wildlife rescue.
- Wildlife feeding reduction advocacy and awareness.
- Register the wildlife trophies under DFO.
- Support and assist FMIS in the event of monitoring.
- Maintain taxa-wise data and submit it to FIRMS for annual update.

2.2.2.4. Administrative Section

- Human resource management under Divisional Forest Office.
- Administrative activities including the meetings, training and workshops.
- Advocate the staff to prevent corruption activities under DFO. (awareness of ACC rules, asset declaration, Maintaining gift records)
- Awareness related to existing financial rules and regulations.
- Store inventory and management of fixed assets, vehicles, equipment, etc.
- Inventory, record, and issuance of forestry documents.
- HR Travel Focal: Process and create travel approval in eDATS (electronic Daily Allowance & Travel System).
- Finance Focal (Cluster Finance): Process payments and maintain records of payments made for the construction/renovation of office buildings and staff quarters.
- Submission of financial and physical progress reports of capital projects.
- Process payments and maintain records of utility bills and other monetary bills.
- Collect, deposit, and maintain records of FWF and Department FWF for transparency.
- Focal for annual budget preparation for the Division.

2.2.3. Human Resources

The Division is currently staffed by a total of 77 technical personnel, complemented by one administrative staff member, four Elementary Service Personnel (ESP), and two drivers. Of the 77 staff, three employees are currently on extraordinary leave, one is on study leave, and another is on secondment.

Table 2: Human resource (technical) capacity of DFO, Paro

Office	CFO/ PFO/ DyCFO	Sr. FO	FO	Sr. FR	FR	Fr.	EoL/ SL	Deputation	Total
Division HO	6	0	1	1	0	0	1	1	**10**
Haa Range	0	0	0	5	6	0	1	0	**12**
Paro Range	0	0	0	12	11	0	1	0	**24**
Bitekha FMU	0	0	0	3	2	1	0	0	**6**
Haa-East FMU	0	0	0	3	1	0	0	0	**4**
Lonchu FMU	0	0	0	3	2	1	0	0	**6**
Selela FMU	0	0	0	2	2	0	0	0	**4**
Zonglela FMU	0	0	0	6	3	1	1	0	**11**
TOTAL	**6**	**0**	**1**	**35**	**27**	**3**	**4**	**1**	**77**

The technical staff, forming the majority of the workforce, provide essential expertise and support to local communities, ensuring professional execution of the Division's mandates. ESP staff maintain essential services, administrative staff manage operations, and drivers facilitate fieldwork by transporting personnel and equipment.

The Division faces significant challenges due to shortage of human resources. With increasing developmental activities and rising demand for forest resources, the office must manage a wide range of services. Additionally, it struggles to combat illegal activities such as poaching and illegal logging, exacerbated by the vastness of its jurisdiction. The issue or challenges is further compounded by personnel being on Extraordinary Leave (EoL) or deputation, placing additional strain on the already limited human resource (Table 2).

Despite limited human resources, there are opportunities to invest in capacity building for staff through professional training and the development of technical skills and competencies. These efforts aim to promote effective and sustainable forest management while improving social livelihoods. Expanding the administrative team could significantly strengthen management capabilities and provide more effective support to the technical workforce. Additionally, leveraging opportunities for growth through a well-structured organizational development plan can enhance the division's overall capacity to deliver high-quality technical support and community-focused services.

2.2.4. Infrastructure

The Divisional Forest Office has essential infrastructure and mobility facilities to support its mandates of service delivery, resource allocation, biodiversity conservation, and climate change mitigation and adaptation. The head office, located in Tshongdue (Paro town), is complemented by Range Offices and FMUs operating across Paro and Haa Dzongkhags, ensuring decentralized and efficient public service delivery. However, the DFO faces significant challenges, including the absence of permanent infrastructure necessary for smooth operations. Currently, Haa Range is the only permanent structure in the region, while Haa-East, Lonchu and Selela FMU offices are being operated from semi-permanent facilities. Similarly, Bitekha FMU and Dawakha Beat Office lack permanent buildings, which hinders the delivery of efficient and effective services.

Mobility constraints also impact operations. The Division relies on just two pool Hilux vehicles and five bikes, which are insufficient for fieldwork. Upgrading infrastructure and expanding transport facilities are critical to meeting the Division's growing needs and mandates effectively.

2.2.5. Budget and Revenue

Table 3: Revenue generated for the past 5 years from 2020 to 2024 (Nu. in million)

Product category	Year				
	2020	2021	2022	2023	2024
Timber	9.669	5.191	6.825	9.549	12.959
Non-wood Forest Product	0.079	0.068	0.067	0.357	0.393
Fines and Penalties	5.814	3.157	4.992	5.516	3.746
Charges and fees	0.591	0.339	0.705	0.071	1.357
Lease rent	0.000	0.000	0.116	0.000	0.001
Total	**16.153**	**8.755**	**12.705**	**15.492**	**18.455**

Table 4: Projected Revenue for the next 5 years from 2026 to 2030 (Nu. in million)

Product category	Year				
	2026	2027	2028	2029	2030
Timber	10.635	5.710	7.507	10.504	14.255
Non-wood Forest Product	0.086	0.075	0.074	0.392	0.432
Fines and Penalties	6.396	3.473	5.492	6.067	4.121
Charges and fees	0.650	0.373	0.776	0.078	1.493
Lease rent	0.000	0.000	0.127	0.000	0.001
Total	**17.768**	**9.631**	**13.976**	**17.041**	**20.301**

Table 5: Detailed budget description (in million) for past 5 financial years (2020-2021 to 2024-2025)

Activity Title	Financial Year				
	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
General Management and Direction Services	34.966	36.218	39.852	53.907	0.000
Preparation of annual Operational Plan for FMUs	0.000	0.000	0.000	0.250	0.250
Revision of two Local Forest Management Plan at Katsho and Bji	0.000	0.000	0.000	0.450	0.000
Strengthen Environmental Education and Ensure Compliance to International Conventions	0.000	0.000	0.000	0.000	0.281
Biodiversity Grid Monitoring	0.000	0.000	0.000	0.060	0.060
Conduct Periodic Survey and Monitoring of Priority Species	0.000	0.000	0.000	0.000	0.300
Resource Protection and Law Enforcement Services	3.800	3.246	0.000	0.000	0.000
Resource Management and Allocation Services	1.452	0.000	0.250	0.000	0.000
Green Climate Fund Support - DFO, Paro	0.600	0.000	0.000	0.000	0.000
Organize awareness training	0.000	0.000	0.000	0.100	0.000
GEF LDCF - Enhancing Climate Resilience of Forests and Agriculture Landscape and Community Livelihood	1.361	3.560	0.890	0.000	0.000
Ensuring Tiger Protection Beyond Protected Areas	4.802	3.595	0.000	0.000	0.100
Monitoring of Zero-Poaching Project	0.000	0.000	0.000	0.600	0.000
Bhutan for Life Project	5.569	4.696	2.833	0.000	0.000
Construction and Infrastructural Development	1.600	0.065	0.000	0.000	0.000
WFP Support for CATS Project	1.250	0.000	0.000	0.000	0.000
REDD Readiness Project Support	0.000	2.110	0.000	0.000	0.000
WWF Project	0.000	0.000	1.422	0.000	0.000
SMART Patrolling	0.000	0.000	0.000	0.420	0.000
Capacity Building for Operation of Thermal Drone	0.000	0.000	0.000	0.362	0.000
Plan and Organize Long-Range Patrolling	0.000	0.000	0.000	0.900	0.500
Develop QRT protocol and establish QRT in 14 Gewogs	0.000	0.000	0.000	0.800	0.000
Organize training for 16 staff	0.000	0.000	0.000	0.700	0.000
AFoCO support sustainable community-based enterprise Development for Improved Livelihood in Bhutan	0.000	0.000	0.000	1.368	0.000
Implement SMART and SMART Connect for all DoFPS Deliveries	0.000	0.000	0.000	0.000	0.420
Strengthening Multistakeholder Coordination Group	0.000	0.000	0.000	0.000	0.100
Enhance FIRMS, OFS, G2C, SDSS	0.000	0.000	0.000	0.000	0.500
Alternative Livelihood Program Identified and Implemented	0.000	0.000	0.000	0.000	0.800

2.3. Biodiversity Conservation

2.3.1. Forest Ecosystem

2.3.1.1. Floral diversity

The biodiversity assessment conducted for 11 Gewogs in 2022 recorded a total of 333 species from 86 families across 206 plots. Of these, 272 species were ground vegetation, including epiphytes and spore-bearing plants, observed in all 206 plots. The remaining 61 species, comprising trees and shrubs, were documented in 168 plots.

The forest area within the Division was classified into five distinct forest types while designing the study area. A total of 86 grids were established, with 28 grids; representing 30% of the study area, selected through random sampling. Each grid adhered to a standardized size of 4 x 4 km, in line with the NFI guidelines.

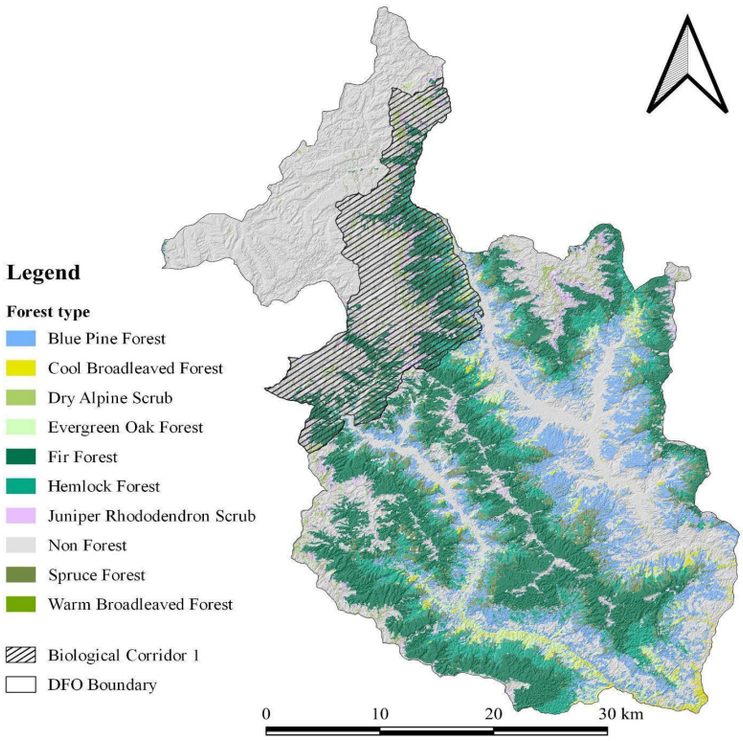


Figure 3: Forest types of DFO, Paro

Cluster analysis revealed that seven of Bhutan's 11 forest types are distinctly represented within the jurisdiction of the DFO, Paro. This classification offers valuable insights into the region's diverse forest types, as illustrated in Figure 4.

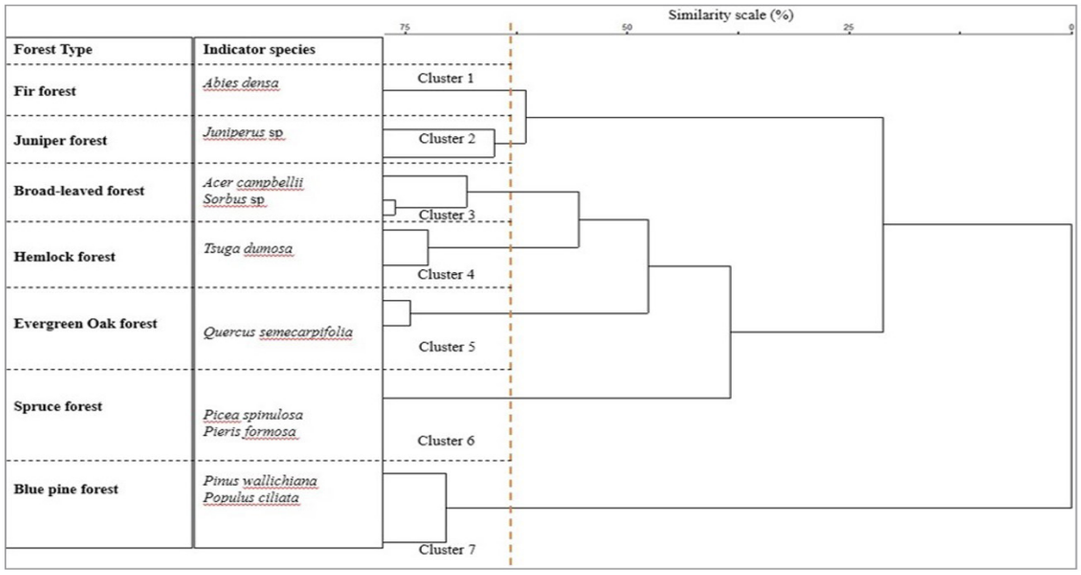


Figure 4: Cluster dendrogram for forest types

2.3.1.2. Fir Forest

The Fir Forest was located at altitudes between 3100 and 3300 meters, receiving precipitation ranging from 1300 to 2000 mm. The primary indicator species of this forest type were *Abies densa* (P*0.0002) and *Prunus sp.* (P*0.0002). Fir trees were most dominant in the Gewogs of Doteng, Essu and Tsento.

2.3.1.3. Juniper Forest

Juniper Forest was found mostly in Dogar, Doteng and Tsento Gewogs of Paro Dzongkhag between an altitude of 3700-4200m. The dominant species recorded were Juniperus species (P*0.0002) and *Larix griffithii* (P*0.0002).

2.3.1.4. Broad-leaved Forest

Broad-leaved Forest was found between an altitudes of 1000-2900m. The indicator species for this type of forest were *Acer campbellii* (P*0.0002), and *Betula alnoides* (P*0.0012). These species were found dominant in Bji Gewog of Haa and Doteng, Hungrel and Tsento Gewogs of Paro Dzongkhag.

2.3.1.5. Hemlock Forest

Hemlock Forests were found between an altitude of 2800-3100m and precipitation of 1300-2000mm. The indicator species recorded was *Tsuga dumosa* (P*0.0002) and was mostly found in Doteng, Lungnyi and Naja Gewogs of Paro and Essu and Samar Gewogs of Haa Dzongkhag.

2.3.1.6. Evergreen Oak Forest

Evergreen Oak Forest was found in Katsho and Samar Gewogs of Haa and Naja and Shaba Gewogs of Paro Dzongkhag between an elevation of 1800-2000m (2600m) and precipitation of 2000-3000mm. The indicator species recorded was *Quercus semecarpifolia* (P*0.0002).

2.3.1.7. Spruce Forest

The Spruce Forest was found in the Dogar, Doteng, Hungrel and Lungnyi Gewogs of Paro Dzongkhag, as well as the Katsho and Samar Gewogs of Haa Dzongkhag, at altitudes between 2500 and 3100 meters, with precipitation ranging from 500 to 1000 mm. The key indicator species recorded were *Picea spinulosa* (P*0.0002) and *Pieris formosa* (P*0.0438). It was also noted that *Picea spinulosa* trees in the Paro and Haa areas were commonly infected by bark beetles (*Ips schmutzenhoferi*).

2.3.1.8. Blue Pine Forest

The Blue Pine Forest was primarily found in the Shaba, Hungrel, Lungnyi and Naja Gewogs of Paro Dzongkhag. The recorded indicator species were *Pinus wallichiana* (P*0.0002) and *Populus ciliata* (P*0.0122). Blue pine trees are highly valued for timber, particularly in construction and furniture making.

2.3.2. Floristic Composition of trees and shrubs

The tree and shrub consisted of 61 species from 27 families. The floristic composition across the 11 Gewogs, along the altitudinal gradient (2408-2649m), is presented and categorized into major life form groups (Figure 5). These groups include Conifers (71.1%), Evergreen trees (10.7%), deciduous trees (6.7%), Evergreen shrubs (4.1%) and Deciduous shrubs (1.4%).

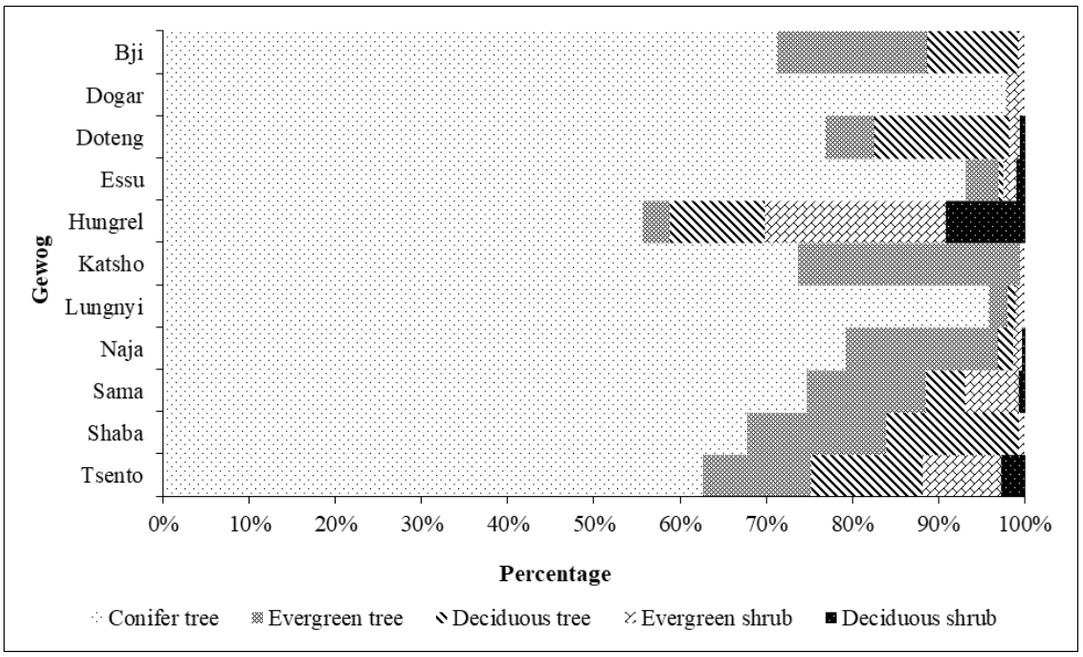


Figure 5: Floristic composition (in percentage) of trees and shrubs

The composition of trees and shrubs was predominantly dominated by Conifer species, including *Pinus wallichiana, Picea spinulosa, Abies densa* and *Tsuga dumosa*, followed by evergreen tree species such as *Quercus semecarpifolia*, *Rhododendron arboreum*, and *Phoebe lanceolata*. Deciduous trees were primarily represented by *Acer campbelli, Populus ciliata*, and *Sorbus sp*. Evergreen shrubs consisted of species like *Pieris formosa, Lyonia ovalifolia*

and various *Rhododendron* species, while deciduous shrubs were represented by *Rhus sp.*, *Viburnum sp.,* and *Enkianthus deflexus.*

2.3.3. Floristic Composition of the ground vegetation and epiphytes

The ground vegetation comprised 272 species from 66 families, including 188 perennial herbs, 26 annual herbs, 10 biennial herbs, and 48 spore-bearing plants. The composition of ground layer species across the 11 Gewogs is categorized by lifeform groups (Figure 6). Perennial herbs accounted for 71.5%, annual herbs 9.7%, biennial herbs 1.1%, and spore-bearing plants 17.6%, respectively.

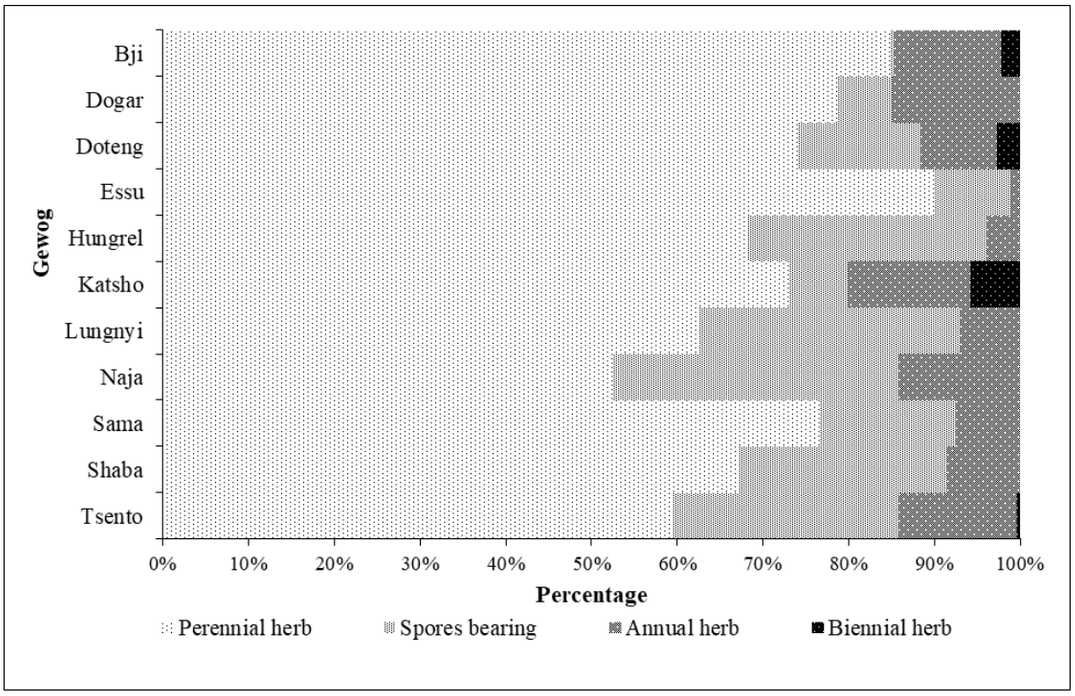


Figure 6: Floristic composition of ground vegetation and epiphytes

2.3.4. Mammal

A total of 30 mammal species from 28 genera and 12 families were recorded, including members of Felidae, Bovidae, Canidae, and Cervidae. Of these, five species are classified as Endangered, eight as Vulnerable, five as Near-Threatened, and 12 as Least Concern, according to the IUCN Red List. The Endangered species include the Tibetan wolf, Asiatic wild dog, Royal Bengal tiger, Himalayan musk deer, and Red Panda. Vulnerable species include the Snow leopard, Common leopard, Asiatic black bear, Bhutan Takin, Sambar deer, Thorold's deer, Himalayan serow, and Gaur. Near-Threatened species are the Asiatic golden cat, Marbled cat, Assamese macaque, Himalayan weasel, and Goral.

In addition, new species records for the Division include the Woolly hare (*Lepus oiostolus*), recorded during the NTS in 2021 and NSLS in 2022. The Tibetan wolf (*Canis lupus filchneri*) and Thorold's deer (*Cervus albitrostris*) were also newly recorded from the Nubri area during the NSLS 2022 survey.

Figure 7: The presence of Thorold's deer in the Division

2.3.4.1. Detection and Occupancy rate of mammal

Considering 30 camera trap days as an occasion, Asiatic golden cat, Himalayan marmot, Asiatic black bear, Bhutan Takin, Sambar deer, Red Panda, Gaur, Marbled cat, and Royal Bengal tiger displayed notably high detection rates. Conversely, Blue sheep, Tibetan wolf, Thorold's deer, Himalayan musk deer, Himalayan serow and grey langur exhibited the highest occupancy rates. The detection of various species and their richness appeared uniformly distributed across all camera trap stations (Figure 8).

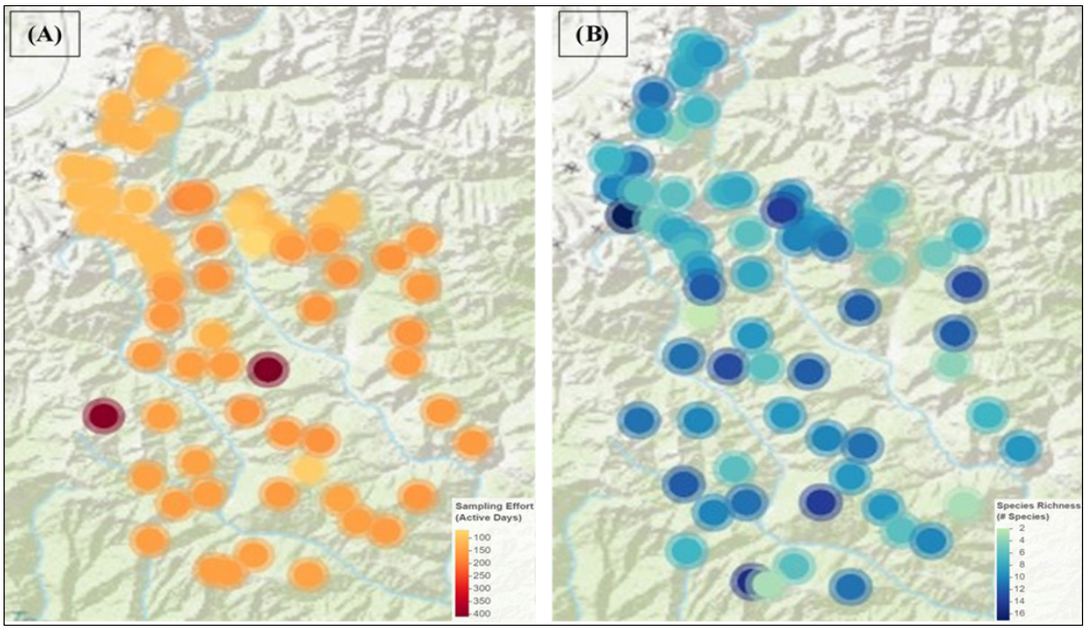


Figure 8: (A) Sampling effort (B) Species richness with the Division

2.3.4.2. Occurrence and Significance of Predator

The Division is endowed with faunal diversity with predators at the apex. These magnificent predators play a vital role in maintaining the ecological equilibrium of the forest and shaping the behaviors and populations of prey species which indicates the overall health of the ecosystem. Top predators such as Royal Bengal tiger, Snow leopard, Asiatic black Bear, Tibetan wolf and Asiatic wild dog (Figure 9) roam within the Division. The occupancy rate for Snow leopard (0.99), Tibetan wolf (1) and Asiatic wild dog (0.99) was relatively higher than Asiatic black Bear (0.5). However, the detection rate of the Asiatic black Bear (0.49) was observed higher than the other three predators.

2.3.4.3. Occurrence and Significance of Prey species

The Division is home to diverse prey species, including Barking deer, Sambar deer, blue sheep, Bhutan takin, Himalayan musk deer, Himalayan serow, Goral, Himalayan marmot and Wild pig. These species are vital to the forest ecosystem, serving as prey for large predators that regulate their populations, thus maintaining balance in the food chain. Species such as Barking deer, Sambar deer, Himalayan serow, Goral and Wild pig contribute significantly to mammal diversity and ecological dynamics in the lower regions of the Division, while blue sheep and Himalayan marmot known for their adaptability to high altitudes, play key roles as herbivores and prey in the mountainous terrain respectively. Their presence highlights the importance of conservation efforts to protect these species and ensure the health and stability of the forest ecosystem.

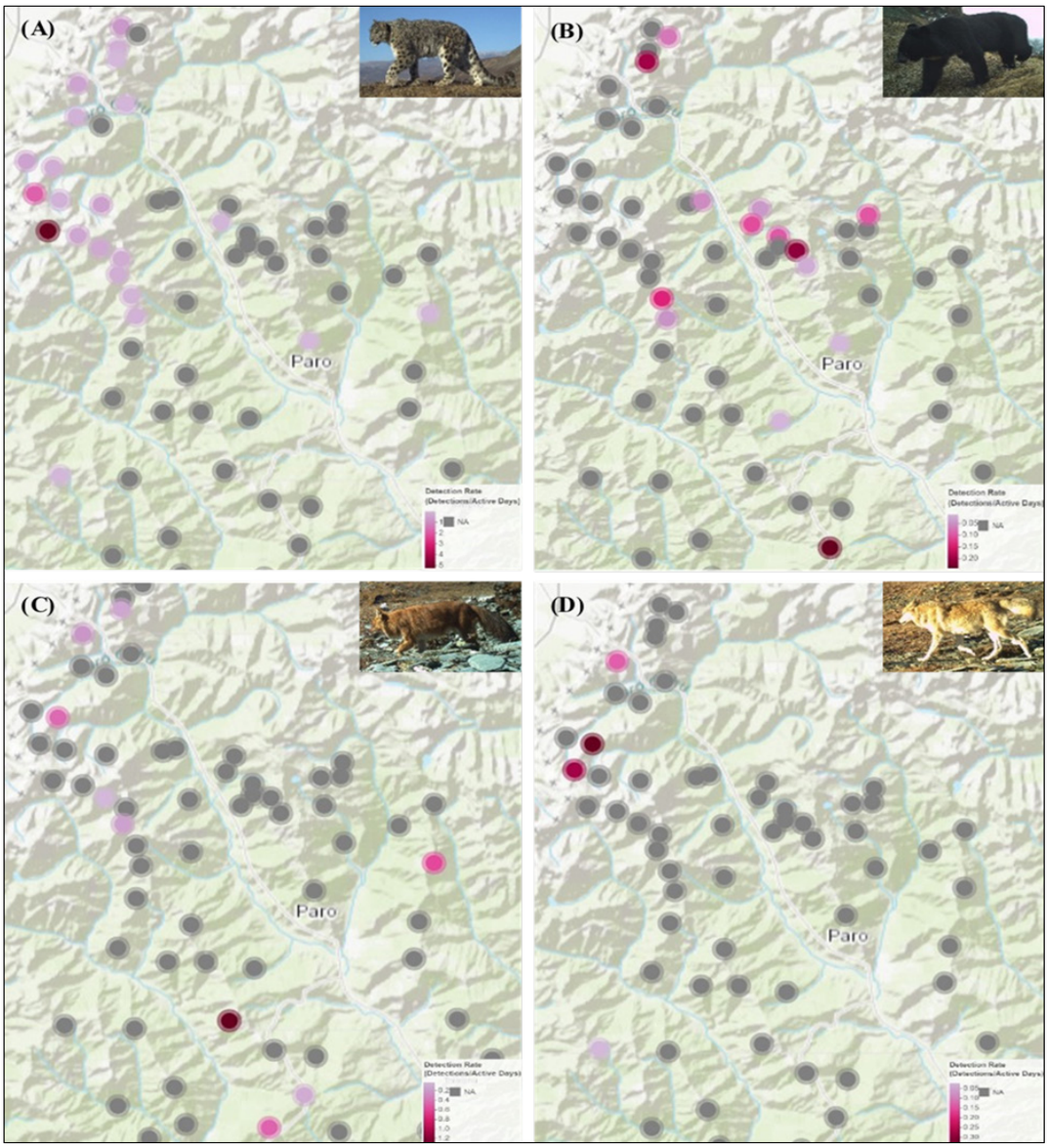


Figure 9: Detection rate of top predators (A) Snow leopard (B) Asiatic black bear (C) Dhole and (D) Tibetan wolf

2.3.5. Avifauna diversity

A total of 83 bird species from 30 families were recorded across various forest types and elevations ranging from around 2100 to 5600m during the RBA. The major forest types surveyed included Alpine, Blue Pine, Broadleaved, Fir and Mixed Conifer forests (Spruce and hemlock). The highest number of species was observed in the MC forest, followed by the Fir and other forest habitats (Figure 10). The bird data was combined with reports from Mr. Chencho Wangdi, who conducted studies along the Pachhu River in 2016, 2020 and 2021. In addition, 23 bird species were recorded during field visits and biodiversity monitoring grid surveys in 2025. As a result, the total bird species recorded for the Division is 235 belonging to 145 genera and 58 families. The Muscicapidae family recorded the highest number of species, followed by Anatidae, Fringillidae and Leiothrichidae.

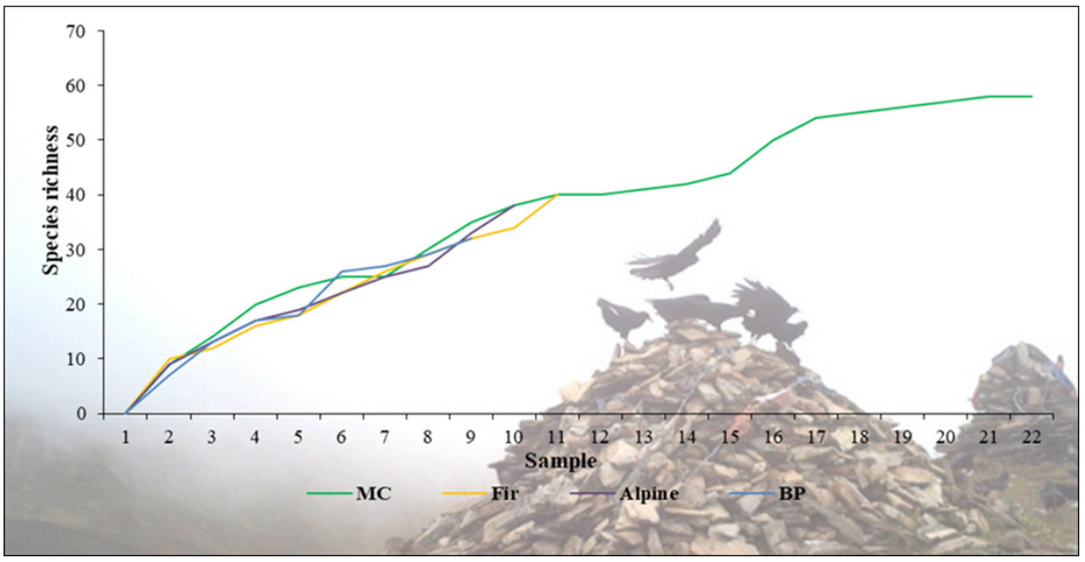


Figure 10: Species richness (running list) in different forest type

Out of 235 bird species recorded in the Division, one is classified as Vulnerable (Wood Snipe), nine are Near-threatened and 225 are of Least Concern according to the IUCN Red List of Threatened Species. Approximately 78% of the recorded species are forest birds, primarily found in forest habitats, while 22% are water birds, residing near water bodies and along the streams and rivers.

2.3.6. Herpeto-fauna

Herpeto-fauna, comprising reptiles and amphibians, play a vital role in maintaining the ecological balance of forest ecosystems. Their presence is an indicator of environmental health, as they are sensitive to habitat changes, pollution, and climate fluctuations. Integrating herpeto-fauna management in the DFO plan ensures the protection and conservation of these species while promoting overall biodiversity.

There is no detailed checklist of herpeto-fauna of DFO, Paro. However, there are few snakes, toads and lizards sighted from Paro and Haa that are mentioned in research papers, biodiversity portals and books of reptiles. A total of nine herpeto-fauna species were recorded from Paro and Haa area, of which six species are snakes; Himalayan Mountain Keelback, Wolf Snake (Wangyal, 2013), Sikkim false wolf snake, Himalayan Eastern Keelback and Bejeweled Lance -headed Himalayan Pit Viper (Wangyel & Das, 2021), two toads; Himalayan Toad and Asian Common Toad (inaturalist bhutan.org, 2023) and one lizard (inaturalist bhutan.org, 2023).

Table 6: The record of herpeto-fauna

Common Name	Scientific Name
Himalayan Mountain Keelback	*Amphiesma platyceps*
Wolf Snake	*Dinodon gammiei*
Himalayan Toad	*Duttaphrynus himalayanus*
Asian Common Toad	*Duttaphrynus melanostictus*

Indian forest skink	*Sphenomorphus indicus*
Sikkim false wolf snake	*Lycodon gammiei*
Himalayan Keelback	*Rhadophis himlayanus*
Eastern Keelback	*Herpetoreas platyceps*
Bejeweled Lance-headed Himalayan Pit Viper	*Protobothrops himalayanus*

2.3.7. Aquatic Ecosystem

In Bhutan, high-altitude wetlands cover approximately 0.60% of the total high-altitude land area (Sherab et al., 2019). The majority of these wetlands, particularly lakes, are located at an elevation ranging from 3800 to 5560m. The lakes in Paro and Haa cover areas of 1.8 km^2 and 1.6 km^2, respectively, contributing significantly to the country's cultural and economic development (Sherab et al., 2019). A total of 168 lakes feed into the Pachhu and Hachhu rivers, which flow into the Wangchu river basin and generate electricity at the Chhukha Hydropower Station. According to a state report, the Chhukha hydropower station generates an annual income of approximately Nu. 4 billion.

The protection of these water towers is crucial for the sustainable energy production from both existing and proposed hydropower plants, as hydropower is a key contributor to Bhutan's economy. It is estimated that 104 bird species rely on freshwater ecosystems in Bhutan, along with numerous other aquatic plant and animal species (Sherub, 2004).

2.3.8. Agriculture Ecosystem

The total landholding in Paro Dzongkhag is around 6,340 ha, with major crops including irrigated paddy, upland paddy, maize, wheat, buckwheat, barley and millet. Agriculture, followed by livestock is the primary livelihood for farmers in Paro. In Haa, farmers have a total of 6,403.08 ha of land, cultivating mainly wheat and buckwheat, followed by maize and paddy (Agriculture Statistics 2022, NSB). As per land use land cover data of Bhutan, 2016 reveals that agricultural land constitutes merely 4.10% of the total area, with the distribution primarily comprising agriculture wetland (18.78%), agriculture dryland (40.74%), and orchard regions (7.42%)

2.3.9. Ecosystem Services

The Division includes a Payment for Environmental Services (PES) initiative as a key component of its Ecosystem Services program. Currently, one PES is established at Rinchen-Lum in Shari Gewog, Paro. Approximately, a total of 1180.86 ha area is being managed as watershed under Shari Gewog.

2.3.10. Conservation and Management Initiatives

As a key part of our conservation and management efforts, the Division conducts surveys for Royal Bengal tiger, Snow leopard and Red Panda. The Division also implements LFMP, CF, FMU and BC management plans, alongside SMART patrolling techniques.

2.4. Existing Management Regimes

The DFO, Paro employs a multifaceted approach to forest management, which is categorized into area-based and cross-cutting management regimes. Area-based management regimes encompass the management of BC 1, FMUs, LFMAs and CFs. These areas are strategically managed to optimize timber production, enhance biodiversity conservation and support community livelihoods. Cross-cutting management regimes include Scientific Thinning Operations, High Conservation Value area, Watershed Management, Pest and Disease Control measures and NWFP Management. These initiatives complement the area-based management and address broader forest and ecosystem challenges.

A. Area Based Management Regimes

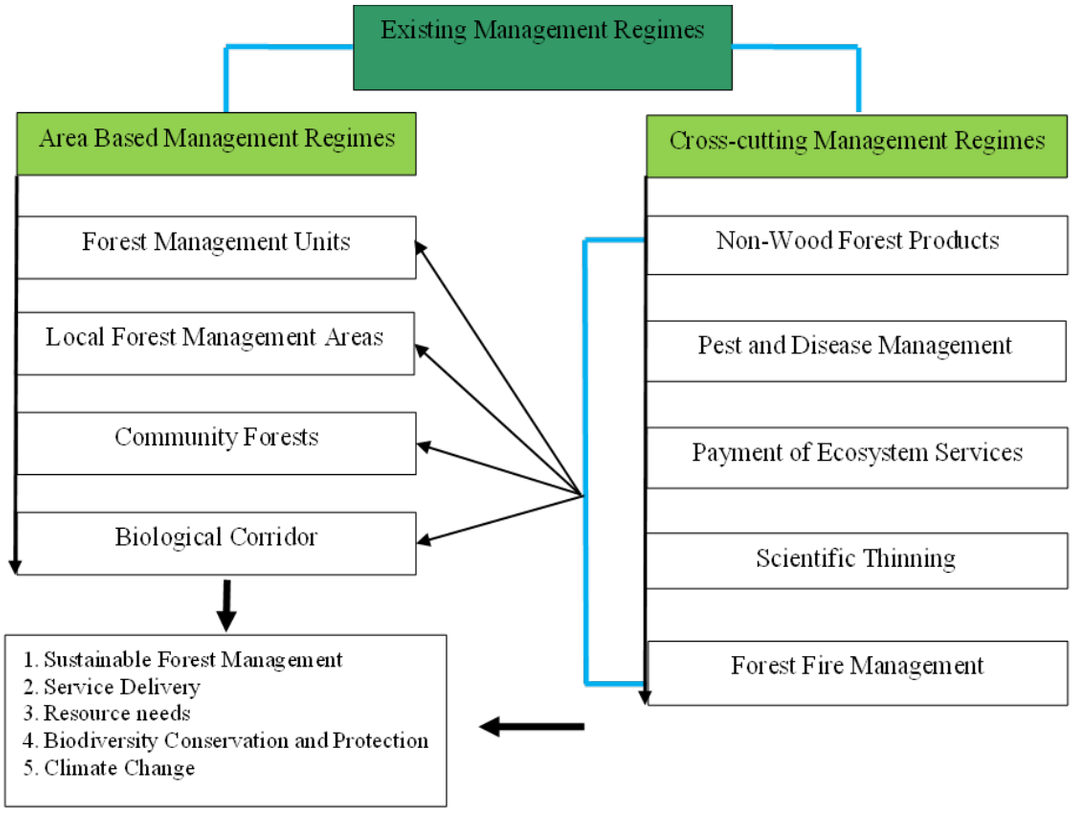


Figure 11: Conceptual framework for the management regimes

1. **Forest Management Unit (FMU):** A Forest Management Unit (FMU) is a designated area of forest land that is managed under a specific management plan. The primary role of a FMU is to ensure the sustainable management of forest resources, balancing the needs of timber production, biodiversity conservation and ecosystem services. However, managing FMU faces challenges such as insufficient funding and the complex task of balancing local community needs, commercial interests and conservation efforts. Currently, the five FMUs produce approximately 32,551m^3 of timber annually, with 8,400m^3 allocated for rural use and 24,151m^3 for commercial purposes.

2. **Local Forest Management Area (LFMA):** A Local Forest Management Area (LFMA) is a designated area outside of PA, CF and FMU. It is managed under a specific local forest management plan. By effectively managing LFMA, the DFO can balance the needs of local communities with the long-term sustainability of their forest resources. They encounter challenges similar to those of FMUs, including resource allocation. The eight LFMAs in Paro and Haa districts collectively produce over 7,425m^3 of timber annually.
3. **Community Forest (CF):** There are 47 Community Forest Management Groups (CFMGs) under the Division, managing a total of 6708.78 ha of forest land, comprising 16 CFs in Haa, 29 in Paro and 2 in Chhukha Dzongkhag. These CFs empower local communities by supporting their resource needs while contributing to biodiversity conservation and the provision of ecosystem services. Despite their role in sustainable forest management, balancing community needs with conservation goals remains a persistent challenge. At present, all 47 CFs contribute to local resource management, protection, conservation and the enhancement of ecosystem service.
4. **Biological Corridor (BC):** Biological corridors are critical habitat linkages that enable wildlife movement for foraging, mating, and migration, helping maintain genetic diversity and ecosystem health. Biological Corridor 1, covering 255.55 km^2, connects Jigme Khesar Strict Nature Reserve (JKSNR) and Jigme Dorji National Park (JDNP) spanning Tsento Gewog in Paro and Bji Gewog in Haa.

Table 7: Area-based Management Regime; Forest Management Units

FMU	Dzong-khag	Gewog	Year of estab-lishment	Total Area (ha)	Forest-ed Area (ha)	Annual Allowable cut (AAC-m^3)			Plan period	Plan cycle
						Rural	Commercial	Total		
Zonglela	Paro	Lungnyi, Wangchang, Lamgong, Shaba, Dogar	1992	16155.8	9450.41	3000	6366	9366	2022-2031	4
Haa-East	Haa	Samar, Eusu, Naja	1994	6580.99	5314.75	500	0	500	2016-2026	3
Selela	Haa	Naja, Samar, Dungna	1998	9157	8192.99	2700	8885	11585	2021-2030	3
Bitekha	Paro	Naja, Dogar	2006	7260.1	5680.58	900	3600	4500	2016-2026	2
Lonchu	Haa	Samar	2010	1264.49	8603.35	1000	5300	6300	2020-2029	2

Table 8: Area-based Management Regime; Local Forest Management Areas

LFMA	Dzongkhag	Gewog	Year of establishment	Total Gewog area (ha)	Total LFMA area (ha)	Forested Area (ha)	AAC (m^3)	Plan period	Plan cycle
Dogar	Paro	Dogar	2014	10603	1203.38	839.84	591	2014-2024	2
Eusu	Haa	Eusu	2014	6645	2161.98	1290.4	383	2014-2024	2
Samar	Haa	Samar	2014	20094	1013.87	685.77	343	2014-2024	2
Bji	Haa	Bji	2014	26200	3493.23	2275.86	723	2014-2024	2
Katsho	Haa	Katsho	2014	4064	2658.21	1664.29	837	2014-2024	2
Tsento	Paro	Tsento	2018	38729	3843.09	2633.56	843	2018-2028	1
Lamgong	Paro	Lamgong	2018	4899	3064.10	1415.25	1073	2018-2028	1
Dotey	Paro	Dotey	2019	13082	3149.74	2233.94	973	2019-2028	1

Table 9: Area-based Management Regime; Community Forests

SL No	Community Forest	Year of establishment	Gewog	Members			Total area	Forested Area (ha)	AHL (m^3)	Plan period	Plan cycle
				Male	Female	Total					
1	Gyensa	2008	Bji	8	6	14	38.81	37.83	218.03	10	2
2	Tashi Gaphel Chethuen	2012	Bji			30	35.89	32.33	35.6	10	1
3	Yangthang	2008	Bji	25	29	54	164.19	131.16	100.59	10	2
4	Chikarwa	2017	Dogar	19	18	37	119.44	89.55	307.16	10	1
5	Dralha Yargay	2008	Dogar	23	18	41	41	13.64	nil	10	1
6	Druk-Thuenpa Puenzhi	2007	Dogar	25	34	59	162.58	77.05	388.43	10	2
7	Juka Jelaling	2008	Dopshari	15	23	41	82.65	74.14	158.43	10	2
8	Zatshen	2018	Dopshari	8	20	28	174.99	128.52	9.15	10	1
9	Chubar Kuenphen	2024	Doteng	17	21	38	170.34	151.45	266.07	10	1
10	Druk Pegon	2008	Doteng	23	25	48	188.71	141.63	1309	10	2
11	Peljum Kuenphen	2009	Doteng	25	35	60	200.59	178.73	475.31	10	2
12	Babana Chigthuen	2000	Dungna	6	13	19	1.25	0.82	178.54	10	3
13	Batsho Yarphel	2009	Eusu	7	3	10	30.69	27.41	782.35	10	2
14	Dumcho	2012	Eusu	27	15	42	118.78	89.81	185.34	10	2
15	Phurb	2009	Eusu	18	7	25	86.01	49.09	782.92	10	2
16	Tak Drong Kip Phuensum	2009	Eusu	14	20	34	102.13	56.77	678.77	10	2
17	Tashi Tsherim	2011	Eusu	4	16	20	69.81	69.28	557.79	10	2
18	Tshaphel	2003	Eusu	16	25	41	138.05	60.04	58.21	10	1
19	Tshelungkha	2016	Eusu	8	4	12	46.45	34.27	74.8	10	1
20	Chubjakha	2007	Hungrel	29	50	79	212.57	112.4	224.26	10	2
21	Ugyen Dralo	2008	Hungrel	34	24	54	50.83	31.71	21.48	10	2
22	Drana Tashi Dingkha	2019	Katsho	32	18	50	142.07	96.25	209.43	10	1
23	Kyentshen	2012	Katsho	14	21	35	232.99	215.76	138.54	10	2
24	Dagophu	2007	Lamgong	22	11	33	140.33	99.52	266.93	10	2
25	Ngoba Phuensum	2007	Lamgong	65	75	140	349.25	276.3	530.07	10	2
26	Bjagay Menchu	2009	Lungnyi	61	51	112	425.52	238.71	893.62	10	2
27	Jari Puensum	2008	Lungnyi	57	48	105	331.3	263.75	1046.65	10	2
28	Nemjo	2007	Lungnyi	29	71	100	245.51	232.05	525.23	10	2
29	Papaling	2013	Metedkha	8	4	12	28.28	8.79	40.89	10	2
30	Drakartsen	2016	Naja	43	29	72	347.59	268.27	523.15	10	1
31	Jagoen Dungkhar Aikhel	2008	Naja	22	25	47	108.43	64.84	1126.66	10	1
32	Jaba Lingzhi	2007	Naja	23	19	52	173.78	160.23	280.26	10	2
33	Nagu	2009	Naja	13	5	18	36.59	17.69	425.64	10	1
34	Tokha Zhisarp	2017	Naja	12	10	22	66.43	56.8	47.66	10	1
35	Chuzokha	2019	Samar	6	8	14	32.32	31.65	302.71	10	1

36	Dorib Yarkhel Phuensum	2011	Samar	29	16	45	106.29	91.81	105.57	10	1
37	Druk Balamna	2011	Samar	20	11	31	169.91	146.94	143	10	2
38	Shari	2008	Samar	30	33	63	168.95	153.72	302.71	10	1
39	Druk Ding	2008	Shaba	6	23	29	157.64	145.35	387.03	10	1
40	Jamling	2008	Shaba	12	16	28	84.99	55.35	nil	10	1
41	Tsento Shari	2006	Tsento	11	9	20	136.72	102.52	505.97	10	2
42	Zamsa	2021	Tsento	20	32	52	262.52	203.12		10	1
43	Lemdo	2017	Tsento	12	6	18	102.03	95	655.3	10	1
44	Namay Nichu	2008	Tsento	11	18	29	160.04	112.94	658.86	10	2
45	Namji	2009	Tsento	24	19	43	113.81	68.84	171	10	2
46	Druk Tshenden	2008	Wangc-hang	70	31	101	298.78	188.86	553.97	10	2
47	Khanku Pendeling	2007	Wangc-hang	16	39	55	156.71	84.46	35.26	10	2

Table 10: Area-based Management Regimes; Biological Corridor 1

Name	Dzongkhag	Gewog	Year of establishment	Total Area (km^2)	Forested Area (km^2)	Plan period	Plan cycle
Biological Corridor 1 (BC 1)	Paro and Haa	Tsento Gewog under Paro and Bji Gewog under Haa	1999	255.55	112.82	2023-2032	2

B. Cross Cutting Management Regimes

Cross-cutting regimes in forest management are those that transcend traditional boundaries of specific forest management units or areas. They address broader issues that affect multiple aspects of forest ecosystems. Some common cross-cutting management regimes prevalent in the DFO, Paro are;

1. **Payment for Ecosystem Services:** This program incentivizes forest conservation and sustainable practices. Currently, a PES scheme has been instituted at Rinchen-Lum, located within Shari Gewog, Paro. The initiative encompasses the management of approximately 1,180.86 hectares of designated watershed area under the jurisdiction of Shari Gewog.
2. **Non-Wood Forest Product Groups:** These groups manage and utilize non-timber forest products, such as medicinal plants and mushrooms that supplements their income through alternative livelihood. There are two NWFP Management Groups (NWFPMG) under Doteng Gewog, Paro Dzongkhag. The Luchu Sangay Shamong Tshogpa, formulated in 2019 with 19 households, is responsible for the sustainable management of Tricholoma matsutake. Meanwhile, the Drakey Chinto Ngomen Tshogpa, formed in 2019 with 22 households, is tasked with managing incense-producing plant species, including *Nardostachys jatamansi* (Pangpoe), *Neopicrorhiza scrophulariiflora, Rhododendron anthopogon, Rhododendron setosum, Juniperus spp*., and *Aconitum spp*.
3. **Pest and Disease Management:** The DFO in Paro recognizes the critical importance of proactive and systematic pest and disease management in safeguarding forest health and sustaining ecosystem services. Given the increasing pressures from climate change and anthropogenic disturbances, the Office has adopted an integrated approach to monitor, prevent, and control forest pests and diseases across its jurisdiction aligning with the monitoring and evaluation framework developed by the Department.
4. **Scientific Thinning Operation:** Scientific thinning is a forestry practice that involves the selective removal of trees from a forest stand to enhance the growth and health of the remaining trees. This practice is considered essential at this time, as it helps improve the overall health and productivity of the forest ecosystem. The DFO, Paro in collaboration with the Department, is undertaking a nation-wide scientific thinning program over the coming years. The goal is to strike a balance between meeting human needs for timber and preserving forest ecosystems.

The primary objective of this scientific thinning is to improve forest health, enhance timber quality, and maintain ecosystem balance. Managing large-scale operations and minimizing environmental impacts are significant challenges. In Paro and Haa districts, 3490.74 hectares of forest are identified for thinning, with an expected production of 1,399,166cft timber in log volume, comprising mixed hardwood and conifer species, over a three-year period (2024-2026).

Table 11: Cross-cutting Management Regimes

Cross cutting management regimes/ Interventions	Name of the area-based management regimes/ Location	Dzongkhag	Gewog	Year of operationalization of the cross-cutting regime	Total area under management intervention (ha)	Area covered by management intervention (ha)	Key management intervention	Plan period
Payment of ecosystem services	Rinchenlum Watershed	Paro	Dopshari	2023	1176	1176	Technical backstopping. Creating awareness. Annual monitoring	5 years
Scientific Thinning Area	Paro - 10 Gewogs Haa - 4 Gewogs Chhukha - 1 Gewog	Paro, Haa and Chhukha	-	2023	3490.74	16879	-	3 years
Drakey Chinto Ngomen Tshogpa	Doteng	Paro	Doteng	2011	14568.7	Nil	Technical backstopping. Creating awareness. Annual monitoring	10 years
Luchu Shamong Tshogpa	Doteng	Paro	Doteng	2014	334.068	Nil	Technical backstopping. Creating awareness. Annual monitoring	10 Years
Pest and disease Management	Zonglela, Haa-East, Lonchu, Selela and Bitekha FMU including CFs	Paro and Haa	All FMUs and CFs	2015 till date	134.49 (CFs) 111.787 (FMUs)	51818	Allotment of infested area to NRDCL for clear felling. Monitoring and afforestation	Nil

2.5. Forest Resources and Utilization

2.5.1. Forest Resources

The following section discusses the various forest parameters under the DFO Paro including the stem count, stem density, volume, biomass and carbon. Since the DFO covers four Dzongkhags of Haa, Paro, Thimphu and Chhukha, the total estimates are calculated using the forest area under the different forest types in the DFO and the per ha estimates of the parameters for the different forest types as reported in the NFI report (FMID, 2023).

2.5.1.1. Forest Cover

According to A.J.C Grierson and D.G. Long, there are 11 types of major vegetation zones or forest in Bhutan (DoFPS, 2022) and forests are broadly categorized into two broad classes viz., Broadleaved Forest and Coniferous Forest and 10 major Forest types; Subtropical Forest (STFr), Warm Broadleaved Forest (WBFr), Chir Pine Forest (CPFr), Cool Broadleaved Forest (CBFr), Evergreen Oak Forest (EOFr), Blue Pine Forest (BPFr), Spruce Forest (SPFr), Hemlock Forest (HMFr), Fir Forest (FIFr) and Juniper Rhododendron Forest (JRFr) (FMID, 2023).

Out of the 11 forest types found in Bhutan, seven (Table 12) are present within the jurisdiction of DFO, Paro: Fir Forest, Blue Pine Forest, Hemlock Forest, Spruce Forest, Juniper Rhododendron Forest, Evergreen Oak Forest, and Cool Broadleaved Forest. However, according to the forest definition outlined in the NFI Report, Dry Alpine Scrub is classified as shrub rather than forest (FMID, 2023). Consequently, the overall forest cover of DFO, Paro is 59.01%.

Table 12: Statistics of Forest cover derived from the forest type map of Bhutan, 2022

Forest type	Area (ha)	Forest Cover %	Forest Cover % of the total area
Evergreen Oak Forest	4597.58	4.78	2.82
Cool Broadleaved Forest	2889.26	3.00	1.77
Blue Pine Forest	21853.91	22.71	13.40
Spruce Forest	7396.61	7.69	4.54
Hemlock Forest	13845.37	14.39	8.49
Fir Forest	39872.32	41.43	24.45
Juniper Rhododendron Forest	5781.59	6.01	3.55

2.5.1.2. Stem Density

Stem density indicates the number of stems or plants within a specific unit area and reflects various forest stand attributes. The number of trees per unit area provides insight into the spacing of individual trees within a given space. The section focused on the tree count per hectare for each forest type within the jurisdiction of DFO, Paro. This data is crucial for evaluating the effectiveness of forest management practices and guiding interventions to enhance stand growth.

Tree count data by forest type, derived from Bhutan's National Forest Inventory (NFI) Volume I: State of Forest Report, reveals variations in tree density across forest types within the four Dzongkhags under the jurisdiction of DFO, Paro. The highest densities recorded in Blue Pine Forests (426 trees/ha) and Evergreen Oak and Cool Broadleaved Forests (417 trees/ha). Fir Forests account for the largest share of the total tree count (41.52%), estimated at over 16 million trees across 39,872.32 hectares. This is followed by Blue Pine Forests, which contribute 24.12% of the total tree count over 21,853.91 hectares. In contrast, Cool Broadleaved Forests have the lowest share (3.12%) with approximately 1.2 million trees at a density of 417 trees per hectare across 2,889.26 hectares (Table 13).

Table 13: Stem density for different forest type derived from the NFI Report, Vol. 1

Forest type	Forest area (ha)	Tree count/ha	Total tree count
Evergreen Oak Forests	4597.58	417	1917190.86
Cool Broadleaved Forest	2889.26	417	1204821.42
Blue Pine Forest	21853.91	426	9309765.66
Spruce Forest	7396.61	401	2966040.61
Hemlock Forest	13845.37	406	5621220.22
Fir Forest	39872.32	402	16028672.64
Juniper Rhododendron Forest	5781.59	269	1555247.71

2.5.1.3. Basal Area

Basal area (BA) represents the cross-sectional area of a tree and is used to calculate the stand basal area and the total basal area at a broader scale. The stand basal area provides insights into the number and size of trees within a given stand. Additionally, measurements of basal area and tree diameter are essential for evaluating the growth of individual trees (FMID, 2023).

With an average basal area per hectare of 35.34, the largest (49.48%) basal area accounts for Fir Forests with around 1.77 million m^2 across 39872.32 hectares of forest area followed by Hemlock Forest (0.64 million m^2) across 13845.37 hectares of forest areas. The lowest (2.47%) basal area accounts for Juniper Rhododendron Forest (0.088 million m^2) followed by Cool Broadleaved Forest (1.24 million m^2) across 5781.59 and 2889.26 hectares of forest areas respectively.

Table 14: Basal Area (BA in m^2) of different forest type derived from NFI Report 2023

Forest type	Forest area (ha)	BA(m^2)/ha	Total BA (m^2)
Evergreen Oak Forests	4597.58	38.07	175029.8706
Cool Broadleaved Forest	2889.26	42.89	123920.3614

Blue Pine Forest	21853.91	23.14	505699.4774
Spruce Forest	7396.61	36.95	273304.7395
Hemlock Forest	13845.37	46.51	643948.1587
Fir Forest	39872.32	44.47	1773122.07
Juniper Rhododendron Forest	5781.59	15.34	88689.5906

2.5.1.4. Growing Stock

Growing stock refers to the total standing volume of all living trees within a specified forest area. This metric is a crucial component of forest inventories, providing essential data for informed policy-making and effective management planning. Consequently, evaluating and monitoring the growing stock is vital for ensuring the sustainable management of forests (FMID, 2023).

Taking the average growing stock of the different forest types under the DFO, the growing stock is estimated at approximately 32.7 million m^3. Among seven forest types, Fir Forest accounts for 15.9 million m^3 across 39872.32 hectares of forest area with estimated volume per hectare of 398.82m^3 followed by Hemlock Forest with a growing stock of 6.12 million m^3 across 13845.37 hectares of forest areas. The lowest growing stock accounts for Juniper Rhododendron Forest (0.58 million m^3) across 5781.59 hectares of forest area followed by Cool Broadleaved Forest with 1.09 million m^3 across 2889.26 hectares of forest area.

Table 15:Growing stock per hectare by different forest type

Forest type	Forest area (ha)	Volume (m^3)/ha	Total growing stock (m^3)
Evergreen Oak Forest	4597.58	341.01	1567821.07
Cool Broadleaved Forest	2889.26	379.15	1095464.61
Blue Pine Forest	21853.91	209.17	4571182.6
Spruce Forest	7396.61	384.84	2846510.48
Hemlock Forest	13845.37	442.7	6129345.17
Fir Forest	39872.32	398.82	15901877.4
Juniper Rhododendron Forest	5781.59	101.04	584172.14

2.5.1.5. Forest Biomass

Watson (2009) defines Forest biomass as "organic matter resulting from primary production through photosynthesis minus consumption through respiration and harvest". Forest biomass includes all components of the plant, such as branches, leaves, bark, trunk, needles, roots, and more, which can be transformed into energy (FMID, 2023). The estimation of biomass is based on the 2023 National Forest Inventory (NFI) report, Volume II. This report provides biomass estimates for four carbon pools: (i) Above Ground Biomass (AGB), (ii) Below Ground Biomass (BGB), (iii) Coarse Woody Debris (CWD) and (iv) Litter.

Considering the biomass density in the different pools by forest types, the total biomass is estimated to be around 28.40 million tonnes, comprising 20.23 million tonnes of AGB, 5.31 million tonnes of BGB, 0.93 million tonnes of CWD and 1.93 million tonnes of litter. Fir Forest has the largest biomass, estimated at around 13.6 million tonnes, followed by Hemlock Forest with 5.02 million tonnes. In comparison, Juniper Rhododendron Forest has the smallest biomass, amounting to 0.63 million tonnes.

Table 16: Total Biomass stock per hectare

Pool	AGB	BGB	CWD	Litter	Total
Total Biomass (million tonnes)	20.23	5.31	0.93	1.93	28.40

Table 17: Total Biomass stock by forest type

Forest type	Forest area (ha)	AGB	BGB	CWD	Litter	Total
Evergreen Oak Forests	4597.58	1.16	0.30	0.01	0.06	1.52
Cool Broadleaved Forest	2889.26	0.76	0.20	0.02	0.05	1.03
Blue Pine Forest	21853.91	2.71	0.74	0.15	0.64	4.23
Spruce Forest	7396.61	1.82	0.47	0.05	0.03	2.36
Hemlock Forest	13845.37	3.61	0.94	0.24	0.24	5.02
Fir Forest	39872.32	9.74	2.54	0.45	0.87	13.60
Juniper Rhododendron Forest	5781.59	0.45	0.13	0.01	0.05	0.63

2.5.1.6. Carbon Stock

The section provides an overview of carbon stock across various forest types in the DFO, Paro. The carbon stock shows considerable variation among these forest types, ranging from 0.72 million tonnes in the Cool Broadleaved Forest to 10.20 million tonnes in the Fir Forest. The total carbon stock within the DFO, Paro is estimated at 21.30 million tonnes, with the Fir Forest contributing the highest share, followed by the Hemlock Forest at approximately 3.64 million tonnes. In contrast, the Cool Broadleaved Forest has the lowest carbon stock, followed by the Juniper Rhododendron Forest at 0.83 million tonnes.

Table 18: Carbon stock for Dzongkhags within the DFO, Paro

Pools	AGB	BGB	CWD	Litter	SOC	Total
Total carbon (million tonnes)	9.51	2.49	0.44	0.91	7.95	21.30

Table 19: Carbon stock by forest type

Forest type	Forest area (ha)	AGB	BGB	CWD	Litter	SOC
Evergreen Oak Forests	4597.58	0.54	0.14	0.01	0.03	0.38
Cool Broadleaved Forest	2889.26	0.36	0.09	0.01	0.02	0.24

Blue Pine Forest	21853.91	1.27	0.35	0.07	0.30	1.03
Spruce Forest	7396.61	0.85	0.22	0.02	0.02	0.67
Hemlock Forest	13845.37	1.70	0.44	0.11	0.11	1.28
Fir Forest	39872.32	4.58	1.19	0.21	0.41	3.80
Juniper Rhododendron Forest	5781.59	0.21	0.06	0.00	0.02	0.54

2.5.1.7. Biomass and Carbon Increment

Biomass and carbon increment estimations in this study are restricted to the above-ground carbon pool of trees, with no assessment of other carbon pools. The data reveal a substantial annual increase in biomass and carbon across various forest types. The total annual biomass increment is approximately 233215.81 tonnes, with a corresponding carbon increment of about 109668.30 tonnes. Among the forest types, Fir Forest contributes the highest share of biomass increment (37.44%), while Juniper Rhododendron Forest accounts for the lowest (1.44%). Likewise, the Fir Forest contributes the largest share of carbon increment at 37.45%, whereas the Rhododendron Forest accounts for the smallest share at 1.42%.

Table 20: Biomass increment per hectare per year by forest type

Forest type	Forest area (ha)	Biomass Increment (tonnes $ha^{-1}yr^{-1}$)	Total increment
Evergreen Oak Forests	4597.58	0.77	3540.14
Cool Broadleaved Forest	2889.26	2.13	6154.12
Blue Pine Forest	21853.91	3.45	75395.99
Spruce Forest	7396.61	3.20	23669.15
Hemlock Forest	13845.37	2.44	33782.70
Fir Forest	39872.32	2.19	87320.38
Juniper Rhododendron Forest	5781.59	0.58	3353.32

Table 21: Carbon increment per hectare per year

Forest type	Forest area (ha)	Carbon Increment (tonnes $ha^{-1}yr^{-1}$)	Total increment
Evergreen Oak Forests	4597.58	0.36	1655.1288
Cool Broadleaved Forest	2889.26	1	2889.26
Blue Pine Forest	21853.91	1.62	35403.3342
Spruce Forest	7396.61	1.51	11168.8811
Hemlock Forest	13845.37	1.15	15922.1755
Fir Forest	39872.32	1.03	41068.4896
Juniper Rhododendron Forest	5781.59	0.27	1561.0293

2.5.1.8. Carbon Sequestration

Carbon sequestration is the process of capturing atmospheric carbon dioxide and storing it as biomass or carbon in plants, soils, geological formations and oceans (FMID, 2023). DFO, Paro falls partially under four Dzongkhags; Chhukha, Haa, Paro and Thimphu Dzongkhag with annual sequestration of 589,573.42, 340,057.01, 419,152.62 and 361,567.46 tonnes CO_2. Therefore, the annual carbon sequestration for Paro DFO is estimated using the biomass growth of the different pools by forest type as discussed in Table 20. Table 22 shows the annual carbon sequestration of forest under Paro DFO (401,908.58 tonnes CO_2 per year).

Table 22: Carbon sequestration per hectare per year

Area	Biomass Growth (tonnes)	Carbon Fraction	CO_2 fraction/ equivalent	Total Carbon Sequestration (tonnes CO_2)
Paro DFO	233215.81	0.47	3.67	401908.58

2.5.1.9. Non-Wood Forest Product (Potential Forest resources)

The demand for NWFPs remains consistently high, driven by both domestic consumption and commercial needs. NWFPs are widely utilized in producing incense, supporting agricultural activities, traditional preparation methods (*Chadree*), manufacturing medicinal products, promoting plantation initiatives, and facilitating various developmental projects. Over the past five years, the DFO in Paro has allocated a range of NWFPs, including soil, organic products, medicinal plants, forest wildlings, ornamental plants, sand, stones, and boulders.

Over 26487m^3 of soil, incense materials, organic products, sand, stones and boulders have been allotted. In addition, around 91289 kg, 110 bundles and 3999 headloads of raw medicinal plant materials have been allotted for pharmaceutical and domestic use, alongside over 4982 numbers of forest wildlings and ornamental plants including 56 Nos. of cordyceps.

However, starting January 2024, sand, stone and boulders were handed over to the Department of Geology and Mines.

2.5.1.10. Key flora and fauna

Spanning area of 1630.48km^2 covering wide range of area with four Dzongkhags viz., Chhukha, Haa, Paro and Thimphu and elevation ranging from around 1900m in the south to 5600m in the north, DFO in Paro harbor globally threatened flora and fauna species.

i. Mammals

A total of 30 mammal species, spanning 28 genera and 12 families (e.g., *Felidae, Bovidae, Canidae,* and *Cervidae*), were recorded in the Division. According to the IUCN Red List, these include five Endangered, eight Vulnerable, five Near Threatened, and 12 Least Concern species. Newly documented species for the Division include Woolly hare (*Lepus oiostolus*), recorded during the 2022 NTS and NSLS surveys, as well as Tibetan wolf (*Canis lupus filchneri*) and Thorold's deer (*Cervus albitrostris*), both observed in the Nubri area during the NSLS 2022.

ii. Avifauna

The Division hosts 235 bird species belonging to 145 genera and 58 families, with *Muscicapidae* contributing the highest species count, followed by *Fringillidae* and *Anatidae*. Out of 235 bird species recorded in the Division, one is classified as Vulnerable (Wood Snipe), nine are Near-threatened and 225 are of Least Concern according to the IUCN Red List of Threatened Species.

iii. Herpetofauna

Comprehensive records of herpeto-fauna within the DFO in Paro, are unavailable. However, available data have been compiled from journal articles, published books, and other media sources. A total of nine species has been recorded from the Paro and Haa areas under the DFO's jurisdiction, comprising six snake species, two toad species, and one lizard species.

2.5.2. Function Mapping

The purpose of forest function mapping is to identify and categorize forest areas based on their unique roles in ecological, social and economic systems, ensuring sustainable management practices. This involves mapping both areas already under established area-based management regimes, such as Forest Management Unit, Local Forest Management Areas, Biological Corridor, and Community Forest, and those under cross-cutting management regimes such as environmental service areas, NWFP management areas, pest and diseases management, scientific thinning and High Conservation Value area.

Forest function mapping extends to areas outside existing management regimes, identifying the different functions such as production, non-production and protection. These areas may include potential timber production, agricultural lands, water sources, important wildlife habitats, and landslide-prone areas including the built-up areas and private registered land. Through this comprehensive classification, forest function mapping aids in effective conservation, resource management, and the enhancement of ecosystem services, while also addressing community needs and achieving the goals and missions of the Division.

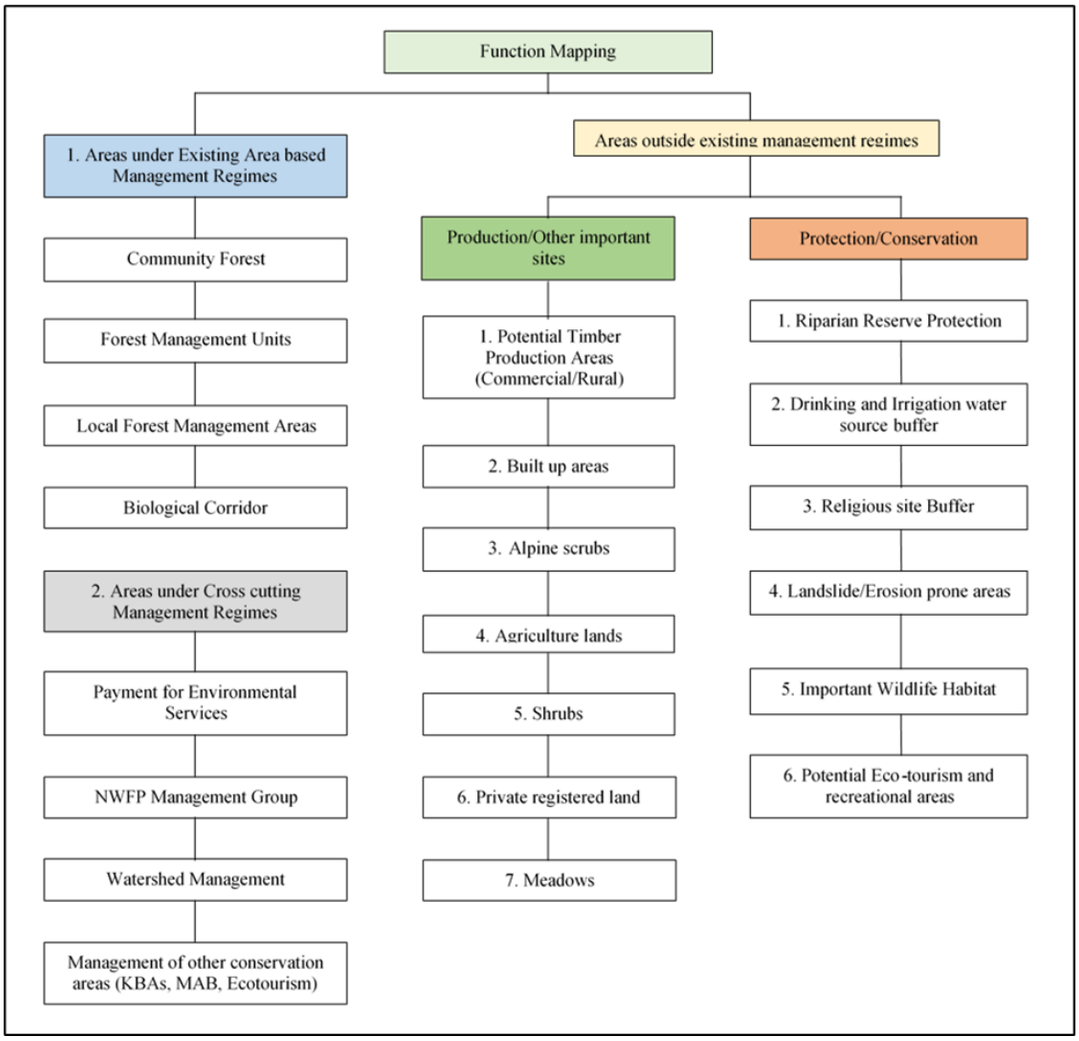


Figure 12: Thematic representation of forest function mapping

2.5.2.1. Areas under Existing Area-Based Management Regimes

For function mapping purposes, the Forest Type Map of Bhutan 2021 was utilized in place of the 2016 Land Use Land Cover data. Forest functions have been categorized into three management circles: Production, Non-Production, and Protection Management Circles. The Production Management Circle includes all forest types in the region, excluding alpine scrub forests. The Non-Production Management Circle comprises areas excluded from the Production Management Circle, such as alpine scrub forests, non-forest areas, private registered land and thromdey areas of Haa and Paro. For the Protection Management Circle, all relevant criteria outlined in the Forest and Nature Conservation Act and associated rules were applied. This circle includes areas with critical soil protection functions, such as slopes exceeding 45 degrees, buffer zones around major rivers and perennial streams, water sources and religious sites (e.g., lhakhangs and dzongs) with a 500-meter buffer.

The Production Management Circle covers 87615.76 ha, the Non-Production Management Circle accounts for 57,633.81 ha and the Protection Management Circle encompasses 17,834.41 ha.

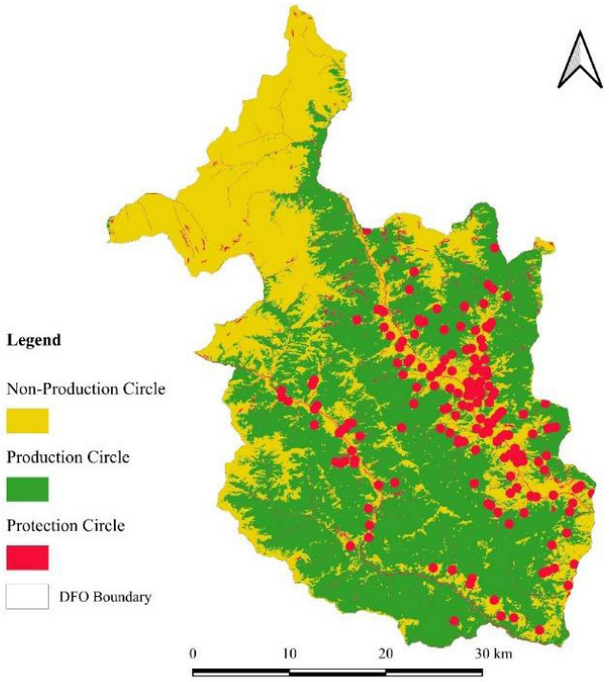


Figure 13: Overall management circle; Production, Non-Production and Protection

The DFO, Paro oversees four major area-based management regimes: Community Forests (6712.52ha), Forest Management Units (48667.52 ha), Local Forest Management Area (21820.25 ha) and Biological Corridor (25551.31 ha) and collectively covering a total area of 102751.6 ha. These regimes currently manage over 63% of the Division's total area.

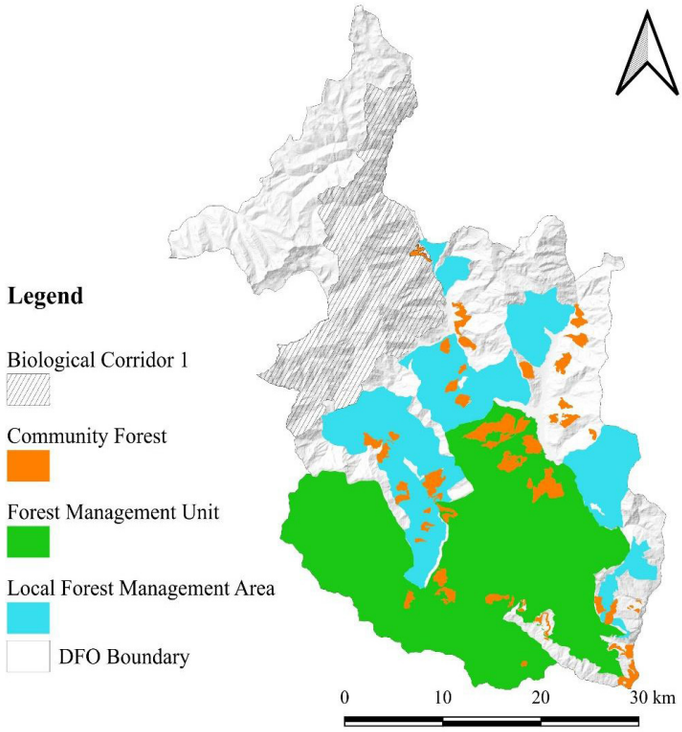


Figure 14: Major Area-based Management Regimes

While the Division manages various regimes, there remain areas within its jurisdiction that are not currently under major area-based management regime accounting to 60334.55 ha. These are categorized as management circles outside the existing management regimes (OEMR). Notably, areas designated as future management areas, particularly within the Local Forest Management Area, are included in this category. The Non-Production Management Circle outside EMR accounts for 32401.14 ha, the Production Management Circle encompasses 20825.79 ha and the Protection Management Circle covers 7107.62 ha.

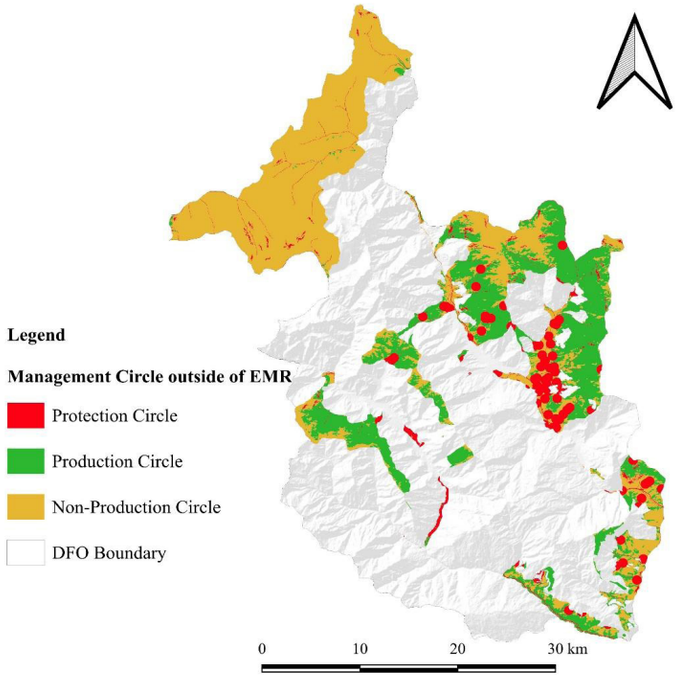


Figure 15: Management Circle outside of the existing area-based management regimes

The AAC was calculated for 70% of area identified as potential production areas outside of the existing Area-based Management Regime using formula:

$$AAC(m^3) = \frac{Net\ Operable\ Area}{Rotation\ Age} \times \left(\frac{Average\ Volume}{ha}\right)$$

Where:

- Rotation age: 130 years (Rotation age: 120 years + 10 years-Regeneration period)
- Average volume/ha is considered as 322.39m^3/ha for DFO, Paro.

The total Annual Allowable Cut (AAC) that can potentially be extracted from the production area of 14578.05ha is 36,152.44m^3 for both commercial and rural use.

There are cross-cutting management regimes within and outside of the EMR such as NWFP Management Areas, Payment for Environmental Services (Watershed), Pest and diseases Management Areas, Scientific thinning and High Value Conservation Area. The HCV Area spans 7217.45 ha, while the NWFP Management Area covers 7,480.67 ha, comprising the Drakey Chinto NWFP Area (7,125.66 ha) and the Luchi Shamong NWFP Area (355.01 ha). Similarly, the PES Area in the Rinchenlum Watershed extends over 1,180.86 ha, and the Pest and Diseases Management Area cover approximately 215.53 ha. The scientific thinning area covers 3490.74 ha.

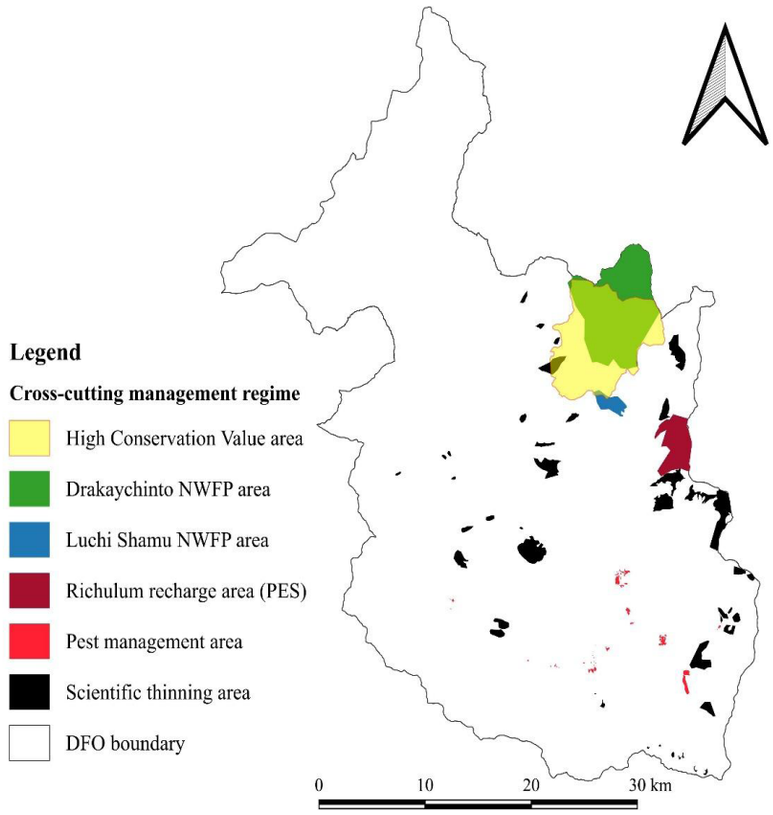


Figure 16: Cross-cutting management regimes

2.5.3. Forest Resources Utilization

2.5.3.1. Volume of commercial timber allotted

Between the financial year 2020-2021 and 2024-2025, a total of 63401.02m^3 of commercial timber (Table 23) were allocated to support economic growth, community needs and infrastructure development. This strategic distribution facilitated diverse projects across sectors, promoting sustainability and resource stewardship while contributing to economic and social progress.

2.5.3.2. Volume of rural timber allotted

The Rural House Building Timber (RHBT) program aims to support rural residents by providing timber for various construction and domestic purposes at subsidized royalty rates. Between the financial year 2020-2021 and 2024-2025, substantial quantities of rural timber amounting to 54927.33m^3 (Table 24) were allocated to facilitate housing, infrastructure and daily needs in rural areas.

2.5.3.3. Allotment of NWFP

The demand for NWFPs remains high, driven by both domestic consumption and commercial purposes. Key applications of NWFPs include the production of incense, agricultural activities, traditional preparation (Chadree), medicinal products, plantation efforts, and other developmental initiatives. Over the past five years, the DFO, Paro has allocated various categories of NWFPs, including soil, organic products, medicinal plants, forest wildlings, ornamental plants, sand, stones, and boulders.

Over 26487m^3 of soil, incense materials, organic products, sand, stones and boulders have been allotted. In addition, around 91289kg, 110bundles and 3999 headloads of raw medicinal plant materials have been allotted for pharmaceutical and domestic use, alongside over 4982 numbers of forest wildlings and ornamental plants including 56Nos. of Cordyceps (Table 25).

2.5.3.4. Forestry Clearance issued in SRF land for developmental activities

FC has been issued for use of State Reserved Forest (SRF) for various purposes, encompassing a total of 56 categories, including other purposes. Among these, 38 categories are designated specifically for developmental activities. Over 2500 ha of SRF land have been exclusively allocated for developmental purposes (Table 26). Key activities in this category include the construction of highways, farm roads, access roads, transmission lines and installation of cable towers.

2.5.3.5. Total SRF land lost to developmental activities

Within the past five financial years (2020-2021 to 2024-2025), a total of 2634.78 ha of SRF land has been lost to the developmental activities, including other categories such as land exchange, Kidu land allocation, sand and stone quarries, rehabilitation projects, cable corridors, and fire line creation.

2.5.3.6. SRF land destroyed by forest fire

Since 2014, over 2590 hectares of State Reserved Forest (SRF) land has been destroyed by 48 forest fire incidents, resulting in a damage value of over Nu. 2.5 million. In 2023, nine forest fire incidents alone caused the destruction of over 790 hectares of SRF land, primarily within Forest Management Units. Most fire incidents have been reported in blue pine forests and majority of the causes were left unknown followed by electric short-circuit and agricultural debris burning.

2.5.3.7. SRF land affected by pests and diseases

Pests and diseases have been prevalent within the jurisdiction of the DFO, Paro affecting over 246 hectares of forest land since 2019 within FMU, LFMA and the CFs. Various pests and diseases have been reported, with the bark beetle being the most significant

pest, primarily infesting spruce trees. Parts of all five Forest Management Units have been impacted by bark beetle infestations, and sanitation operations are ongoing in the affected areas to mitigate the damage.

2.5.3.8. Wood-based Industries

A total of 107 active Wood-Based Industries, both primary and secondary are registered. Of these, 55 are classified as Primary Wood-Based Industries, including six handicrafts, one Incense Production Units, 45 stationary sawmills, and one mobile sawmill. Additionally, 45 Furniture units are categorized as Secondary Wood-Based Industries, and seven are classified as IWBI, according to the Forest and Nature Conservation Rules and Regulations (FNCRR) Amendment 2020.

Table 23: Statistics on forest resource allotment for commercial purpose (2020-2021 to 2024-2025)

Forest Resources (m^3)	Year					
	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
Timber allotment	2894.76	1547.01	2209.19	30075.36	19216.07	55942.39
Poles (Flag post / Chadri/fencing post)	95.13	45.22	108.97	172.38	597.36	1019.06
Firewood	147.27	292.02	599.06	3402.36	1752.00	6192.71
Mushroom Billet	57.56	14.16	28.32	13.39	33.49	146.92
Others	1.13	23.29	20.67	44.31	10.54	99.94

Table 24: Statistics on forest resource allotment for rural purpose (2020-2021 to 2024-2025)

Purpose (Timber allotment in cubic meter)	Year					
	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025	Total
Timber allotment	6856.49	7814.60	5496.77	7706.65	10989.66	38864.20
Poles (Flag post/Chadri/ fencing post)	134.30	123.47	73.56	309.17	238.94	879.44
Firewood	568	562.50	7844.00	558.00	4903.14	14435.6
Mushroom Billet	28.34	28.34	0.00	0.00	0.00	56.68
Others	1.70	1.70	680.00	0.00	8.00	691.40

Table 25: Different category of Non-Wood Forest Product allotted in five years (2020-2021 to 2024-2025)

Product	Year				
	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
Abies densa					$8m^3$
Aggregates				$40m^3$	
Artemisia spp.					400kg
Boulders	$1008m^3$	$1552m^3$	$4232m^3$		
Clay soil	$864m^3$	$752m^3$	$8m^3$		
Gentiana spp.			240kg		
Color soil	$24m^3$	$60m^3$			
Gravel	$424m^3$	$312m^3$	$1216m^3$		
Juniperus spp.	$112m^3$	20bundle, $240m^3$, 2Nos.	$144m^3$	1595hl, 30000kg, $64.5m^3$	2404hl, 58000kg, $8m^3$
Large bamboo			$8m^3$	200Nos.	
Leaf moulds	$383m^3$	$840m^3$	$216m^3$		
Nardoschys spp.			40kg	154kg	30kg
Lycopodium clavatum (Zalagadang)	$8m^3$	$16m^3$			
Ophiocordyceps sinensis (Cordyceps)	300kg		32Nos.	24Nos.	
Mushroom		300kg			70kg
Picea spinulosa (Spruce)	75Nos.	3Nos, $8m^3$			
Pinus wallichiana (Blue pine)	$8m^3$, 150Nos.	3Nos.			
Pine needle		$72m^3$	$8m^3$	$8m^3$	$16m^3$
Rhododendron spp.	$104m^3$	$208m^3$	50kg	80Nos.	600kg, 40Nos.
Rhodiola spp.		$64m^3$			
Rubia cordifolia	25kg				
Sand	$680m^3$	$3020m^3$	$496m^3$		
Small bamboo	40bundle				3bundle
Stone	$3040m^3$	$1092m^3$	$1112m^3$		
Stone chips	$104m^3$	$16m^3$	$40m^3$		
Top soil	$276m^3$	$3392m^3$	$96m^3$		
Tanacetum spp.		1100kg			
Tsuga domsa (Hemlock)	$56m^3$				
Wildlings (Saplings)	$24m^3$, 657Nos.	50bundles, 750kg, 3164Nos.	121Nos.	123Nos.	
Wood-burr			100Nos.		

Table 26: Land allotment for various purposes in five years (2020-2021 to 2024-2025)

Land allotment for various purpose (Area in hectare)	Year				
	2020-2021	2021-2022	2022-2023	2023-2024	2024-2025
Acquiring land User Right Certificate (URC)	0.00	0.00	0.00	0.41	0.00
Archery range	0.56	0.00	0.00	0.11	0.00
Chain-link fencing	0.00	0.00	0.00	0.00	32.97
Clearing of transmission line ROW	0.00	0.00	3.97	38.59	0.00
Collection of gravels for road construction	0.00	0.00	0.00	0.00	0.09
Construction of access road to private land	0.00	0.00	0.05	1.98	1.19
Construction of gabion wall	0.00	0.00	0.00	0.03	0.00
Construction of integrated multipurpose hydropower project	0.00	0.00	0.00	1.68	0.00
Construction of Menchu facility	0.00	0.00	0.00	0.00	0.39
Construction of new secondary national high way construction	0.00	0.00	0.00	0.00	0.01
Construction of ORC	0.00	0.00	0.05	0.00	0.00
Construction of transmission line	0.00	0.00	0.31	0.27	3.43
Construction of water tank	0.00	0.00	0.00	0.04	0.00
Creation of fire line	0.00	0.00	0.13	0.00	0.00
Development of Recreational Park	0.00	0.00	0.96	0.04	0.41
Dredging	0.00	0.00	0.06	2.20	0.33
Dumping of waste materials	0.00	0.00	0.13	0.00	0.00
Ecotourism infrastructure development	0.00	0.00	0.00	0.61	0.00
Ecotourism trail development	0.00	0.00	0.00	0.00	0.21
Electric fencing	0.00	0.00	0.00	0.01	0.00
Extension of exiting farm road	0.00	0.00	0.16	11.32	1.08
Extension of transmission line	0.00	0.00	0.40	0.07	0.00
Installation of Cable Crane	0.00	0.00	0.30	0.00	0.00
Irrigational channel realignment	0.00	0.00	0.37	0.00	2.46
Kidu land	0.00	0.00	0.00	0.04	0.00
Land acquisition by Government Institution	0.12	0.00	4.89	21.35	1.11
Land Exchange	0.06	0.00	0.65	1.29	3.22
Land lease	0.72	0.00	8.99	8.36	4.08
Land Substitute	0.16	0.00	1.06	8.22	0.67
New farm road construction	4.88	0.00	7.45	1.24	0.83
New approach road construction	29.60	0.00	8.15	7.97	4.10
New Irrigational Channel construction	0.15	0.00	0.38	0.00	0.03
New Transmission line construction	540.85	0.00	0.84	0.00	14.35
Others	1720.41	0.00	0.00	0.00	0.00

Power substation	0.00	0.00	0.84	0.00	0.00
Realignment of farm road	0.00	0.00	1.03	0.04	0.00
Realignment of private approach road	0.00	0.00	0.00	0.00	0.03
Removal of NWFP (surface collection material) from SRFL	0.00	0.00	2.65	0.61	0.69
Removal of NWFP (plant) from private land	0.00	0.00	0.17	0.00	0.00
Removal of NWFP (plant) from registered institutional land	0.00	0.00	3.80	0.00	0.00
Removal of NWFP (Surface collection materials) from private land	0.00	0.00	2.12	0.45	0.00
Removal of timber from private land	0.00	0.00	0.01	0.20	0.00
Removal of timber from registered institutional land	0.00	0.00	14.35	0.48	0.00
Removal of timber from SRFL	0.00	0.00	3.37	0.93	28.29
River mitigation	0.00	0.00	0.00	0.39	4.28
Sand quarry	0.00	0.00	0.00	0.00	10.82
Spring-shed management	0.00	0.00	0.01	0.00	0.00
Stone quarry	0.00	0.00	0.00	0.11	0.00
Telecom tower	0.00	0.00	0.06	0.29	0.14
Temporary approach road for transportation of construction materials	0.00	0.00	0.00	1.00	0.00
Transmission Tower	0.04	0.00	0.07	0.23	0.00
Water pipeline	0.60	0.00	0.02	0.40	0.14
Widening of farm road	0.26	0.00	2.08	0.25	0.39
Widening of Gewog center road	0.00	0.00	0.00	0.88	0.00
Widening of National Highway	0.00	0.00	0.00	37.43	0.00
Widening of private approach road	0.00	0.00	1.10	0.00	0.14

2.6. Local People and Livelihood

The DFO, Paro comprises approximately 4,832 households, with 3,973 located in the 10 Gewogs of Paro Dzongkhag and 859 in the 4 Gewogs of Haa Dzongkhag. A socio-economic survey was conducted using structured questionnaires, collecting data from 1,308 respondents out of 1,350 sampled households. Women represented 62% of the respondents, while men made up 38%. The average household size was four members, ranging from one to twelve. Housing varied, with 8% living in three-storey houses, 67% in two-storey houses, 22% in single-storey houses and 3% residing in huts.

Landholdings averaged 1.73 acres per household, with the largest holdings recorded in Naja Gewog at 3.72 ± 2.07 SD and the smallest in Lamgong Gewog at 1.20 ± 1.09 SD. The most common land size was two acres. Proximity to forests was notable, as 97% of the respondents lived within one kilometer of a forest, with only 3% residing farther away.

Agriculture emerged as the primary livelihood, complemented by cash crops, vegetables, livestock, portering, labor wages, business, beekeeping, mushroom cultivation, NWFPs and timber. The average annual household income across the 14 Gewogs over the last three years was Nu. 1,71,714. Livestock played a significant role, with poultry accounting

for 91% of the total livestock population, followed by yaks at 3%, and both local cattle and Jersey cattle at 2%. These findings highlight the close dependence of the local population on agriculture, livestock, and forest resources for their livelihoods.

Table 27: Dzongkhag wise population by gender (Source: NSB, 2017)

Dzongkhag	Total population				
	Male	%	Female	%	Total
Paro	23,941	51.7	22,375	48.3	46,316
Haa	7,435	54.4	6,220	45.6	13,655
	Rural population				
Paro	17,883	51.98	16,520	48.01	34,403
Haa	5,763	54.54	4,803	45.46	10,566

2.6.1. Profile of the respondents

The survey successfully interviewed 1,308 respondents out of the 1,350 sampled households, achieving a response rate of 97%. 42 households could not be interviewed due to the absence of members at the time or because they were gung-tong (empty households). Of the respondents, 62% (n = 803) were female, and 38% (n = 487) were male, indicating a significant gender difference among respondents as confirmed by a chi-square test (x^2 = 49.748, p > 0.05) across the 14 Gewogs. The respondents' ages ranged from 17 to 96 years, with an average age of 52 years.

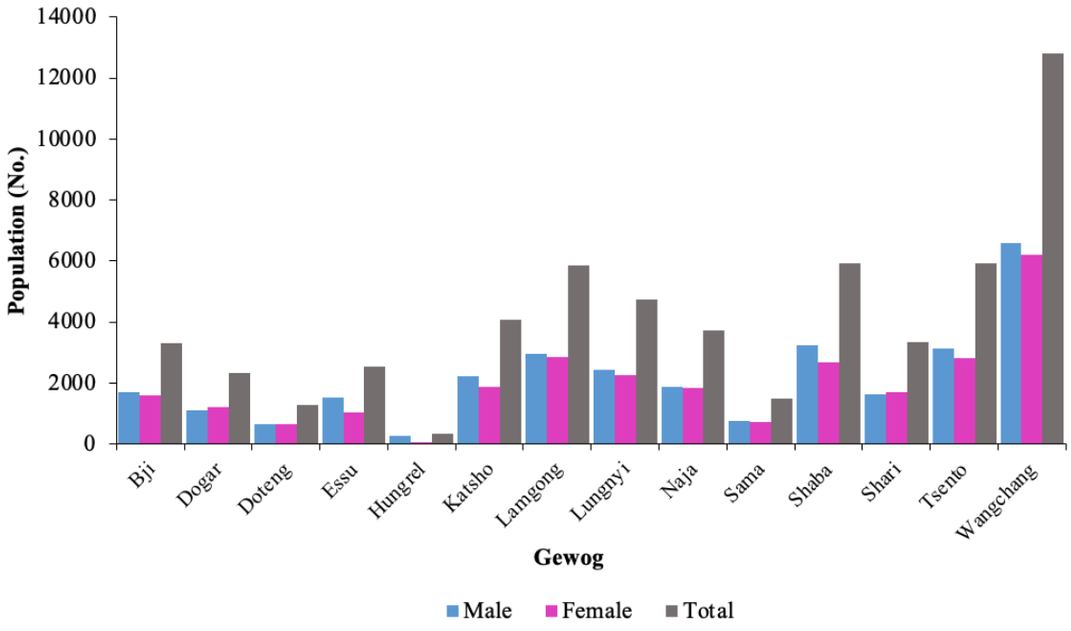


Figure 17:Human population and gender ratio (Data source: PHCB, 2017)

2.6.2. Gender representation and age distribution of the respondent

The average age of respondents across both surveys was approximately 55 years. The socio-economic survey had a broader age range (17–96 years) compared to the CVCA survey (21–95 years). Most respondents in both surveys fell within the 40–59 age group, while the oldest age group had the fewest participants. A significant proportion of households were headed by women, with 64% of individuals and 86% of overall Gewog falling into this category, highlighting a notable prevalence of female-led households in the study population. Among the Gewogs, Shaba had the highest percentage (15%) of households led by educated individuals, compared to Katsho and Samar, which had only 2.52%. The average household size was four members, ranging from 1 to 12 individuals. Most households consisted of 2 to 5 members. No significant differences were observed in the average household sizes across the 14 Gewogs ((x^2 = 182), (p > 0.05)), indicating that household sizes are generally consistent and relatively small throughout the region.

2.6.3. Education Level

Among the 1,308 respondents, the majority (n = 1,070) were farmers with no formal education. Of the remaining respondents, 89 had primary education, 38 had completed middle secondary education, and 33 had attained a high school education. Additionally, 27 were Gomchens or lay monks, 17 held a bachelor's degree, 16 had undergone non-formal education, five had completed a diploma, and three had achieved a master's degree.

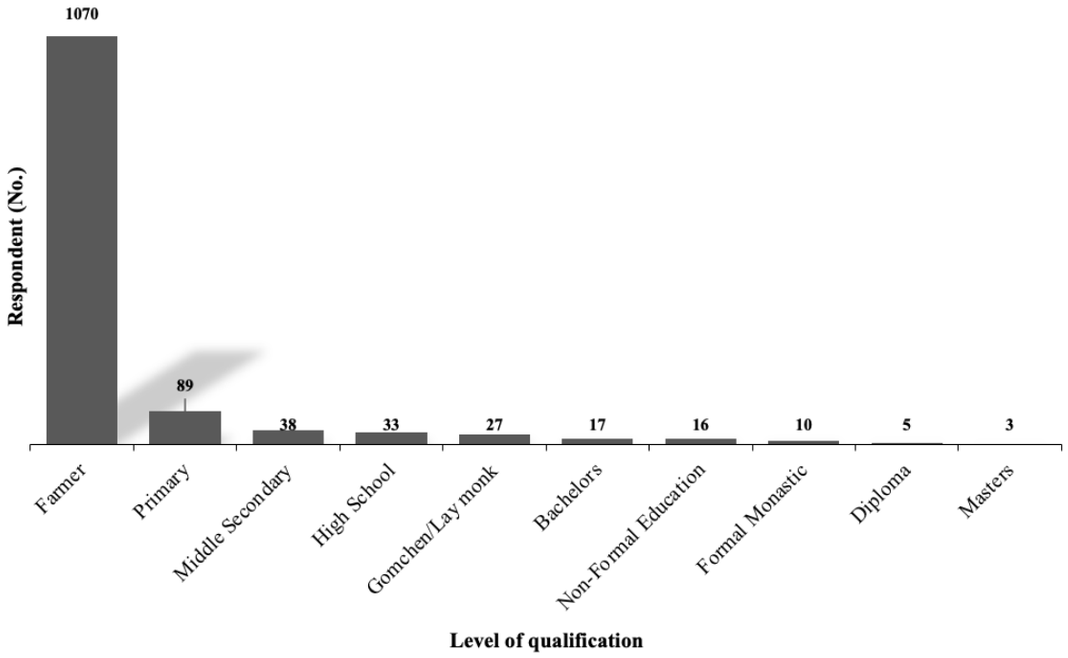


Figure 18: Literacy rate and the level of qualification for respondent

2.6.4. Land holdings

The average landholding per household in 14 Gewogs was found to be 1.73 acres. However, there were significant variations across the 14 Gewogs. Naja Gewog had the largest average landholding at 3.72 acres, while Lamgong Gewog had the smallest average landholdings at 1.20 acres.

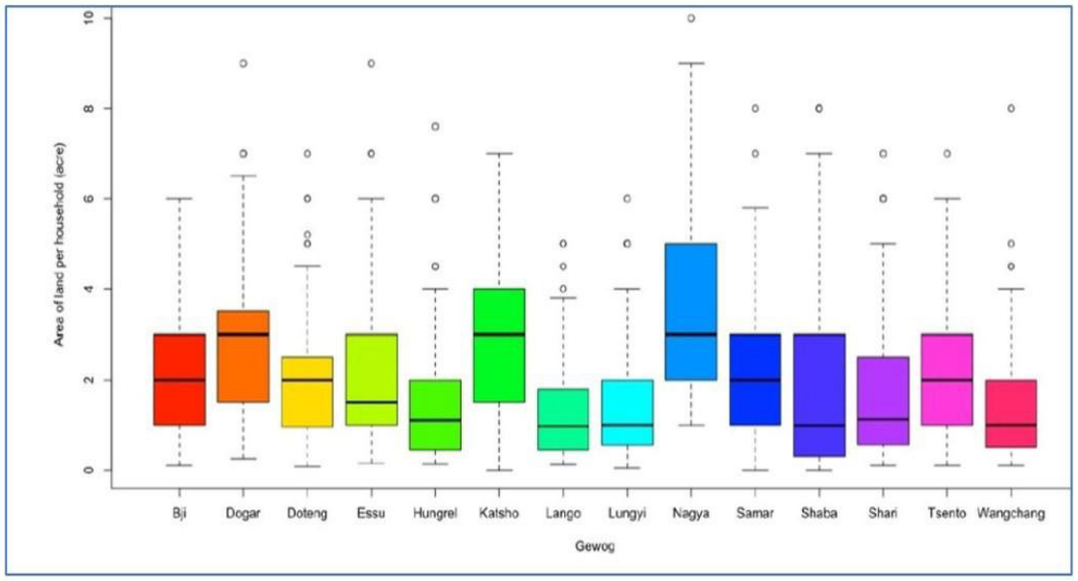


Figure 19: Land holdings per household against each Gewog

A box plot analysis revealed a wide range of private registered land ownership, ranging from 0.11 to 16 acres. This indicates substantial disparities in land distribution among households. The most common landholding size was 2 acres. Statistical analysis confirmed that the differences in landholding sizes across the Gewogs were statistically significant ($x^2 = 2500$, $p < 0.05$).

2.6.5. Livestock holdings

The people of Haa and Paro raise eight types of livestock, with poultry being the most common, comprising 91% (n = 68,084) of the total. Yaks account for 3% (n = 2,373) followed by local breed cattle at 2% (n = 2,014) and Jersey cattle at 2% (n = 1,749). Other livestock types are present in smaller numbers.

Dogar Gewog has the highest number of local breed cattle (n = 487), followed by Samar (n= 308), Naja (n = 189), and Tsento (n = 178), with other Gewogs having fewer than 152 cattle. For improved breed livestock, Samar Gewog leads with 273, followed by Katsho (n = 227), Shari (n = 200), and Naja (n = 174), with the rest having fewer than 174. Tsento Gewog has the highest number of horses (n = 212), followed by Shari (n = 85) and Katsho (n = 81), with other Gewogs having fewer than 62. Brown Swiss cattle are rare across all Gewogs.

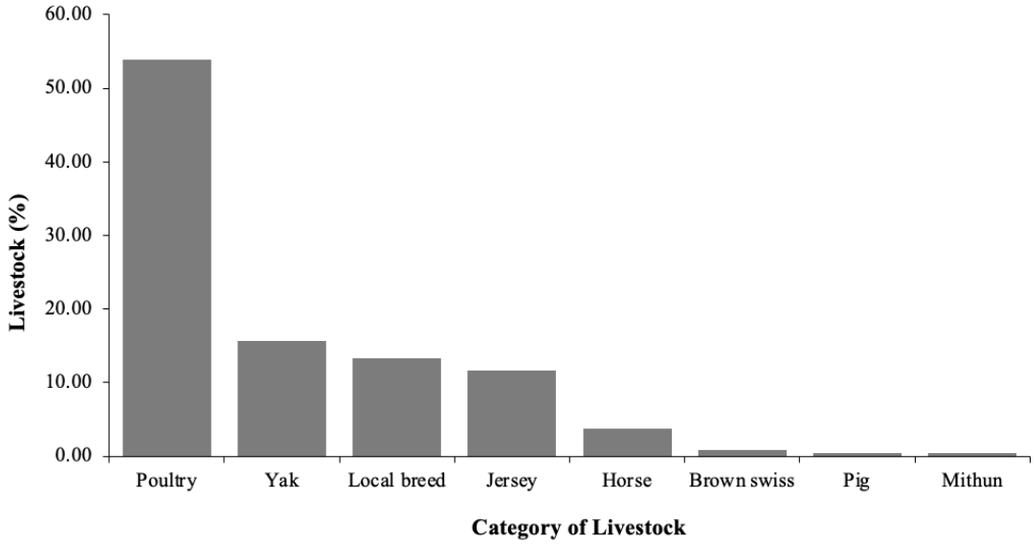


Figure 20: Various category of livestock holdings (Percentage) in 14 Gewogs

2.6.6. Annual household income

The primary sources of annual cash income in the 14 Gewogs include cash crops, vegetables, livestock, portering, labor wages, business activities, beekeeping, mushroom cultivation, NWFPs, timber, and other sources. The average annual household income across the Gewogs was Nu. 171,714. Katsho Gewog recorded the highest average income per household at Nu. 234,000, while Lango Gewog reported the lowest at Nu. 92,000. There was a significant variation in average annual household income across the Gewogs ($p < 0.05$).

Livestock was the primary income source for Bji, Essu, Katsho, and Samar Gewogs, while vegetables were the highest income contributors for Dogar and Naja Gewogs. In Doteng Gewog, labor wages were the primary income source. Business activities dominated as the main income source in Shaba, Tsento, and Lungnyi Gewogs, whereas in Lango Gewog, both business and vegetable farming were key contributors. Overall, 92% of respondents were classified as low-income, 6% as middle-income, and 3% as high-income earners.

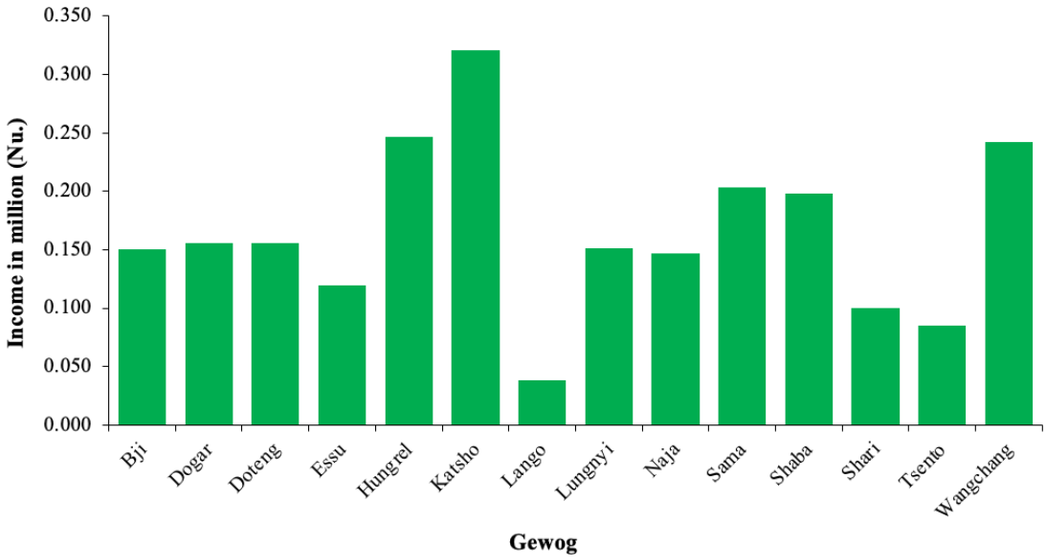


Figure 21: Annual average household income against each Gewog

2.6.7. Ranking of sources of livelihood

Respondents were asked to rate the importance of major livelihood sources; agriculture, livestock rearing, portering and tourism, labor wages, business, and the sale of non-timber forest products (NTFP) on a scale from 1 (lowest) to 10 (highest). Agriculture emerged as the primary livelihood source, with most respondents rating it a 10, signifying its critical role in their lives. Similarly, livestock rearing was rated highly by most respondents, though some in Hungrel, Tsento, and Wangchang Gewogs indicated less importance. Livestock rearing remains significant across most Gewogs, except for Doteng, Hungrel, Lango, and Wangchang.

Portering and tourism were generally not considered vital income sources, with most respondents rating them as 0, except in Dogar, Doteng, Shaba, and Tsento Gewogs, where a few households found them relevant. Labor wages, however, were an important livelihood source for many households in Bji, Katsho, Lango, Lungnyi, Naja, Shaba, and Tsento Gewogs. Overall, agriculture and livestock rearing stand out as the most critical sources of income across the 14 Gewogs.

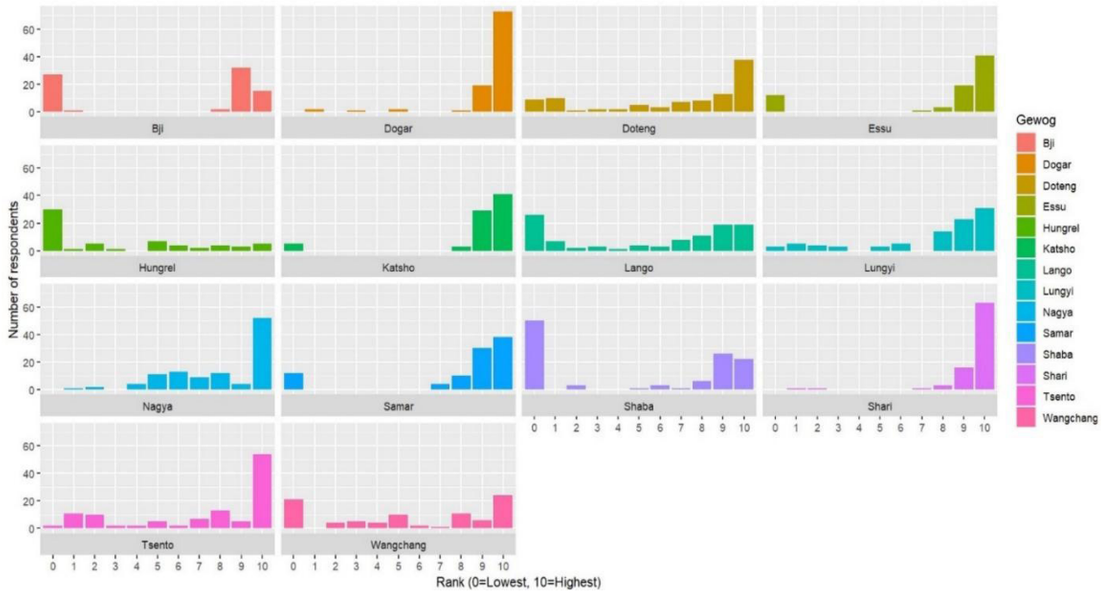


Figure 22: Number of respondents rating agriculture as a source of livelihood

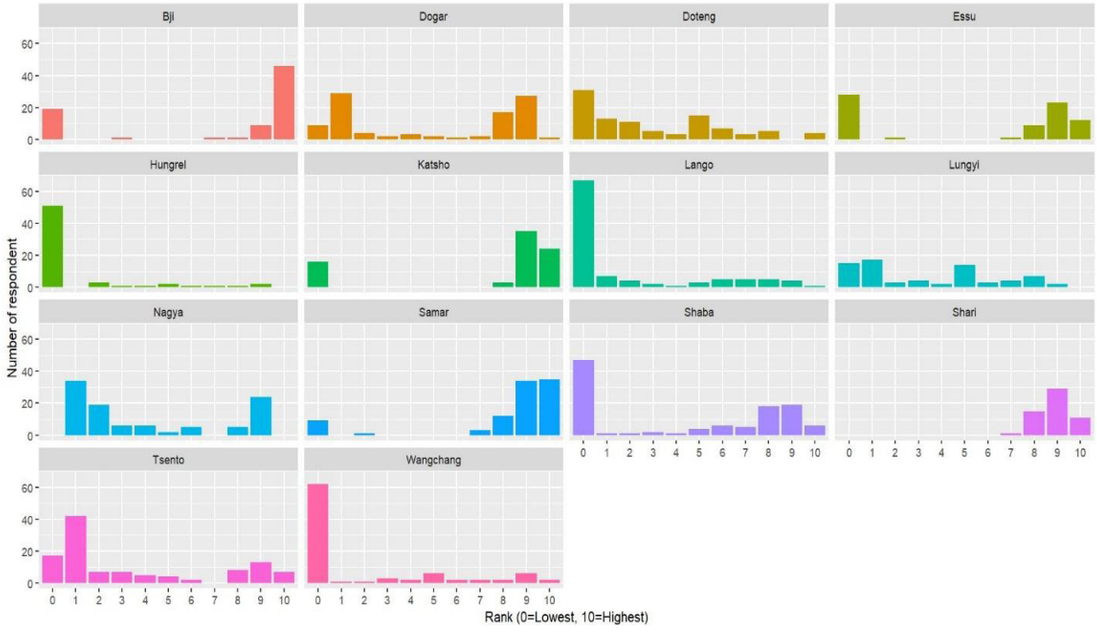


Figure 23: Number of respondents rating Livestock as a source of livelihood

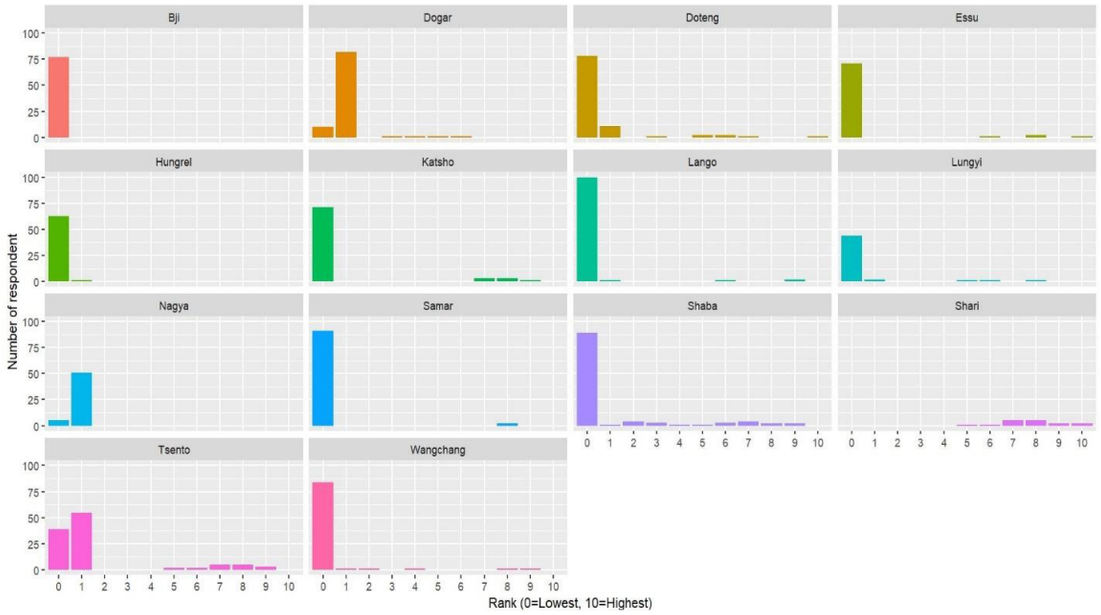


Figure 24:Number of respondents rating porter and tourism as source of livelihood

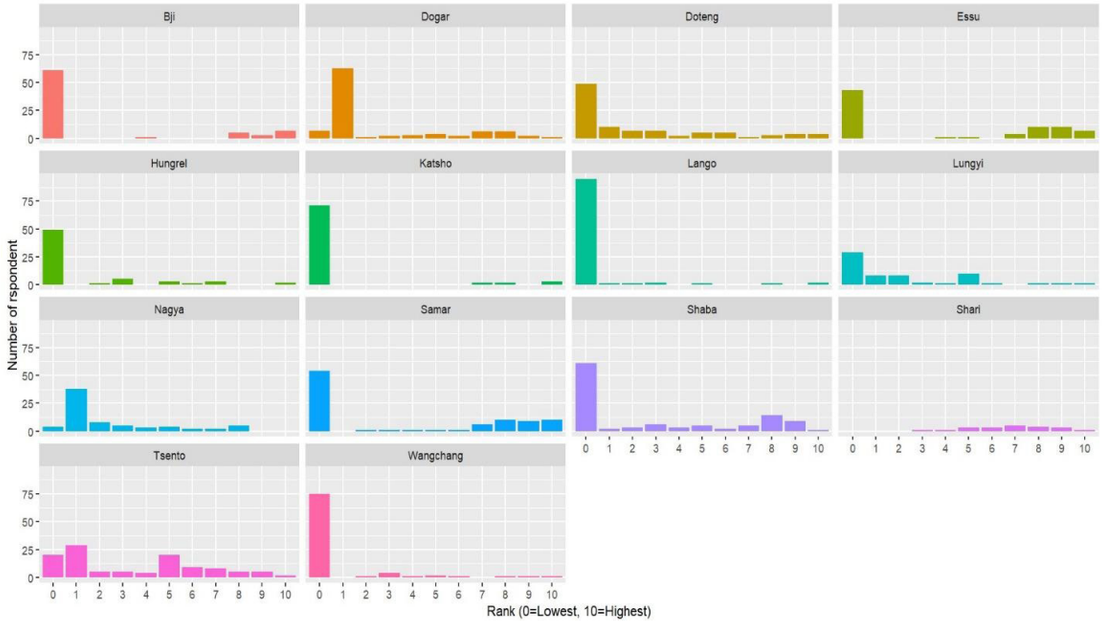


Figure 25: Number of respondents rating Labor wage as a source of livelihood

2.7. Human Wildlife Conflict

In all 14 Gewogs, 94% of respondents reported conflicts with wild animals, with crop depredation being the most common issue, followed by livestock depredation. Over the past three years (2020-2022), a total of Nu. 28.35 million worth of crops were lost to wild animals across the Gewogs. Naja Gewog experienced the highest average annual crop loss, amounting to Nu. 27,960 per household, while Lungnyi Gewog had the lowest at Nu. 4,450. Wild pig was identified as the primary crop predators. Nine types of crop

protection methods were used in the survey area, with electric fences and chain link fences proving to be the most effective.

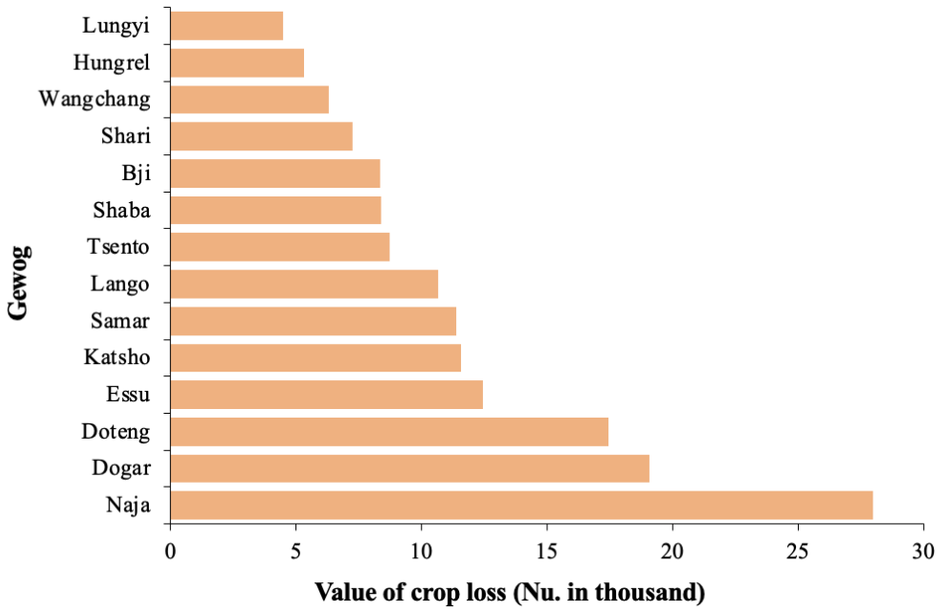


Figure 26: Value of crop lost to wild animals (Nu. in thousand)

Local breed were the most commonly preyed-upon livestock across the 14 Gewogs. Tsento Gewog reported the highest cases of livestock predation, followed by Samar and Essu Gewogs. Wild dog was the most frequent predator followed by Asiatic black bear, Snow leopard and Common leopard. Over the three years (2020-2022), the total estimated loss from livestock depredation in the 14 Gewogs was approximately Nu. 34.03 lakhs, with Tsento Gewog suffering the highest loss, totaling Nu. 22.71 lakhs.

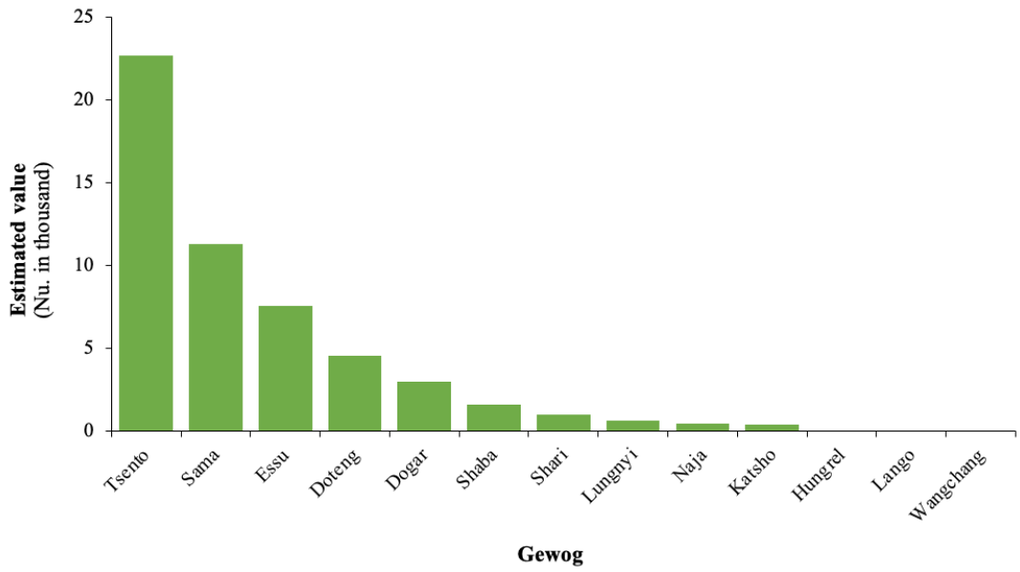


Figure 27: Estimated value of livestock lost (Nu. in thousand)

2.7.1. Human Wildlife conflict hotspot

The common conflict in the Gewogs was crop depredation (93.5%, n = 883) followed by livestock depredation (5.9%, n = 56) with a few cases of property damage (0.3%) and human casualty (0.2%). Naja Gewog had the highest number of crop depredation cases (n = 107) followed by Dogar Gewog (n = 85). A chi-squared test indicated a significant difference in the occurrence of conflict types across the 14 Gewogs (x^2 = 123.99, p < 0.05). The highest number of livestock depredation cases occurred in Tsento Gewog (n = 24) followed by Samar Gewog (n = 12).

While performing hotspot map and as per the existing HWC baseline report, Naja and Dogar Gewog under Paro Dzongkhag were identified as the HWC hotspot Gewogs within the Division. To develop the C2C strategy for the identified Gewogs, a detailed assessment was carried out in these Gewogs. Based on the findings, a tailored C2C strategy will be developed for guidance and implementation.

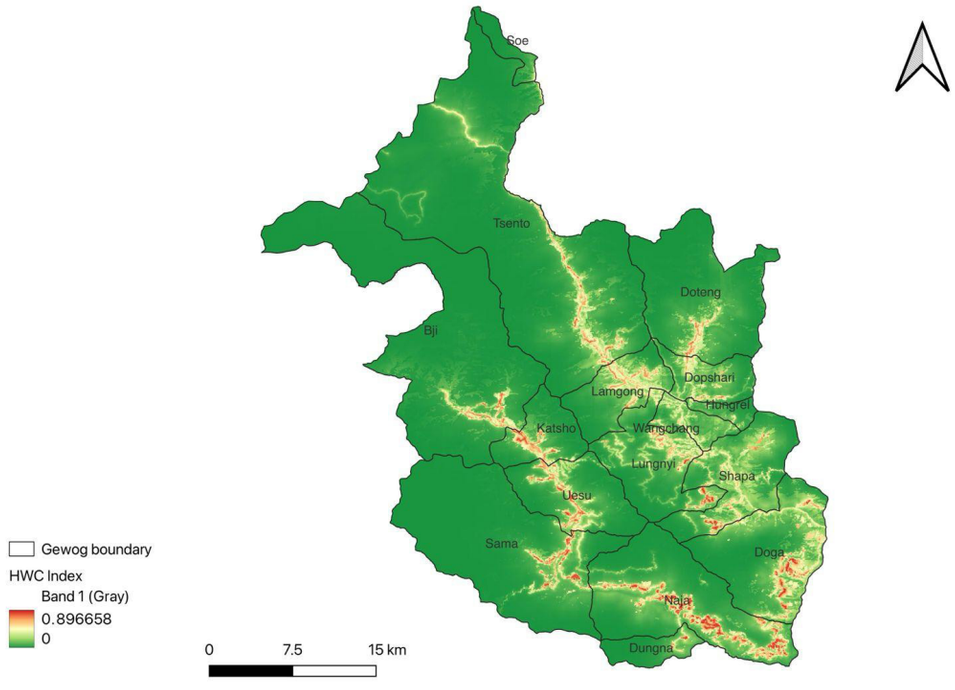


Figure 28: Human-wildlife Conflict (HWC) hotspot

2.8. Climate Change and its impacts

Gewogs within the jurisdiction of DFO, Paro are significantly vulnerable to climate change, facing hazards such as windstorms, heatwaves, flashflood and it has been worsened by erratic monsoon patterns and the occurrence of seasonal drought. Their dependence on climate-sensitive sectors like agriculture, livestock and forestry increases risks to local livelihoods, highlighting the urgent need for effective adaptation strategies to enhance resilience.

2.8.1. Present climatic conditions in the area

The temperature and rainfall data for Paro and Haa Dzongkhags (1988 - 2022) show that July month is typically the warmest month with average maximum temperature reaching 28°C in Paro and 24°C in Haa. January recorded the lowest average minimum temperatures dropping to -5°C in Paro and -8°C in Haa. Rainfall peaks in July for both the areas averaging 113mm in Paro and 189mm in Haa, while the highest recorded monthly totals were 231mm in July for Paro and 257mm in July for Haa.

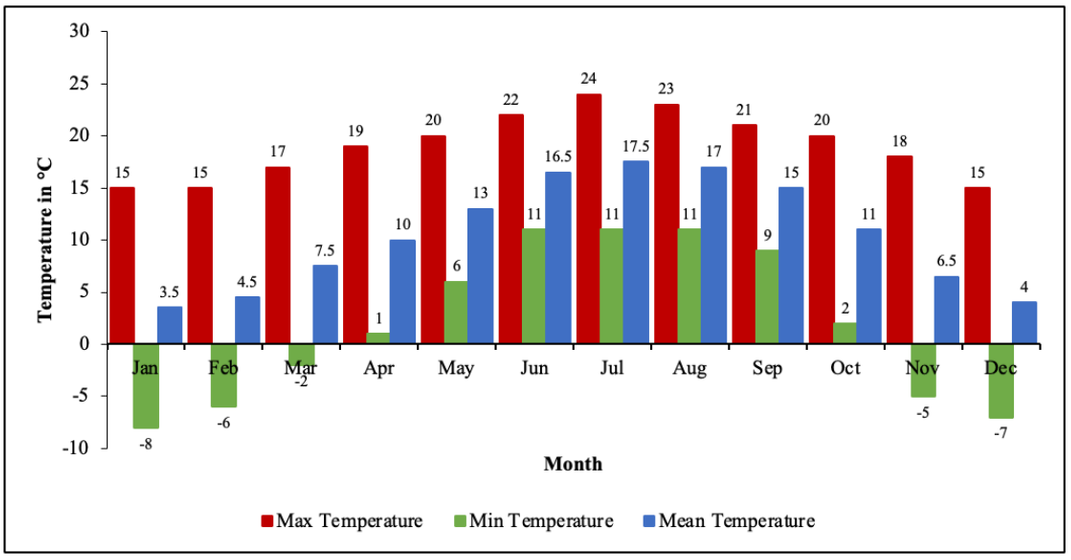


Figure 29: Average historical temperature of Haa

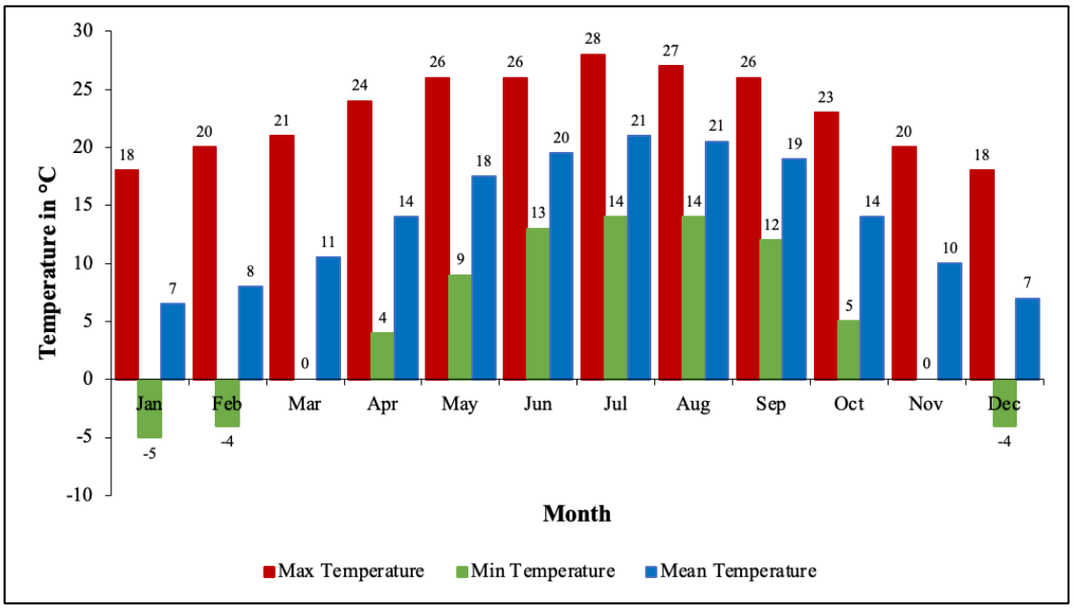


Figure 30: Average historical temperature of Paro

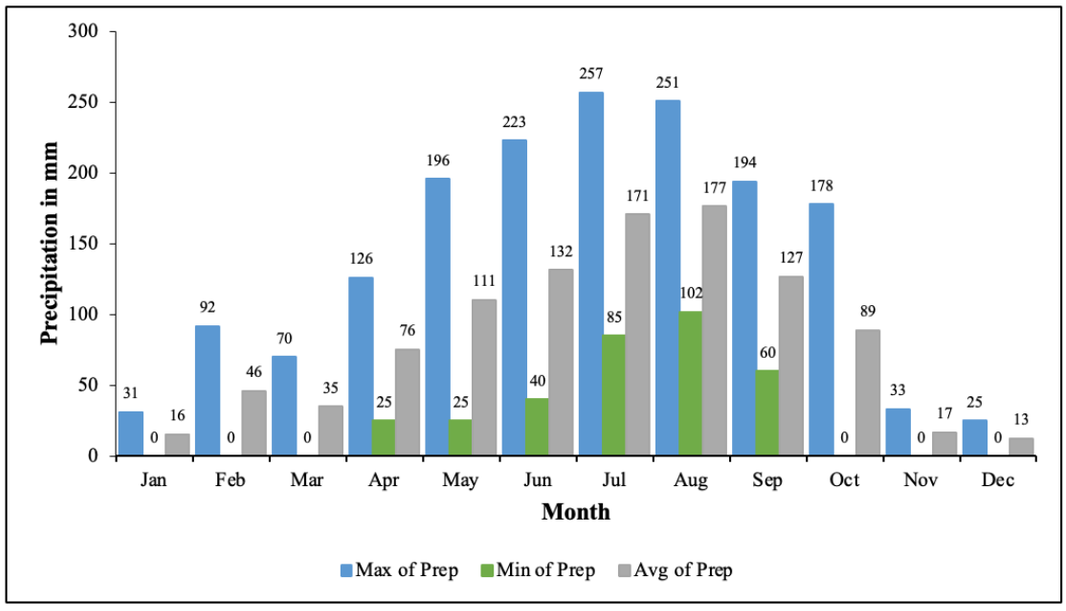


Figure 31: Average historical precipitation of Haa

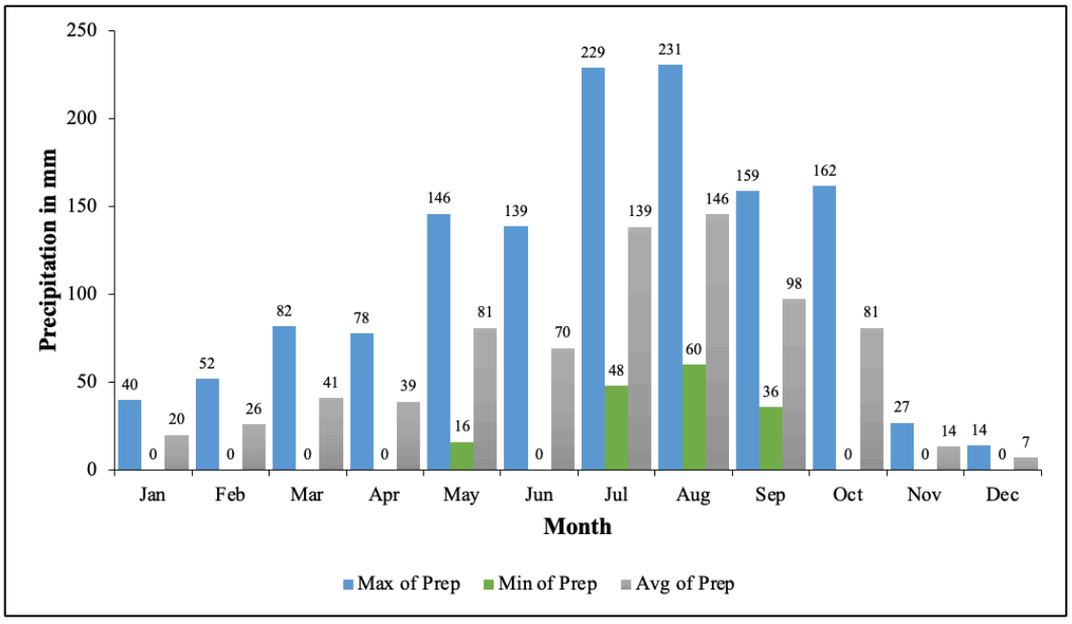


Figure 32: Average historical precipitation of Paro

2.8.2. Farmers' vulnerability to climate change and peoples' perceptions

Overall vulnerability is calculated by subtraction of sum of exposure and sensitivity from the adaptive capacity. Gewogs with higher negative scores of vulnerability index are more vulnerable, however, a lower negative score of the vulnerability index does not mean that those Gewogs are not vulnerable, but they are comparatively less vulnerable. The vulnerability indices across different Gewogs are presented in table 28 and figure 33.

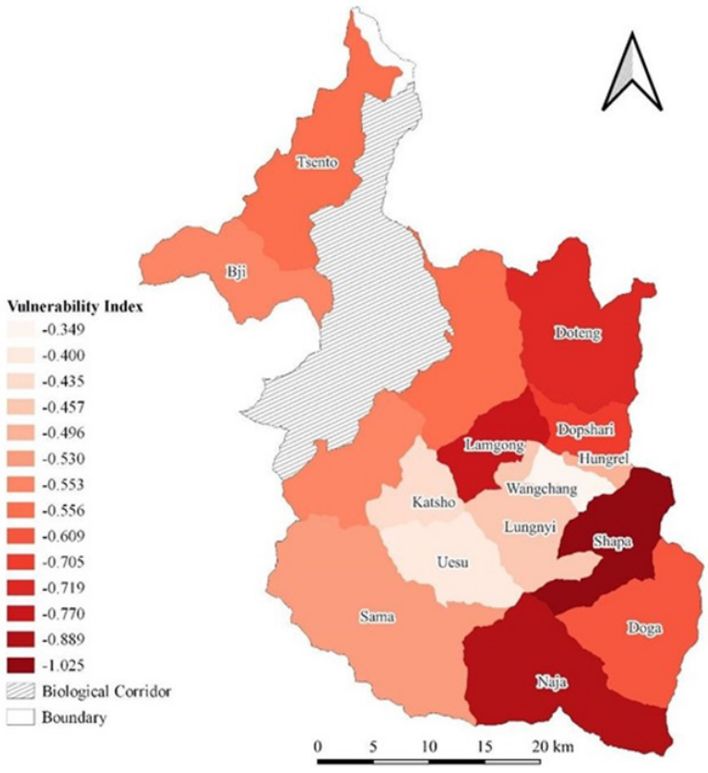


Figure 33: Vulnerability of Gewogs within DFO, Paro

Based on the vulnerability index of respective Gewogs, it was found that Shaba and Naja Gewogs are the most vulnerable Gewogs with vulnerability index of -1.026 and -0.890 respectively. The vulnerability of these Gewogs is mainly attributed to its high exposure and sensitivity. On the other hand, Wangchang, Essu and Katsho Gewogs with vulnerability index of -0.349, -0.400 and -0.436 are found to be relatively less vulnerable Gewogs with relatively higher adaptive capacity. The study found that Shaba and Naja as the Gewogs with high risk from climate impacts.

Table 28: Exposure, sensitivity, adaptive capacity and vulnerability index scores for14 Gewogs of DFO, Paro

Gewog	Adaptive capacity	Exposure	Sensitivity	Vulnerability
Bji	0.375	0.487	0.441	-0.554
Dogar	0.404	0.570	0.444	-0.610
Dopshari	0.276	0.553	0.429	-0.706
Doteng	0.213	0.396	0.537	-0.720
Hungrel	0.594	0.617	0.474	-0.496
Katsho	0.371	0.410	0.397	-0.436
Lamgong	0.162	0.453	0.480	-0.771
Lungnyi	0.448	0.481	0.424	-0.457
Naja	0.159	0.566	0.482	-0.890
Samar	0.329	0.481	0.379	-0.531
Shaba	0.166	0.726	0.466	-1.026
Tsento	0.241	0.370	0.429	-0.557
Essu	0.483	0.451	0.432	-0.400
Wangchang	0.319	0.514	0.154	-0.349

2.8.3. Water resources

Out of the 261 mapped water sources, 53.6% (n=140) are springs, 41.4% (n=108) are stream-fed, 3.8% (n=10) are sourced from marshes, and 1.1% (n=3) are supplied by ponds. Tsento Gewog recorded the highest number of mapped water sources (n=41), while Hungrel and Katsho Gewog had the lowest (n=7). 67% of the mapped water sources (n=175) are used exclusively for drinking, 15.3% (n=40) serve both drinking and irrigation, 3.8% (n=10) are used solely for irrigation, and 3.1% are utilized for multiple purposes, including drinking, irrigation, and commercial use. Additionally, 10.7% of the mapped water sources (n=28) remain untapped.

Table 29: Status of water resources based on the utility

Utility	Frequency	Percent
Untapped	28	10.73
Drinking	175	67.05
Irrigation	10	3.83
All of the above	8	3.07
Drinking and Irrigation	40	15.33

2.8.3.1. Status of water source

The majority 58.6% (n=153) of water sources remain unchanged, while a significant portion 41% (n=107) is experiencing drying trends, and very few 0.4% (n=1) have completely dried up. Dopshari Gewog reported the most drying water sources (n = 24), followed by Lamgong Gewog (n = 19), Doteng Gewog (n = 17), and Dogar Gewog (n = 13). The water source mapping data showed that 8% (n = 21) started drying up in 2011, 6.5% (n = 17) in 2017, and 4.6% (n = 12) in 2013.

2.8.4. Forest Fire

Forest fires remain one of the most critical factors contributing to forest degradation in Bhutan, with their occurrence overwhelmingly linked to human activities. Studies and incident reports indicate that over 90% of forest fires in the country are anthropogenic in origin, while natural causes such as lightning or spontaneous combustion account for only a negligible proportion.

Among the human-induced causes, traditional agricultural practices, particularly the burning of crop residues and field debris emerge as a predominant source of ignition. This is notably prevalent in Paro and Haa, where agriculture constitutes the primary livelihood for much of the population. In these areas, the seasonal burning of fields for land preparation significantly elevates the risk of accidental forest fires, especially during dry and windy conditions. Moreover, a substantial portion of land in both Paro and Haa falls within the fire-prone zones, further intensifying the vulnerability of these regions to fire outbreaks (Figure 34).

Based on FIRMS data, the Division has recorded 48 forest fire incidents within its jurisdiction since 2014, leading to the loss of approximately 2,593.35 hectares of forested

land (Figure 35). These fires pose serious threats to forest ecosystems and biodiversity, while also undermining sustainable forest management efforts and adversely affecting the socio-economic wellbeing of local communities. Notably, the highest number (n = 12) of fire incidents since 2022 was recorded in 2025 (Figure 35).

This trend underscores the urgent need for integrated fire management strategies, including awareness campaigns, stricter regulation of burning practices, and community-based fire prevention measures to minimize the risk of future fire outbreaks and safeguard forest resources.

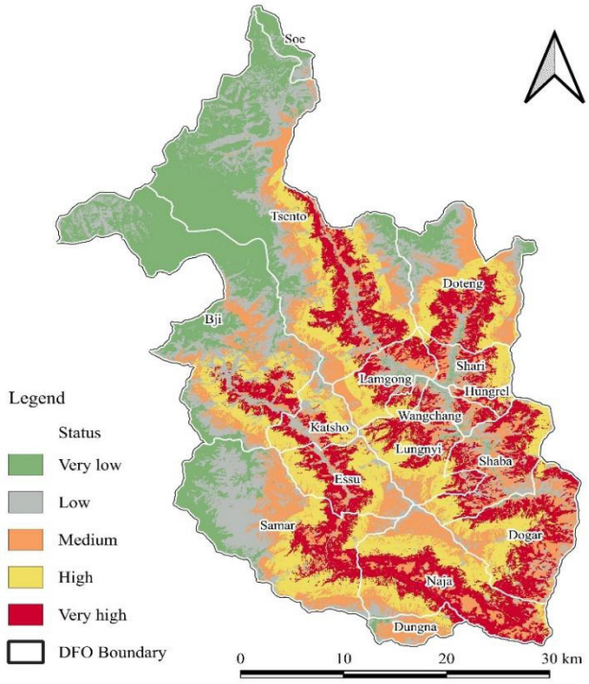


Figure 34: Hotspot map of forest fire prone area within the DFO, Paro

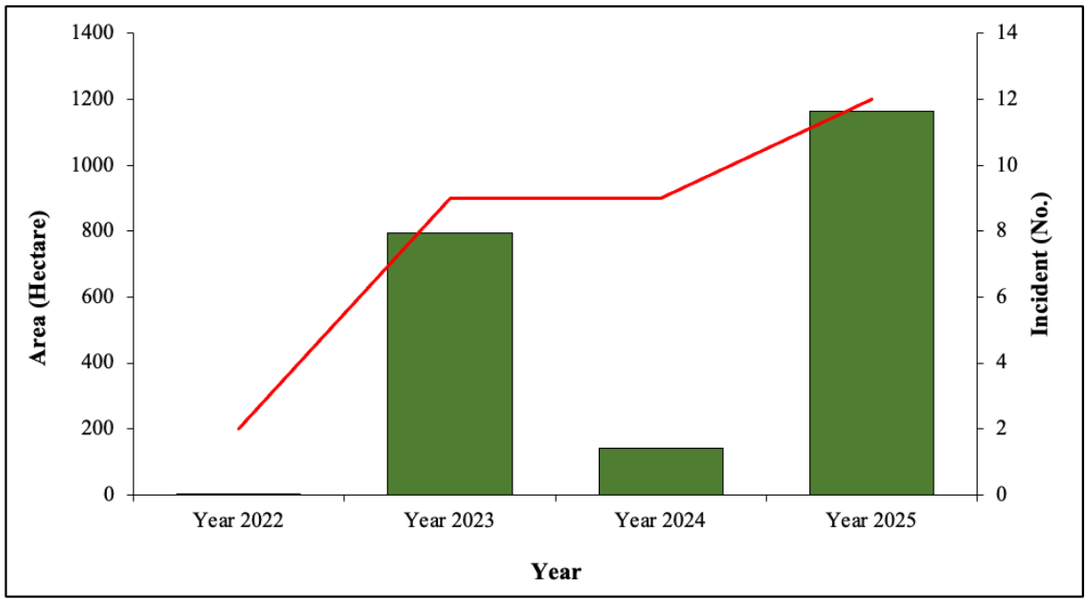


Figure 35: Number of forest fire incidences and area affected

2.8.5 Impact of climate change on vegetation and wildlife

The DFO, Paro, has observed significant impacts of climate change on vegetation and wildlife within its jurisdiction. A major concern is the drying of water sources, with 8% (n = 21) drying up in 2011, 4.6% (n = 12) in 2013 and 6.5% (n = 17) in 2017. These changes have adversely affected forest health, causing stress to vegetation and creating conditions conducive to pests and invasive species, including bark beetles (246.28 ha) and dieback. Wildlife has also been impacted, with 13 Bhutan takin (*Budorcas taxicolor whitei*) presumed to have succumbed to Black Quarter disease. In addition, climate change has led to an increase in forest fire incidents, along with reports of mistletoe and aphid infestations affecting healthy trees. These challenges pose serious threats to biodiversity, disrupt ecological balance, and increase the vulnerability of ecosystems in the region.

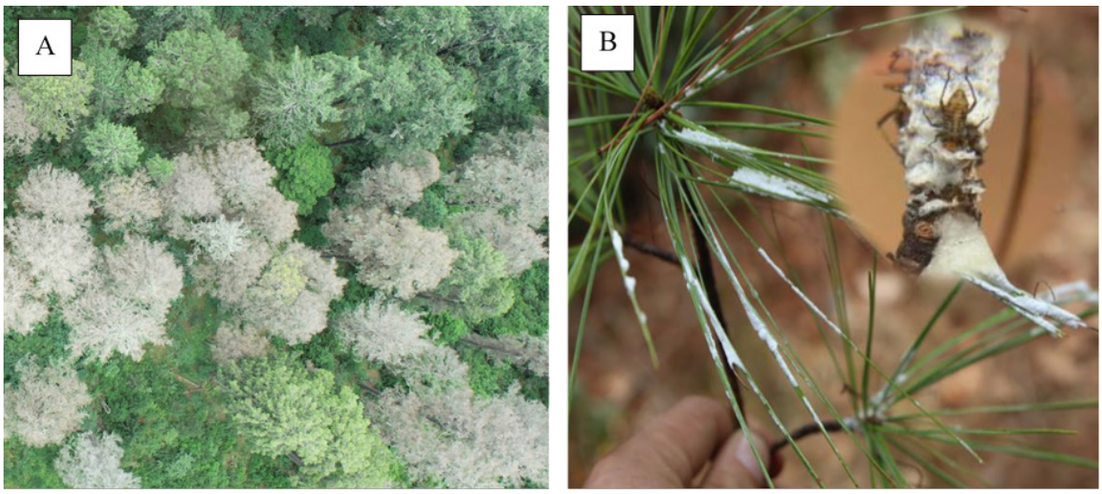


Figure 36: (A) Bark beetle infested trees (B) Giant conifer aphids with its honey dew

2.8.6. Adaptation/mitigation measures adopted

Households report that extreme temperatures reduce crop yields, dry up water sources, increase pests and livestock diseases, cause heat stress and lower milk production. Coping mechanisms include switching to climate-resilient crops, improved livestock breeds, practicing conservation agriculture, irrigation, rainwater harvesting, changing grazing areas and pursuing alternative income sources.

Change in rainfall seasonality leads to reduced crop yields, declining soil quality and limited freshwater. Communities adapt through altered cropping seasons, intercropping, increased irrigations and fertilizers.

For extreme events, impacts include crop and water loss, soil degradation, invasive species and livestock deaths. Communities respond with crop diversification, land management, agroforestry, rainwater harvesting, wells, dams and rely on government or NGO support.

Local government offices are the main institutions that assist people to cope with climate change impacts and disasters. Communities reported that the Dzongkhag, Gewog office,

District disaster office, District kidu office, Gewog RNR extension offices (agriculture, livestock, and forestry), community center, and health offices assisted them in dealing with climate change impacts. Other agencies such as financial and insurance offices, non-government organizations (Tarayana Foundation), Department of Disaster Management (DDM), National Center for Hydrology and Meteorology (NCHM), Department of Forests and Park Services (DoFPS), Department of Agriculture and Livestock (DoAL), also mentioned to have assisted communities in adapting to climate change. These commonly practiced coping mechanisms could be considered while developing climate change adaptation plans for the DFO, Paro. Institutional capacities of local government and other relevant agencies should be built in order to assist communities in undertaking climate change mitigation and adaptation measures.

2.8.7. Carbon sequestration and climate mitigation

Forest biomass, defined as organic matter accumulated through photosynthesis, underpins carbon storage and energy potential. Based on the NFI, 2023 Vol. II, the DFO at Paro holds 32.68 million tonnes of biomass across five carbon pools, with Fir Forest contributing the largest share. Total carbon stock is estimated at 21.30 million tonnes, dominated by Fir forests, while Cool Broadleaved and Juniper-Rhododendron forests hold the least. Annual increments are 233215.81 tonnes biomass and 109668.3 tonnes carbon.

2.9. High Conservation Value Areas (HCVA)

2.9.1. High Conservation Value Concept Overview

"High Conservation Values (HCVs) refer to biological, ecological, social, or cultural values of outstanding significance or critical importance. These values are identified within natural habitats and need to be managed appropriately to maintain or enhance their identified values" (HCV Resource Network, 2013). Globally, the concept of HCV was first introduced in 1998 by the Forest Stewardship Council (FSC), an international non-profit multi-stakeholder organization established in 1993.

The government and people of Bhutan recognize the environmental, social and cultural values in the development process and accordingly place top priority to the protection of the cultural and natural heritage including supporting community needs. The HCVs as a holistic approach can further complement and strengthen these efforts and initiatives of the country. Therefore, recognizing the benefits of the HCV approach it was introduced in 2020 in Bhutan by WWF through the living landscapes program of the International Climate Initiative (IKI) project.

The legality to manage HCVA has been drawn from Section 9 of Forest and Nature Conservation Act of Bhutan 2023 as Other Effective Management Conservation Area (OEMCA). The purpose of its inception was to use it as a tool and framework to protect important environmental, social and cultural values within forest production landscapes, with 6 HCV categories and global definitions.

There are six different HCV categories based on the National Interpretation for HCV in Bhutan;

HCV 1: Species Diversity

The concentration of biological diversity including endemic species, and rare, threatened or endangered species, that are significant at global, regional or national levels. This pertains to areas with notable concentrations of biological diversity that are globally, regionally, or nationally significant. While the focus is on areas with high concentrations, the presence of any rare, threatened, or endangered (RTE) species in a location is sufficient to classify it as HCV 1. This includes species identified on the IUCN Red List or those fully protected under existing forestry Acts and Rules.

HCV 2: Landscape-level ecosystems, ecosystem mosaics and Intact Forest Landscape

Large landscape-level ecosystems, ecosystem mosaics and Intact Forest Landscapes (IFL) that are significant at global, regional or national levels, and that contain viable populations of the great majority of the naturally occurring species in natural patterns of distribution and abundance. In general, the threshold size for HCV 2 should correspond to the area required to support viable populations, particularly for large or wide-ranging species. Although the specific size needed to qualify as an HCV 2 area may vary depending on the species present, a minimum of 50,000 hectares (500km^2) is commonly regarded as a baseline.

HCV 3: Ecosystems and habitats

HCV 3 encompasses ecosystems, habitats or refugia that hold significant value due to their rarity, the threats they face, their distinctive species composition, or other unique attributes. An ecosystem that is widespread in one region or country may be scarce and fragmented, hence rare and threatened in another. Additionally, rare areas include both those that are naturally rare and those that have become rare as a result of human activities such as degradation, land-use changes, or other forms of environmental impact.

HCV 4: Ecosystem services

Basic ecosystem services in critical situations, including protection of water catchments and control of erosion of vulnerable soils and slopes. Ecosystem services are the benefits people obtain from ecosystems. An ecosystem service is considered critical when its disruption could lead to severe, catastrophic, or cumulative negative effects on the welfare, health, or survival of local communities. Such disruptions may also adversely affect other HCVs and compromise the functionality of essential infrastructure, including roads, dams, reservoirs, hydroelectric systems, irrigation networks, and buildings, thereby threatening the well-being and survival of local populations.

HCV 5: Community needs

A site or resource is deemed essential for meeting basic needs if the services it provides are irreplaceable, meaning that suitable alternatives are neither easily accessible nor

affordable. Its loss or degradation would result in significant hardship or harm to the affected stakeholders. In the context of HCV 5, basic needs may include provisioning services that are fundamental to daily life, such as food, fresh water, wood, and fuel. HCV 5 is often present in areas where water sources, such as rivers, streams, and other natural bodies, are vital for human activities like drinking, cooking, washing, and irrigation, and where no practical or readily available alternatives exist.

HCV 6: Cultural values

HCV 6 refers to areas of cultural importance that hold traditional value for local communities. These can include religious or sacred locations, burial or cremation grounds, and sites used for traditional ceremonies. Such areas are often well-recognized by local populations, and in some cases, national legislation mandates their identification and protection. The traditions and customs practiced by communities form the core of our cultural heritage. The concept of a cultural landscape, or the cultural landscape approach, is inherently incomplete without the involvement of communities.

In the context of Bhutan, HCV 6 includes religious and cultural sites of local or national importance, identified through engagement and consultation with local communities. These living heritage sites are often unique to specific locations and play a fundamental role in shaping a community's identity, history and spiritual connection.

2.9.2. High Conservation Value Area

The DFO, Paro has identified Taktshang-Bumdrak-Dragay Pangtsho area as HCV 6 with an area of 7217.45 hectares. The HCV 6 lies in between 27.48° N, 89.35° E to 27.57° N, 89.37° E and 27.48° N, 89.46° E to 27.56° N, 89.46° E. Distinct landmarks such as La-Nam Tsho in the north, Lemchi-Goenpa in the west, Taktshang (Tiger nest) in the south and Shera-Drangu in the east are used as the boundary. The boundary basically follows prominent features of mountain ridges and old trails.

The area covers culturally sacred sites of around more than 10 monasteries, four lakes, two ancient trails and three burial grounds. There are eight forest types in the area as per the Forest Type Map (FTM) of Bhutan 2021 comprised of Blue pine forest (4%), Cool Broadleaved Forest (1%), Evergreen Oak Forest (3%), Fir Forest (34), Hemlock Forest (15%), Spruce Forest (4%), Juniper-Rhododendron Scrub (11%) and Dry Alpine Scrub (6%). About 23% of the area is non-forest consisting of agriculture land, open grassland, alpine scree and rocky out crops.

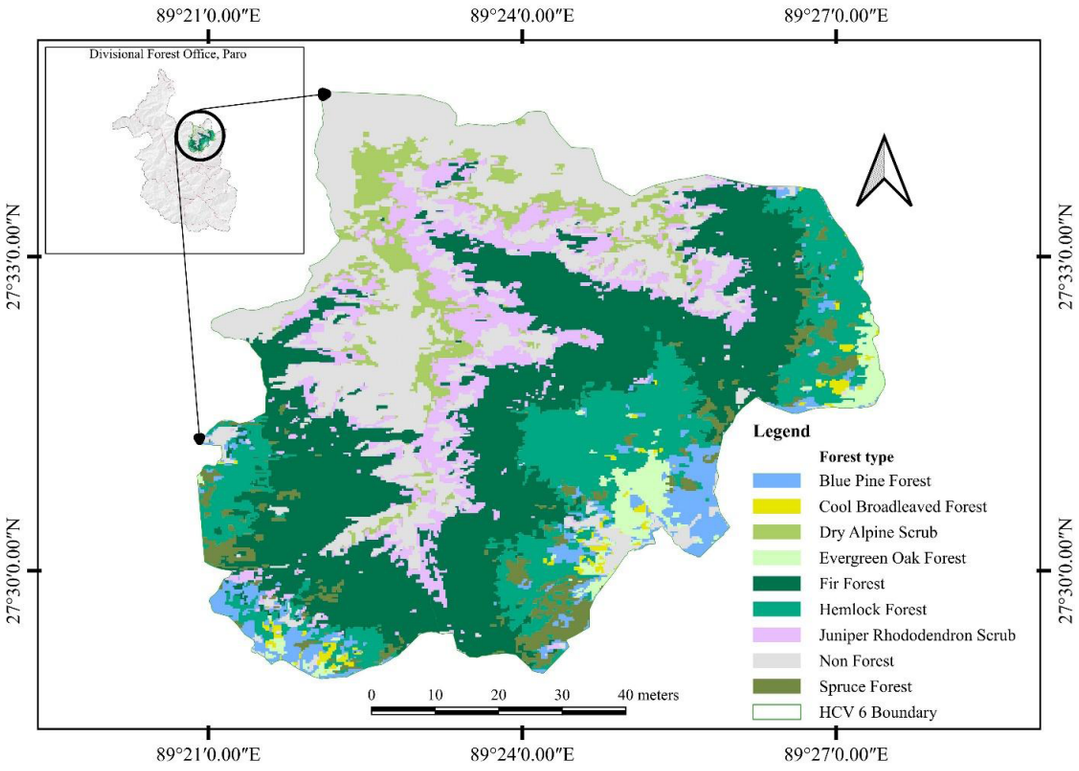


Figure 37: Location of the High Conservation Value Area (HCVA) along with forest types

2.9.3. Significance of High Conservation Value (HCV 6) Area

The Taktshang-Bumdrak-Dragay Pangtsho region, designated as a High Conservation Value Area (HCVA 6), exemplifies the intersection of ecological, social and cultural importance. Comprising sacred sites, diverse ecosystems and biodiversity-rich landscapes that is integral to Bhutan's identity and sustainability goals. Approximately 23% of the area consists of non-forest land, including agricultural land, open grassland, alpine scree and rocky outcrops. This area also serves as a sanctuary for endangered species such as the Royal Bengal tiger, Musk deer, Red Panda and other cat species such as Snow leopard and Asiatic golden cat. The NTS of 2015 recorded six tigers in the Ragoe and Chinto Goenpa area, highlighting the area's significance. In addition, the area is home to bird species such as the Himalayan Monal (*Lophophorus impejanus*), Satyr Tragopan (*Tragopan satyra*) and Blood Pheasant (*Ithaginis cruentus*).

Culturally, Taktshang Monastery is a globally renowned Buddhist pilgrimage site, and Dragay Pangtsho and Bumdrak hold spiritual significance, reinforcing traditional practices and fostering harmony between people and nature. These areas play a vital role in biodiversity conservation, ecosystem services and community well-being. The HCV area preserves critical habitats and regulates water cycles with Dragay Pangtsho acting as a water reservoir.

Ecotourism associated with these sites generate sustainable livelihoods, promotes economic growth and strengthens the spiritual and cultural fabric of local communities. Other HCVs in the region include high-altitude ecosystems, glacial lakes and

sacred cultural sites all of which are deeply interconnected. Spiritual reverence drives environmental stewardship, while tourism revenue supports conservation efforts.

Preserving this HCVA is essential for future generations to ensure ecological stability, cultural continuity and resilience against climate change. Its protection aligns with Bhutan's constitutional mandate to maintain at least 60% forest cover and support global frameworks like the Convention on Biological Diversity (CBD) and Sustainable Development Goals (SDGs), particularly SDG 13 (Climate Action) and SDG 15 (Life on Land). This region embodies Bhutan's holistic approach to integrating ecological conservation, cultural reverence and sustainable development.

2.9.4. Screening and identification of the High Conservation Value Area

In 2023, HCV screening was conducted to identify priority areas for effective HCV management and monitoring. This process, designed by the HCV Resource Network (HCVRN), utilized desktop analysis based on the National Interpretation, complemented by the HCV Screening Open Standards for the Practice of Conservation (Conservation Standards) to guide the identification of HCVs.

The open-source standards of the Conservation Measures Partnership (CMP) provide a systematic and transparent framework for managing, monitoring, and addressing complex environmental challenges. These Conservation Standards were applied to design strategies for effective management of high-priority High Conservation Value Areas (HCVAs). A workshop held in Thimphu from April 2023, documented suitable approaches for monitoring and mitigating threats to HCVAs. Additionally, recommendations were made for potential management and monitoring strategies in Priority III and IV areas identified during the HCV screening.

The HCVRN toolkit outlines six essential steps in the screening process to identify and prioritize areas with significant conservation value. This process aims to strengthen biodiversity conservation, protect ecosystems, and support local community well-being. The screening effort was supported by global HCVRN specialists, conducted in collaboration with the Department of Forests and Park Services (DoFPS), and involved participation from IKI Task Force members and field focal points.

i. Define purpose and scope

The program uses spatial analysis to define the geographic scope for identifying HCVs. Landscape-level screening is categorized into Priority I to IV, with DFOs identifying HCV areas in Priority I, II, or both.

ii. Gather information for analysis

A data gap analysis was conducted prior to screening. Primary and secondary data were gathered from national surveys (National Tiger Survey, Snow Leopard Survey and National Forest Inventory), jurisdictional studies, and SMART wildlife observational data to analyze species diversity and distribution. Threat analysis relied on SMART data and national/DFO-level studies to assess landscape threats.

iii. Determine likelihood of HCV presence

The probability of HCV presence within the landscape was evaluated using spatial analysis of critical species. This included overlaying data from species identified by DoFPS, Task Force, and DFOs as part of the screening process.

iv. Determine likelihood of threats to HCVs

Spatial analysis was also used to assess the likelihood of threats to HCVs. This process involved overlaying species data collected by DoFPS, Task Force, and DFOs during the screening.

v. Identify priorities in the landscape

Species presence and mapped threats were spatially overlaid to determine final HCV sites. Results from the national and landscape-level screening were shared with DFOs to identify and prioritize HCVs (Priority I or II) and to design management interventions based on stakeholder consultations to mitigate threats.

vi. Present results

All the DFOs were encouraged to use these findings to guide land-use planning, conservation strategies, and management actions. The results of the screening process were consulted with relevant stakeholders of Doteng and Tsento Gewog.

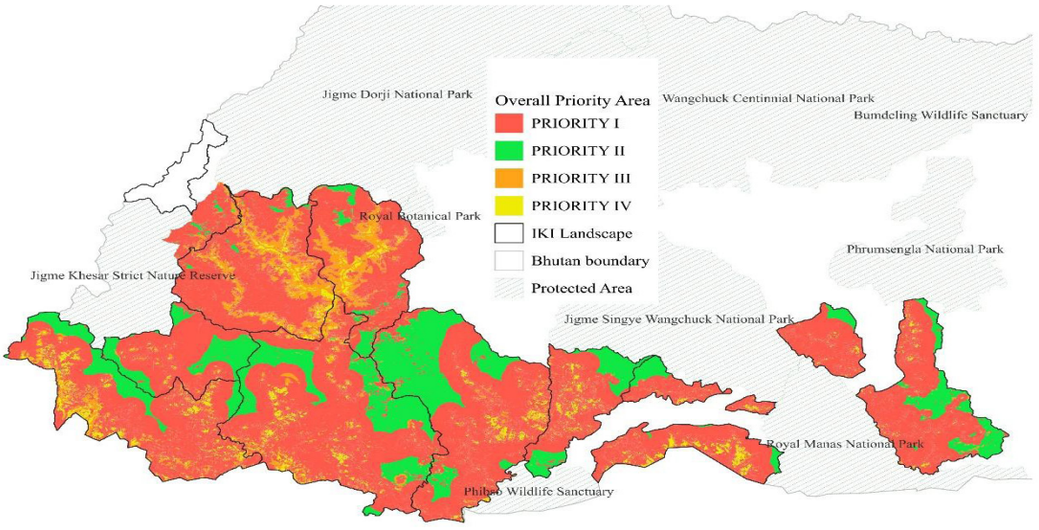


Figure 38: Summary Map of all Priority areas within the IKI Living Landscape

2.9.5. Threats and strategic approach to mitigate the threat

The HCV screening summary for the Landscapes identifies HCV 6 of DFO, Paro as Priority 2, indicating a high likelihood of HCV presence alongside low threats that require preventative action. The identification of the HCVA within the DFO, Paro was based on the following criteria:

- Priority was given to Priority 2 areas, which have a high likelihood of containing HCV.
- Priority 1 areas were not selected due to the extensive coverage of this category within the entire division.

Priority 2 areas were chosen for their manageability in terms of HCV management and monitoring capacity of the Division.

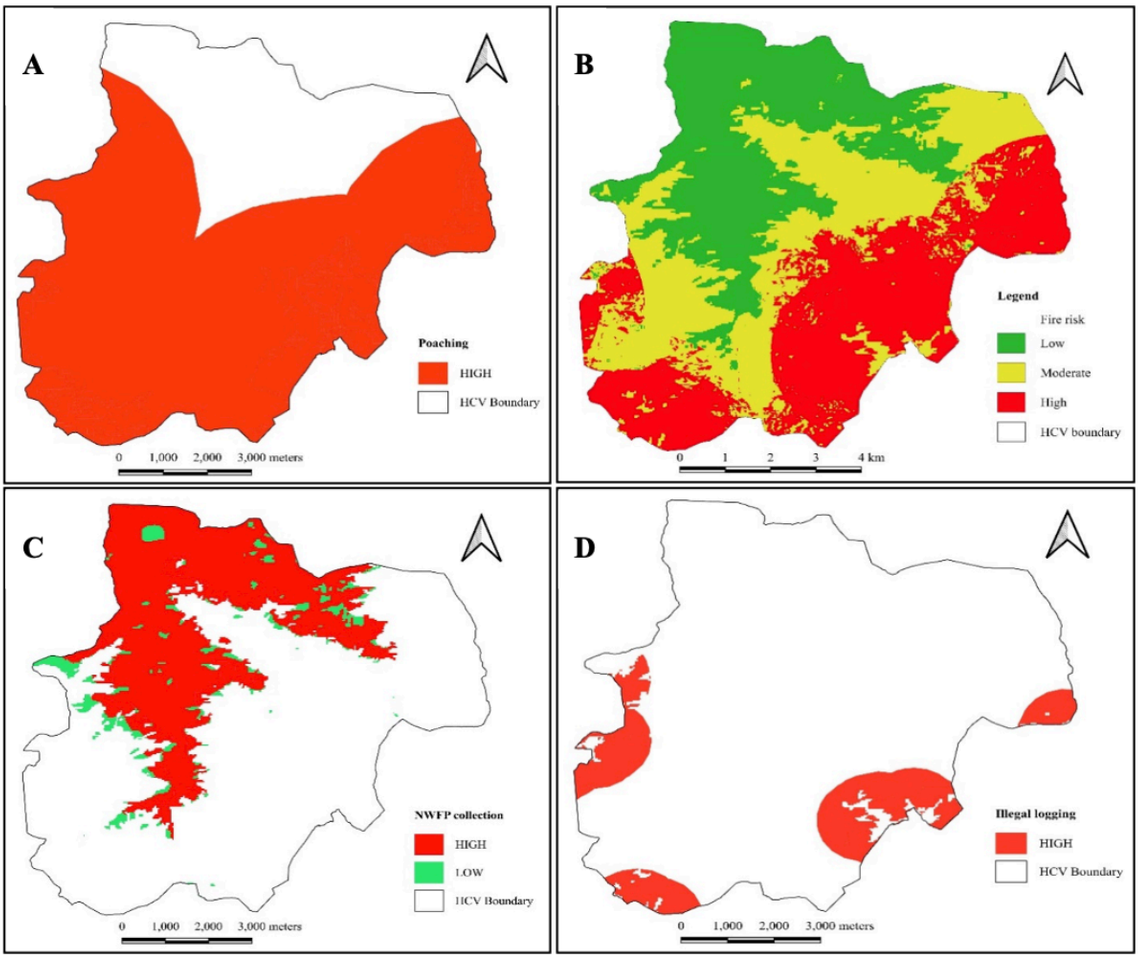


Figure 39: Threats (A) Poaching, (B) Forest fire, (C) NWFP and (D) Illegal logging

The threat analysis, conducted using SMART data, climate data, and other sources during the screening process, highlights four primary threats: illegal logging, NWFP collection, poaching, and forest fires. These threats are both current and emerging, posing potential risks to the conservation of HCV 6. According to the screening summary map based on threats, HCV 6 under DFO Paro also faces challenges from unsustainable fishing, illegal road construction, pest and diseases. However, these threats are considered less significant compared to the four primary threats.

Table 30: The significant threats within HCV6 and its strategic approaches

Sl. No.	Significant Threat	Proposed strategic approach
1	Poaching	*(Sustainable Livelihoods, Surveillance and monitoring; Institutional and Human Resource Capacity, and Awareness and education)* Strengthen surveillance, law enforcement, and capacity, while providing alternative livelihoods and engaging communities.
2	Forest fire	*(Integrated Fire Management, Surveillance and monitoring, Institutional and Human Resource Capacity, and Awareness and education)* Enhance awareness, strengthen surveillance, develop capacity, collaboration and implement effective forest fire management.
3	Over harvesting of NWFP	*(Sustainable Livelihoods, Surveillance and monitoring, Institutional and Human Resource Capacity, and Awareness and education)* Promote sustainable harvesting practices, alternative livelihoods, and capacity building.
4	Illegal logging	*(Sustainable Livelihoods, Surveillance and monitoring, Institutional and Human Resource Capacity, and Awareness and education)* Promote alternative livelihoods through enhancement of eco-tourism and sustainable forestry. Strengthen enforcement through capacity building, awareness and community engagement.

The integration of these strategies into the broader management plan will ensure a holistic approach to mitigating the four primary threats to the area. Strengthening surveillance, law enforcement, and capacity will be a basis of this plan, enabling better monitoring and enforcement across all threats. Alternative livelihoods, such as enhancement of eco-tourism and sustainable forestry, communities will have reduced dependence on harmful practices, while enhancing local economic resilience. Community or local involvement in resource management promotes shared responsibility and strengthens the overall enforcement.

Moreover, promoting sustainable harvesting practices and raising awareness will play a crucial role in addressing overharvesting of NWFPs and minimizing forest fire risks. By educating local communities on responsible harvesting techniques, the management plan will ensure that resource extraction remains within sustainable limits. Strengthening forest fire management, through monitoring, early warning systems, and community preparedness, will help mitigate forest fire threats. These strategies will work in synergy, reinforcing each other to create a cohesive management plan that balances conservation, community well-being, and sustainable resource use across the HCV area.

2.9.6. Management and Monitoring of High Conservation Value Area (HCVA)

The HCVA Management and Monitoring plan follows the Guidelines for Management and Monitoring of High Conservation Value Areas in Bhutan (2024). HCV screening identifies Priority 1 areas as requiring the highest level of response, where significant threats and a high likelihood of HCV presence necessitate active threat reduction using most resources available at the DFO level. For Priority 2 areas, with a high likelihood of HCV presence but lower threats, a preventative approach focuses on mitigating potential future risks. Priority 3 areas, where HCV presence is less likely but threats remain high, require a precautionary response, such as verifying HCV absence before development and enforcing regulations. Priority 4 areas, with low HCV likelihood and minimal threats, do not demand immediate action but may benefit from future habitat restoration efforts.

The management prescriptions for High Conservation Value of DFO at Paro are outlined in Chapter 5, followed by the implementation plan and financial outlay in Chapter 6, and the monitoring and evaluation framework in Chapter 7.

Chapter 3: Threat and Challenges

Threat analysis plays a critical role in the effective management of forests and the promotion of social well-being. By identifying and assessing potential threats, it enables the implementation of proactive measures to safeguard biodiversity and ecosystem services. From a management perspective, it helps prioritize resource allocation, enhance monitoring systems, and support evidence-based decision-making. Furthermore, addressing these threats contributes to the sustainable livelihoods of local communities, ensuring equitable access to forest resources and fostering harmony between conservation efforts and social development.

The existing, emerging and potential threats within the DFO, Paro were identified through socio-economic surveys (SES), climate vulnerability and capacity adaptability (CVCA) surveys, and biodiversity surveys conducted across the Division. In addition, the threats were assessed through consultations with forestry staff stationed at various locations within the jurisdiction of the DFO, Paro. The Division faces numerous threats that significantly hinder efforts to conserve and protect its natural resources and wildlife, while also affecting the livelihoods of local communities. Using the Miradi threat analysis tool 4.5.0, ten threats were identified and assessed. These challenges present notable obstacles to the sustainable management and preservation of the areas. The evaluation classified and prioritized these challenges based on three key dimensions: scope (the geographic range of the threat), severity (the level of impact), and irreversibility (the complexity of recovery if the threat materializes). A four-point absolute scale; Low, Medium, High, and Very High was utilized for scoring. This methodology produced an overall threat rating, with the assessment for DFO, Paro being categorized as high.

One of the most critical threats is pest and disease outbreaks, rated as "Very High". This highlights the importance of addressing health issues within forest ecosystems to ensure their long-term viability. Similarly, illegal logging is another severe threat with a "Very High" impact on forest resilience, as it directly undermines forest resources and biodiversity, contributing to an overall high threat level. Forest fires also represent a substantial risk, particularly affecting the objective of enhancing forest resilience, with a high overall impact. The threat of fires is amplified by factors like climate variability, making proactive fire management essential.

Table 31: The existing threats for each target

Threats \ Targets	Objective 1	Objective 2	Objective 3	Objective 4	Summary Threat Rating
Pest & Diseases	Very High		Medium		High
Illegal logging	Very High			Medium	High
Forest fire	High		High	Medium	High
Habitat fragmentation	Medium	Medium	Low		Medium
Drying watersource	Medium	High	Medium	Low	Medium
Poaching & trade	Medium		Low	Medium	Medium
Waste	Low	Low	Medium	Low	Low
Landslide/Soil erosion	Low			Low	Low
Unsustainable harvesting of NWFP	Low	Medium	Medium	High	Medium
Human-wildlife conflict		High	High	Medium	High
Summary Target Ratings:	Very High	High	High	Medium	**Overall Project Rating** High

Habitat fragmentation poses a "Medium" threat, affecting the connectivity of ecosystems and leading to isolated wildlife populations, which undermines biodiversity conservation efforts. In addition, drying up of water sources is a significant concern, rated "High" for reducing vulnerability, as it impacts water availability for both forests and surrounding communities, creating stress on the ecosystem and reducing resilience. Poaching is rated as a "Medium" threat, posing risks to wildlife populations and conservation efforts aimed at protecting biodiversity.

Unsustainable harvesting of NWFPs also stands as a moderate threat, as unsustainable extraction rates can deplete resources and affect forest productivity. Meanwhile, landslides and soil erosion are rated as "Low" threats, presenting minimal concerns in comparison to other threats but still requiring attention to prevent localized environmental degradation. Waste management is similarly rated as a "Low" priority in the Division, indicating it has a relatively minor impact on forest sustainability. However, human-wildlife conflict (HWC) comes out to be one of the most significant challenges, rated "High" for its impact on both forest resilience and habitat maintenance. HWC poses ongoing challenges for the coexistence of human communities and wildlife, often leading to crop damage, livestock loss and safety concerns, which hinder community support for conservation efforts.

Therefore, overall assessment of threats for DFO, Paro was classified as HIGH. Among the identified threats, pest and diseases, illegal logging, forest fires and human-wildlife conflict are rated high threats and pose challenges. These threats are anticipated to potentially and significantly impact the preservation and sustainable management of wildlife and forest resources, necessitating focused conservation efforts.

3.1. Pest and Diseases

A critical challenge in managing these pests is the lack of knowledge and capacity, stemming from limited understanding and insufficient resources for identification, monitoring, and intervention. This gap hinders timely action and the development of effective, ecologically sound management strategies. A particular concern is the recurrent bark beetle infestations, which have affected 246.28 hectares of forest between 2019 and 2025. Despite efforts such as sanitation operations and pheromone traps, a lack of expertise and proper training hampers these actions.

Pests and diseases are a significant threat to forest health in the Division, as evidenced by the clearance of bark beetle-infested trees across several Forest Management Units (FMUs) and range Offices. Since 2019, a total of 17 incidents related to forest pests and diseases have been reported within the Division, with a notable prevalence of bark beetle infestations affecting tree health and vitality.

In addition to pests, disease transmission poses a significant threat. In 2021, 13 cases of deceased Takin were reported in the Nubri area, and concerns about the spread of "Black Quarter" from livestock to wildlife were raised. Feral dogs were also identified as carriers of diseases like canine distemper and rabies, further endangering wildlife health.

Addressing these challenges requires investing in research, education, and training to improve knowledge and capacity for forest health management. Strengthening resources, technology, and skilled personnel will enable proactive, science-based strategies to combat pests and diseases. In addition, poor sanitation practices and non-scientific harvesting methods contribute to the spread of pests such as bark beetles. Inadequate or inexistence of budget, the disposal of plant material and overharvesting, especially in infested areas, further exacerbates the problem and weakens the overall resilience of the forest ecosystem.

3.2. Illegal Logging

Illegal logging poses a significant threat to the long-term sustainability of forest resources. The FIRMS data from the past five financial years (2020 - 2021 to 2024 - 2025) recorded 507 cases within the Division, with consistently high incidences until 2022 - 2023. However, a notable decline has been observed since 2023 - 2024, largely attributed to intensified and strategically focused SMART patrols in illegal logging prone areas.

Despite the recent decline, the earlier rising trend underscores the persistent challenge of combating illegal logging. Addressing this issue effectively requires sustained enforcement efforts, robust monitoring systems, and active community engagement to ensure the continued protection of forest resources.

3.3. Wildlife Poaching and Illegal Trading

According to SMART data, there have been 41 cases of hunting and 10 cases of illegal fishing. In addition, FIRMS recorded 41 instances of illegal fishing in the past five years. Notably, a tiger skin was confiscated in 2015, while incidents involving the apprehension of one wild boar and one Asiatic black bear occurred in 2019 and 2020, respectively. There are records of apprehension or seizure of *Pterocarpus santalinus* (Red Sandalwood),

Nardostachys jatamansi, Neopicrorhiza scrophulariflora and feather of *Pavo cristatus*. Therefore, rampant poaching of wildlife remains a pressing concern within the Division. The species are often poached either for personal consumption or commercial trade, placing them at significant risk. The widespread use of traps in forest habitats exacerbates the situation, as does the ongoing challenge of unlawful fishing activities. Despite regular patrolling efforts, including long-range and impromptu patrols by the Division staff, the detection and apprehension of offenders continue to pose significant challenges.

3.4. Forest Fire

Since 2014, the Division has recorded 48 forest fire incidents, which have cumulatively destroyed over 2,590 hectares of State Reserved Forest (SRF) land, leading to estimated damages exceeding Nu. 2.5 million. These fires have inflicted significant ecological and economic losses, particularly affecting forest resources, biodiversity and local livelihoods.

In 2023 alone, nine separate fire incidents caused the destruction of more than 790 hectares of SRF land, with most of the affected areas located within the Forest Management Units. The majority of these fires occurred in blue pine-dominated forests, known for their high flammability, especially during the dry season.

While the causes of many fire incidents remain unidentified due to challenges in investigation and reporting, available records indicate that electrical short circuits and the burning of agricultural debris were among the known contributing factors. This trend underscores the urgent need for strengthened fire prevention measures, timely detection and community awareness to mitigate future forest fire risks.

3.5. Human-Wildlife Conflict

Human-wildlife conflict poses a significant threat within the jurisdiction of DFO, Paro, affecting crops and livestock across all 14 Gewogs in Paro and Haa. Crop depredation, mainly by wild pigs, is the most prevalent issue, followed by livestock depredation. Crop losses have totaled Nu. 28.35 million over the last three years, with Naja Gewog experiencing the highest average annual loss per household (Nu. 27,960). For livestock, local breed cattle faced the most predation, primarily from wild dogs, followed by Asiatic black bear and Snow leopard. Tsento Gewog recorded the highest financial loss in livestock depredation (Nu. 22.71 lakhs out of a total Nu. 34.03 lakhs).

Apart from the initiatives from the agricultural sector, the DFO, Paro, carried out rescue over 140 animals, covering various species, including 43 Barking deer, 20 Sambar deer, 10 Asiatic black bear, five Wild pig, four Himalayan monal, and other notable species like the Common leopard, Red Panda and Himalayan Griffon. To mitigate conflict, the Division has supplied five corral fencing set to Nubri community, installed electric fencing of 1.94 km in Tsento Gewog and installed 9.34 km in Bji Gewog. To further address this issue, Dogar and Naja Gewogs have been identified for a detailed assessment using the Conflict to Coexistence (C2C) approach, with the aim of developing an effective HWC management strategy.

3.6. Drying up of Water Sources

The drying up of water sources has emerged as a significant environmental concern, impacting both the ecosystem and the communities dependent on these sources. The recent mapping and assessment exercise revealed that among the 261 water sources surveyed, a considerable 41% (107 sources) are experiencing reduced water discharge levels, with one source already fully dried up. This trend is alarming given the heavy reliance of local communities on these sources for drinking, irrigation, and other purposes, with a substantial portion of the sources used exclusively for drinking (67%).

The drying trend appears to be influenced by a combination of factors. Climate change was identified as a key driver, affecting 18.4% (48 sources) of the drying water sources. Additional pressures, such as logging, increased water demand, and infrastructure development, further exacerbates the problem. Road construction, bark beetle outbreaks, and an uptick in water consumption by nearby households were also highlighted as contributing factors. This water scarcity poses a serious threat to both the biodiversity within the Division and the human populations depending on these resources. Critical species, such as the Royal Bengal tiger, Snow leopard, Red Panda and Takin are part of the region's unique fauna, and the drying up of water sources disrupts their natural habitat.

The trend underscores the need for urgent conservation measures and the development of sustainable water management practices to mitigate the risk of further resource depletion in this ecologically rich region. To address this issue, the DFO, Paro aims to build baseline data that will track the drying trend over time, enabling the identification of underlying causes and informing long-term solutions to conserve the watershed and secure water resources for both wildlife and human communities.

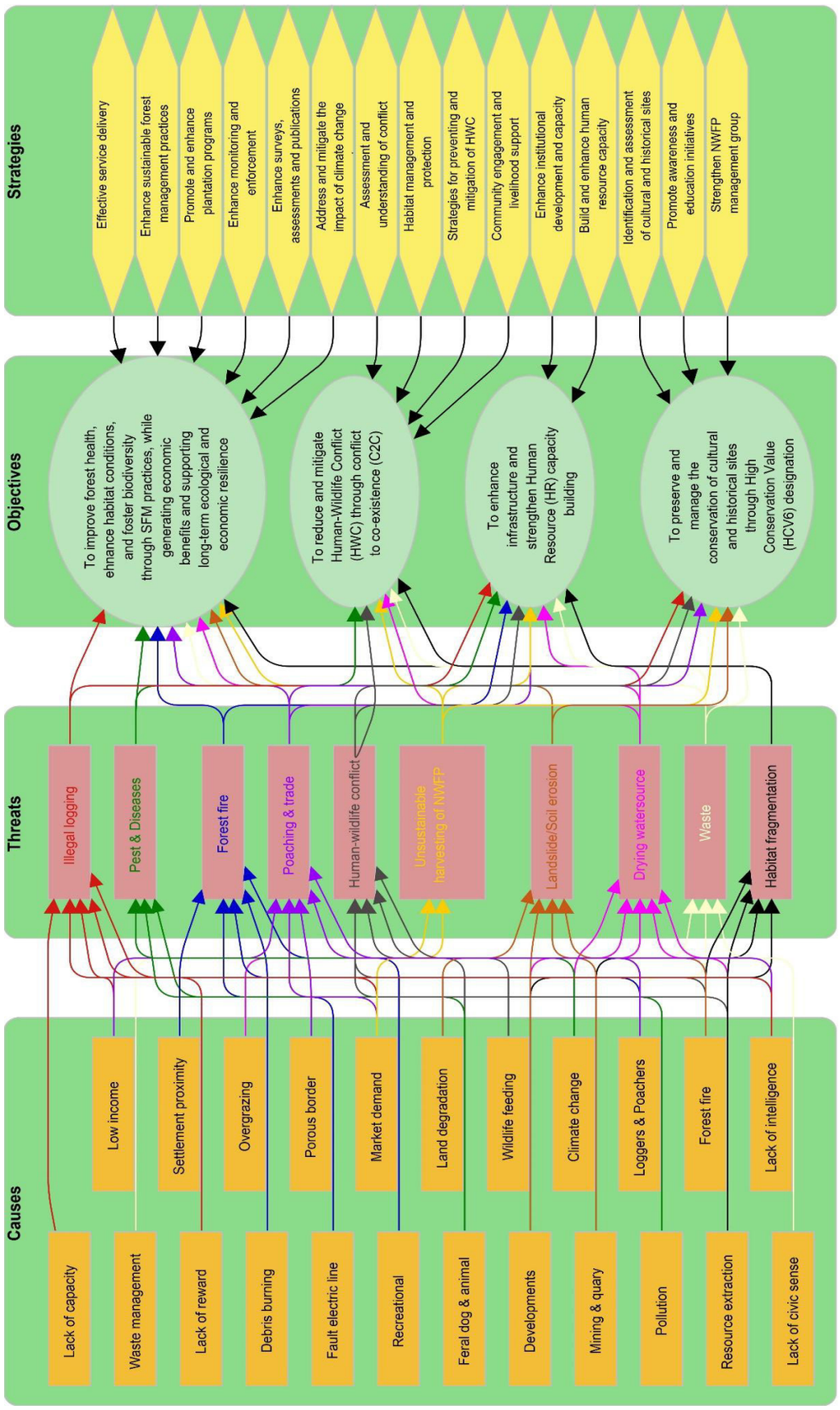


Figure 40: Conceptual framework for management strategies to achieve targets

Chapter 4: Management prescription

The strategies and actions in this management plan are based on the overall goals and objectives to achieve the vision and mission of protecting and to conserve biodiversity while continuing to improve the livelihood of the local people. These strategic actions will try to address the issues, threats, and challenges to overcome the barriers of the conservation objectives set herein.

Total of 84 actions which are detailed below under 14 strategies of four objectives have been identified for implementation in the next 10 years (2026-2035).

4.1. Services

Objectives 1. To improve forest health, enhance habitat conditions and foster biodiversity conservation through nature-based solutions and sustainable forest management practices, while generating economic benefits and supporting long-term ecological and economic resilience.

Strategy 1.1. Effective and efficient public service delivery.

- **Action 1.1.1.** Facilitate public services delivery through issuance of Forestry Clearance for land lease, allocation of kidu land, land substitution and other developmental activities.
- **Action 1.1.2.** Facilitate delivery of public services through Government to Citizen (G2C) and Online Forestry System (OFS) platforms.
- **Action 1.1.3.** Ensure data entry and integration into Forest Information and Resource Management System (FIRMS).

4.2. Technical Prescriptions (Forest and wildlife management)

Objectives 1. To improve forest health, enhance habitat conditions and foster biodiversity conservation through nature-based solutions and sustainable forest management practices, while generating economic benefits and supporting long-term ecological and economic resilience.

Strategy 1.2: Enhance sustainable forest management practices.

- **Action 1.2.1.** Carryout revisions of sustainable forest management plans for Forest Management Units (FMUs).
- **Action 1.2.2.** Revision of Community Forest (CF) management plans to enhance sustainable resource management and community livelihood.

- **Action 1.2.3.** Carry out revisions of Local Forest Management Plans to optimize sustainable forest management and ecological resilience of forest stands.
- **Action 1.2.4.** Carry out revision of management plans for cross-cutting management regimes (Non-Wood Forest Product Management Group) to ensure sustainable resource utilization.
- **Action 1.2.5.** Develop technical guideline for sustainable harvesting of NWFP.
- **Action 1.2.6.** Preparation of annual Operational Plan (OP) of FMUs and DFO Management plan to ensure strategic and effective implementation.
- **Action 1.2.7.** Carryout scientific thinning activities in the identified areas within the Division.
- **Action 1.2.8.** Execute monitoring and evaluation of major area-based and cross cutting management regimes through adoption of technologies such as drone, camera traps, remote sensing alongside the existing M&E frameworks.
- **Action 1.2.9.** Conduct mid-term and final Bhutan METT+ assessment to evaluate and strengthen the Division's management effectiveness.

Strategy 1.3: Promote and enhance plantation programs.

- **Action 1.3.1.** Initiate plantation programs in degraded areas through community-driven initiatives, focusing on native and economically valuable species.
- **Action 1.3.2.** Maintenance and enhancement of the existing forestry nursery at Shaba to ensure its productivity.

Strategy 1.4: Strengthen surveillance and enforcement.

- **Action 1.4.1.** Conduct SMART patrols to detect and deter illegal activities.
- **Action 1.4.2.** Procurement of advanced surveillance drone equipped with high-resolution and thermal imaging capabilities for enhanced monitoring and surveillance of illegal activities.
- **Action 1.4.3.** Conduct Drone surveillance on bi-monthly basis.
- **Action 1.4.4.** Conduct systematic highland surveillance and targeted patrolling for Ophiocordyceps sinensis to ensure effective and sustainable collections.
- **Action 1.4.5.** Procure SIM enabled Closed Circuit Television (CCTV) camera for advanced SMART patrolling operations.
- **Action 1.4.6.** Conduct awareness on the Forestry legal framework in the illegal hotspot areas (Poaching, logging, fishing, encroachment, NWFP and forest fire).

Strategy 1.5: Enhance surveys, assessments and publications related to biodiversity conservation and ecosystem services.

- **Action 1.5.1.** Implement systematic monitoring and assessment of forest pests and diseases.
- **Action 1.5.2.** Conduct assessments and systematic surveys of wild flora for comprehensive documentation.
- **Action 1.5.3.** Execute comprehensive assessments and surveys of wild fauna for precise documentation.
- **Action 1.5.4.** Perform comprehensive hotspot mapping of fire-prone areas to facilitate forest fire management and enhance prevention strategies.
- **Action 1.5.5.** Identify habitat containing essential features for wildlife conservation.
- **Action 1.5.6.** Conduct biodiversity assessment (Biodiversity Monitoring Grid) in the identified permanent monitoring grid.
- **Action 1.5.7.** Determine the population of Snow leopard and its prey as a part of the Nation-wide Snow Leopard Survey using structured, grid-based camera trap surveys.
- **Action 1.5.8.** Determine the population or abundance of Musk Deer as a part of the nationwide survey.
- **Action 1.5.9.** Conduct eDNA survey as a part of the nationwide eDNA survey.
- **Action 1.5.10.** Conduct Takin Survey as a part of the nationwide survey to determine the population estimate of Bhutan Takin.
- **Action 1.5.11.** Carry out tiger population survey as a part of the nationwide tiger population revalidation surveys every five years.
- **Action 1.5.12.** Conduct National Forest Inventory as a part of nationwide inventory on forest coverage and carbon stock.
- **Action 1.5.13.** Conduct comprehensive assessment on aquatic diversity for précised documentation (Haa Chu and Pa-Chhu).

Strategy 1.6: Implement Nature-based Solutions to enhance ecosystem resilience and address the adverse impacts of climate change events.

- **Action 1.6.1.** Implement targeted awareness campaigns to educate local communities and stakeholders on preventative measures for forest fire mitigation.
- **Action 1.6.2.** Conduct training to local communities and forestry staff, focused on post-fire management techniques to enhance community resilience.
- **Action 1.6.3.** Propose procurement of high-payload drones to support carrying essential firefighting equipment, integrated with surveillance capabilities for effective forest fire detection and management.
- **Action 1.6.4.** Strengthen collaboration, resource integration and unified response protocols of the Inter-agency Forest Fire Coordination Group (IFFCG).

- **Action 1.6.5.** Facilitate procurement and distribution of forest fire-fighting equipment to IFFCG members, field offices, local communities and stakeholders ensuring enhanced operational readiness.
- **Action 1.6.6.** Conduct comprehensive assessment and spatial delineation of water sources and spring shed in collaboration with the Water Department.
- **Action 1.6.7.** Intimate with water department on initiation of revival programs for drying spring-sheds and water sources.
- **Action 1.6.8.** Carryout surveys and assessment of invasive species in the forest area and within the settlements.

Objective 2. To reduce and mitigate human-wildlife conflict through Conflict to Co-existence (C2C) strategies

Strategy 2.1: Assessment and understanding of conflict.

- **Action 2.1.1.** Undertake socio-economic survey to evaluate the impact of human-wildlife conflict (HWC) and to examine the adaptive strategies employed.
- **Action 2.1.2.** Identify and develop Conflict-to-Coexistence (C2C) strategy aimed at mitigating human-wildlife conflicts and fostering sustainable harmony between communities and wildlife populations.
- **Action 2.1.3.** Carryout comprehensive assessment of HWC status (C2C strategies) implemented in the two identified hotspot Gewogs (Dogar and Naja).

Strategy 2.2: Sustainable conservation and adaptive management of natural habitats.

- **Action 2.2.1.** Enhancement and maintenance of existing natural waterholes to support ecological balance and promote biodiversity conservation.
- **Action 2.2.2.** Implement community-driven awareness and action campaigns on sustainable waste management practices.

Strategy 2.3: Strategies for preventing and mitigating human-wildlife conflict (HWC).

- **Action 2.3.1.** Strengthen and enhance capabilities of the existing quick response team of local communities to ensure heightened efficiency and effectiveness.
- **Action 2.3.2.** Enhance the operational capacity and responsiveness of forestry rapid response team.
- **Action 2.3.3.** Facilitate procurement of equipment (Projectile syringe gun and accessories) ensure that the QRT is comprehensively equipped with all necessary tools and resources in the field offices.
- **Action 2.3.4.** Support and facilitate corral fencing to protect livestock and enhance the livelihoods of migrating and highland communities.

4.3 Institutions (Human Resources and Infra-structures)

Objective 3: To strengthen infrastructure and Human Resource capacity building for the conservation

Strategy 3.1: Build and enhance human resource capacity.

- **Action 3.1.1.** Conduct training on OFS, FIRMS, BIRMS, GIS, Remote Sensing, G2C platforms, SMART patrolling and SDSS to enhance the technical capacity and digital proficiency of forestry personnel.
- **Action 3.1.2.** Organize refresher training program focused on the uniform code of conduct and proficient handling of arms.
- **Action 3.1.3.** Conduct training on book-keeping for CFMG and NWFPMG members, focusing on effective management practices.
- **Action 3.1.4.** Strengthen staff capacity through targeted training in diverse areas (Drone operation, resource assessment, crime investigation, forest pest and diseases and forest equipment handling).
- **Action 3.1.5.** Conduct training on the preparation of annual Operational Plans (OP) and management plans of different management regimes, emphasizing on strategic planning, documentation and effective implementation.

Strategy 3.2: Enhance institutional development and capacity.

- **Action 3.2.1.** Construction and site development of the Haa Range Office and Forest Management Unit (FMU) office facilities.
- **Action 3.2.2.** Construction and site development of Bitekha Forest Management Unit Office facilities at Naja Gewog.
- **Action 3.2.3.** Construction and site development of Dawakha Forest Beat Office at Dogar Gewog.
- **Action 3.2.4.** Undertake maintenance and renovation of the Division Office, Range Offices, Forest Management Unit (FMU) Offices, Jewphu and Haa Check Posts, including essential upgrades to the Wildlife Rescue Center at Shaba.
- **Action 3.2.5.** Procure high-specification laptops, computers and tablets to establish a robust data repository to enhance the efficiency and quality of service delivery.
- **Action 3.2.6.** Procurement of DCM Truck (Transportation of seized timber, fire-fighting, patrolling etc.,).
- **Action 3.2.7.** Provision for fuel and maintenance of office vehicles (DCM Truck, Hilux, and bikes) to ensure efficient mobility and support field operations.
- **Action 3.2.8.** Facilitate procurement of field gear, tents, utensil and first aid kits to support field personnel during extended patrolling operations.
- **Action 3.2.9.** Facilitate procurement and installation of CCTV cameras to enhance office surveillance and security monitoring.

- **Action 3.2.10.** Procurement of essential field equipment (Hypsometer, Densometer, Diameter tape, Digital caliper, GPS) to ensure accuracy and efficient field data collections.
- **Action 3.2.11.** Enhance and improve communication efficiency in remote work places through facilitating procurement of handsets and enhancement of antenna systems.
- **Action 3.2.12.** Enhancement and maintenance of the repeater station at Chelela to strengthen communication networks.
- **Action 3.2.13.** Upgradation and enhancement of forest check-post facilities and amenities to strengthen infrastructure and improve service delivery.

Objectives 4: To manage, preserve and conserve significant cultural and historical sites through designation of High Conservation Value Area (HCV6) in the Division.

Strategy 4.1: Conservation and sustainable promotion of both cultural and biological heritage, encompassing the preservation of diverse flora, fauna and associated natural ecosystems.

- **Action 4.1.1.** Mapping and documentation of sites with cultural, historical and spiritual significance.
- **Action 4.1.2.** Conduct systematic floral survey to generate precise and comprehensive documentation of the floral diversity.
- **Action 4.1.3.** Carryout fauna survey to produce precise and comprehensive documentation of faunal diversity.
- **Action 4.1.4.** Assessment and mapping of water sources and spring-shed.
- **Action 4.1.5.** Creation and monitoring of Fireline around the Lhakhangs.

Strategy 4.2: Promotion of environmental education and adoption of sustainable resource management practices.

- **Action 4.2.1.** Installation of signage at the designated sites.
- **Action 4.2.2.** Raise awareness on the importance of cultural and historical sites (school children and local communities).
- **Action 4.2.3.** Conduct waste management awareness and education programs.
- **Action 4.2.4.** Provide awareness and training on sustainable harvesting of NWFP to Drakey Chinto Ngomoen Tshogpa.
- **Action 4.2.5.** Provide training on Online Forestry Services to forest officials and local communities.
- **Action 4.2.6.** Sensitization of local communities on HCV area.

Strategy 4.3: Strengthening environmental safeguarding mechanisms through monitoring, adaptive management approaches and continuous capacity enhancement.

- **Action 4.3.1.** Forest fire risk assessment and recommendations for preventive and remedial measures.
- **Action 4.3.2.** Conduct long-range SMART patrolling (anti-snaring surveillance) in the illegal and poaching prone area.
- **Action 4.3.3.** Installation of surveillance devices at the poaching and illegal prone area.
- **Action 4.3.4.** Monitoring and Evaluation of HCV area.
- **Action 4.3.5.** Heritage-focused international study exchanges for advancing conservation and preservation of cultural and natural assets.

4.4. Gender Mainstreaming

Gender mainstreaming involves examining the roles and relationships between genders in various aspects of conservation, including policy-making, research, resource management, access to resources, division of labor, socio-cultural gender perception, and community engagement. All DFOs understands that this approach recognizes that gender dynamics influence how individuals interact with their environment, access resources, and participate in decision-making processes. As such, integrating gender considerations into conservation efforts is a fundamental step toward achieving equitable and sustainable outcomes of the DFO management plan.

The"Gender Analysis, Gender Mainstreaming Strategy and Gender Action Plan"2019 has indicated that in order to mainstream gender into the DFO management plans, adequate budget allocation is needed (indicative budget in relation to gender mainstreaming is provided in the Gender Action Plan). The report recommends the need to involve women's organization both at national and local level to enhance gender mainstreaming, building capacity of project team, enhancing skill development at local level for nature-based product diversification, identification of alternative livelihood and incentives for participation and support to CFMG. Integrating the above recommendations within the overall structure of the DFO management plan is supposed to ensure gender aspects are addressed.

In addition, the following are some important outcomes that are generally accepted if gender integration, specifically women are considered:

- **Diverse Knowledge and Perspectives:** Women and men often possess distinct knowledge about local ecosystems, resources, and species. Incorporating this diverse knowledge can lead to more comprehensive and accurate conservation strategies. Therefore, women participation would be considered of outmost significance when planning and implementing biodiversity action plans.
- **Resource Management:** Women frequently play key roles in natural resource management, including agriculture, water collection, and fuelwood collection. As a result, women involvement in the management of forest resources in the CF and SRF would be encouraged.

- **Empowerment:** The Division shall empower women by providing them with opportunities to actively engage in decision-making processes related to conservation and land management.
- **Equitable Benefits:** Ensure gender equity in conservation initiatives and promotes fair distribution of benefits and resources, preventing potential gender-based disparities.

Table 32: Activities related to inclusion of gender mainstreaming

Activity	Details
Stakeholder Consultations and Decision-Making	Ensure both men and women are provided with equitable opportunities to participate in consultations and decision-making during management planning, implementation, and evaluation.
Training Programs for Staff	Provide gender-responsive training programs for staff on various topics such as GIS application, field botanization, enterprise development, and SMART technologies.
Awareness Campaigns on Biological Corridor and High Conservation Value Areas (HCVAs)	Conduct awareness campaigns that address the diverse needs and contributions of women, men, and youth.
Management of Community Forests and Local Forest Management Areas	Ensure that the planning, establishment, and management of community forests and local forest management areas include gender considerations. This includes the translation of management plans into local languages and engaging local communities in sustainable practices.
Implementation of Plantations	Include women in the selection of barren areas for plantations and maintenance activities.
Protection and Restoration of Ecosystem Services	Involve both men and women in the restoration of waterholes, and management of watershed (PES).
Revenue Generation from Forestry Resources	Ensure that women have access to opportunities for generating revenue through timber allotment, other forestry services, and NWFP collections.
Human-Wildlife Conflict Management	Include both men and women in awareness and advocacy programs on conflict to coexistence strategies, and involve them in the establishment of wildlife rescue and rehabilitation activities.

4.5. Environmental and Social Safeguards (ESS)

An Environmental and Social Safeguard (ESS) assessment will be conducted to identify actions that could lead to negative environmental or social outcomes. Plans will be formulated to prevent, lessen, or control these impacts. The application and success of these mitigation efforts will be regularly reviewed, with any issues arising during management plan execution swiftly managed. ESS factors have been embedded into both the planning and execution stages of the management guidelines. This process will follow the framework set by the Department of Forests and Park Services (DoFPS), ensuring comprehensive oversight throughout.

Table 33: Various activities categorized and proposed strategies

Categories	Activity	Proposed Mitigation Strategies
Management of Forests with Sustainable Practices for Biodiversity Conservation and Ecosystem Services	Logging and timber harvesting	Implement sustainable logging practices, enforce legal compliance, reforestation and afforestation efforts, monitor logging activities
Protect the Integrity of Biological Corridor and High Conservation Value Areas (HCVAs)	Human intrusions and disturbance (e.g., unmanaged ecotourism, construction, artificial watering points, dams)	Develop ecotourism guidelines, regulate visitor access, use eco-friendly construction methods, minimize habitat disruption, monitor human activities
Address Climate Change	Natural system modifications (e.g., fire and fire suppression, dams, hydrological modifications, water management/use)	Implement controlled burns, establish firebreaks, conduct impact assessments for dams, promote sustainable water management practices
Control Invasive and Problematic Species and Genes	Invasive non-native/ alien plants, animals, freshwater fish, pathogens	Conduct regular monitoring, implement eradication programs, promote native species, develop quarantine measures
Pollution Control	Pollution (e.g., household sewage, urban wastewater, industrial effluents, mining effluents, military effluents, agricultural and forestry effluents, garbage, solid waste, air-borne pollutants, excess energy)	Establish waste management systems, enforce pollution control regulations, promote recycling and waste reduction, monitor pollution levels, develop pollution response plans

Adapt to Climate Change and Severe Weather	Habitat shifting and alteration, droughts, temperature extremes, storms, flooding	Develop climate adaptation strategies, enhance habitat resilience, implement water conservation measures, develop early warning systems, promote community awareness
Preserve Cultural and Social Heritage	Loss of cultural links, traditional knowledge, and management practices; natural deterioration of cultural site values; destruction of cultural heritage buildings, gardens, sites	Preserve cultural heritage sites, promote traditional knowledge and practice, engage local communities in conservation efforts, develop restoration programs, enforce heritage protection regulations

Chapter 5: Implementation Plan and Financial Outlay

5.1. Implementation plan and financial outlay for DFO management plan

Table 34: Implementation plan and financial outlay for the DFO, Paro

Objective	Strategy	Action	Yearly along with budget outlay (Nu. In million)									
		1. Services	I	II	III	IV	V	VI	VII	VIII	IX	X
1. To improve forest health, enhance habitat conditions, and foster biodiversity conservation through nature-based solutions and sustainable forest management practices, while generating economic benefits and supporting long-term ecological and economic resilience.	1.1. Effective and efficient public service delivery											

		1.1.1. Facilitate public services delivery through issuance of Forestry Clearance for land lease, allocation of kidu land, land substitution and other developmental activities.	0.700	0.700	0.700	0.700	0.700	0.800	0.800	0.800	0.800	0.800
		1.1.2. Facilitate delivery of public services through Government to Citizen (G2C) and Online Forestry System (OFS) platforms.	0.300	0.300	0.300	0.300	0.300	0.400	0.400	0.400	0.400	0.400
		1.1.3. Ensure data entry and integration into Forest Information and Resource Management System (FIRMS).	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	1.2. Enhance sustainable forest management practices	2. Technical Prescription (forest and wildlife management)										
		1.2.1. Carryout revisions of sustainable forest management plans for Forest Management Units (FMUs).	2.000	0.000	0.500	0.500	1.500	0.000	0.000	0.00	0.00	3.000
		1.2.2. Revision of Community Forest (CF) management plans to enhance sustainable resource management and community livelihoods.	0.600	0.900	0.540	0.000	0.240	0.180	0.120	0.060	0.000	0.180
		1.2.3. Carry out revisions of Local Forest Management Plans to optimize sustainable forest management and ecological resilience of forest stands.	0.000	0.600	0.300	0.000	0.000	0.000	1.500	0.000	0.000	0.000

		1.2.4. Carry out revision of management plans for cross-cutting management regimes (Non-Wood Forest Product Management Group) to ensure sustainable resource utilization.	0.300	0.000	0.000	0.000	0.400	0.000	0.000	0.000	0.500	0.000
		1.2.5. Develop technical guidelines for sustainable harvesting of NWFP.	0.000	0.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		1.2.6. Preparation of annual Operational Plan (OP) of FMUs and DFO Management plan to ensure strategic and effective implementation.	1.000	1.000	1.000	1.000	1.000	1.300	1.300	1.300	1.300	1.300
		1.2.7. Carry out scientific thinning activities in the identified areas within the Division.	0.000	0.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		1.2.8. Execute monitoring and evaluation of major area-based and cross cutting management regimes through adoption of technologies such as drone, camera traps, remote sensing alongside the existing M&E frameworks.	1.000	1.000	1.000	1.000	1.000	1.200	1.200	1.200	1.200	1.200
		1.2.9. Conduct mid-term and final Bhutan METT+ assessment to evaluate and strengthen the Division's management effectiveness.	0.000	0.100	0.000	0.000	0.000	0.150	0.000	0.000	0.000	0.100

	1.3. Promote and enhance plantation programs	1.3.1. Initiate plantation programs in degraded areas through community-driven initiatives, focusing on native and economically valuable species.	0.700	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250	0.250
		1.3.2. Maintenance and enhancement of the existing forestry nursery at Shaba to ensure its productivity.	0.100	0.100	0.100	0.100	0.100	0.120	0.120	0.120	0.120	0.120
	1.4. Strengthen surveillance and enforcement	1.4.1. Conduct SMART patrols to detect and deter illegal activities.	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600	0.600
		1.4.2. Procurement of advanced surveillance drone equipped with high-resolution and thermal imaging capabilities for enhanced monitoring and surveillance of illegal activities	0.000	0.000	1.700	0.000	0.000	0.000	1.700	0.000	0.000	0.000
		1.4.3. Conduct Drone surveillance on bi-monthly basis	0.040	0.040	0.040	0.040	0.040	0.060	0.060	0.060	0.060	0.060
		1.4.4. Conduct systematic highland surveillance and targeted patrolling for Ophiocordyceps sinensis to ensure effective and sustainable collections.	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
		1.4.5. Procure SIM enabled Closed Circuit Television (CCTV) camera for advanced SMART patrolling operations.	0.000	0.300	0.300	0.000	0.000	0.000	0.000	0.300	0.300	0.000

		1.4.6. Conduct awareness on the Forestry legal framework in the illegal hotspot areas (Poaching, logging, fishing, encroachment, NWFP and forest fire).	0.000	0.000	0.200	0.000	0.300	0.000	0.000	0.300	0.000	0.000
	1.5. Enhance surveys, assessments and publications related to biodiversity conservation and ecosystem services	1.5.1. Implement systematic monitoring and assessment of forest pests and diseases.	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
		1.5.2. Conduct assessments and systematic surveys of wild flora for comprehensive documentation.	0.000	0.000	0.000	0.000	0.800	0.000	0.000	0.000	0.000	0.900
		1.5.3. Execute comprehensive assessments and surveys of wild fauna for precise documentation.	0.000	0.000	0.000	0.000	0.700	0.000	0.000	0.000	0.000	0.800
		1.5.4. Perform comprehensive hotspot mapping of fire-prone areas to facilitate forest fire management and enhance prevention strategies.	0.000	0.000	0.200	0.000	0.000	0.000	0.000	0.400	0.000	0.000
		1.5.5. Identify habitat containing essential features for wildlife conservation.	0.000	0.300	0.000	0.000	0.000	0.000	0.000	0.000	0.400	0.000
		1.5.6. Conduct biodiversity assessment (Biodiversity Monitoring Grid) in the identified permanent monitoring grid.	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060

		1.5.7. Determine the population of Snow leopard and its prey as a part of the Nation-wide Snow Leopard Survey using structured, grid-based camera trap surveys.	0.000	0.000	2.500	0.000	0.000	0.000	0.000	2.500	0.000	0.000
		1.5.8. Determine the population or abundance of Musk Deer as a part of the nationwide survey	0.365	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		1.5.9. Conduct eDNA survey as a part of the nationwide eDNA survey.	0.225	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		1.5.10. Conduct Takin Survey as a part of the nationwide survey to determine the population estimate of Bhutan Takin.	0.800	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		1.5.11. Carry out tiger population survey as a part of the nationwide tiger population revalidation surveys every five years.	0.000	1.250	0.000	0.000	0.000	0.000	1.450	0.000	0.000	0.000
		1.5.12. Conduct National Forest Inventory as a part of nationwide inventory on forest coverage and carbon stock.	0.000	0.000	0.000	0.000	0.000	0.000	4.050	0.000	0.000	0.000
		1.5.13. Conduct comprehensive assessment on aquatic diversity for precise documentation (Hachhu and Pachhu).	0.000	0.000	0.800	0.000	0.000	0.000	0.000	0.900	0.000	0.000

	1.6. Implement Nature-based Solutions to enhance ecosystem resilience and address the adverse impacts of climate change events.	1.6.1. Implement targeted awareness campaigns to educate local communities and stakeholders on preventative measures for forest fire mitigation.	0.000	0.000	0.300	0.000	0.000	0.000	0.300	0.000	0.000	0.000
		1.6.2. Conduct training to local communities and forestry staff, focused on post-fire management techniques to enhance community resilience.	0.000	0.000	0.000	0.500	0.000	0.000	0.000	0.000	0.600	0.000
		1.6.3. Propose procurement of high-payload drones to support carrying essential firefighting equipment, integrated with surveillance capabilities for effective forest fire detection and management.	0.000	0.000	3.000	0.000	0.000	0.000	0.000	3.000	0.000	0.000
		1.6.4. Strengthen collaboration, resource integration and unified response protocols of the Inter-agency Forest Fire Coordination Group (IFFCG).	0.100	0.000	0.300	0.000	0.100	0.000	0.300	0.000	0.100	0.000
		1.6.5. Facilitate procurement and distribution of forest fire-fighting equipment to IFFCG members, field offices, local communities and stakeholders ensuring enhanced operational readiness.	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500

		1.6.6. Conduct comprehensive assessment and spatial delineation of water sources and spring shed in collaboration with the Water Department.	0.000	0.600	0.000	0.000	0.600	0.000	0.000	0.600	0.000	0.000
		1.6.7. Intimate with the water department on initiation of revival programs for drying spring-sheds and water sources.	0.000	0.100	0.000	0.000	0.100	0.000	0.000	0.100	0.000	0.000
		1.6.8. Carryout surveys and assessment of invasive species in the forest area and within the settlements.	0.000	0.000	0.000	0.650	0.000	0.000	0.000	0.000	0.700	0.000
2. To reduce and mitigate human-wildlife conflict through conflict to co-existence (C2C) strategies	2.1. Assessment and understanding of conflict	2.1.1. Undertake socio-economic survey to evaluate the impact of human-wildlife conflict (HWC) and to examine the adaptive strategies employed.	0.000	0.000	0.500	0.000	0.000	0.000	0.000	0.600	0.000	0.000
		2.1.2. Identify and develop Conflict-to-Coexistence (C2C) strategy aimed at mitigating human-wildlife conflicts and fostering sustainable harmony between communities and wildlife populations.	0.000	0.000	0.800	1.200	0.800	0.000	0.000	0.000	0.000	0.000
		2.1.3. Carryout comprehensive assessment of HWC status (C2C strategies) implemented in the two identified hotspot Gewogs (Dogar and Naja).	0.000	0.200	0.000	0.000	0.000	0.000	0.400	0.000	0.000	0.000

	2.2. Sustainable conservation and adaptive management of natural habitats	2.2.1. Enhancement and maintenance of existing natural waterholes to support ecological balance and promote biodiversity conservation.	0.000	0.400	0.000	0.000	0.500	0.000	0.000	0.600	0.000	0.000
		2.2.2. Implement community-driven awareness and action campaigns on sustainable waste management practices.	0.100	0.300	0.100	0.100	0.100	0.350	0.100	0.100	0.100	0.350
	2.3. Strategies for preventing and mitigating human-wildlife conflict (HWC)	2.3.1. Strengthen and enhance capabilities of the existing quick response team of local communities to ensure heightened efficiency and effectiveness.	0.000	0.800	0.000	0.000	0.000	0.000	0.800	0.000	0.000	0.000
		2.3.2. Enhance the operational capacity and responsiveness of the forestry rapid response team.	0.200	0.000	0.200	0.000	0.200	0.000	0.200	0.000	0.200	0.000
		2.3.3. Facilitate procurement of equipment (Projectile syringe gun and accessories) ensure that the QRT is comprehensively equipped with all necessary tools and resources in the field offices.	0.000	0.800	0.000	0.000	0.000	1.200	0.000	0.000	0.000	0.000
		2.3.4. Support and facilitate corral fencing to protect livestock and enhance the livelihoods of migrating and highland communities.	0.000	1.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

3. To strengthen infrastructure and human resource capacity building for the conservation	3.1. Build and enhance human resource capacity	Institution (Human Resource and Infrastructure)										
		3.1.1. Conduct training on OFS, FIRMS, BIRMS, GIS, Remote Sensing, G2C platforms, SMART patrolling and SDSS to enhance the technical capacity and digital proficiency of forestry personnel.	0.300	0.000	0.300	0.000	0.350	0.000	0.350	0.000	0.400	0.000
		3.1.2. Organize refresher training programs focused on the uniform code of conduct and proficient handling of arms.	0.300	0.000	0.300	0.000	0.300	0.000	0.400	0.000	0.400	0.000
		3.1.3. Conduct training on book-keeping for CFMG and NWFPMG members, focusing on effective management practices.	0.000	0.000	0.600	0.000	0.000	0.600	0.000	0.000	0.600	0.000
		3.1.4. Strengthen staff capacity through targeted training in diverse areas (Drone operation, resource assessment, crime investigation, forest pest and diseases and forest equipment handling).	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500	0.000	0.500
		3.1.5. Conduct training on the preparation of annual Operational Plans (OP) and management plans of different management regimes, emphasizing on strategic planning, documentation and effective implementation.	0.300	0.000	0.000	0.300	0.000	0.000	0.400	0.000	0.000	0.400

	3.2. Enhance institutional development and capacity	3.2.1. Construction and site development of the Haa Range Office and Forest Management Unit (FMU) office facilities.	10.000	0.000	0.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		3.2.2. Construction and site development of Bitekha Forest Management Unit Office facilities at Naja Gewog.	0.000	0.000	15.000	0.000	0.200	0.000	0.000	0.000	0.000	0.000
		3.2.3. Construction and site development of Dawakha Forest Beat Office at Dogar Gewog.	0.000	15.000	0.000	0.200	0.000	0.000	0.000	0.000	0.000	0.000
		3.2.4. Undertake maintenance and renovation of the Division Office, Range Offices, Forest Management Unit (FMU) Offices, Jewphu and Haa Check Posts, including essential upgrades to the Wildlife Rescue Center at Shaba.	0.000	0.300	0.000	0.400	0.000	0.500	0.000	0.600	0.000	0.600
		3.2.5. Procure high-specification laptops, computers and tablets to establish a robust data repository to enhance the efficiency and quality of service delivery.	0.000	0.500	0.000	0.500	0.000	0.000	0.550	0.000	0.600	0.000
		3.2.6. Procurement of DCM Truck (Transportation of seized timber, fire-fighting, patrolling etc.,).	0.000	3.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		3.2.7. Provision for fuel and maintenance of office vehicles (DCM Truck, Hilux, and bikes) to ensure efficient mobility and support field operations.	0.450	0.500	0.500	0.500	0.500	0.600	0.600	0.600	0.600	0.600

		3.2.8. Facilitate procurement of field gear, tents, utensil and first aid kits to support field personnel during extended patrolling operations.	0.000	0.250	0.000	0.000	0.300	0.000	0.000	0.250	0.000	0.300
		3.2.9. Facilitate procurement and installation of CCTV cameras to enhance office surveillance and security monitoring.	0.000	0.100	0.000	0.100	0.000	0.100	0.000	0.000	0.000	0.000
		3.2.10. Procurement of essential field equipment (Hypsometer, Densometer, Diameter tape, Digital caliper, GPS) to ensure accuracy and efficient field data collections.	0.000	1.500	0.000	0.000	0.000	1.500	0.000	0.000	0.000	0.000
		3.2.11. Enhance and improve communication efficiency in remote work places through facilitating procurement of handsets and enhancement of antenna systems.	0.000	0.600	0.000	0.000	0.000	0.300	0.000	0.250	0.000	0.000
		3.2.12. Enhancement and maintenance of the repeater station at Chelela to strengthen communication networks.	0.800	0.000	0.100	0.000	0.000	0.100	0.000	0.000	0.100	0.000
		3.2.13. Upgradation and enhancement of forest check-post facilities and amenities to strengthen infrastructure and improve service delivery.	0.000	0.450	0.000	0.000	0.300	0.000	0.000	0.400	0.000	0.000
Total			**21.940**	**36.700**	**34.490**	**10.600**	**12.940**	**11.970**	**18.610**	**17.950**	**10.990**	**13.620**

5.2. Implementation Plan and Financial Outlay for High Conservation Value Area

Table 35: Implementation plan and financial outlay for HCV 6

Strategy	Outcome	Outputs	Activity	Location	Time Frame	Budget (Nu. In million)
4.1. Conservation and sustainable promotion of both cultural and biological heritage, encompassing the preservation of diverse flora, fauna and associated natural ecosystems	Increased knowledge base of important cultural and historical areas.	Documented list and maps of significant sites.	4.1.1. Mapping and documentation of sites with cultural, historical and spiritual significance.	HCV area	Year 1 and Year 2	0.50
	Improved understanding of biodiversity in the area.	Baseline data on local floral species within HCV area.	4.1.2. Conduct systematic floral survey to generate precise and comprehensive documentation of the floral diversity.	HCV area	Year 2 and Year 3	0.70
		Baseline data on local wildlife species within HCV area.	4.1.3. Carryout fauna survey to produce precise and comprehensive documentation of faunal diversity.	HCV area	Year 2 and Year 3	0.70
	Better understanding of water availability and potential for water management.	Mapped water sources and identified spring-shed areas.	4.1.4. Assessment and mapping of water sources and spring-shed.	HCV area	Year 2 and Year 3	0.80
	Reduced risk of fire damage to important religious structures.	Fireline created and monitored around Lhakhangs.	4.1.5. Creation and monitoring of Fireline around the Lhakhangs.	HCV area	Year 1 to Year 10	1.00
4.2. Promotion of environmental education and adoption of sustainable resource management practices	Improved navigation and information dissemination for visitors and locals.	Signages installed at relevant locations.	4.2.1. Installation of signage at the designated sites.	HCV area	Year 1 and Year 2	0.30
	Enhanced appreciation and understanding of cultural heritage among diverse audiences.	Awareness program conducted for various groups.	4.2.2. Raise awareness on the importance of cultural and historical sites (school children and local communities).	HCV area	Year 2, Year 4, Year 6, Year 8 and Year 10	0.50
	Increased understanding of proper waste disposal methods among participants.	Waste management awareness conducted and programs initiated.	4.2.3. Conduct waste management awareness and education programs.	HCV area	Year 1, Year 3, Year 5, Year 7 and Year 9	0.90

	Improved skills and knowledge in sustainable resource management and online forestry services.	Training on NWFP harvesting and Online Forestry Services completed.	4.2.4. Provide awareness and training on sustainable harvesting of NWFP to Drakey Chinto Ngomoen Tshogpa.	Doteng Gewog	Year 2, Year 5 and Year 8	0.40
			4.2.5. Provide training on Online Forestry Services to forest officials and local communities.	HCV area	Year 2, Year 5 and Year 8	0.60
	Increased awareness and understanding of High Conservation Value (HCV) areas.	Sensitization workshops conducted for local communities.	4.2.6. Sensitization of local communities on HCV area.	HCV area	Year 3	0.10
4.3. Strengthening environmental safeguarding mechanisms through monitoring, adaptive management approaches and continuous capacity enhancement	Enhanced preparedness and reduced risk of forest fires.	Forest fire risk assessment report with recommendations.	4.3.1. Forest fire risk assessment and recommendations for preventive and remedial measures.	HCV area	Year 1	0.10
	Increased presence and monitoring in conservation areas.	Patrolling reports generated.	4.3.2. Conduct long-range SMART patrolling (anti-snaring surveillance) in the illegal and poaching prone area.	HCV area	Year 1 to Year 10	1.20
	Improved detection of illegal activities and strengthened wildlife protection	Camera traps strategically installed in identified illegal activity and poaching hotspots	4.3.3. Installation of surveillance devices at the poaching and illegal prone area.	Doteng and Tsento area within HCV area	Year 2, Year 4, Year 6 and Year 8	0.80
	Regular assessment of the status and effectiveness of conservation efforts in HCV areas.	Monitoring reports and evaluation findings for HCV areas.	4.3.4. Monitoring and Evaluation of HCV area.	HCV area	Year 1 to Year 10	2.40
	Enhanced knowledge and best practices for forestry officials.	Report on lessons learned from the study visit.	4.3.5. Heritage-focused international study exchanges for advancing conservation and preservation of cultural and natural assets.	Ex-country	Year 3	2.00
Total						**13.00**

Chapter 6: Monitoring and Evaluation

Monitoring and Evaluation (M&E) are essential components for assessing the effectiveness, efficiency and overall impact of any program or management plan. Through regular monitoring, the Division can track implementation progress, recognize achievements and promptly identify areas requiring corrective action. Periodic evaluations serve to enhance accountability, reduce risks and ensure that the management objectives remain on course.

Under this plan, monitoring will be conducted annually, while formal evaluations are scheduled twice during the plan period, a midterm review in the last quarter of the 4th year and a final review in the last quarter of the 9th year in aligning with the Monitoring and Evaluation Framework of the DoFPS. These evaluations will be jointly undertaken by internal teams from the DFO in Paro and an external committee composed of members from relevant Functional Divisions and other Divisions.

To further strengthen the assessment process, the evaluations will utilize the Bhutan METT+ (Management Effectiveness Tracking Tool Plus) and the M&E Framework during both the midterm and final reviews, providing a standardized measure of management effectiveness and supporting adaptive management practices for the Division.

6.1. Monitoring and Evaluation (M&E) framework for the DFO management plan

Table 36: Monitoring and evaluation framework

Objective	Action / Services	Output Indicator	Unit	Baseline (2024)	Yearly Target									
					I	II	III	IV	V	VI	VII	VIII	IX	X
1. To improve forest health, enhance habitat conditions, and foster biodiversity conservation through sustainable forest management practices, while generating economic benefits and supporting long-term ecological and economic resilience.														
	1.1.1. Facilitate public services delivery through issuance of Forestry Clearance for land lease, allocation of kidu land, land substitution and other developmental activities.	Turn Around Time (TAT)	No. of days	10	8	8	8	8	8	8	8	8	8	8
	1.1.2. Facilitate delivery of public services through Government to Citizen (G2C) and Online Forestry System (OFS) platforms.	Turn Around Time (TAT)	No. of days	10	10	10	10	10	10	10	10	10	10	10
	1.1.3. Ensure data entry and integration into Forest Information and Resource Management System (FIRMS).	Turn Around Time (TAT)	No. of days	7	2	2	2	2	2	2	2	2	2	2
	Technical Prescription (forest and wildlife management)													
	1.2.1. Carryout revisions of sustainable forest management plans for Forest Management Units (FMUs).	No. of FMU management plan revised	No. of plans	5	2	0	1	1	1	0	0	0	0	2

	1.2.2. Revision of Community Forest (CF) management plans to enhance sustainable resource management and community livelihoods.	No. of CF management plan revised	No. of plans	47	10	15	9	0	3	3	2	1	0	3
	1.2.3. Carry out revisions of Local Forest Management Plans to optimize sustainable forest management and ecological resilience of forest stands.	No. of Local Forest management plan revised	No. of plans	8	0	2	1	0	0	0	5	0	0	0
	1.2.4. Carry out revision of management plans for cross-cutting management regimes (Non-Wood Forest Product Management Group) to ensure sustainable resource utilization.	No. of NWFP management plan revised	No. of plans	2	1	0	0	0	1	0	0	0	1	0
	1.2.5. Develop technical guideline for sustainable harvesting of NWFP.	No. of guidelines developed for NWFP	No. of guidelines	0	0	0	1	0	0	0	0	0	0	0
	1.2.6. Preparation of annual Operational Plan (OP) of FMUs and DFO Management plan to ensure strategic and effective implementation.	No. of annual Operational Plan prepared for FMU	No. of plans	5	6	6	6	6	6	6	6	6	6	6

	1.2.7. Carryout scientific thinning activities in the identified areas within the Division	No. of areas brought under scientific thinning management	No.	1	1	1	0	0	0	0	0	0	0	0
	1.2.8. Execute monitoring and evaluation of major area-based and cross cutting management regimes through adoption of technologies such as drone, camera traps, remote sensing alongside the existing M&E frameworks	No. of management regimes monitored and evaluated	No. of monitoring and evaluation	61	1	1	1	1	1	1	1	1	1	1
	1.2.9. Conduct mid-term and final Bhutan METT+ assessment to evaluate and strengthen the Division's management effectiveness.	Bhutan METT+ carried out for the Division	No. of Bhutan METT+ carried out	1	1	0	1	0	0	0	0	0	0	1
	1.3.1. Initiate plantation programs in degraded areas through community-driven initiatives, focusing on native and economically valuable species	Areas brought under plantation regime	Area(hectare)	15	2	2	2	2	2	2	2	2	2	2
	1.3.2. Maintenance and enhancement of the existing forestry nursery at Shaba to ensure its productivity.	No. of forest nursery maintained and enhanced	No.	1	1	1	1	1	1	1	1	1	1	1

	1.4.1. Conduct SMART patrols to detect and deter illegal activities	No. of SMART patrol conducted	No.	500	778	778	778	778	778	778	778	778	778	778
	1.4.2. Procurement of advanced surveillance drone equipped with high-resolution and thermal imaging capabilities for enhanced monitoring and surveillance of illegal activities	No. of surveillance drone procured	No.	0	0	0	1	0	0	0	1	0	0	0
	1.4.3. Conduct Drone surveillance on bi-monthly basis	No. of drone surveillance carried out	No.	10	24	24	24	24	24	24	24	24	24	24
	1.4.4. Conduct systematic highland surveillance and targeted patrolling for Ophiocordyceps sinensis to ensure effective and sustainable collections.	No. of surveillance carried out	No.	2	1	1	1	1	1	1	1	1	1	1
	1.4.5. Procure SIM enabled Closed Circuit Television (CCTV) camera for advanced SMART patrolling operations.	No. of CCTV procured for advanced patrolling	No.	0	0	1	1	0	0	0	0	1	1	0
	1.4.6. Conduct awareness on the Forestry legal framework in the illegal hotspot areas (Poaching, logging, fishing, encroachment, NWFP and forest fire)	No. of awareness conducted	No.	14	0	0	1	0	1	0	0	1	0	0

	1.5.1. Implement systematic monitoring and assessment of forest pests and diseases	Forest pests and diseases monitored and assessed periodically	Times	5	1	1	1	1	1	1	1	1	1	1
	1.5.2. Conduct assessments and systematic surveys of wild flora for comprehensive documentation	Wild flora species systematically assessed and documented	No. of report	1	0	0	0	1	0	0	0	0	0	1
	1.5.3. Execute comprehensive assessments and surveys of wild fauna for precise documentation	Wild fauna species systematically assessed and documented	No. of report	1	0	0	0	1	0	0	0	0	0	1
	1.5.4. Perform comprehensive hotspot mapping of fire-prone areas to facilitate forest fire management and enhance prevention strategies.	No. of hotspot mapping report produced	No. of report	0	0	0	1	0	0	0	0	1	0	0
	1.5.5. Identify habitat containing essential features for wildlife conservation	No. of habitats identified	No.	0	0	1	0	0	0	0	0	0	1	0
	1.5.6. Conduct biodiversity assessment (Biodiversity Monitoring Grid) in the identified permanent monitoring grid	No. of taxa monitored and assessed	No.	3	3	3	3	3	3	3	3	3	3	3

	1.5.7. Determine the population of Snow leopard and its prey as a part of the Nation-wide Snow Leopard Survey using structured, grid-based camera trap surveys	No. of camera trap installed and monitored	No.	1	0	0	1	0	0	0	0	1	0	0
	1.5.8. Determine the population or abundance of Musk Deer as a part of the nationwide survey	Population and abundance assessed for Musk deer	No. of report	0	1	0	0	0	0	0	0	0	0	0
	1.5.9. Conduct eDNA survey as a part of the nationwide eDNA survey	eDNA samples collected and analyzed	No. of report	0	1	0	0	0	0	0	0	0	0	0
	1.5.10. Conduct Takin Survey as a part of the nationwide survey to determine the population estimate of Bhutan Takin	Estimated Bhutan Takin population through systematic assessment	No. of report	0	1	0	0	0	0	0	0	0	0	0
	1.5.11. Carry out tiger population survey as a part of the nationwide tiger population revalidation surveys every five years	No. of tiger populations systematically validated	No. of report	2	0	1	0	0	0	0	1	0	0	0
	1.5.12. Conduct National Forest Inventory as a part of nationwide inventory on forest coverage and carbon stock	National forest coverage and carbon stock assessed	No. of report	2	0	0	0	0	0	0	1	0	0	0

	1.5.13. Conduct comprehensive assessment on aquatic diversity for precise documentation (Hachhu and Pachhu)	Comprehensive assessments conducted on aquatic biodiversity for precise documentation	No. of report	0	0	0	1	0	0	0	0	1	0	0
	1.6.1. Implement targeted awareness campaigns to educate local communities and stakeholders on preventative measures for forest fire mitigation.	No. of targeted awareness campaigns conducted	No. of programs	14	0	0	3	0	0	0	3	0	0	0
	1.6.2. Conduct training to local communities and forestry staff, focused on post-fire management techniques to enhance community resilience	No. of training sessions conducted for local communities and forestry staff	No. of trainings	0	0	0	0	2	0	0	0	0	2	0
	1.6.3. Propose procurement of high-payload drones to support carrying essential firefighting equipment, integrated with surveillance capabilities for effective forest fire detection and management	No. of high-payload drones proposed for integrated firefighting and surveillance operations	No.	0	0	0	1	0	0	0	0	1	0	0

	1.6.4. Strengthen collaboration, resource integration and unified response protocols of the Inter-agency Forest Fire Coordination Group (IFFCG).	No. of coordinated actions implemented	No. of events	2	1	0	1	0	1	0	1	0	1	0
	1.6.5. Facilitate procurement and distribution of forest fire-fighting equipment to IFFCG members, field offices, local communities and stakeholders ensuring enhanced operational readiness.	No. of forest fire-fighting equipment procured and distributed	No.	60	30	0	30	0	30	0	30	0	30	0
	1.6.6. Conduct comprehensive assessment and spatial delineation of water sources and spring shed in collaboration with the Water Department.	No. of water sources and spring sheds comprehensively assessed and spatially mapped	No. of document	1	0	1	0	0	1	0	0	1	0	0
	1.6.7. Intimate with water department on initiation of revival programs for drying spring-sheds and water sources.	No. of coordination instances with the Water Department	No. of events	0	0	1	0	0	1	0	0	1	0	0
	1.6.8. Carryout surveys and assessment of invasive species in the forest area and within the settlements	No. of comprehensive surveys and assessments conducted	No. of report	1	0	0	0	1	0	0	0	0	1	0

2. To reduce and mitigate human-wildlife conflict through conflict to co-existence (C2C).	2.1.1. Undertake socio-economic survey to evaluate the impact of human-wildlife conflict (HWC) and to examine the adaptive strategies employed.	Reports generated on socio-economic surveys assessing human-wildlife conflict impacts	No. of report	1	0	0	1	0	0	0	0	1	0	0
	2.1.2. Identify and develop Conflict-to-Coexistence (C2C) strategy aimed at mitigating human-wildlife conflicts and fostering sustainable harmony between communities and wildlife populations.	No. of Conflict-to-Coexistence (C2C) strategies developed	No. of strategies	2	0	2	3	2	0	0	0	0	0	0
	2.1.3. Carryout comprehensive assessment of HWC status (C2C strategies) implemented in the two identified hotspot Gewogs (Dogar and Naja)	No. of report produced for HWC assessments conducted in identified hotspot Gewogs	No. of report	0	0	2	0	0	0	0	2	0	0	0
	2.2.1. Enhancement and maintenance of existing natural waterholes to support ecological balance and promote biodiversity conservation.	No. of existing natural waterholes enhanced and maintained	No.	7	0	5	0	0	6	0	0	7	0	0

	2.3.1. Strengthen and enhance capabilities of the existing quick response team of local communities to ensure heightened efficiency and effectiveness.	No. of QRT with enhanced operational efficiency and strengthened capabilities	No. of QRT	14	0	5	0	0	0	0	5	0	0	0
	2.3.2. Enhance the operational capacity and responsiveness of forestry rapid response team	No. of forestry QRT operations conducted with enhanced capacity and efficiency	No. of staff	25	15	0	15	0	15	0	15	0	15	0
	2.3.3. Facilitate procurement of equipment (Projectile syringe gun and accessories) ensure that the QRT is comprehensively equipped with all necessary tools and resources in the field offices	No. of equipment fully equip with QRT in the field offices	Set	1	0	1	0	0	0	2	0	0	0	0
	2.3.4. Support and facilitate corral fencing to protect livestock and enhance the livelihoods of migrating and highland communities.	No. of households supported with coral and solar fencing	No.	4	0	3	0	0	0	0	0	0	0	0

3. To strengthen infrastructure and HR capacity building for the conservation	Institution (Human Resource and Infrastructure)													
	3.1.1. Conduct training on OFS, FIRMS, BIRMS, GIS, Remote Sensing, G2C platforms, SMART patrolling and SDSS to enhance the technical capacity and digital proficiency of forestry personnel.	No. of staff equipped with enhanced knowledge on FIRMS, BIRMS, GIS, G2C, SMART, SDSS and OFS platforms	No.	73	73	0	73	0	73	0	73	0	73	0
	3.1.2. Organize refresher training program focused on the uniform code of conduct and proficient handling of arms.	No. of staff attended refresher course on uniform code of conduct and Arms handling	No.	45	73	0	73	0	73	0	73	0	73	0
	3.1.3. Conduct training on book-keeping for CFMG and NWFPMG members, focusing on effective management practices.	No. of community members trained in bookkeeping and effective management practices	No.	49	0	0	30	0	0	30	0	0	30	0

	3.1.4. Strengthen staff capacity through targeted training in diverse areas (Drone operation, resource assessment, crime investigation, forest pest and diseases and forest equipment handling)	No. of staff trained with enhanced expertise	No.	73	0	73	0	73	0	73	0	73	0	73
	3.1.5. Conduct training on preparation of annual Operational Plans (OP) and management plans of different management regimes, emphasizing on strategic planning, documentation and effective implementation.	No. of training provided on annual OP and management plan writing of different management regimes	No.	1	1	0	0	1	0	0	1	0	0	1
	3.2.1. Construction and site development of the Haa Range Office and Forest Management Unit (FMU) office facilities	No. of office constructed and site developed	No.	1	1	0	0	0	0	0	0	0	0	0
	3.2.2. Construction and site development of Bitekha Forest Management Unit Office facilities at Naja Gewog	No. of office constructed and site developed	No.	1	0	0	1	0	0	0	0	0	0	0
	3.2.3. Construction and site development of Dawakha Forest Beat Office at Dogar Gewog	No. of office constructed and site developed	No.	0	0	1	0	0	0	0	0	0	0	0

	3.2.4. Undertake maintenance and renovation of Division Head Office, Range Offices, Forest Management Unit (FMU) Offices, Jewphu and Haa Check Posts, including essential upgrades to the Wildlife Rescue Center at Shaba	No. of office maintenance completed and essentials upgraded	No.	4	0	1	0	1	0	1	0	1	0	1
	3.2.5. Procure high-specification laptops, computers and tablets to establish a robust data repository to enhance the efficiency and quality of service delivery.	No. of office equipment such as laptop, computer and tablets procured	No.	5	5	0	4	0	5	0	5	0	5	0
	3.2.6. Procurement of DCM Truck (Transportation of seized timber, fire-fighting, patrolling etc.,)	No. of DCM trucks procured	No.	0	0	1	0	0	0	0	0	0	0	0
	3.2.7. Provision for fuel and maintenance of office vehicles (DCM Truck, Hilux, and bikes) to ensure efficient mobility and support field operations	No. of office vehicles maintained and fueled to ensure operational efficiency and field mobility	No.	7	7	8	8	8	8	8	8	8	8	8
	3.2.8. Facilitate procurement of field gear, tents, utensil and first aid kits to support field personnel during extended patrolling operations.	No. of offices	No.	7	0	8	0	0	8	0	0	8	0	8

	3.2.9. Facilitate procurement and installation of CCTV cameras to enhance office surveillance and security monitoring.	No. of offices issued and deployed with CCTV cameras	No.	2	0	1	0	1	0	1	0	0	0	0
	3.2.10. Procurement of essential field equipment (Hypsometer, Densometer, Diameter tape, Digital caliper, GPS) to ensure accuracy and efficient field data collections	No. of offices issued with essential field equipment	No.	7	0	7	0	0	0	7	0	0	0	0
	3.2.11. Enhance and improve communication efficiency in remote work places through facilitating procurement of handsets and enhancement of antenna systems.	No. of Motorola handset procured with optimized connectivity through antenna enhancements	No.	15	0	10	0	0	0	10	0	10	0	0
	3.2.12. Enhancement and maintenance of the repeater station at Chelela to strengthen communication networks.	Repeater station at Chelela enhanced and maintained periodically	Time	3	1	0	1	0	0	1	0	0	1	0
	3.2.13. Upgradation and enhancement of forest check-post facilities and amenities to strengthen infrastructure and improve service delivery.	No. of forest check-posts upgraded and enhanced with improved facilities and amenities	No.	2	0	2	0	0	2	0	0	2	0	0

6.2. Monitoring and Evaluation (M&E) for the High Conservation Value Area (HCVA)

Table 37: Monitoring and evaluation of High Conservation Value Area

Outcome	Outputs	Activity	Location	Time Frame	Budget (Nu. In million)	Monitoring indicator	Target
Increased knowledge base of important cultural and historical areas.	Documented list and maps of significant sites.	4.1.1. Mapping and documentation of sites with cultural, historical and spiritual significance.	HCV area	Year 1 and Year 2	0.50	No. of document produced	1
Improved understanding of biodiversity in the area.	Baseline data on wildlife and plant and animal species in the HCV area documented	4.1.2. Conduct systematic floral survey to generate precise and comprehensive documentation of the floral diversity.	HCV area	Year 2 and Year 3	0.70	No. of assessment report produced	1
		4.1.3. Carryout fauna survey to produce precise and comprehensive documentation of faunal diversity.	HCV area	Year 2 and Year 3	0.70	No. of assessment report produced	1
Better understanding of water availability and potential for water management.	Mapped water sources and identified spring-shed areas.	4.1.4. Assessment and mapping of water sources and spring-shed.	HCV area	Year 2 and Year 3	0.80	No. of assessment and monitoring carried out	1
Reduced risk of fire damage to important religious structures.	Fireline created and monitored around Lhakhang.	4.1.5. Creation and monitoring of Fireline around the Lhakhang.	HCV area	Year 1 to Year 10	1.00	No. of fire line created	2
Improved navigation and information dissemination for visitors and locals.	Signages installed at relevant locations.	4.2.1. Installation of signage at the designated sites.	HCV area	Year 1 and Year 2	0.30	No. of signage installed	5
Enhanced appreciation and understanding of cultural heritage among diverse audiences.	Awareness program conducted for various groups.	4.2.2. Raise awareness on the importance of cultural and historical sites (school children and local communities).	HCV area	Year 2, Year 4, Year 6, Year 8 and Year 10	0.50	No. of awareness program held	5

Increased understanding of proper waste disposal methods among participants.	Waste management awareness conducted and programs initiated.	4.2.3. Conduct waste management awareness and education programs.	HCV area	Year 1, Year 3, Year 5, Year 7 and Year 9	0.90	No. of waste awareness conducted	5
Improved skills and knowledge in sustainable resource management and online forestry services.	Training on NWFP harvesting and Online Forestry Services completed.	4.2.4. Provide awareness and training on sustainable harvesting of NWFP to Drakey Chinto Ngomoen Tshogpa.	HCV area	Year 2, Year 5 and Year 8	0.40	No. of training conducted	3
		4.2.5. Provide training on Online Forestry Services to forest officials and local communities.	HCV area	Year 2, Year 5 and Year 8	0.60	No. of training conducted	2
Increased awareness and understanding of High Conservation Value (HCV) areas.	Sensitization workshops conducted for local communities.	4.2.6. Sensitization of local communities on HCV area.	HCV area	Year 3	0.10	Sensitization conducted to no. of people	30
Enhanced preparedness and reduced risk of forest fires.	Forest fire risk assessment report with recommendations.	4.3.1. Forest fire risk assessment and recommendations for preventive and remedial measures.	HCV area	Year 1	0.10	No. of report produced	1
Increased presence and monitoring in conservation areas.	Patrolling reports generated.	4.3.2. Conduct long-range SMART patrolling (anti-snaring surveillance) in the illegal and poaching prone area.	HCV area	Year 1 to Year 10	1.20	No. of patrolling conducted	7
Improved detection of illegal activities and strengthened wildlife protection	Camera traps strategically installed in identified illegal activity and poaching hotspots	4.3.3. Installation of surveillance devices at the poaching and illegal prone area.	Illegal and poaching prone area	Year 2, Year 4, Year 6 and Year 8	0.50	No. of camera traps installed	12
Regular assessment of the status and effectiveness of conservation efforts in HCV areas.	Monitoring reports and evaluation findings for HCV areas.	4.3.4. Monitoring and Evaluation of HCV area.	HCV area	Year 1 to Year 10	2.40	No. of HCV area monitored and report produced	9
Enhanced knowledge and best practices for forestry officials.	Report on lessons learned from the study visit.	4.3.5. Heritage-focused international study exchanges for advancing conservation and preservation of cultural and natural assets.	Countries with established HCV	Year 3	2.00	No. of officials approved for exchange program	10

Chapter 7: Stakeholder consultation and endorsement

7.1. Stakeholder consultation

Engaging with different stakeholders is crucial to the success of any organization or project, as it brings people from different backgrounds together to pool knowledge, experience and expertise to co-create solutions. Engaging and collaborating with different stakeholders will enable DFO, Paro to have clear and shared vision and goals amongst its key influencers. Therefore, it is vital to identify the stakeholders and carry out consultation meetings with them before the endorsement of the management plan.

The following stakeholders are identified as most significant and crucial for the management plan to fulfill its goal and objectives:

Table 38: Identified stakeholders

Sl. No	Stakeholder	Description/Responsibilities
1	Ministry of Energy and Natural resources	Provide guidance and support in any policy related matters; Approving management plan for implementation
2	Department of Forest and Park services	Provide guidance and support in any policy related matters
3	Funding Agencies (WWF, BFL, GEF, Zero-poaching, AFoCO)	Provides support in funding different activities
4	Dzongkhag administration, Paro and Haa	Collaborate in implementing activities that requires support from Dzongkhag administration
5	Local government	Collaborate in implementing activities; Coordination with general public in any forestry related activities
6	NGOs (UNDP, RSPN, BES)	Fund support for carrying out environmental and socio-economic development activities

7.2. Finalization and Endorsement of the DFO Management Plan

The management plan, upon finalization by the respective Divisional Forest Offices, shall be submitted to the IKI Taskforce. From 2 - 5 September 2025, the IKI focal persons convened in Paro to undertake a comprehensive review of the draft management plan. The plan will thereafter be uploaded or submitted to the IKI Taskforce and subsequently endorsed by the Department's Technical Advisory Committee (DTAC). Following technical endorsement, the plan will be recommended to the Ministry by the Head of Department for final approval. Upon ministerial endorsement, the plan shall be formally adopted and implemented.

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Annexure 1: Annual Operational Plan Framework

Framework for Annual Operational Plan for Division Forest Office						
*** The Annual Operational plan for the Division Forest Office shall be prepared and submitted to ..... latest by 31st July.*						
Name of the office:						
Prepared by and date:						*(Seal and sign)*
Verified by and date:						
Recommended by and date						
Approved by and date:						
I. REVIEW OF THE PREVIOUS YEARS' PLAN						
I.a. SUMMARY OF THE PLAN						
No. of Planned activities	Status of the activities (in Nos.)					
	Achieved		On-going		Not Implemented	
I.b. DETAILED REVIEW OF THE PLANNED ACTIVITIES						
Activities	Target with unit	Budget utilization status	Brief report on the progress of the activities		Remarks (Justification/reasoning if not completed or not implemented)	
II. ANNUAL OPERATIONAL PLAN SCHEDULE (For the new FY)						
II.a. DETAILS OF THE PLANNED ACTIVITIES						
Output Indicator as per the management plan/APA	Activities	Target with Unit	Timeline	Budget (in Nu.(m))	Fund Source	Specify location, if relevant
Program I: Nature Conservation[1]						
Program II: Forest Resources Management[2]						
Program III: Social Forestry and Extension[3]						
Program IV: Forest Protection and Enforcement[4]						
Program IV: Adminsitration and Direction[5]						

[1] *Program I shall include but not limited to; Surveys, research, HWC management, habitat management, watershed&wetland protection, ecotourism&nature recreation, waste*

[2] *Program II shall include but not limited to; LFMA plan preparation, timber allocation and monitoring.*

[3] *Program III shall include but not limited to; CF management, NWFP management, plantation, livelihood improvement initiatives.*

[4] *Program IV shall include but not limited to; patrolling, forest offence compounding/prosecution, forestry clearances, pest & diseases surveillance, forest fire management.*

[5] *Program V shall include but not limited to; Park management plan preparation, work planning, coordination meetings, administrative and accounting activities, monitoring*

**Note: Activities such as Awareness, capacity building, etc to be tagged with respective program activities*

Annexure 2: Bhutan METT+ form (refined for FD)

Name, affiliation and contact details for person responsible for completing the Bhutan METT + (email etc.)		Sonam Phuntsho, Sr. Forestry Officer Contact: +975-17933849 Email: sonamphuntsho1@moenr.gov.bt		
Date assessment carried out		15/12/2025-18/12/2025		
Name of Forest Division		Divisional Forest Office, Paro		
WDPA site code (codes can be searched for on: www.protectedplanet.net/)				
Designations	National (SRF land: Community Forest, Local Forest Management Area, Forest Management Unit)	IUCN category National Category (to list based on site needs - CFs, FMUs		International (see below)
Location of Divisional Forest Office Area (province and if possible, map reference)		Paro District (10 Gewogs-Sub blocks) and Haa District (Four Gewogs - Sub blocks) located at the western part of Bhutan		
Date of establishment (dd/mm/yyyy)		1991		
Ownership details (please tick)	State √	Private	Community	Other
Management Authority	Namgay, Chief Forestry Officer			
Size of Divisional Forest Office (sq/km)	1630.84			
Number of staff	Permanent (technical and non-technical) (sex-disaggregated data Gender -Male, Female): 86 Technical - 73 (Male - 57, Female - 16) and non-technical - 7 (Adm - 1, Driver - 2, ESP/Night Guard - 4)		Extra-ordinary Leave (EoL) - 4 Study Leave - 1 Deputation - 1	
Annual budget (million Nu) – excluding staff salary costs (2025-2026)	Current budget (operational costs, e.g. staff costs): Nu. 52.798		Capital budget (infrastructure development etc.): Nu. 12.260	

What are the main values for which the area is designated		1. Sustainable management and utilization of forest resources 2. Effectively managed trade-off between the economic utilization and conservation 3. Conservation and protection of biodiversity and forest resource 4. Effective service delivery 5. Strengthen protection, enforcement and surveillances		
List the two primary Divisional Forest Office management objectives.				
Management objective 1		Sustainable forest resource management and utilizationresources		
Management objective 2		Effectively managed trade-off between economic development and conservation		
No. of people involved in completing assessment: 1				
Including: (highlight where appropriate)	FD manager - 1 agency staff	FD staff: 25	Other PA agency staff	NGO
	Local community	Donors	External experts	Other
Please note if assessment was carried out in association with a particular project, on behalf of an organization or donor.		International Climate Initiative (IKI) Project, WWF-Bhutan		
Information on International Designations (where applicable)				
UNESCO World Heritage site				
Date listed	Site name		Site area	
Criteria for designation (i.e. criteria i to x)				
Statement of Outstanding Universal Value				
Ramsar site				
Date listed	Site name and number		Site area	
Criteria for Designation & ecological character (see Ramsar Information Sheet)				
UNESCO Man and Biosphere Reserves				
Date listed	Site name		Site area	
Total:				
Core:				
Buffer:				
Transition:				
Criteria for designation				
Fulfilment of three functions of MAB (conservation, development and logistic support.)				
Please list other designations and any supporting information below				
Name:	Detail:			
Name:	Detail:			
Name:	Detail:			

Annexure 3: List of mammals

Common name	Scientific name	Family
Alpine marmot	*Marmota*	Sciuridae
Asiatic black bear	*Ursus thibetanus*	Ursidae
Asiatic Golden Cat	*Catopuma temminckii*	Felidae
Barking deer	*Muntiacus muntjak*	Cervidae
Bengal Tiger	*Panthera tigris*	Felidae
Bhutan Takin	*Budorcas taxicolor ssp. Whitei*	Bovidae
Blue Sheep	*Pseudois nayaur*	Bovidae
Common Leopard	*Panthera pardus*	Felidae
Gaur	*Bos gaurus*	Bovidae
Goral	*Naemorhedus goral*	Bovidae
Grey Langur	*Semnopithecus entellus*	Cercopithecidae
Himalayan Musk Deer	*Moschus leucogaster*	Moschidae
Himalayan serow	*Capricornis sumatraensis ssp. thar*	Bovidae
Leopard Cat	*Prionailurus bengalensis*	Felidae
Macaca assamensis	*Assamese macaque*	Cercopithecidae
Marbled Cat	*Pardofelis marmorata*	Felidae
Red fox	*Vulpes*	Canidae
Red Panda	*Ailurus fulgens*	Ailuridae
Sambar deer	*Rusa unicolor*	Cervidae
Snow leopard	*Panthera uncia*	Felidae
Thorold's deer	*Cervus albirostris*	Cervidea
Tibetan Wolf	*Canis lupus ssp. filchneri*	Canidae
Wild boar	*Sus scrofa*	Suidae
Wild dog	*Cuon alpinus*	Canidae
Wolley Hare	*Lepus oiostolus*	Leporidae
Yellow-throated Marten	*Martes flavigula*	Mustelidae

Annexure 4: List of birds

Sl.No.	Bird Species	*Family*	Genus	IUCN Red List Status
1	Alpine Thrush	*Turdidae*	Turdus	Least Concern
2	Asian Barred Owlet	*Strigidae*	Glaucidium	Least Concern
3	Bar-headed Goose	*Anatidae*	Anser	Least Concern
4	Barn Owl	*Tytonidae*	Tyto	Least Concern
5	Bearded Vulture	*Accipitridae*	Gypaetus	Near Threatened
6	Bhutan Laughingthrush	*Leiothrichidae*	Trochalopteron	Least Concern
7	Black Bulbul	*Pycnonotidae*	Hypsipetes	Least Concern
8	Black Eagle	*Accipitridae*	Ictinaetus	Least Concern
9	Black Kite	*Accipitridae*	Milvus	Least Concern
10	Black Stork	*Ciconiidae*	Ciconia	Least Concern
11	Black-throated Thrush	*Turdidae*	Turdus	Least Concern
12	Black-crowned Night Heron	*Ardeidae*	Nycticorax	Least Concern
13	Black-faced Laughingthrush	*Leiothrichidae*	Trochalopteron	Least Concern
14	Black-necked Crane	*Gruidae*	Grus	Near Threatened
15	Black-tailed Crake	*Sarothruridae*	Amaurornis	Least Concern
16	Black-winged Cuckooshrike	*Campephagidae*	Lalage	Least Concern
17	Blood Pheasant	*Phasianidae*	Ithaginis	Least Concern
18	Blue Whistling-Thrush	*Turdidae*	Myophonus	Least Concern
19	Blue-fronted Redstart	*Muscicapidae*	Phoenicurus	Least Concern
20	Blue-rock Thrush	*Turdidae*	Monticola	Least Concern
21	Blyth's Leaf Warbler	*Phylloscopidae*	Phylloscopus	Least Concern
22	Brown Dipper	*Cinclidae*	Cinclus	Least Concern
23	Brown Parrotbill	*Paradoxornithidae*	Paradoxornis	Least Concern
24	Brown Shrike	*Laniidae*	Lanius	Least Concern
25	Brown-headed Gull	*Laridae*	Chroicocephalus	Least Concern
26	Brown-throated Fulvetta	*Leiothrichidae*	Alcippe	Least Concern
27	Buff-barred Warbler	*Phylloscopidae*	Phylloscopus	Least Concern
28	Cattle Egret	*Ardeidae*	Bubulcus	Least Concern
29	Chestnut-bellied Rock Thrush	*Turdidae*	Monticola	Least Concern
30	Chestnut-crowned Laughingthrush	*Leiothrichidae*	Garrulax	Least Concern
31	Chestnut-crowned Warbler	*Phylloscopidae*	Phylloscopus	Least Concern
32	Chestnut-tailed Minla	*Leiothrichidae*	Minla	Least Concern
33	Citrine Wagtail	*Motacillidae*	Motacilla	Least Concern
34	Coal Tit	*Paridae*	Periparus	Least Concern
35	Collared Grosbeak	*Fringillidae*	Mycerobas	Least Concern

36	Collared Owlet	*Strigidae*	Glaucidium	Least Concern
37	Common Buzzard	*Accipitridae*	Buteo	Least Concern
38	Common Kestrel	*Falconidae*	Falco	Least Concern
39	Common Kingfisher	*Alcedinidae*	Alcedo	Least Concern
40	Common Moorhen	*Rallidae*	Gallinula	Least Concern
41	Common Myna	*Sturnidae*	Acridotheres	Least Concern
42	Common Quail	*Phasianidae*	Coturnix	Least Concern
43	Common Raven	*Corvidae*	Corvus	Least Concern
44	Common Greenshank	*Scolopacidae*	Tringa	Least Concern
45	Common Rosefinch	*Fringillidae*	Carpodacus	Least Concern
46	Common Sandpiper	*Scolopacidae*	Actitis	Least Concern
47	Common Teal	*Anatidae*	Anas	Least Concern
48	Crimson-breasted Woodpecker	*Picidae*	Dryocopus	Least Concern
49	Crested Kingfisher	*Alcedinidae*	Megaceryle	Least Concern
50	Crimson-browed Finch	*Fringillidae*	Pinicola	Least Concern
51	Crow-billed Drongo	*Dicruridae*	Dicrurus	Least Concern
52	Darjeeling Woodpecker	*Picidae*	Dendrocopos	Least Concern
53	Dark-breasted Rosefinch	*Fringillidae*	Carpodacus	Least Concern
54	Dark-rumped Rosefinch	*Fringillidae*	Carpodacus	Least Concern
55	Dark-sided Flycatcher	*Muscicapidae*	Muscicapa	Least Concern
56	Eurasian Coot	*Rallidae*	Fulica	Least Concern
57	Eurasian Cuckoo	*Cuculidae*	Cuculus	Least Concern
58	Eurasian Hoopoe	*Upupidae*	Upupa	Least Concern
59	Eurasian Jay	*Corvidae*	Garrulus	Least Concern
60	Eurasian Sparrowhawk	*Accipitridae*	Accipiter	Least Concern
61	Eurasian Tree Sparrow	*Passeridae*	Passer	Least Concern
62	Eurasian Treecreeper	*Certhiidae*	Certhia	Least Concern
63	Eurasian Wigeon	*Anatidae*	Mareca	Least Concern
64	Eurasian Woodcock	*Scolopacidae*	Scolopax	Least Concern
65	Eurasian Wren	*Troglodytidae*	Troglodytes	Least Concern
66	European Golden Plover	*Charadriidae*	Pluvialis	Least Concern
67	Ferruginous Duck	*Anatidae*	Aythya	Near Threatened
68	Fire-tailed Myzornis	*Paradoxornithidae*	Myzornis	Least Concern
69	Fire-tailed Sunbird	*Nectariniidae*	Aethopyga	Least Concern
70	Gadwall	*Anatidae*	Mareca	Least Concern
71	Goldcrest	*Regulidae*	Regulus	Least Concern
72	Golden Eagle	*Accipitridae*	Aquila	Least Concern
73	Golden-naped Finch	*Fringillidae*	Pyrrhoplectes	Least Concern
74	Common Merganser (Goosander)	*Anatidae*	Mergus	Least Concern

75	Grandala	*Turdidae*	Grandala	Least Concern
76	Great Bittern	*Ardeidae*	Botaurus	Least Concern
77	Great Cormorant	*Phalacrocoracidae*	Phalacrocorax	Least Concern
78	Greater White-fronted Goose	*Anatidae*	Anser	Least Concern
79	Green Sandpiper	*Scolopacidae*	Tringa	Least Concern
80	Green Shrike-babbler	*Vireonidae*	Pteruthius	Least Concern
81	Green-backed Tit	*Paridae*	Parus	Least Concern
82	Greenish Warbler	*Phylloscopidae*	Phylloscopus	Least Concern
83	Green-tailed Sunbird	*Nectariniidae*	Aethopyga	Least Concern
84	Grey Bushchat	*Muscicapidae*	Saxicola	Least Concern
85	Grey Heron	*Ardeidae*	Ardea	Least Concern
86	Grey Nightjar	*Caprimulgidae*	Caprimulgus	Least Concern
87	Grey Wagtail	*Motacillidae*	Motacilla	Least Concern
88	Grey-backed Shrike	*Laniidae*	Lanius	Least Concern
89	Grey-crested Tit	*Paridae*	Lophophanes	Least Concern
90	Grey-sided Bush Warbler	*Scotocercidae*	Cettia	Least Concern
91	Grey-winged Blackbird	*Turdidae*	Turdus	Least Concern
92	Hill Partridge	*Phasianidae*	Arborophila	Least Concern
93	Himalayan Beautiful Rosefinch	*Fringillidae*	Carpodacus	Least Concern
94	Himalayan Bluetail	*Muscicapidae*	Tarsiger	Least Concern
95	Himalayan Monal	*Phasianidae*	Lophophorus	Least Concern
96	Himalayan Vulture	*Accipitridae*	Gyps	Near Threatened
97	Himalayan White-browed Rosefinch	*Fringillidae*	Carpodacus	Least Concern
98	Himalayan Wood Owl	*Strigidae*	Strix	Least Concern
99	Hodgson's Redstart	*Muscicapidae*	Phoenicurus	Least Concern
100	Hodgson's Treecreeper	*Certhiidae*	Certhia	Least Concern
101	Horned Lark	*Alaudidae*	Eremophila	Least Concern
102	House Sparrow	*Passeridae*	Passer	Least Concern
103	Ibisbill	*Ibidorhynchidae*	Ibidorhyncha	Least Concern
104	Indian Pond Heron	*Ardeidae*	Ardeola	Least Concern
105	Indian Roller	*Coraciidae*	Coracias	Least Concern
106	Indian-blue Robin	*Muscicapidae*	Luscinia (or Cyanoptila)	Least Concern
107	Isabelline Wheatear	*Muscicapidae*	Oenanthe	Least Concern
108	Kalij Pheasant	*Phasianidae*	Lophura	Least Concern
109	Large Hawk Cuckoo	*Cuculidae*	Hierococcyx	Least Concern
110	Large-billed Crow	*Corvidae*	Corvus	Least Concern
111	Large-billed Leaf Warbler	*Phylloscopidae*	Phylloscopus	Least Concern
112	Lemon-rumped Warbler	*Phylloscopidae*	Phylloscopus	Least Concern
113	Little Bunting	*Emberizidae*	Emberiza	Least Concern

114	Little Forktail	*Cinclidae*	Enicurus	Least Concern
115	Little Owl	*Strigidae*	Athene	Least Concern
116	Long-bellied Thrush	*Turdidae*	Turdus	Least Concern
117	Long-billed Plover	*Charadriidae*	Charadrius	Least Concern
118	Long-legged Buzzard	*Accipitridae*	Buteo	Least Concern
119	Long-tailed Minivet	*Campephagidae*	Pericrocotus	Least Concern
120	Long-tailed Shrike	*Laniidae*	Lanius	Least Concern
121	Mallard	*Anatidae*	Anas	Least Concern
122	Mandarin Duck	*Anatidae*	Aix	Least Concern
123	Maroon-backed Accentor	*Prunellidae*	Prunella	Least Concern
124	Mrs. Gould's Sunbird	*Nectariniidae*	Aethopyga	Least Concern
125	Northern Lapwing	*Charadriidae*	Vanellus	Near Threatened
126	Northern Pintail	*Anatidae*	Anas	Least Concern
127	Olive-backed Pipit	*Motacillidae*	Anthus	Least Concern
128	Oriental Cuckoo	*Cuculidae*	Cuculus	Least Concern
129	Oriental Hobby	*Falconidae*	Falco	Least Concern
130	Oriental Honey Buzzard	*Accipitridae*	Pernis	Least Concern
131	Oriental Skylark	*Alaudidae*	Alauda	Least Concern
132	Oriental Turtle Dove	*Columbidae*	Streptopelia	Least Concern
133	Oriental White-eye	*Zosteropidae*	Zosterops	Least Concern
134	Osprey	*Pandionidae*	Pandion	Least Concern
135	Pacific Golden Plover	*Charadriidae*	Pluvialis	Least Concern
136	Paddyfield Pipit	*Motacillidae*	Anthus	Least Concern
137	Pallas's Gull	*Laridae*	Ichthyaetus	Least Concern
138	Peregrine Falcon	*Falconidae*	Falco	Least Concern
139	Plain Mountain Finch	*Fringillidae*	Leucosticte	Least Concern
140	Plumbeous Water Redstart	*Muscicapidae*	Phoenicurus	Least Concern
141	Red Crossbill	*Fringillidae*	Loxia	Least Concern
142	Red-billed Chough	*Corvidae*	Pyrrhocorax	Least Concern
143	Red-billed Leiothrix	*Leiothrichidae*	Leiothrix	Least Concern
144	Red-breasted Thrush	*Turdidae*	Turdus	Least Concern
145	Red-crested Pochard	*Anatidae*	Netta	Least Concern
146	Red-headed Bullfinch	*Fringillidae*	Pyrrhula	Least Concern
147	Red-vented Bulbul	*Pycnonotidae*	Pycnonotus	Least Concern
148	Red-wattled Lapwing	*Charadriidae*	Vanellus	Least Concern
149	River Lapwing	*Charadriidae*	Vanellus	Least Concern
150	Robin Accentor	*Prunellidae*	Prunella	Least Concern
151	Rock Pigeon	*Columbidae*	Columba	Least Concern
152	Rosy Pipit	*Motacillidae*	Anthus	Least Concern
153	Ruddy Shelduck	*Anatidae*	Tadorna	Least Concern
154	Ruddy-breasted Crake	*Rallidae*	Porzana	Least Concern

155	Rufous Sibia	*Leiothrichidae*	Heterophasia	Least Concern
156	Rufous-bellied Niltava	*Muscicapidae*	Niltava	Least Concern
157	Rufous-bellied Woodpecker	*Picidae*	Dendrocopos	Least Concern
158	Rufous-breasted Accentor	*Prunellidae*	Prunella	Least Concern
159	Rufous-fronted Tit	*Paridae*	Parus	Least Concern
160	Rufous-gorgeted Flycatcher	*Muscicapidae*	Ficedula	Least Concern
161	Rufous-vented Tit	*Paridae*	Parus	Least Concern
162	Rufous-vented Yuhina	*Zosteropidae*	Yuhina	Least Concern
163	Russet Sparrow	*Passeridae*	Passer	Least Concern
164	Rusty-flanked Treecreeper	*Certhiidae*	Certhia	Least Concern
165	Satyr Tragopan	*Phasianidae*	Tragopan	Near Threatened
166	Scaly-breasted Munia	*Estrildidae*	Lonchura	Least Concern
167	Short-billed Minivet	*Campephagidae*	Pericrocotus	Least Concern
168	Silver-eared Laughingthrush	*Leiothrichidae*	Garrulax	Least Concern
169	Slaty-blue Flycatcher	*Muscicapidae*	Ficedula	Least Concern
170	Snow Pigeon	*Columbidae*	Columba	Least Concern
171	Solitary Snipe	*Scolopacidae*	Gallinago	Least Concern
172	Speckled Wood Pigeon	*Columbidae*	Columba	Least Concern
173	Spotted Dove	*Columbidae*	Spilopelia	Least Concern
174	Spotted Laughingthrush	*Leiothrichidae*	Garrulax	Least Concern
175	Spotted Nutcracker	*Corvidae*	Nucifraga	Least Concern
176	Streak-breasted Scimitar Babbler	*Leiothrichidae*	Pomatorhinus	Least Concern
177	Stripe-throated Yuhina	*Zosteropidae*	Yuhina	Least Concern
178	Tibetan Partridge	*Phasianidae*	Perdix	Least Concern
179	Tibetan Snowcock	*Phasianidae*	Tetraogallus	Least Concern
180	Tickell's Leaf Warbler	*Phylloscopidae*	Phylloscopus	Least Concern
181	Ultramarine Flycatcher	*Muscicapidae*	Ficedula	Least Concern
182	Verditer Flycatcher	*Muscicapidae*	Eumyias	Least Concern
183	Wallcreeper	*Tichodromidae*	Tichodroma	Least Concern
184	Ward's Trogon	*Trogonidae*	Harpactes	Near Threatened
185	Water Pipit	*Motacillidae*	Anthus	Least Concern
186	Whiskered Tern	*Laridae*	Chlidonias	Least Concern
187	Whiskered Yuhina	*Zosteropidae*	Yuhina	Least Concern
188	Whistler's Warbler	*Phylloscopidae*	Phylloscopus	Least Concern
189	White-browed Starling	*Sturnidae*	Sturnia	Least Concern
190	White-collared Blackbird	*Turdidae*	Turdus	Least Concern
191	White Wagtail	*Motacillidae*	Motacilla	Least Concern
192	White-browed Bush Robin	*Muscicapidae*	Tarsiger	Least Concern
193	White-browed Fulvetta	*Leiothrichidae*	Fulvetta	Least Concern
194	White-capped Redstart	*Muscicapidae*	Chaimarrornis	Least Concern

195	White-tailed Nuthatch	*Sittidae*	Sitta	Least Concern
196	White-throated Fantail	*Monarchidae*	Rhipidura	Least Concern
197	White-throated Laughingthrush	*Leiothrichidae*	Garrulax	Least Concern
198	White-throated Redstart	*Muscicapidae*	Phoenicurus	Least Concern
199	White-winged Grosbeak	*Fringillidae*	Mycerobas	Least Concern
200	White-winged Redstart	*Muscicapidae*	Phoenicurus	Least Concern
201	Winter Wren	*Troglodytidae*	Troglodytes	Least Concern
202	Wood Snipe	*Scolopacidae*	Gallinago	Near Threatened
203	Yellow-bellied Fantail	*Rhipiduridae*	Rhipidura	Least Concern
204	Yellow-billed Blue Magpie	*Corvidae*	Urocissa	Least Concern
205	Yellow-breasted Green Finch	*Fringillidae*	Carduelis	Least Concern
206	Yellow-rumped Honeyguide	*Indicatoridae*	Indicator	Least Concern
207	Little Egret	*Ardeidae*	Egretta	Least Concern
208	Golden Bush-Robin	*Muscicapidae*	Tarsiger	Least Concern
209	Dark-sided Bush Warbler	*Scotocercidae*	Cettia	Least Concern
210	White-throated Dipper	*Cinclidae*	Cinclus	Least Concern
211	Grey-chinned Minivet	*Campephagidae*	Pericrocotus	Least Concern
212	Himalayan Swiftlet	*Apodidae*	Aerodramus	Least Concern
213	White-bellied Redstart	*Muscicapidae*	Myiomela	Least Concern
214	Red-tailed Minla	*Leiothrichidae*	Minla	Least Concern
215	Himalayan Cuckoo	*Cuculidae*	Cuculus	Least Concern
216	Lesser Cuckoo	*Cuculidae*	Cuculus	Least Concern
217	Ground Pecker	*Paridae*	Pseudopodoces	Least Concern
218	Mountain Hawk-eagle	*Accipitridae*	Nisaetus	Near Threatened
219	Tawny Fish-owl	*Strigidae*	Ketupa	Least Concern
220	Northern Goshawk	*Accipitridae*	Accipiter	Least Concern
221	Common Merganser	*Anatidae*	Mergus	Least Concern
222	Wedge-tailed Green-pigeon	*Columbidae*	Treron	Least Concern
223	White-throated Kingfisher	*Alcedinidae*	Halcyon	Least Concern
224	Siberian Stonechat	*Muscicapidae*	Saxicola	Least Concern
225	Himalayan Buzzard	*Accipitridae*	Buteo	Least Concern
226	Great Myna	*Sturnidae*	Acridotheres	Least Concern
227	Indian White-eye	*Zosteropidae*	Zosterops	Least Concern
228	Scarlet Minivet	*Campephagidae*	Pericrocotus	Least Concern
229	House Crow	*Corvidae*	Corvus	Least Concern

Annexure 5: List of Trees and shrubs

Species	Family	Tsento	Doteng	Hungrel	Lungnyi	Shaba	Naja	Dogar	Sama	Essu	Katsho	Bji
(Lifeform-Conifer tree)		RBA	RBA	RBA	RBA	RBA	RBA	RBA	RBA	RBA	RBA	RBA
Pinus wallichiana	*Pinaceae*	29.73	0.67	40.23	38.02	60.14	35.22	10.66	28.64	22.27	31.11	34.52
Abies densa	*Pinaceae*	19.44	28.58		16.00		1.33	19.03	3.71	35.49	0.34	8.13
Juniperus sp.	*Cupressaceae*	6.85	14.99									
Tsuga dumosa	*Pinaceae*	2.65	9.14	1.73	14.27		25.93	1.27	14.94	11.95	0.18	4.21
Picea spinulosa	*Pinaceae*	2.18	15.90	13.65	20.06	7.62	16.43	60.50	25.44	8.94	42.06	15.79
Larix griffithiana	*Pinaceae*	1.77	2.56		7.43		0.00	2.45	1.26	14.23		0.85
Taxus baccata	*Taxaceae*	0.07	4.96				0.23		0.67			7.70
Juniperus recurva	*Cupressaceae*				0.07		0.01	3.93				
Juniperus squamata	*Cupressaceae*								0.01			
Juniperus pseudosabina	*Cupressaceae*									0.22		
Sub-Total		**62.68**	**76.80**	**55.61**	**95.84**	**67.77**	**79.14**	**97.84**	**74.68**	**93.10**	**73.69**	**71.20**
(Lifeform-Deciduous shrub)	**Family**	**RBA**	**RBA**	**RBA**	**w**	**RBA**	**RBA**	**RBA**	**RBA**	**RBA**	**RBA**	**RBA**
Viburnum sp	*Caprifoliaceae*	2.09	0.25						0.09			
Enkianthus deflexus	*Ericaceae*	0.51			0.01				0.11	0.77		
Viburnum nervosum	*Caprifoliaceae*	0.12					0.33		0.05			
Corylus ferox	*Betulaceae*	0.05	0.04									
Rosa sp.	*Rosaceae*	0.02							0.01	0.03		
Lonicera sp.	*Caprifoliaceae*	0.01	0.03									
Hydrangea sp.	*Hydrangeaceae*		0.32							0.15		
Rhus sp.	*Anacardiaceae*			9.22								
Berberis asiatica	*Berberidaceae*						0.05					
Rosa sericea	*Rosaceae*						0.01	0.15			0.03	
Berberis aristata	*Berberidaceae*							0.00				
Corylus sp	*Betulaceae*								0.34			
Euonymus sp.	Celastraceae								0.14			
Sub-Total		**2.80**	**0.65**	**9.22**	**0.01**	**0.00**	**0.39**	**0.15**	**0.74**	**0.94**	**0.03**	**0.00**

(Lifeform-Deciduous tree)	Family	RBA	RBA	RBA	w	RBA	RBA	RBA	RBA	RBA	RBA	RBA
Acer campbellii	*Aceraceae*	6.00	5.85				0.83		0.85			9.83
Sorbus sp.	*Rosaceae*	3.13	0.09	10.23								
Betula utilis	*Betulaceae*	1.02	2.51									
Betula sp.	*Betulaceae*	0.82	4.21						0.26			
Populus ciliata	*Salicaceae*	0.81	0.13	0.23	0.28	15.40	0.54					0.60
Prunus cerasoides	*Rosaceae*	0.58	0.14						0.22			
Prunus sp.	*Rosaceae*	0.49	0.10						0.34	0.03		
Salix alba	*Alismataceae*	0.08	2.05	0.01	0.55			0.05				
Fraxinus sp.	*Oleaceae*	0.02	0.53									0.04
Populus sp.	*Salicaceae*			0.65					1.54			
Phyllanthus emblica	*Euphorbiaceae*						0.45					
Elaeagnus parvifolia	*Elaeagnaceae*						0.02		0.28		0.03	
Salix sp.	*Salicaceae*								0.80	0.35		
Malus sp.	*Rosaceae*								0.12	0.09		
Lindera sp.	*Lauraceae*								0.04			
Magnolia sp.	*Magnoliaceae*								0.02			
Acer sp.	*Aceraceae*									0.00		
Sub-Total		**12.94**	**15.60**	**11.11**	**0.83**	**15.40**	**1.83**	**0.05**	**4.47**	**0.47**	**0.03**	**10.47**
(Lifeform-Evergreen shrub)	**Family**	**RBA**	**RBA**	**RBA**	**w**	**RBA**	**RBA**	**RBA**	**RBA**	**RBA**	**RBA**	**RBA**
Rhododendron sp.	*Ericaceae*	8.16	0.64	0.17	0.31		0.58	1.26	0.93	0.45	0.07	0.26
Ilex dipyrena	*Aquifoliaceae*	0.67	0.24				0.06					0.19
Pieris formosa	*Ericaceae*	0.09	0.04	9.24	0.08		0.35	0.38	1.90	0.82	0.49	
Lyonia ovalifolia	*Ericaceae*	0.09	0.26	10.88	0.75	0.70	0.01	0.22	0.21	0.23		
Benthamidia capitata	*Cornaceae*	0.03	0.04									0.42
Ilex sp.	*Aquifoliaceae*			0.65					0.00			
Daphne bholua	*Thymelaeaceae*							0.10				
Rhododendron falconeri	*Ericaceae*								3.13			

Daphne sp.	*Thymelaeaceae*								0.08			
Rhododendron barbatum	*Ericaceae*								0.01			
Rhododendron triflorum	*Ericaceae*								0.00			
Lynonia aungtusfiloa	*Solanaceae*								0.00			
Rhododendron cinnabarinum	*Ericaceae*									0.06		
Piptanthus nepalensis	*Leguminosae*								0.00	0.01		
Rhododendron campylocarpum	*Ericaceae*									0.01		
Sub-Total		**9.05**	**1.23**	**20.94**	**1.13**	**0.70**	**0.99**	**1.96**	**6.27**	**1.58**	**0.56**	**0.88**
(Lifeform-Evergreen tree)	**Family**	**RBA**	**RBA**	**RBA**	**w**	**RBA**	**RBA**	**RBA**	**RBA**	**RBA**	**RBA**	**RBA**
Quercus semecarpifolia	*Fagaceae*	7.52	1.82		2.18	15.68	14.45		12.17	2.51	25.70	3.92
Symplocos sp.	*Symplocaceae*	2.66					0.08		0.26			
Rhododendron arboreum	*Ericaceae*	2.00	3.15	1.88		0.45			0.86	1.39		13.53
Gamblea ciliata	*Araliaceae*	0.35	0.75									
Quercus sp.	*Fagaceae*			1.24					0.54			
Phoebe lanceolata	*Lauraceae*						3.11					
Sub-Total		**12.54**	**5.72**	**3.12**	**2.18**	**16.13**	**17.64**	**0.00**	**13.83**	**3.90**	**25.70**	**17.45**
Grand Total		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Annexure 6: List of ground vegetation

Species (Habitat-Annual herb)	Family	Bji RD%	Dogar RD%	Doteng RD%	Essu RD%	Hungrel RD%	Katsho RD%	Lungnyi RD%	Naja RD%	Sama RD%	Shaba RD%	Tsento RD%
Artemisia sp	*Compositae*	0.00	0.00	0.32	0.00	0.00	0.00	1.00	3.44	0.27	0.00	0.00
Artemisia thellungiana	*Compositae*	0.00	7.30	0.00	0.00	0.00	0.00	0.00	4.29	0.00	0.00	0.00
Aster sp	*Compositae*	0.19	0.12	0.07	0.00	0.16	0.00	0.92	0.42	0.00	0.00	0.28
Drymaria sp	*Caryophyllaceae*	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00
Eleusine indica	*Gramineae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.00
Euphorbia sp	*Euphorbiaceae*	0.00	2.48	0.00	0.00	3.45	0.00	0.15	1.49	0.03	0.00	0.03
Euphrasia melanosticta	*Scrophulariaceae*	0.74	0.00	0.00	0.00	0.00	1.02	0.00	0.00	0.10	0.00	0.00
Fagopyrum sp	*Polygonaceae*	0.00	0.00	0.76	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Galinsoga parviflora	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02	0.00	0.00	0.00
Galium aparine	*Rubiaceae*	0.00	0.00	0.00	0.00	0.00	0.00	1.08	0.05	0.00	0.00	0.00
Galium sp	*Rubiaceae*	0.00	2.69	0.05	0.00	0.00	0.38	0.00	0.35	0.21	0.00	0.00
Gentiana sp	*Gentianaceae*	3.62	0.00	0.19	0.00	0.00	3.07	0.09	0.00	0.63	0.00	1.90
Geranium sp	*Geraniaceae*	5.24	0.00	0.42	0.31	0.00	2.05	0.33	0.00	0.08	0.00	0.79
Grass	*Compositae*	0.00	0.00	0.10	0.00	0.00	0.00	0.00	2.07	0.00	8.67	7.78
Hackelia sp	*Boraginaceae*	0.00	0.00	0.00	0.00	0.00	1.65	0.00	0.00	0.23	0.00	0.00
Impatiens sp	*Balsaminaceae*	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.06
Oxalis sp	*Oxalidaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.06
Persicaria sp	*Polygonaceae*	0.38	0.00	0.02	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.33
Pilea sp	*Urticaceae*	0.00	2.44	2.55	0.00	0.00	0.00	0.00	0.20	0.00	0.00	1.44

Primula denticulata	*Primulaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.71	0.00	0.00
Primula smithiana	*Primulaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.00
Primula sp	*Primulaceae*	0.00	0.00	1.70	0.61	0.30	0.59	1.14	0.17	2.56	0.00	0.13
Ranunculus sp	*Ranunculaceae*	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Senecio sp	*Compositae*	2.28	0.00	2.48	0.00	0.00	5.49	2.10	0.00	1.05	0.00	0.62
Sonchus sp	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52
Torilis japonica	*Umbelliferae*	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00
Sub-total		**12.44**	**15.02**	**9.08**	**0.92**	**4.12**	**14.26**	**6.90**	**14.18**	**7.35**	**8.67**	**13.94**
(Habitat-Biennial herb)	**Family**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**
Cirsium sp	*Compositae*	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Cynoglossum furcatum	*Boraginaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00
Cynoglossum sp	*Boraginaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
Heracleum nepalense	*Umbelliferae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Heracleum wallichii	*Umbelliferae*	0.00	0.00	2.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oenanthe javanica	*Umbelliferae*	1.32	0.00	0.00	0.00	0.00	2.46	0.00	0.00	0.00	0.00	0.00
Pleurospermum sikkimense	*Umbelliferae*	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pleurospermum sp	*Umbelliferae*	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taraxacum eriopodum	*Compositae*	0.00	0.00	0.00	0.00	0.00	2.20	0.00	0.00	0.31	0.00	0.31
Taraxacum parvulum	*Compositae*	0.57	0.00	0.00	0.31	0.00	1.23	0.00	0.00	0.05	0.00	0.00
Sub-total		**2.23**	**0.00**	**2.74**	**0.31**	**0.00**	**5.89**	**0.10**	**0.18**	**0.35**	**0.00**	**0.45**
(Habitat-Perennial herb)	**Family**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**
Abelmoschus manihot	*Malvaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.19	0.00	0.00
Acanthocalyx nepalensis	*Morinaceae*	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Acmella uliginosa	*Compositae*	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.30
Aconogonon hookeri	*Polygonaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.00
Aconogonon polystachyum	*Polygonaceae*	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aconogonon sp	*Polygonaceae*	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26

Ainsliaea aptera	*Compositae*	0.00	0.00	0.01	0.00	0.00	0.70	0.00	0.04	0.14	0.00	0.06
Ainsliaea latifolia	*Compositae*	0.00	0.00	7.16	0.00	1.29	0.00	5.06	0.19	4.22	0.00	2.41
Ajania nubigena	*Compositae*	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.00
Aletris pauciflora	*Melanthiaceae*	0.44	0.00	0.00	0.00	0.00	0.00	0.28	0.42	0.00	0.00	5.61
Allium sp	*Alliaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.00
Allium wallichii	*Alliaceae*	0.00	0.00	0.00	0.00	0.00	0.00	1.15	0.00	0.00	0.00	0.00
Ananas comosus	*Bromeliaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00
Anaphalis margaritacea	*Compositae*	0.00	0.00	0.14	0.00	0.00	0.00	0.00	3.35	0.00	0.00	2.75
Anaphalis nepalensis	*Compositae*	0.00	0.00	1.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Anaphalis sp	*Compositae*	0.00	0.42	0.62	0.09	7.62	2.35	2.20	3.25	5.84	0.00	0.19
Anemone demissa	*Ranunculaceae*	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00
Anemone sp	*Ranunculaceae*	0.00	0.00	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
Artemisia indica	*Compositae*	0.00	0.00	0.00	0.00	2.09	0.00	0.19	0.00	0.00	0.00	0.00
Astilbe rivularis	*Saxifragaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Astragalus sp	*Leguminosae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.00
Bergenia sp	*Saxifragaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00
Bistorta macrophylla	*Polygonaceae*	4.53	0.00	0.00	3.68	0.00	0.00	0.00	0.00	0.54	0.00	3.12
Bistorta sp	*Polygonaceae*	1.68	0.00	0.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Bistorta vacciniifolia	*Polygonaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
Bistorta vivipara	*Polygonaceae*	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bryocarpum himalaicum	*Primulaceae*	0.00	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bupleurum candollei	*Umbelliferae*	0.00	0.00	0.03	0.00	2.28	0.82	0.54	0.00	0.12	0.00	1.08
Calanthe sp	*Orchidaceae*	0.00	0.07	0.00	0.00	0.68	0.00	0.00	0.59	0.00	0.00	0.03
Caltha palustris	*Ranunculaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Campanula sp	*Campanulaceae*	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00
Carex duthiei	*Cyperaceae*	0.00	0.00	0.00	0.25	0.00	0.07	0.00	0.00	0.04	0.00	0.00
Carex sp	*Cyperaceae*	47.04	19.47	18.16	36.00	3.32	3.52	9.17	2.42	17.19	15.50	4.22

Chusua pauciflora	*Orchidaceae*	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Circaea alpina subsp. imaicola	*Onagraceae*	0.00	0.00	1.33	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.21
Clematis montana	*Ranunculaceae*	0.00	0.24	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.01
Clematis sp	*Ranunculaceae*	0.00	0.00	0.00	0.73	0.00	0.00	0.66	0.00	0.00	0.00	0.00
Clinopodium umbrosum	*Labiatae*	0.00	0.00	0.00	0.00	0.32	0.00	0.68	0.17	0.02	0.00	0.00
Clintonia udensis	*Uvulariaceae*	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33
Cortiella hookeri	*Umbelliferae*	0.15	0.00	0.02	0.00	0.00	0.76	0.00	0.00	0.00	0.00	0.00
Corydalis juncea	*Fumariaceae*	0.00	0.00	0.00	0.00	0.00	1.37	0.00	0.00	0.19	0.00	0.00
Corydalis sp	*Fumariaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Cremanthodium sp	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
Cyananthus incanus	*Campanulaceae*	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyananthus lobatus	*Campanulaceae*	0.60	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.04	0.00	0.34
Cyananthus sp	*Campanulaceae*	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32
Cynanchum auriculatum	*Asclepiadaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00
Cynodon sp	*Gramineae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41	0.00	0.00	0.00
Danthonia sp	*Gramineae*	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Digitaria sp	*Gramineae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00
Dubyaea hispida	*Compositae*	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.05	0.00	0.00
Elatostema lineolatum	*Urticaceae*	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71
Elatostema sp	*Urticaceae*	0.00	0.00	0.74	0.00	0.00	0.00	0.00	0.20	0.30	0.00	1.15
Elsholtzia sp	*Labiatae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
Elsholtzia strobilifera	*Labiatae*	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00
Epiglossum sp	*Orchidaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00
Epilobium sp	*Onagraceae*	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Equisetum diffusum	*Gesneriaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00
Eupatorium nodiflorum	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.90	0.00
Euphorbia griffithii	*Euphorbiaceae*	0.00	0.00	0.33	0.00	0.00	0.00	0.87	0.00	2.00	8.12	0.09

Festuca sp	*Gramineae*	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00
Fragaria nubicola	*Rosaceae*	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Fragaria sp	*Rosaceae*	0.00	0.22	1.35	0.00	2.38	3.52	1.56	0.00	5.43	0.00	0.08
Gentiana algida	*Gentianaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Gentiana urnula	*Gentianaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Goodyera sp	*Orchidaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Gueldenstaedtia himalaica	*Leguminosae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00
Halenia elliptica	*Gentianaceae*	0.57	0.66	0.14	3.68	1.32	8.34	0.66	1.49	0.34	0.00	1.68
Hedera nepalensis	*Araliaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.34	0.00	0.00	0.00
Hedychium sp	*Zingiberaceae*	0.00	0.00	0.00	0.00	0.00	0.00	1.78	0.00	0.00	0.00	0.33
Hemiphragma heterophyllum	*Scrophulariaceae*	0.38	0.00	0.14	0.00	0.00	0.00	0.12	0.12	0.84	0.00	0.53
Herminium sp	*Orchidaceae*	0.00	0.00	0.00	0.00	0.00	2.05	0.00	0.00	0.00	0.00	0.00
Holboellia latifolia	*Lardizabalaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00
Houttuynia cordata	*Saururaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00
Hydrangea sp	*Hydrangeaceae*	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hypoxis aurea	*Hypoxidaceae*	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00
Inula hookeri	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00
Iris clarkei	*Iridaceae*	0.00	14.83	0.00	0.00	0.00	8.21	0.00	0.99	1.86	0.00	0.00
Iris sp	*Iridaceae*	0.00	0.00	0.00	3.61	0.00	0.00	3.89	0.00	2.98	0.00	0.00
Juncus sp	*Juncaceae*	4.80	0.00	0.00	0.00	0.00	0.00	0.22	0.00	5.28	0.00	0.00
Lagotis sp	*Scrophulariaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Leontopodium sp	*Compositae*	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lespedeza gerardiana	*Leguminosae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.84	0.00
Leucas ciliata	*Labiatae*	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ligularia atkinsonii	*Compositae*	0.00	0.00	0.00	0.00	0.00	10.68	0.00	0.00	2.05	0.00	0.00
Ligularia mortonii	*Compositae*	0.00	0.00	0.00	0.00	0.00	3.70	0.00	0.00	0.71	0.00	0.00
Ligularia sp	*Compositae*	0.00	0.00	0.25	10.19	0.00	0.00	0.00	0.00	1.55	0.00	1.84

Lobelia sp	*Campanulaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.09	0.00
Lomatogonium brachyantherum	*Gentianaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29
Lomatogonium sp	*Gentianaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.02
Lomatogonium stapfii	*Gentianaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29
Maianthemum sp	*Convallariaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.04
Meconopsis paniculata	*Papaveraceae*	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Meconopsis sp	*Papaveraceae*	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Meeboldia sp	*Umbelliferae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.30	0.00	0.00
Megacodon stylophorus	*Gentianaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00
Mentha spicata	*Labiatae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Microstegium sp	*Gramineae*	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.00	0.00	0.00
Microstegium vimineum	*Gramineae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	18.08	0.00
Mulgedium sp	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00
Myriactis nepalensis	*Compositae*	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
Myriactis wallichii	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00
Nardostachys grandiflora	*Ranunculaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00
Neopicrorhiza scrophulariiflora	*Scrophulariaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Nepeta sp	*Labiatae*	0.00	0.00	0.00	0.37	0.00	3.43	0.00	0.10	0.53	0.00	0.00
Onosma hookeri	*Boraginaceae*	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ophiopogon sp	*Convallariaceae*	0.00	0.00	5.12	0.00	7.63	0.00	0.09	5.63	0.00	0.00	0.39
Ophiopogon wallichianus	*Convallariaceae*	0.00	0.00	1.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Osmanthus sp	*Melastomataceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
Oxygraphis endlicheri	*Ranunculaceae*	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oxytropis lapponica	*Leguminosae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.09
Panax pseudo-ginseng	*Araliaceae*	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02

Parasenecio palmatisectus	*Compositae*	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parasenecio sp	*Compositae*	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parnassia chinensis	*Parnassiaceae*	1.09	0.00	0.00	0.00	0.00	0.46	0.00	0.00	0.15	0.00	0.00
Pedicularis megalantha	*Scrophulariaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.00	0.00
Pedicularis siphonantha	*Scrophulariaceae*	3.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00
Pedicularis sp	*Scrophulariaceae*	2.76	0.00	0.26	0.00	0.00	0.00	0.03	0.00	0.05	0.00	0.14
Phaeonychium parryoides	*Cruciferae*	0.00	0.00	0.00	0.00	6.72	0.00	2.65	0.00	0.00	0.00	0.00
Phlomis rotata	*Labiatae*	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32
Phlomis sp	*Labiatae*	0.00	0.00	0.00	0.00	1.06	0.00	0.00	0.02	0.00	0.00	0.00
Phyallanthus virgatus	*Euphorbiaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Plantago depressa	*Plantaginaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Plantago erosa	*Plantaginaceae*	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00
Plantago sp	*Plantaginaceae*	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.43	0.01	0.00	0.00
Poa sp	*Gramineae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00
Polygonatum sp	*Convallariaceae*	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50
Potentilla anserina	*Rosaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
Potentilla coriandrifolia	*Rosaceae*	0.46	0.00	0.00	0.61	0.00	8.20	0.00	0.00	0.09	1.34	3.44
Potentilla cuneata	*Rosaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
Potentilla fruticosa	*Rosaceae*	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Potentilla peduncularis	*Rosaceae*	0.00	0.00	0.00	1.23	0.00	0.37	0.00	0.00	0.18	0.00	0.00
Potentilla sp	*Rosaceae*	5.57	0.00	3.46	0.98	0.00	0.00	0.33	0.73	1.35	0.00	2.99
Prangos sp	*Urticaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Prunella vulgaris	*Labiatae*	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00
Pterisanthes sp	*Rubiaceae*	0.00	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pyrola rotundifolia	*Pyrolaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00
Pyrola sp	*Pyrolaceae*	0.00	0.00	0.00	14.81	0.00	0.00	0.00	0.00	0.13	0.00	0.00
Rheum nobile	*Polygonaceae*	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Rhodiola sp	*Crassulaceae*	3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91
Roscoea sp	*Zingiberaceae*	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rubia manjith	*Rubiaceae*	0.00	1.93	0.00	0.00	0.00	0.00	2.13	0.00	0.00	0.00	0.10
Rubia sp	*Rubiaceae*	0.00	0.00	0.00	0.00	5.31	0.00	0.26	0.28	0.00	0.00	0.09
Rubus calycinus	*Rosaceae*	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rubus fockeanus	*Rosaceae*	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
Rubus fragarioides	*Rosaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.80	0.00	0.00	0.00
Rubus sp	*Rosaceae*	0.00	2.31	6.11	12.51	2.84	0.76	7.33	14.39	7.49	0.00	2.73
Rumex nepalensis	*Polygonaceae*	0.00	0.00	2.52	0.00	0.62	0.00	0.38	0.74	0.00	0.00	0.00
Rumex sp	*Polygonaceae*	2.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Salvia campanulata	*Labiatae*	0.00	0.00	0.00	0.00	0.00	0.00	1.18	0.00	0.00	0.00	0.00
Salvia sp	*Labiatae*	0.00	29.56	3.25	0.00	0.00	0.00	4.92	3.88	0.85	0.00	3.27
Sambucus adnata	*Caprifoliaceae*	0.00	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	0.00	0.05
Sanicula elata	*Umbelliferae*	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00
Saussurea auriculata	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.55	0.00	0.00
Saussurea nishiokae	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.18	0.00	0.00
Saussurea sp	*Compositae*	0.00	0.00	0.04	0.00	0.00	0.55	0.00	0.00	0.08	0.00	0.78
Saxifraga sp	*Saxifragaceae*	0.71	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Selinum candollei	*Umbelliferae*	0.00	0.00	1.38	0.00	1.64	5.34	1.23	0.12	0.23	0.00	2.24
Selinum wallichianum	*Umbelliferae*	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.01
Senecio laetus	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Senecio raphanifolius	*Compositae*	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00
Senecio royleanus	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Senecio scandens	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Smilax sp	*Smilacaceae*	0.00	2.53	0.00	0.00	0.00	0.00	0.00	5.44	0.00	0.00	0.00
Soroseris hookeriana	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
Soroseris sp	*Compositae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62

Spenceria parviflora	*Rosaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00
Stellaria sp	*Caryophyllaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.70	0.00
Streptopus simplex	*Uvulariaceae*	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Strobilanthes sp	*Acanthaceae*	0.00	0.00	2.67	0.00	0.70	0.00	0.53	0.00	0.00	0.00	1.40
Swertia bimaculata	*Gentianaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.00	0.00	0.24
Swertia hookeri	*Gentianaceae*	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Swertia multicaulis	*Gentianaceae*	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Swertia sp	*Gentianaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00
Synotis sp	*Compositae*	0.00	0.00	4.34	0.05	14.96	0.00	4.74	0.00	0.00	7.03	3.83
Synotis wallichii	*Compositae*	0.00	0.00	3.23	0.00	0.00	5.87	0.00	0.00	1.33	0.00	0.46
Thalictrum foliolosum	*Ranunculaceae*	0.00	6.07	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00
Thalictrum reniforme	*Ranunculaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	3.14	0.68
Thalictrum sp	*Ranunculaceae*	0.00	0.00	0.56	0.00	2.25	0.00	0.45	1.55	0.00	0.00	0.32
Trifolium repens	*Leguminosae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.59	0.00	0.00
Triosteum himalaynum	*Caprifoliaceae*	0.00	0.00	0.00	0.00	0.51	0.58	0.00	0.00	0.06	0.00	0.00
Urtica dioica	*Urticaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00
Utricularia sp	*Lentibulariaceae*	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Veronica sp	*Scrophulariaceae*	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00
Vincetoxicum hirundinaria	*Asclepiadaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.70	0.00
Viola biflora	*Violaceae*	0.00	0.00	0.00	0.00	0.00	1.41	0.00	0.00	0.32	0.00	0.00
Viola sp	*Violaceae*	0.00	0.00	0.11	0.00	0.01	0.00	1.39	0.00	0.00	0.00	0.00
Waldheimia glabra	*Campanulaceae*	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total		**84.76**	**78.66**	**73.92**	**89.96**	**68.24**	**73.05**	**62.41**	**52.52**	**76.57**	**67.16**	**59.50**
(Habitat-Spore bearing)	**Family**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**	**RD%**
Athyrium sp	*Acanthaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00
Atrichum undulatum	*Acanthaceae*	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bazzania tirlobata	*Leguminosae*	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

Breutelia sp	*Cruciferae*	0.00	0.00	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cladonia sp	*Rutaceae*	0.00	0.00	0.00	0.00	0.00	0.00	2.20	0.00	0.00	0.00	0.34
Conocephalum sp	*Connaraceae*	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dicranum scoparium	*Acanthaceae*	0.00	0.00	0.22	0.00	11.88	0.00	0.31	0.00	0.00	0.00	4.56
Dicranum sp	*Acanthaceae*	0.00	0.00	1.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
Drynaria sp	*Caryophyllaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.00	0.00	0.00
Dryopteris sp	*Caryophyllaceae*	0.00	6.21	0.81	0.00	0.00	0.00	0.00	11.84	0.00	0.00	4.38
Entodon sp	*Leguminosae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Helodium sp	*Loranthaceae*	0.00	0.00	0.00	0.00	0.00	0.00	2.06	0.00	0.00	0.00	0.15
Hymenophyllum sp.	*Rubiaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47
Hypnum cupressiforme	*Hypericaceae*	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hypnum sp	*Hypericaceae*	0.00	0.00	0.37	0.00	3.18	0.00	6.86	0.00	0.00	16.63	3.62
Lepisorus sp	*Sapindaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.09	0.00	0.00	0.00
Lobaria sp	*Liliaceae*	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lycopodium	*Solanaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00
Metzgeria furcata	*Araliaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
Neckera	*Rubiaceae*	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onychium cryptogrammoides	*Boraginaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00
Onychium sp	*Boraginaceae*	0.00	0.00	0.93	0.00	0.00	0.00	0.38	0.44	0.00	0.00	0.00
Osmunda cinnamomea	*Umbelliferae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	0.00	0.00	0.00
Osmunda sp	*Umbelliferae*	0.00	0.00	0.03	0.00	0.04	0.00	0.61	0.00	0.00	0.00	0.00
Peltigera sp	*Convallariaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.47	0.00
Philonotis fanacata	*Philadelphaceae*	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Philonotis sp	*Philadelphaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00
Plagiochila	*Pittosporaceae*	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Plagiomnium sp	*Pittosporaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01

Plagiomnium undulatum	*Pittosporaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
Pogonatum sp	*Gramineae*	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
Polystichum sp	*Gramineae*	0.00	0.00	1.21	0.00	0.00	0.00	0.15	0.74	0.00	0.00	1.55
Polytrichum sp	*Gramineae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Polytricum commue	*Gramineae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16
Pteridium aquilinum	*Rubiaceae*	0.00	0.00	0.00	0.00	0.00	5.98	0.00	6.81	0.00	0.00	0.00
Pteridium sp	*Rubiaceae*	0.00	0.00	2.75	2.46	11.52	0.00	6.88	0.00	6.71	0.00	4.91
Pteris cretica	*Rubiaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.31	5.36	0.00	0.00	0.00
Pteris sp	*Rubiaceae*	0.00	0.00	0.16	0.00	0.00	0.00	5.60	0.00	0.00	0.00	0.29
Ptilium crista-castrensis	*Sterculiaceae*	0.00	0.00	2.39	0.00	0.00	0.00	2.90	0.00	0.00	0.00	0.45
Rhodobryum giganteum	*Crassulaceae*	0.00	0.00	0.00	0.00	0.73	0.00	0.09	0.00	0.00	0.00	0.02
Rhodobryum roseum	*Crassulaceae*	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.27
Rhytidium rugosum	*Gesneriaceae*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00
Selaginella sp	*Crassulaceae*	0.00	0.00	0.23	0.00	0.00	0.00	0.00	5.36	0.00	0.00	0.00
Sphagnum sp	*Meliaceae*	0.57	0.00	0.00	6.36	0.00	0.82	0.00	0.00	9.02	0.00	0.71
Thamnolia vermicularis	*Gramineae*	0.00	0.00	1.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Thelypteris sp	*Gramineae*	0.00	0.00	0.24	0.00	0.28	0.00	0.44	0.00	0.00	0.00	1.68
Thuidium sp	*Orchidaceae*	0.00	0.00	0.19	0.00	0.00	0.00	0.63	0.00	0.00	6.34	1.36
Woodwardia unigemmata	*Lythraceae*	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sub-total		**0.57**	**6.32**	**14.26**	**8.82**	**27.63**	**6.80**	**30.58**	**33.12**	**15.72**	**24.17**	**26.12**
Grand total		**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Annexure 7: Lists of medicinal plant

Sl. no	Botanical name	Dzongkha name
1	*Abis densa*	ཐང་ནག།།
2	*Anemone griffithii*	སྨུག་ཀ།།།
3	*Arenaria kansuensis*	རྩྭ་ཚ་ཀོང་།།
4	*Aster flaccidus*	ཨེ་ཏོག་ལྷག་མིག།
5	*Bergenia stracheyii*	ཁ་དུར།
6	*Bergenia ciliata*	ཁ་དུར།
7	*Carum Carvi*	ཞོ་སྐྱོད།
8	*Cautleya spicata*	སྐ་སྐྱ།
9	*Chrysanthemum coccineum*	འཁན་སེ།
10	*Clematis acutangula*	དབྱི་མོང་ཏཀར་པོ།
11	*Ophiocordyceps sinensis*	དབྱར་རྩ་དགུན་བྱད།
12	*Corydalis crispa*	བ་ཤ་ཀ།
13	*Cotoneaster microphyllus*	NA
14	*Ephedra gerardiana*	མཚེ་ལྷམ།
15	*Dracocephalum tanguiticum*	ཐྱི་ཡང་ཀྱ།
16	*Euphorbia griffithii*	དུར་ཁྱེད།
17	*Eriophyton wallichi*	ཐུང་ཚན་སྨུ་རྩ།
18	*Fragaria nubicola*	འབྱི་རྟ་ས་འཛིན།
19	*Euphorbia wallichii*	ཐར་ཀུ།
20	*Gentiana urnula*	གང་གི་ཆུང་།
21	*Gentiania robusta*	ཀྱི་ལྷྱི་དཀར་པོ།
22	*Helina eliptica*	ལྷགས་ཏིག་རང་མགོ་མ།
23	*Heracleum obtusifolium*	སྨུ་དཀར།
24	*Panax pseudoginseng*	ཐྱིང་གི་ར་ཙ།
25	*Hippophae salicifolia*	ཤུར་བྱ།
26	*Inula racemosa*	མ་ཀུ།

27	*Iris goniocarpoa*	ཀོ་ཐ།
28	*Juniperus indica*	ཤུག་པ།
29	*Lancea tibetica*	པ་ཡག།
30	*Megacordon stylophorus*	ཀྱེ་ཕྱི་རི་གས།
31	*Leontopodium himalayanum*	སྤྱ་བ།
32	*Iris kemaonensis*	དེས་ཨ་ཙོ།
33	*Maconopsis peniculata*	ཞུཏྲལ་སེར་པོ།
34	*Nardostachys jatamansi*	ཇ་སྤོས།
35	*Nardostachys grandiflora*	སྤང་སྤོས།
36	*Neopicrorhiza scrophulariiflora*	
37	*Onosma hookeri*	འཐི་ཨ་གཡ།
38	*Oxytropis lapponica*	སྡད་དཀར།
39	*Pedicularis integrifolia*	མེ་ཏོག་གྲང་སྣ།
40	*Pedencularis megalantha*	ལག་རྩེ་དམར་པོ།
41	*Pedicularis siphonantha*	འདེ་གྲང་།
42	*Phytolacca acinosa Roxb*	དཔའ་བོ་ཏོགར་པོ།
43	*Phlomis rotata Benth*	རྟ་ཁྲག་ས།
44	*Plantago depressa*	ཐ་རམ།
45	*Polygonum macrophylla*	སྤང་རམ།
46	*Potentila anserina*	གོོ་མ།
47	*Podophyllum hexandrum*	འོལ་ཨ་ས།
48	*Potentila spp*	ས་ལས་གོོན་མ།
49	*Potentila arbuscula*	ཕྱེན་མ་ནག་པོ།
50	*Quercus grifithii*	མོན་ཆར།
51	*Rheum moorcroftianum*	ལྷུམ་རྩ།
52	*Ranunculus brotherusi*	སྐུ་ཚྭ།
53	*Rheum australe*	ཆུ་རྩ།
54	*Rhodiola dumulosa*	ཚན་ཆུངས་པ།
55	*Rheum nobile*	ཆུ་ཁངར་མེ་ཏོག།
56	*Rhododendron anthopogon*	བ་ལུ་དཀར་པོ།
57	*Rhododendron setosum*	བ་ལུ་ནག་པོ།

58	*Salvia castanea*	འཇིབ་ཙི་ཆེན་པོ།
59	*Sambucus nigr*	སྨུ་རིགས།
60	*Rosa sericea*	ས་བའི་མེ་དོག
61	*Sassurea pachyneura*	ཀོན་པ་གབ་སྐྲེས།
62	*Saussurea lappa*	རྩ་རྐ།
63	*Swertia angustifoli*	རྒྱ་ཏིག
64	*Swertia chirata*	རྒྱ་ཏིག
65	*Selinum wallichianum*	འབམ་པོ།
66	*Taraxacum eriopodum*	ཁྲུང་མོང་།
67	*Thypha elephantia*	ཤུ་དག་དཀར་པོ།
68	*Thalictrum chelidonii*	སྟོ་སྦྲིན།
69	*Taxus bacata*	ཀི་རངཤིང་།
70	*Thermopsis barbata*	སྨ་བ་སྣད་མ།
71	*Valeriana wallichii*	ཚུ་སྤོས།
72	*Veronica cephaloides*	ལྟམ་དག་དོམ་མཁྲིས།
73	*Meconopsis simplicifol*	ཤུཏྤལ་སྟོན་པོ།

Annexure 8:Tree density

Dzongkhag	Forest type	Forest area (ha)	Tree count/ha	Total tree count
Chhukha	Blue Pine Forest	270.81	426	115365
	Cool Broadleaved Forest	67.32	417	28072
	Evergreen Oak Forest	291.98	417	121756
	Fir Forest	871.69	402	350419
	Hemlock Forest	470.27	406	190930
	Juniper Rhododendron Scrub	27.02	269	7267
	Spruce Forest	23.70	401	9502
Haa	Blue Pine Forest	3955.42	426	1685011
	Cool Broadleaved Forest	476.17	417	198564
	Evergreen Oak Forest	956.06	417	398675
	Fir Forest	18107.24	402	7279111
	Hemlock Forest	4394.21	406	1784047
	Juniper Rhododendron Scrub	2157.99	269	580499
	Spruce Forest	2649.36	401	1062394
Paro	Blue Pine Forest	17627.68	426	7509390
	Cool Broadleaved Forest	2345.77	417	978187
	Evergreen Oak Forest	3349.55	417	1396760
	Fir Forest	20865.53	402	8387944
	Hemlock Forest	8980.89	406	3646243
	Juniper Rhododendron Scrub	3529.19	269	949353
	Spruce Forest	4723.55	401	1894143
Thimphu	Fir Forest	27.85	402	11197
	Juniper Rhododendron Scrub	67.40	269	18129