CONSERVATION MANAGEMENT PLAN
JOMOTSANGKHA WILDLIFE SANCTUARY

(January 2023 to December 2032)

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

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FOR
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Department of Forests and Park Services

Ministry of Energy and Natural Resources

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Jomotsangkha Wildlife Sanctuary

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

ENDORSEMENT AND APPROVAL OF THE ROYAL GOVERNMENT OF BHUTAN

CONSERVATION MANAGEMENT PLAN OF JOMOTSHANGKHA WILDLIFE SANCTUARY (2023-2033)

"In accordance with the provisions of the Forests and Nature Conservation Act of Bhutan, 1995."

Submitted for Approval

Ugyen Tshering
Chief Forestry Officer
Jomotsangkha Wildlife Sanctuary

Sonam Wangdi
Chief Forestry Officer
Nature Conservation Division

Recommended for Approval

Director
Department of Forests and Park Services

Approved By:

Hon'ble Secretary
Ministry of Energy and Natural Resources

Forward

Jomotsangkha Wildlife Sanctuary has an area of 362 km² and plays a vital role in conservation of Royal Bengal Tiger, Common Leopard, Himalayan Black Bear, Asiatic Elephant, Gaur and the rare and endangered Pygmy hog, hispid hare, Temminck's tragopan and Blyth tragopan and other tropical wildlife species in the region. The sanctuary is connected with Sakteng Wildlife Sanctuary and the Royal Manas National Park through biological corridors also with the protected areas in the Indian states of Assam and Arunachal Pradesh (India) and it covers the Administrative Gewogs of Samrang, Langchenphu, part of Serthi, Pemathang and Phuntshothang. The sanctuary also forms part of the Himalayan subtropical broadleaved forest ecosystem which is an important element in the Himalayan ecoregion. The communities residing inside the sanctuary are agro-pastoralists, and they belong to two groups, namely the Tshanglas and Lhotshampas.

This is the first conservation management plan of the Sanctuary and covers period from January 2023 until December 2033. The activities in this plan will be implemented through annual operation plan and performance targets. This plan consists of 7 Parts and all the activities will be monitored by following the monitoring framework mentioned in this plan. Zonation of the area was carried out based on the "Protected Area Zonation Guidelines of 2019" with an objective to delineate sanctuary into different zones as per the functions of the area.

The Ministry highly values the contributions made by sanctuary staffs and appreciates everyone for demonstrating unwavering support, commitment and dedication in preparing this management plan and achieve conservation milestone towards greater heights.

While this management plan highlights our achievement, we also recognize the challenges and limitations that we face. We remain committed to addressing these hurdles through ongoing research, innovation, and collaboration, as we strive for a greener and more prosperous Bhutan.

I am optimistic that this management plan will contribute immensely towards conservation of rich biodiversity of Southeastern Bhutan and bring in balance between conservation and developmental needs of the rural communities.

I wish Jomotsangkha Wildlife Sanctuary all the best in fulfillment of this management plan.

Tashi Delek!

(Karma Tshering)

Preface

It gives me enormous satisfaction to applaud the management of Jomotsangkha Wildlife Sanctuary for coming with its First Conservation Management Plan for ten years (January 2023-December, 2033). The sanctuary has made remarkable achievements in terms of conservation of the rich biodiversity in southeastern region of the country and in enhancement of livelihood of the residents during the implementation of its previous management plans.

The main goal of this conservation Management Plan is to conserve wildlife and habitats while ensuring local people derive continuous benefit from the landscape. The key areas that will be covered under this management plan will be species conservation, habitat management, anti-poaching, human wildlife conflict, sustainable utilization of timber and NWFPs.

It is with great pleasure that we present this management plan reflecting unwavering commitment to the conservation and sustainable management of our precious forest resources and the sanctuary areas.

With this management plan in place, we aim to provide a comprehensive overview of the management intervention by highlighting our efforts in preserving forest ecosystems, and enhancing sustainable forest management practices through various strategies and actions. We also face greater challenges in striking the delicate balance between conservation and socio-economic development of our country.

I would like to extend my deepest appreciation to the dedicated staff of the sanctuary, whose unwavering dedication, expertise, and tireless efforts form the foundation of this management plan. I also express my gratitude to the Royal Government of Bhutan for its guidance and support in our conservation endeavors.

Tashi Delek!

(Lobzang Dorji)

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BACKGROUND

1.1 History and Significance

Jomotsangkha Wildlife Sanctuary (JWS), previously known as the Khaling Wildlife Sanctuary, was gazetted as a Wildlife Sanctuary in 1993 after the merger of Khaling Reserved Forest (which was notified in 1974) and Neoli Wildlife Reserve (notified in 1983). The Sanctuary is located in the extreme southeastern part of the country and falls under Samdrup Jongkhar Dzongkhag. It connects to Sakteng Wildlife Sanctuary and Royal Manas National Park through biological corridors thus providing connectivity of protected areas in the country. Until 2014, the Sanctuary was known as Khaling Wildlife Sanctuary and later changed its name to Jomotsangkha Wildlife Sanctuary. The Sanctuary was initially under the administrative jurisdiction of Samdrup Jongkhar Forest Division until it got delinked from 1st May 2017 upon order from Department of Forests and Park Services vide order no. DoFPS/FPED/FSFS/14/2017/1195 dated 31st March 2017.

The Sanctuary covers an area of 362 sq.km encompassing whole of Samrang and Langchenphu Gewogs and part of Serthi, Pemathang and Phuntshothang Gewogs. The Sanctuary forms an important part of the Himalayan subtropical broad-leaved forest ecosystem which is an important element in the Himalayan eco-region. The Sanctuary lies within the Indo-Bhutan border and is a part of Transboundary Manas Conservation Area (TraMCA) which provides critical habitat for survival of several threatened species.

As the Sanctuary lies in the Indo-Malayan realm, it is a hotspot for biodiversity and it houses a wide array of the endangered wildlife species such as Royal Bengal Tiger (*Panthera tigris tigris*), Common Leopard (*Panthera pardus*),

Himalayan Black Bear (*Ursus thibetanus*), Gaur (*Bos gaurus*), and Asiatic Wild Elephant (*Elephus maximus*). The Sanctuary is said to be the only habitat for the rare and endangered Pygmy hog (*Porcula salvania*) and hispid hare (*Caprolagus hispidus*). Until now, 34 mammals, 311 birds, 331 butterflies, 79 fish, 80 dragonfly and damselfly, 82 herpetofauna and 571 plant species were recorded. The list could increase with extensive survey over the coming years.

The Sanctuary harbors all the four species of hornbill found in Bhutan and all of these four species breed and roost in the Sanctuary. Of the 11 cat species in Bhutan, seven of these species are found in the Sanctuary. In Bhutan, JWS is the only protected area which got first photographic evidence of Temminck's tragopan and Blyth tragopan, the rare and beautiful birds.

1.2. Vision, Mission and Goals

Vision

To create safe habitat for wildlife and ensure sustainable utilization of natural resources to benefit present and future generations.

Mission

To manage and protect subtropical forest and its habitat for the conservation of biodiversity and sustainable utilization of natural resources for the benefit of local residents.

Goals

To conserve wildlife and habitats while ensuring local people derive continuous benefit from the landscape.

Objectives

1. To manage forest sustainably in order to provide habitat for wildlife and support livelihood of local people in the Sanctuary through efficient land-use system
2. To maintain viable population of wildlife and assess the presence of new wildlife species
3. To develop infrastructure and strengthen institutional capacity of the Sanctuary

1.3 Salient features of the plan

This management plan will be known as Conservation Management Plan for Jomotsangkha Wildlife Sanctuary (JWS). This is the first conservation management plan of the Sanctuary and covers period from January 2023 until December 2033.

This conservation plan aims to address conservation of species and their habitats, anti-poaching, human wildlife conflict, sustainable utilization timber and NWFP and strengthening institutional efficiency. All issues reflected in the plan have been gathered during the last four years of its operation. The activities in the plan shall be implemented by way of annual operation plan and setting annual performance targets.

This plan consists of 7 Parts. Part 1 of the plan describes about history and significance, vision, mission, goal and objectives. It also covers types of zones of the Sanctuary. Part 2 encompasses physical characteristics of the landscape, floral & faunal description, social and livelihood information, water energy and administrative structure. Part 3 of the plan contains review of the past activities instead of management plan as there was no management plan before this. The past activities comprise habitat Management, community-based resource management, documentation of biodiversity, antipoaching activities and HWC management. Part 4 includes threats and challenges. Based on the severity of the

incidence, the threats and challenges have been categorized into high, medium and low. Part 5 of the plan explicates management prescription in terms of strategic actions and Part 6 implementation plan and financial outlay. Part 7 contains monitoring and evaluation modality. All activities shall be monitored every year by set of monitoring framework mentioned in this plan. A mid-year review shall be carried out at the end of five years of its implementation. The objectives and activities will be tuned to the objectives of Department of Forests and Park Services whenever deemed necessary.

1.4 Zones of the Sanctuary

Zonation of the area was carried out based on the "Protected Area Zonation Guidelines of 2019" with an objective to delineate Wildlife Sanctuary into different zones as per the functions of the area and accordingly prescribed regulations and management interventions. Three types of zones are designated (Table 1).

Table 1. Area of Sanctuary under various zones

Zones	**Area (SqKm)**	**% area**
Multiple use zone	197	54.42
Buffer zone	41	11.33
Core zone	124	34.25
Total Area	**362**	**100**

Core and multiple zones comprised of two blocks each (Figure 1). Buffer zone that aligned through the middle of the Sanctuary is the road buffer for Jomotsangkha-Samrang highway.

Physical features and settlement in the zones are depicted in Figure 2.

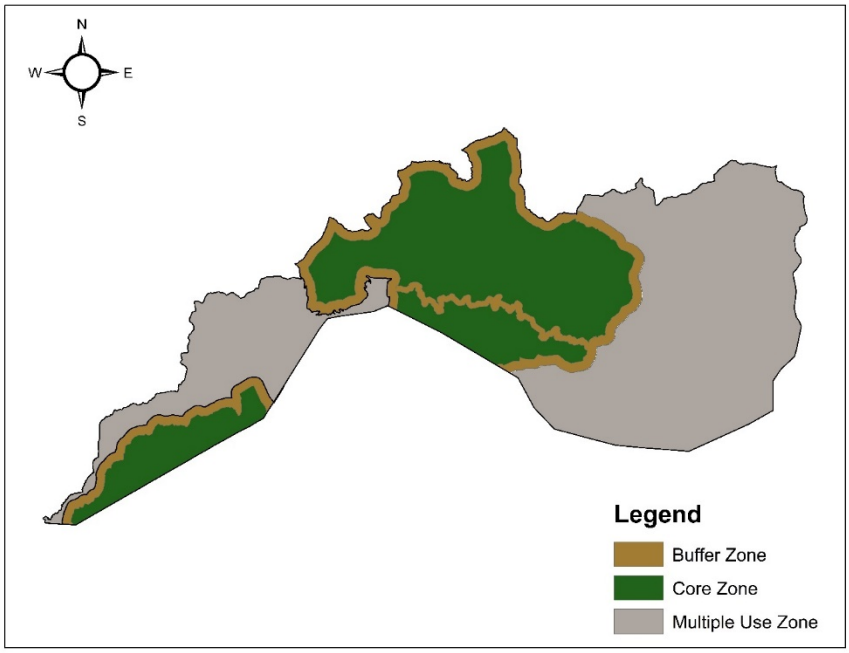


Figure 1. Management zones in Jomotsangkha Wildlife Sanctuary

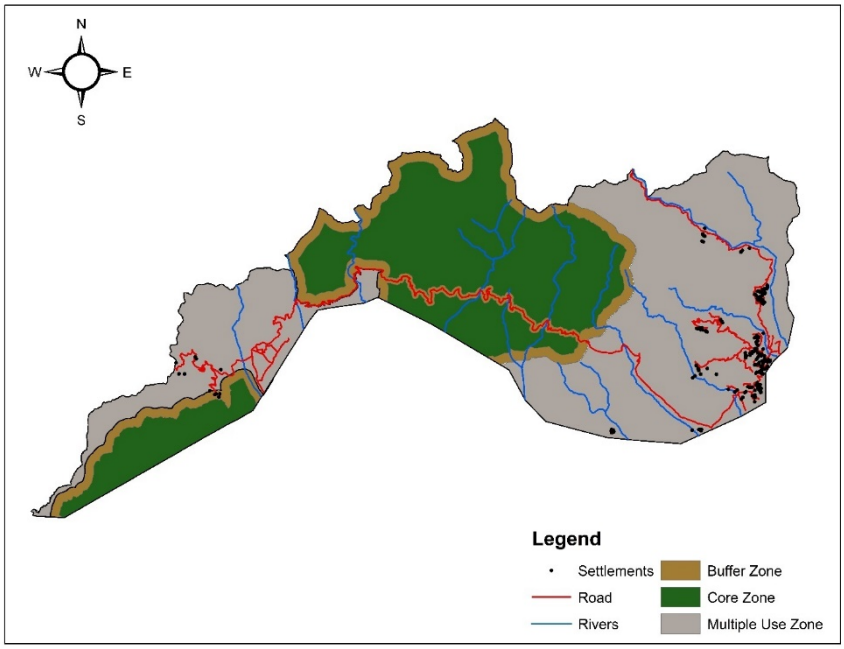


Figure 2. Settlements within the zones

1.4.1 Core Zone

Core zones are areas with high conservation values that provide critical services for the persistence of flora and fauna of international, national or local importance including resident or migratory fauna. This is a non-negotiable zone. In Jomotsangkha Wildlife Sanctuary, two blocks totaling up to 124 sq.km, encompassing areas mostly of pristine forest that provide habitats for several species such elephants, gaur, tiger, common leopard, Himalayan black bear, sambar and other lesser-known species of fauna and flora have been identified as core zones. Places such as Kherkheri, Borla, Nunai and Koilakata are included in the core zone.

1.4.2 Buffer Zone

Buffer zone is classified mainly to provide cushioning function to the core zone when this zone is located in the immediate vicinity of anthropogenic disturbances both from within and outside of the Sanctuary. The buffer zone may be regarded as an area in which human interventions is less intensive than what might be found in the multiple-use zone and may accommodate activities for environmental education, tourism, traditional resource use and recreation facilities. An area of 11.43 sq.km based on the exercises and assessment has been identified as buffer zone.

1.4.3 Multiple Use Zone

Multiple use zone which is also termed as ‘zone of cooperation’ include settlements, built-up areas, private registered lands and resource allocation areas for the Sanctuary residents. This is a zone where stakeholders agree to work together to manage and use the area in a sustainable manner to benefit both people and wildlife. About 197 sq.km of the sanctuary area has been mapped as the multiple use zone. The multiple use zone includes Dramzeygang, Samrang, Rongchuthang, Agurthang, Langchenphu, Tsangporong and Tokaphu.

Area coverage of different land use categories in each zone has been assessed. Broadleaved forest and shrub comprised major area in all three zones (Table 2). Similarly, area coverage has been assessed in various elevation class against respective zones. Highest area in core zone is within the elevation of 500-1000m while multiple use zone has highest area below the elevation of 500 (Table 3).

Table 2**.** Land use categories within various zones

Land use Class	**Park Area (km2)**	**Core zone (km2)**	**Multiple use zone (km2)**	**Buffer zone (km2)**
Broadleaved Forest	339.45	121.74	178.45	39.09
Built up	0.09	0.00	0.09	0.00
Chhuzhing	1.22	0.00	1.20	0.00
Kamzhing	2.82	0.00	2.79	0.03
Landslides	0.97	0.26	0.42	0.30
Meadows	0.16	0.01	0.15	0.01
Orchards	0.06	0.00	0.06	0.00
Rivers	8.61	0.41	7.18	0.99
Rocky Outcrops	0.18	0.00	0.18	0.00
Shrubs	7.03	1.39	4.97	0.64

Table 3. Area of elevation classes within respective zones

Zones	Elevation class (m)	Area (km2)	% Area
Core Zone	<500	23.31	6.44
	500-1000	44.12	12.19
	1000-1500	33.39	9.22
	>1500	22.65	6.26
Multiple use Zone	<500	94.63	26.14
	500-1000	76.25	21.06
	1000-1500	16.06	4.44
	>1500	7.72	2.13
Buffer Zone	<500	12.20	3.37
	500-1000	13.49	3.73
	1000-1500	5.36	1.48
	>1500	9.6 5	2.67

Foothills in Jomotshangkha Wildlife Sanctuary

PART-II

CURRENT STATUS

2.1 Landscape Characteristics

2.1.1 Site description

Jomotsangkha Wildlife Sanctuary situated on the south eastern border of Bhutan is bordered by Udalguri district of Assam to its south, Arunachal Pradesh in the east while its western border is shared with Pemathang and Phuntshothang Gewog, and northern border with Serthi Gewog under Samdrup Jongkhar Dzongkhag (Figure 3).

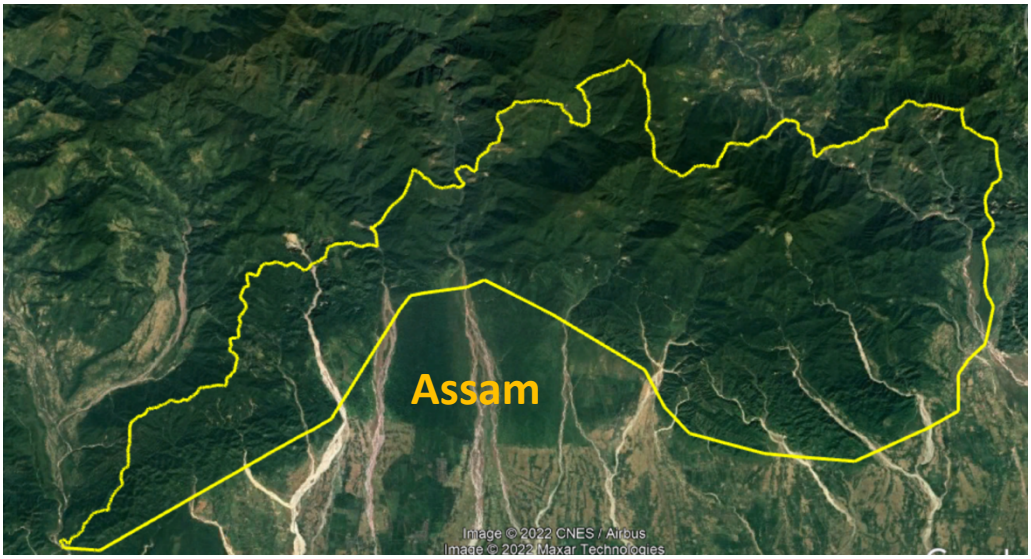


Figure 3. Location map of Jomotsangkha Wildlife Sanctuary

The sanctuary covers whole or part of five gewogs (Figure 4) under two Dungkhags of Jomotshangkha and Samdrupcholing under Samdrup Jongkhar Dzongkhag (Table 4).

Table 4. Administrative jurisdiction and park area

Dungkhag	Gewog Name	Gewog Area (km^2)	Area inside Sanctuary (km^2)	% Area in Sanctuary
Jomotsangkha Dungkhag	Langchenphu	222.43	222.43	100.00
	Serthig	306.17	57.99	18.94
Samdrupcholing Dungkhag	Samrang	51.25	39.12	76.34
	Pemathang	76.54	33.63	43.94
	Phuntsthothang	130.18	9.41	7.23
	Total	**786.57**	**362.58**	

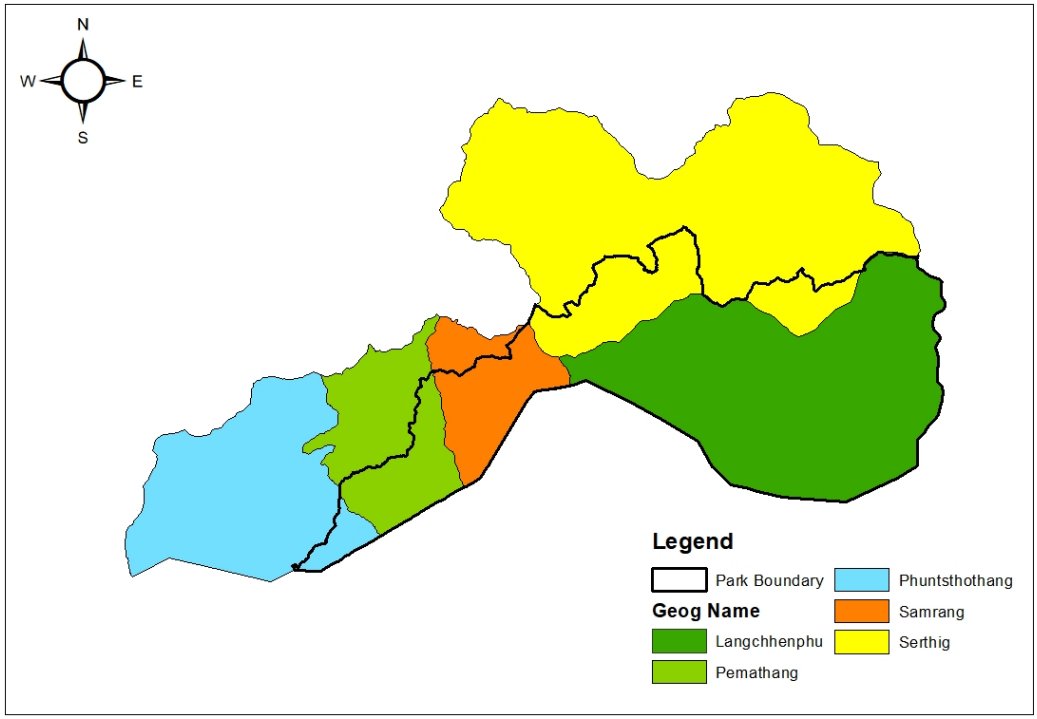


Figure 4. Gewogs area in the Sanctuary

2.1.2 Landscape and Elevation

The topography of the Sanctuary usually starts from the low land plain bordering Assam, India but mostly gorges dominate along the numerous water courses which drain to the Indian Plains. The elevation of JWS starts from 133m to 2200 m from the sea level. Most notable peaks in the Sanctuary are Ani, Auni, Magpoen Singye and Chenla which have legendary tales to share.

2.1.3 Hydrology and Drainage

The major river that flows through the Sanctuary are Jomochu, Kalanadi, Borla, Kherkheri and Nunnai which ultimately drains into the Bharmaputra river basin in India (Figure 5).

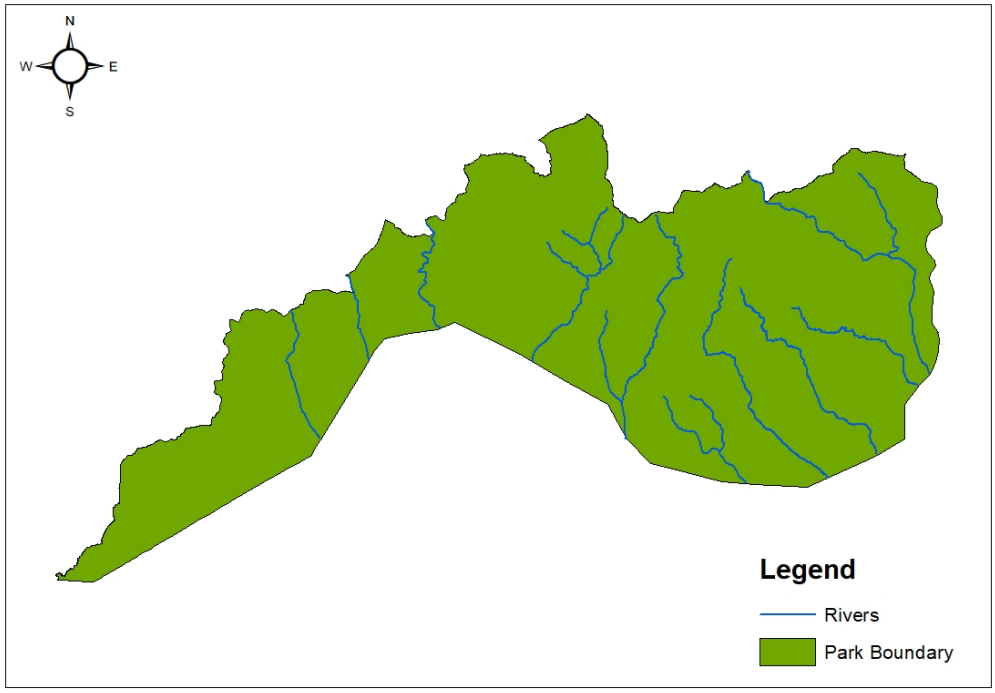


Figure 5. Prominent rivers within administrative and jurisdiction

2.1.4 Climate and Topography

The Sanctuary experiences tropical climate with moist-humid summer and warm-cool winters. Average annual rainfall over the last five years is 2824mm. Average maximum temperature of 27.87 C° and minimum of 16.84 C° has been experienced over the last five years within the Sanctuary.

2.1.5 Geology and Soil

Geophysical feature of the Sanctuary is characterized by foothill plain and also abrupt rise of topography from the Indian plain. The area is represented by Siwalik group with presence of coal, siltstone, sandstone and conglomerates. There is a presence of alluvial and colluvial flood plains resulted from slow erosion of young foothills and upstream activities of Kalanadi, Nunai and Jomo Rivers.

2.2 Floral Description

2.2.1 Forest Types

There are three types are found within the boundary of the Sanctuary and they are sub-tropical, warm broad-leaved and cool broad-leaved forests. Sub-tropical forest dominates the Sanctuary area.:

a) Sub-tropical forest (133-1000m)

In continuation to forested areas of India, the sub-tropical forest inhabits from foothills till 2200masl. So, the areas along the southern part of the Sanctuary such as Samrang, Nunai, Borla, Kherkheri, Diasam, Rongthuthang and Langchenphu consist of sub-tropical forests. The forest is characterized by *Daubanga grandiflora, Acrocarpus fraxinifolius, Bombax ceiba, Dillenia pentagyna, Gmelina arborea, Pterospermum acerifolium, Tetrameles nudiflora, Ficus, Musa* and *Pandanus.* This forest was exposed to commercial

logging in the early 1990s in the areas such as Daisam, Langchenphu, Kherkheri, and Borla.

b) Warm broad-leaved forest (1000-2000m)

Warm broadleaved forest prevails mostly on the northern part of the Sanctuary. The common species encountered are *Altingia excelsa, Bischofia javanica, Callicarpa arborea, Schima wallichii, Toona ciliata, Dendrocalamus hookeri, Dichroa febrifuga, Macaranga, stereospermum personatum, Helicia nilagrica, Ostodes paniculata.* This forest type encompasses area between sub-tropical and cool broad-leaved forest along Taktapa and below Chemari.

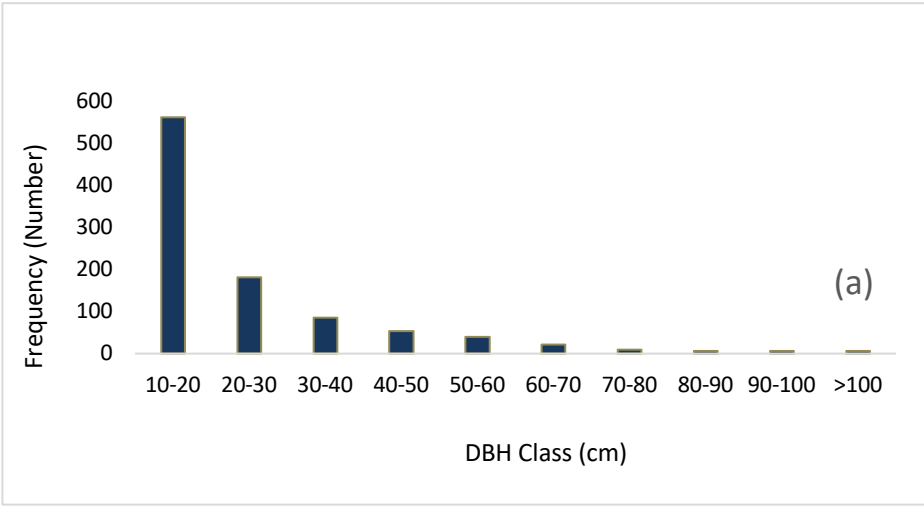
c) Cool broad-leaved Forest (2000-3000)

The highest elevation of the Sanctuary is 2200m. So, small area of cool broadleaved forest is found on the north-eastern part of the Sanctuary along Ani Uni ridge. The common species are Acer campbelli, *Lindera sp and Persea sp.*

2.2.2 Floral Species Diversity

Within a total area sampled we have recorded 559 plant species representing 444 genera under 119 family. The families with highest number of species are Euphorbiaceae (37), Leguminosae (32), Rubiaceae (28), Lauraceae (22), Compositae (21), Moraceae (20) and Urticaceae (20). Average Shannon diversity index is 3.12 in the Sanctuary area.

Forest structural analysis was performed based on the dbh and height classes. Relatively high proportion of trees belong to dbh 10-20cm and high proportion of trees are within the height of 5-10 m (Figure 6).



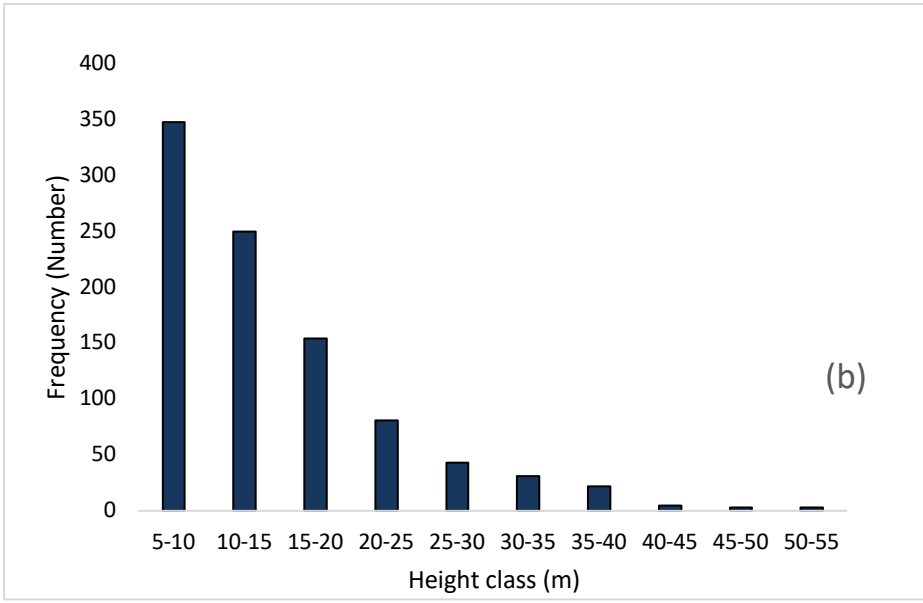


Figure 6. Distribution of dhb (a) and height (b) classes

In addition, there are 111 species of orchid belonging to 50 genera were recorded in Jomotsangkha Wildlife Sanctuary of which five species (*Biermannia arunachalensis*, *Coleogyne rigida, Eria javanica, Porpax fibuliformis, Sarcoglyphis smithiana*) were recorded for the first time from Bhutan.

2.3 Faunal Description

Considering the small size of the sanctuary, it is amazing to have records of diverse species of fauna. In less than four years, a total of 34 species of mammals, 311 species of birds, 331 species of butterflies, 82 species of herpetofauna, 79 species of fishes and 80 species of odonata were recorded. The survey was not carried out to ascertain lesser-known species such as small mammals like squirrels, bats and rats. More species could be recorded upon extensive survey.

2.3.1 Mammal Diversity

Among 34 mammal species, Royal Bengal Tiger (*Panthera tigris tigris*), Common Leopard (*Panthera pardus*), the Himalayan Black Bear (*Ursus thibetanus*), Gaur (*Bos gaurus*), and Asiatic Elephant (*Elephus maximus*) are flagship species present in the sanctuary. The sanctuary is said to be the only habitat for the rare and endangered Pygmy Hog (*Porcula salvania*) and the Hispid Hare (*Caprolagus hispidus*) but these species have not recorded in the last five years. During this plan period, a survey will be carried out to document small mammals and other lesser-known species.

2.3.2 Avifauna Diversity

Data from the survey and observation by staff recorded 311 species of birds till date. This list is not exhaustive as many areas remain un-surveyed.

All the four species of hornbill namely wreathed hornbill, rufous-necked hornbill, great hornbill and oriental-pied hornbill found in Bhutan inhabit the Sanctuary throughout the year. The charismatics Timminck's Tragopan and Blyth's Tragopan are also recorded.

2.3.3 Butterfly Diversity

331 Species of butterflies are recorded in the sanctuary including a new record for the country. Commonly known as witch, *Araotes lapithis* is recorded in the sanctuary which is a new species to the country in 2021. However, this number is not absolute as the survey period was limited to few months in pocket area within the sanctuary.

2.3.4 Herpetofauna Diversity

The recent survey recorded 82 species of herpetofauna of which two species of snakes namely the Cing cobra and Burmese Python are vulnerable as per IUCN red list of threatened species. Assamese Cat Snake (*Boiga quincunciata*), a new record to Bhutan is also found in the sanctuary. There is a need to conduct survey on presence of other species of herpetofauna.

2.3.5 Fish Diversity

About 79 species of fish has been recorded within the jurisdiction of the sanctuary of which two species are Endangered, four are Near Threatened and three are Vulnerable.

2.3.7 Odonata

Odonata commonly known as Dragonflies and Damselflies comprised about 7000 species, 630 genera and 28 families all over the world. In Bhutan, 128 species under 70 genera and 18 families are known to be occurring (Gurung et al., 2021). In Jomotsangkha Wildlife Sanctuary, 80 species under 44 genera and 11 families have been recorded from opportunistic survey. More species are likely to be recorded from extensive systematic surveys in future.

2.4 People and Livelihood

2.4.1 Household size

There are 457 households inside the Sanctuary including government and private houses (Table 5). Samrang has only 44 households (HH) which is the least among gewogs and many are gungtong. Part or whole of five gewogs and Jomotsangkha town fall within the Sanctuary and spatial distribution of settlement is portrayed in the map (Figure 6).

Table 5. Number of households in gewogs and town

SlNo	Gewog/Town	Households within the Gewog Jurisdiction	Household Inside Sanctuary
1	Jomotsangkha Town	287	287
2	Langchenphu	202	202
5	Pemathang	380	8
6	Samrang	44	44
7	Serthi	439	6
	Total	**1352**	**457**

Source: SES Survey, JWS

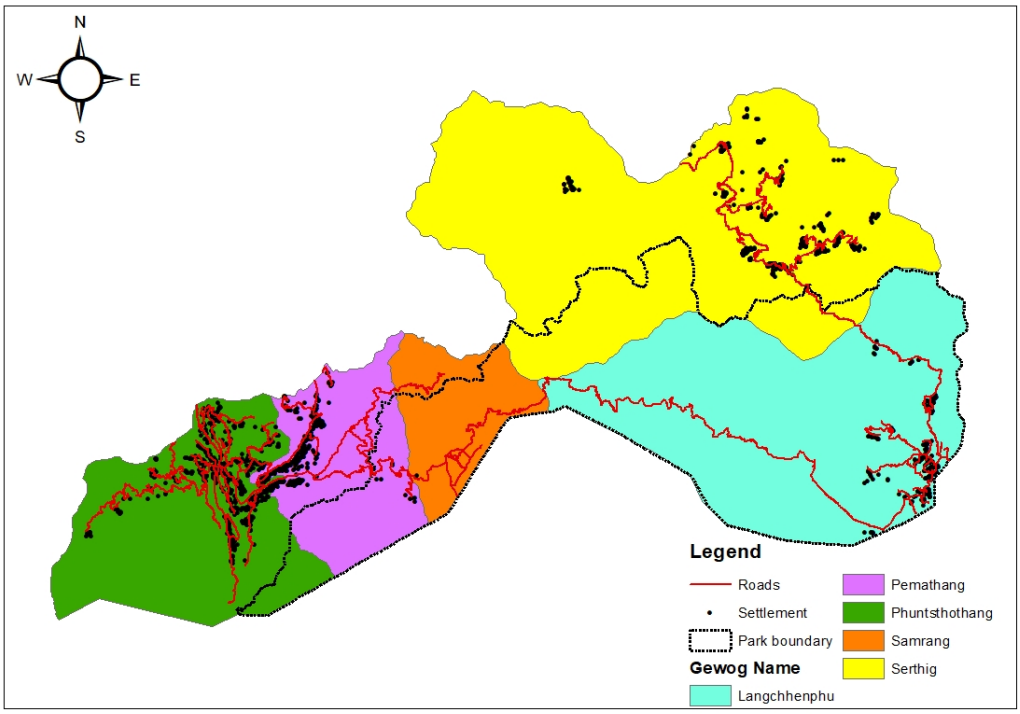


Figure 6. Spatial distribution of settlement

2.4.2 Demography

A total of 457 households including Jomotsangkha town with a population of 1752 (male: 922, female: 830) reside within the Sanctuary (Table 6). The population residing within the Sanctuary are mainly composed of the two major ethnic groups namely the Tshanglas and the Lhotsampas.

Table 6. Total population residing in the gewogs inside the park

		Present Population		Absent Population		Total Population	
Gewogs	No. of House Holds	Male	Female	Male	Female	Male	Female
Serthi	6	6	6	12	10	18	16
Samrang	44	100	109	55	55	155	164
Langchenphu	202	421	362	304	252	725	614
Pemathang	8	14	21	10	15	24	36
Jomotsangkha town	287	600	536	0	0	600	536
	260	**541**	**498**	**381**	**332**	**922**	**830**

Source: SES Survey JWS, 2021

2.4.3 Housing

Residents of the Sanctuary dwell in three types of houses such as permanent (91.30% of HH) semi-permanent (5.1%) and temporary shelter (3.5%) (Figure 7). Majority of the houses are single storied (71.4%) followed by two storied (26.3%) while 7.5% are huts (Figure 8). All the houses have CGI sheet roof. 36.2% of the houses were constructed between 6-12 years while 24.8% were constructed more than 25 years ago. 154 HHs have plan for new house construction in near future.

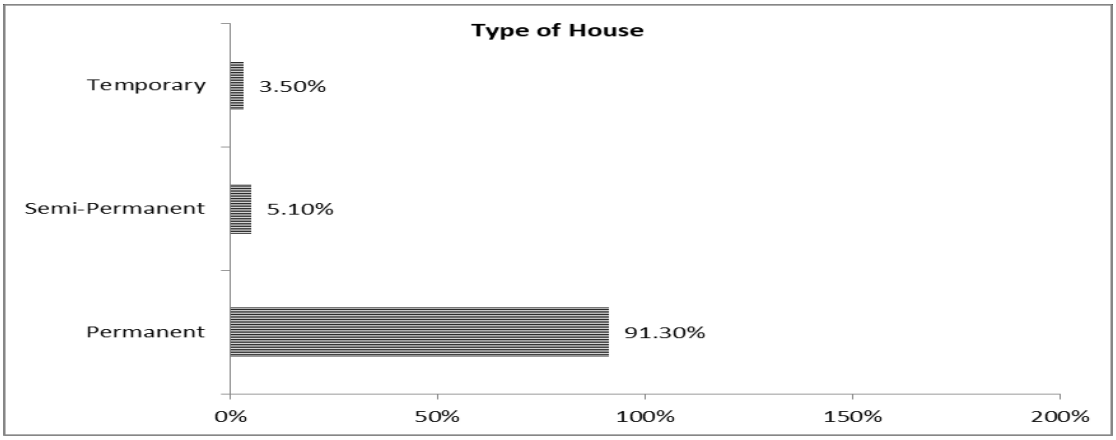


Figure 7. Type of house owned by the residents of the Sanctuary

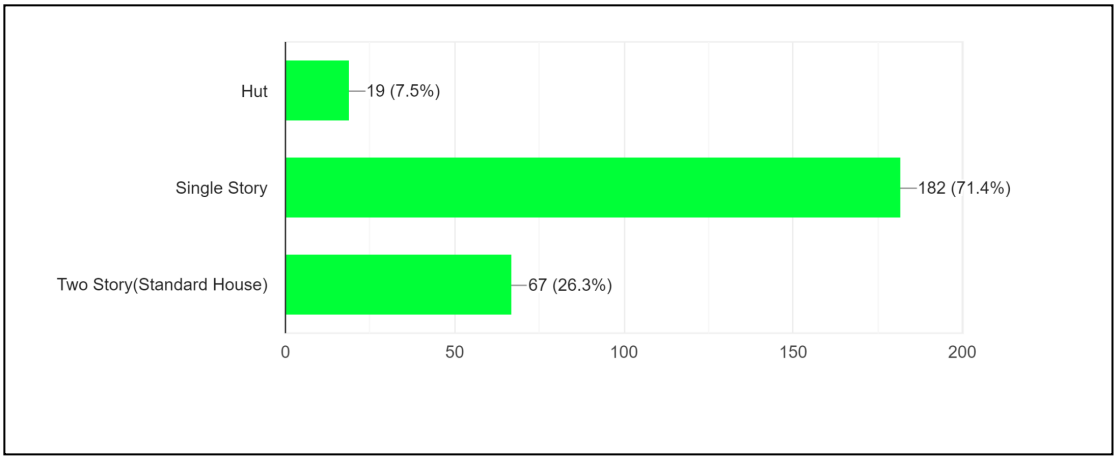


Figure 8. Category of houses owned by the Sanctuary residents

2.4.4 Landholding

Landholding is broadly classified into different categories like Chuzhing (wetland), Kamzhing (dry land), Tsesa (kitchen/backyard garden) and orchard. About 772.052 acres (ac) of total land of various categories are registered with residents of the Sanctuary. Except Serthi, all the 3 three gewogs have chuzhing with highest in Langchenphu Gewog. All the four gewogs have kamzhing with highest in Langchenphu followed by Samrang Gewogs (Figure 9).

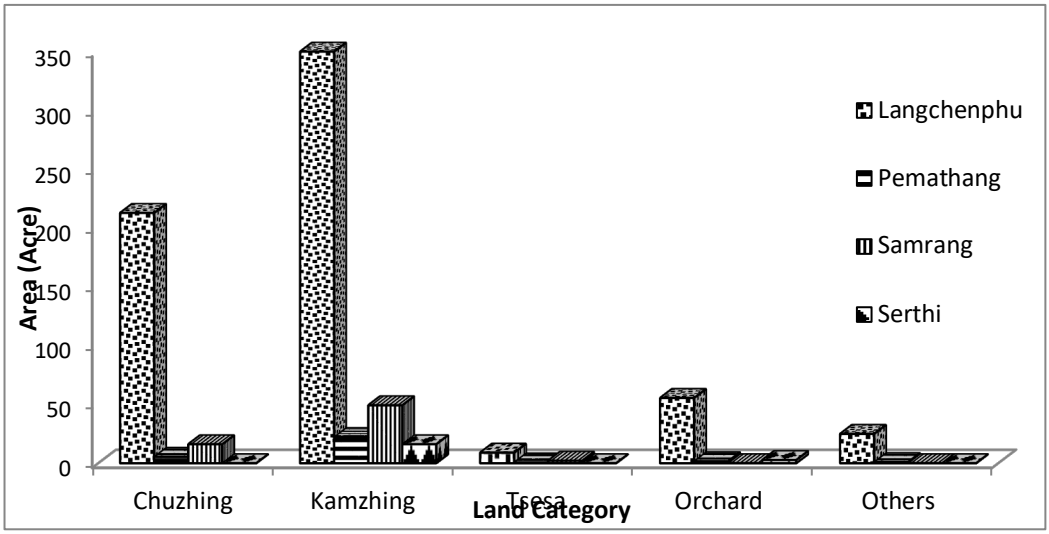


Figure 9. Gewog-wise land holding

2.5 Agriculture

2.5.1 Cereal Crop

Of the total households within the Sanctuary, 91.90% of the households cultivate cereal crops. They cultivate wetland paddy, dry land paddy, maize, millet, wheat, sweet buckwheat, bitter buckwheat and mustard are the cereal crops. The main cereal crops grown are wetland paddy 55.77% followed by maize 45.77%, millet 18.85% and others 8.46%.

5.2.2 Vegetables

95% of the households cultivate vegetables. About 14 types of vegetables are grown by farmers. Popular vegetables cultivated are chilly (73.08%) followed by beans (51.54%) and spinach (45.38%).

2.5.3 Fruit Crops

Sanctuary residents grow 11 types of fruit crop and 89% of the households grow one or more types of fruits. Some households grow maximum of 5 types of fruit crops. The most grown fruits are betel nut, mango and litchi.

2.5.4 Other Special Agricultural Activities

Only 27.3% (n=56) HHs reported to have engaged in other agriculture or livestock activities. Beekeeping is reported to be the major off farm activities followed by mushroom and fishery.

2.5.5 Constraints to Agriculture

More than 83% of all households interviewed perceive crop damage by wild animals as the most serious impediment to agriculture. Other notable constraints included shortage of irrigation facilities & pests and diseases (41%), insufficient labour (32%) and inadequate land (23%).

2.6 Livestock

2.6.1 Livestock Types and Population

A total of 225 HHs (n=260) reported to own livestock. The park residents own about 1331 numbers of cattle and is the most dominant form of livestock in the Sanctuary considering the number of households which own cattle (Figure 10). It is found in all gewogs at an average of greater than 5 cattle per household.

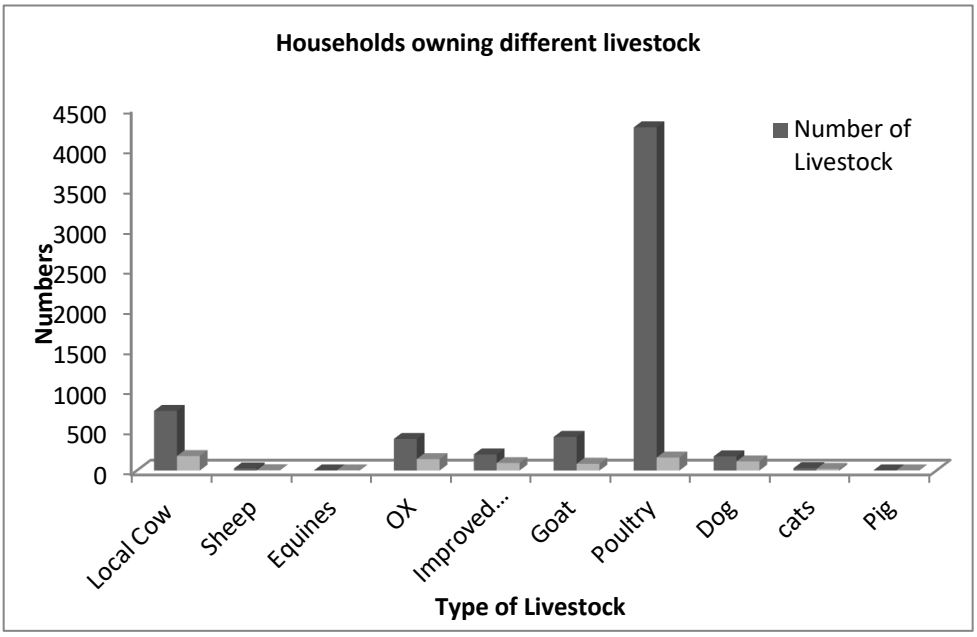


Figure 10. Livestock by type and population

2.6.2 Grazing and Cattle Husbandry

More than 61% of the HHs keeps livestock in stables/enclosures followed by tethering in the fields. Only about 8% reported to graze in the nearby forests or pastures. Livestock are fed with fodder from forests and private lands, improved fodder grasses (viz. Napier etc), banana trunk and leaves, paddy straw and other fodder grasses. Additional feeding includes karma feed, mustard cake, and maize flour and rice husks. None of the HHs reported to have registered Tsamdro.

The most dominant form of problem in rearing livestock is insufficient grazing land (43% of the respondents) followed by low milk yield. The problems have been ranked according to the severity (Table 7).

Table 7. Problems faced by local residents while rearing livestock

Problems	Rank 1	%response	Rank 2	%response	Rank 3	%response	Over all
Diseases & Pests	19	8.41	24	10.62	20	8.85	27.88
Insufficient grazing Land	52	23.01	27	11.95	18	7.96	42.92
Loss due to Predations	28	12.39	3	1.33	1	0.44	14.16
Low Milk Yields	50	22.12	14	6.19	13	5.75	34.07
Poor Pasture Quality	9	3.98	21	9.29	11	4.87	18.14
Poor quality local breeds	12	5.31	25	11.06	8	3.54	19.91
Shortage of Man power	24	10.62	19	8.41	17	7.52	26.55
No Tsamdo	0	0.00	6	2.65	8	3.54	6.19

2.7 Human Wildlife Conflict Status

2.7.1 Crop Damage

More than 89% (n=231) of the households within the Sanctuary area reported to have experienced Human-Wildlife Conflict in the form of crop damage in the past few years. Wild pig was reported as the most prevalent pest with 77% of households ranking it as the most problematic animal. Macaques and Elephants are also considered as significant pests followed by Barking Deer and Birds. Bear is the least problematic in terms of crop damage as per the respondents. Other wild animals that damage crops include, rodents (rats, porcupines & squirrels), Sambar Deer and Hares. Residents have ranked up to five animals based on the severity of the damage (Table 8).

Table 8. Number of respondents affected by wild animals

Wild Animal	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Total
Wild pig	133	48	13	3	3	905
Monkey	41	80	26	8	6	625
Elephant	39	37	13	2	5	391
B/Deer	2	17	34	26	4	236
Birds	1	7	29	14	27	175
Rats	1	9	11	28	19	149
Porcupine	5	8	13	20	9	145
Squirrel	0	2	16	16	14	102
Sambar Deer	6	6	6	4	7	87
Hares	2	3	7	11	2	67
Bear	0	0	1	1	1	6

2.7.2 Livestock Depredation

A total of 51 HHs reported to have lost 166 heads of livestock to wild predators in last 10 years. Four main predators; Tiger, Leopard, Dhole and Pythons were reported to be the species that depredate on livestock. Leopards and Dholes are the most problematic wild predators in terms of livestock depredation mostly depredating on Cow, Poultry Birds and Goats.

Table 9. Types of livestock lost and extent of loss

Livestock	No. of livestock lost			
	HH	Livestock lost in 1-5 years	HH	Livestock lost in 5-10 years
Adult Cow lost (No)	19	39	8	11
Young Cow lost (No.)	6	10	3	5
Goat Lost (No.)	7	11	1	6
Poultry Lost (No.)	1	70	4	10
Dog Lost (no.)	2	4	0	0
Total	**35**	**134**	**16**	**32**

In the last 1-5 years 39 adult and 10 young cows, 11 goats and 70 poultry has been lost to wild predators. 25 households in all the gewogs lost 49 cattle in the span of just 1-5 years.

Seven adult cattle were reported as killed by a tiger. Young cattle were reported as the most attacked by wild animals followed by adult cattle. Leopards and dhole mostly attacked young cattle compared to tigers which killed adult cattle.

2.7.3 Human-Wildlife Mitigation Practice

The local farming communities employed different protective measures to protect their crops damage from wild animals. More than 81% of the respondents said they guard their crops against wildlife damage. Other protective measures employed are electric fencing, clearing of fields and use of scare crows. Of the different measures used for preventing crop damage from wild animals, the most effective protective measures used by the HHs is guarding their fields followed by electric fence and clearing around the fields (Table 10).

Table 10. Protective measures adopted by farmers against crop damage by wild animals

Protective measures	Rank in order of most effective measures					
	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5	Total score
Guarding	84	64	27	1	0	759
E-Fence	116	16	6	1	1	665
Clearing of Fields	4	44	46	4	0	342
Scarecrow	6	28	53	7	1	316
Fencing	17	14	12	0	0	177
Hunting in the Fields	4	9	0	0	0	56
Trapping in the Fields	2	0	0	0	0	10

2.8 Water

Majority of the Sanctuary residents (97%) have access to tap water facility while 2% HHs share water from neighbors and 1% HH get from nearby streams. More than 60% of the HHs reported that the status of drinking water in their area is same for the last 5-10 years while over 33% of the HHs said its decreasing and 17% of the HHs said it is increasing. Majority of the HHs reported that the drinking water in their area is sufficient while 27% said insufficient. However, 5% of the HHs reported acute shortage of drinking water as a serious concern. The increase in users, drying up water sources, poor maintenance and climate change are some of the reasons spelled out by the local communities for water shortage in their area.

About 47% HHs reported the status of irrigation water as decreasing while 41% of HHs stated as same and 8% reported increasing. The reasons for decreasing water for irrigation are increasing users, dependent on seasonal streams (Less rainfall), climate change, and developmental activities like roads, timber felling and lack of proper irrigation channels.

Water source assessment and mapping was carried out in 5 gewogs under jurisdiction of Jomotsangkha Wildlife Sanctuary. A total of 124 water sources across 5 gewogs. The highest water sources were recorded from Langchenphu (*n=45*) and least from Samrang Gewog (*n=3*) (*Table 11*).

Table 11. Type of Water Sources

Gewog	Springs	Streams	Rivers	Ponds	Marshes
Langchenphu	15	20	3	7	0
Pemathang	2	8	0	0	0
Phuntshothang	17	5	0	0	1
Samrang	2	0	1	0	0
Serthi	32	11	0	0	0
Total	**68**	**44**	**4**	**7**	**1**

2.9 Energy

The main source of energy for lighting purpose is electricity followed by kerosene and woods while for cooking its electricity, gas and firewood. For space heating only wood and electricity are used (Figure 11).

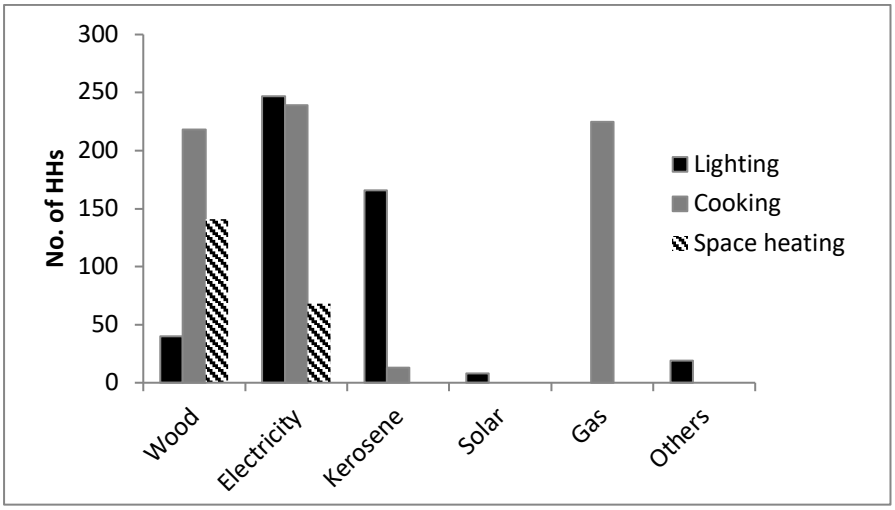


Figure 11. Different energy sources used by local communities

2.10 Sources of Income

The main source of income is reported to be agriculture activities followed by animal husbandry (Table 12). Other significant sources of income include earnings from the off-farm activities such as casual labour contribution, employment, trade and business etc. About 73.5% of the HHs sale betel nuts followed by vegetables and livestock products like butter and cheese.

Table 12. Number of households indicated main source of income

Sources	Rank1	Rank2	Rank3	Rank4	Total
Agriculture	117	70	18	2	716
Animal Husbandry	42	94	28	2	508
Casual Labour	41	22	47	3	327
Employment	29	16	18	6	206
Trade and business	14	11	20	2	131
Others	5	8	3	0	50
Sale of Handicrafts	0	4	5	8	30

Most of the HHs are found to be self-sufficient in terms of food requirement. However, some of the additional items purchased by the HHs includes salt, oils, rice, some vegetables, tea leaves, sugar, soaps, meat items and clothes. The vegetable requirements are met mainly from own production supplemented with purchase from market and collection from forests.

2.11 Other Management Regimes

2.11.1 Community Forest Management Group

There are 4 Community Forest Management Groups (CFMG) comprising an area of 423.11ha that benefit 119 households (Table 13). Community Forest (CF) in the Sanctuary has been established starting 2010.

Table 13. Community Forest area and resources

SlNo	Name of Community Forest (CF)	Est year	Area (Ha)	No. of HH	AAC (No)	Trees allotted as of 2020 (No)
1	Jampani Fakchuthang	2010	90.92	23	40	49
2	Langchen Agurung Norbuthang	2011	117.56	42	16	34
3	Langchenphu Rigsar	2013	132.97	27	48	34
4	Haspokhare	2012	81.66	27	43	47

2.11.2 Non-Wood Forest Products

There is one NWFP groups within the Sanctuary. Main NWFP produce is broom grass (*Thysanolaena maxima*). Resource collection is guided by the management plan prepared using NWFP frame work.

Table 14. NWFP management group

SlNo	Name of NWFP group	Gewog	Estab year	No.of HH	Traded NWFP	Qty collected as of 2020 (kgs)	Amount genertated (Nu)	Other NWFP found in the sites
1	Chitori Shingmein Thuenkyed Tshogpa	Serthi	2012	6	*Ailanthus grandis*	150	1100	*Mushroom,Knema tenuiervia (durku),Thysanolaena maxima, Plectocomia himalayana (bangdo)*
					Elatostemma lineolatum	20	400	

2.11.3 Local Forest Management Plan

Local Forest Management Plan (LFMP) has been completed for Samrang Gewog. There are three blocks and 12 compartment comprising a total area of 4132.90 ha (Figure 12). There is a need to prepare LFMP for remaining four gewogs.

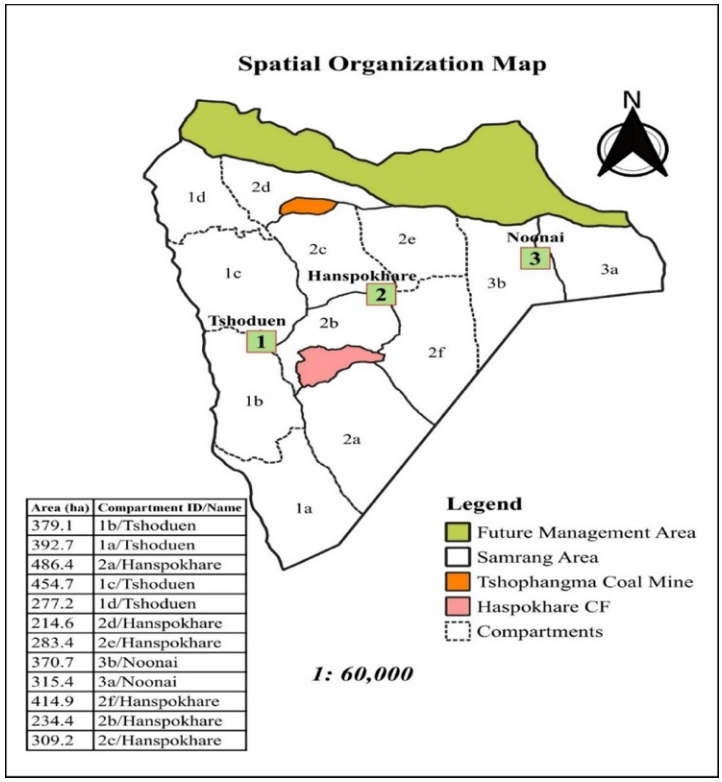


Figure 12. Location of compartment and sub-compartment

Table 15 Summary of Forest Management Area of Samrang Gewo

Summary Results for Forest Management Area: Samrang

Unit	Area Distribution				
	Non Production	Protection	Inaccessible	Net Production	Total
ha	453.1	1378.1	518.2	1783.5	4132.9
%	11%	33%	13%	43%	100%

Average basal area (m2/ha)	Aver. Stand Volume (m3/ha)	No of accessible sample plots
15.2	131	222

Unit	Forest Type Distribution								
	Hemlock	Fir	Spruce	Mix. Con.	Bluepine	Chirpine	Hardwood	Mixed HC	Total
%	0%	0%	0%	0%	0%	0%	100%	0%	**100%**
Unit	**Age distribution**					**Stand type distribution**			
	young	immature	mature	Overmature	Total	plantation	natural	coppice	Total
%	31%	28%	42%	0%	**100%**	2%	98%	0%	**100%**
Unit	**Canopy closure**					**Condition**			
	dense	closed	open	unstocked	Total	good	average	poor	Total
%	5%	42%	44%	9%	**100%**	24%	57%	19%	**100%**

Unit	Site Condition								
	Slope			Erosiveness			Soil Cover		
	gentle	moderate	steep	stable	moderate	unstable	high	moderate	low
%	48%	42%	9%	52%	36%	11%	9%	68%	23%

Unit	Forest Use					
	Intensive Side Uses			Extensive Side Uses		
	grazing	sokshing	lopping	grazing	sokshing	lopping
ha	282.4	0.0	0.0	435.5	0.0	0.0
%	7%	0%	0%	11%	0%	0%

Unit	NWFP Occurence and Firewood							
	NWFP abundant				NWFP sparse			
	Firewood	Bamboo	Cane	Daphne	Firewood	Bamboo	Cane	Daphne
ha	734.5	261.0	177.8	0.0	1534.0	789.1	272.3	103.0
%	18%	6%	4%	0%	37%	19%	7%	2%

Unit	Potential Production				
	Timber				
	Drashing	Cham	Tsim	Poles,posts	Total
Ntot	17489	55068	75443	153895	**301895**
N/ha	10	31	42	86	**169**
m3	80963	44808	21065	11062	**157898**
m3/ha	45.4	25.1	11.8	6.2	**88.5**
Unit	**Firewood**				
	> 49cm	30-49cm	20-29 cm	10-19 cm	Total
Ntot	5875	21908	54892	146788	**229463**
N/ha	3	12	31	82	**129**
m3	26556	17117	14810	9484	**67967**
m3/ha	14.9	9.6	8.3	5.3	**38.1**

Unit	Sivicultural Measures				
	Planting	Thinning	Felling (firewood)	Felling (timber)	No Activity
ha	1117.0	470.2	514.9	418.2	1641.8
%	27	11	12	10	40

Yield Regulation		
AAC	**1794**	m3
	1.0	m3/ha
Prod. Potential / AAC	**126**	years

Table 16. Compartment wise Production Potential of Forest Management Area

of Forest Management Area:						Samrang								
Block No	Compartment Name		Net Prod. Area	Volume	harv. Volume	Extract.	Timber (Total Volume m3)				Firewood (Total Volume m3)			
	Block	Comp No	(ha)	(m3/ha)	(m3/ha)	Rate	Drashing	Cham	Tsim	Poles, posts	> 49cm	30-49cm	20-29 cm	10-19 cm
1	Tshoduen	1a	206.9	67.5	12832.0	91.9%	393	3761	1438	1035	985	2036	2453	731
1	Tshoduen	1b	240.1	166.7	39418.0	98.5%	12037	7858	3705	1050	7923	2431	2839	1575
1	Tshoduen	1c	252.8	124.9	31345.0	99.3%	14527	6217	3396	1932	1009	1139	1440	1685
1	Tshoduen	1d	141.4	143.7	19817.0	97.5%	5243	2465	1700	992	5020	2364	1028	1005
2	Hanspokhare	2a	83.9	91.9	7705.0	99.9%	3493	487	432	222	1341	987	432	311
2	Hanspokhare	2b	139.5	118.5	15258.0	92.3%	2952	2623	1973	1108	578	1601	3315	1108
2	Hanspokhare	2c	134.3	130.1	17339.0	99.2%	9776	3363	1538	1326	530	724	82	0
2	Hanspokhare	2d	61.4	163.7	9691.0	96.4%	4590	2336	662	865	908	136	194	0
2	Hanspokhare	2e	89.5	132.8	11127.0	93.6%	5137	2473	1688	984	328	248	269	0
2	Hanspokhare	2f	126.5	154.7	18794.0	96.0%	9569	3706	1068	473	919	1256	739	1064
3	Noonai	3a	132.5	125.0	16382.0	98.9%	6529	3921	1841	421	230	1676	658	1106
3	Noonai	3b	174.7	157.5	26157.0	95.1%	6717	5598	1624	654	6785	2519	1361	899

or Forest Management Area:				Samrang										
Block No	Compartment Name		Compartment Area	Sivicultural Measures (in ha)					Sivicultural Measures (in % of area)					Total %
	Block	Comp No	(ha)	Planting	Thinning	Felling (firewood)	Felling(timber)	No activity	Planting	Thinning	Felling (firewood)	Felling(timber)	No activity	
1	Tshoduen	1a	392.7	276.3	87.3	29.1	29.1	0.0	70	22	7	7	0	107
1	Tshoduen	1b	379.0	54.1	108.3	40.6	13.5	162.4	14	29	11	4	43	100
1	Tshoduen	1c	454.6	58.7	29.3	102.7	73.3	190.6	13	6	23	16	42	100
1	Tshoduen	1d	277.2	29.2	29.2	58.4	14.6	145.9	11	11	21	5	53	100
2	Hanspokhare	2a	486.4	324.3	32.4	64.9	32.4	32.4	67	7	13	7	7	100
2	Hanspokhare	2b	234.5	97.7	39.1	0.0	0.0	97.7	42	17	0	0	42	100
2	Hanspokhare	2c	309.3	0.0	0.0	85.9	137.5	85.9	0	0	28	44	28	100
2	Hanspokhare	2d	214.7	0.0	0.0	61.3	92.0	61.3	0	0	29	43	29	100
2	Hanspokhare	2e	283.4	77.3	25.8	25.8	25.8	128.8	27	9	9	9	45	100
2	Hanspokhare	2f	414.9	73.2	0.0	24.4	0.0	317.3	18	0	6	0	76	100
3	Noonai	3a	315.5	126.2	31.6	0.0	0.0	157.8	40	10	0	0	50	100
3	Noonai	3b	370.7	0.0	87.2	21.8	0.0	261.7	0	24	6	0	71	100

Yield Regulation

The sustainable annual allowable cut $AAC_{sust.}$ for the management area is calculated as follows:

$AAC_{sust.}$ = total standing volume / average rotation period. = **1794** m^3/year

Taking into account of forest type distribution, the average production period for the forest management area is **126** years. The total standing volume is 233182 m^3 from production areas.

The actual volume potential for harvesting was calculated to be 225865 m^3.

Dividing the overall production potential by the planning period of 10 years gives the silvicultural AAC:

$AAC_{silv.}$ = total production potential / 10 years = **22586** m^3/year.

AAC_{sust} = determined as 1794m^3/year

As the $AAC_{sust.}$ is lower than the $AAC_{silv.}$, the AAC is fixed at the level of the $AAC_{sust.}$ whichever is less.

The AAC per ha is **1.0 m^3** (AAC/Production area)

2.12 Administrative, Service Delivery and Park Infrastructure

2.12.1 Administration and Infrastructure

Head Office of Jomotsangkha Wildlife Sanctuary is located in Langchenphu Gewog under Jomotsangkha Dungkhag. Jomotsangkha Range Office is housed in the Head Office building. A Range Office is established at Samdrupcholing and there are two staff quarter of two units each. A Beat Office is established at Minjiwoong under Serthi Gewog. A watch tower specially to respond HWC has been established in Samrang.

The JWS is spearheaded by Chief Forestry Officer (CFO) supported by four functional sections (Figure 13).

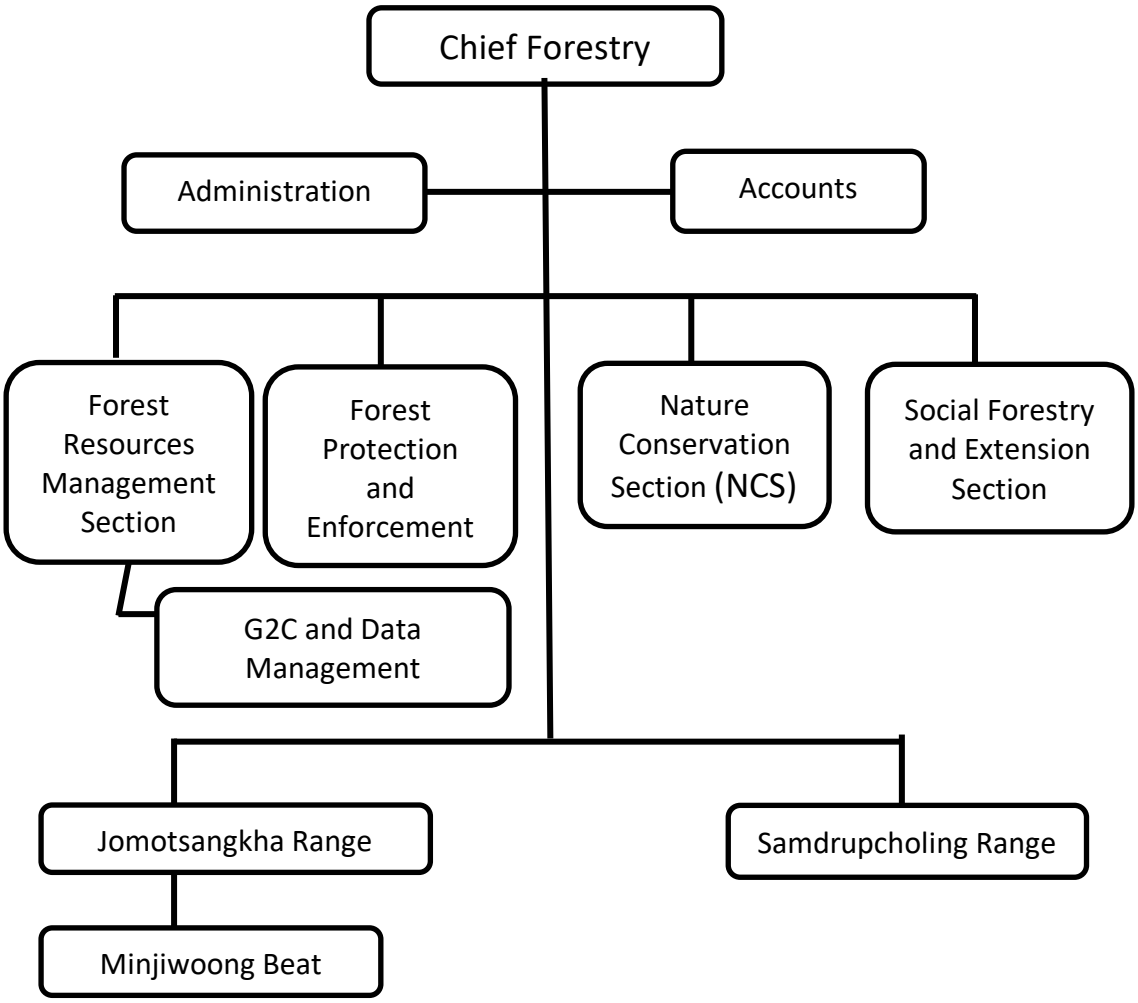


Figure 13. Organizational structure

2.13.2 Service Delivery and Mobility

Efficient Service Delivery has been one of the priority activities for the Sanctuary. Range Offices and Beat Office are at the first interface with service beneficiaries. A minimum of one staff has been designated as focal staff for every gewog. The focal staff coordinates with Tshogpa and Gup. With the rolling out of online service delivery, a group has been created on telegram among the staff. Community Service Executive (CSE) and Gewog Administration sort most of the issues with appropriate solutions.

JWS has two 4WD Toyota hilux, one truck and two Enfield bike. One hilux is allotted to Samdrupcholing Range and other to Head Office. One bike is allotted to Jomotsangkha Range and other to Minjiwoong Beat.

PART III: SUMMARY REVIEW OF THE PAST PLAN

This is the first scientific management plan of the Sanctuary. Prior to May 2017, the Sanctuary has been under the administrative jurisdiction of Samdrup Jongkhar Forest Division where activities were mostly confined to antipoaching patrol. The records with the office show that scientific logging was carried out in areas like Diasam, Kherkheria and Borla within JWS in early 1990s, after which there has been no logging carried out in those areas. In absence of Conservation Management Plan, the following activities were carried out by developing annual operational plan.

3.1. Habitat Management

3.1.1 Grassland management

About 1078.35 acres of grassland have been identified to carryout out management activities which are situated at 11 different locations. From 2018 to 2021, a total of 425 acres of grassland have been managed.

3.1.2 Waterhole management

About 25 potential waterholes have been identified for management (Table 21). Similar to grassland areas, waterholes are concentrated in few locations. An effort has to be made to create and manage waterholes in the area where water is scarce especially during winter months. During the past four years, about 8 number of water holes have been created or improved.

3.1.3 Saltlick Management

There are 16 saltlick sites identified for management in future. About six sites are under management.

3.2 Community based Resource Management

3.2.1 Community Forest Management

There are 4 community forests (CFs) established in two gewogs within the sanctuary. During the past four years, two CFs were established and five CF management plan were revised. Annual monitoring of CF has been carried out every year and the result of monitoring disseminated to the CF management groups.

3.3 Documentation of Biodiversity

During the past four years of its operation, efforts were directed towards documentation of biodiversity in the Sanctuary. Except for the small mammals, comprehensive record on other taxa have been achieved.

3.4 SMART Implementation

All staff were trained on SMART data collection for activities conducted in the field. SMART patrolling has been fully operational and report is being produced

every month. SMART patrolling has helped identify hotspot of illegal activities and also habitat use of animals.

3.5 Infrastructure Development and Immobile Property

Construction of a two storied building was completed in 2021 at Langchenphu, Jomotsangkha . The building houses Head Office (1st floor) and Jomotsangkha Range Office (ground floor). Samdrupcholing Range Office has three rooms office quarter. There are five-unit staff quarter in Samdrupcholing and five-unit staff quarter in Jomotsangkha (Table 27).

Table 17. Infrastructure information

Location	Category	Land	House Description	Remarks
Jomotsangkha	Head Office	2 acres	2 storied building and caretake quarter	Langchenphu
	Staff colony	2.81 acres	3 nos 1 unit staff quarter and 1 no 2-unit staff quarter	Jomotsangkha Town
	Guest House		3 guest room, 2 rooms for support and a kitchen. New VVIP building was constructed by Dungkhag	Near RBP camp
Samdrupcholing	Range Office		2 nos 2-unit staff quarter and 1 quarter attached to Range office	Phuntshothang
Samrang	Watch Tower		3 storied house (kitchen in ground floor, 1st floor has a room and 2nd floor is belcony	Near gewog office

PARK IV
CONSERVATION THREATS AND CHALLENGES

Consultation meeting was carried out with whole staff of the Sanctuary to gather experiential information and determine the threat to conservation of natural resource. Secondary data from field reports and surveys provided additional information. Threats and challenges are confined to conservation of wildlife and their habitats.

4.1 Conservation Threats

4.1.1 Increasing developmental activities and land-use change (Medium)

During the last Five-Year Plan, many development activities have taken place in and around the Sanctuary. Construction and mining activities have been booming around the Sanctuary. We have lost 58 ha of area to Samrang-Jomotsangkha highway, 14.40ha to transmission line and 20.60ha to farm road. The road traverse in the middle of the sanctuary and it has destroyed animal trail.

There is a plan to construct hydro power plant in Neyra Amachu and Jomochu. The feasibility survey has already been carried out for Neyra Amachu. A small portion of Neyra Amachu below Khameythang falls within the sanctuary boundary. However, if the plan for hydro power plant in Jomochu is realized, there will be an adverse impact to wildlife and their habitats in the Sanctuary as Jomochu runs through it.

4.1.2 Illegal exploitation of forest resources (High)

Illegal harvesting of timber in the area along the Assam border is the key threat to habitat loss and disturbance. The timber smugglers from nearby Indian village capitalized on the prevalence of porous border. The high incidence of timber offences is reported from Kherkheria, Diasam, Laptsa, Khampakangri and Borla

under Jomotsangkha Range and Sukuni, Gerwa and Demola under Samdrupcholing Range. Beside timber, they collect NWFPs such as wild vegetables, broom, hornet, incense, etc. It is a worrying development as most of these areas have high prevalence of wildlife species and cause disturbance to wild animals in the area.

picture -Timber smugglers

4.1.3 Poaching of wild animals (High)

Poaching is considered as one of the biggest threats to the conservation of wildlife species in the Sanctuary. People from within the country as well as from across borders are involved in the poaching. The recent camera trapping exercises for also captured images of poachers with locally fabricated gun. Poaching is common opposite to Sachanglu near Arunachal border while Borla and Khampakangri are frequented by poachers.

Figure top, bow and arrows; bottom poacher with gun

4.1.4 Human wildlife conflict (High)

More than 89% of the households reported to have experienced Human-Wildlife Conflict in the form of crop damage in the past few years. Crop raiding by herbivores and livestock depredation by predators has been increasing trend in the Sanctuary. The most common animals that come into conflicts with people are elephant, leopard, wild pig and barking deer. Two men were killed by an elephant in 2018 and 2019, one man injured in two different occasions. Two elephants died by falling in garbage pit and 1 died from electric current when bitten wire. The elephants mostly affect Pemathang, Phuntshothang, Samrang and Langchenphu gewogs. However, leopard and ungulates come into conflict with people in other gewogs. There is also retaliatory killing by local people. A common leopard was killed in Serthi Gewogs in 2018. A King Cobra was killed in Langchenphu Gewog in 2019 in retaliation to depredation of poultry. The Sanctuary is also seriously considering the issue to deal with indiscriminate killing of snakes by people. People kill any type of snakes whether they are venomous or not.

Paddy field damage by elephant (left), Elephant died due to electrocution (right)

4.1.5 Landslide and soil erosion (Medium)

The fragile geology formation in the foothill coupled by erratic rainfall is causing landslide and soil erosion. About 357 acres forest area were identified as prone to landslide in twenty different locations. During the monsoon landslide from slopes causes river plains to flood and deposit sand and boulders. Thus, grassland habitats located along flood plains get destroyed. Beside wildlife habitat, the soil erosion poses threat to the inhabitants along the river basin. Annually the river basin of Chukarpo, Jangsa, Rongchuthang, Khekheria, Daisam, Samrang, Kalanadi and Diklai gets flooded.

4.1.6 Disposal of garbage (Medium)

Waste is becoming an emerging threat to the natural habitat of the Sanctuary. With the increasing accessibility and shops being opened in remote villages, waste such as plastic and bottles are mounting. Some areas in Samrang and Langchenphu Gewogs are visited by picnickers who leave behind a huge amount of non-biodegradable wastes especially in winter. At the moment, Jomotsangkha town does not have waste disposal site.

4.2 Conservation Challenges

4.2.1 Lack of adequate information on wildlife population

So far none of the wild animals in the Sanctuary have estimated their populations except tiger and elephant. There is a presence data on large and medium mammals but lack data on small mammals and other faunal species. Due to the absence of adequate information on wildlife population, it provides challenge to conduct monitoring of wild animals.

4.2.2 Dependency on natural resources by local residents

There are people residing inside the Sanctuary. These people depend on adjacent forest for timber, firewood, fodder, and other NWFPs. The past practice of harmonious coexistence of people with nature is deteriorating as it is evident from excessive collection of forest resources. It is an acknowledged fact that people have inhabited the Sanctuary prior to its delineation. However, over the years pressure on forest resources, land for agriculture and encroachment into forest land keep rising due to Socio-Economic Development and changing Government Policies from time to time. Consequently, the Sanctuary has to strike a balance between socio-economic development and Nature Conservation.

4.2.3 Porous International border

The Sanctuary borders with two Indian states of Assam and Arunachal Pradesh within a distance of 60km and 42km respectively. Due to this long stretch of porous international border, monitoring of resource, illegal trade and anti-poaching activities are extremely difficult. Every year numerous people are caught in the act of illegal logging, poaching, fishing and collection of NWFPs. From Arunachal side, people come mainly for wildlife poaching. While from Assam side, people come for illegal logging, poaching and fishing.

4.2.4 Shortage of man power and antipoaching camp

Inadequate man power is the critical challenge to conduct effective anti-poaching activity in the Sanctuary. Considering the security threats along the international border in addition to danger posed by wild animals like elephant and guar, it is practically not possible to travel with less than 10 people in a group for patrolling in forest. Current strength of 33 technical staff is hard pressed to provide service to the public along with anti-poaching and monitoring activities. There is also a need for patrol camp at the poaching hotspot areas.

4.2.5 Lack of conservation awareness

The Sanctuary became operational only in 2017 and many people do not know about their area being part of protected area. In recent socio-economic survey, almost 42% of residents were found to be unaware of their village being inside the Sanctuary.

PART V
CONSERVATION MANAGEMENT PRESCRIPTION

This section outlines the strategic management intervention to address threats and challenges that were discussed in PART IV of this plan.

5.1 Conservation of key wildlife habitat

Wildlife habitats are exposed to destruction by natural and man-made activities. The construction of Jomotsangkha-Samrang highway passes through very good habitats of gaur and elephant thereby disturbing wildlife and disrupting the habitat connectivity and migratory routes. Illegal harvesting of timber by local and people across border also attributes to habitat degradation. Wetland and water body are drying and saltlick areas are exposed to risks of landslide and erosion. Therefore, a serious attention is required to improve the quality and extent of habitats.

Strategic Actions

1.Carryout habitat management works such as grassland management, removal of invasive weeds, enrichment plantation and prescribed burning

2. Maintain waterholes and saltlicks
3. Map and maintain migratory route and habitat connectivity of animals especially elephants
4.Establish biodiversity monitoring grid and conduct periodic monitoring

5.2 Sustainable use of natural resources and management

Extraction of natural resources by locals is not a serious concern within the Sanctuary. However, there is huge pressure from people across border for over exploitation of forest resources. Furthermore, the areas outside the Sanctuary have high pressure for timber and non-timber resources. On an average about 86899 cft of trees were allotted for rural house construction annually for an average of 98 households. The timber extraction at the moment is haphazard and there is no area delineated and harvesting limit determined.

Strategic actions

1.Prepare and implement LFMP for multiple use zone in four gewogs
2. Map degraded areas and carryout plantation in degraded areas
3.Carry out stock assessments of forest through National Forest Inventory to understand the state of forest and carbon stocks
4.Monitor utilization of timber supplied for rural and commercial construction
5.Carryout bioengineering work at landslide prone areas

5.3 Reduce poaching and wildlife trade

Wildlife poaching for trophy and meat is common by people across border. Ungulates and hare are hunted for meat while elephant and cats are poached for

trophies. They also hunt almost all aquatic species for consumption and trade. Hunting is also prevalent in our locality but to a minimum degree.

Strategic actions

1.Conduct regular SMART patrolling focusing hotspot areas
2. Conduct meeting with Indian counterpart annually and establish good rapport to tackle illegal activities
3.Establish patrol camps and outpost at strategic locations

5.4 Reduce Human-Wildlife Conflict

Conflict of farmers with elephant is the most prevalent form of human-wildlife conflict in the sanctuary. Elephants depredate agriculture crops and damage properties. Sometimes, lives of the farmers were lost to elephants. The other common animals that come into conflict with farmers are barking deer, sambar, wild pig, porcupine, monkey, hare, Himalayan black bear and snakes.

Strategic actions

1.Provide technical support to install and maintain solar/electric fence at the most affected or hotspot areas
2.Conduct elephant behavior study in relation to the seasonal change and with regard to the cropping pattern
3.Carryout habitat enrichment for wild animals and protect their identified migratory route
4.Establish community HWC Rapid Response Team
5.Update HWC hotspot area

5.5 Initiate effective waste management program

Indiscriminate disposal of waste is becoming an emerging threat to the natural habitat of the Sanctuary. With the increasing accessibility and shops being opened in remote areas, waste such as plastic and bottles are mounting. Some areas in Samrang and Langchenphu Gewogs are visited by Indian picnickers who leave behind a huge amount of non-biodegradable wastes especially in winter. The Samrang-Jomotsangkha highway could plagued by waste generated from commuters.

Strategic actions

1.Create awareness on waste prevention rules and regulations and enforce rules
2.Establish signage in restricted areas and along the highway
3.Identify and form community waste management group
4.Collaborate with local authorities on waste management

5.6 Protection of keystone and flagship species

Variety of species such as elephants, gaur, tiger and hornbills inhabit the sanctuary. The species need to be given attention and protect their habitat and poaching.

Strategic actions

1.Carry out field survey to determine population of elephant and gaur
2.Conduct monitoring of tiger and prey regularly
3.Conduct patrolling in identified and prioritized routes in the areas of Kherkheri, Diasam, Borla, Agurthang, Kalanadi and Agurungs and maintain the routes regularly
4.Conduct refresher arms training for forestry staffs

5. Carryout education and awareness program to communities and schools on conservation
6.Conduct national tiger survey

5.7 Provide alternate livelihood opportunities for local communities

Community engagement in management of forest resources can foster collaboration and cooperation with sanctuary staff. Communities could be supported to manage community forests and NWFP management. There are 3 CF and 1 NWFP management groups under the jurisdiction of JWS.

Strategic actions

1. Revise Jampani Phakchuthang and Tokaphu NWFP management plan
2.Conduct monitoring and evaluation of CF and NWFP management groups
3. Establish nursery and domestication of Thogsampa (*Paris polyphylla*)
4. Establish nature-based enterprise for income generation (soft broom, chirata & bamboo)
5.Coordinate and support trade and export of NWFP

5.8 Establish field offices and improve communication and mobility

Establishment of adequate infrastructure and development of institutional capacity is necessary to carryout effective conservation activities and efficient delivery of service for the people.

Strategic actions

1.Construct Beat Office at Samrang for effective monitoring of the Sanctuary

2.Equip offices with laptops, printer, binoculars, night vision to carryout regular activities
3.Maintain vehicle regularly
4.Procure wireless handset and repeater

5.9 Strengthen effective management of the Sanctuary

Conservation Management Plan would guide implementation of activities in the Sanctuary. The plan will be reviewed in 5 years and revised in 10 years. There will be also effective assessment every five years using METT+ framework. It is also crucial to build capacity of the staff with the changing situation and technology.

Strategic actions

1.Review of Conservation Management Plan
2.Revision of Conservation Management Plan
3.Assessment of Bhutan METT+
4.Build capacity of the staffs

PART VI: IMPLEMENTATION PLAN & FINANCIAL OUTLAY

6.1 Implementation Plan and Budget Outlay (June 2023 – December 2033)

Objectives	Strategies	Actions	Year along with budget (in Nu. millions)										
			Y1	Y2	Y3	Y4	Y5	Y 6	Y7	Y8	Y9	Y10	Remarks
To manage forest sustainably in order to provide habitat for wildlife and support livelihood of the local people in the park through efficient land-use system	Conserve key wildlife habitat	1.Carryout habitat management works such as grassland management, removal of invasive weeds, enrichment plantation and prescribed burning	0.3	0.1	0	0.2	0.2	0	0	0.3	0.2	0	1070 acres grassland,
		2. Maintain waterholes (9 nos) and saltlicks (11 sites)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
		3. Map and maintain migratory route and habitat connectivity of animals especially elephants	0.15	0	0	0	0.2	0	0	0	0.2	0	

		4. Establish biodiversity monitoring grid and conduct regular monitoring	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	Annual Monitoring
	Sustainable use of natural resources and management	1.Prepare and implement LFMP for multiple use zone	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0	0	0	4 gewogs to cover
		2.Map degraded areas and carryout plantation in degraded areas	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	Survey & monitoring
		3.Carry out stock assessments of forest through National Forest Inventory to understand the state of forest and carbon stocks	0	0	0	0	0	0	0	0	34.4	0	Periodic National Program
		4.Monitor utilization of timber supplied for rural and commercial construction	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	Annual Monitoring
		5.Carryout bioengineering work at the landslide prone areas	0	0.15	0	0.2	0	0	0	0.15	0	0	

	Provide alternate livelihood opportunities for local communities	1.Revise Jampani Fakchuthang, Langchenphu and Haspokhare CFs and Tokaphu NWFP management plan	0	0	0	0	0	0	0	0	0.06	0.06	
		2.Conduct annual monitoring of CF and NWFP management groups	0.00	0.07	0.07	0.07	0.00	0.07	0.07	0.07	0.07	0.07	Annual Monitoring
		3.Establish nursery and plantation of Satuwa for Deptsang NWFP group	0.45	0	0	0	0	0	0	0	0	0	
		4. Establish nature-based enterprise for income generation (soft broom, chirata & bamboo)	0	0.15	0.15	0	0	0	0	0	0	0	

		5.Coordinate and support trade and export of NWFP	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	
	Initiate effective waste management program	1.Create awareness on waste prevention rules and regulations and enforce rules	0.10	0	0	0.10	0	0	0.10	0	0	0	
		2.Establish signage in restricted areas and along the highway	0.09	0	0	0	0	0.05	0	0	0	0	
		3.Identify and form community waste management group	0	0	0.2	0	0	0	0.3	0	0	0	
		4.Collaborate with local authorities on waste management	0	0	0.2	0	0	0	0	0	0	0	

Viable population of wildlife is maintained and presence of new wildlife assessed	Protection of keystone and flagship species	1.Carry out field survey to determine population of elephant and gaur	0	0	1	0	0	1	0	0	0	0	
		2.Conduct monitoring of tiger and prey once in two years	0	0	0.5	0	0	0.5	0	0	0.5	0	
		3.Conduct National Tiger Survey	0	0	0	0	1.4	0	0	0	0	0	
		4.Conduct patrolling in identified routes in the areas of Diasam, Kherkheri, Borla, Agurthang, Kalanadi, Agurong and maintain the routes regularly	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
		5.Conduct refresher arms training for forestry staffs	0	0.08	0	0.08	0	0.08	0	0.08	0	0.08	
		6. Carryout education and awareness program to schools	0	0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	

		and communities on significance of conservation											
	Reduce poaching and illegal wildlife trade	1.Conduct regular SMART patrolling focusing on hotspot areas	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	
		2.Conduct meeting with Indian counterpart annually and establish good rapport to tackle illegal activities	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
		3. Establish patrol camp at Kherkheri	0	0	1.8	0	0	0	0	0	0	0	
	Reduce Human Wildlife Conflict	1.Provide technical support to install and maintain solar/electric fence at the most affected or hotspot areas	0	0	0	0	0	0	0	0	0	0	Budget central to Dzongkhag
		2.Conduct regular monitoring of elephants to understand their behaviour in relation to the	0	0	0	0.3	0	0	0	0	0	0	

		seasonal change and with regard to the cropping pattern											
		3.Carryout habitat enrichment for wild animals and protect their migratory route in the areas identified	0	0	0	0	0.15	0	0	0.15	0	0	
		4.Establish community HWC Rapid Response Team in Samrang and Langchenphu	0	0	0.05	0	0	0	0.05	0	0	0	
		5.Update HWC hotspot areas	0	0	0	0	0	0	0	0	0	0	

To develop infrastructure and strengthen institutional capacity	Establish field offices and improve communication and mobility	1.Construct Beat Office at Samrang for effective monitoring of the Sanctuary.	0	0	0	3	0	0	0	0	0	0	
		2.Equip offices with laptops, printer, binoculars, night vision to carryout regular activities	0	0.5	0	0	0.6	0	0	0	0.6	0	
		3.Procure wireless handset and repeater	0	0	0	0.40	0	0	0	0	0	0	
		4.Annual maintenance of office equipment and vehicles.	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	
	Strengthen effective management of the Sanctuary	1.Review of Conservation Management Plan	0	0	0	0	0.20	0	0	0	0	0	
		2.Revision of Conservation Management Plan	0	0	0	0	0	0	0	0	0	1	
		3.Assessment of Bhutan METT+	0	0	0	0	0.03	0	0	0	0	0	

		4.Build capacity of the staffs	0	0.4	0	0.2	0	0.2	0	0.2	0	0.2	

To develop infrastructure and strengthen institutional capacity	Establish field offices and improve communication and mobility	1.Construct Beat Office at Samrang for effective monitoring of the Sanctuary.	0	0	0	3	0	0	0	0	0	0	
		2.Equip offices with laptops, printer, binoculars, night vision to carryout regular activities	0	0.5	0	0	0.6	0	0	0	0.6	0	
		3.Procure wireless handset and repeater	0	0	0	0.40	0	0	0	0	0	0	
		4.Annual maintenance of office equipment and vehicles.	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	

	Strengthen effective management of the Sanctuary	1.Review of Conservation Management Plan	0	0	0	0	0.20	0	0	0	0	0	
		2.Revision of Conservation Management Plan	0	0	0	0	0	0	0	0	0	1	
		3.Assessment of Bhutan METT+	0	0	0	0	0.03	0	0	0	0	0	
		4.Build capacity of the staffs	0	0.4	0	0.2	0	0.2	0	0.2	0	0.2	
To develop infrastructure and strengthen institutional capacity	Establish field offices and improve communication and mobility	1.Construct Beat Office at Samrang for effective monitoring of the Sanctuary.	0	0	0	3	0	0	0	0	0	0	
		2.Equip offices with laptops, printer,	0	0.5	0	0	0.6	0	0	0	0.6	0	

		binoculars, night vision to carryout regular activities											
		3.Procure wireless handset and repeater	0	0	0	0.40	0	0	0	0	0	0	
		4.Annual maintenance of office equipment and vehicles.	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	
	Strengthen effective management of the Sanctuary	1.Review of Conservation Management Plan	0	0	0	0	0.20	0	0	0	0	0	
		2.Revision of Conservation Management Plan	0	0	0	0	0	0	0	0	0	1	

		3.Assessment of Bhutan METT+	0	0	0	0	0.03	0	0	0	0	0	
		4.Build capacity of the staffs	0	0.4	0	0.2	0	0.2	0	0.2	0	0.2	

PART VII: MONITORING AND EVALUATION

7.1 Monitoring and Evaluation

Monitoring is important process of any conservation management plan cycle. This will be carried out in regular intervals to assess how proposed activities are being implemented towards achievement of goals and objectives. It will also help keep track of the plan progress for timely adjustments of the management activities if the targets are not likely to be achieved as planned.

Evaluation is the analysis of the effectiveness of planned activities. Evaluation is intended to improve performance during the implementation of activities of conservation management plan. It will also assess implementer to determine the extent to which anticipated outcomes are produced as per the objectives.

The monitoring and evaluation will be done at the midterm and at the end of the plan period. For the assessment of JWS management effectiveness, standards of Bhutan Management Effectiveness Tool Plus (METT+) will be adopted.

Strategies	Actions	Output Indicator	Base-line	Unit	Yearly Target										
					Y1	Y2	Y3	Y4	Y5	Y 6	Y7	Y8	Y9	Y10	Remarks
Conserve key wildlife habitat	1.Carryout habitat management works such as grassland, removal of invasive weeds, enrichment planting and prescribed burning	Acre of area brought under habitat management.	170	Acre	75	25	0	50	50	0	0	75	50	0	
	2. Maintain waterholes and saltlicks	No. of waterholes/salt licks maintained.	8 water holes and 6 saltlick	No	4	4	4	4	4	4	4	4	4	4	
	3. Map and maintain migratory route and habitat	No. of activity report and location map			6	0	0	0	8	0	0	0	8	0	

	connectivity of animals especially elephants		0	No											
	4.Establsih biodiversity monitoring grid and conduct regular monitoring	No. of grids established and monitored	6	No	6	6	6	6	6	6	6	6	6	6	
Sustainable use of natural resources and management	1.Prepare and implement LFMP for multiple use zone	No. of LFM plan developed	1	No	0	1	0	0	0	0	0	0	0	0	
	2.Map degraded areas and carryout plantation degraded in areas	Area brought under plantation	16	Ha	12	20	20	25	25	30	30	40	40	40	
	3.Carry out stock assessment of forest through National Forest Inventory to	No. of NFI plots surveyed.		No	0	0	0	0	0	0	0	0	86	0	

	understand the state of forest and carbon stocks		86 plots												
	4.Monitor utilization of timber supplied for rural construction	Epicollect data and report	started from 2022	HH	All households who have availed timber previous year and not completed construction or renovation of house										
	5.Carryout bioengineering work at the landslide prone areas	Number of sites developed	0	No	0	2	2	1	0	0	2	2	2	0	

Support in natural resources conservation by local communities	1. Revise CF and NWFP management plan	CF and NWFP plan revised	3 CF and 1NWFP	No	0	0	0	0	0	0	0	0	2	2	
	2.Conduct annual monitoring of CF	Monitoring reports	3 CF and 1	No	4	4	4	4	4	4	4	4	4	4	

	and NWFP management groups		NWFP												
	3.Establish Satuwa nursery at Deptsang	No. of nursery established	1	No	1	0	0	0	0	0	0	0	0	0	
	4.Establish nature-based enterprise for income generation (soft broom, chirata & bamboo)	No of enterprise established	0	No	0	1	1	0	0	0	0	0	0	0	
Initiate effective waste management program	1.Create awareness on waste prevention rules and regulations and enforce rules	No of awareness program conducted	0	No	0	1	0	1	0	0	1	0	0	0	
	2.Establish signage in restricted areas and along the highway	No. of signages installed.	0	No	0	8	0	0	0	5	0	0	0	0	

	3.Identify and form community waste management group	No of group formed/operationalized.	0	No	0	0	2	0	0	0	3	0	0	0	
	4.Collaborate with local authorities on waste management	Number of support provided	0	No	1	0	1	1	0	1	1	0	1	1	
Protection of keystone and flagship species	1.Carry out field survey to determine population of elephant and gaur	Survey report produced	0	No	0	0	1	0	0	1	0	0	0	0	
	2.Conduct monitoring of tiger and prey periodically	Report	2	No	0	0	1	0	0	1	0	0	1	0	
	3.Conduct National Tiger Survey	Camera trap installed in 64 grids	2022	No	0	0	0	0	0	1	0	0	0	0	
	4.Conduct patrolling in identified routes and	No. of patrolling report			0	0	6	0	0	0	6	0	0	0	

	maintain routes regularly		2	No											
	5.Conduct arms refresher training to forestry staff	Training report	1	No	1	0	1	0	1	0	1	0	1	0	
	6.Carryout education & awareness program to school and communities on significance of conservation	No. of program conducted and report	0	No	0	0	1	1	1	1	1	1	1	1	
Reduce poaching and wildlife trade	1.Conduct regular SMART patrolling focusing hotspot areas	No. of patrol conducted and reported	3	No	12	12	12	12	12	12	12	12	12	12	
	2.Conduct meeting with Indian counterpart and establish good	No of meetings conducted/coordinated.	1	No	1	1	1	1	1	1	1	1	1	1	

	rapport to tackle illegal activities													
	3.Establish patrol camp at Kherkheri	No. of structure	0	No	0	0	1	0	0	0	0	0	0	0
Reduce Human Wildlife Conflict	1.Provide technical support to install and maintain of solar/electric fence at the most affected or hotspot areas	No. of technical support provided	1	No	2	2	2	2	2	2	2	2	2	2	Shall be carried out by dzongkhag & gewog
	2.Conduct regular monitoring of elephant to understand behaviour in relation to the seasonal change and with regard to the cropping pattern	Report	0	No	0	1	0	1	0	1	0	1	0	0	

	3.Carryout habitat enrichment for wild animals and protect their migratory route	Area brought under habitat enrichment	2	Acre	0	0	0	0	6	0	0	6	0	0	
	4.Establish community HWC Rapid Response Team	No of QRT/RRT formed/operationalized.	3	No	0	0	2	0	0	0	2	0	0	0	
	5. Update HWC hotspot areas	Hotspot map produced	1	No	0	0	1	0	0	0	1	0	0	0	
Establish field offices and improve communication and mobility	1.Construct Beat Office at Samrang	Year by which the outpost is established	0	Year	0	0	0	2026	0	0	0	0	0	0	
	2.Equip offices with laptops, printer, binoculars, night vision to carryout regular activities	No. of equipment procured		No	0	6	0	0	7	0	0	0	0	0	Laptop & printer

	4.Maintain office equipment and vehicles	Equipment and vehicle functional	1 hilux, 1 truck, 2 bikes	No	4	4	4	4	4	4	4	4	4	4	
	5.Procure wireless handset and repeater	No. of wireless handset and repeater procured	20 handset	No	0	10	0	0	10	0	0	10	0	0	
Strengthen effective management of the Sanctuary	1.Review of Conservation Management Plan	No. Plan reviewed	1	0	0	0	0	0	1	0	0	0	0		
	2.Revision of Conservation Management Plan	No. Plan revised	1	0	0	0	0	0	0	0	0	0	0	1	
	3.Assessment of Bhutan METT+	MEET+ assessment conducted	1	2	0	0	0	0	1	0	0	0	0	1	

	4.Build capacity of staffs	No. of staff trained	0	No	10	10	10	10	10	10	10	10	10	10	

Bibliography

1. Conservation Management Plan, July 2020-June 20308, Bumdeling Wildlife Sanctuary
2. Conservation Management Plan, (Amendment 2019), Sakteng Wildlife Sanctuary
3. Conservation Management Plan, July 2013-June 2018, Bumdeling Wildlife Sanctuary
4. Conservation Management Plan, July 2015-June 2020, Royal Manas National Park
5. Conservation Management Plan, January 2015-December 2019, Jigme Dorji National Park
6. Conservation Management Plan, January 2014-December 2018, Jigme Singye Wangchuck National Park
7. Vision and Strategy for the Nature Conservation Division, 2003, Department of Forestry Services
8. National Forest Inventory Report Volume I & II, 2018, Forest Resources Management Division
9. Guidelines for Management Planning of Protected Areas, World Commission on Protected Areas (WCPA), Best Practice Protected Area Guidelines Series No. 10, IUCN – The World Conservation Union 2003
10. Integrated Wildlife Management Plan for West Singhbhum, Jharkhand, India, 2013

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