SNOW LEOPARD CONSERVATION ACTION PLAN FOR BHUTAN 2024-2033

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

SNOW LEOPARD CONSERVATION ACTION PLAN FOR BHUTAN (2024-2033)

A Climate-integrated Landscape Approach to Snow Leopard Conservation

NATURE CONSERVATION DIVISION
Department of Forests and Park Services
Ministry of Energy and Natural Resources

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SECRETARY

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Ministry of Energy and Natural Resources
Royal Government of Bhutan
Thimphu

BHUTAN
Believe

FOREWORD

The snow leopard is a magnificent predator, symbolizing resilience and serving as a vital indicator of high-altitude ecosystem health. In Bhutan, the snow leopard is not merely a charismatic inhabitant of our mountains but an integral part of our natural heritage. Its presence signifies healthy prey populations, thriving alpine meadows, and a balanced mountain environment. However, snow leopards face numerous threats: habitat loss due to human encroachment, the constant danger of poaching, and the looming threat of climate change. These challenges cast a shadow over the future of these majestic cats.

Guided by the philosophy of Gross National Happiness and a profound reverence for nature, Bhutan has a proud history of safeguarding its natural heritage. The most recent nationwide snow leopard survey estimated 134 individuals in the country, up from 96 in 2015, reflecting the effectiveness of our multi-pronged approach to conservation.

We have achieved this by focusing on few key areas. Expanding protected areas secures safe havens, while corridors between them allow for crucial movement and genetic diversity. Recognizing the ever-present threat, Bhutan has significantly bolstered anti-poaching efforts. Research is also key, with collaborations using advanced technology to gain deeper insights into snow leopard populations. But we know that true success hinges on community involvement. Bhutan fosters a sense of shared responsibility through outreach programs, encouraging participation in conservation activities. This goes beyond protecting a species; it's about safeguarding the entire high-altitude ecosystem and recognizing the interconnectedness of nature.

I am confident that Snow Leopard Action Plan (2024-2033) will go a long way in securing a future where snow leopards continue to grace the peaks of Bhutan, not just as a symbol of our natural heritage but as a testament to our unwavering commitment to a healthy and vibrant natural world. We invite all stakeholders to join us in this endeavor, for the benefit of snow leopards, the ecosystems they inhabit, and future generations. Let us work together to safeguard the spirit of the mountains, ensuring that the call of the snow leopard continues to echo through the ages.

Tashi Delek!

(Karma Tshering)
Secretary

PREFACE

The Snow Leopard *Panthera uncia* acts as an indicator of the health of the mountain ecosystem in which they live, due to their position as the top predator in the food web. However, the snow leopard faces numerous threats that have pushed it to the brink of extinction. Factors such as habitat loss, climate change, poaching, and retaliatory killing due to human-wildlife conflict pose significant challenges to the survival of this iconic species. The urgency to act and implement effective conservation measures is felt necessary in the wake of advancing development in the country.

The second Snow Leopard Conservation Action Plan (2024-2034) is a comprehensive and collaborative effort that brings together conservation organizations, local communities, researchers, and other stakeholders. The plan is not just about protecting a single species; it is about recognizing the interconnectedness of all life forms and understanding that the conservation of the snow leopard is essential for maintaining ecosystem balance in the alpine areas. By conserving the snow leopard, we are also preserving the landscapes that snow leopards inhabit, which provide vital ecosystem services such as clean water sources and climate regulation, benefiting both wildlife and human communities.

The Snow Leopard Conservation Action Plan outlines a multifaceted approach that includes habitat conservation, community engagement, anti-poaching efforts, research and monitoring, and advocacy programs. We acknowledge that implementing this action plan will require support and cooperation from the government and in particular from the international funding agencies/NGOs. However, the benefits obtained from these would far outweigh the costs. By investing in snow leopard conservation, we are investing in a future where these majestic creatures continue to thrive freely, ensuring the integrity of the ecosystems they inhabit and inspiring future generations.

I am optimistic that this action plan with a clear goal will secure the future of snow leopards in Bhutan with communities as conservation stewards. I also express my heartfelt appreciation to NCD and all other participants engaged in formulating this plan. I wish them good luck for the successful implementation of this plan.

(Lobzang Dorji)
Director

ACKNOWLEDGEMENT

I would like to extend my sincere gratitude to the Director for his exemplary guidance in steering the Department of Forests and Park Services and Snow Leopard Conservation in Bhutan. Your leadership and vision have been instrumental in shaping the strategic approach towards snow leopard conservation.

My heartfelt appreciation goes out to our colleagues at the Nature Conservation Division (NCD) for their unwavering commitment to coordinating and overseeing the meticulous development of the action plan. Their dedication and collaborative spirit have been pivotal in crafting a comprehensive strategy for the conservation of snow leopards in Bhutan. I would like to express our profound thanks to our field colleagues from various regions of the country. Their active engagement and invaluable contributions during the development of the action plan reflect the collective effort and commitment to safeguarding snow leopards and their habitats. A special acknowledgment is extended to the Technical Advisory Committee at the Department of Forests and Park Services for their meticulous review of the document. Their insightful comments and recommendations have significantly enriched the quality and effectiveness of the Snow Leopard Action Plan.

I would also like to extend our gratitude to our conservation partners, Bhutan for Life, for their substantial support in the development of the action plan. Additionally, our appreciation goes to esteemed collaborators such as WWF Bhutan, Bhutan Trust Fund for Environmental Conservation, and Bhutan Foundation, whose dedicated efforts contribute significantly to the protection of this iconic species.

Last but not least, we would like to thank all the rangers for their unwavering commitment and hard work in the field. Their dedication forms the backbone of our conservation efforts, ensuring the effective implementation of the action plan on the ground.

Together, with the collective efforts of these individuals and organizations, we strive towards ensuring a sustainable and thriving future for snow leopards in the majestic landscapes of Bhutan.

Sonam Wangdi
Chief Forestry Officer


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ACRONYMS

BFDA	Bhutan Food Drug Authority
BTFEC	Bhutan Trust Fund for Environmental Conservation
BWS	Bumdeling Wildlife Sanctuary
CITES	Convention on International Trade of Endangered Species of Wild Fauna and Flora
CVA	Climate Vulnerability Assessment
DECC	Department of Environment and Climate Change
DoFPS	Department of Forests and Park Services
DoL	Department of Livestock
FNCRR	Forests and Nature Conservation Rules and Regulations
RMID	Forest Monitoring and Information Division
FRMD	Forest Resources Management Division
GEF	Global Environment Facility
GIGO	Garbage In Garbage Out
IUCN	International Union for Conservation of Nature
JDNP	Jigme Dorji National Park
JKSNR	Jigme Khesar Strict Nature Reserve
MoAF	Ministry of Agriculture and Forests
MoHCA	Ministry of Home and Cultural Affairs
NBC	National Biodiversity Centre
NCD	Nature Conservation Division
NEC	National Environment Commission
NSB	National Statistics Bureau
PTFD	Paro Territorial Forest Division
SFED	Social Forestry and Extension Division
SLIMS	Snow Leopard Information Management System
SWS	Sakteng Wildlife Sanctuary
TCB	Tourism Council of Bhutan
UWIFoRT	Ugyen Wangchuck Institute for Forestry Research and Training
WCNP	Wangchuck Centennial National Park
WWF	World Wide Fund for Nature

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EXECUTIVE SUMMARY

The snow leopard *Panthera uncia*, an emblematic species symbolizing the alpine mountain ecosystem's vitality across Asia, faces global threats like habitat loss, prey depletion, poaching, and conflicts, classifying it as Vulnerable on the IUCN red list. Despite Bhutan's commendable increase in snow leopard numbers from 96 in 2015 to 134 in 2023, persistent challenges demand attention. These include habitat degradation propelled by uncontrolled shrub growth, cordyceps collection, potential infrastructure development, and amplified by climate change affecting critical alpine meadows. Additional concerns involve poaching risks due to porous borders, retaliatory killings, occasional livestock depredation, and other complexities such as disease transmission, localized grazing pressure, and limited awareness, funds, and information.

To address these multifaceted challenges, Bhutan has devised a comprehensive Snow Leopard Conservation Action Plan for 2024-2033. This 10-year plan envisions a thriving coexistence between snow leopards and well-informed local communities, positioning them as conservation stewards. The primary goal is to maintain a viable snow leopard population through active community engagement. Specific objectives are as follows:

Habitat Management:
To counteract degradation in alpine regions, the plan includes initiatives such as identifying and mapping prime snow leopard habitats, managing invasive species, and implementing effective waste management practices.

Population Monitoring & Protection:
To ensure a flourishing snow leopard population, the plan focuses on enhancing patrolling activities, strengthening intelligence capabilities against poaching, monitoring disease spread, and controlling feral dog populations.

Conflict Reduction & Community Engagement:
Recognizing the importance of community involvement, the plan emphasizes raising awareness through educational programs, implementing Human-Wildlife Conflict (HWC) mitigation measures, and promoting ecotourism and alternative income sources.

Knowledge Generation:
Acknowledging the significance of knowledge, the plan outlines initiatives like advanced monitoring techniques, habitat preference studies, assessments of human-snow leopard interactions, and behavioural responses in the context of climate change.

The Snow Leopard Action Plan seeks to address specific challenges through habitat management, population monitoring and protection, conflict reduction, and knowledge generation. By implementing targeted actions, the plan aims to ensure the long-term viability of snow leopards while fostering harmonious coexistence with local communities.


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01 INTRODUCTION

1.1 Snow leopards: A global status

The snow leopard *Panthera uncia* spans a vast region exceeding 2.8 million km², encompassing the Himalayan mountains and central Asia across 12 countries (McCarthy et al., 2017). Population estimates for this elusive species vary widely, with figures ranging from 3,920 to 7,500, and mature adults estimated at 2,710 to 3,386 (McCarthy and Chapron, 2003; Jackson et al., 2010; Snow Leopard Working Secretariat, 2013; McCarthy et al., 2017). Recent advancements in field surveys and technologies like satellite GPS telemetry challenge the lower estimates, suggesting a global population likely within the range of 7,446 to 7,996 individuals (McCarthy et al., 2017).

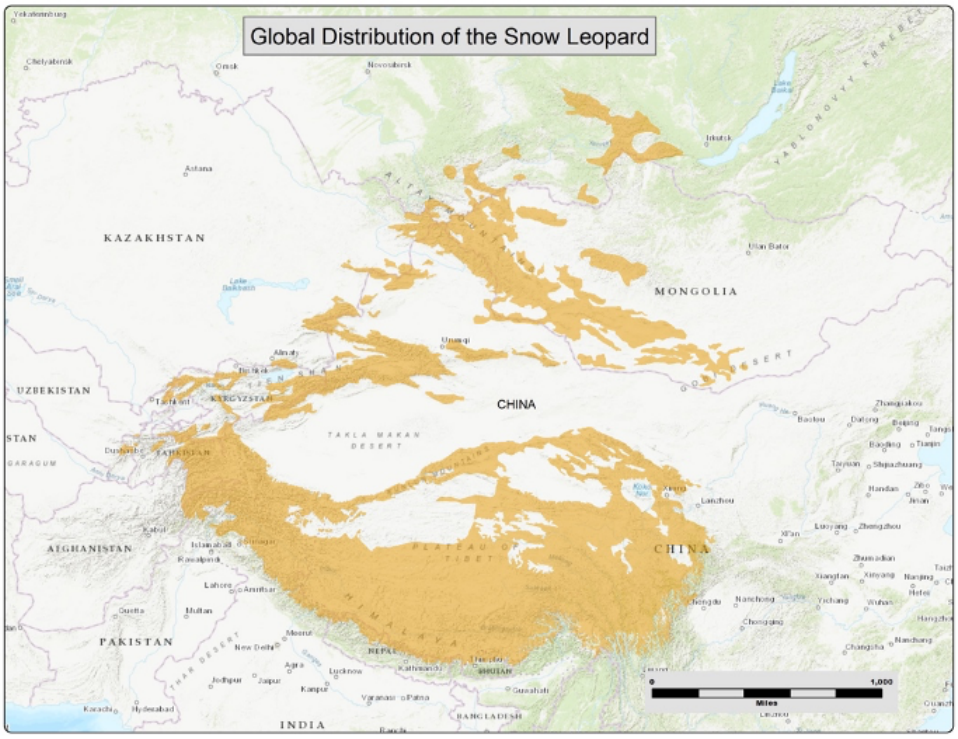


Figure 1: Global snow leopard distribution map

Despite its global threat status and limited study, the snow leopard remains one of the least studied large carnivores (Snow Leopard Network, 2014). Challenges arise from the species' secretive nature, low population densities, and remote mountainous distribution, hindering reliable population estimates (Suryawanshi et al., 2021). While progress has been made at local scales, regional and global estimates remain uncertain. The IUCN Red List classifies the snow leopard as 'Vulnerable,' with a projected decline of at least 10% over three generations (22.62

years) (McCarthy et al., 2017). Additionally, it is listed in CITES Appendix I, strictly prohibiting trade in the animal and its parts.

Despite residing in remote and inaccessible habitats, snow leopards face increasing anthropogenic threats. These include habitat degradation, natural resource extraction, poaching, and retaliatory killings by herders. Climate change further amplifies these challenges by altering land cover and land use in alpine regions. To address these concerns, the Bishkek Declaration was established in 2013, uniting snow leopard range countries in a commitment to a global conservation plan. This declaration, also known as the Global Snow Leopard Ecosystem Protection Program (GSLEP), outlines 12 National Snow Leopard and Ecosystem Protection Priorities (NSLEPs) representing collective goals for conservation. The overarching aim is to secure 20 snow leopard landscapes by 2020, defined as areas with at least 100 breeding-age snow leopards, adequate prey populations, and functional connectivity across international boundaries (Snow Leopard Working Secretariat, 2013).

1.2. Biodiversity conservation in Bhutan

Bhutan, nestled in the eastern Himalayan Mountain range between China and India, follows a way of life deeply rooted in Buddhism and the unique principle of 'Gross National Happiness.' These cultural elements play a crucial role in the country's commitment to conservation, evident in its legal and policy frameworks. The Forest and Nature Conservation Act of Bhutan 1995 strictly prohibits hunting, except for regulated fishing, and the constitution mandates a perpetual 60% forest cover. Bhutan's robust conservation efforts are manifested in the extensive network of protected areas and biological corridors, collectively known as the Bhutan Biodiversity Conservation Complex (B2C2), covering over 50% of the country's land.

Situated at the ecotone of the temperate Palearctic and tropical Indo-Malayan Biogeographic Realms, Bhutan boasts rich biodiversity, encompassing over 5,600 vascular plant species, nearly 200 terrestrial mammal species, and 772 bird species (NBC 2014). The country's topography is marked by three physiographic zones: the southern foothills (200-2,000m), the inner Himalayas (2,000-4,000m), and the Greater Himalayas (above 4,000m). These zones correspond to six ecoregions defined by distinct vegetation and faunal communities (Wikramanayake et al. 2001, Olson and Dinerstein 2002). The northern alpine ecoregions, inhabited by Palearctic species like the snow leopard and its primary prey, the blue sheep, are of particular conservation interest.

Despite Bhutan's relatively small population of 763,249, with over 62% residing in rural areas below 4,000m elevation (NSB 2022), there is a unique pastoral community living above 4,000m. This community, primarily engaged in herding yak and horses, practices vertical transhumance and coexists with the snow leopard in its habitat. The harmonious coexistence of cultural values, conservation practices, and biodiversity highlights Bhutan's commitment to preserving its natural heritage.

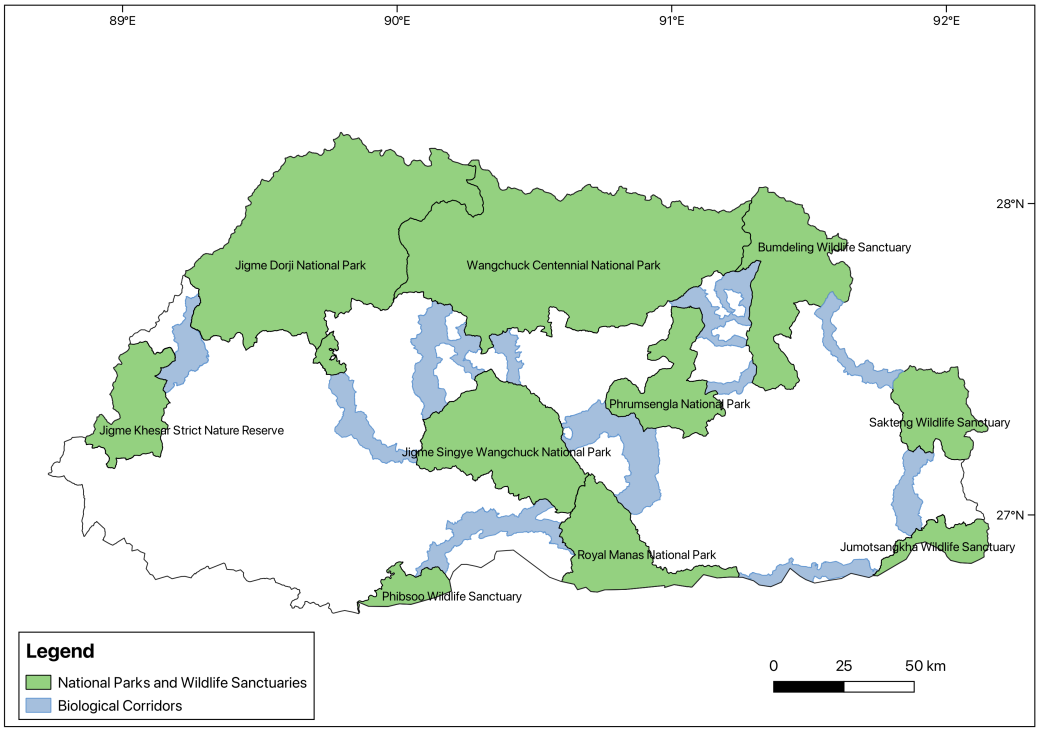


Figure 2 Bhutan's protected area network comprising of national parks, wildlife sanctuaries, strict nature reserve and biological corridors

1.3. Ecological significance of snow leopard

The snow leopard, an apex predator in the Himalayan alpine ecosystems, holds a pivotal role in shaping ecological dynamics through top-down trophic cascades that regulate herbivore populations (Devkota et al., 2013). Its extensive spatial usage further positions the snow leopard as an umbrella species, signifying its importance in conserving other high-elevation biodiversity in the Himalayas (Roberge and Angelstam, 2004). The conservation efforts directed towards snow leopards and their habitats in Bhutan extend beyond species preservation; they contribute to safeguarding water towers and ensuring overall ecosystem integrity.

In Bhutanese culture, the snow leopard carries spiritual significance as a mountain deity, particularly revered by yak herders and mountain communities. Its charismatic and mystical nature also designates it as a flagship species, capable of garnering widespread support for wildlife conservation across the highlands of Asia. Beyond cultural reverence, the snow leopard plays a vital role in the economic landscape, offering opportunities for tourism-based revenue streams in local communities. The breath-taking vistas of snow leopard habitats in Bhutan attract alpine trekkers, and involving local communities as guides, naturalists, and homestay owners leverages their intimate knowledge of snow leopard habitats, biodiversity, and cultural traditions. Engagement with local communities not only promotes sustainable tourism but also nurtures a sense of stewardship for snow leopard conservation. The economic benefits derived from

activities linked to snow leopard habitats incentivize local communities to actively participate in and champion the cause of snow leopard preservation.

Snow leopard captured during survey of 2022

1.4. Conservation status of snow leopards in Bhutan

The Royal Government of Bhutan has granted maximum protection to snow leopards by listing the species as a protected species in Schedule I of the Forest and Nature Conservation Act of Bhutan, 1995, and the same status was retained in the revised Forest and Nature Conservation Act of Bhutan, 2023. The government has also conducted several capacity-building programmes, including training provided to Jigme Dorji National Park (JDNP) staff on Snow Leopard Information Management System (SLIMS) in 1997 and 2000 (Jackson et al. 2000). In 1996, the Department of Forests (now Department of Forests and Park Services, DoFPS) initiated the Tiger Conservation Programme which included a component to compensate livestock kills by snow leopards as well.

In 2012, a camera-trap survey of snow leopards was conducted in JDNP, and between 2012 and 2014 in WCNP with financial assistance from the WWF Bhutan Programme (Thinley et al. 2014, Shrestha and Tenzin 2015). These surveys catalysed the subsequent nationwide survey, which was conducted in two phases: 1) a sign and prey base survey from 2014 to mid-2015 and, 2) the camera trap survey from mid-2015 – 2016. In 2022-2023, the second nationwide snow leopard survey using camera traps was carried out.

1.5. Population status of the snow leopard and prey in Bhutan

The first nationwide camera trap survey of the snow leopard in Bhutan was conducted from 2014 to 2016 using grid-based sign surveys and camera traps (DoFPS 2016, Thinley et al. 2016). Snow leopards were confirmed for the first time in Jigme Khesar Strict Nature Reserve (JKSNR) and

Paro Territorial Forest Division (PTFD) during the survey. The results estimated the snow leopard population in Bhutan at 96 animals (*SE* ± 8), with an estimated density of 1.08 (*SE* ± 0.09) animals per 100 km^2.

The National Snow Leopard Survey (NSLS) is one of the key progress indicators under the National Key Result Areas (NKRA) and Agency Key Result Areas (AKRA) of the 12th Five Year Plan of the erstwhile Ministry of Agriculture and Forests, Royal Government of Bhutan (MoAF 2019) and the indicator requires Bhutan to maintain the 2016 baseline of 96 snow leopard individuals by the end of 12th FYP. The conservation Milestone 7 of Bhutan for Life project requires the country to maintain a stable population of snow leopards by year seven, i.e., 2024 (BFL 2015). To achieve these national objectives and to contribute towards the global goal of assessing the global snow leopard populations, the NSLS 2022-2023 was undertaken.

310 camera stations yielded a survey effort of 22,636 trap nights and captured over 10,000 images of snow leopards. We used 476 images for snow leopard individual identification and could identify 96 adult individuals, of which 45 were identified as male, and 51 as female. The Bayesian SECR model yielded a total estimated number of snow leopards in Bhutan at 134 individuals (SD ± 7.06). The estimated range of snow leopard abundance was between 121 and 148 individuals at 95% CI. This is an increase in the snow leopard population in Bhutan by 39.5% from the baseline population of 2016. The density estimates varied from 1.2 individuals to 1.48 individual snow leopards per 100 km^2 (at 95% CI) with a mean density estimate of 1.34 snow leopards per 100 km^2 (SD ± 0.071). The posterior density map predicted a higher density of animals in western Bhutan (JDNP, JKSNR, PTFD) as compared to similar habitats in central and eastern Bhutan (Figure 4). The density estimate for females was marginally higher than for males.

In terms of prey, although a detailed assessment is currently lacking, past surveys in WCNP estimated the average blue sheep population density in the central and western ranges of the park at 1.8 and 2.4 individuals per km^2, respectively, which is relatively low compared to other adjacent blue sheep range areas (Shrestha et al 2013). A double-observer method of estimating ungulate population (Forsyth and Hickling 1997), adapted for mountain ungulates by Suryawanshi et al. (2012) was tested in Lingzhi Park Range of JDNP by Leki et al. (2017), and can now be used to conduct blue sheep population surveys in all parts of Bhutan.

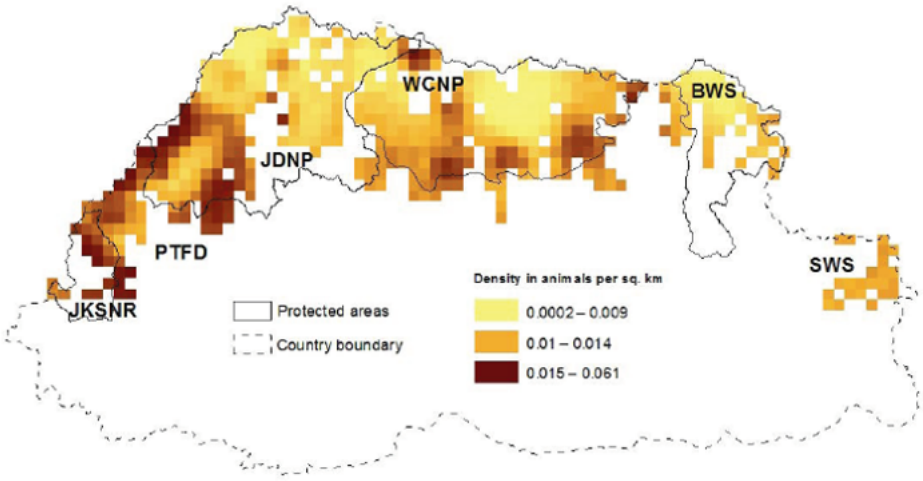


Figure 3: Snow leopard densities (animals/ km^2) estimated from SPACECAP analysis using the camera trap data from the national snow leopard survey of 2015-2016 (Source: DoFPS 2016).

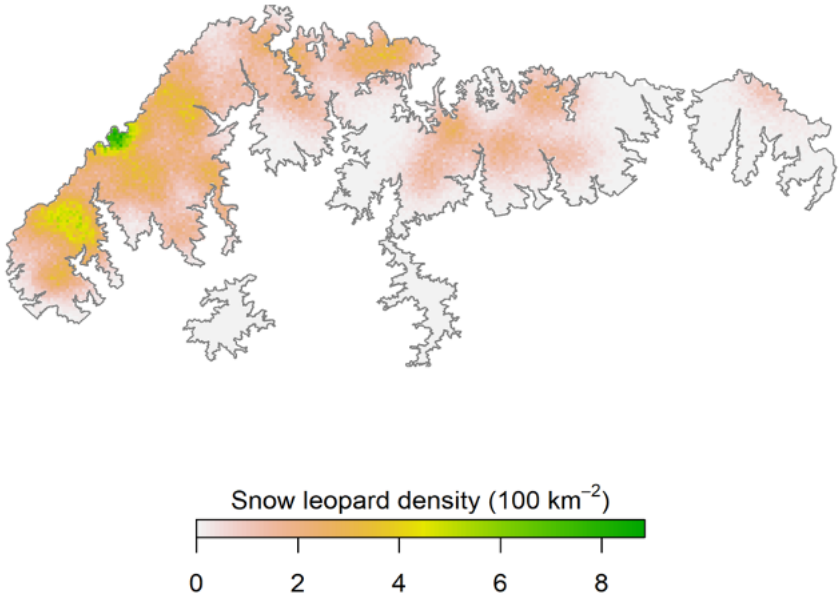


Figure 4: Map of the study area showing the posterior density estimate from the 2022-2023 nationwide survey using a Bayesian Framework (Source: DoFPS 2023).

02 REVIEW AND REFLECTION

2.1. Review of the recent action plan (2018-2023)

With an ambitious goal of maintaining a stable population of snow leopards in the country, the previous Snow Leopard Action Plan 2018–2023 was developed with 54 identified actions categorized under eight objectives. Out of the 54 actions prioritized, 48% (26) were fully achieved, 35.19% (19) were partially achieved and 16.67% (9) were not achieved. The Bhutan for Life project, the Global Environmental Facility (GEF) LDCF NAPA III project, and projects supported by WWF Bhutan and Bhutan Foundation, besides the Royal Government of Bhutan (RGoB) funding were sources of financial assistance in the implementation of those activities that were completed or partially completed.

Objective 1. To ensure harmonious co-existence of snow leopards and local communities and prevent retaliatory killing

Activities under this objective were directed towards the assurance of harmonious co-existence of snow leopards and local communities to prevent retaliatory killings. Some of the actions prioritized by the department were providing solar fencing equipment and researching highlanders' attitudes toward snow leopard conservation. The livestock compensation scheme revival was planned but not well regarded by local communities. Various awareness programs related to the conservation importance of snow leopards were conveyed to instill a sense of harmonious co-existence of snow leopards and local communities.

Objective 2. To fill knowledge gaps necessary for snow leopard conservation through research and monitoring, including in response to community activities and climate change

In pursuit to snow leopard conservation, it was crucial to address knowledge gaps. In the previous plan, research and monitoring were given significant attention. Forest officials during the plan period have managed to capture numerous evidences snow leopard and its abundant prey; identified preferred routes of snow leopard through SMART patrol module. Additionally, after the commencement of snow leopard action plan 2018-2023, with funding support from BFL project, a feasibility study on snow leopard was conducted at Sakteng Wildlife Sanctuary in collaboration with UWIFoRT. This initiative also helps the department in purchasing numbers of camera traps for future surveys and field gears for frontline staff.

Objective 3. To prevent the spread of diseases between wildlife and domestic animals

Wildlife disease prevention was of paramount importance. Therefore, activities like vaccination of livestock and feral dogs, training on wildlife rescue and forensics were conducted in collaboration with the Department of Livestock (DoL). One such evidences are feral dog vaccination in Lunana under JDNP and wildlife rescue training conducted in Bumthang in the year 2022. Recognizing the alarming rate of zoonotic diseases (e.g., mass takin deaths in JDNP and PFD in 2019), basic training on wildlife disease identification and wildlife rescue operations

is being included in the current plan. Under these objectives, three activities were fully accomplished and one activity was partially achieved.

Objective 4. To stop poaching of snow leopards in Bhutan

Snow leopard poaching emerged as a threat during the development of SLAP 2018-2023 and is still included as a threat with medium severity in the current plan. The main issues reported were retaliatory killings and a lack of support from stakeholder groups and local populations. Thus, SMART patrolling was carried out regularly to identify patrol routes based on indirect evidence (such as scats, pugmarks, and prey) to stop such retaliatory killings. Individual rangers attended numerous SMART handling training during the plan period mainly targeted to collect uninterrupted data collection and reporting. Despite the rangers' continuous efforts, gaining support for the conservation of snow leopards was a challenge. Identifying the need to gain support, the department through international donor assistance was able to train more than 100 nature guides, strengthened collaboration with stakeholders (RBA, RBP, BFDA & Custom) through meetings/workshops at the national level and identified a few local people in the highland to report poaching incidences to nearest forest office primarily aimed to breakdown the network among poachers and counterpart.

Objective 5: To manage adequate habitat areas with ecological connectivity to maintain a viable snow leopard population in Bhutan

Effective snow leopard habitat management is essential for the conservation of this endangered species. It requires a range of strategies and actions targeted at enhancing the quality of snow leopard habitats. Some of the key actions implemented in the previous action plan were waste management in alpine meadows which were coordinated by field staff with community engagement. As per JDNP's waste collection report submitted through epi-collect by Range Offices in Lingzhi, Seo, Laya and Lunana, a total of 2.9 tons and 1.8 tons of non-degradable and degradable were managed. The institution of zero waste hour and mandatory cleaning on the 9th of every month supported the engagement of highlanders. Development of ecotourism products like the establishment of homestays, camping sites, NWFPs group, supply of breeding bulls and trail developments are few of the noticeable evidence of support rendered to highland communities under these objectives. Moreover, small-scale pasture land management (> 2 ha) was also conducted by the management of JKSNR, PFD, JDNP and WCNP. The activity involves prescribed burning and supply of seeds for fodder grasses.

Objective 6. To provide sustainable and alternative income sources to local communities linked to snow leopard conservation

Three actions have been identified under this objective to elevate the economic well-being of the local communities living in the snow leopard landscapes which includes the supply of renewable fuel, materials, and alternative sources of energy to reduce dependence on natural resources. A few of the prominent indicators such as coral fencing, the availability of milk churning equipment, and solar lighting are visible if one enters the highland of JKSNR, JDNP, WCNP, and PFD. The construction of eco-trail routes (Laya-Lingzhi and Zhabdrung trails) and the restoration of Lingzhi Dzong has also aided in achieving this goal through providing wages and potter charges during non-cordyceps season.

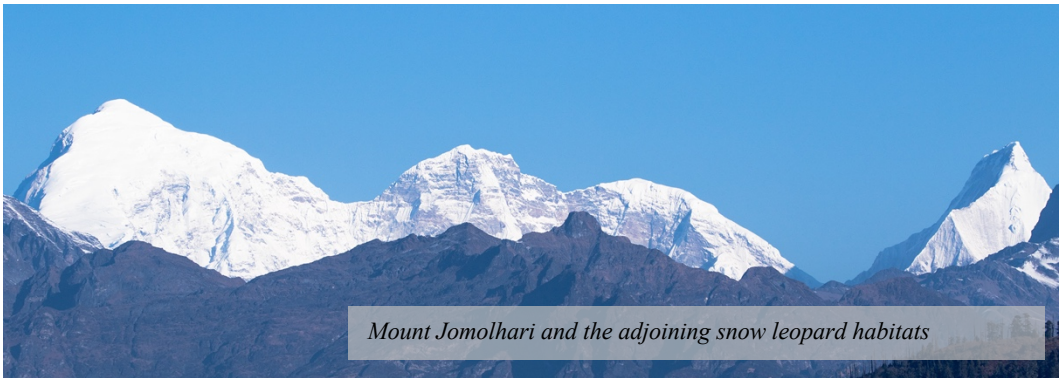
Objective 7. To monitor and address climate change-related impacts and natural disasters on snow leopard, habitats and communities

The key sectors recognized by the government as causatives of climate change are agriculture, hydropower, human health and sanitation, and infrastructure development. Erratic rain falls patterns with consequent landslides, flash floods, changing water availability, and detectable extreme temperatures are leading to phenological changes and glacial retreats are some of the impacts that are already prevalent in the country.

It is not an easy task to address climate change and its effects. However, the previous action plan has directed a few steps to reduce the impact. The development of a climate vulnerability adaptive plan for each PA and TFD is one of the major activities achieved. Climate Change Vulnerability Assessments (CCVA) is a method that can be used to evaluate vulnerability to climate change. The vulnerability index, exposure, sensitivity, and adaptive capability were used to frame the adaptive plans. The SLMP activity such as construction of a stone check dam in high land areas were done in SWS and WCNP.

Objective 8. To raise awareness of importance of snow leopard conservation at local and national levels

To advocate the local community on the conservation of snow leopard, Snow Leopard Day is observed in Lingshi and snow men trekking is organized as part of the Jomolhari Mountain Festval every october. In Laya, Royal Highland Festival is organized to encourage highlander for conservation and coexistence.



Mount Jomolhari and the adjoining snow leopard habitats

2.2. Need for a snow leopard conservation action plan

Despite the conservation potential for snow leopards in Bhutan, growing threats and challenges loom. Climate change has become a tangible and pervasive menace to both natural ecosystems and human communities in Bhutan, particularly in the alpine regions. Projections indicate a 3.5°C temperature increase by 2069, accompanied by a steady rise in rainfall to over 500 or 600 mm annually, with shifting patterns from the predictable monsoon-driven regime to a more erratic one

(RNR 2016). Additional analyses suggest a northward movement of forests, agriculture, and species into the alpine regions (Lhendup et al. 2011).

Favourable living conditions in the alpine areas may trigger anthropogenic land use changes as people seek refuge from warming and crowded conditions in the south (Forrest et al. 2012). All these factors pose potential threats to the persistence of snow leopards in Bhutan. Hence, a timely and holistic approach to snow leopard conservation is imperative—one that contextualizes Bhutan's conservation opportunities and contributions within a regional framework. This approach must integrate climate change impacts that will manifest at scales requiring landscape-scaled approaches, combining conservation with human land and resource use patterns. The first conservation action plan for 2018-2023 established clear goals and conservation outcomes. This second plan, built on the results of the 2nd National Snow Leopard Survey in 2022-23, is crucial for upscaling actions and addressing gaps in snow leopard conservation efforts.

Snow leopard passing through a ridge early in the morning

03 THREATS, CHALLENGES AND OPPORTUNITIES

3.1. Threats

Key threats to snow leopards, and blue sheep *Pseudois nayaur* (the primary prey species), and their habitats were discussed and assessed during the consultative workshop conducted in September 2023. Threats discussed in the previous plan were reviewed and new threats were discussed based on inputs from the field officials. The assessment of these threats was conducted in accordance with the Miradi principle and was categorized based on a scoring system that considers three vital dimensions: scope, severity, and irreversibility. These scores are then aggregated to generate the final assessment score, as shown in Table 1. Final scores falling within the range of 11-16 are classified as very high, while scores between 7-11 are deemed high. Scores ranging from 4-6 are categorized as medium, and scores below 4 are characterized as low.

Table 1: Threats to snow leopard ranked by scope, severity, and irreplaceability

SI. No.	Direct threats	Scope	Severity	Irreversibility	Total	Overall Threat Rating
1	Poaching	1	1	1	5	Low
2	Retailatory killing	1	1	2	6	Medium
3	Livestock depredation	3	3	2	14	High
4	Prey depletion	1	1	1	5	Low
5	Diseases	1	2	3	9	Medium
6	Habitat degradation and fragmentation	3	2	2	12	High
7	Collection of cordyceps and NWFP	3	2	3	13	High
8	Climate change	3	2	3	13	High
9	Localized grazing pressure	1	2	2	8	Medium
10	Solid waste	1	1	1	5	Low
11	Feral dogs	2	2	1	9	Medium
12	Interspecific competitions	1	1	1	5	Low
	Overall Threat Ranking				**9**	**Medium**

Of the 12 threats identified, 4 threats were ranked high; livestock depredation, habitat degradation and fragmentation, collection of cordyceps and NWFPs, and climate change. Four were ranked

medium; retaliatory killing, diseases, localized grazing pressure, and feral dogs, and remaining four as low; poaching, prey depletion, solid wastes, and interspecific competitions. Over threat towards snow leopard conservation was medium (Table 1). Miradi software was used to identify the relationships among these threats and their impacts on the conservation targets by mapping out a conceptual model (Figure 3).

3.1.1. Habitat degradation and fragmentation

Alpine meadows, delicate ecosystems easily disturbed or damaged, confront imminent threats from factors like shrub invasions, climate change, spreading settlements, and improper waste disposal. The unchecked spread of rapidly advancing shrubs such as *Juniperus spp*, *Salix spp*, and *Rhododendron spp* poses a significant risk, diminishing habitats crucial for the snow leopard. Furthermore, these invasive shrubs reduce the diversity of palatable grasses and medicinal herbs essential for the prey species like blue sheep, yak, and Marmot. The loss of alpine grasslands is a major conservation concern, given their role in harbouring numerous rare and endemic species (Brandt et al., 2012). The uncontrolled intensity of shrub growth in alpine meadows is predicted to lead to the disappearance of these meadows over time.

Another contributing factor to the loss of alpine areas, compounding the degradation of meadow quality, is climate change (Parmesan, 2006). Climate change, described below, results in the displacement of native alpine vegetation. The combined impact of these factors underscores the urgent need for comprehensive conservation efforts to safeguard these vulnerable ecosystems and the species dependent on them.

Receding glaciers and shifting tree line

The degradation of alpine meadows emerges as a direct and significant threat to snow leopards and blue sheep, with various drivers exacerbating habitat decline beyond climate change. Among these, the collection of Cordyceps and other alpine medicinal and incense plants, along with the associated activities of collectors, stands out as a substantial contributor to degradation. The

legalization of cordyceps collection in 2004 led to a surge in collectors descending on alpine areas, impacting the ecosystem. Monitoring collection levels is challenging, given the vast and challenging terrain of Bhutan's high mountain regions and the limited park staff available.

Habitat degradation is further fuelled by irresponsible practices such as garbage disposal into water bodies by trekkers, trekking companies, and locals. Effective prevention of these practices is crucial. Visitors and trekking companies must be educated to ensure the retrieval of all solid waste taken into alpine areas, supported by a robust Garbage In-Garbage Out (GIGO) policy enforced through regulations. Unregulated camping, particularly in Jigme Dorji National Park (JDNP), adds to habitat degradation. Tour guides reportedly set camps outside designated sites, intruding on blue sheep and snow leopards. The rising demands from the tourism sector overwhelm park management, necessitating better collaboration between the Tourism Council of Bhutan (TCB) and the Department of Forests and Park Services' Nature Conservation Division (NCD).

Future infrastructure plans in alpine areas, especially if market-based agriculture is introduced, may include highways and linear projects, similar to those in other Himalayan regions. It's crucial to ensure climate resilience and ecological connectivity in planning, with responsible Environmental Impact Assessments (EIAs) incorporating safeguards during construction. Natural disasters like GLOFs, landslides, and fires can contribute to localized habitat degradation, posing a threat to alpine ecosystems.

Habitat degradation, resulting in fragmentation and loss, poses a significant risk to species survival, particularly for snow leopards and entire ecosystems dependent on them. Anthropogenic activities, accelerated by climate change, lead to habitat fragmentation in mountainous landscapes. Studies show that forest intrusion and land uses can convert and fragment alpine habitats, affecting snow leopard populations and ecological connectivity. Encroachment of scrub and tree species into existing meadows further reduces habitat for snow leopards and impacts wild ungulates and domestic livestock.

3.1.2. Collection of cordyceps and NWFPs

The legalization of cordyceps collection in Bhutan in 2004 led to significant gatherings of local communities engaging in this activity due to its high commercial value attributed to medicinal properties. However, this practice, occurring in the same mountainous regions where snow leopards primarily hunt blue sheep and other ungulates, poses potential threats to both prey and predators. The disturbance caused by cordyceps collectors can disrupt the natural behaviour and movements of these prey species, impacting the snow leopard's ability to find food and resulting in reduced prey availability. To mitigate habitat degradation caused by the collection of Non-Wood Forest Products (NWFPs) in alpine meadows, constant patrolling and monitoring are crucial measures. However, the challenging high mountain terrain in Bhutan limits the feasibility of regular patrolling and monitoring due to a scarcity of park staff.

The environmental impact of cordyceps collection extends beyond the disturbance to wildlife. Collectors often leave behind large quantities of trash, including plastic wraps, cloth, plastic and

glass bottles, and used batteries, which accumulate over time. This trash negatively affects plant life by smothering and altering micro-climatic conditions, hindering growth. Additionally, batteries release toxic chemicals into the sensitive and fragile ecosystems. Unsustainable harvesting methods, such as digging and loosening the soil during cordyceps collection, impede meadow community regeneration, contribute to soil erosion, and degrade the alpine ecosystem. Compounding these issues, the cordyceps collection period coincides with the blue sheep birthing period from May to July (Wegge 1979; Wilson 1981), causing stress and disruption that can impact population growth rates in blue sheep.

Camp of a yak herder and cordyceps collectors

3.1.3. Poaching

Information on the direct poaching of Snow Leopards and their prey species, Blue Sheep, is notably limited. However, the absence of information doesn't necessarily indicate an absence of poaching. Reported cases include the poaching of Musk Deer and the trapping and killing of various bird species, as documented by SMART Patrolling Teams. Challenges to conservation arise from the porous border and inadequate network connectivity. The patrolling and monitoring teams can only observe camps and gather evidence of poaching activities. The proximity to international borders provides poachers with an opportunity to transport snow leopard parts with a relatively low risk of detection. To ensure the maintenance of a viable snow leopard population, there is a crucial need to enhance patrolling and SMART monitoring in the range areas. This involves the provision of adequate intelligence networks, equipment, and facilities to bolster the effectiveness of patrolling efforts.

3.1.4. Retaliatory killing

Retaliatory killing emerges as a direct threat to Snow Leopards, even though the number of reported cases is currently limited. The growing snow leopard population raises concerns

about potential predation on livestock, particularly yaks and other animals in highland areas. Additionally, the frequent movement of local communities, visitors, and pilgrims to snow leopard habitats for activities such as collecting Non-Wood Forest Products (NWFPs), trekking, and pilgrimage can disturb the snow leopards.

While there haven't been reported cases of retaliatory killings so far, the risk increases if snow leopards' prey on livestock, akin to instances involving tigers in Trongsa in recent years. Only one case has been reported from Jigme Dorji National Park (JDNP) in the past few years. Snow leopards tend to attack humans and livestock near settlements when their natural prey is depleted due to factors like hunting, overgrazing, and disease outbreaks. This underscores the need for proactive measures to mitigate potential conflicts and foster coexistence between snow leopards and local communities.

3.1.5. Livestock depredation

Yak rearing serves as the primary livelihood for the inhabitants of Bhutan's alpine regions. Although occasional reports of depredation on yaks, especially juveniles and calves, exist, there appears to be significant tolerance, with limited evidence of retaliatory killing. Records indicate merely three instances of retaliatory killing of snow leopards, likely due to the absence of a compensation scheme. Discussions about continuing the livestock compensation scheme are underway, exploring avenues for sustainable funding, which could potentially halt retaliatory killings. Moreover, the introduction of alternative income sources tied to snow leopard conservation efforts could further deter such killings.

3.1.6. Wild prey depletion

Blue sheep killings are infrequent, with reports attributing such incidents to local residents, lowland visitors, and collectors of medicinal plants. There have been occasional allegations that border security forces resorted to killing blue sheep during times of ration shortages. Accidental killings of wild prey, such as getting trapped in traps set for other animals (e.g., Musk deer traps), have also been documented. Retaliatory killings by herders, perceived as competitors with livestock for grazing areas, do not appear to pose a significant threat.

Domesticated dogs accompanying Non-Wood Forest Products (NWFP) collectors to snow leopard habitats have been observed being left unattended. These dogs, in turn, compete for the snow leopard's prey, contributing to a decline in prey populations. Herder-owned dogs are also considered a threat to wild prey depletion as they are occasionally involved in killing wild animals while guarding domestic animals.

However, habitat degradation leading to the loss of nutritious food crucial for ungulates to survive winters can also depress wild prey populations. The influx of medicinal plant collectors and herding communities displaces blue sheep to smaller and marginal alpine habitats, where density-dependent population controls restrict population growth.

Blue sheep, an important prey for the snow leopard

3.1.7. Disease

Disease transmission from domestic livestock and feral dogs to wild ungulates and snow leopards constitutes a significant yet often overlooked threat. Livestock in certain areas have reported cases of Foot and Mouth Disease and Lumpy Skin Disease, which can potentially be transmitted to wild ungulates like blue sheep, takin *Budorcas taxicolor whitei*, and musk deer *Moschus chyrsogaster*. Additionally, livestock officials highlight the potential spread of 'black quarter' disease, caused by the bacterium *Clostridium chauvoei*, from yaks and horses to wild ungulates. Despite livestock vaccination efforts, controlling these diseases becomes more challenging if they extend to wild ungulates.

In alpine areas, packs of feral dogs pose another risk by potentially spreading diseases like canine distemper and rabies to snow leopards. Furthermore, both external and internal parasites pose a continuous threat to the health of these wild animals.

3.1.8. Climate change

Climate change projections signal a northward forest shift due to global warming, posing a worldwide threat to ecosystems and communities (IPCC 2014; Parmesan 2006; IPCC 2007; Rupa et al. 2006). Mountain ecosystems, notably in the Himalayas, face vulnerability, anticipating shifts in vegetation, species loss, and altered ecosystem services (Beaumont et al. 2011; Shrestha et al. 2012). Snow leopards, along with their prey and habitats, are also susceptible to climate-induced changes (Forrest et al. 2012; Li et al. 2016).

Climate models predict a northward treeline shift in Bhutan, encroaching on alpine scrub and meadows (Figure 4; Lhendup et al. 2012). As temperatures become milder, there's a likelihood of converting alpine areas to horticulture and agriculture before forests establish, mirroring changes observed in Nepal's Trans Himalayan region (Forrest et al. 2012). Overall, this could restrict snow leopards to a narrower, fragmented space between a hypoxic zone and unsuitable habitat (Xu et al. 2009).

Janecka et al (2015) have shown that snow leopards do not possess genetically determined physiological adaptation mechanisms for high-altitude, hypoxic conditions. Thus, it is unlikely that snow leopards in the high elevations of the Himalaya could adapt fast enough to live in hypoxic elevations since the impacts of climate change will occur relatively more rapidly than physiological evolution. As the extent of alpine habitats shrinks, there will be fewer grazing areas for domestic livestock, potentially increasing competition with wild ungulates. If the ungulate prey population declines, the snow leopards will have less wild prey and begin to prey on domestic livestock, thus increasing conflict with local people.

3.1.9. Localised grazing pressure

Growing livestock densities can lead to diet overlap and forage competition with wild herbivores, potentially causing overgrazing and local extinction in wild herbivore populations (Mishra et al., 2019). Disputes surround the levels of livestock grazing, with yak populations in Bhutan reportedly increasing according to annual livestock statistics from the Department of Livestock (DoL), along with a rising demand for grazing areas. This trend raises concerns about the degradation of ecologically sensitive alpine meadows, impacting ecosystem health, sustainability of practices, and cultural livelihoods, potentially leading to increased competition for fodder between blue sheep and livestock.

A case study conducted in Lingzhi Park Range in 2016 suggested dietary overlap between blue sheep and domestic ungulates, indicating potential competition (personal communication, Leki, Park Range Officer for Lingzhi Range). Similar overlaps have been noted in other alpine Himalayan areas under high stocking rates (Shrestha and Wegge, 2008). Conversely, studies suggest a decline in Yak-based pastoralism in Bhutan, with a 31% decrease in yak-herding households over the past decade (Wangchuk, 2017). This shift is attributed to changing lifestyles and perceptions of transhumant pastoralism as 'backward' (Namgay et al., 2014). Recommendations for government policies to support and sustain transhumant pastoral lifestyles in alpine areas have emerged (Wangdi, 2016). These conflicting views require urgent attention, as both overgrazing and undergrazing of alpine meadows pose threats to the essential habitat for snow leopard conservation.

Alpine meadows are crucial for the primary prey species, blue sheep, of snow leopards. Overgrazing by livestock may lead to a loss of fodder for blue sheep, potentially resulting in declining blue sheep populations and increased livestock depredation by snow leopards. Conversely, undergrazing due to declining livestock numbers could lead to alpine meadows being encroached by trees and shrubs. The decrease in livestock populations might allow blue sheep populations to increase, maintaining alpine grasslands and benefiting snow leopards through

enhanced prey availability. Research is crucial to understand the ecological dynamics of grazing by livestock, wild ungulates, and the regeneration capacities of alpine meadows.

Herders also contribute to environmental challenges by removing alpine shrubs for firewood, causing soil erosion and landslides. Monitoring and regulating such activities are challenging due to the considerable distance of park offices from park boundaries in large protected areas.

3.1.10. Waste problem

The waste problem within the snow leopard habitat, produced by yak herders, tourists, cordyceps collectors, and armed forces personnel, is an urgent issue demanding immediate attention. This issue entails the improper disposal of waste and pollution, which not only harms the delicate mountain ecosystem essential for the snow leopard's survival but also poses a significant threat. To address this pressing concern, it is imperative to focus on education, regulation, community engagement, and ongoing research to safeguard the future of this iconic species and its habitat.

3.1.11. Feral dogs

The alpine regions are witnessing a concerning rise in the population of feral dogs, primarily introduced by local trekkers, pilgrims, tour guides, traders, yak herders, and even armed forces personnel. These dogs are not only posing a threat to yaks but also raising alarms about their potential to prey on vulnerable species like blue sheep and even snow leopard cubs. Furthermore, there is a legitimate concern about disease transmission from these dogs to snow leopards and other wildlife in the area. This situation underscores the need for urgent measures to manage the growing feral dog population and protect the delicate alpine ecosystem, including the iconic snow leopards.

3.1.12. Interspecific competition

Interspecific competition, the ecological struggle between snow leopards and other species competing for shared resources, significantly impacts snow leopard behaviour and survival. These elusive cats compete with predators like wolves, bears, and sometimes tigers for the same prey, potentially leading to food scarcity, territorial conflicts, and displacement. Snow leopards adapt through solitary behaviour, nocturnal hunting, and altitudinal segregation. Managing these competition dynamics and preserving their habitat is vital for snow leopard conservation efforts.

3.2. Challenges

The principal challenges and contributing factors to snow leopard and prey conservation were also exhaustively discussed during the consultative meetings, especially with field staff from the snow leopard areas.

3.2.1. Proximity to the international border

One of the biggest challenges to snow leopard conservation is the proximity to international borders with China and India. The market demand for snow leopard and other wildlife parts and products in the illegal market across the border is high, and monitoring, patrolling, and protection

along the long, porous border is arduous, especially with the small protected areas cadre. Thus, monitoring has to be strategic based on intelligence from local communities and engaging them as guardians.

3.2.2. Limited knowledge among local people

There is little awareness among the local communities about the conservation significance of snow leopards and prey, and their roles in maintaining ecosystem structure and functions. There are also several local people who view protected areas and conservation policies as being restrictive and pose threats to their livelihood, instead of seeing them as national and even global assets of which they could become guardians. Thus, considerable awareness is required to apprise them of the benefits and importance of conserving mountain biodiversity and take pride in their contributions as guardians of Bhutan's natural assets.

3.2.3. Lack of adequate funds

Bhutan is still a donor-dependent country, and most capital expenditures require external fund support. As such, the government cannot set aside a sustainable budget towards conservation activities. Very recently, the government had to stop the livestock compensation scheme, which provided monetary compensation to livestock owners whose livestock have been depredated by wildlife, including snow leopards. Limited funding also restricts transportation and communication facilities, and general equipment required for effective patrolling and monitoring. Most field offices require permanent structures in strategic locations to enable effective patrolling and anti-poaching operations. Frontline staff cannot be provided with sufficient travel allowances and training opportunities on patrolling and wildlife surveys, monitoring, and management.

3.2.4. Dependency on natural resources

The local people living in snow leopard areas are heavily dependent on natural resources for their livelihoods which range from grazing pastures to collection of firewood, and medicinal and aromatic plants. This heavy dependence puts a lot of pressure on the natural resources, making management a daunting task due to frequent conflicts arising between the local people and the field staff.

3.2.5. Information and knowledge gaps

Several information gaps have to be addressed for better conservation of snow leopards and prey, and to manage the habitat at landscape scales with ecological and demographic connectivity.

A. Snow leopard ecology, habitat, and ranging behaviour

All information related to habitat use by snow leopards is based on sign surveys and camera trap data. These data are inherently biased since they are collected from areas that are accessible to researchers who conduct the surveys, while snow leopards likely use another rugged, steeper, and higher terrain. Thus, an unbiased habitat assessment will require additional satellite GPS collaring of snow leopards. These data, when overlaid on satellite images classified for land cover, will provide a better understanding of habitat use and preferences of snow leopards, including

movement pathways. This information is essential to define and protect movement corridors for metapopulation management of snow leopards and to identify core habitats.

B. Population status of the blue sheep

There is limited information on the population estimates and densities of blue sheep in Bhutan. Consequently, there is no way to track their population status and to establish a baseline to manage the desired population.

C. People's attitude towards snow leopards

There is limited baseline information to gauge and monitor local people's perceptions and tolerance levels towards snow leopards. Several livestock insurance schemes have been established in the upland communities, but their efficacy towards snow leopard conservation is yet to be assessed.

3.3. Conservation opportunities

- Community Engagement and Education: Engage local communities residing in snow leopard habitats through awareness programs, educational initiatives, and capacity-building workshops. Fostering a sense of stewardship among communities enhances their understanding of the species and promotes collaborative conservation efforts.

- Livestock Insurance Programs: Implement and enhance livestock insurance schemes to compensate herders for any losses incurred due to snow leopard predation. This not only addresses conflicts between snow leopards and local communities but also provides economic incentives for supporting conservation efforts.

- Alternative Livelihoods: Introduce alternative income-generating activities that reduce dependency on natural resources within snow leopard habitats. This could include promoting sustainable tourism, handicrafts, or other enterprises, providing local communities with alternative revenue streams that alleviate pressure on the environment.

- Effective Waste Management: Implement and enforce proper waste management practices in alpine areas frequented by snow leopards. This helps mitigate the adverse effects of pollution and habitat degradation caused by indiscriminate waste disposal, contributing to a healthier environment for both wildlife and local communities.

- Conservation Partnerships: Strengthen collaborations with national and international conservation organizations, governmental agencies, and non-profits. Partnerships can facilitate the sharing of resources, expertise, and funding, enhancing the overall capacity for snow leopard conservation in Bhutan.

- Scientific Research and Monitoring: Invest in scientific research to enhance understanding of snow leopard behaviour, habitat preferences, and population dynamics. Implement advanced monitoring techniques, such as camera traps, satellite collaring, and DNA analysis, to gather crucial data for informed conservation strategies.

- Climate Resilience Planning: Develop and implement climate-resilient conservation plans to address the impact of climate change on snow leopard habitats. This includes assessing and adapting to shifts in vegetation, potential habitat loss, and changes in prey distribution due to climate variability.

- Community-Based Conservation Initiatives: Empower local communities as active participants in conservation through community-based initiatives. This could involve the creation of community-based conservation reserves, where communities play a role in protecting and managing snow leopard habitats.

- Strategic Anti-Poaching Measures: Enhance anti-poaching efforts with strategic patrolling, intelligence gathering, and the use of modern technologies. This ensures the effective protection of snow leopards from poaching activities, especially in areas with porous borders.

- Legislation and Policy Strengthening: Leverage existing national policies and regulations in Bhutan that provide strong administrative and policy support for the conservation of natural resources. Collaborate with the Royal Government to ensure the effective implementation of laws such as the Forest and Nature Conservation Act of 2023, which accords the highest protection status to the snow leopard.

- Public-Private Partnerships: Foster partnerships with private sector entities, encouraging corporate social responsibility initiatives that contribute to snow leopard conservation. This may include funding, expertise sharing, or direct involvement in conservation projects.

- Institutional Mechanisms: Collaborate with key institutions such as the Department of Forests and Park Services (DoFPS), Nature Conservation Division (NCD), and Ugyen Wangchuk Institute for Forestry Research and Training (UWIFoRT) to ensure coordinated efforts in implementing the snow leopard conservation plan.

- Stakeholders and Conservation Partners: Engage with a diverse range of stakeholders, including government agencies (Department of Tourism, Traditional Medicine Services, Water, Environment and Climate Change, Livestock, Agriculture Marketing and Cooperatives, Culture, Local Governments, Revenues and Customs), institutes (College of Natural Resources, National Institute of Traditional Medicine, Dratshang Lhentshog, Ugyen Wangchuck Institute of Forestry Research and Training), corporations (Natural Resources Development Corporation Limited, Druk Green Power Corporation), NGOs (Royal Society for Protection of Nature, Bhutan Ecological Society, Association of Bhutan Tour Operators, Guides Association of Bhutan, National Commission for Women and Children, Tarayana Foundation), and conservation donors (WWF Bhutan Programme, Bhutan Trust Fund for Environmental Conservation, UNDP, Bhutan Foundation) for comprehensive and collaborative conservation efforts.

- Armed Forces Collaboration: Collaborate with the Royal Bhutan Police and Royal Bhutan Army for information networking, apprehending wildlife criminals, joint patrolling, tackling forest fires, and addressing natural disasters related to climate change.

By capitalizing on these opportunities and leveraging institutional support, Bhutan can create a holistic and sustainable framework for snow leopard conservation, fostering a harmonious coexistence between these iconic big cats, their habitats, and the communities sharing these precious ecosystems.

04 ACTION PLAN

4.1. Vision and Goal

Vision: Snow leopards in Bhutan are thriving and co-existing with well-informed and dedicated local communities as conservation stewards.
Goal: To maintain a viable population of snow leopards in Bhutan with community support accrued through active engagement.

4.2. Objectives and outputs

Objective 1. To manage adequate habitat areas to maintain the snow leopard population in Bhutan
The snow leopard habitat in alpine regions is degrading due to landslides, soil erosion, and shifting tree lines. In many areas, grasslands and alpine meadows are being overrun by undesirable and non-palatable vegetation such as *Berberis spp*., *Rhododendron spp*., *Salix sikkimensis*, juniper spp., and other trees, hindering the foraging of prey species. Additionally, habitat deterioration is exacerbated by improper waste management, free grazing, and non-timber forest product (NWFP) collection. To ensure effective habitat management by 2033, the following actions need to be implemented.

Output 1.1. Snow leopard habitat mapped, monitored and managed

Action 1.1.1. Identify and map the prime habitats of snow leopards
Action 1.1.2. Survey and monitor salt lick areas
Action 1.1.3. Control trees/shrub invaders towards alpine meadows
Action 1.1.4. Carry out prescribed burning in pasture land for management of alpine meadows
Action 1.1.5. Train on scientific management and improvement of alpine meadows
Action 1.1.6. River bank protection using climate-smart structures

Output 1.2. Effective waste management practices in the alpine areas enhanced

Action 1.2.1. Conduct regular awareness of waste management
Action 1.2.2. Strengthen and reinforce GIGO (Garbage In, Garbage Out)
Action 1.2.3. Install signage and information boards at strategic locations
Action 1.2.4. Organize waste management campaigns in collaboration with communities and local tour operators along the trails and camping sites

Objective 2. To monitor and protect snow leopard populations to ensure thriving snow leopard
Monitoring and protection are critical measures to ensure a thriving snow leopard population in the country. The actions outlined below aim to safeguard this iconic species. The provision of enhanced knowledge, skills, and equipment is intended to motivate rangers for SMART patrolling. Another strategy involves intelligence networking to help rangers identify poacher

behaviour, including killing and trafficking. Transboundary conservation and community engagement through awareness programs, and moral incentives, are key recommended actions to protect these iconic species. Implementing disease control measures is also identified as a crucial action to prevent the spread of diseases to snow leopards and their prey. Activities under this strategy include feral dog vaccination and enhanced skills in wildlife forensics.

Output 2.1. Patrolling and intelligence enhanced and stakeholder coordination improved to strengthen the protection of snow leopards

Action 2.1.1. Provide training on the use and application of updated SMART modules and versions

Action 2.1.2. Equip all the field offices with additional patrolling and intelligence gadgets and equipment

Action 2.1.3. Identify and map patrolling routes and surveillance sites in each snow leopard conservation area

Action 2.1.4. Train field staff and relevant stakeholders (e.g., RBP/RBA/Custom) on wildlife forensics

Action 2.1.5. Strengthen zero poaching task force at the national level

Action 2.1.6. Integrate a hotline reporting system at the national level to reduce poaching activities

Action 2.1.7. Strengthen collaboration with Royal Bhutan Police, Royal Bhutan Army, Customs, and Bhutan Food and Drug Authority, inter alia to deal with poachers

Output 2.2. The Spread of diseases between wildlife and domestic animals is monitored, and the feral dog population is controlled to ensure the health and safety of snow leopards

Action 2.2.1. Train staff on sample collection and basic wildlife diseases

Action 2.2.2. Strengthen feral dog population control measures

Action 2.2.3. Strengthen and initiate transboundary conservation

Objective 3. To reduce conflict with herders through proactive measures and alternative income streams that promote tolerance among highland communities

Raising awareness among local communities about the ecological and cultural significance of snow leopard conservation in alpine meadows is key to mitigating snow leopard-human conflicts in these areas. This effort is crucial for garnering local support to implement conservation programs focused on protecting habitats and wild prey, ultimately reducing conflict. Human-wildlife conflict (HWC), particularly the prevalent issue of snow leopards preying on livestock in Bhutan, results in economic costs and frustration among local communities. The absence of a compensation scheme increases the risk of retaliatory killings, posing a serious threat to snow leopard survival and future extinction. Establishing a compensation mechanism for livestock losses is vital to reducing conflict and fostering successful coexistence.

Introducing alternative livelihood options, such as snow leopard ecotourism in their habitat range, not only elevates the living standards of local communities but also positions snow leopards as sources of income opportunities. This perspective positively influences snow leopard conservation efforts. While local communities possess the potential to produce sufficient

livestock products, the lack of advanced technologies hinders their market reach. Providing technology, packaging training, and exploring markets for their products not only improves livelihoods but also garners support for snow leopard conservation.

Output 3.1. Knowledge and awareness of snow conservation increased in the communities

Action 3.1.1. Conduct awareness and education programs for the highland communities on the conservation significance of snow leopard

Action 3.1.2. Publish posters, audio-visual, air radio and TV programs on the conservation of snow leopard

Action 3.1.3. Promote traditional belief on snow leopard among highlanders

Action 3.1.4. Organize exposure visits for local leaders and highlanders to learn about snow leopard conservation efforts both within and outside Bhutan

Action 3.1.5. Community engagement in the conservation of Snow leopards through education and awareness programs

Output 3.2. HWC mitigation measures strengthened

Action 3.2.1. Support coral fencing/solar fencing materials to herder

Action 3.2.2. Train beneficiaries on installation, repair and maintenance of solar lighting/fencing

Action 3.2.3. Supply of solar lighting

Action 3.2.4. Supply of fodder grass seed in collaboration with the Department of Livestock

Action 3.2.5. Establish a community-based livestock insurance scheme to compensate livestock kills

Action 3.2.6. Improve the livestock migratory routes

Output 3.3. Snow leopard-based ecotourism promoted and alternative income streams diversified

Action 3.3.1. Coordinate with the Tourism Council of Bhutan and monastic bodies to maintain culturally significant areas and monuments in the snow leopard conservation areas

Action 3.3.2. Explore wildlife tourism in Snow leopard habitats

Action 3.3.3. Strengthen existing ecotourism products in the snow leopard landscapes

Action 3.3.4. Strengthen and form a new NWFP Management Group

Action 3.3.5. Build capacity on NWFP Product value addition

Action 3.3.6. Coordinate with the Department of Livestock to develop a strategy that will facilitate marketing their livestock products

Action 3.3.7. Encourage and support practice using dried yak dung for heating and cooking

Objective 4. To generate knowledge on the ecology and behaviour of snow leopards and prey, including in response to community activities and climate change

Acquiring knowledge about the ecology and behaviour of snow leopards and their prey is essential for effective snow leopard conservation. The information can be pivotal in identifying

critical habitats, managing human-wildlife conflicts, and adapting to climate-induced changes within the snow leopard habitat. Additionally, knowledge generated through research promotes community engagement, informs policy development, and safeguards the broader biodiversity of snow leopard habitats.

Output 4.1. Knowledge and information on snow leopard population and habitat increased

Action 4.1.1. The population of snow leopard and its prey are monitored using structured grid-based camera trap surveys

Activity 4.1.2. Study on habitat preferences, habitat alterations, invasive species dynamics and their implication for snow leopards and their prey

Action 4.1.3. Research on the population demography, connectivity through non-invasive genetics

Action 4.1.4. Use satellite GPS collars to determine habitat use, movement patterns and pathways of snow leopards

Action 4.1.5. Study the ecological relationships of blue sheep, livestock, and impacts on alpine meadow

Action 4.1.6. Assess the availability and spatial distribution of Snow leopard prey species

Output 4.2. Human-snow leopard interaction knowledge enhanced

Action 4.2.1. Human settlement impact assessment on Snow leopard populations, prey occupancy and, habitat conditions

Action 4.2.2. Assess local views on Snow leopard conservation and retaliatory killing trends

Action 4.2.3. Assess the occurrence and frequency of human-snow leopard conflict

Action 4.2.4. Study on interspecific competition (Tiger, Snow Leopard and Tibetan wolf) over prey and habitat use

Action 4.2.5. Spatial-temporal trends of poaching and hotspot mapping through SMART data

Action 4.2.6. Analysis of behavioural response of snow leopard in the context of climate change

Output 4.3. Snow leopard database strengthened and institutional capacity and collaborations enhanced

Action 4.3.1. Maintain the snow leopard data at the respective field office and central level

Action 4.3.2. Enhance knowledge of frontline staff through exchange programs or exploration tours to ex-country Snow leopard nations

Action 4.3.3. Organize/Take part in national and international workshops to discuss and share lessons to mitigate the impact of climate change on snow leopards

05 IMPLEMENTATION AND MONITORING PLAN

5.1. Manpower requirements

To effectively implement this snow leopard action plan, a dedicated and well-trained team is essential. The Ministry of Energy and Natural Resources (MoENR) and the Department of Forests and Park Services (DoFPS) should recruit and deploy trained personnel to field offices within snow leopard conservation areas. Each field office should maintain a minimum staff of 10 at the range level to carry out regular field patrolling, surveys, monitoring, and other necessary activities.

The staff members are required to closely collaborate with other line agencies and local governments to integrate snow leopard conservation requirements into community development and awareness programs. The Chief Forestry Officers of the snow leopard range parks and territorial divisions should appoint a focal person at both the range and division levels to coordinate these activities. These appointed individuals will be responsible for submitting timely reports to the National Conservation Division (NCD), which, in turn, will report to the department.

5.2. Equipment

Conducting snow leopard surveys necessitates a substantial number of camera traps, along with related survey equipment, satellite GPS collars, and adequate implementation budgets. Securing funds for these requirements will involve reaching out to donor organizations, including the Bhutan for Life Project, Bhutan Trust Fund for Environmental Conservation (BTFEC), Bhutan Foundation, and WWF Bhutan. To minimize overall costs, an inventory of existing camera traps and survey equipment at the National Conservation Division (NCD) and field offices will be conducted. Additionally, any defective camera traps will be repaired if possible.

5.3. Implementation mechanism

As all snow leopard habitats are situated in protected areas and the Divisional Forest Offices of Paro and Thimphu, the field offices (JSKNR, DFO Paro and Thimphu, JDNP, WCNP, BWS, JSWNP, and SWS) will execute field-based activities. Simultaneously, the National Conservation Division (NCD) will oversee centralized and coordinated activities, including coordinating surveys, and major procurements, organizing workshops and seminars, liaising with the Global Snow Leopard and Ecosystem Protection Program (GSLEP), and serving as the focal point for transboundary coordination. UWIFORT will be responsible for organizing staff and farmer training, as well as implementing all research activities. The Forest Management and Infrastructure Division (FMID) of the department will monitor the implementation of the action plan, ensuring that actions align with the department's priorities.

5.4. Monitoring and evaluation

The Forest Management and Infrastructure Division and the National Conservation Division will oversee the monitoring of plan implementation. Progress will be assessed through periodic reports submitted by focal persons from the field offices, which will be presented during departmental meetings. The logical framework (Table 2) will serve as the basis for monitoring and evaluation, utilizing provided indicators and specified monitoring frequencies.

Table 2: Logical framework and implementation plan

Objectives and output	Output Indicator	Means of verification	Implementing Agency	Budget (in millions)	Timeline (Year1-10)									
					1	2	3	4	5	6	7	8	9	10
Objective 1. To manage adequate habitat areas to maintain the snow leopard population in Bhutan														
Output 1.1. Snow leopard habitat mapped, monitored and managed														
Action 1.1.1. Identify and map the prime habitats of snow leopard	Habitat identified and mapped	Technical report and map	DoFPS	2.0	1									1
Action 1.1.2. Survey and monitor salt lick areas	Surveyed and yearly monitored	Smart report and map	DoFPS	4.0		2					2			
Action 1.1.3. Control trees/shrub invaders towards alpine meadows	Area managed and controlled (50 ha/year)	Technical report /Physical	DoFPS	2.2	1					1				0.2
Action 1.1.4. Carry out prescribed burning in pasture land for management alpine meadows	Area burnt and managed	Technical report/physical	DoFPS	3.5		1			1			1		0.5
Action 1.1.5. Train on scientific management and improvement of	Staff trained	Training Report	DoFPS	1.5	1					0.5				

alpine meadows														
Action 1.1.6. River bank protection using climate smart structures	Number of reiver bank protection constructed	Report/physical	DoFPS/LG	22.0			15				5		2	
Output 1.2. Effective waste management practices in the alpine areas enhanced														
Action 1.2.1. Conduct regular awareness on waste management	Number of awareness organized	Report	DoFPS	2.1	0.6		0.5			0.5			0.5	
Action 1.2.2. Strengthen and reinforce GIGO (Garbage In, Garbage Out)	Quantity of waste collected	Report	DoFPS/LG	2.0	1			0.5			0.5			
Action 1.2.3. Install signage and information boards at strategic locations	Number of signages installed	Report/Physical	DoFPS/LG	1.0	0.5				0.2			0.2		0.1
Action 1.2.4. Organize waste management campaign in collaboration with communities and local tour operator along the trails and camping sites	Organized and conducted campaign	Report	DoFPS/DoT/LG	1.0		0.4			0.3			0.3		0.3

Objective 2. To monitor and protect snow leopard populations to ensure thriving snow leopard population in Bhutan														
Output 2.1. Patrolling and intelligence enhanced and stakeholder coordination improved to strengthen protection of snow leopards														
Action 2.1.1. Provide training on use and application of updated SMART modules and versions	Training provided	Training report	DoFPS & respective Field Office	1.5			1						0.5	
Action 2.1.2. Equip all the field offices with additional patrolling and intelligence gadgets and equipment	Field gears and equipment provided	Stock register record	DoFPS	2.0		1				0.5				0.5
Action 2.1.3. Identify and map patrolling routes and surveillance sites in each snow leopard conservation area	1Surveillance site by each SL area	Report & map	DoFPS & respective Field Office	1.5	1				0.5					
Action 2.1.4. Train field staff and relevant stakeholders (e.g., RBP/RBA/Custom) on wildlife forensics	Training provided	Report	DoFPS	2.5	1.5						1			
Action 2.1.5. Strengthen zero poaching task force at the national level	Task force formed	Report	DoFPS	1.0				0.5						0.5

Action 2.1.6. Integrate hotline reporting system at national level to reduce poaching activities	Hotline set-up	Under use	DoFPS	0.7		0.5				0.1				0.1
Action 2.1.7. Strengthen collaboration with Royal Bhutan Police, Royal Bhutan Army, Customs, and BFDA, inter alia to deal with poachers	Support strengthened	Report	DoFPS	1.5		0.5			0.5			0.5		
Output 2.2. Spread of diseases between wildlife and domestic animals monitored, and feral dog population controlled to ensure health and safety of snow leopard														
Action 2.2.1. Train staffs on sample collection and basic wildlife diseases	Training conducted	Training report	DoFPS	5.5	2			2			1.5			
Action 2.2.2. Strengthen feral dog population control measures	Type & number of control measures implemented	Report	DoFPS, DoL & Field Offices	3.0	1			1			1			
Action 2.2.3. Strengthen and initiate trans-boundary conservation	Number of trans-boundary discussion	Minutes	DoFPS & RBA & Field offices	1.5			1.5						1	

Objective 3. To reduce conflict with herders through proactive measures and alternative income streams that promote tolerance by highland communities														
Output 3.1. Knowledge and awareness of snow conservation increased for the communities														
Action 3.1.1. Conduct awareness and education program for the highland communities on the conservation significance of snow leopard	No. of awareness program conducted	Report	NCD/Respective field offices	1.5						1			0.5	
Action 3.1.2. Publish posters, audio-visual, air radio and TV programs on the conservation of snow leopard	No. of poster printed, Name of recording audio-visual studio	Printed poster,	NCD/Respective field offices	2.1			2.1							
Action 3.1.3. Promote traditional belief on snow leopard among highlanders	No. of event	Report & positive attitudes enhancement	NCD/Respective field offices	0.7		0.7								
Action 3.1.4. Organize exposure visits for local leaders and highlanders to learn about snow leopard conservation efforts both within and outside	No. of exposure visits organised	Exposure visits reports	NCD/Respective field offices	16.0			4		4		4			4

Bhutan														
Action 3.1.5. Community engagement in conservation of Snow leopard through education and awareness programs	Number of awareness program conducted	Report	DoFPS	2.0		1			0.5				0.5	
Output 3.2. HWC mitigation measures strengthened.														
Action 3.2.1. Support coral fencing/solar fencing materials to herder	Number of alternative materials supplied	Number of beneficiaries	NCD & Field offices	12.0	4			4					4	
Action 3.2.2. Train beneficiaries on installation, repair and maintenance of solar lighting/fencing	Frequency of training provided	Number of beneficiaries	Field office	1.0	0.6			0.2					0.2	
Action 3.2.3. Supply of solar lightings	Quantity procured and supplied	Report	DoFPS/TCB	5.0				2	2	1				
Action 3.2.4. Supply of fodder grass seed in collaboration with Department of	Quantity of fodder supplied	Report	DoFPS	0.5			0.3				0.2			

Livestock														
Action 3.2.5. Establish community-based livestock insurance scheme to compensate livestock kills	Operational plan	No. of household involved, Compensation payment receipts	NCD/Respective field offices	7.0	6								1	
Action 3.2.6. Improve the livestock migratory routes	Number of trails improved	Report/physical	DoFPS	18.0		6			6			6		
Output 3.3. Snow leopard-based ecotourism promoted and alternative income streams diversified														
Action 3.3.1. Coordinate with tourism department and monastic bodies to maintain culturally significant areas and monuments in the snow leopard conservation areas	No. of sites identified	Report & change in perception	NCD/Respective field offices	2.8				2				0.8		
Action 3.3.2. Explore wildlife tourism in Snow leopard habitats	No. of sites explored													

Action 3.3.3. Strengthen existing ecotourism products in the snow leopard landscapes	No. of products strengthened													
Action 3.3.4. Strengthen and form new NWFP Management group	Number of groups benefited	Management plan	DoFPS	2.0			1			0.5				0.5
Action 3.3.5. Build capacity on NWFP Product value addition	Group trained	Training Report	DoFPS	3.0	2			0.5						0.5
Action 3.3.6. Coordinate with Department of Livestock to develop a strategy that will facilitate to market their livestock products	No. of beneficiaries involved	Strategy plan	NCD/Respective field offices	7.0	5	2								
Action 3.3.7. Encourage and support practice using dried yak dung for heating and cooking	Number of communities benefited	Report	DoFPS	3.0					2			1		
Objective 4. To generate knowledge on ecology and behaviour of SL and prey, including in response to community activities and climate change														
Output 4.1. Knowledge and information on snow leopard population and habitat increased														

Action 4.1.1. The population of snow leopard and its prey monitored using structured, grid-based camera trap surveys	Grid identified and camera traps deployed	Report	DoFPS	35.0					17.5					17.5
Activity 4.1.2. Study on habitat preferences, habitat alterations, invasive species dynamics and their implication for snow leopard and its prey	Survey conducted	Report	DoFPS/ all respective field office	5.5			1.5				4			
Action 4.1.3. Research on the population demography, connectivity through non-invasive genetics	Survey conducted/samples collected	Report	UWIFoRT/ respective field office	30.0	30									
Action 4.1.4. Use satellite GPS collars to determine habitat use, movement patterns and pathways of snow leopards	Research conducted	Report &data	NCD/ respective field office	10.0				10						
Action 4.1.5. Study the ecological relationships of blue sheep, livestock, and impacts	Study conducted	Report	DoFPS/ Respective field office	3.0					3					

on alpine meadow															
Action 4.2.6. Assess the availability and spatial distribution of Snow leopard prey species	Survey conducted	Report	DoFPS/JDNP, WCNP, JKSNR	4.0	2					2				
Output 4.2. Human-snow leopard interaction knowledge enhanced.															
Action 4.2.1. Human settlement impact assessment on Snow leopard populations, prey occupancy and, habitat conditions	Survey conducted	Report	NCD, UWIFoRT & respective field Office	14.0							14			
Action 4.2.2. Assess local views on Snow leopard conservation and retaliatory killing trends	Social survey conducted	Report	DoFPS/field office	3.7				1.85				1.85		
Action 4.2.3. Assess occurrence and frequency of huma-snow leopard conflict	Social survey conducted	Report	DoFPS/respective field office	3.7				1.85				1.85		
Action 4.2.4. Study on interspecific competition (Tiger, Snow Leopard and	Camera trap survey conducted	Report	DoFPS/respective field office	14.0	7					7				

Tibetan wolf) over prey and habitat use														
Action 4.2.5. Spatial-temporal trends of poaching and hotspot mapping through SMART data	SMART Patrol conducted	Report and map	DoFPS/ all respective field office	12.0	3		3			3			3	
Action 4.2.6. Analysis of behavioural response of Snow leopard in the context of climate change	Analysed data	Report	NCD	1.0		0.5								0.5
Output 4.3. Snow leopard database strengthened and institutional capacity and collaborations enhanced														
Action 4.3.1. Maintain the snow leopard data at the respective field office and central level	Identified data focal	Data bank	DoFPS/ all respective field office	1.5	1.5									
Action 4.3.2. Enhance knowledge of frontline staffs through exchange program or exploration tour to ex-country Snow leopard nations	Exposure visits organized	Report	NCD, Field offices	12.0		3		3		3		3		

Action 4.3.3. Organize/Take part in national and international workshops to discuss and share lessons to mitigate the impact of climate change on snow leopards	Workshops/ Conference conducted	Reports	DoFPS	5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Total Budget Estimate				**Nu. 300.0 million**										

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