Snow Leopard and Ecosystem Management Plan

(2017-2026)

Eastern Himalaya Landscape, Nepal

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Government of Nepal
Ministry of Forests and Soil Conservation
2017

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Foreword

Snow leopard is a flagship species of the mountain ecosystem of Nepal. The habitat of the species ranges from Kanchenjunga Conservation Area in the east to Api Nampa Conservation Area in the west. Considering the importance of the species to sustain the mountain ecosystem, the Government of Nepal has given especial attention to conserve the species and to manage its habitat.

Despite the best efforts of the Government of Nepal to save the snow leopard from extinction, habitat of the species is facing pressure due to various causes. Poaching for illegal trade of skin and bones are major challenges of snow leopard conservation. Similarly, climate change and natural disasters are other threats to the conservation of this species.

The Government of Nepal is fully committed to implement the National Snow Leopard and Ecosystem Protection Program and Snow Leopard Conservation Action Plan (2017-2021) in order to resolve the aforementioned threats and challenges. However, the government efforts alone may not be enough to address all the aspects of snow leopard conservation. Therefore, I request local communities, national and international conservation partners and donor agencies to support the government in its mission of snow leopard conservation.

I believe that effective implementation of "Snow Leopard and Ecosystem Management Plan for Eastern Himalaya Landscape" will be instrumental in the conservation of snow leopard and its habitat.

August, 2017
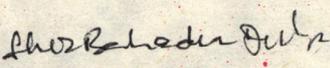
Sher Bahadur Deuba

Government of Nepal

Ministry of Forests and Soil Conservation

Acknowledgements

Nepal is an important country that hosts the elusive snow leopard in the wild. In Nepal, as in other range countries, snow leopard faces multiple threats. Yet, the situation is not all that grim. Strong government commitment, collaboration of conservation partner organizations, participation of local people and use of satellite telemetry in research and monitoring have helped in the conservation of this iconic species.

As per the 2013 Bishkek Declaration, which aims to secure 20 snow leopard landscapes by 2020 under the framework of Global Snow Leopard and Ecosystem Protection Program (GSLEP), Nepal takes pride in preparing one of the first climate integrated landscape level management plans for snow leopard conservation. This plan encompasses 11,516 km^2 of Eastern Himalaya Landscape of Nepal. While following the GSLEP guidelines, this plan also aligns with the Government of Nepal's ongoing programs, Snow Leopard Conservation Action Plan for Nepal (2017-2021) as well as the UN Convention on Biological Diversity.

This management plan would not have been possible without the support of many individuals and organizations. Ministry of Forests and Soil Conservation acknowledges the support received from government officials, local people as well as conservation partners including World Wildlife Fund (WWF) and National Trust for Nature Conservation (NTNC). I would like to appreciate the hard work and commitment of the preparation team formed under the leadership of Dr. Maheshwar Dhakal. The efforts of the technical team and the comments of the reviewers are highly appreciated. I owe especial thanks to the USAID funded Asia High Mountains Project of WWF Nepal for providing financial and technical support to prepare this management plan.

August, 2017

Prakash Mathema

Secretary

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Acronyms and Abbreviations

ACAP	Annapurna Conservation Area Project		LAPA	Local Adaptation Plans for Action
AHM	Asia High Mountains		LLOF	Landslide Lake Outburst Floods
BZ	Buffer Zone		LNP	Langtang National Park
CA	Conservation Area		MBNP	Makalu Barun National Park
CA|TS	Conservation Assured Tiger Standards		METT	Management Effectiveness Tracking Tool
CBAPU	Community Based Anti-Poaching Units		MoCTC	Ministry of Culture, Tourism and Civil Aviation
CBD	Convention on Biological Diversity		MoFALD	Ministry of Federal Affairs and Local Development
CBO	Community Based Organization		MoPE	Ministry of Population and Environment
CBS	Central Bureau of Statistics		MoWR	Ministry of Water Resources
CC	Climate Change		MoFSC	Ministry of Forests and Soil Conservation
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora		MoU	Memorandum of Understanding
			NAPA	National Framework for Local Adaptation Plans for Action
CDM	Clean Development Mechanism			
CMP	Conservation Measures Partnership		NAST	Nepal Academy of Science and Technology
CSO	Civil Society Organization		NBCC	National Biodiversity Coordination Committee
DCC	District Coordination Committee		NBSAP	National Biodiversity Strategy and Action Plan
DFO	District Forests Office		NCC	NSLEP Coordination Committee
DFSCC	District Forestry Sector Coordination Committee		NP	National Park
DNPWC	Department of National Parks and Wildlife Conservation		NSLEP	National Snow Leopard and Ecosystem Protection Program
DoF	Department of Forests		NTFP	Non-Timber Forest Products
DSCO	District Soil Conservation Office		NTNC	National Trust for Nature Conservation
DSCWM	Department of Soil Conservation and Watershed Management		PA	Protected Area
			PES	Payment for Ecosystem Services
EHL/N	Eastern Himalaya Landscape/Nepal		QNP	Quomolangma Nature Preserve
EFGDCC	Environment Friendly Governance District Coordination Committee		REDD+	Reducing Emissions from Deforestation and Forest Degradation
EFLGVCC	Environment Friendly Governance District Coordination Committee		SAWEN	South Asia Wildlife Enforcement Network
			SCAPES	Sustainable Conservation Approaches in Priority Ecosystems
FFI	Flora and Fauna International			
GCA	Gaurishankar Conservation Area		SHL	Sacred Himalaya Landscape
GEF	Global Environment Facility		SLC	Snow Leopard Conservancy
GCF	Global Climate Fund		SLCC	Snow Leopard Conservation Committee
GLOF	Glacial Lake Outburst Floods		SLEMP	Snow Leopard and Ecosystem Management Plan
SMART	Spatial Monitoring and Reporting Tool		SNP	Sagarmatha National Park
GoN	Government of Nepal		TRAFFIC	The Wildlife Trade Monitoring Network
GPS	Global Positioning System		UNDP	United Nations Development Program
GSLEP	Global Snow Leopard and Ecosystem Protection Program		USAID	United States Agency for International Development
ICIMOD	International Centre for Integrated Mountain Development		R/M	Rural/Municipality
			WCCB	Wildlife Crime Control Bureau
INGO	International Non-Governmental Organization		WCN	Wildlife Conservation Nepal
IPCC	Intergovernmental Panel on Climate Change		WCS	Wildlife Conservation Society
IUCN	International Union for Conservation of Nature		WWF	World Wildlife Fund
KCA	Kangchenjunga Conservation Area		ZSL	Zoological Society of London
KL	Kangchenjunga Landscape		LDF	Least Developed Countries Fund

Executive Summary

This management plan has been prepared by the Government of Nepal in response to the Bishkek declaration (2013) to secure 20 snow leopard landscapes by 2020. The management plan process involved extensive consultation and in-depth analyses of the current bio-climatic and socio-economic situation; an assessment of future scenario based on anthropogenic pressures and climatic impacts; and development of climate integrated conservation plan. In doing so, geospatial, hydrological and climatic analyses were undertaken to devise robust strategies that are anchored in the best available science. In addition, biodiversity, climate adaptation and landscape conservation policies, snow leopard conservation action plan, and management plans of the Protected Areas and District Forests Offices were reviewed to align the management strategies and activities with the priorities of the Government of Nepal.

Spreading over 11,516 km^2 area, the Eastern Himalaya Landscape of Nepal (EHL/N) is an exceptional landscape that houses the world's tallest mountain- the Mt. Everest and repositories of globally important biodiversity. It also houses vital water towers that provide ecological services critical for lives and livelihoods of hundreds of millions of people downstream. The snow leopards are the top predators of the EHL system and play a pivotal role in structuring the ecological processes and ensuring a sustained supply of the ecosystem services in the landscape.

Nearly 50% of the EHL/N is comprised by snow leopard habitats (5800 km^2), which is distributed across the four habitat complexes[1],1) Langtang; 2) Gaurishankar; 3) Sagarmatha; and 4) Kangchenjunga. It is imperative to secure a connectivity among these habitat complexes to safeguard a meta-population of snow leopard and thus to ensure the survival of the species. The spatial analyses carried out for this management plan mapped 14 potential habitat corridors that are expected to be instrumental in this regard.

The EHL/N is also one of the most vulnerable areas of Nepal due to the impacts of climate change. The climate risk analyses carried out for this management plan indicated that annual average temperature and precipitation would increase as much as by 2.6°C and 27%, respectively in the EHL/N by 2070 with reference to the current baseline. The warmer and wetter climate will have profound effects on hydrological and biological processes and the livelihoods of people who rely directly on the climate and land. The snow leopard is considered to be one of the hardest hit species

as they are likely to lose substantial portion of habitats in the EHL/N due to the upslope movement of tree line in the alpine regions. In addition, ongoing anthropogenic threats to snow leopards' survival are also likely to exacerbate as the cascading effects of climate change would negatively affect the natural, human and socio-cultural capital of the landscape. Acknowledging this scenario and integrating both climatic and anthropogenic stressors, 11 critical conservation sites were identified in the EHL/N as the hotspots for intensive management.

In addition, the period over which this management plan was developed represents a period of unprecedented change within the governance structure of the country in accordance with the 2015 Constitution of Nepal. These changes will have a dramatic impact on mandates, organizational structure, roles and responsibilities, budgets, resources, and priorities of stakeholder institutions.

Therefore, this management plan was prepared by focusing on adaptive mechanisms to cope with changing economic, social, political and climatic conditions, while maintaining the essence of the vision and goal for the EHL/N.

Vision

"The Eastern Himalaya Landscape of Nepal supports viable populations of snow leopards and the sustained flow of ecosystem services, ensuring the well-being of local people"

Goal

"Metapopulation of the snow leopard consisting of at least 100 breeding age individuals and their ecosystem are conserved, climate resilience is enhanced, and local livelihoods are improved"

Strategies

In order to achieve EHL/N vision and goal, the following eight strategies are developed.

1. Landuse planning and habitat management
2. Mitigating human-snow leopard conflict
3. Improving people's livelihoods
4. Strengthening institutions and engaging local communities
5. Strengthening law enforcement
6. Climate adaptation
7. Enhancing knowledge on snow leopard biology, behavior and ecosystem
8. International cooperation

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1   Habitat complexes include the snow leopard habitats both inside and outside of the Protected Areas

Snow Leopard and Ecosystem Management Plan (2017-2026)
Eastern Himalaya Landscape, Nepal

Outcomes/Outputs

Outcome 1. Important snow leopard habitats are secured using climate-integrated approaches

Outputs

Short term (2017-2021)

▸ 14 habitat corridors and 11 critical sites identified in this plan are field verified
▸ Climate refugia identified and protected
▸ Climate adapted grazing system and pasture management promoted in 30 sites
▸ Feasibility for snow leopard's prey population reintroduction evaluated
▸ The status of the high-altitude wetlands and peatlands assessed and conserved

Long term (2022–2026)

▸ A climate-integrated landscape vision map prepared for each of the four habitat complexes
▸ Prey population reintroduced in prey deficit areas

Outcome 2. Human-wildlife conflict reduced

Outputs

Short term (2017-2021)

▸ Existing livestock insurance schemes and relief mechanism up-scaled and new schemes launched
▸ Local leaders (elected, religious and social) are engaged in snow leopard conservation initiatives

Long term (2022–2026)

▸ Efficient animal husbandry practices developed and implemented
▸ Best practices such as the 'Safe Systems Approach' adopted from the snow leopard range countries

Outcome 3. Economic well-being of local people enhanced through green development

Outputs

Short term (2017-2021)

▸ Livelihood diversification promoted in at least 30 households from each Rural/Municipality of the EHL/N
▸ Climate-smart water management scheme devised and implemented
▸ Community managed eco-tourism promoted along major trekking routes within the EHL/N.

Long term (2022–2026)

▸ 3000 households directly benefitted by NTFP including agro-biodiversity based green enterprises

Outcome 4: Strong institutions and good governance ensured and local communities especially indigenous people and women are empowered

Outputs

Short term (2017-2021)

▸ Relevant institutions at all levels including policy, management, planning and implementation are established and strengthened
▸ Community-based organizations are established in all Rural/Municipalities across the landscape

Long term (2022–2026)

▸ Elected leaders from each Rural/Municipality receive awareness training on snow leopard conservation and benefit sharing from natural resource management
▸ At least 10 people from each Rural/Municipality are trained as Citizen Scientists
▸ At least 30% of NRM institution members comprise women and indigenous people

Outcome 5. Poaching and illegal trade in snow leopard and associated wildlife significantly reduced

Outputs

Short term (2017-2021)

▸ WCCB units and CBOs capacitated and strengthened for effective patrolling and monitoring
▸ 40 relevant law enforcement staff personnel trained each year, to detect, apprehend, prosecute wildlife traders and dismantle trade networks.

Long term (2022–2026)

▸ Wildlife conservation acts and policies of the Government of Nepal reviewed and updated

Outcome 6. Reduced risk and vulnerabilities due to climate change impact to the local livelihoods and snow leopard ecosystem

Outputs

Short term (2017-2021)

▸ Appropriate climate adaptation measures are identified on the basis of the findings of climate vulnerability assessments, water provision and geospatial analyses
▸ Protected Area and District Forests management plans are updated to account for climate change impacts

Long term (2022–2026)

▸ Relevant stakeholders are aware of and/or capacitated to cope with the impacts of climate change on natural and human systems

- Climate change adaptation measures adopted by communities and other relevant stakeholders

Outcome 7. Benchmark database on snow leopards and their ecosystem established and long-term monitoring and knowledge management ensured

Outputs
Short term (2017-2021)
- Snow leopard conservation research station established and strengthened in the KCA
- Databases of population status of snow leopards and their prey established and updated regularly
- All PAs and DFOs are supported in generating/storing a database on snow leopard ecosystems
- A detailed report prepared on livestock depredation, wildlife poaching and illegal trade, and human perceptions towards snow leopard conservation
- Scientific assessments of the important ecological processes, such as the predator-prey relationships, and resource partitioning/competition among co-predators; their wild prey and livestock conducted
- Management effectiveness of PAs appraised using contemporary tools (for example CA|TS, METT)

Long term (2022-2026)
- One comprehensive document on ecology and conservation of snow leopard in the EHL/N produced
- One consolidated report on the impact of climate change on snow leopard and their ecosystem produced

Outcome 8. Transboundary cooperation among neighbouring countries enhanced and collaboration with international partners strengthened

Short term (2017-2021)
- Existing transboundary cooperation mechanism with India and China reviewed and strengthened
- Adequate technical and financial support from international partners are secured for implementation of this management plan

Long term (2022-2026)
- Snow leopard conservation beyond the national boundary institutionalized for joint monitoring of habitats and sharing of best practices

Stakeholder Participation
A stakeholder analysis was undertaken to identify and promote complementary actions in order to fulfil financial, technical, legal, and institutional requirements of the EHL/N management plan. The process involved identification of potential stakeholders, their roles and responsibilities, and analyses of core competencies relevant to the EHL/N vision and goal. A diverse group of stakeholders ranging from government ministries and subsidiary departments/protected area and district level offices; local government bodies; business, industry and financial institutions; community based institutions; national and international non-governmental organizations; and academic institutions were identified. In addition, an indicative framework for collaboration with potential non-governmental partners was also developed.

Governance Mechanism
The governance mechanism for the implementation of this management plan was prepared by drawing upon the recently endorsed landscape management plan for the central Nepal (GoN 2015). Accordingly, the National Biodiversity Coordination Committee under the leadership of the Minister, MoFSC with support from relevant government institutions, academia and the non-governmental organizations will act as an apex body for overall supervision and policy directives. The NSLEP coordination committee (NCC) will be the focal point for stream lining various projects and program activities undertaken by multiple actors. The EHL/N working group is a core task force for the field level coordination and monitoring of the program/activities. The Protected Area Offices and District Forest Offices in close collaboration with respective Rural/Municipalities will implement the management plan in the four habitat complexes across the landscape.

Funding Mechanism
An estimated budget of USD 5.57 million is required to cover the costs of project activities over a period of 10 years. The sources of funding to implement the management plan is anticipated from government sources, locally generated revenue, civil society organizations, and international assistance. Likewise, innovative sustainable financing mechanism such as the Payment for Ecosystem Services (PES), and Reducing Emissions from Deforestation and Forest Degradation (REDD+) were also identified as promising sources to fund the project activities over a long run.

Monitoring and Evaluation
Activity/output and impact/outcome monitoring will be undertaken during and immediately after the implementation of annual workplan to make sure that the progress being made is consistent with the EHL/N goals. The overall performance of the management plan implementation, however will be evaluated in two phases, each lasting for a 5-year period. In each phase, the review will take place after three years and towards the end of the 5-year period. Doing so, will provide ample opportunities for adaptive management throughout the life of the project.

PART A: Situation Analyses

1 Overview

The charismatic snow leopard (*Panthera uncia*) is the flagship species spearheading environmental conservation momentum across one of the most ecologically fragile landscapes on the planet -the high mountains of Asia. As a wide ranging, apex predator, it plays a pivotal role in structuring ecosystem processes and is thus considered an indicator of healthy mountain systems. Yet, its future is uncertain due to ongoing anthropogenic (Li et al. 2014; Suryawanshi et al. 2014), and climatic pressures (Forrest et al. 2012; Li et al. 2016) to their population and habitats. They are found in 12 countries and believed to number not more than 6500 snow leopards globally (GLSEP 2013). It is listed as a vulnerable species by the International Union for Conservation of Nature (IUCN 2017) and included in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The species is also fully protected by the Government of Nepal (GoN) through National Park and Wildlife Conservation (NPWC) Act (1973)/Fifth Amendment (2017).

To address both conventional and emerging threats and also seize the enormous opportunity to address current and future environmental issues in High Asia, the snow leopard range countries pledged to work together through the Global Snow Leopard and Ecosystem Protection Program (GSLEP) in the "Bishkek Declaration" of 2013. The GSLEP is the only focused program for a cohesive action that is coordinated among a suite of stakeholders to secure a future for snow leopards throughout their entire range (GSLEP 2013). By garnering much needed political support as well as providing technical and financial assistance, GSLEP envisages to secure 20 snow leopard landscapes across the big cat's range by 2020.

In Nepal, about 300 to 400 snow leopards are known to be distributed across Nepal Himalayas. To translate the GSLEP's vision into action, the Government of Nepal (GON) has identified three conservation landscapes: Eastern, Central, and Western; and aims to secure 100 breeding age snow leopards in each through the active involvement of local communities in each landscape (DNPWC 2017).

This management plan encompasses 11,516 km^2 Eastern Himalaya Landscape of Nepal (EHL/N), which is Nepal's side of the snow leopard range within the vast transboundary Sacred Himalaya Landscape (39,021 km^2; Figure 1; GoN 2006). It extends from the Bhotekoshi and Trishuli river of the Langtang National Park (LNP) in central Nepal through Gaurishankar Conservation Area (GCA), Sagarmatha National Park (SNP), Makalu Barun National Park (MBNP) to the Kangchenjunga Conservation Area (KCA) in eastern Nepal (Figure 2). The northern boundary of the EHL/N is contiguous with the 35,000 km^2 Quomolangma Nature Preserve of China, which provides an overarching link to all core snow leopard habitat patches within the landscape. As the EHL/N is a part of a larger, contiguous transboundary landscape, it connects to the snow leopard habitats of Sikkim and Bhutan in the east through the Kangchenjunga Landscape (25,086 km^2; ICIMOD et al. 2017). From a regional perspective, the snow leopard habitats in EHL/N are thus an important bridge between the western and eastern snow leopard populations of the Himalaya range. Therefore, it is of vital importance to acknowledge the transboundary character of EHL/N to achieve the GSLEP's vision.

Figure 1 Location of the Eastern Himalaya Landscape, Nepal (EHL/N). Also shown is the Sacred Himalaya Landscape of Nepal
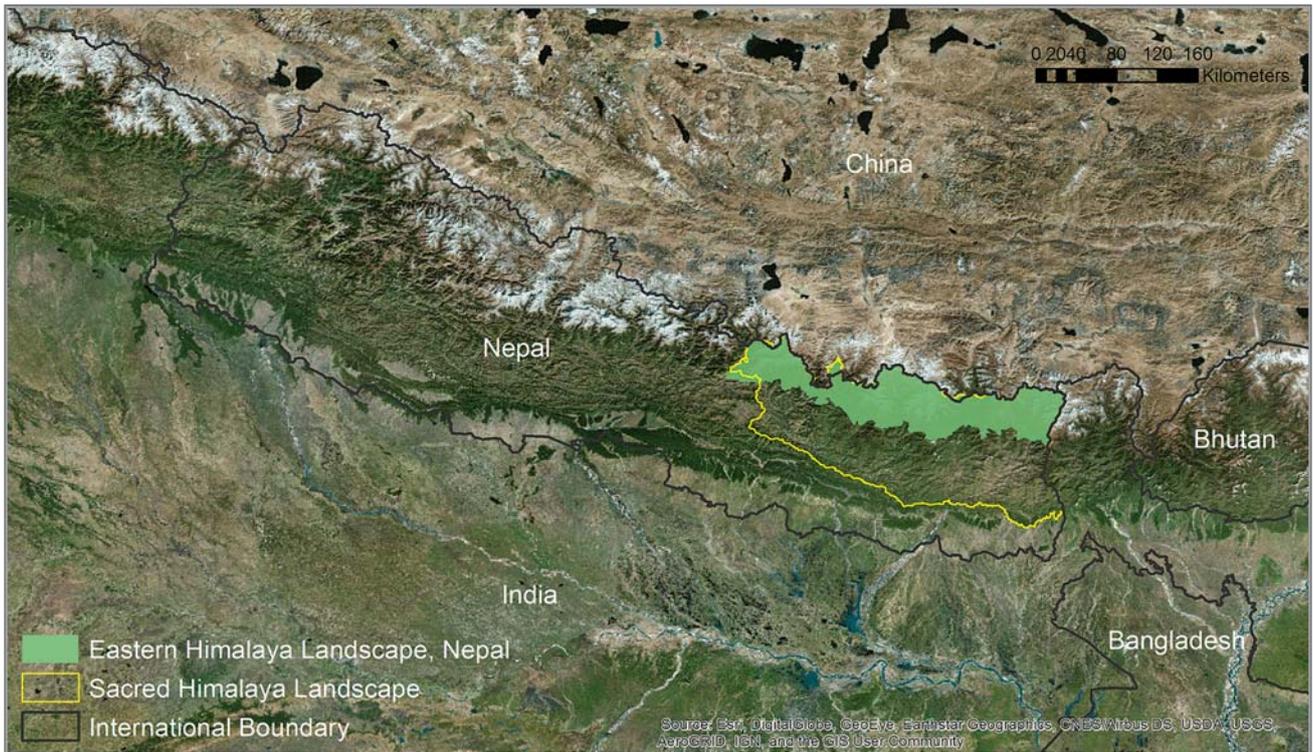
Figure 2 Protected Areas in and around EHL/N
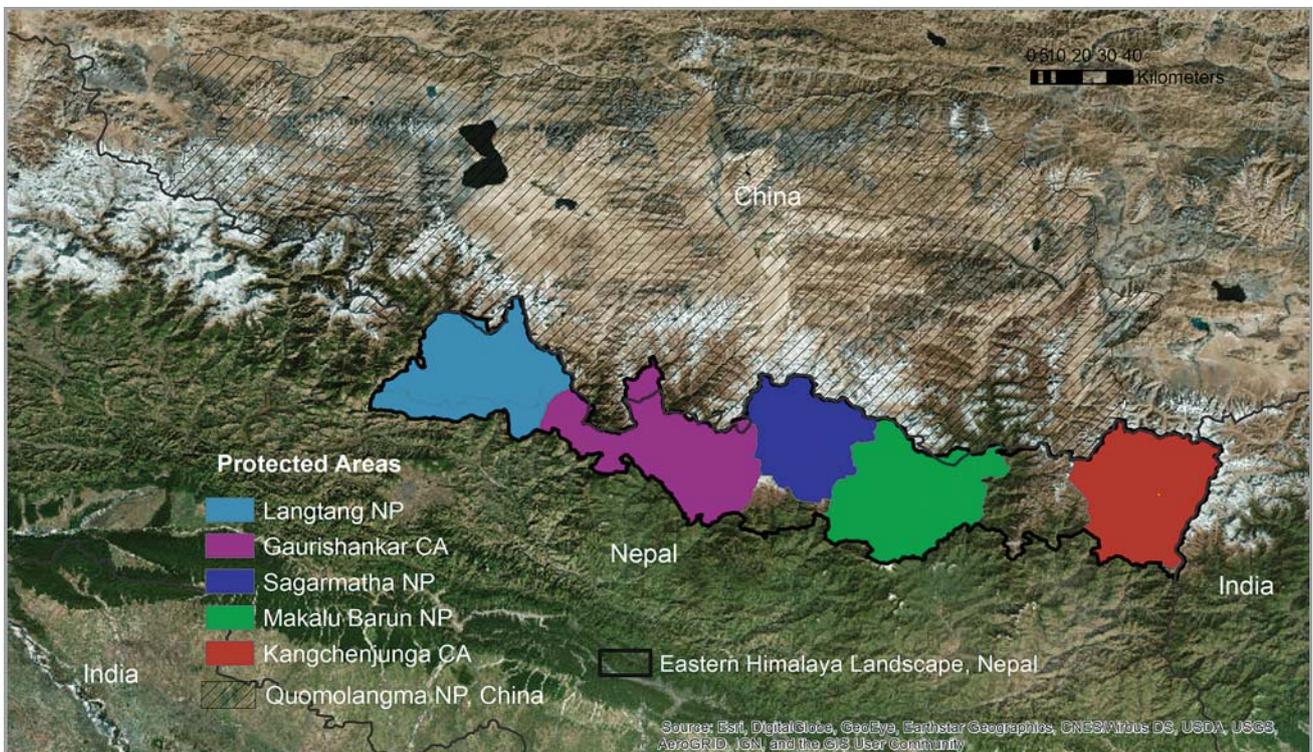
To mainstream conservation efforts across the Eastern Himalaya towards a common goal of biodiversity conservation, water resource management, and the safeguarding of local cultural heritage and livelihood, the Government of Nepal (GoN) in collaboration with WWF-Nepal and other partners launched the Sacred Himalaya Landscape (SHL) Program in 2006 (GoN 2006). Following the approval of SHL strategy plan (2006-2016), a comprehensive implementation plan (2010-2014) was prepared and subsequently rolled out in 18 districts of the SHL (GoN 2010). This management plan has been designed under the framework of the SHL implementation strategy so as to make it consistent with the overarching vision and ongoing program/activities of the Government of Nepal in the EHL/N.

Moreover, the snow leopard range, part of the so-called 'third pole' of Central Asia's high mountain ranges and associated glaciers, snow, and ice, is regarded as one of the most fragile regions of the planet to the impacts of climate change (Xu et al. 2009). Therefore, it is imperative that conservation strategies here account for the impacts of global climate change in landscape conservation. Such strategies require planning for both current impacts and future potential range shifts in the snow leopard's habitat under different climate scenarios. To this effect, this management plan is prepared by using spatially explicit climate models with a combination of ecological, biogeographical and hydrological information to predict potential future changes across the landscape. In doing so, we acknowledge many uncertainties inherent to climate projections and their inability to precisely reflect the complex interactions and dynamics of the real-world ecosystems (Heikkinen et al. 2006). While these uncertainties are challenging, bioclimatic models can nevertheless provide much-needed guidelines for climate integrated conservation planning if the limitations are recognized, acknowledged, and the outputs are judiciously used in conjunction with knowledge of the ecology and natural history of the species and their ecosystems, and with constant monitoring (Hannah et al. 2002; Keith et al. 2008).

1.1 Management plan preparation process

This management plan has been prepared by utilizing the best available science and local expert knowledge to provide the most practical, and hands-on approach to secure a future for snow leopards in the EHL/N. The figure below summarizes the management plan preparation procedure (Figure 3).

1.1.1. Consultative workshop/meetings

As a first step of the management planning process, a series of consultative meetings with relevant stakeholders were organized during April and May of 2016. Subsequently, a task force comprising plan development and technical team was formed to draft the management plan and a methodology to be followed was agreed among the core team members. Likewise, the existing EHL/N boundary was adjusted by adopting a spatially-explicit mapping technique that integrates snow leopard's biological landscape with the landscape of human interventions (Sanderson et al. 2002). An outline of the boundary delineation procedure is given in Box 1.

Box 1. Delineation of EHL/N boundary

The boundary of the EHL/N was systematically delineated by considering both biological and anthropogenic aspects of snow leopard conservation. Based on the biological requirements of ecologically functioning snow leopard populations, potential snow leopard habitats ('biological' landscapes) were first mapped using geospatial techniques. In order to account for the elements of human interventions, we then overlapped these maps with the different management units such as Protected Areas (PA) and their buffer zones, and the wards of the Rural/Municipalities. The landscape thus encompasses all the Protected Areas and those wards containing at least a portion of snow leopard habitat. Because both PAs and Rural/Municipalities function as a basic unit of management, it is essential to integrate the biological landscape of snow leopards with the administrative boundaries to ensure the effective implementation of the management plan.

Figure 3 Management plan preparation process

Consultative Meeting → Literature Review → Data Analysis and Write up → Review and Field Verification

Snow Leopard and Ecosystem Management Plan (2017-2026)
Eastern Himalaya Landscape, Nepal
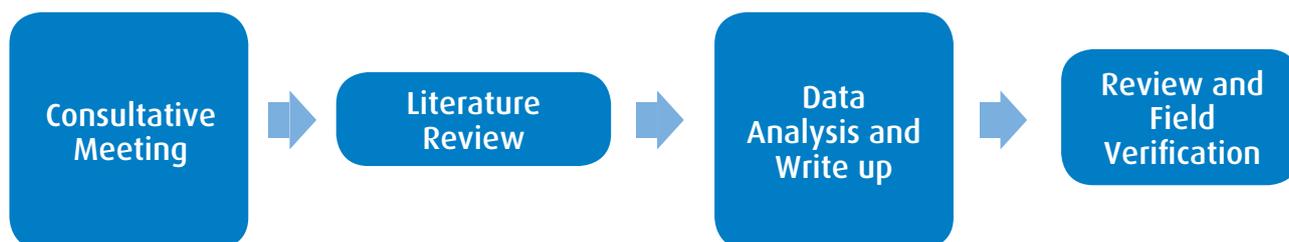
1.1.2. Literature review

EHL/N is one of the most intensively studied regions within Nepal's Himalayas, and there is urgent need to convert all this knowledge into effective conservation action. As such, relevant gray and published documents were reviewed in conjunction with national and international policy papers and action plans endorsed by the Government of Nepal. In this context, the EHL/N management plan is primarily guided by National Biodiversity Strategy and Action Plan (2014-2020), Protected Area and District Forests management plans, Snow Leopard Conservation Action Plan (2017-2021), and national policy documents pertaining to climate adaptation, forest, soil and watershed conservation, etc.

1.1.3. Data analyses

Information on the snow leopard's ecosystem dynamics with respect to the present and future climate scenario of the EHL/N is a prerequisite to develop a climate-integrated snow leopard management plan. In this regard, spatial information such as the current extent of snow leopard habitats, biological corridors, habitat degradation potential and climate refugia were obtained through the combination of contemporary statistical and geospatial techniques (see Forrest et al. 2017). Because snow leopard habitats are also the headwaters of major rivers in Asia that support millions of people downstream, the hydrological processes of the EHL/N, both now and under future climate change, were also assessed to understand potential water management implications. A comprehensive analysis was undertaken to understand the major drivers of freshwater hydrology, including local run off, river system layout, snow melt, snow cover and frost line, glacier, wetlands, aridity, etc. (see Sindorf 2017). To determine climate risk, annual and monthly temperature and precipitation data spanning from 1980 to 2005 were analyzed to produce baseline estimates and projected future climate for two periods; 1) the near-term (consisting of the time period of 2011-2040), and 2) mid-century (consisting of the time period of 2041-2070) (see Peters et al. 2017). This information was then used in the hydrological analyses to determine future changes in water availability, frost line, and aridity. Likewise, spatial analyses to project impact of climate change on snow leopard habitats were carried out for following three different IPCC emission scenarios from the Fourth Assessment Report (IPCC 2007); High emissions (A2), Moderate emissions (A1B), and Low emissions (B1).

1.1.4. Review and field verification

A draft management plan was reviewed by wide range of stakeholders including natural and social scientists, academia, policy makers, Protected Area managers and front-line staff members from Government and NGOs, citizen scientists and community group representatives. A workshop was carried out over three days in Kathmandu in March 2017 to appraise the baseline data, threat analyses, logical framework, stakeholder engagement plan and the implementation mechanism.

A field consultation of management plan was conducted in MBNP, as the available data from the region in particular was sketchy. Meetings were held among community leaders and park staff to glean information on the site-specific conservation threats, possible strategies and activities. As for the other sites, such information was largely available in the form of Protected Area management plans. However, field verification of the outcomes of hydrological and geo-spatial analyses needs to be undertaken and is included in this management plan as one of the key activities.

2 Baseline information

2.1. Topography and climate

EHL/N is home to the five mountain peaks that exceed 8,000m in elevation, including the Mt. Everest –the highest mountain in the world (Figure 4). The extreme degree of relief that ranges from 500m to 8848m, as provided by these mountain systems, has created outstanding topographic complexity and the climatic variability across the EHL/N. Mean monthly precipitation varies by as much as 500mm in July and temperature by 30-35 degrees Celsius for any given month across the landscape (Figure 5). EHL/N can thus be regarded as one of the world's most climatically diverse landscapes (Sindorf 2017).

Figure 4 Relief map of Eastern Himalaya Landscape, Nepal (Sindorf 2017)
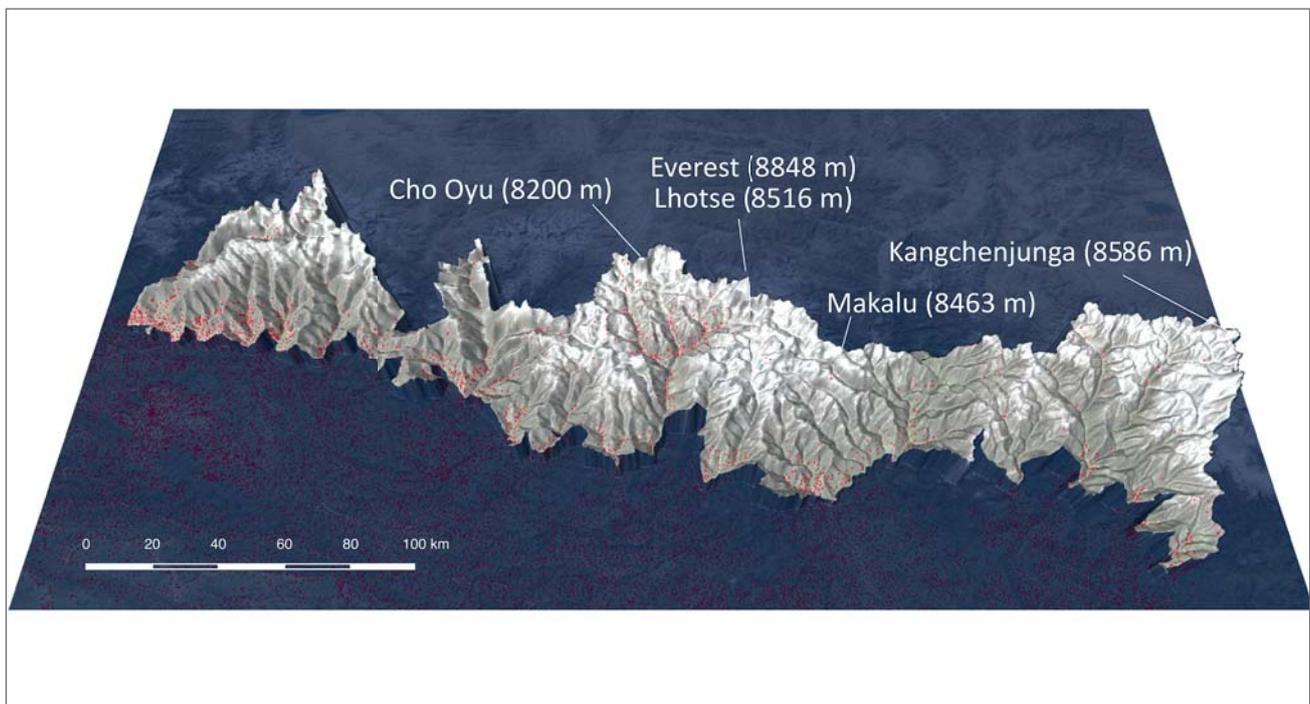
Figure 5 Historic monthly mean precipitation (left) and temperature (right) of the Eastern Himalaya Landscape/Nepal for the period between 1995-2000. Symbols "+" and "-" denote highest and lowest means of the landscape, respectively (Sindorf 2017).
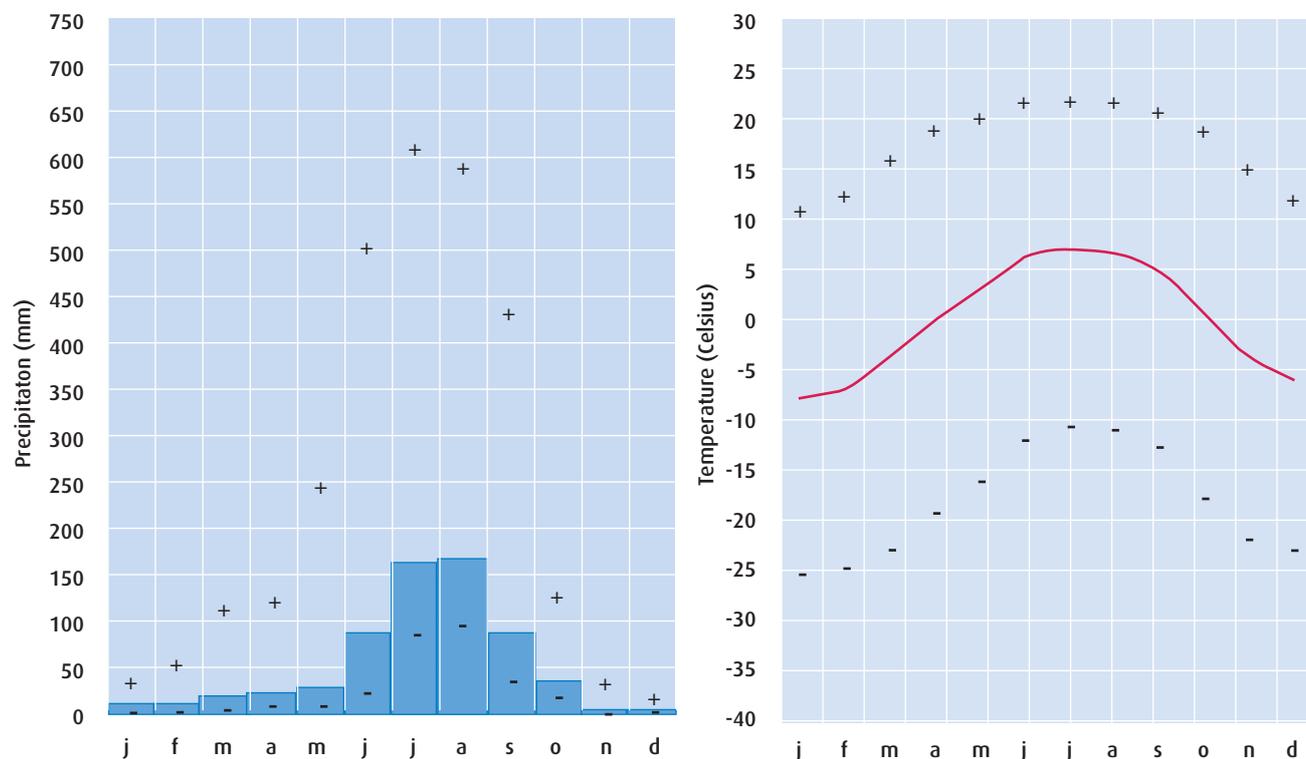
2.2. Ecoregions

Because of the topographic complexity, climatic variability and the overlap between multiple biogeographical realms, the Eastern Himalayas host unique assemblages of plant and animal life along the continuum of ecological gradients, some of which are known as the centres of origin for many species. The distribution of biodiversity in this region has been mapped across the horizontal axis of the mountain range referred to as the ecoregions (Olson et al. 2001). EHL/N hosts five ecoregions including two of the 200 globally most valuable ecoregions (Table1, Figure6); 1) Eastern Himalayan Broadleaf Forests, and 2) Eastern Himalayan Alpine Shrub and Meadows (Global 200 Ecoregions, WWF). These two global 200 ecoregions together comprise over 50% area of the EHL.

Global 200 ecoregions carry special merit not only due to the presence of the outstanding levels of species diversity and endemism, but they also play a pivotal role in maintaining altitudinal connectivity between the habitat types that make up the larger Himalayan ecosystem. Habitat continuity and intactness are also essential to safeguard the ecological processes and ecosystem function along the steep slopes of the Himalaya mountains.

Table 1 Ecoregions in the EHL/N.

Ecoregions	Biogeographic realm	Area within the EHL/N (km²)
Himalayan Subtropical Broadleaf Forests	Indo-Malayan	41
Eastern Himalayan Broadleaf Forests*	Indo-Malayan	2392
Eastern Himalayan Subalpine Conifer Forests	Indo-Malayan	1963
Eastern Himalayan Alpine Shrub and Meadows*	Palearctic	3437
Rock and Ice	Palearctic	3682

*Note: * Global 200 ecoregions*

Figure 6 Ecoregions of the EHL/N

Figure 6 Ecoregions of the EHL/N
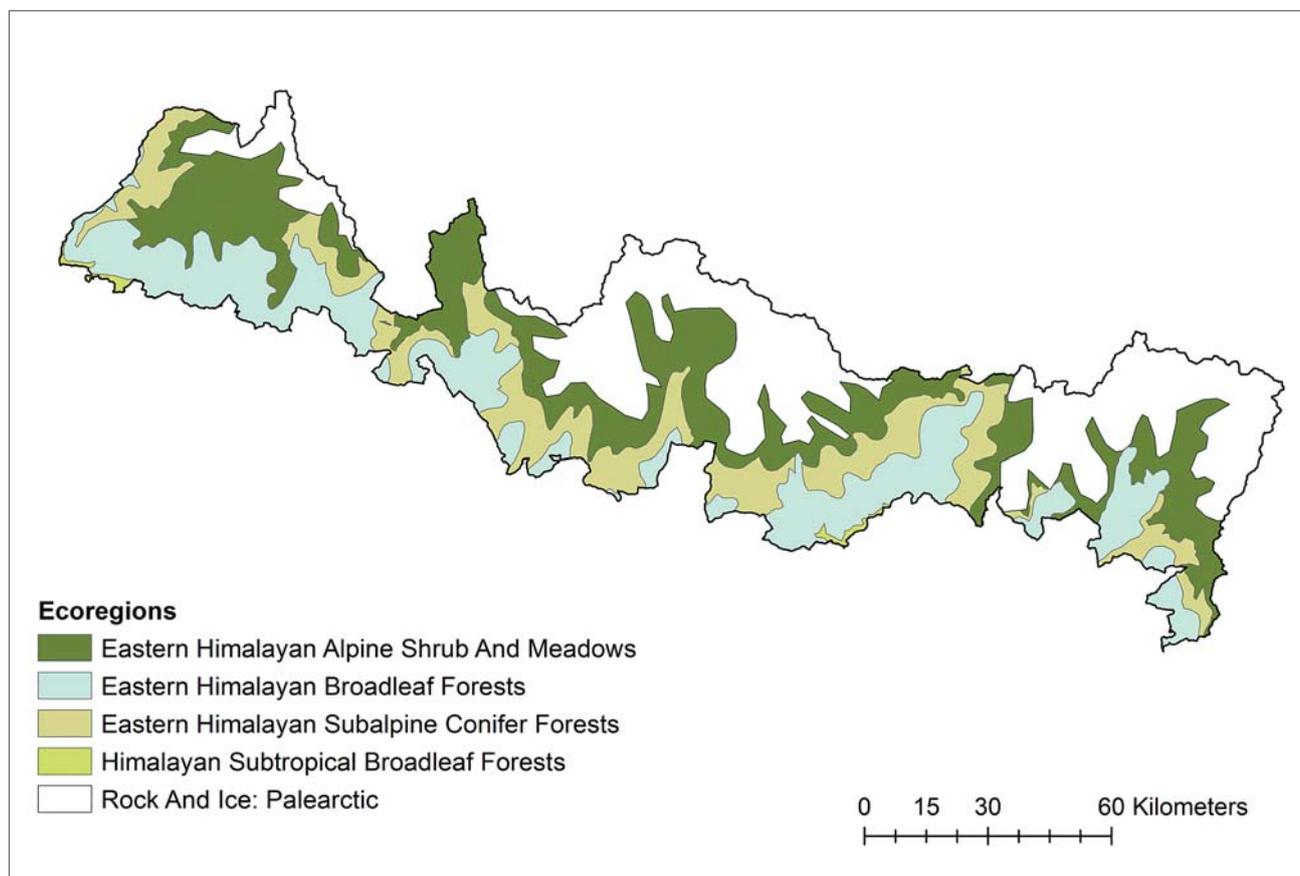
2.3. Biodiversity

2.3.1. Plant Diversity

A total of seven distinctive floral assemblages are found in the EHL/N nested within the ecoregions along the gradient of altitude (Figure 7). The lower slopes of the EHL/N are occupied by evergreen broadleaf forests, dominated by trees belonging to families such as Fagaceae, and Laraceae. Higher up, they are replaced by deciduous broad leaf (e.g. *Acer, Betula, Magnolia*, etc.) and mixed conifers (e.g. *Tsuga, Taxus*, etc.). Bamboo (*Arundinaria* spp.) is patchily distributed as understory vegetation within this zone. Subalpine conifer forests occur between 3,000m and 4,000m, and *Tsuga, Picea* or *Larix* dominate forests in lower belts and *Abies* dominates the upper reaches. The forest line vegetation is marked by *Juniperus*, that often creates a dwarf krummoltz formation above 4,700m. Further upslope from the forest line extending upto 4500m, a moist alpine scrub community of Juniper and Rhododendron shrubberies dominate the landscape. From 4,500m to 4,700m the vegetation consists of alpine meadows with a diverse assemblage of alpine herbs and woody shrubs, such as dwarf rhododendrons, and numerous alpine herbs including *Ranunculus* and the alpine *Saussure*. This zone also comprises prime snow leopard habitats and important grazing grounds for both wild and domestic ungulates. In recent times, this zone has been heavily used for the collection of caterpillar fungus, *Ophiocordyceps sinensis*. Periglacial and subnival communities occur in the high alpine areas above 4,700m and specialized plants such as *Androsace, Arenaria, Saxifraga, Meconopsis* and *Primula* are found in this zone. The latter two have their global centres of diversity in the eastern Himalayas. The nival zone generally starts upwards of 5,500m to 6000m upwards, and mostly characterized by permanent ice and bare rock. Even here, at the highest elevations on Earth, micro-climates may support small cushion-forming vascular plants, such as *Arenaria bryophylla*, which was recorded at 6,180m (Polunin & Stainton 1987).
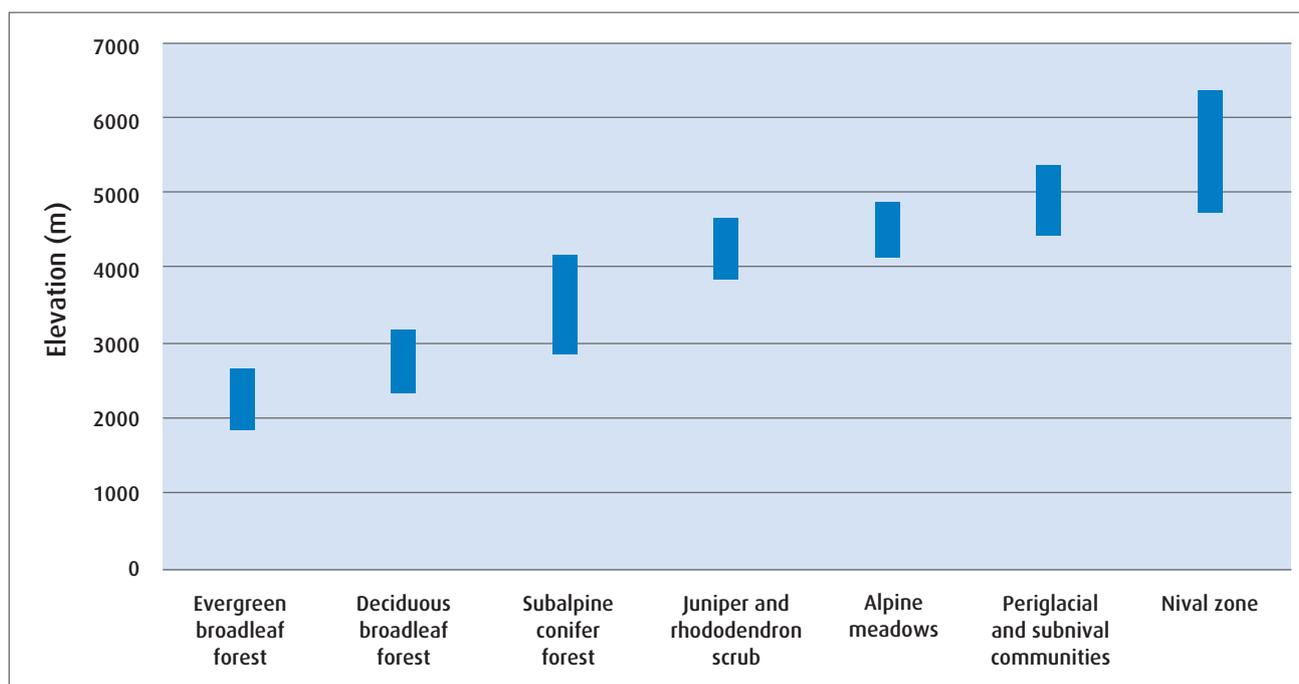
2.3.2. Animal diversity

Over 85 species of mammals and 450 species of birds are known to inhabit the Eastern Himalaya region (WWF & ICIMOD 2001). Apart from snow leopards (*Panthera uncia*), other globally important fauna includes Tibetan wolf (*Canis lupus)*, Manul (*Otocolobus manul*), red panda (*Ailurus fulgens*), clouded leopard (*Neofelis nebulosa*), Asiatic black bear (*Ursus thibetanus*) and an ungulate assemblage comprising musk deer (*Moschus leucogaster*), blue sheep (*Pseudois nayaur*) and Himalayan tahr (*Hemitragus jemlahicus*). Because the Himalayas have a relatively recent origin, endemism is low, especially among the better-known higher taxonomic groups. Endemism among birds in the region is higher than among mammals. Some species restricted to the larger Eastern Himalaya region (covering Bhutan, northeast India, southeastern Tibet and northern Myanmar) include chestnut-breasted partridge (*Arborophila mandellii*), Blyth's tragopan (*Tragopan blythii*), Temminck's tragopan (*Tragopan temminckii*), Sclater's monal (*Lophophorus sclateri*), Tibetan eared pheasant (*Crossoptilon harmani*) and rusty-bellied shortwing (*Brachypteryx hyperythra*).

Compared to mammals and birds, other taxonomic groups are poorly studied. Forty-one species of reptiles including three turtles, nine lizards and 29 snakes, and 200 species of butterflies have been recorded to date. Endemic species of frogs and salamanders are also documented from the region (CEPF/WWF-US/Asia Program 2005).

2.4. Important ecological processes and ecosystem services

The top predators, large herbivores and frugivores, and specialized pollinators that inhabit the Eastern Himalaya region play critical roles in maintaining the integrity of the ecosystems (CEPF/WWF-US/Asia Program 2005). Many birds and fishes, and likely many insects, undertake seasonal migrations up and down the mountains. Higher up the mountains, top predators like the snow leopard regulate the populations of blue sheep and Himalayan tahr thereby safeguarding the health of grasslands. These ecological processes help sustain multitude of vital ecosystem services such as the sustained delivery of food, water, medicines, fuel wood, timber, NTFPs, grazing, hydropower. Among these, the water provision by the EHL is regarded as one of the most crucial ecosystem services affecting the lives and livelihoods of hundreds of millions of people in the region. Hence, the EHL's fresh water systems are important targets of all the conservation and development initiatives implemented in the region.

2.5. Landscape hydrology and water provision functions

The EHL/N is almost entirely drained by the Koshi river system, one of three large basins in Nepal, comprising seven tributaries: Indrawati, Sunkoshi, Tama Koshi, Likhu, Dudh Koshi, Arun and Tamor (Figure 8). A smaller western part of the landscape is located outside the Koshi basin that includes Trishuli river and its tributaries, which drain into Narayani river. Both Koshi and Narayani rivers are among the important water sources of the Ganges River – one the world's largest rivers – a lifeline of over 300 million people (Sindorf et al. 2014).
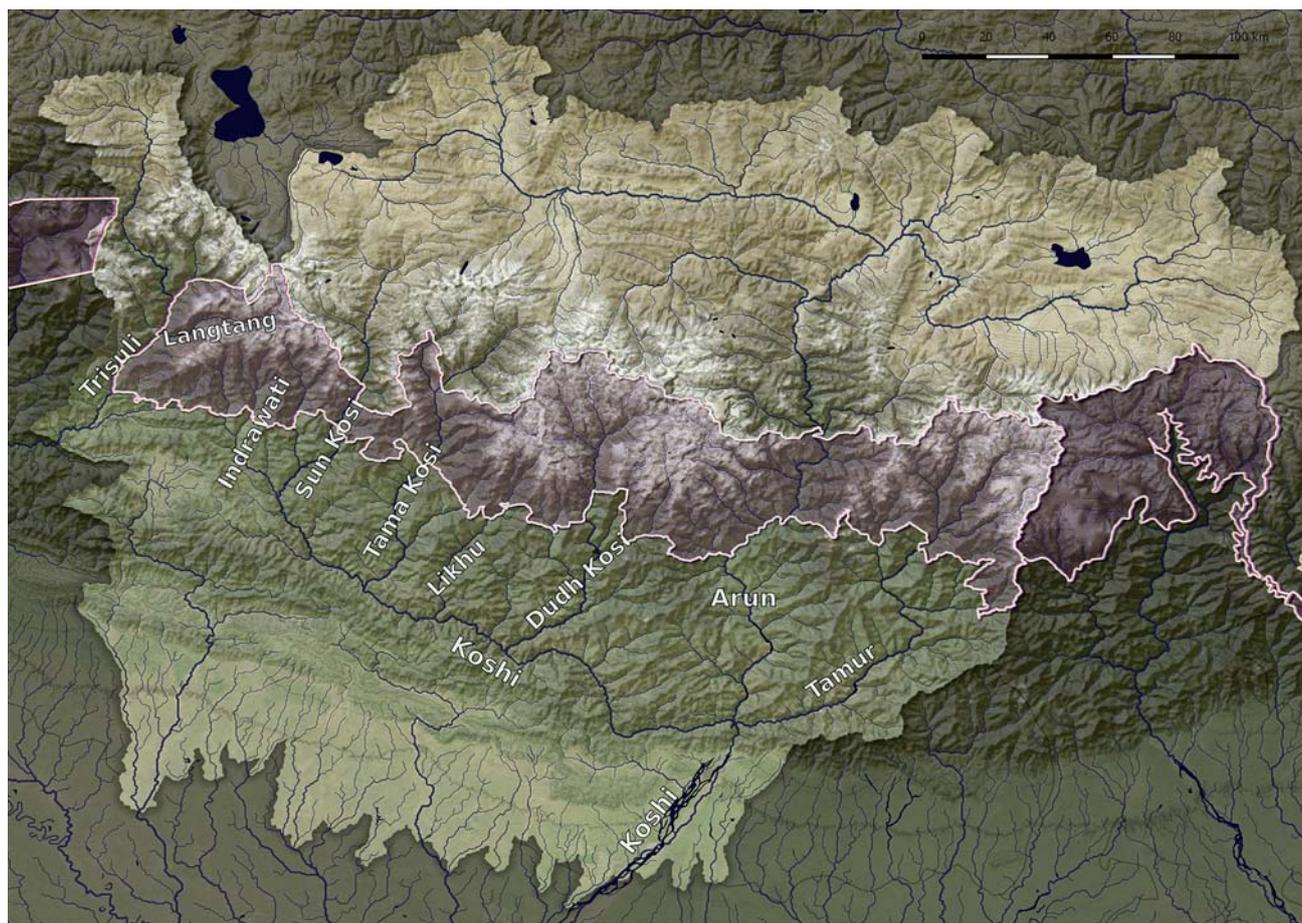
The hydrological processes governing water provision in the EHL/N are a complex function of seasonal snowmelt, retreating glaciers, changing permafrost, groundwater aquifers, the enormous rains of the summer monsoon, and the complex topography of the Himalaya. For this plan, that complexity is reduced to seven key functions that could be analysed through readily available geospatial data: local runoff, snowmelt, aridity, river system layout, presence of glaciers, permafrost coverage, snow cover and freeze line. Please refer to Sindorf (2017) for a detailed report on the hydrological analyses.

2.6. Land use and land cover
The dominant land cover type in the EHL/N is alpine meadow followed by conifer (needle leaved) forests (Figures 9 and 10). The alpine meadows are the prime grazing grounds for both wild and domestic ungulates and thus are important habitats of snow leopard (Shrestha & Wegge 2008). The presence of extensive tracts of forested habitats in the Arun, Bhotekoshi, and Tamakoshi valleys may pose a critical barrier for snow leopards' movement. The human dominated landscapes including agriculture, built-up area and fallow land comprise less than 1% of the total land cover.

2.7 Natural resource governance
Nearly 86% of the total area of EHL/N (10,097 km^2) is covered by the network of Protected Areas. Protected areas are, and have been, the cornerstones of natural resource management in Nepal and represent one of the largest financial investments in conservation efforts.

The management of the EHL/N's Protected Areas is guided by the National Park and Wildlife Conservation Act 1973/ Fifth Amendment (GoN 2017), while habitats outside of Protected Areas are governed by Forest Act (1993). The EHL/N's Protected Area system comprise three national parks, their buffer zones and the two conservation areas (Figure 11, Table 2). "National Park" is defined as the area set aside for the conservation, management and utilization of flora, fauna and scenery along with the natural environment and is managed by the Government (GoN 2017). Activities like hunting, grazing, cultivation, tree felling are prohibited in the national parks. "Buffer Zone", on the other hand, is the peripheral area of a national park that often consist multiple land uses such as forests, agricultural lands, settlements, villages, etc. The primary purpose of buffer zone is to reduce the human foot

Figure 9 Land use and land cover types in the EHL/N

Built up
0%

Barren land
12%

Snow/Glacier
14%

Fallow land
1%

Agriculture
0%

Alpine meadow
36%

Needle leaved forest
29%

Broad leaved forest
3%

Shrubland
5%
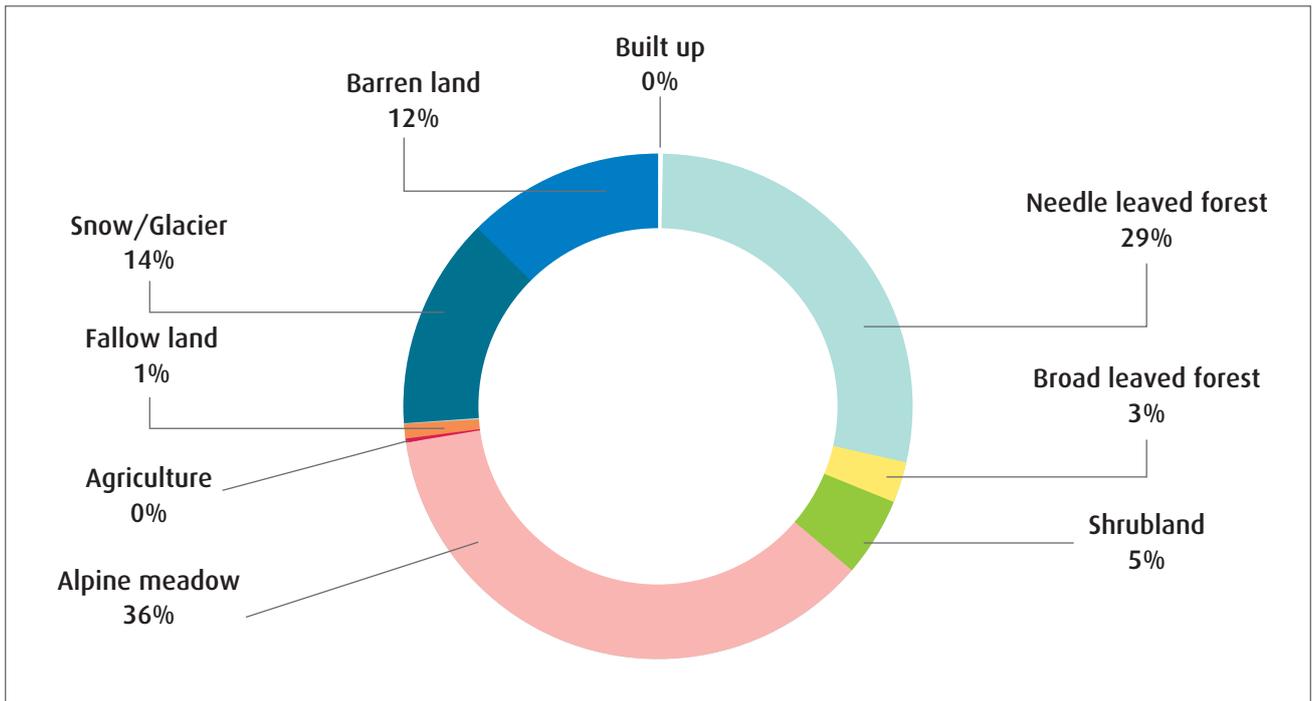
Figure 10 Spatial distribution of land cover types in the EHL/N

Land Use and Land Cover Classes
- Barren Ground
- Snow and Glacier
- Agriculture
- Alpine Meadow
- Shrubland
- Broad Leaved Forest
- Builtup Area
- Water
- Needle Leaved Forest

0   15   30   60 Kilometers
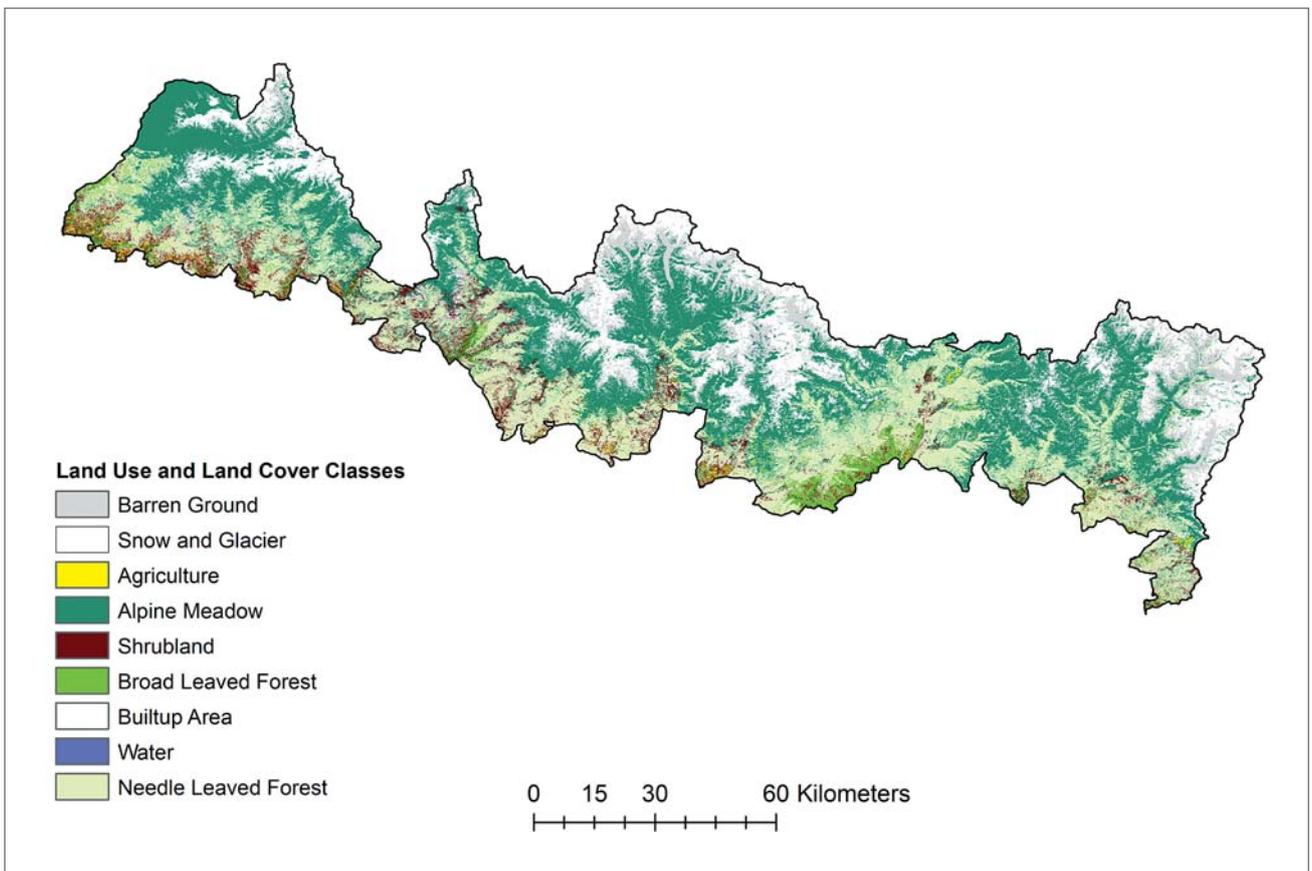
print in the national park through the implementation of community based natural resource management programs. "Conservation Area" is a special type Protected Area where the local community members take the lead in managing the park under the framework of an integrated plan for the biodiversity conservation and community development through a sustainable utilization of natural resources. Of the two conservation areas of the EHL/N, the KCA is managed by the locally elected body referred to as the KCA Council whereas the management of the GCA is currently being

undertaken by the national non-governmental organization, the National Trust for Nature Conservation (NTNC).

Administratively, the EHL/N's Protected Area network extends over 9 districts comprising 3 Municipalities and 33 Rural Municipalities. Out of this, 11 Rural Municipalities (RM) are either partially or completely located outside of the Protected Area system where the natural resource governance is being coordinated by the respective RMs in collaboration with district line agencies.

Figure 11 Natural Resource Governance in the EHL/N
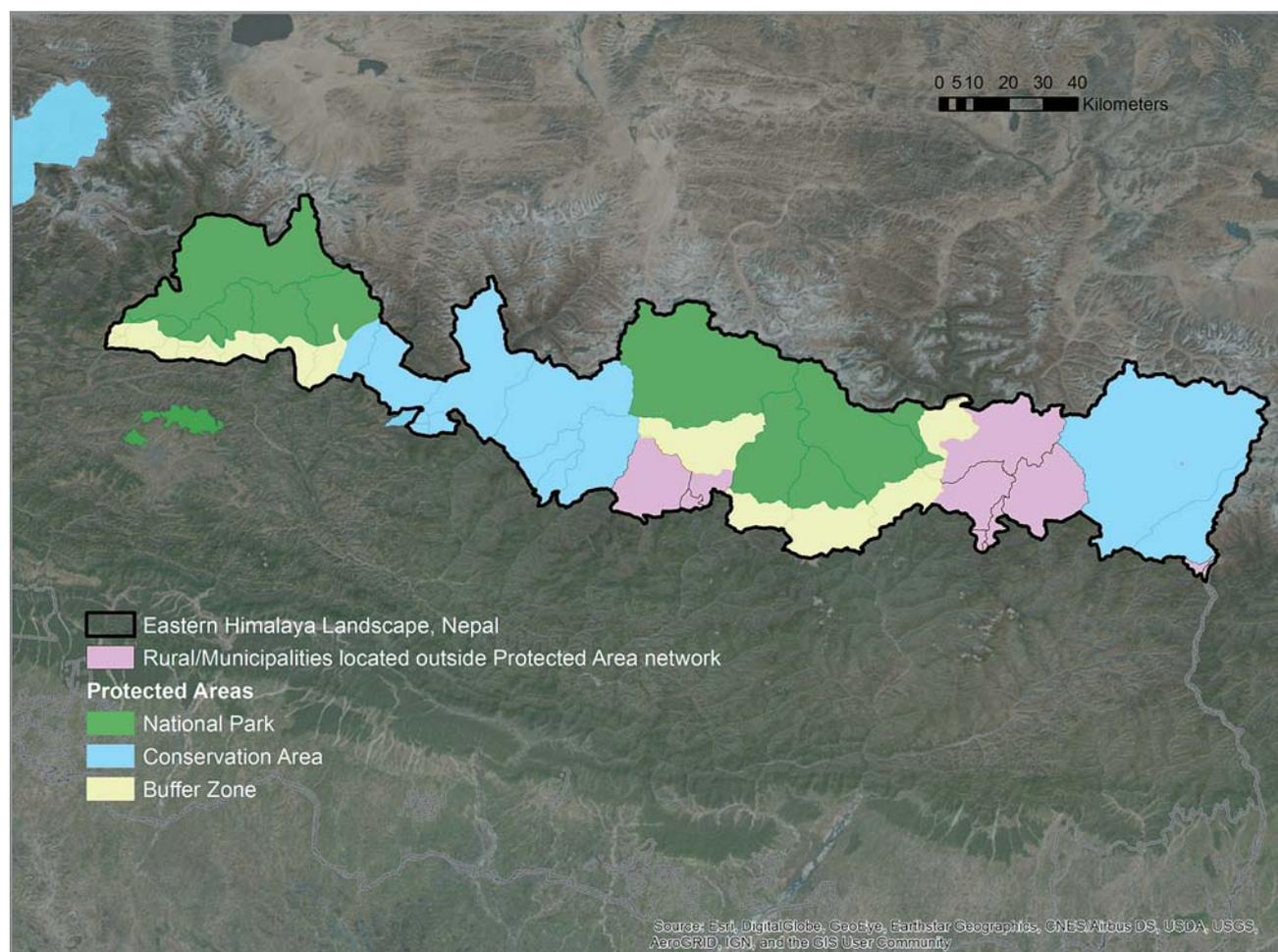
Table 2 Description of Protected Areas in the EHL/N

Protected Area	Established Year	Area (km²)		
		Core	Buffer	Total
Kangchenjunga Conservation Area (KCA)	1997	2035	-	2035
Makalu-Barun National Park (MBNP)	1991	1500	830	2330
Sagarmatha National Park (SNP)	1976	1148	275	1423
Gaurishankar Conservation Area (GCA)	2010	2179	-	2179
Langtang National Park (LNP)	1976	1710	420	2130

Snow Leopard and Ecosystem Management Plan (2017-2026)
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2.8 People, culture, and livelihood

The EHL/N is inhabited by 339,685 people with 76,161 number of households (CBS 2014). The average population density is estimated at 86 individuals per km^2. Human presence is most heavily concentrated southwest of the landscape, and tends to diminish on a north-east gradient. Accordingly, LNP and GCA together hold over 60% of total population. Population growth was close to 0% from 2001 to 2014. The 11 Rural Municipalities with 31,212 people are located partially or completely outside of the Protected Area system. A list of Municipalities and Rural Municipalities are given in Annex I.

There are many small villages and hamlets connected by footpaths and small roads in the EHL/N. These population centres are mainly distributed along the rivers and streams, and in the valleys. The majority of population centres are concentrated in the western part of the EHL/N in and around LNP and along the Dudhkoshi river basin of SNP (Figure 12).

Subsistence agriculture and animal husbandry are the two primary livelihoods of the people in EHL/N. The major crops are maize, millet, potato, and wheat, and the livestock is dominated by sheep, goats, cattle, yak and yak hybrids. As a source of cash income, crops such as cardamom and *chiraito*

are also widely cultivated in the eastern part of the EHL/N, while trekking tourism is mostly popular in the western regions in and around SNP and LNP.

Ethnic diversity, mirroring Nepal in general, is remarkably high in the EHL/N with 40 ethnic caste groups, dominated by Sherpa, Limbu, Rai and Tamang. In accordance with the ethnic and cultural diversity, the EHL/N has unique indigenous natural resource management practices that are known to be conducive to local biodiversity conservation, climate adaptation, and livelihood security (GoN 2010). In addition, this region is home to several natural and cultural heritage sites that are equally important for promoting eco-tourism as thousands of people regularly visit these places, making the region an attractive tourist destination.

There is, however, substantial poverty and livelihoods insecurity in the EHL/N. The food deficit is pervasive, with Rasuwa, Dolakha, and Panchthar topping the list of the food deficient districts (i.e., the districts that do not grow enough food to feed their population) (WFP 2006, in: GoN 2010). Likewise, poverty is widespread, with 46.5% households living below poverty threshold. The highest poverty incidence was found in Taplejung (58.1%), while the lowest was reported in Dolakha district (33.6%) (World Bank & CBS 2006).

Figure 12 Population centres of the EHL/N
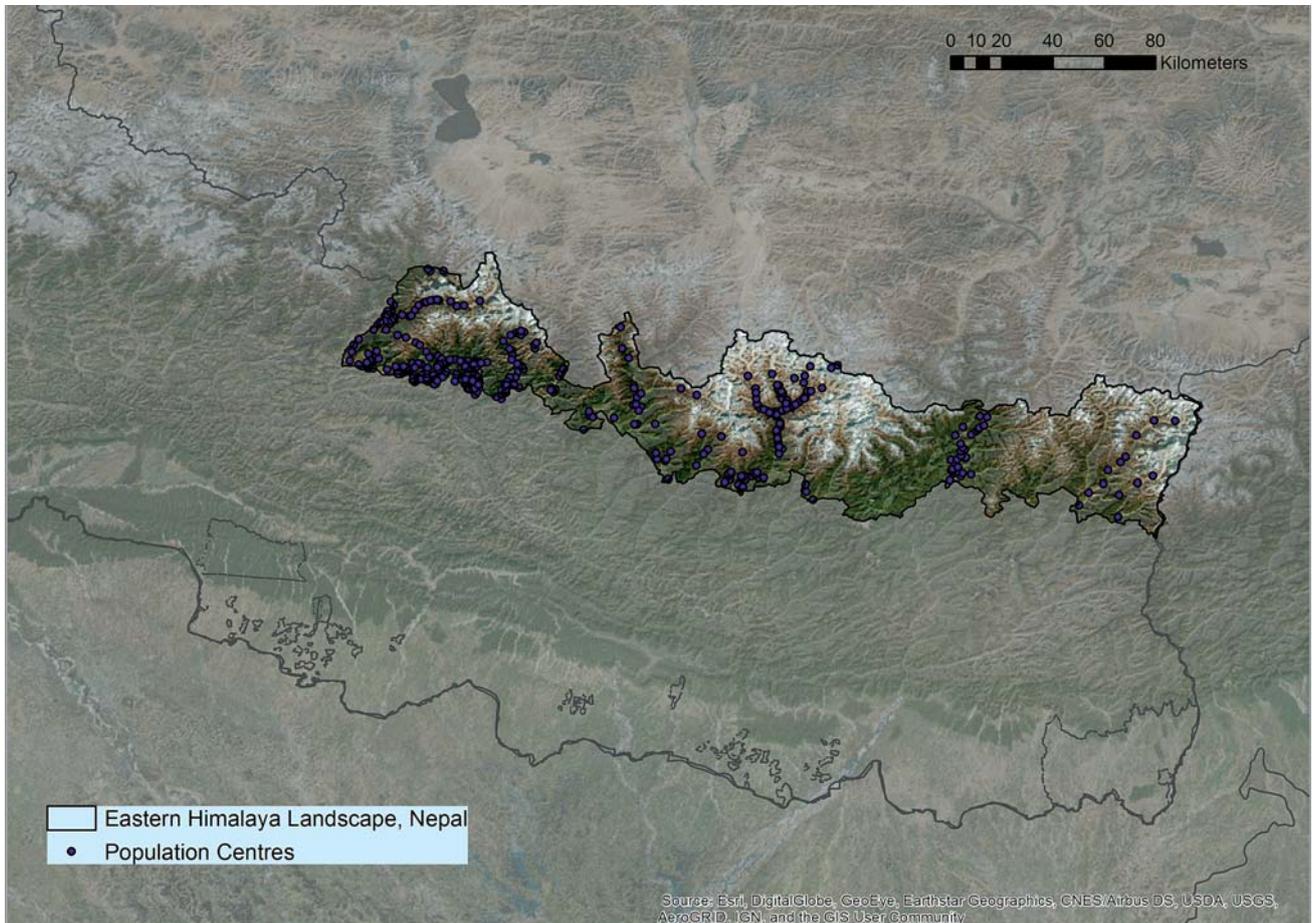
3 Ecology and conservation of snow leopards in the EHL/N

3.1. Population status and spatial ecology

Updated snow leopard population data is not available for the EHL/N. A population assessment undertaken in 2009 based on the linear relationship between sign surveys, molecular genetic analyses and potentially available habitats and that was cross-verified through prey availability estimated that the landscape was inhabited by approximately 39 snow leopards with density varying between 1.5 to 2.6 individuals per 100 km^2 (Table 3; DNPWC 2012). KCA has the highest density of snow leopards among the Protected Areas within EHL/N.

A recent analysis based on the probability of snow leopard occurrence and the putative barriers for their movement revealed that the potential snow leopard range in the EHL/N is arranged in the four discrete habitat complexes (Figure 13; Forrest et al. 2017); Langtang, Gaurishankar, Sagarmatha and Kangchenjunga that are separated by river valleys of Bhotekoshi (N 27.99°, E 85.94°), Tamakoshi (N 28.00° E 86.19°), and Arun (N 27.80°, E 87.43°). The spatial analyses estimated a total of 5,800 km^2 of potential snow leopard habitats in the EHL/N. Of this, 2,743 km^2 is classified as good habitat, and 3,084 km^2 is classified as fair habitat (see Forrest et al. 2017 for details).

Table 3 Snow leopard population status in the EHL/N (Source: DNPWC 2012)

Survey complexes	Density (Individuals/100 km²)	Number		
		Mean	Lower Range (95% CI)	Upper Range (95% CI)
GCA (Rolwaling Valley)	1.5	17	6	24
SNP	1.8	4	2	5
KCA	2.6	18	13	21
Total		39		

Figure 13 Potential snow leopard habitats distributed in the four discrete habitat complexes; Langtang, Gaurishankar, Sagarmatha and Kangchenjunga in the EHL/N (Forrest et al. 2017).
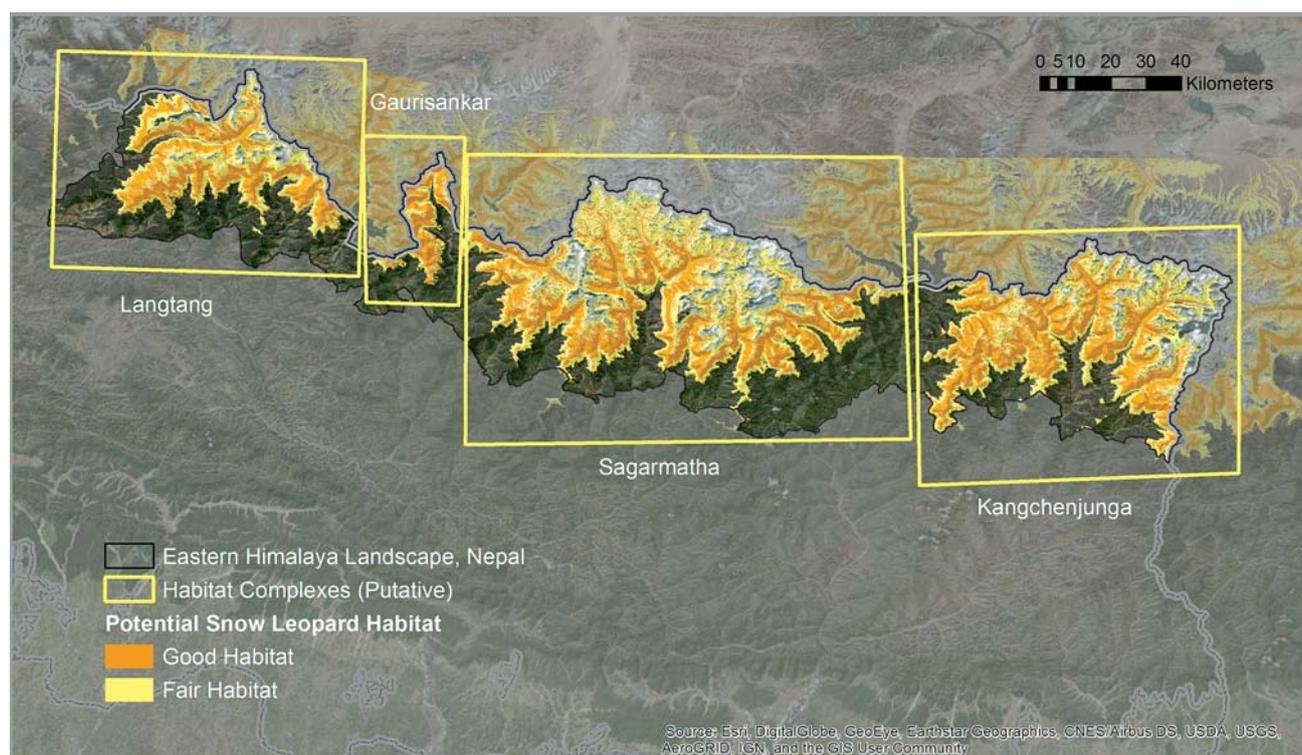
Protected Areas cover over 5,000 km^2 or 86% of the total snow leopard habitat in the EHL/N (Table 4). 826 km^2 (10%) of habitat remains outside of the PA system, most of it located west of KCA (Figure 11). This habitat forms a vital connection between KCA and MBNP via Quomolangma Nature Preserve in China (Figure 2). There is a smaller area of habitat outside of PA network at the south of SNP and the southeast corner of Kangchenjunga, adjacent to the Nepal-India border (Figure 11).

As shown in the table below, KCA has the most snow leopard habitat among the Protected Areas, with more than 1,200 km^2 of total habitat area.

The large spatial requirement of snow leopards is increasingly reported from the recent studies that employed state-of-the-art technologies such as Satellite GPS telemetry. The home range of snow leopards fitted with GPS enabled satellite collars in the KCA accounted for as large as 2,600 km^2 and extended over neighboring countries including Sikkim, India and Tibet, China (Figure 14). Within these vast home ranges, snow leopards are found to use multiple habitats by moving around the landscape in non-random ways as per the spatial and temporal distribution of their ecological and behavioral needs. In this context, their territories often fall outside of the Protected Area network as exemplified by two collared snow leopards in the KCA (Figure 14).

Table 4 Distribution of potential snow leopard habitats across the Protected Areas of the EHL/N (Forrest et al. 2017)

Protected Area Name	Good Habitat (km^2)	Fair Habitat (km^2)	Total Habitat (km^2)
Langtang National Park & Buffer Zone	497	516	1013
Gaurishankar Conservation Area	458	447	905
Makalu Barun National Park & Buffer Zone	382	470	852
Sagarmatha National Park & Buffer Zone	391	630	1021
Kangchenjunga Conservation Area	574	636	1210
Total Protected	**2,302**	**2,698**	**5,001**

Figure 14 **Snow leopard home ranges around Kangchenjunga Conservation Area (KCA). The home range calculations are based on 90% Minimum Convex Polygons (MCP).**
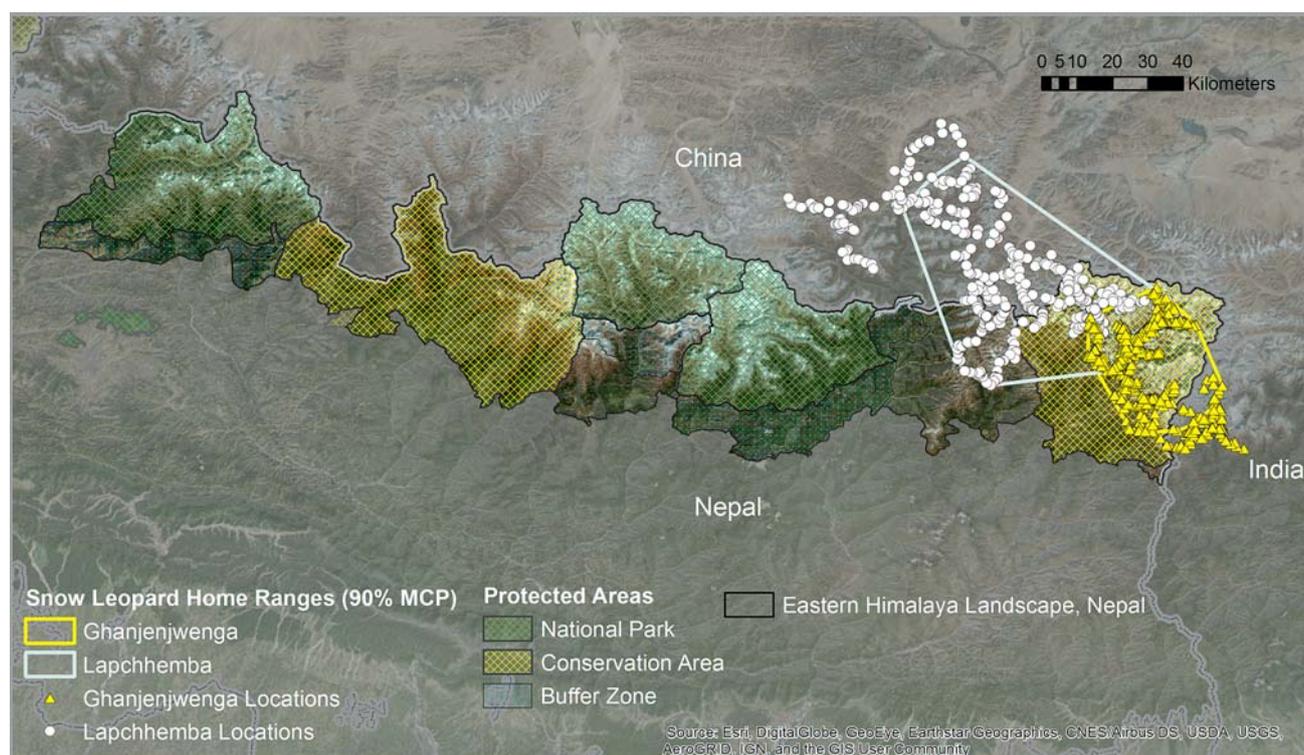
Securing habitat connectivity across the landscape is thus a prerequisite to stem decline in snow leopard population (Janecka et al. 2017). In addition, impending threats from climate change impacts further accentuates the need for connecting local snow leopard populations through a network of habitat corridors to safeguard the functional integrity of their meta-population now and in the future as micro-climates and habitats shift (Zhao et al. 2011; Forrest et al.

2012). In doing so, it is crucial to map the habitat linkages for snow leopards across the EHL/N.

Spatial analyses identified 14 potential corridors in the EHL/N (Table 5, Figure 15; Forrest et al. 2017) that are expected to contribute in maintaining snow leopard meta-population by connecting local populations within the EHL/N and between the adjoining transboundary snow leopard ranges of China and India. See details in Annex II.

Table 5 **Potential habitat corridors in the EHL/N (Source: Forrest et al. 2017)**

SN	Name	Corridor Type	PA or Rural/ Municipality	District	Habitat Complex
1	Langtang	Transboundary	LNP	Rasuwa	Langtang
2	Tatopani	Transboundary	GCA	Sindhupalchok	Langtang
3	Alampu	Transboundary	GCA	Dolakha	Gauri Shankar
4	Lamabagar	Transboundary	GCA	Dolakha	Sagarmatha
5	Taksindu	In-country	Solududhkunda Municipality	Solukhumbu	Sagarmatha
6	Beni	In-country	Umakunda Rural Municipality	Solukhumbu	Sagarmatha
7	Nangpa la	Transboundary	SNP	Solukhumbu	Sagarmatha
8	Khote	In-country	SNP-MBNP	Solukhumbu	Sagarmatha
9	Khare	In-country	SNP-MBNP	Solukhumbu	Sagarmatha
10	Chheskam	In-country	SNP-MBNP	Solukhumbu	Sagarmatha
11	Kimathanka	Transboundary	MBNP	Sankhuwasabha	Sagarmatha
12	Thudam	Transboundary	MBNP	Sankhuwasabha	Kangchenjunga
13	Gola	Transboundary	KCA	Taplejung	Kangchenjunga
14	Yamphudin	Transboundary	KCA	Taplejung	Kangchenjunga

Figure 15 Potential habitat corridors in the EHL/N. The corridors are expected to facilitate snow leopard movement between the habitats patches. (See details in Annex II)
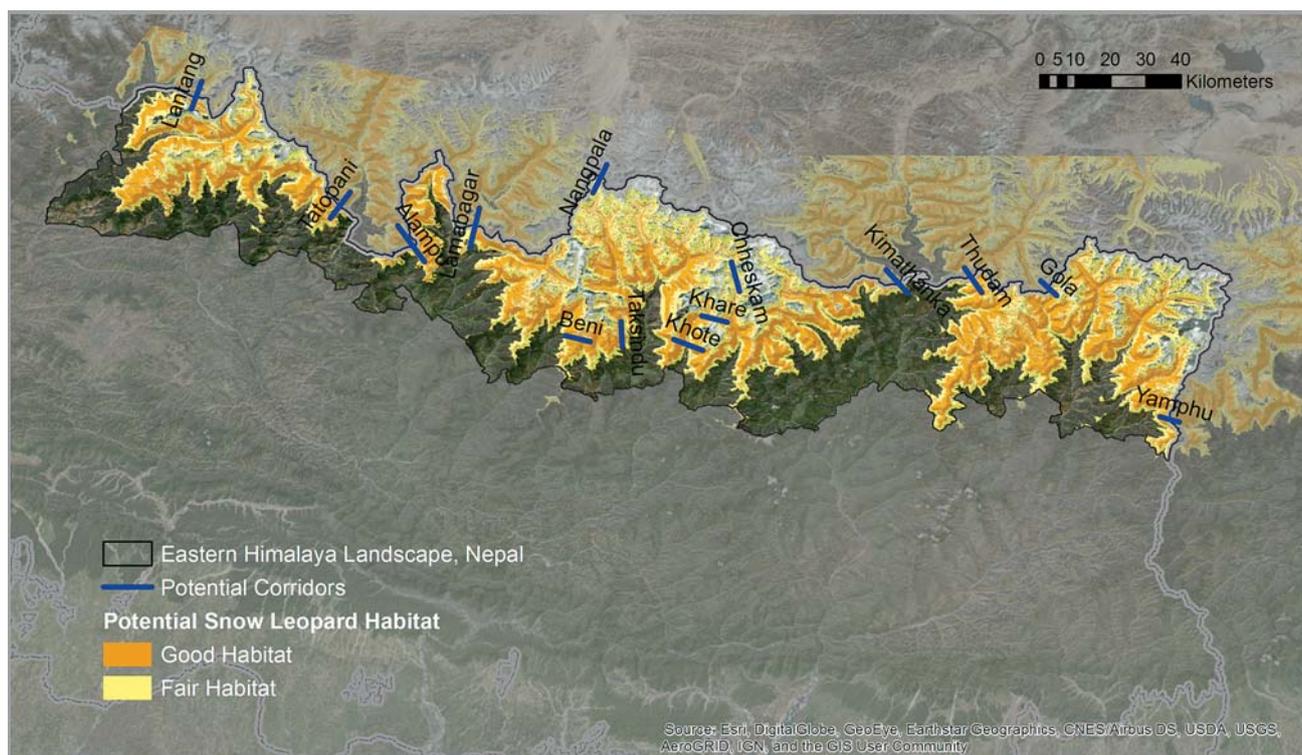
Although there appears to be *de facto* connectivity due to the relatively low human disturbance in the EHL/N, the deeply incised river systems particularly in Bhotekoshi, Tamakoshi, and Arun valleys contain extensive tracts of forest that at least partially sever east-west connectivity, thereby resulting into four discreet habitat complexes (Figure 13). Therefore, the transboundary corridors that link the snow leopard habitats on the other side of the border through the Quomolangma Nature Preserve of China and Khangchendzonga National Park of India (Figure 15) are vital to maintain the integrity of ecosystem as well as viable snow leopard population in the EHL/N.

3.2. Prey base and food habits

Blue sheep and Himalayan tahr are the two major wild prey species of the snow leopard in EHL/N, and the alternative prey species comprise by marmot, pheasants, musk deer and domestic livestock, among others (Mallon et al. 2016). Blue sheep are distributed throughout the EHL/N except in SNP, where the Himalayan tahr replaces blue sheep as the main food of snow leopard (Lovari et al. 2009).

The blue sheep population in the KCA is reported to have increased by nearly 25% over the period between 2007 to 2010 and the population density accounted for 4.2 individuals/km^2 (WWF 2010). Himalayan tahr population in SNP, on the other hand, declined by as much as 70% from 2003 to 2010 (Ferretti et al. 2014) and the current density stands at 2-3 individuals/km^2 (Lovari & Mishra 2016).

As for the diet composition, wild prey constituted over 50% of their diet both in ACA (53% blue sheep, Wegge et al. 2012) and in SNP (56% Himalayan tahr, Ferretti et al. 2014). Livestock comprising over 40% of the total diet also formed a bulk of snow leopard's food base (Wegge et al. 2012; Ferretti et al. 2014). Furthermore, Wegge et al. (2012) estimated snow leopard's dietary requirement as two blue sheep and one livestock per month and annual prey requirements are estimated at 20–30 adult ungulates, with radio telemetry suggesting a large kill every 10–15 days (Jackson 1996).

3.3. Interaction with co-predators

In the EHL/N, the snow leopard habitats are increasingly being used by other predators, such as common leopard and Himalayan wolf. Because of their comparable body sizes, they have similar ecological requirements, increasing potential for resource competition among them. Studies, however, suggest varying results: snow leopards and common leopards shared about 70% of their diet but not the habitats in SNP (Lovari et al. 2013), and the former had a low dietary overlap with wolf in ACAP (Chetri et al. 2017), whereas they significantly shared both habitats and diet in Kyrgyzstan (Jumabay-Uulu et al. 2014). The lack of any consistent pattern may be due to the large geographical distributions of these species, with associated local ecological adaptations and human interventions (Lyngdoh et al. 2014). Nevertheless, impending impacts of climate change coupled by anthropogenic disturbances would likely force them to compete as their shared resources would become increasingly

limited in the future (Durant et al. 2007). Judging by biology and behaviour of snow leopards, it is anticipated that they will be displaced from their preferred range or even become locally extinct, if competition among these co-predators does take place.

3.4. Legal status

The snow leopard is listed under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) thereby completely prohibiting the international trade of snow leopards and their body parts. In Nepal, they are given full protection under the National Parks and Wildlife Conservation Act 1973 (Fifth Amendment; GoN 2017) and the penalties for crime related to snow leopard range from USD 5000 to USD 10000 or 5 or 15 years in prison or both (GoN 2017). The Act has also established 'whistle-blower' regulations and there is a provision of USD 500 paid for information that leads to the conviction of an offender.

PART A: Situation Analyses

4 Climate change information

The Eastern Himalaya is regarded as one of the most at risk landscapes to the impacts of climate change (Eriksson et al. 2009; Xu et al. 2009; Shrestha et al. 2012; Dey et al. 2017; Uprety et al. 2017). Climate vulnerability assessments carried out in EHL/N (Sharma et al. 2009; SCAPES 2011; Smith 2014) suggest that the region is experiencing unusual changes in local biodiversity (e.g. changes in species structure and composition, plant phenology, invasive species, etc.), ecosystem processes (plant and animal migration, hydrological cycle, animal disease, etc.), and people's livelihoods (cropping patterns, human migration, loss of agricultural and livestock productivity, etc.). These perturbations will profoundly affect the ability to conserve snow leopards and their habitats on which they depend (Farrington & Juan 2016). Therefore, understanding the elements of climate change that affect the snow leopard's ecosystem is critical to develop an effective conservation strategy for the EHL/N.

A climate risk analysis was carried out by the Centre for Climate Systems Research (CCSR) of Columbia University in collaboration with USAID funded WWF's Asia High Mountains Project, as a part of the management planning process (Peters et al. 2017). In doing so, annual and monthly temperature and precipitation were assessed to determine likely future climate change, depending on emissions scenarios. The latter was analyzed for two time periods, 1) the near-term (consisting of the time period from 2011-2040), and 2) mid-century (consisting of the time period from 2041-2070). Baseline estimates were derived using modeled climate data ranging from 1980 to 2005. Key findings are presented in the following sections:

4.1. Predicted change in temperature

With increase in global warming, the annual mean temperature in the EHL/N is expected to rise by 0.9°C to 1.3°C in the 2011-2040 time frame (near-term), and 1.9°C to 2.6°C in the 2041-2070 time period (mid-century). The greatest projected warming is anticipated during the month of March, when the temperatures in the near-term are expected to rise by 1.2°C to 1.7°C, and by 2.3°C to 3.4°C by mid-century. As for the seasonal pattern of warming, the rate of temperature increase during winter (Dec to Mar) is more rapid compared to summer months (Figure 16).

One of the most conspicuous impact of warmer winters would be the significant decrease in the number of months under frost (Sindorf 2017). Analyses show that the low altitude zones and mountain peaks will lose as many as 2-3 months of frost by the year 2050 (Figure 17). The loss of frost months would occur during late winter and spring seasons (March-May), thereby preponing the onset of spring season from May to April (Sindorf 2017).

Figure 16 Projected range (low to high estimate) in annual and monthly temperature increase (°C) in EHL/N by mid-century in reference to the 1980-2005 baseline (See Peters et al. 2017)
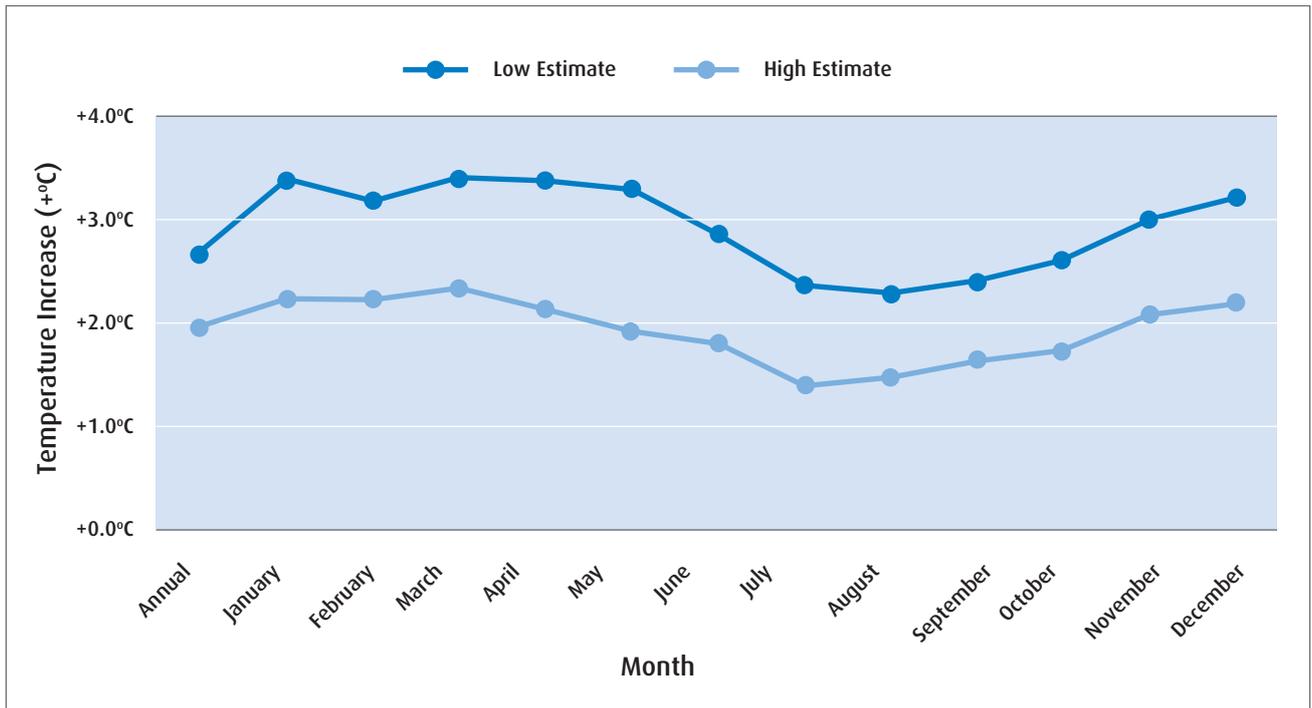
Figure 17 Projected loss of number of months under frost across the EHL/N sub basin (Sindorf 2017)
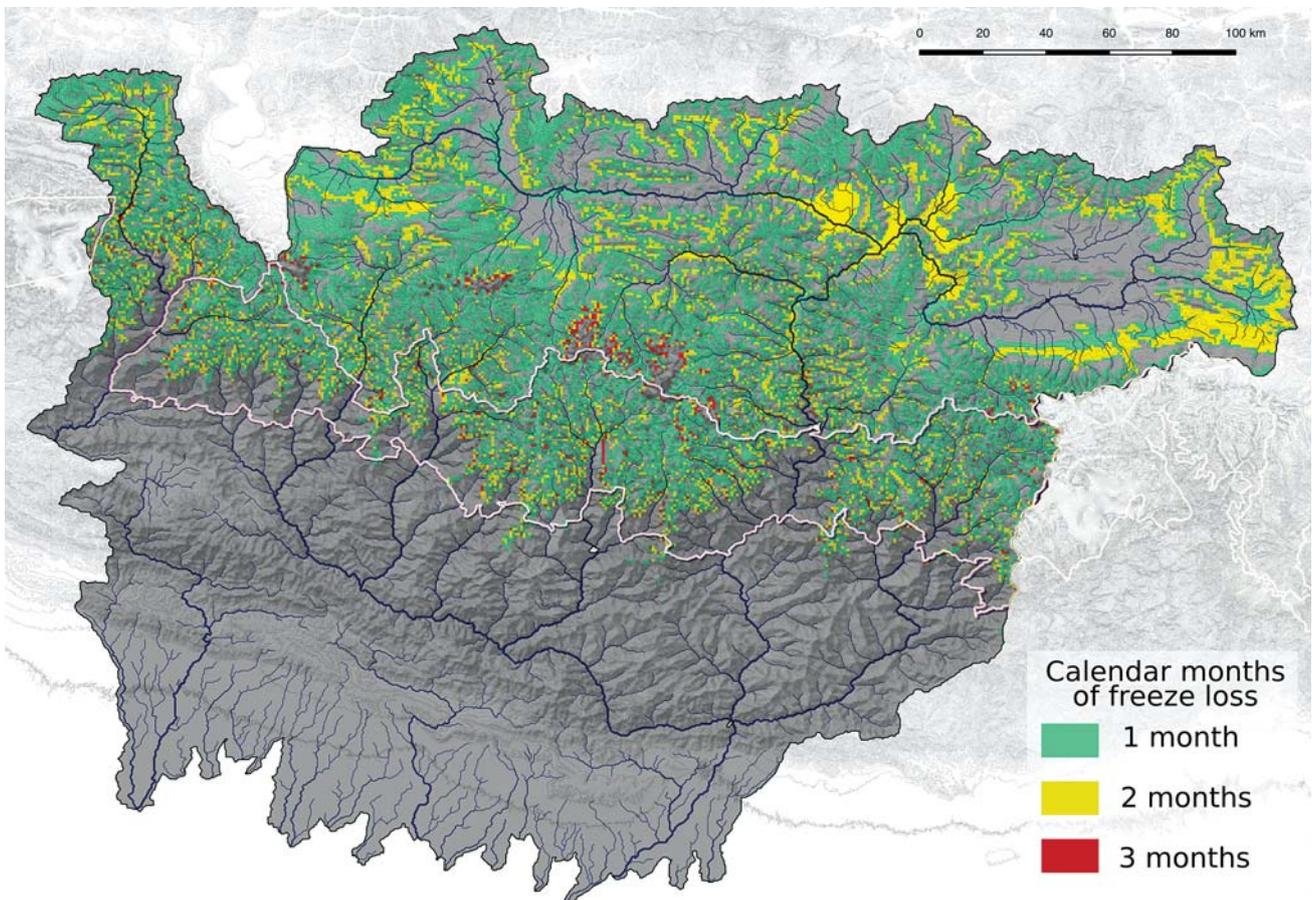
4.2. Predicted change in precipitation

Global warming is projected to increase the annual precipitation by 1% to 16% in the near-term and by 12% to 27% in mid-century with respect to annual baseline mean (Peters et al. 2017). The monsoon season, particularly from May through September, is expected to become wetter than now where the projected direction of rainfall change is almost entirely positive (Figure 18). For example, rainfall in May in the near-term is expected to increase 4% to 39%. By mid-century, the increase could be as great as 48% above the baseline average May rainfall. As the monsoon season progresses, rainfall is also projected to increase in June (up to 34%), July (up to 32%), August (up to 37%), and September (up to 37%) through mid-century. In a region already significantly affected by heavy monsoon rains, these increases would likely lead to a substantial increase in hazards like landslides and flooding, especially in downstream areas that collect the substantial flows of these tributaries.

Months receiving the least amount of precipitation, notably November through January, are about equally likely to receive some amount of precipitation in the future. However, because the total precipitation in these months is already so low in comparison with other months (for example, 2 mm baseline average in December, in contrast with 361 mm in July) the absolute changes in rainfall can be negligible.

4.3. Impact of climate change on snow leopards, their ecosystem and human well-being

The impacts of climate change are an unavoidable threat to snow leopards, their prey and habitats. Analyses of climate models indicate that EHL/N is trending towards wetter and warmer conditions, with temperatures increasing by as much as 2.6 degree Celsius and precipitation by 1% to 26% in the coming decades (Peters et al. 2017). A pronounced increase in monsoon precipitation coupled by shorter winters and the early start of the spring season is the more likely climate scenario by mid-century. Ecosystem responses to this scenario are expected to be complex as dictated by the extreme topographic complexity of landscape. In general, the impact of warmer and wetter conditions on the snow leopard's habitat and ecosystem will be reflected through cascading effects on the local hydrology, biological processes, and people's livelihood (Figure 19, see details in Annex III). Based on the analyses carried out for this management plan, the nature and outcome of predicted impacts are discussed below.

4.3.1. Impact on hydrological processes

Increasing frequency of high intensity monsoon precipitation results in an upsurge in local runoff, adding more water into the already saturated local hydrological system. Warming, particularly during the month of March

Figure 18 Projected range (low to high estimate) in annual and monthly precipitation change (%) in EHL/N by mid-century in reference to the 1980-2005 baseline. Source: Peters et al. (2017)
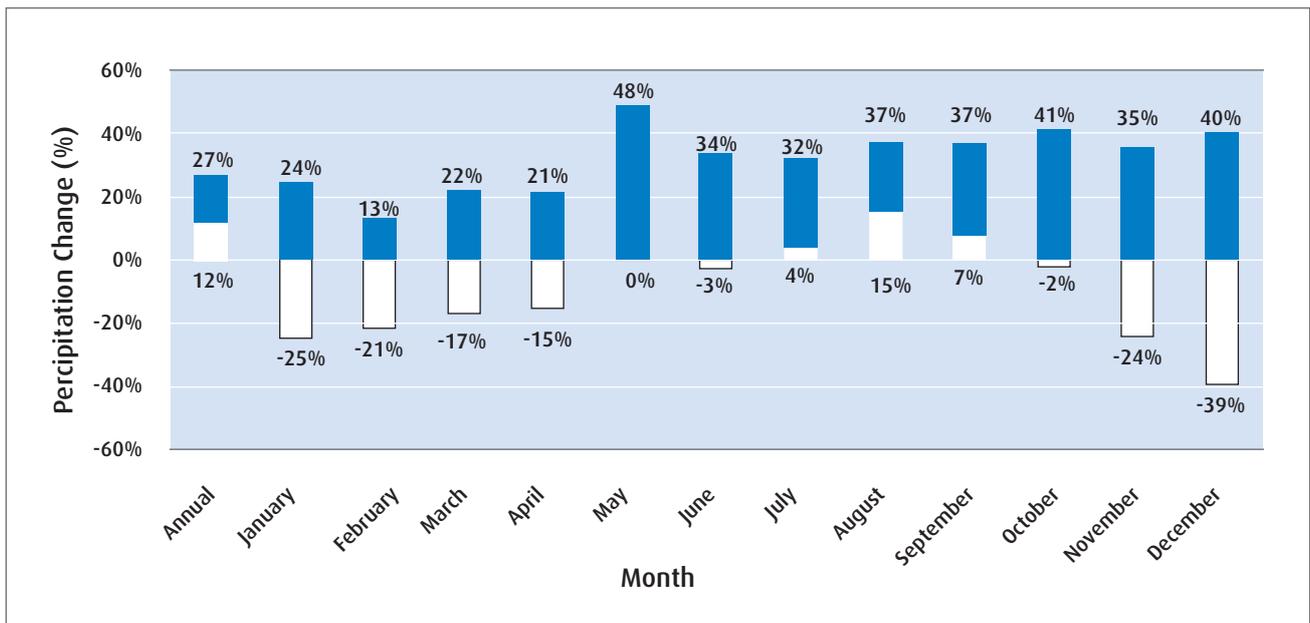
Figure 19 A conceptual model showing the impacts of climate change on snow leopard's population, habitat and ecosystem in the EHL/N. See Annex III for a full illustration.
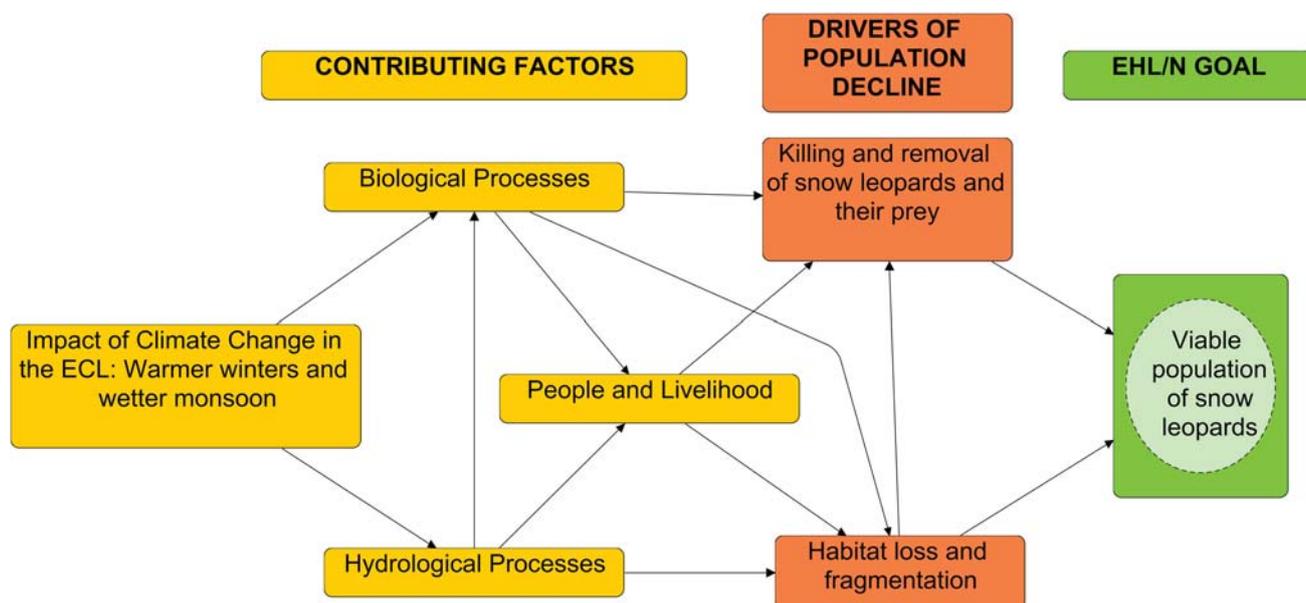
will cause early and rapid melting of snow cover, glaciers and permafrost. Analyses show a marked increase in the surface area covered by water over the period between 1984-2015 in the prime snow leopard habitats, i.e., altitudinal range of 4,000m to 5,500m (Sindorf 2017, Figure 20). These shifts indicate an increased risk of flash floods, landslides and Landslide Lake Outburst Floods (LLOFs) and Glacier Lake Outburst Floods (GLOFs), and can also trigger irreversible changes to the larger hydrology and ecology of the alpine systems, affecting snow leopards, their prey, and herding communities.

Climate vulnerability analyses carried out in the EHL/N corroborate these projections, with local communities reporting significant changes in temperature and precipitation (rain, snow, hailstorm, etc.) patterns, resulting in forest fires, floods, landslides and drought in the region (SCAPES 2011; Smith 2014). It is, therefore, highly pertinent to focus on adaptive management by regular monitoring of climatic patterns and their impacts as an integral component of the climate-integrated landscape management plan.

4.3.2. Impact on snow leopard's ecosystem
Increases in temperature, precipitation and subsequent changes in local water budgets will have the greatest impact on alpine ecosystems: the range shifts of plants, animals and biomes, altered timing of life events such as plant flowering and animal migration, changes in predator-prey interactions, and resource competition, leading to species displacement and local extinctions.

The spring season is regarded as the most crucial period for ecosystems characterized by seasonal environments. For snow leopards, spring is important as the mating season. The early onset of spring is likely to affect the fecundity and the reproductive success of snow leopards through its effect on the relative timing of food requirement and food availability across the food chain. In addition, the shift in freeze line, snow cover, and changes in surface water dynamics in and around prime snow leopard habitats will have profound effects on snow leopard's ecosystem. Among others, the upslope movement in treeline has been reported to be one of the most distinct impacts of global warming in the snow leopard's range (Gaire et al. 2012, 2014; Schickhoff et al. 2015). The analyses carried out for this management plan indicate that about 58% of snow leopard habitat would be lost in the EHL/N due to the upward shift of treeline under the IPCC's high emission scenario (A2 Scenario; Forrest et al. 2017; Figure 21; IPCC 2007). The projected change in snow leopard habitat due to climate induced tree-line shift in the EHL/N (Figure 21) illustrate a gradient in vulnerability from southeast to northwest and from low elevations to high, with habitats in the southeast and lowest elevations as most vulnerable to tree-line shift. Because of this, the snow leopard habitat in the EHL/N is predicted to compress to the north, west and upslope within its current distributional range and increased severity on the eastern part of the landscape (Figure 21). Our analyses also indicate an extended dry season in the EHL/N, which would possibly reduce primary productivity, thereby contributing to the decline in snow leopard's prey base.

Figure 20 Observed change in surface water area between 1984 and 2015 in EHL/N. The inset shows the distribution of land area across the altitudinal zones (Sindorf 2017).
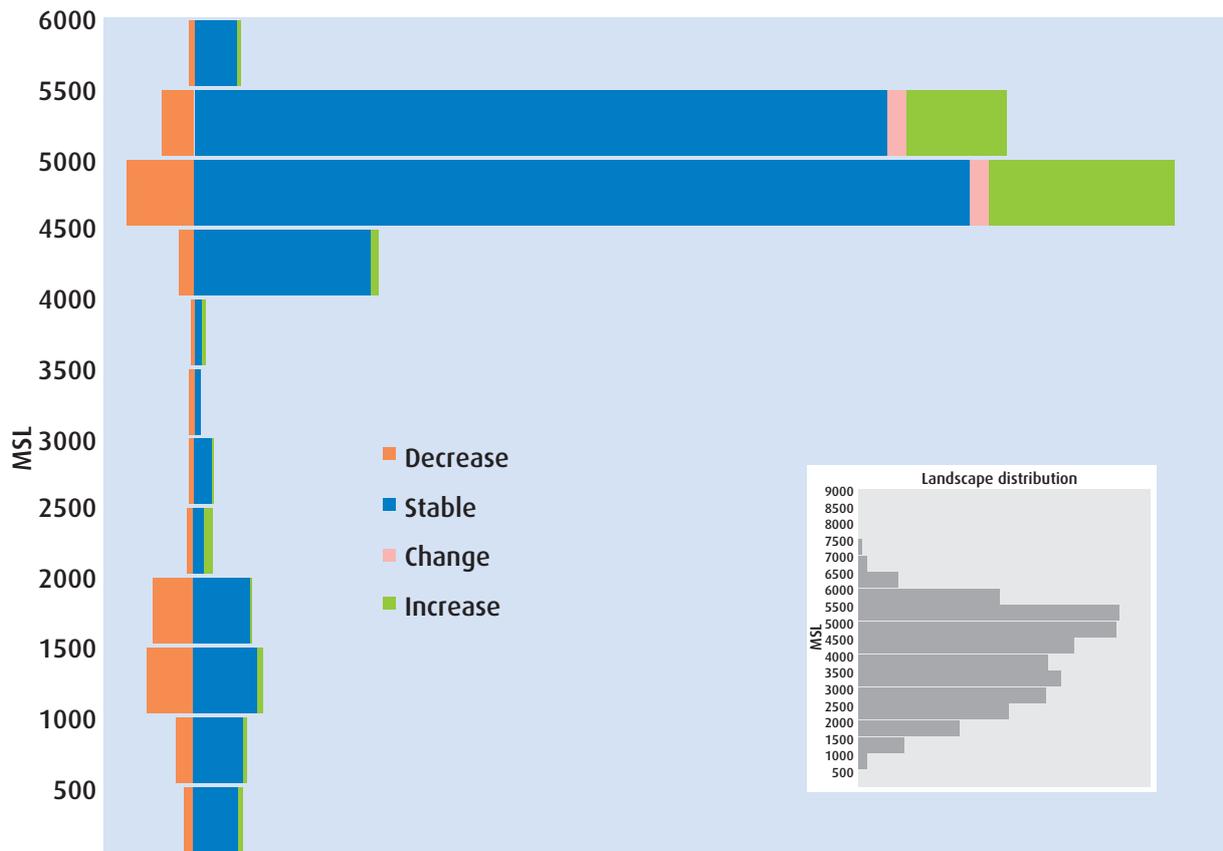
Figure 21 Predicted change in snow leopard habitats due to the shift in treeline under 3 different IPCC emission scenarios; high (A2), moderate (A1B) and low (B1) (Forrest et al. 2017).
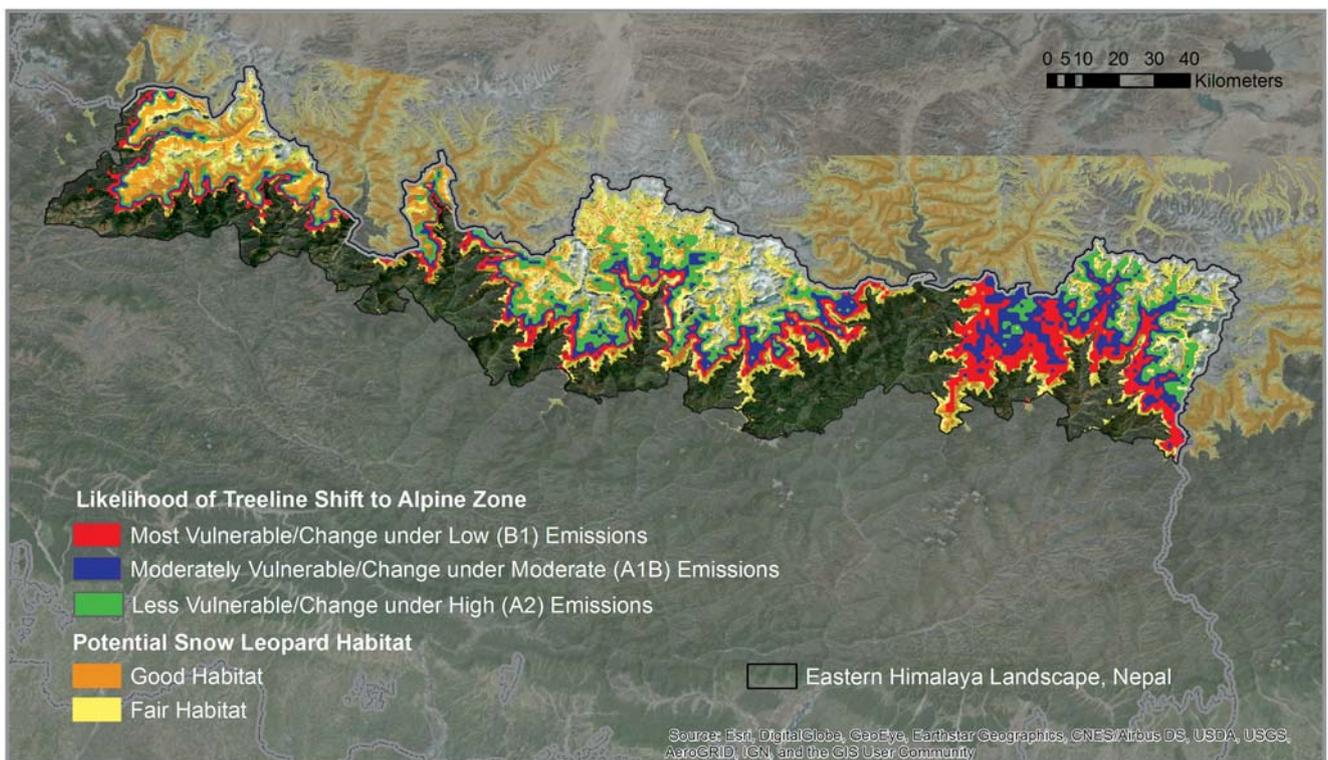
Additionally, there is also a possibility of habitat colonization by other predators, such as common leopards, as the shift in tree-line facilitate their movement upslope (Lovari et al. 2013). Snow leopard range in the EHL/N is otherwise known to be a relatively simple system with a single predator structuring the ecosystem. The colonization by similar sized predators might lead to the displacement of snow leopards from their preferred range as they compete for resources with other predators.

4.3.3 Impact on people's livelihood

The lives and livelihoods of people together with local and national economic investments in the Himalaya are strongly dependent on ecosystem services, especially on sustained and naturally regulated provision of water (Eriksson et al. 2009). A clean environment that minimizes diseases, ecosystems that support pollination of crops and provide forest products are some other ecosystem services that are vital for communities in the EHL. The effect of climate change will adversely affect the flow of these ecological services by disrupting the functional integrity of biological communities and ecosystem processes. The loss or degradation of these natural capital based benefits can have serious repercussions for human well-being and economic and social stability

(Ehrlich et al. 2012). Poverty stricken regions like EHL/N will be disproportionally affected as the local people here are the least capable of adaptation, and are at the highest risk of climate induced suffering (Smith 2014). These communities comprise subsistence agro-pastoralist people who rely on consistent weather patterns for cropping, and on the distribution and phenology of plant species for grazing livestock.

In the EHL/N, the most noticeable changes currently being observed by the local people include the shift in harvesting season of major crops like maize and potato; crop decay due to excessive rainfall especially during the late summer; emergence of new types of livestock and crop diseases (*Maruwa, Daduwa Chhirke/Furke*, etc.); and drying up of springs. In addition, increased intensity and frequency of floods often accompanied by massive landslides are causing substantial damage to rural infrastructures such as roads, bridges, and hydroelectricity plants. Crop raiding by black bear and wild boar is also increasingly becoming a wide spread concern. These effects have manifested into the decline in agricultural productivity which is putting the local food security at a heightened risk (SCAPES 2011).

5 Conservation threats to snow leopard

The impact of climate change on local ecosystem and people's livelihood is expected to exacerbate ongoing anthropogenic threats to snow leopards in the region (see Appendix III). For example, the climate induced livelihood insecurity in the region may lead to upsurge in poaching of snow leopard and their prey. Also, the warmer and wetter climate will potentially trigger human encroachment of snow leopard habitats as they become suitable for crop cultivation.

Understanding how climate change affects the snow leopard's biological requirement is critical to develop climate smart conservation strategies. In this context, the linkages between climatic and anthropogenic threats contributing to the drivers of their population decline were assessed through expert consultations and review of literature during the management planning process (Appendix III, Figure 19). Killing/removal of snow leopards and their prey, and habitat loss/fragmentation are recognized as the key drivers of snow leopard's population decline. Twelve threats are identified which are directly related to these two key drivers (Table 7, Appendix III). The section below explains the linkages between key drivers, direct threats and the contributing factors in the context of the EHL/N.

5.1. Killing and removal of snow leopards and their prey

Blue sheep and Himalayan tahr are the two primary natural prey of snow leopards in the EHL/N. Studies undertaken in KCA reveal that blue sheep population is stable or increasing (WWF 2010), though a more recent assessment is needed. The population of Himalayan tahr in SNP, on the other hand, is reported to be decreasing. The decline in prey not only makes it difficult for snow leopards to survive and reproduce

but also intensifies the possibility of human-snow leopard conflict as snow leopards turn to domestic livestock for food (Wegge et al. 2012).

The primary reasons for prey population decline are poaching, overgrazing, disease, human harassment and persecution. Increasing herds of the domestic livestock can also displace snow leopards' principal prey from their preferred range as they are known to be competitively superior over their wild counterparts (Mishra et al. 2004). Unregulated harvesting of NTFPs, such as Yartsa Gumbu (caterpillar fungus) is also a significant conservation issue, as its collection season coincides with the breeding season of blue sheep.

Poaching for illegal trade of snow leopards in Nepal is reported as one of the most critical issues (Nowell et al. 2016). One of the primary contributing factors to poaching is the rapid growth of illegal wildlife market centres close to the international border such as Tatopani in the eastern part of EHL/N. Such illicit activities are expected to increase in the days ahead with the opening up of new trade routes along the Nepal/China border at Lamabagar (Dolakha), Kimathanka (Sankhuwasabha) and Olangchungola (Taplejung) (DNPWC 2017). Another reason for increased poaching is unregulated harvesting of NTFP, particularly the Yartsa Gumbu as the collectors often resort to killing snow leopards and their prey during their harvesting trips (Shahi 2012).

Retaliatory killing is also another key factor contributing to the decline in snow leopard population in Nepal. The most recent report on snow leopard poaching and illegal wildlife trade suggests that 75% of known poaching cases are due to the retaliatory killing of snow leopards in Nepal (Nowell et al. 2016). Weak community participation, ineffective relief mechanisms

and poor animal husbandry practices are considered as the contributing factors leading to the retaliatory killing.

5.2. Habitat loss and fragmentation

As a wide-ranging species, snow leopards require large space to roam. Extensive home ranges of the snow leopards in the KCA (spreading up to 2,600 km²) imply that any loss and fragmentation of their habitats would isolate populations to insular habitat pockets, threatening their survival. Human activities such as excessive grazing and the encroachment of habitats are the two key issues leading to the loss and fragmentation of habitats in the EHL/N. Although the herders have been using the alpine grasslands to graze livestock for centuries, the herd sizes of livestock have increased over the years and thus, degraded the sensitive and fragile alpine grasslands (Singh 2008). Moreover, the traditional practice of transhumance herding pattern is increasingly becoming sedentary, which not only depletes the rangelands but also gives rise to permanent dwelling structures causing encroachment of habitats. Together with this, unplanned development of roads, dams and tourism infrastructures such as hotels/camp sites, etc. in prime snow leopard habitats will further disrupt their normal movement and ranging behavior.

The analyses of human foot print (i.e., potential degradation and human influence) in snow leopard habitats in the EHL/N revealed that about 16% of land area have medium to high human foot print scores (Table 6, Forrest et al. 2017) and they are mostly located in the middle and western part of the landscape (Figure 22).

Table 6 Potential degradation of snow leopard habitats due to human disturbance in the EHL/N (see Forrest et al. 2017 for details)

Human foot print scores*	Area (km²)	Percent Area
Low (<= 4)	4880.4	83.8%
Medium (5-12)	813.6	14%
High (>12)	133.1	2.3%

*Scores <4, 5-12, and >12 represent low, moderate and high human foot print, respectively.

Figure 22 Potential degradation and human influence in snow leopard habitats. Source: Forrest et al. (2017).
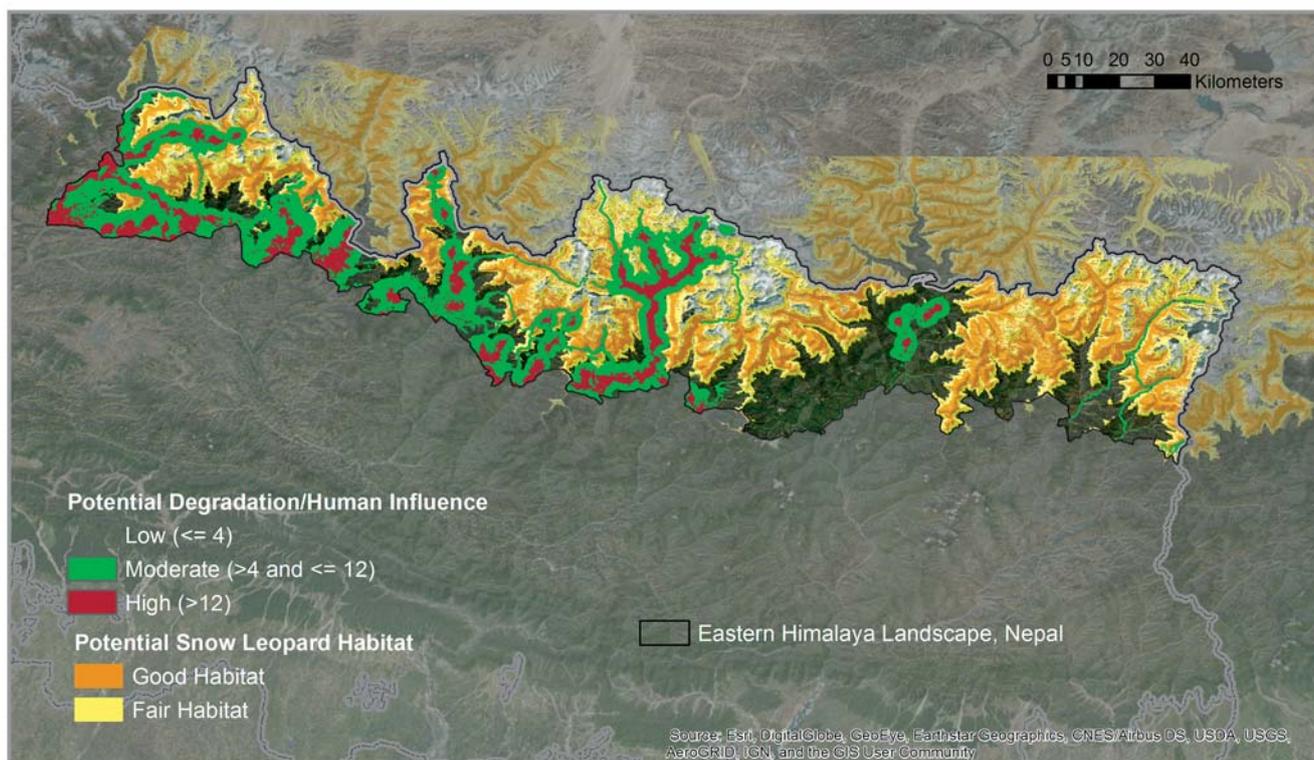
5.3. Threats analyses

In order to determine where and how to focus efforts to achieve the best conservation outcomes, direct threats were systematically ranked following the Open Standards Approach (CMP 2013). As such, the following three criteria were used to evaluate the threats to snow leopard, their prey base and habitat.

Scope: Defined spatially as the proportion of snow leopard or their prey population that can be affected by the threat within 10 years given the continuation of current circumstances and trends.

Severity: Within the scope, the level of damage to the snow leopard (or prey) population from the threat that can be expected given the continuation of current circumstances and trends.

Irreversibility: The degree to which the effects of a threat can be reversed and the snow leopard (or prey) restored.

Of all the threats, poaching of snow leopards was ranked high, and other threats were ranked medium and low (Table 7). In general, the overall threat rating for EHL/N is medium which implies that the threats are expected to moderately affect the snow leopard populations with potential to eliminate or reduce their population by 11% to 30% within 10 years or three generations. Thus, it should be possible to reverse the effects of these threats and snow leopard populations can be restored with a reasonable commitment of resources within 6-20 years given that impacts of climate change remain under the threshold. This scenario offers a great deal of promise for the population recovery of snow leopards in the EHL/N, if we continue and/or scale-up climate adaptation and snow leopard conservation efforts in the EHL/N.

Table 7 Ranking of threats to snow leopard's survival in the EHL/N (Source: SLEMP workshop 2017)

Threats	Snow Leopard	Prey base	Habitat	Summary Threat Rating
Poaching	High	Medium		Medium
Natural hazards (Landslides, avalanche, GLOF)	Medium	Medium	Medium	Medium
Human disturbance	Low	Medium	Low	Low
Diseases	Low	Low		Low
Livestock grazing			Low	Low
Large/Mega infrastructures			Medium	Low
Retaliatory killing	Medium	Low		Low
Invasive species			Low	Low
Forest/pasture burning		Low	Low	Low
Feral dogs	Low	Low		Low
Introduced or exotic species			Low	Low
Co-predators/competition	Low	Medium		Low
Overall Threat Rating				Medium

6 Integrated spatial scoping and critical conservation sites in the EHL/N

To integrate all the information on ecology and conservation of snow leopards, anthropogenic threats and climatic impacts, and thus to prioritize conservation efforts and facilitate resource allocation toward the most critical areas of the EHL/N, a desktop spatial scoping analysis was done in GIS. By inputting several data layers, a snow leopard conservation significance was spatially compared against the actual and potential impacts of human footprint and climate change across the landscape. Data for conservation significance comprised habitat suitability, potential corridors, and movement costs for snow leopards. Likewise, actual and potential impacts included tree-line shift, number of freeze-months loss, and human footprint (Forrest et al., 2017). The spatial map thus produced, indicated that the most of the northern part of the landscape, except Arun valley had higher snow leopard conservation significance with low to medium level of actual and potential impacts (Figure 23). This compares closely with the results of the threat analyses that was obtained through expert opinion (Table 7).

Based on the Protected Area coverage, size and configuration of habitat patches, ease of snow leopard's movement (permeability) and the visual interpretation of the spatial scoping map, 11 critical conservation sites were identified across the four habitat complexes in the EHL/N (Figure 23). The characteristics features of habitat complexes and the critical conservation sites are explained in the following section. A more detailed illustration of the critical sites is given in the Annex IV.

6.1. Langtang Complex

Except for the southern and eastern regions, majority of the sites in the Langtang complex had medium to high level of snow leopard conservation significance. Four critical conservation sites; Rasuwagadi (N28.1947^o, E85.3368^o), Langtang (N28.2015^o, E85.5489^o), Gosaikunda (N28.0548^o, E85.4514^o) and Balephi Khola (N28.0828^o, E85.7996^o) were identified in this habitat complex. The Rasuwagadi critical conservation site had a very high degree of human foot print and hence posed a significant threat to snow leopards from poaching as well as a potential market centre for illegal trade. The Gosaikunda and Langtang conservation sites represent a good snow leopard habitats but with a higher potential for habitat degradation due to human activities, such as livestock grazing, tourism, linear infrastructure development etc. The Balephi Khola conservation site, on the other hand, had a moderate level of human foot print and is expected to play an important role to maintain the habitat connectivity between GCA and LNP.

6.2. Gaurishankar Complex

The Northern regions of the Gaurishankar complex had a higher conservation significance but also had a higher degree of threat due to human activities. This is especially obvious in the Lapchi critical conservation site (N28.0865^o, E85.7996^o), which is located along the international border between Nepal and China and therefore constitute an important transboundary habitat and yet the ongoing infrastructural development activities in and around this site could be detrimental for snow leopards.

6.3. Sagarmatha Complex

In the Sagarmatha Complex, three critical conservation sites were identified; upper Dudhkoshi (N27.8962^o, E86.7536^o), Saharsha Beni (N27.6838^o, E86.5951^o), and Hinku Dranka (N27.6346^o, E86.7711^o). The former is situated along one

of the most popular trekking destinations of Nepal. Hence, there is a high potential for habitat degradation and wildlife poaching around the trekking route. The other two critical conservation sites, Saharsa Beni and Hinku Dranka have generally low human foot print scores but currently located outside of the Protected Areas system. Both the sites provide highly conducive habitats to maintain the habitat contiguity between GCA and MBNP (Forrest et al. 2017).

6.4. Kangchenjunga Complex

The Kangchenjunga Complex had the lowest human foot print among the other three habitat complexes. The climate analyses, however indicated that the snow leopard habitats here would be hardest hit by the climate change thereby potentially isolating snow leopard populations and compromising their demography, including ecological and genetic viability.

Three critical conservation sites are located in this complex; Arun (N27.6912°, E87.5685°), Gumsa (N27.6594°, E87.9295°),

and Tseram (N27.5671°, E87.9692°). The former is currently located outside the Protected Areas system despite being intensively used by snow leopards as per the preliminary analyses of the satellite telemetry data. In addition, human foot print is generally low and the snow leopard habitats here are vital to maintain the connectivity across the eastern snow leopard range. Gumsa and Tseram are the other two critical conservation sites, which are located along the Kangchenjunga trekking route with a medium level of human foot print. It is likely that these sites will witness a substantial anthropogenic pressure following the development of road network and tourism infrastructures in the region.

In general, the three critical conservation sites of the Kangchenjunga complex represent a snow leopard habitat complex with relatively higher conservation importance, indicating it should be prioritized both for climate resilience and a high return on conservation investment due to lower human footprint.

Figure 23 Climate-integrated spatial scoping map for the EHL/N. The map is developed by combining multiple spatial layers belonging to: 1) Conservation significance, for e.g. habitat suitability, potential corridors, and movement costs for snow leopards; and 2) Actual and Potential disturbance, for e.g., tree-line shift, number of freeze-months loss, and human footprint. Source: Forrest et al. (2017).

PART B: Management

The Eastern Himalaya Landscape of Nepal (EHL/N) is an exceptional landscape that houses the world's tallest mountain and a World Heritage Site, Ramsar sites, Important Bird Areas (IBAs), Global 200 ecoregions, water towers and repositories of globally important biodiversity. The landscape provides ecosystem services critical for lives and livelihoods of hundreds of millions of people downstream. The snow leopards are the top predators of EHL/N and hence play a pivotal role in maintaining the ecological integrity of the region. The health of snow leopard populations in the EHL/N are a strong indicator of the health of the surrounding ecosystem and its ability to provide services to the hundreds of thousands within its borders and millions downstream. In addition, their habitats provide a critical linkage to maintain landscape connectivity throughout the Himalayas.

The EHL/N is also one of the most vulnerable and perilous regions on Earth due to climate change (Eriksson et al. 2009; Sharma et al. 2009; Shrestha et al. 2012; Sindorf et al. 2014). In keeping pace with global warming, the climate here is projected to be wetter and warmer, especially in the winter and monsoon months, thereby triggering significant changes to local hydrology and biological processes, and profoundly affecting the lives and livelihoods of people who rely very directly on the climate and the land.

Apart from climatic and anthropogenic changes, Nepal is currently undergoing a political transformation in accordance with the 2015 Constitution. As such, this management plan will have to cater to substantial shifts in the present system of governance in the country. It therefore focuses on adaptive strategies to cope with changing economic, social, political and climatic conditions, while maintaining the essence of the vision and goal for the EHL/N.

1 Vision

"The Eastern Himalaya Landscape supports viable populations of snow leopards and a sustained flow of ecosystem services, ensuring the present and future well-being of local people inhabiting in and around the snow leopard habitats"

2 Goal

"Metapopulation of the snow leopard consisting of at least 100 breeding age individuals and their ecosystem are conserved, climate resilience is enhanced, and local livelihoods are improved"

A target viability table below illustrates the overarching goal (Table 8).

Table 8 Snow leopard viability rating table (Format adapted from WWF 2012)

Component	Indicator	Current State (2010)	Current Rating*	Desired State (2027)	Notes
Total Population of Snow Leopards	Number of individuals	39	Good	100	Population data obtained from DNPWC (2012)
Extent of Habitats	Area	5773 km²	Very good	5773 km²	Based on Maxent Analyses (Forrest et al. 2017)
Total Population of Prey Base	Density of individuals (individuals per km²)	4	Fair	8	Population data from SNP (Lovari & Mishra 2016) and KCA (WWF 2010)

*Note: The rating explanations are as follows; Very good = requires little intervention to maintain, Good = some intervention required to maintain, Fair = requires considerable human intervention to maintain.

3 Strategies

EHL/N management strategies were developed by focusing on those actions that would mitigate the most critical threats to snow leopards in the EHL/N. In doing so, rigorous science was used, including the information from the climate-integrated spatial scoping exercise as well as expert consultations, and review of existing national policies and plans. The following eight strategies are thus devised to contribute to achieving the EHL/N vision and goal.

1. Landuse planning and habitat management
2. Mitigating human-snow leopard conflict
3. Improving people's livelihoods
4. Strengthening institutions and engaging local communities
5. Strengthening law enforcement
6. Climate adaptation
7. Enhancing knowledge on snow leopard's ecosystem
8. International cooperation

The following sections provide rationale and theories of change for each strategy to illustrate the associated threats and the mechanism for how the strategy works in practice. Outputs are planned for two time periods, including short term (2017-2021) and long term (2022 -2026), and the activities are pulled together to contribute to the expected outputs. A detailed log frame is provided in Annex V.

3.1. Land use planning and habitat management

Rationale

The large spatial requirement of snow leopards and ongoing anthropogenic and climatic threats to their habitat highlight the need for a judicious landuse planning and habitat management across the EHL/N. Spatial analyses conducted for this plan indicate that anthropogenic pressures such as linear infrastructure development, hydropower development, unregulated tourism and animal husbandry practices are anticipated to bring about 16% of total snow leopard habitats under moderate to high level of risk of degradation. These threats are expected to exacerbate as warmer and wetter conditions allow humans to settle in and around snow leopard habitats. In addition, climate vulnerability assessment of snow leopard habitats predicts that as much as 58% could be lost due to upslope movement of tree-line into the alpine grasslands. Such habitat loss and fragmentation can isolate snow leopard populations in small spaces, compromising the ecological, genetic, and demographic viability of this species that lives at low densities and requires vast spaces.

Apart from addressing the spatial needs, managing snow leopard habitats by restoring prey population is also equally important to ensure the population persistence of snow leopards (Sandom et al. 2017). The declining prey population particularly in the SNP is a crucial management concern (Lovari et al. 2009). The active management of prey base is thus urgently required in SNP and other prey deficient sites within the EHL/N.

The impact of climate change on the local hydrological system also depicts a scenario of heightened natural hazards such as the GLOF, LLOF, landslides and drought. Proactive land use planning is required not only to conserve snow leopard populations but also to maintain ecosystem processes, functions and services.

Theory of change

Managing wide-ranging landscape species' such as the snow leopard as a meta-population is one of the most viable solutions to secure the long-term persistence of their population. To do so, a fundamental requirement is the

identification of critical habitats and biological corridors by taking into account both climatic and anthropogenic threats. A spatial analysis carried out as a part of the management planning process revealed 14 potential corridors and 11 critical sites nested within the four habitat complexes. Effective management of these sites as well as restoring prey base in currently prey deficient habitats are necessary to secure snow leopard populations now and in the future. Considering the potential impact of climate change on the snow leopard range, and following the results of the spatial scoping exercise carried out for this management plan, it will be necessary to focus long term efforts on high conservation value sites such as climate refugia and, relatively undisturbed sites in the north-western part of the landscape while also managing human impacts on the critical sites and movement corridors across the landscape. In this regard, a comprehensive landscape vision map should be developed for each habitat complexes by highlighting the conservation value, economic development and the climate adaptation with respect to the national regulations pertaining to wildlife conservation, forest regulation and water policy. Integrated management of the drivers of local fresh water system such as the snow melt, run off, and permafrost are also equally important for securing local livelihoods and ecosystem integrity.

Expected outputs
Short term (2017-2021)
- 14 habitat corridors and 11 critical sites identified in this plan are field verified
- Climate refugia (sites) identified and protected
- Climate adapted grazing system and pasture management promoted in 30 sites
- Feasibility for snow leopard's prey population reintroduction evaluated
- The status of the high-altitude wetlands and peatlands assessed and conserved

Long term (2022–2026)
- A climate-integrated landscape vision map prepared for each of the four habitat complexes
- Snow leopard's prey population reintroduced in prey deficit areas

Activities
- Field verification of potential corridors and critical conservation sites
- Identification and protection of climate refugia through further research and monitoring
- Promotion of traditional rotational grazing management systems, in conjunction with climate science, to help transhumance herders adapt to climate change impacts
- Undertake climate smart management of pasture lands and local fresh water systems

- Prepare and implement a science-based workplan for snow leopard prey population restoration in SNP and LNP
- Prepare a climate integrated landscape vision map for habitat complexes identified in this management plan by highlighting the conservation value, economic development and the climate adaptation in the critical conservation sites and potential corridors.
- Update Protected Area management plans in consistent with the landscape vision map
- Undertake habitat management activities including improving access to pasture lands (trails, bridges etc.), water holes and conservation pond development, fire management and controlled burning, etc.

3.2. Mitigating human-snow leopard conflict
Rationale
The conflict between humans and snow leopard represents the most widespread and complex challenge currently affecting snow leopard conservation initiatives across the snow leopard range. The combination of high food requirements and wide-ranging behavior of snow leopards often bring them into conflict with humans as snow leopards feed on livestock. A recent TRAFFIC report suggests that 75% of known poaching cases are due to the retaliatory killing of snow leopards in Nepal (Nowell et al. 2016). In addition, the main prey of snow leopard, such as blue sheep and Himalayan tahr are often physically harassed by local people as crop raiders and competitors to their livestock. The lack of wild prey often forces snow leopard to prey on domestic livestock, increasing the conflict with herders (Bagchi et al. 2004). The overstocking of unproductive livestock and the habitat colonization by co-predators such as wolf and common leopards are also contributing to increased conflicts between human and wildlife. Without mitigating human-snow leopard conflict, there will be further impoverishment of the poor, reduced local support for conservation, and increased vulnerability of snow leopard populations.

Theory of change
To create a landscape where local people and snow leopards can coexist, the conservation managers are required to shift their conventional policy from that of managing wildlife populations to enhancing their societal values. In this regard, snow leopard based livelihood improvement programs such as promotion of eco-tourism together with the agro-biodiversity enterprises (for e.g., essential oil from *Rhododendron* and *Juniper spp.*, jam and juice from *Hippophae sp.*, cultivation of spices such as *Allium wallichii*, *Elettaria cardamomum*, etc.) are considered best practices. In Nepal, community-based livestock insurance schemes for loss of livestock have proven to be a promising tool in increasing the local people's tolerance to damage inflicted by snow leopards (Gurung et al. 2011). The conventional conflict mitigation techniques, including improvement of traditional

corrals, effective guarding system, and engagement of local religious leaders, have also proven to be effective in reducing human-snow leopard conflict. In the long term, however, a recently developed technique the "Safe Systems Approach" (see Brooks 2015 for details) can be adopted. The "Safe Systems Approach" is a holistic and innovative technique originally developed to address the human-tiger conflict situation. It integrates both preventive and curative human-wildlife conflict mitigation measures to contribute to the following five strategic outcomes: safe person, safe wildlife, safe assets, safe habitat, and effective monitoring and evaluation.

Expected outputs
Short term (2017-2021)
- Existing livestock insurance schemes and relief mechanism up-scaled and new schemes launched
- Local leaders (elected, religious and social) are engaged in snow leopard conservation initiatives

Long term (2022 – 2026)
- Efficient animal husbandry practices developed and implemented
- Best practices such as the 'Safe Systems Approach' adopted from the snow leopard range countries

Activities
- Review, update and simplify existing relief guidelines and community-based livestock insurance schemes
- Launch the community based livestock insurance schemes in three Protected Areas
- Capacitate herders for the efficient management of livestock herds including improved guarding, supplementary feeding, and improved veterinary services
- Adopt 'Safe Systems Approach' (Brooks 2015) for snow leopards
- Apply innovative deterrents such as predator-proof corrals, colour changing lights
- Train, sensitize and engage community leaders (including elected and religious leaders) in conservation
- Facilitate rescue and handling of problematic animals
- Provide emergency funds for immediate relief to conflict victims

3.3. Improving people's livelihoods
Rationale
The EHL/N is home to nearly 350,000 people belonging to over 75,000 households. Poverty is widespread with close to 50% of households living below the poverty threshold (World Bank & CBS 2006). Like other mountain regions of Nepal, communities in the EHL/N are also suffering from the emigration of an economically active population, which is adversely affecting the already deficient social and financial

capital of the region. It is thus crucial to address livelihood issues of local people to ensure effective implementation of this plan. In addition, appropriate interventions are also needed to reduce natural disaster risks to communities, specifically in the context of climate change impacts on local hydrological and ecosystem processes. A warmer and wetter climate is predicted to trigger landslides, GLOF, LLOF and the "cloud burst" floods as well as prolonged and intensified drought in the region. These will have serious repercussions on people's lives, livelihoods, and natural ecosystems, and should be addressed through the application of appropriate adaptive strategies that prioritize disaster risk reduction.

Theory of change
This strategy seeks to generate conservation benefits for local communities by promoting innovative and traditional livelihood opportunities based on sustainable resource use, tourism, and green enterprises for economic prosperity, equality and social justice. With rich natural capital and unique cultural heritage across the EHL/N, there is tremendous potential to promote ecotourism, culture-based hospitality, and natural resource based on-farm and off-farm livelihoods. The engagement of the private sector in green enterprise development through good governance practices that ensure gender equality and social inclusion would be pivotal for effective implementation of this strategy. Ongoing efforts to promote the Great Himalaya Trail as the world's longest mountain trekking route provides additional opportunity, as a significant portion of the trekking route passes through the EHL/N.

To address the water deficit during the dry season, the application of indigenous irrigation practices, coupled with ecosystem-friendly engineering techniques, constitute a realistic strategy for climate-smart water management in the region. The diversification of livelihoods has been widely acknowledged as the most effective way of minimizing vulnerability (Smith 2014); so it is important to promote in the region.

Among the strategic actions proposed below, many are already being implemented by various agencies. This management plan will help to build on, streamline and scale up these activities to meet the overall goal of the EHL/N management plan.

Expected outputs
Short term (2017-2021)
- Livelihood diversification promoted in at least 30 households from each Rural/Municipality of the EHL/N
- Climate-smart water management scheme devised and implemented
- Community managed eco-tourism promoted along major trekking routes within EHL/N.

Long term (2022–2026)

▸ 3000 households directly benefitted by NTFP including agro-biodiversity based green enterprises

Activities

▸ Promotion of eco-tourism in 10 major trekking routes in three sites across the landscape
▸ Tourism management plan developed for five potential trekking destinations in the region (Kangchenjunga, Makalu Barun, Pathibhara, Khumjung and Solukhumbu)
▸ Strengthening of NTFP enterprises, including regulating Yartsa Gumbu collection, and promotion of small scale enterprises for handicrafts and other products across critical snow leopard conservation sites
▸ Promotion of livestock product development through increased investment in livestock productivity including dairy production and marketing that reduces unsustainable use of ecosystem services (for e.g., livestock grazing, water and energy consumption, etc.)
▸ Development and application of catchment level climate-smart water management schemes
▸ Provide training on alternative livelihood options to bring about economic diversification and build household and community climate resilience
▸ Arrange soft-loans or micro-credits for poor and marginalized people, including women, to invest in agro-biodiversity based enterprises
▸ Coordinate police and local government for safety of tourists visiting the area
▸ Conduct nature guide training to the local people

3.4. Strengthening institutions and engaging local communities

Rationale

Strong institutions and active engagement of local communities are critical for ensuring good governance, robust planning and implementation of strategic programs and activities. Recent changes in political and administrative structures following the implementation of the new constitution of Nepal, will require restructuring and aligning policies, strategies, and governance mechanisms pertaining to conservation and management of EHL/N. The strengthening of institutional capacities of the relevant institutions at all levels of the government, as well as among communities, is essential for effective execution of this management plan.

Theory of change

This strategy seeks to create an enabling environment to implement the conservation and management interventions. As such, the strategy supports policy reform, strengthening institutional capacities of government bodies and local community-based organizations, such as the Snow Leopard Conservation Committees.

Existing landscape institutions need to be capacitated to ensure good governance and effective intra- and inter-sectoral collaboration at various levels. The landscape institutions include the Landscape Management Coordination Committees at the Department of National Parks and Wildlife Conservation, Protected Area Offices, District Forest Offices, as well as the community-based institutions such as Buffer Zone Management Committees and Conservation Area Management Councils.

Snow leopards live in one of the harshest regions of the planet, so the study, research, and conservation of snow leopards requires motivated, skilled and well-equipped human resources. Engaging local people as citizen scientists by providing necessary training and equipment has proven to be a cost-effective strategy in the KCA, and is worth replicating across the landscape. Moreover, if the trainees comprise ex-hunters, the program would benefit immensely from their knowledge of local biodiversity. In doing so, the conservation managers benefit from valuable information pertaining to ecology and conservation of snow leopards, and increase local community support and stewardship of snow leopards and the management plan.

Expected outputs

Short term (2017-2021)

▸ Relevant institutions at all levels including policy, management, planning and implementation are established and strengthened
▸ Community-based organizations (such as Snow Leopard Conservation Committees) are established in all Rural/ Municipalities across the landscape

Long term (2022–2026)

▸ Elected leaders from each Rural/Municipality receive awareness training on snow leopard conservation and benefit sharing
▸ At least 10 people from each Rural/Municipality are trained as Citizen Scientists
▸ At least 30% of NRM institution members comprise women and indigenous people

Activities

▸ Support institutional set up of the landscape institutions in the MoFSc, DNPWC, DoF, Protected Areas and Rural/ Municipalities
▸ Strengthen Management Information System (MIS) of MoFSC and database management capability of DNPWC, DoF, Protected Areas and Rural/Municipalities
▸ Launch intensive conservation education and awareness campaigns focusing on biodiversity and climate change in the area
▸ Conduct training on natural resource governance and climate change adaptation focusing on women and

indigenous groups, ensuring that it is consistent with the restructuring of the administrative units under the new constitution

- Formation of community-based organizations, and provide orientation on roles and responsibilities
- Train citizen scientists on field techniques to monitor snow leopard, their prey populations and habitat, and climate change impacts
- Develop accreditation system for citizen scientists
- Update Protected Area management plans in line with the national snow leopard and ecosystem conservation strategy, with emphasis on climate change adaptation
- Construct and equip check posts/camping sites inside Protected Areas

3.5. Strengthening law enforcement
Rationale
Weak law enforcement is a key challenge to successful implementation of conservation initiatives in the EHL/N. Because of this, direct threats to snow leopards are on the rise, such as poaching, illegal wildlife trade, unregulated tourism and infrastructure development, and unsustainable harvest of NTFPs (including Yartsa Gumbu). The primary issues pertaining to weak law enforcement are largely attributed to porous international borders, limited intelligence network, inadequate staff and under equipped and ineffective anti-poaching operations and logistical complexity in the remote mountain Protected Areas. The opening up of new trade routes such as Lambagar (Dolakha District), Kimathanka (Sankhuwasaba District), and Olangchungola (Taplejung) have also significantly raised the potential for illegal trade.

Theory of change
Successful law enforcement depends on efficient interventions at strategic, operational, and tactical levels, directed by sound intelligence information (Beale & Botezatu 2016). In doing so, it is crucial to ensure a robust law enforcement policy, strong institutions, well-equipped and dedicated anti-poaching personnel, inter-agency collaboration, and engagement of a wide range of stakeholders locally and globally.

It is imperative to review and update the existing wildlife act and regulations to increase the mandate of park authorities and to ensure more severe punishments for illegal wildlife trade, storage, and transportation. Likewise, recently established coordination committees, WCCB Units, and local community groups, such as CBAPU need to be strengthened to ensure strong 'boots on the ground'. Cutting-edge technologies, such as sniffer dogs, Trail Guard, and DNA barcoding can be adopted to help detect, apprehend, prosecute wildlife traders and dismantle wildlife trade networks. However, having well-trained and well-

equipped people on the ground is insufficient, and the effectiveness of these efforts needs to be regularly evaluated and improvements made. SMART (Spatial Monitoring and Reporting Tool) is technological solution that has proven to be an effective tool for anti-poaching patrolling. SMART is a software system used by park authorities to track anti-poaching patrol efficiency and effectiveness, and to identify hotspots of poaching and illegal activities. The data inputs for SMART are gathered in GPS devices used on patrols by guards and local communities. It is also important to mobilize local enforcement authorities to uproot the illegal transboundary trade nexus. The effective implementation of the MoU signed between the governments of Nepal and China in 2010 will be instrumental in boosting transboundary coordination to curb the illegal trade of wildlife parts and products across the international border.

Expected outputs
Short term (2017-2021)
- WCCB units and CBOs are capacitated and strengthened for effective patrolling and monitoring
- 40 relevant law enforcement staff personnel each year are trained to detect, apprehend, prosecute wildlife traders and dismantle wildlife trade networks.

Long term (2022–2026)
- Wildlife conservation acts and policies of the Government of Nepal reviewed and updated

Activities
- Review and update wildlife conservation acts and policies of the Government of Nepal
- Establish and strengthen WCCB units, APOs, and CBAPUs in all Protected Areas and district forest offices by enhancing security and safety, insurance, rewards and incentives for frontline staff
- Develop a guideline document and train law enforcement officers to detect, apprehend and prosecute poachers and traders
- Application of cutting-edge surveillance technologies such as SMART, sniffer dogs, Trail Guard, and DNA barcoding.
- Conduct awareness raising programs to inform local people about wildlife acts and regulations
- Conduct joint patrolling by Protected Areas, community and enforcement staff
- Orient frontline staff on CITES and other international and national wildlife policies

3.6. Climate adaptation
Rationale
The EHL/N is one of the most vulnerable regions to the impacts of climate change. Our analyses have shown the region will experience warmer winters and a wetter monsoon. Because the

snow leopard ecosystem is shaped by seasonal environments, even a slight shift in seasonal weather patterns is expected to bring about substantial changes to both natural and human systems in the region. As described in the previous chapter, the key impacts include shifts in ecological functions and processes (vegetation shifts, species displacement, changes in animal migration patterns and natural life history,) and hydrological processes (rapid spring snow-melt, prolonged and intensified dry and wet season, permafrost melting).

The results from the climate vulnerability assessment in the EHL/N aligns with the projected impacts regionally. The region is known to be experiencing a pronounced change in timing and intensity of monsoon rainfall, accompanied by more frequent extreme events and hazards such as hailstorm, floods, landslides, drought and forest fire (SCAPES 2011). These changes have greatly affected the ecosystems and the people who depend upon their services, thereby further endangering the already precarious livelihoods of local communities. Failing to address these changes and their impacts will raise the possibility of local extirpation of snow leopards through the intensification of ongoing anthropogenic threats to snow leopards and their habitats.

Theory of change

Climate adaptation strategy involves continuous adjustments in natural and human systems in response to actual or expected effects of climate change (Parry et al. 2007) to reduce the threats to snow leopards, their habitats, and local communities. As such, the adaptation approach focuses on monitoring change through increased investments in weather monitoring, harnessing ecosystems and their services to help people adapt (i.e. "ecosystem-based adaptation"), and works through multi-stakeholder platforms to meet the economic development aspirations of local communities through sustainable, resilient approaches within the framework of Nepal's commitments to various international agreements, including the Sustainable Development Goals and the Paris Agreement, among others.

In this regard, the findings of the climate analyses, water provision, and geo-spatial assessments conducted for this management plan provide much-needed impetus in formulating climate adaptation policy, institutional set-up and strengthening, program development and implementation in the EHL/N. In doing so, it is essential to mainstream the EHL/N's initiatives with the National Framework for Local Adaptation Plans for Action (LAPA), which was developed to implement the National Adaptation Program of Action (2010).

It is also crucial that climate adaptation measures acknowledge a host of uncertainties associated with the dynamic impact of climate change. This is especially true in the context of Himalayas, as the extreme topographic complexity makes climate projections, that are often based on regional scale analyses, very difficult. Judging by the level of uncertainty and the pervasiveness of climate change impacts, the adaptation measures in this management plan have been factored in for all conservation outputs, strategies, and activities. Below are the outputs and activities that are exclusively related to this strategy.

Expected outputs
Short term (2017-2021)
▸ Appropriate climate adaptation measures are identified on the basis of the findings of climate vulnerability assessments, water provision and geospatial analyses
▸ Protected Area and District Forests management plans are updated to account for climate change impacts

Long term (2022–2026)
▸ Relevant stakeholders are aware of and/or capacitated to cope with the impacts of climate change on natural and human systems
▸ Climate change adaptation measures adopted by communities and other relevant stakeholders

Activities
▸ Identification of vulnerable communities and bio-physical resources in all the 14 critical conservation sites within the four habitat complexes identified in this plan
▸ Investments in improved weather monitoring to better understand changes in the landscape associated with shifts in weather
▸ Improved monitoring and development of early warning systems for hazard risks like landslides, flooding and extreme drought
▸ Trainings for national park and conservation area managers and staff in the principles of climate smart conservation, including scenario planning exercises to plan for future climate changes
▸ Development and mainstreaming of climate change adaptation strategies into governance mechanism, strategic plans and policies of the line agencies
▸ Capacity building of relevant stakeholders including government, non-government and community-based organizations/individuals
▸ Community education and engagement to sensitize about changes in the landscape in the critical conservation sites
▸ Implementation of site-specific adaptation measures focusing on food, water and livelihood security in all the critical conservation sites

3.7. Enhancing knowledge on snow leopard's biology, behavior and its ecosystem

Rationale

The knowledge of snow leopard biology, behavior and ecosystem is required to formulate, revise and update policy instruments, and provide scientific inputs for sound management. In the EHL/N, a considerable amount of studies has been undertaken in recent years compared to other GSLEP landscapes of Nepal. Based on these studies, potential snow leopard habitats, including core areas, biological corridors, and critical habitats have now been mapped and are included in this document.

However, the data available for population analyses as well as human-snow leopard interactions, and the effects of climate change, are currently limited and biased. Climate adaptation strategies need to be continuously modified to suit changing conditions, based on updated data. This is especially challenging because the projected changes in climate are often rough and lack the spatial or temporal resolution to provide adequate guidance in the planning of interventions. Therefore, it is crucial to undertake a long-term, fine-grained, and widespread measurements of environmental and climate data for reliable climate modeling and prediction, and to obtain the landscape-scale information on the snow leopard's habitat and ecosystem in the EHL/N.

Theory of change

Recent advances such as camera trapping surveys, non-invasive molecular genetics, and satellite GPS tracking techniques offer a great deal of promise to study elusive animals like snow leopards. Population and spatial information gathered through these studies will be instrumental in understanding the meta-population dynamics of snow leopards in the EHL/N. In addition, merging the ecological and geo-spatial information with climate projection models, it is possible to identify climate refugia for snow leopards to make climate-smart conservation decisions.

As a way forward, a well-equipped and fully functional snow leopard conservation and research station is proposed in this plan. Such a research facility is expected to facilitate the constant monitoring of climatic and environmental factors affecting snow leopard ecosystems in the EHL/N. The research station can also serve as a platform for capacity building and knowledge sharing among students, community groups, academia and scholars in Nepal and globally. Moreover, collaborative research with both India and China needs to be initiated to obtain more precise information on snow leopard meta-population structure and underlying dynamics in the EHL/N.

Expected outputs
Short term (2017-2021)

▸ Snow leopard conservation research station established and strengthened in the KCA

▸ Databases of population status of snow leopards and their prey established and updated regularly

▸ All Protected Areas and DFOs are supported in generating/storing a database on snow leopard ecosystems

▸ A detailed report prepared on livestock depredation, wildlife poaching and illegal trade, and human perceptions towards snow leopard conservation

▸ Scientific assessments of the important ecological processes, such as the predator-prey relationships, and resource partitioning/competition among co-predators; their wild prey and livestock conducted

▸ Management effectiveness of Protected Areas appraised using contemporary tools (for example CA|TS, METT)

Long term (2022-2026)

▸ One comprehensive document on ecology and conservation of snow leopard in the EHL/N produced

▸ One consolidated report on the impact of climate change on snow leopard and their ecosystem produced

Activities

▸ Establish snow leopard conservation research station in the KCA

▸ Undertake ground truthing and fine tuning of the geospatial analyses carried out for this plan

▸ Advocate for population survey of snow leopard and their prey, with collaboration with India and China

▸ Conduct molecular genetic study and satellite telemetry of snow leopards to understand metapopulation dynamics and the ecology of snow leopard in the EHL/N

▸ Undertake exploratory surveys pertaining to livestock depredation, wildlife poaching, and human perceptions of snow leopard conservation

▸ Carry out study on interspecific interactions with other potential predators, including wolf and common leopard

▸ Identification and intensive monitoring of climate change effects on grasslands and the prey base

▸ Identify climate refugia and habitat corridors under the scenario of climate changing landscape

▸ Intensive monitoring of biological corridors to assess the corridor functionality

▸ Assess pasture quality, herding practices, and interactions between wild and domestic ungulates

▸ Intensive monitoring of critical habitats to keep track of impacts of climate change and human-footprint

▸ Management effectiveness of the Protected Area network assessed through contemporary tools such as METT, CA|TS

3.8. International cooperation

Rationale

As a landscape species, snow leopard habitat often extends beyond country borders. This is especially true in the mountain regions, where national boundaries often run along ridges, making the landscape transboundary. The findings from the recent satellite telemetry study and geospatial analyses clearly revealed the EHL/N as a transboundary landscape encompassing contiguous snow leopard habitats across neighboring countries, namely China and India. It is thus imperative to galvanize collaboration among Nepal, China and India to view the landscape as a single habitat matrix to secure a long-term persistence of a viable snow leopard population in the EHL/N.

Snow leopard conservation initiatives to date have underscored the need to deepen international collaboration. The Global Snow Leopard and Ecosystem Protection Program (GSLEP) was established to consolidate snow leopard conservation efforts across snow leopard range countries, as well as among international conservation partners, such as WWF, UNDP, USAID, GEF, WCS, Panthera, SLCO and FFI. GSLEP provides an excellent platform for Nepal to collaborate with China and India, and to explore the needed technical and financial support to undertake conservation activities on the ground. In addition, the Government of Nepal is a signatory to several international conventions and bodies, including CITES, CBD, IUCN, INTERPOL, and SAWEN. The collaboration with these institutions will be instrumental for the successful implementation of the EHL/N management plan.

Theory of change

Although the local level coordination through regular joint meetings is already taking place, there is consensus among the range of stakeholders including government, non-government and local communities that it should be up scaled and harmonized to support wildlife crime control, research and monitoring, and sharing of best practices. The potential transboundary habitat corridors described in the previous section, including Langtang, Tatopani, Alampu, Lamabagar, Nangpala, Kimathanka, Thudam, Gola and Yamphudin, should be emphasized as the focal areas for management intervention.

In addition, the EHL/N lacks the financial and technical capacity for effective implementation of the management plan. In this regard, GSLEP and other conservation partners can be approached to explore the fundraising and capacity building opportunities. These efforts could be pursued through the NSLEP Coordination Committee (Figure 24), in collaboration with national and international conservation partners, donors, and the private sector.

Expected outputs

Short term (2017-2021)

‣ Existing transboundary cooperation mechanism with India and China reviewed and strengthened
‣ Adequate technical and financial support from international partners are secured for implementation of this management plan

Long term (2022-2026)

‣ Snow leopard conservation beyond the national boundary institutionalized for joint monitoring of habitats and sharing of best practices

Activities

‣ Review and update regional transboundary cooperation arrangements, including bilateral agreements and MoUs
‣ Organize regular trainings on capacity building and information sharing at transboundary and regional level
‣ Conduct periodic meetings to share intelligence and best practices
‣ Explore potential funding sources and prepare proposals for collaborative conservation initiatives
‣ Advocate for joint patrolling to curb illegal wildlife trade along the international border between Nepal, China and India, particularly focusing on transboundary habitat corridors
‣ Participate and contribute to international symposia, workshops and training programs to share and learn about the best practices in snow leopard conservation

4 Framework for stakeholder cooperation

The landscape approach to conservation involves interdisciplinary planning and management that necessitates the engagement of a diverse group of stakeholders with varied interests, capabilities, and rights and responsibilities. Successful implementation of the EHL/N management plan depends on the mechanism that integrates these diverse group of stakeholders into a common platform to contribute to the EHL/N's vision and goal, and sharing necessary resources as well as risks through complementary actions. This section provides a working framework for collaboration among stakeholders to bring the needed synergy to fulfill financial, technical, legal, and institutional requirements of the management plan.

Objectives
- To generate synergy for the implementation of the EHL/N management plan through interdisciplinary action
- To harmonize/mainstream program strategies and activities of different stakeholders, consistent with the EHL/N workplan
- To establish strong networking among local, regional and international stakeholders to address climate change, biodiversity conservation and livelihood security

Expected Outcomes
- Resource gaps for the implementation of the EHL/N management plan minimized through the sustainable use of resources and expertise
- A collective agreement among the stakeholders will be reached to advocate for planners and policy makers to review existing acts and policies to promote alignment of the EHL/N management plan.
- Sustainable funding and technical expertise ensured through engagement of national and international donors

- Multi-dimensional and cross-cutting issues addressed through integrated and holistic approaches of all stakeholders
- Geospatial and hydrological information documented in this management plan will be incorporated into future Environmental Impact Assessments that will be carried out for development activities, including roads and hydroelectricity plants

4.1 Analyses of stakeholders of the EHL/N management plan
The potential stakeholders in the EHL/N were identified through expert consultations and literature review (DNPWC 2006, 2017, GoN 2006, 2010, 2014, 2015; SCAPES 2011; WWF 2015; ICIMOD et al. 2017). The stakeholders in the EHL/N can broadly be categorized as government and public organizations, non-governmental national and international organizations, community-based organizations, academic institutions, private entities including business and industry, farmers, herders, and tourists. These stakeholders have diverse roles and responsibilities and most are already actively engaged in the region while a few others have visions and goals relevant to the conservation and development of the EHL/N. A detailed list of stakeholders along with their key roles, spatial scope, and the potential influence in the management plan implementation is given in the Annex VI.

4.2. Framework for stakeholder cooperation
A prevailing mechanism will be followed for effective communication and coordination among relevant stakeholders. As such, the apex body will be led by the Ministry of Forests and Soil Conservation (MoFSC) in close collaboration with other pertinent ministries including Ministry of Population and Environment (MoPE), Ministry

of Federal Affairs and Local Development (MoFALD), and Ministry of Culture, Tourism and Civil Aviation (MoCTC). The role of the ministries will be pivotal in formulating policies and coordinating the subsidiary offices to facilitate the EHL/N management process. As such, the Department of National Parks and Wildlife Conservation (DNPWC) and Department of Forests (DoF) will have a major stake in the EHL/N management and are expected to play a key role in mediating the implementation of the plan through effective intersectoral coordination. Field based offices of the Protected Areas, Conservation Area Councils and their affiliates will communicate, coordinate and implement the program activities in close collaboration with local government bodies such as the District Coordination Committee, Municipalities

and other line agencies. Likewise, cooperation with private business and industries will be established and strengthened for the sustainable utilization of resources, equitable benefit sharing and livelihood improvement.

The partnership with Academia, National and International NGOs and Business/Industries is required for garnering the much-needed technical expertise and financial resources. A comprehensive framework for collaboration with these institutions based on the relevant competencies of the institutions with reference to EHL/N strategies as well as the past and current level of their engagement in the EHL/N needs to be worked out during the implementation of this plan.

5 Implementation mechanism

It is necessary to align the EHL/N's governance mechanism with the existing system of landscape conservation governance of the Government of Nepal to ensure a coherent framework for the smooth implementation and monitoring of the EHL/N management plan. Hence, the governance mechanism proposed here is prepared by drawing upon another recently endorsed landscape management plan, namely Strategy and Action Plan: 2016-2025, Chitwan-Annapurna Landscape, Nepal (GoN 2015).

The political transformations underway in Nepal, while this management plan is being drafted, will result in substantial changes to the present system of natural resource governance. These changes are expected to occur during the implementation of this management plan. This plan attempts to develop a flexible framework that provides enough opportunities for future adjustment, as needed, as per the changes in the political and institutional structure of the country. The chart below summarizes an indicative framework of the governance mechanism (Figure 24).

Figure 24 **EHL/N governance mechanism (Adpated from GoN 2015)**
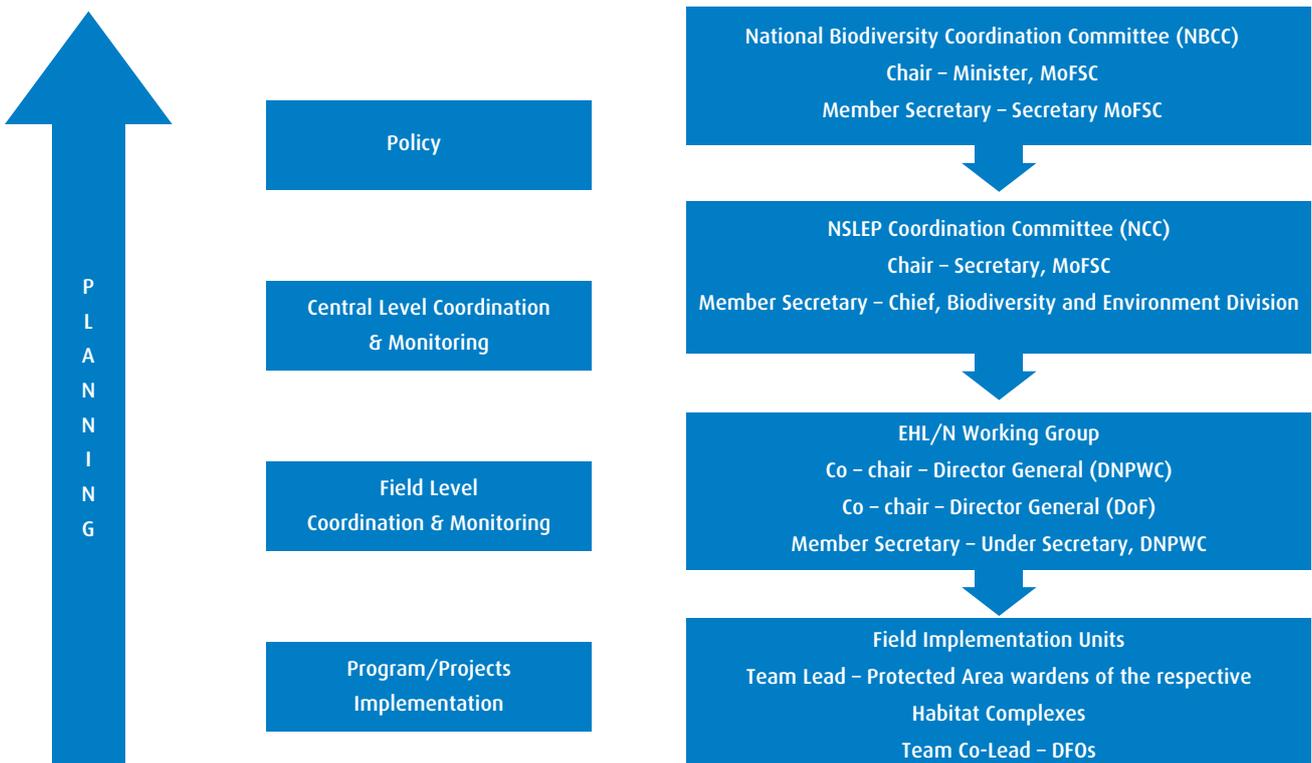
5.1 National Biodiversity Coordination Committee (NBCC)

The NBCC is the apex body chaired by the Minister of Forests and Soil Conservation and represented by wide range of relevant government, academic, non-government institutions and independent experts. It is envisaged that NBCC will undertake overall supervision of the EHL/N implementation and provide policy directives at the national level. A composition of NBCC is adapted from GoN 2014 and is given in Annex VII.

5.2 NSLEP Coordination Committee (NCC)

The National Snow Leopard and Ecosystem Protection Plan (NSLEP) Coordination Committee will act as a focal point for all three GSLEP landscapes of Nepal and will be chaired by the Secretary of the MoFSC. It will be comprised by diverse group of stakeholders engaged in the EHL/N and other two GSLEP landscapes (Table 9).

The NCC's key role will be to monitor and coordinate the management plan implementation across the GSLEP landscapes of the country. In doing so, it will attempt in mainstreaming activities of diverse group of stakeholders towards the Snow Leopard and Ecosystem Plan (SLEMP) vision. The specific responsibilities of NCC are as follows:

- Review and approve annual workplans, budget and provide strategic directions
- Policy formulation and process for endorsement
- Stakeholder coordination
- Engage with international organizations, donors including GSLEP for technical and financial assistance
- Ensure effective transboundary collaboration

- Communicate and market the landscape vision
- Provide guidance to sectoral ministries, departments and local government bodies including DCC and Municipalities/Rural Municipalities to ensure an integrated landscape planning and program implementation
- Monitor the work of landscape working groups including DFSCC.

5.3 EHL/N Working Group

The EHL/N working group is a core task force for the field level coordination, monitoring and implementation of EHL/N management plan (Table 10). Director General of the DNPWC and DoF will act as Co-chairs. The heads of programs and projects in the implementing organizations will serve as members. The under secretary at the DNPWC will be the Member Secretary of the working group.

The key responsibilities of EHL/N working group are as follows:

- Coordinate and facilitate the implementation of field programs and activities
- Liaise between NSLEP Coordination Committee and field offices to communicate and monitor the directives of the former and feed backs/inputs from the latter
- Coordinate the programs/projects among district and local level partners/line agencies
- Arrange external expertise as required for the program implementation
- Media outreach regarding EHL/N management plan implementation
- Undertake joint monitoring of programs/projects

Table 9 Composition of NSLEP Coordination Committee

SN	Representation	Position in NCC
1	Secretary, MoFSC	Chairperson
2	Chief - Planning Division, MoFSC	Member
3	Chief –Foreign Aid Coordination Division, MoFSC	Member
4	Chief – Monitoring and Evaluation, MoFSC	Member
5	Chief – Forestry Enterprises and Management Division, MoFSC	Member
6	Director General – DoF	Member
7	Director General - DNPWC	Member
8	Country Representative - WWF	Member
9	Member Secretary - NTNC	Member
10	Representation from other relevant partners	Members (2)
11	Experts	Members (2)
12	FNCCI representative	Member
13	Civil Society representatives	Members (2)
14	Chief – Biodiversity and Environment Division	Member Secretary

Table 10 Composition of EHL/N working group

SN	Representation	Position in Working Group
1	Director General - DNPWC	Co-chair
2	Director General - DoF	Co-chair
3	Deputy Director General - DoF	Member
4	Deputy Director General – DNPWC	Member
5	Under Secretary - DoF	Member
6	Implementing Partner Organization Representatives	Members
7	Under Secretary - DNPWC	Member Secretary

5.4. Field implementation of programs and activities

As 86% of EHL/N is occupied by the Protected Area Network, the National Park, Buffer Zone and Conservation Area offices will constitute the primary implementing institutions. District Forest Office will implement the projects outside of the Protected Areas. In doing so, an implementing body will be formed in each of the four habitat complexes which will be led by respective Protected Area managers and DFOs. During plan implementation, a strong collaboration will be maintained with Rural/Municipalities and all other relevant district level line agencies. At the site level, in order to harmonize the project activities with the Local Biodiversity Strategy and Action Plan (GoN 2014), a strong collaboration will be maintained with the Environment Friendly Governance District Coordination Committee (EFGDCC) at the District level and Environment Friendly Local Governance Village Coordination Committees (EFLGVCCs) at the local level. Apart from the project execution, the field level offices will also be engaged in project planning and monitoring of the field activities.

6 Funding mechanism

The provision of funding is pre-requisite for successful implementation of the management plan. It is thus essential to have a realistic financial plan beforehand. This section provides an outline of the financial plan based on assessments including budget requirements (Annex VIII), potential sources of funding, and the risk analyses. The analyses were undertaken largely based on the expert opinion supplemented by extensive review of action plans (GoN 2010; DNPWC 2017), Protected Area management plans (MBNPCA Task Force 1990; LNP 2012; NTNC 2013; KCAMC 2015; SNP 2016), and past and ongoing projects of the WWF Nepal.

6.1 Fund requirements

The total fund requirement for the implementation of EHL/N management plan is USD 5.57 million for the period of 10 years. A detailed cost allocation is given in Annex VIII, that was obtained through costing of activities defined in the log frame. The chart below provides cost estimates for each strategy which was prepared by merging the activity wise costs under each strategy (Figure 25).

It should be noted that the cost estimates are indicative only, which will be periodically reviewed by the Government of Nepal in consultation with relevant stakeholders over the course of management plan implementation.

Figure 25 Allocation of budget (in USD) to program strategies

International cooperation **212,500** — 4%

Enhancing knowledge on snow leopard's ecology, behavior and its ecosystem **302,500** — 5%

Climate adaptation **536,000** — 10%

Strengthening law enforcement **685,000** — 12%

Strengthening institutions and engaging local communities **767,500** — 14%

Improving people's livelihoods **661,000** — 12%

Mitigating human-snow leopard conflict **515,000** — 9%

Land use planning and habitat management **1,893,000** — 34%

A bulk of the cost is allocated for land use planning and habitat management (~34%). Considering the extensive habitats of snow leopard and the magnitude of climatic and anthropogenic threats, it is imperative to invest on this strategy. The estimated cost for research and climate adaptation are low compared to other strategies. This is mainly because these are inherently cross cutting and as such, several activities linked with this strategy are already incorporated into other relevant strategies.

6.2 Sources of funding

Government sources:
A major part of the funding to implement this management plan is anticipated to come from the Government sources. The administrative expenditure such as staff salaries and benefits, will be almost entirely funded by the Government. Furthermore, as most interventions outlined in this management plan closely aligns with the vision and goals of the government line agencies, the development expenditures are expected to be partially covered by incorporating the activities of this management plan into the annual workplans of the regional, district and local level government agencies.

Locally generated revenue:
Locally generated revenue primarily comprise the taxes and fees collected from the natural resources (forest products, sand, gravel, stones, and boulders) and tourism (trekking fee, park entry fee, etc.) sectors. Local governments (DCCs and Municipalities/Rural Municipalities), District Forest Office, and Protected Area and Buffer Zone offices are entitled to collect these types of revenues. Currently, the two conservation areas, and the three buffer zones of the EHL/N are largely designed to operate from the revenue generated from the local sources.

Civil Society Organizations (CSOs):
There is a good number of CSOs actively engaged in the EHL/N with a common goal as of this management plan. These CSOs primarily include consortium of individual experts from various disciplines, national non-governmental organizations, academic institutions, community-based organizations, target groups, etc. These CSOs constitute a critical resource for the EHL/N management plan implementation to share funds as well as technical expertise.

International assistance:
This management plan provides an opportunity to upscale the ongoing conservation efforts to the next level by rallying the key donors behind the strategic direction of climate-integrated management of large-scale conservation landscapes. This will deliver on donors' core conservation mission as well as fulfilling their global pledges such as CBD, Climate Finance, etc. In this regard, the grants and loans from multilateral and bilateral agreements, funding assistance from international NGOs, inter-governmental agencies, government aid agencies, multinational corporate donors would constitute a significant source of funding for the EHL/N management plan.

Innovative sustainable financing mechanisms:
Sustainable financing mechanism based on ecosystem services, natural capital and public-private partnership offer a great deal of promise to secure funds needed to implement the EHL/N management plan. As such, innovative concepts such as Payment for Ecosystem Services (PES), Clean Development Mechanism (CDM), and Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) can be linked to the snow leopard's ecosystem. The Green Climate Fund (GCF) and Least Developed Countries Fund (LDCF) constitute potential sources of funding.

6.3 Risk analyses
The funding for the implementation of this management plan is expected from the contributions of a diverse range of partners ranging from international agencies to local community-based organizations. This diversification of funding base reduces the risk of budgetary shortage. However, it is envisaged that the stakeholders might not be able to contribute due to the unforeseen reasons. During the preparation of this plan, following key potential risks were identified and the mitigation actions were proposed (Table 11).

Table 11 Potential risk to financial security and suggested mitigation measures

Potential Risk	Mitigation Measures
As the country is currently transitioning to the federal system of governance, the donors may become less willing to support the plan due to the uncertainty brought about by political instability.	Actively involve local community-based organizations and government administration to ensure institutional sustainability and establish strong alliances with influential multi and bi-lateral donors and prominent conservationists for advocacy.
Sudden withdrawal of funds by the donor	Define clear spending priorities across strategies and operations to clarify where spending cuts can be made if needed.
Major financial surprise e.g. exchange rate loss, market inflation, etc.	Identify investments that could be delayed with least conservation impact. Ensure minimum reserves targets are met through regular cost control/ monitoring and implementing prompt cost savings action if needed.

7 Monitoring and evaluation

The ultimate success of the management plan will be judged by the ability to measure the impact of the implementation of strategies and activities towards achieving the EHL/N goal and vision. Therefore a monitoring and evaluation plan is prepared as a part of the management planning process and is presented below.

7.1 Monitoring

The EHL/N management plan has embraced the adaptive management process, focusing on both monitoring (assess progress) and learning (analyze, adapt and sharing lessons) to improve conservation actions during and after the project implementation. Monitoring of program activities, thus, essentially constitute a continuous process of timely reporting, collecting and analyzing information to measure the progress towards expected outputs and outcomes. In doing so, it requires an active participation of diverse group of stakeholders including the representatives from government, non-government sectors, donors and local people as the members of the monitoring team. Likewise, conducting public hearing exercise is acknowledged as one of the most effective and efficient means to ensure the transparency. These approaches not only enhance the monitoring quality by clearly indicating the precise implementation scenario at different levels but also creates desired level of ownership among the stakeholders by conveying them the actual field status of the plan implementation.

In addition, the results of the monitoring such as action learning, best practices, and successes/failures need to be communicated to all the stakeholders through proper channels in order to enable them to adopt the successful program strategies/approaches.

Key monitoring components

Following two components of the strategic plan/log frame of this management plan need to be monitored:
‣ Activities/outputs
‣ Outcomes/impacts

Activity/output monitoring:

The activity monitoring is geared towards assessing the technical progress of activities against the annual workplan. An indicative list of monitoring indicators is provided in the log frame (Appendix V). However, the baseline against which the progress will be monitored is largely lacking for most of the interventions. Also, a standardized monitoring format needs to be developed to bring about consistency among the diverse group of implementing agencies.

Field level implementing offices in coordination with relevant stakeholders will make up a monitoring team. Some basic tools for monitoring comprise direct observation, interview of beneficiaries/users, examination of physical progress against expenditures, and public auditing. Table 12 provides a few key aspects of monitoring that needs to be considered during the monitoring process.

Outcomes/impact monitoring:

Outcomes and impact monitoring is required to examine if the implementation of management plan is in consistent with the EHL/N goal and vision. As such, it constitutes a higher-level undertaking normally carried out after the implementation of project activities. Table 12 provides indicative list of elements for outcome/impact monitoring.

Table 12 A list of elements to be considered during the monitoring of activities/outputs and outcomes/impacts (Adapted from GoN 2015)

Monitoring elements	Activity and output monitoring	Outcome/Impact monitoring
Indicators	Annual workplans/ EHL/N log frame/ Baseline to compare needs to be updated from field surveys	EHL/N log frame
Timing	During the implementation or immediately after implementation of the activities	After the implementation of activities
Scope	Technical progress, physical outputs, resources incurred (Time, funds and labour)	Changes/modifications in the annual plans/log frame
Implementation procedure	Consistency with approved technical, social and financial norms/protocols	Consistency with approved technical, social and financial norms/protocols
Recommendations	Adaptive measures for ongoing and forthcoming activities Resource optimization Results for action learning	Adaptive measures for the next project cycle (Reinvention or continuation of the program strategies/implementation mechanism, etc.) Resource optimization Lessons (best practices, pitfalls) for sharing
Monitoring tools	Field observation Progress reports Direct interactions/consultative meetings with the relevant stakeholders/beneficiaries/users Visual data (Photographs, video, etc.) Public auditing and public hearing	Field observation Management effectiveness analyses Measurement of outcomes/impacts Interview with relevant stakeholders
Responsibility	Implementing agencies: • Protected Area Offices • District Line Agencies • Local Government Offices • Community-Based Organizations	Regional Directorates Central level agencies (Monitoring and Evaluation Division of MoFSC and departments) Biodiversity and Environment Division
Information sharing	Annual report Annual planning process Output level monitoring team Line agencies across the landscape Database management units	Project planning and adaptive management teams Fund raising team Global forums Management Information Systems

7.2 Evaluation

An overall performance of the EHL/N management intervention is assessed through project evaluation. Hence, it examines the implementation procedure (efficiency and effectiveness of cost and activities, processes or the methods/tools used) and the observed impacts of outcomes achieved. In doing so, it not only measures the overall successes/failures of the interventions but also provides much-needed lessons for improvement or changes in institutional, behavioral, managerial capacity, policy/strategy instrument, livelihood processes, etc.

The evaluation process will largely build on the data generated through outputs/outcomes level monitoring supplemented by field verifications. An indicative check-list of activities that need to be accounted for during the evaluation is given below:

▸ Review overall performance of the EHL/N implementation against the EHL/N targets and goals
▸ Identify specific accomplishments
▸ Identify failures and shortcomings in the execution of the strategy/activities
▸ Assess the validity of the conservation mechanism and the program strategy, and
▸ Formulate recommendations

The composition of the evaluation team will be finalized by NCC and will broadly comprise external (international) experts/individuals representing donors, advocacy groups, academia, etc. As for the evaluation schedule, it is suggested to be carried out in two phases of the project, each lasting for the 5-year period. It should be noted here that the outputs of the EHL/N strategic plan have also been designed accordingly. In doing so, the lessons learnt from the first phase can be incorporated into the next phase of the project implementation. Table 13 provides a schedule for EHL/N management plan implementation.

Table 13 Evaluation schedule for the EHL/N management plan

Project Phase	Evaluation Period	Implementation Year
First	Mid-term	2019
	Final	2021
Second	Mid-term	2024
	Final	2026

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ANNEXES

Annex I

A list of Rural/Municipalities of the Eastern Himalaya Landscape

S No	District	Name of Rural/Municipality	Rural/Municipality
1	Dolakha	Bigu	Rural Municipality
2	Dolakha	Gaurishankar	Rural Municipality
3	Dolakha	Jiri	Municipality
4	Dolakha	Kalinchok	Rural Municipality
5	Nuwakot	Dupcheshwar	Rural Municipality
6	Nuwakot	Langtang	Rural Municipality
7	Nuwakot	Suryagadhi	Rural Municipality
8	Nuwakot	Tadi	Rural Municipality
9	Panchthar	Yangwarak*	Rural Municipality
10	Ramechhap	Gokulganga	Rural Municipality
11	Ramechhap	Umakunda	Rural Municipality
12	Rasuwa	Gosaikunda	Rural Municipality
13	Rasuwa	Kalika	Rural Municipality
14	Rasuwa	Kispang	Rural Municipality
15	Rasuwa	Naukunda	Rural Municipality
16	Rasuwa	Uttargaya	Rural Municipality
17	Sankhuwasabha	Bhotkhola	Rural Municipality
18	Sankhuwasabha	Makalu*	Rural Municipality
19	Sankhuwasabha	Sabhapokhari*	Rural Municipality
20	Sankhuwasabha	Silichong	Rural Municipality
21	Sindhupalchok	Barhabise	Municipality
22	Sindhupalchok	Bhotekoshi	Rural Municipality
23	Sindhupalchok	Helambu	Rural Municipality
24	Sindhupalchok	Jugal	Rural Municipality
25	Sindhupalchok	PanchpokhariThangpal	Rural Municipality
26	Sindhupalchok	Tripurasundari	Rural Municipality
27	Solukhumbu	Dudhkoshi*	Rural Municipality
28	Solukhumbu	Khumbu pasang lahmu	Rural Municipality
29	Solukhumbu	Mahakulung	Rural Municipality
30	Solukhumbu	Solududhakunda	Municipality
31	Taplejung	Maiwakhola*	Rural Municipality
32	Taplejung	Meringden*	Rural Municipality
33	Taplejung	Mikwakhola*	Rural Municipality
34	Taplejung	Phaktanglung	Rural Municipality
35	Taplejung	Sidingba*	Rural Municipality
36	Taplejung	Sirijangha	Rural Municipality

Note: - Rural/Municipalities located outside Protected Area network*

Annex II

Potential habitat corridors in the EHL/N

Langtang corridor:

Langtang corridor (N 28.3084 and E 85.5649, altitude 4000 m) is situated on the north-eastern boundary of the Langtang National Park in the Gosaikunda Rural Municipality of the district of Rasuwa (Figure a). Considering the highly disturbed habitats around Rasuwagadi in the west and natural barriers formed by Langtang Lirung Himalaya range in the south and east, this transboundary corridor is expected to provide a passageway for connecting snow leopard populations within EHL/N via Quomolangma Nature Preserve of China.

Figure a: Langtang corridor and the snow leopard habitat in and around the corridor
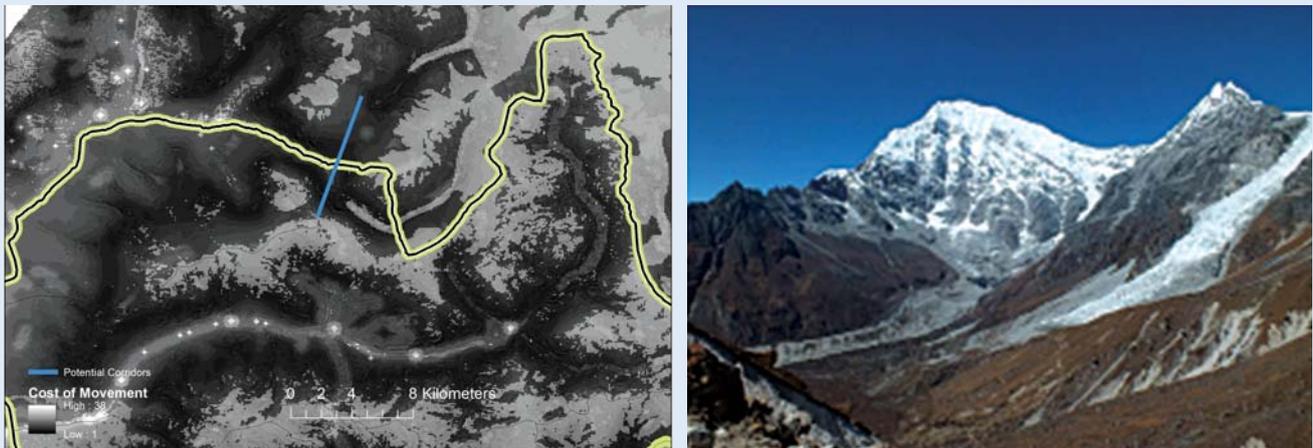
Tatopani corridor

Tatopani corridor (N 28.0339, E 85.9348, Altitude 4500 m) is in the Bhotekoshi Rural Municipality of the Sindhupalchok District (Figure b). It is a transboundary corridor that connects the western part of the Gaurisankar CA with the Quomolangma NP of China. Kodari Highway is located on the eastern side of this corridor.

Figure b: Tatopani corridor and the snow leopard habitat around the corridor

Alampu and Lamabagar corridor

Alampu (N 27.9257, E 86.1171, Altitude 4800 m) and Lamabagar (N 27.9762, E 86.2788, Altitude 4900m) corridors are in the Gaurisankar CA in the east and west side of the upper Tamakoshi river valley, respectively (Figure c). They fall within the Bigu Municipality in Dolakha district. As the depression created by Tamakoshi river is likely to act as a barrier for snow leopard movement within Nepal, these two transboundary corridors are expected to link snow leopard populations via Quomolangma NP of China.

Figure c: Alampu (left) and Lamabagar (right) corridors
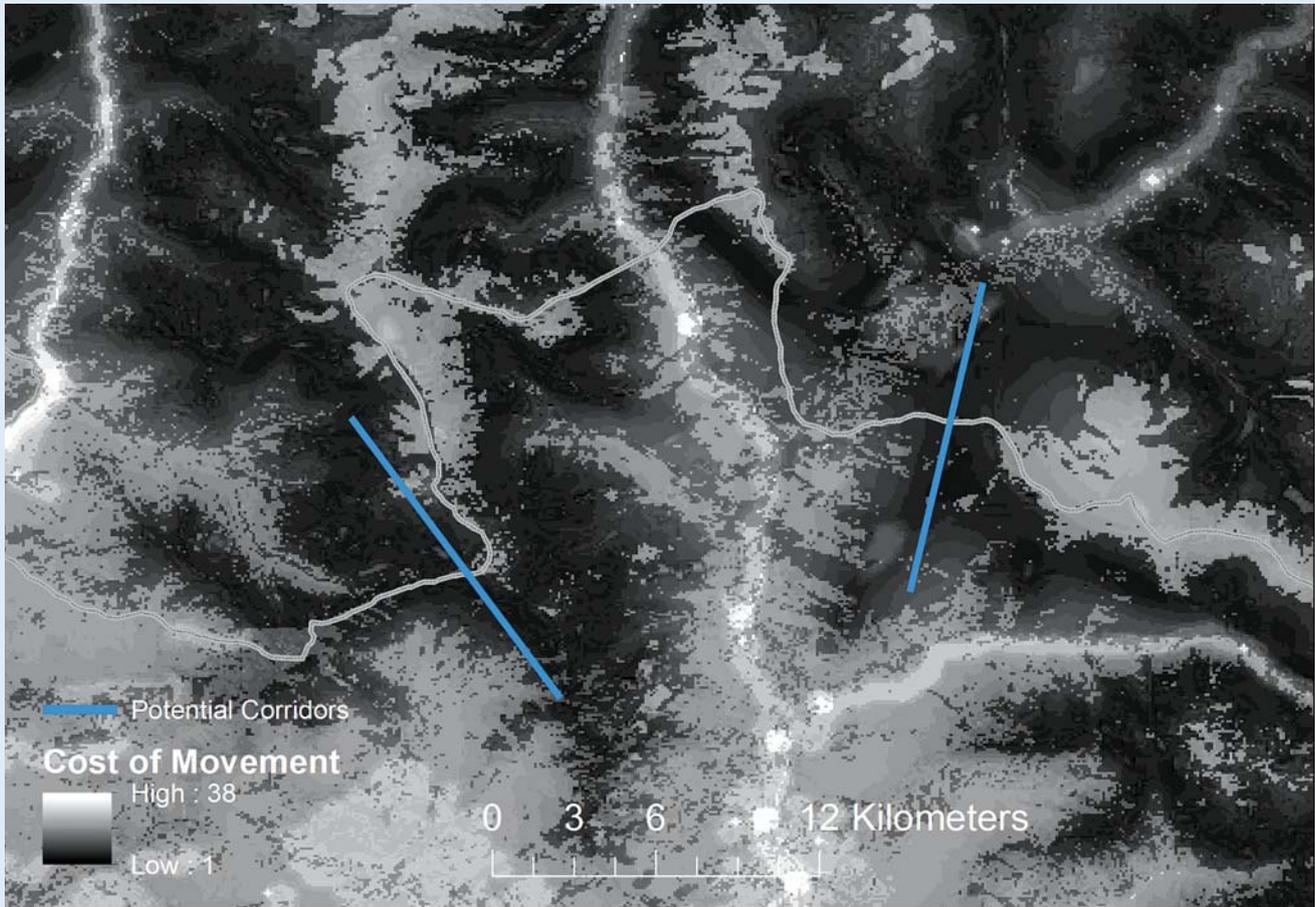
Taksindu and Beni corridor

Taksindu (N 27.7048, E 86.6510, Altitude 4500m) and Beni (N 27.6897, E 86.5453, Altitude 4800m) corridors are situated on the southern side of the GCA and SNP, respectively (Figure d). These two corridors are expected to link snow leopard populations between GCA and SNP as the habitats on the northern side of the snow leopard range are likely to be disconnected because of the topographic barrier created by mountain peaks Dangnok, Takargo and Numbur. It should be noted that both of these corridors are located outside of the Protected Area network. Taksindu falls in Khumbu pasang lhamu Rural Municipality and Soludhakunda Municipality in Solukhumbu district. Beni corridor falls partly in Umakunda Rural Municipality in Ramechhap and Soludhakunda Municipality.

Figure d: Location of Beni (left) and Taksindu (right) corridors
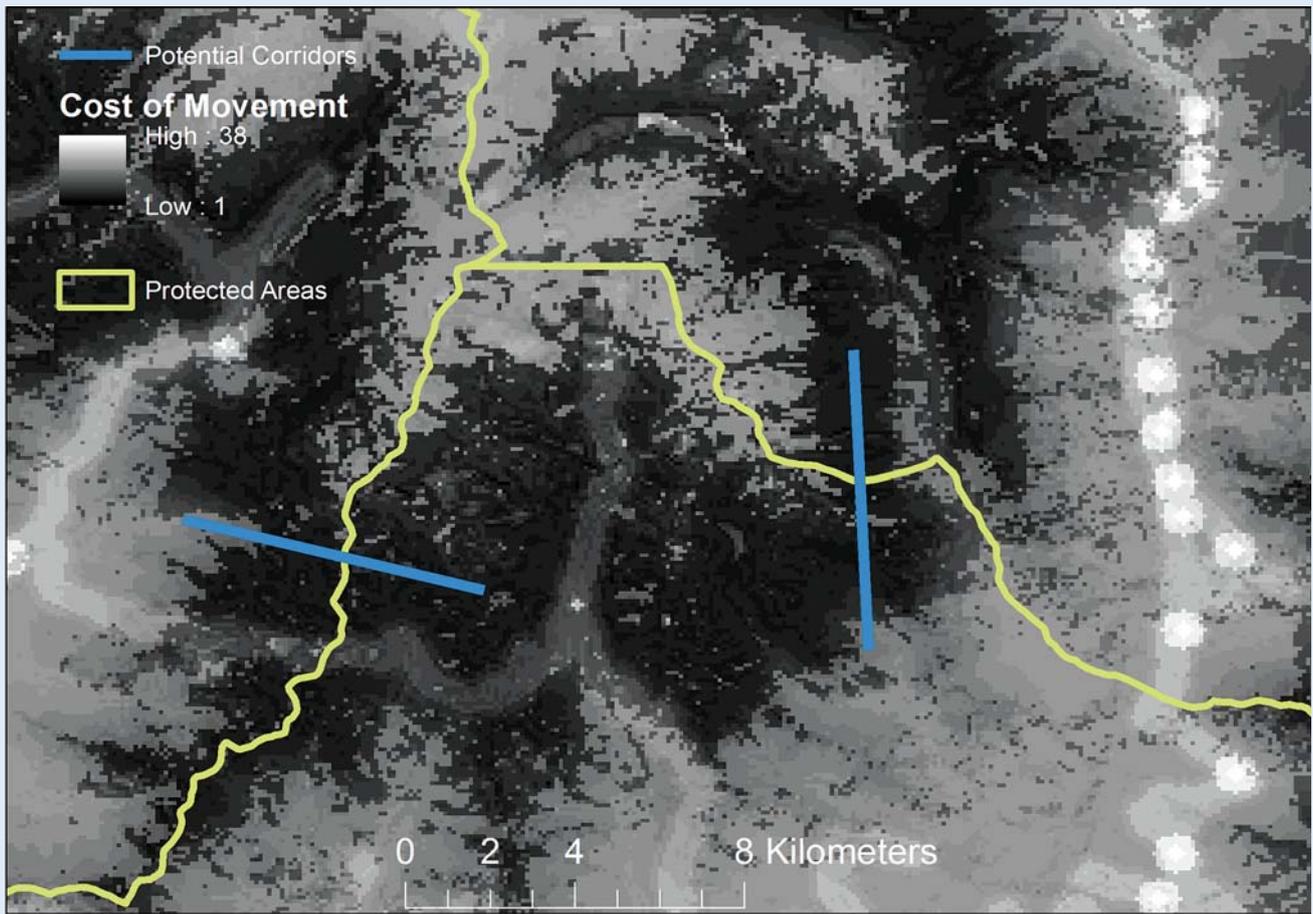
Nangpa la corridor

Nangpa la (N 28.1012,E 86.5871, Altitude 5700m) is essentially a high mountain pass between Nepal and China along the Khumbu Himal range in the Sagarmatha NP (Figure e). It falls in Khumbu pasang lhamu Rural Municipality in Solukhumbu district. Anecdotal records suggest the movement of snow leopards through this pass into China. If this holds true, the corridor is expected to play a critical role in meta-population management of snow leopards in the EHL/N.

Figure e: Nangpa la corridor and snow leopard habitat in the mountain pass at 5700 m

Khote, Khare and Chheskam corridors

Khote (N 27.6710, E 86.8244, Altitude 3700m), Khare (N 27.7414, E 86.9045, Altitude 4800 m), and Chheskam (N 27.8588, E 86.9366, Altitude 5700m) corridors link snow leopard habitats of SNP with MBNP (Figure f). All three corridors fall in Khumbu and Mahakulung Rural Municipalities in Solukhumbu district. The topographic barrier created by mountain peaks including Everest, Nupse, and Lhotse along the international border with China has made the transboundary movement of snow leopard highly unlikely on the northern side. For this reason, these three potential corridors are crucial to maintain the habitat contiguity in this region.

Figure f: Khote (Bottom), Khare (Middle) and Chheskam (Top) corridors and snow leopard habitat around Chheskam along the boundary between SNP and MBNP
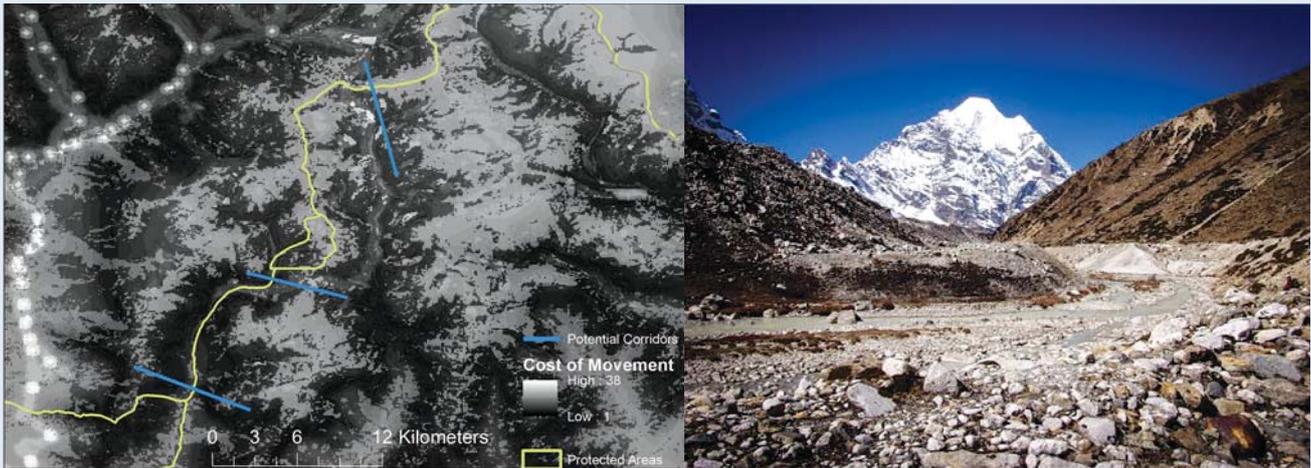
Kimathanka and Thudam corridors

Kimathanka (N 27.8441, E 87.2534, Altitude 4400m) and Thudam (N 27.8387, E 87.5461, Altitude 4400m) corridors are in the upper Arun Valley in Bhotkhola Rural Municipality in the Sankhuwasabha District (Figure g). Extensive tracts of forests in the Arun Valley pose a significant barrier for snow leopards to move across the EHL/N via Nepali side of the border. It is, therefore, these two transboundary corridors are expected to contribute in maintaining habitat connectivity via Quomolangma NP of China. Recent satellite telemetry study carried out in the KCA also substantiated the functionality of these two corridors. It is also important to note here that Thudam corridor is currently located outside of the Protected Area network.

Figure g: Kimathanka (left) and Thudam (right) corridors and snow leopard habitat around Kimathanka

Gola corridor

Gola corridor (N 27.8181, E 87.7384, Altitude 5200m) is in the northern boundary of KCA and links snow leopard habitat with the Quomolangma NP of China (Figure h). It is contiguous with Thudam corridor to the west but there is a topographical barrier on the eastern part of the landscape created by Kangchenjunga Himalaya range; it falls in Phaktanglung Rural Municipality in Taplejung district. Satellite telemetry study has revealed the intensive use of this corridor by the snow leopard to enter the habitats on the Chinese side of the border.

Figure h: Gola corridor and snow leopard habitats around the corridor

Yamphudin corridor

Located in the southeastern boundary of the KCA, the Yamphudin corridor (N 27.4808, E 88.0458, Altitude 4600m) is so far, the only known habitat corridor that links snow leopard population of Nepal with India via the Khangchendzonga National Park of Sikkim, India (Figure i). It falls in Sirijangha Rural Municipality in Taplejung district. A snow leopard fitted with satellite GPS collar frequently used this corridor to travel to Sikkim, India.

Figure i: Yamphudin corridor and snow leopard habitat around the corridor
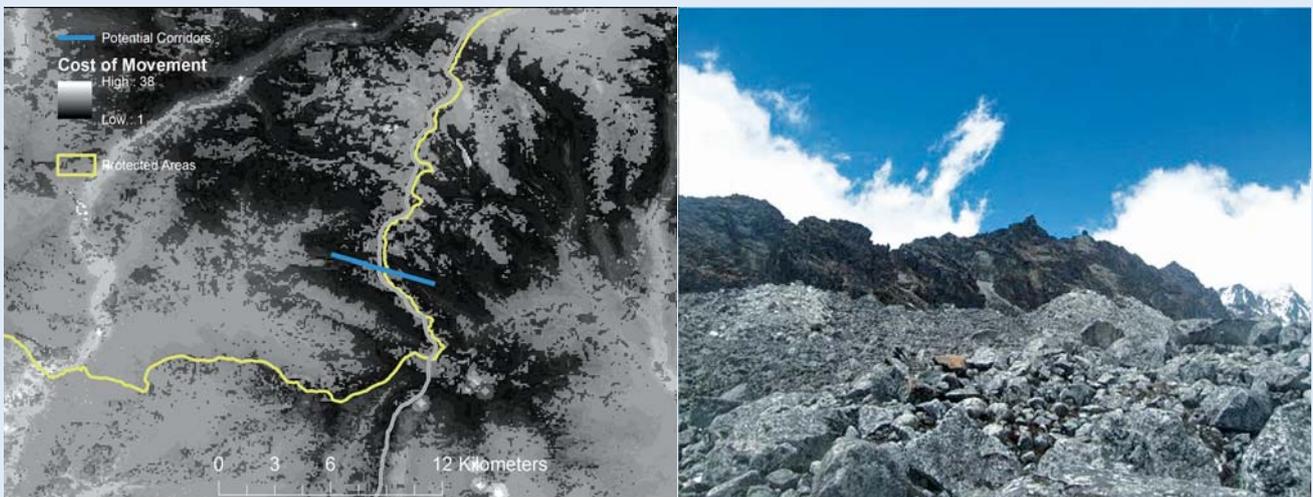
Annex III

A conceptual model of threats to snow leopard's survival, ecosystem services and the human well-being in the EHL/N. CC in parentheses denote those direct threats having strong association with climate change. To simplify the model, only the basic linkages are shown.
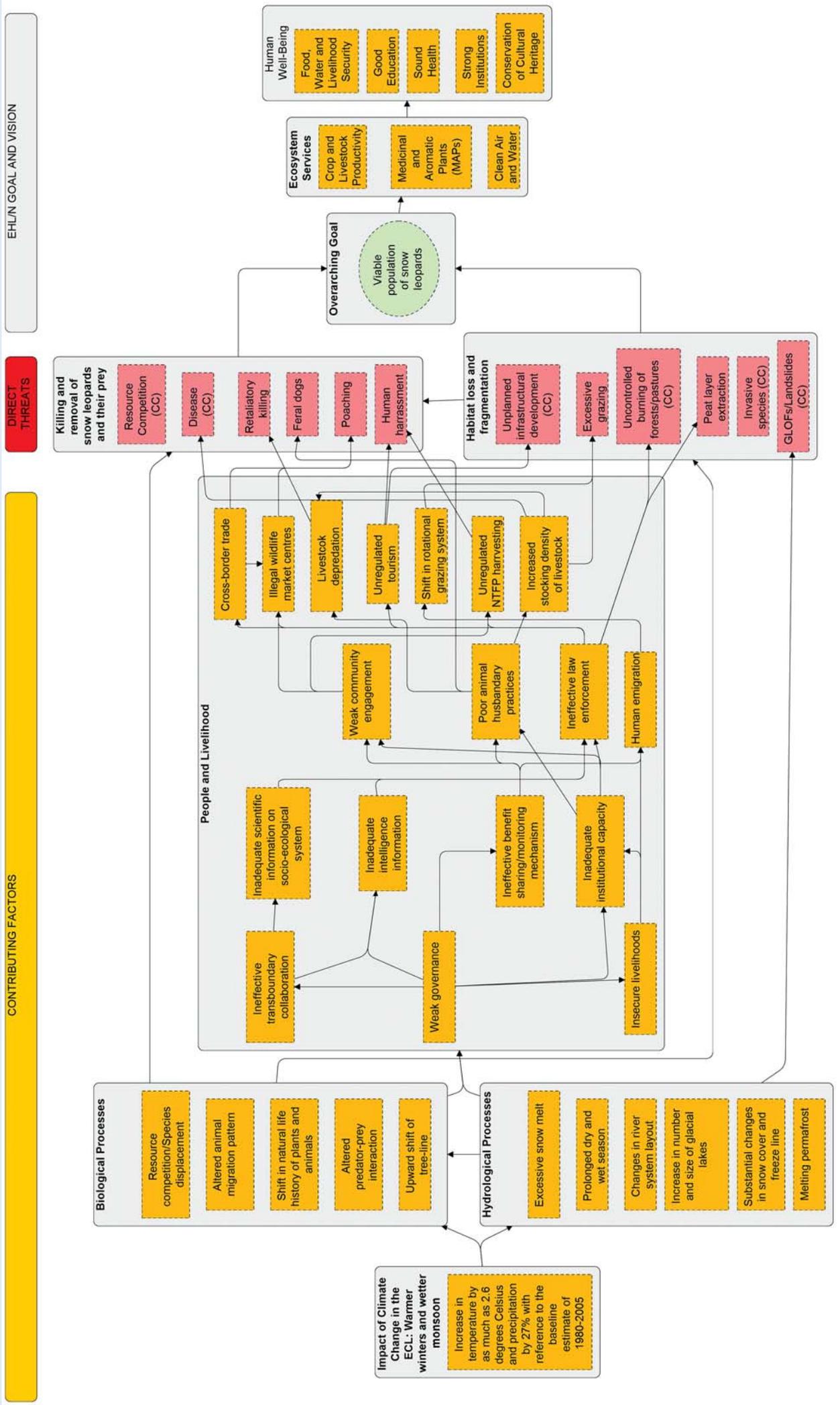
Annex IV

Critical Snow Leopard Conservation Sites of the Eastern Himalaya Landscape, Nepal.

Site Name	Population Centres	Spatial Reference	Protected Areas	Rural/ Municipalities	Permeability*	Human Foot Print Score**	Significance
Sarharsabeni	Sarharsabeni hamlet	N 27.6838 E 86.5951	N/A	Khumbu pasang lhamu Rural Municipality	High	Low	Important habitat to maintain the connectivity between GCA and SNP, currently outside of PA network
Upper Dudhkoshii	Sagrmatha trek including Namche Bazar, Khumjung, GokdyoTenboze,etc.	N 27.8962 E 86.7536	SNP	Khumbu pasang lhamu Rural Municipality	Moderate	High	Human dominated landscape with high potential for habitat degradation
Hinku Dranka		N 27.6346 E 86.7711	N/A	Khumbu pasang lhamu Rural Municipality	High	Low	Important habitat to maintain the connectivity between MBNP and SNP, currently outside of PA network
Rasuwagadi	Syabru Bensi, Bridhim, Lingling Brabal, Domen Kangjim, Sano Bharkhu, etc.	N 28.1947 E 85.3368	Western Boundary of LNP	Gosaikunda Rural Municipality	Low	High	Human dominated landscape potentially important from the perspective of curbing poaching and trade
Langtang	Langtang Trek including Sherpa gaon, Langtang Village, KyangjinGompa, Numtha village and LangshingKharka	N 28.2015 E 85.5489	LNP	Gosaikunda Rural Municipality	Moderate	Moderate	Human dominated landscape with high potential for habitat degradation
Gosaikunda	Gosaikunda Trek including Lauribena, Gosaikunda, Phedi, Gopte and ThadePati	N 28.0548 E 85.4514	LNP	Gosaikunda Rural Municipality	Moderate	High	Human dominated landscape with high potential for habitat degradation

Site Name	Population Centres	Spatial Reference	Protected Areas	Rural/ Municipalities	Permeability*	Human Foot Print Score**	Significance
Balephi Khola	Isolated dwellings	N 28.0828 E 85.7996	GCA	Jugal Rural Municipality	Moderate	Moderate	Site necessitating an intensive conservation focus to maintain the connectivity between GCA and LNP
Lapchi	Lapchi	N 28.0865 E 86.1686	GCA	Bigu Rural Municipality	Moderate	Moderate	Site necessitating an intensive conservation focus to maintain connectivity within GCA and transboundary connectivity with China
Arun		N 27.6912 E 87.5685	N/A	Phaktanglung Rural Municipality	High	Low	Contiguous habitat between MBNP and SNP, and transboundary connectivity with China - currently outside of Protected Area network
Gumsa	Kangchenjunga Trek including Ghumsa, Khambachhen, Gyabla	N 27.6594 E 87.9295	KCA	Phaktanglung Rural Municipality	Moderate	Moderate	Site necessitating an intensive conservation focus to maintain connectivity within KCA
Tseram	Kangchenjunga Trek including Tseram and Ramchhe	N 27.5671 E 87.9692	KCA	Phaktanglung Rural Municipality	Moderate	Moderate	Site necessitating an intensive conservation focus to maintain trans-boundary connectivity with India

* *Permeability estimates how easy it is for snow leopards to move across the landscape (i.e., lesser the cost of movement, higher the permeability). Average cost of movement scores; High permeability = < 7, Moderate permeability = 8 – 9 and Low permeability = > 10.*

** *Human foot-print scores denotes relative habitat degradation potential due to human disturbance (High = >12, Moderate = 5-12, and Low = < 4)*

Annex V

Logical Framework for Snow Leopard and Ecosystem Conservation Plan, Eastern Himalaya Landscape, Nepal.

Strategy/Outcome/Outputs	Objectively verifiable Indicators	Baseline Value (2017)	Expected Value	Methods or Source of Verification	Assumptions and Risks
1. Land use planning and habitat management					
Outcome 1. Important snow leopard habitats are secured using climate-integrated approaches	Habitat occupancy and population abundance of snow leopards and their prey in core areas, corridors, climate refugia and other potential habitats	Base line data needs to be determined by 2018	Increase habitat occupancy and abundance of snow leopards and their prey	Survey reports	Timely availability of base line data, Application of same methods between the successive surveys so as to make comparison possible
Output 1.1: By 2021, 14 habitat corridors and 11 critical sites identified in this plan are field verified	Number of corridors field verified and protected	Nil	At least 14 corridors	GIS maps, population and habitat assessment reports	Availability of resources, continued government and local community support
Output 1.2: By 2021, climate refugia (sites) identified and protected	Number and extent of climate refugia	Base line data needs to be determined by 2018		GIS Maps and reports of snow leopard population and habitat assessment	Timely availability of base line data
Output 1.3: By 2021, climate-adapted grazing system and pasture management promoted in 30 sites	Ratio of palatable to non-palatable grasses in the pasture, milk yield, livestock mortality and fecundity rates	Baseline needs to be determined by 2018.	Increased ratio between palatable to non-palatable grasses, increased livestock productivity as expressed as milk yield and fecundity and survival	Survey reports	Timely availability of baseline data
Output 1.4: By 2021, feasibility for prey population reintroduction evaluated	Number of sites	N/A		Progress report	Availability of resources, continued government and local community support
Output 1.5: By 2021, the status of the high-altitude wetlands and peatlands assessed and conserved	Number of wetlands and peatlands	N/A			
Output 1.6: By 2026, a climate-integrated landscape vision map prepared for each of the four habitat complexes	a) Maps showing current and future economic development/human foot print/important snow leopard habitat, b) land use plan illustrating conservation strategies	N/A	Four landscape vision maps	Strategy document with land use vision map	Timely availability of current and future economic development data/ snow leopard habitat use data
Output 1.7: By 2026, prey population reintroduced in prey deficit areas	Prey abundance	N/A		Technical Report	Availability of resources, willingness of local communities

Strategy/Outcome/ Outputs	Objectively verifiable Indicators	Baseline Value (2017)	Expected Value	Methods or Source of Verification	Assumptions and Risks
2. Mitigating human-snow leopard conflict					
Outcome 2. Human-wildlife conflict reduced	Number of incidences of livestock depredation, retaliatory killing of snow leopards, index of people's attitude towards snow leopard conservation.	Baseline data needs to be determined by 2018	Reduction in the livestock depredation incidence/zero retaliatory killing of snow leopards/ increased positive index	Official records maintained by park authorities and community groups/ survey reports	Availability of resources, timely availability of baseline data, survey reports
Output 2.1: By 2021, existing livestock insurance schemes and relief mechanism up-scaled and new schemes launched	Number of schemes	Baseline data needs to be determined by 2018	Zero retaliatory killing of snow leopards	Official records maintained by park authorities and community groups	Availability of resources, continued government and local community support
Output 2.2: By 2021, local leaders (elected, religious and social) are mobilized in snow leopard conservation initiatives	Number of religious leaders and villages	Baseline data needs to be determined by 2018	50 villages	Survey reports	Availability of resources
Output 2.3: By 2026, efficient animal husbandry practices developed and implemented	Number of initiatives and villages	Baseline data needs to be determined by 2018	50 villages	Progress report	Availability of resources
Output 2.4: By 2026, best practices such as the 'Safe Systems Approach' adopted from the snow leopard range countries	Number of sites	N/A	5 Protected Areas	Progress report	Availability of resources
3. Improving people's livelihoods					
Outcome 3. Economic well-being of local people enhanced through green development	Increased per capita income/decreased average poverty incidence/	N/A		Socio-economic survey reports	Availability of resources, timely availability of survey reports
Output 3.1: By 2021, livelihood diversification promoted in at least 30 households from each Rural/ Municipality of the EHL/N	Number of Rural/ Municipality	N/A	36 Rural/ Municipalities	Progress report	Continued support from all the stakeholders
Output 3.2: By 2021, at least one climate smart water management scheme devised and implemented	Number of water conservation schemes, and water availability for irrigation and household use	Baseline data needs to be determined by 2019	Increased water availability	Progress report	Availability of resources, continued government and local community support

Strategy/Outcome/ Outputs	Objectively verifiable Indicators	Baseline Value (2017)	Expected Value	Methods or Source of Verification	Assumptions and Risks
Output 3.3: By 2021, community managed eco-tourism promoted along major trekking routes within EHL/N.	Number of sites managed under the framework of eco-tourism development/ visitor satisfaction rating	Baseline data needs to be determined by 2020	3 sites with increased visitor satisfaction rating	NTB and NTNC, DNPWC records/ Visitor survey report	Government created enabling environment for tourism
Output 3.4: By 2026, 3000 households directly benefitted by NTFP including agro-biodiversity based enterprises	Number of households benefited	N/A	3000 households	Survey reports	Communities and stakeholders fully supportive
4. Strengthening institutions and engaging local communities					
Outcome 4: Strong institutions and good governance ensured and local communities especially indigenous people and women are empowered	Management effectiveness score of Protected Areas and other units, percentage representation of indigenous people and women in NRM institutions	Baseline data needs to be determined by 2018	All Protected Areas and DFOs within the EHL/N	Survey reports	Government continue supporting the landscape vison/ goals, community willingness, availability of resources
Output 4.1: By 2021, relevant institutions at all levels including policy, management, planning and implementation are established and strengthened	Number of Institutions	N/A	Four habitat complexes	Progress Report	Government continue supporting the landscape vison/ goals
Output 4.2: By 2021, community-based organizations are established in all Rural/Municipalities across the landscape	Number of CBOs	N/A	36 CBOs in all Rural/ Municipalities	Progress report	Availability of resources
Output 4.3: By 2026, elected leaders from each Rural/ Municipality receive awareness training on snow leopard conservation and benefit sharing from natural resource management	Number of leaders trained	N/A	At least five persons from each Rural/ Municipalities	Training records	Availability of resources (funds, expertise)
Output 4.4: By 2026, at least 10 people from each Rural/ Municipality trained as Citizen Scientists	Number of people trained		360 people	Training records	Availability of resources (funds, expertise)
Output 4.5: By 2026, at least 30 percentage of NRM institution members comprise women and indigenous people	Percentage of NRM leaders from women and indigenous communities in various institutional frameworks	Baseline data needs to be determined by 2020	30%	Survey reports	Communities and stakeholders fully supportive

Strategy/Outcome/ Outputs	Objectively verifiable Indicators	Baseline Value (2017)	Expected Value	Methods or Source of Verification	Assumptions and Risks
5. Strengthening law enforcement					
Outcome 5. Poaching and illegal trade in snow leopard and associated wildlife significantly reduced	Number of incidences of poaching and illegal trade in snow leopard and associated wildlife	Baseline data needs to be determined by 2018		Official records maintained by park authorities and community groups	Availability of resources, continued government and local community support
Output 5.1: By 2021, WCCB units, APOs, and CBAPUs are capacitated and strengthened for effective patrolling to curtail poaching of snow leopards	Number of staff trained and institutions strengthened	N/A		Progress report	Availability of resources
Output 5.2: By 2021, 40 relevant law enforcement staff personnel are trained each year to detect, apprehend, prosecute wildlife traders and dismantle wildlife trade networks	Number of trained persons	N/A	40 staff per year	Progress Report	Availability of resources
Output 5.3: By 2026, wildlife conservation acts and policies of the Government of Nepal reviewed and updated in accordance with the National Strategy on Illegal Wildlife Trade and Poaching Control for Nepal (2012-2022)	Number of revised policy and acts	N/A	Revised policy and acts	Gazette	Government continue supporting the concept
6. Climate adaptation					
Outcome 6. Reduced risk and vulnerabilities due to climate change impact to the local livelihoods and snow leopard ecosystem	Number of incidences environmental risks and hazards	N/A		Survey reports	Availability of resources
Output 6.1: By 2021, appropriate climate adaptation measures are identified on the basis of the findings of climate vulnerability assessments, water provision and geospatial analyses	Climate change adaptation measures in place	N/A	Realistic climate adaptation measures reviewed by climate experts	Field reports	Availability of resources

Strategy/Outcome/Outputs	Objectively verifiable Indicators	Baseline Value (2017)	Expected Value	Methods or Source of Verification	Assumptions and Risks
Output 6.2: By 2021, Protected Area and District Forests management plans are updated to account for climate change impacts	Number of management plans	N/A	All Protected Areas and DFOs	Management plans	Availability of resources
Output 6.3: By 2026, relevant stakeholders are made aware of and/or capacitated to cope with the impact of climate change on natural and human systems	Number of stakeholders		Number of stakeholders	Field reports	Availability of resources
Output 6.4: By 2026, climate change adaptation measures adapted by communities and other relevant stakeholders	Number of stakeholders integrating climate change adaptation measures into their program strategies	N/A	Number of stakeholders	Field report	Willingness of stakeholders
7. Enhancing knowledge on snow leopard biology, behavior and its ecosystem					
Outcome 7. Benchmark database on snow leopards and their ecosystem established and long-term monitoring and knowledge management ensured	Baseline data/ effective monitoring protocols/functioning knowledge management system	N/A		EHL/Ndatabase, survey reports, Progress reports	Availability of resources
Output 7.1: By 2021, snow leopard conservation research station established and strengthened in the KCA	Research station	N/A	One research station	Progress report	Availability of resources
Output 7.2: By 2021, databases of population status of snow leopards and their prey established and updated regularly	Population data	N/A		Revised map	Availability of resources
Output 7.3: By 2021, PAs and DFOs are supported for generating/storing data base on snow leopard's ecosystem	Number of PAs and DFOs	N/A	All PAs and DFOs	Training records	Availability of resources (funds, expertise)

Strategy/Outcome/ Outputs	Objectively verifiable Indicators	Baseline Value (2017)	Expected Value	Methods or Source of Verification	Assumptions and Risks
Output 7.4: By 2021, a detailed report prepared on livestock depredation, wildlife poaching and illegal trade, and human perceptions towards snow leopard conservation	Technical reports	N/A	At least 3 technical reports	Technical reports on livestock depredation, poaching and people's attitude survey	Availability of resources
Output 7.5: By 2021, scientific assessments on the important ecological processes such as predator-prey relationships between snow leopard and its prey, and resource partitioning/ competition among the co-predators as well as their prey species and livestock carried out.	Technical reports	N/A	At least 4 technical reports	Technical reports	Availability of resources
Output 7.6: By 2021, management effectiveness of Protected Areas appraised using contemporary tools (for eg. CA|TS, METT).	Technical reports	None	One technical report	Technical report	Availability of resources
Output 7.7: By 2026, one comprehensive outlook document on ecology and conservation of snow leopard's ecosystem in the EHL/N produced	Outlook document	None	One technical guideline document	Technical report	Availability of resources
Output 7.8: By 2026, one consolidated report on the impact of climate change on snow leopard and its ecosystem produced	Technical report	None	One technical report	Technical report	Availability of resources
8. International cooperation					
Outcome 8. Transboundary cooperation among neighboring countries enhanced and collaboration with international partners strengthened	Number of MOUs and agreements amended/ signed			Progress report	Political will and continued support from respective governments/ international partners

Strategy/Outcome/ Outputs	Objectively verifiable Indicators	Baseline Value (2017)	Expected Value	Methods or Source of Verification	Assumptions and Risks
Output 8.1: By 2021, existing transboundary cooperation mechanism with India and China reviewed and strengthened	Number of meetings/ joint initiatives for e.g. population surveys, intelligence and research data sharing, etc.	N/A	Regular meetings	Report	Continued support from respective governments/ availability of resources
Output 8.2: By 2021, adequate technical and financial support from international partners are secured for implementation of this management plan	Number of donors and funds made available	N/A		Progress report	Willingness of international partners
Output 8.3: By 2026, snow leopard conservation beyond the national boundary institutionalized for joint monitoring of habitats and sharing of best practices	Events of joint monitoring	N/A		Reports	

Annex VI

Potential stakeholders of the EHL/N management plan

Institutions	Spatial scope	Primary role relevant to EHL/N	Key influence
Ministry of Forests and Soil Conservation	National	Forests, soil and watershed, biodiversity conservation	Policy
Ministry of Population and Environment	National	Climate change	Policy
Ministry of Federal Affairs and Local Development	National	Poverty alleviation and Governance	Policy
Ministry of Culture, Tourism and Civil Aviation	National	Tourism promotion, entrepreneurship building	Policy
Ministry of Water Resources	National	Policy and plan formulation pertaining to water resources	Policy
Department of National Parks and Wildlife Conservation	National	Wildlife conservation and Protected Area management	Coordination
Department of Forests	National	Forest and NTFP conservation, utilization and management	Coordination
Department of Soil and Watershed Conservation	National	Soil Conservation and watershed management/land slide and erosion control, crop management, etc.	Coordination
Department of Hydrology and Meteorology	National	Climate research and monitoring	Coordination
National Forensic Lab	National	Forensic investigation/assist crime investigation	Coordination
Natural History Museum	National	Species identification/CITES	Coordination
Nepal Army	National	Wildlife crime control, natural Disaster Response	Coordination
CIB, Nepal Police	National	Wildlife crime control, natural Disaster Response	Coordination
Central WCCB	National	Wildlife crime control, natural Disaster Response	Implementation
Protected Area Offices	Protected Areas	Wildlife and Protected Area management	Implementation
WCCB Units at Districts	District	Wildlife crime control	Implementation
District Administration Office	District	Governance, crime control, development	Coordination
District Forest Offices	District	Forest management and conservation	Implementation
District Agricultural Development Office	District	Agriculture services	Implementation
District Livestock Services Office	District	Animal husbandry services	Implementation
District Police Office	District	Public security and emergency assistance	Implementation
District Coordination Committee	District	Governance and development	Implementation
Municipal/Rural Municipal Committee	Local	Governance and development	Implementation
Business, Industry and Finance			
Nepal Bank Limited	District	Loans, Cash Deposits	Implementation
District Chamber of Commerce	District	Regulation of NTFP market	Implementation
Nepal Tourism Board	National	Tourism promotion and management	Coordination
Trekking Agencies Association of Nepal	National	Tourism promotion and management	Coordination
Hotel Association of Nepal	National	Hospitality management	Coordination
Nepal Mountaineering Association	National	Tourism promotion and management	Coordination
Federation of Nepalese Chamber of Commerce and Industries	National	Enterprise development, economic growth	Coordination
NTFP entrepreneurs	District/Local	Sustainable utilization of NTFPs	Implementation
Community-Based Institutions			
Kangchenjunga Conservation Area Management Council and subsidiary committees	Protected Area	Integrated conservation and development, Participatory management, empowerment of local people	Implementation
Gaurishankar Conservation Area Management Council and subsidiary committees	Protected Area	Integrated conservation and development, Participatory management, empowerment of local people	Implementation

Institutions	Spatial scope	Primary role relevant to EHL/N	Key influence
Langtang National Park Buffer Zone Management Council and Committees (BZUC, BZUG, BZCFUG)	Protected Area	Integrated conservation and development, Participatory management, empowerment of local people	Implementation
Sagarmatha National Park Buffer Zone Management Council and Committees	Protected Area	Integrated conservation and development, Participatory management, empowerment of local people	Implementation
Snow Leopard Conservation Committees	Local	Snow leopard research and survey, livestock insurance schemes, human - snow leopard conflict mitigation	Implementation
Community-Based Anti-Poaching Units	Local	Wildlife crime control	Implementation
Mother's groups	Local	Women in conservation and development, Micro-credit, scholarships, health and sanitation and awareness	Implementation
Monasteries	Local	Awareness on biodiversity conservation	Implementation
Himali Conservation Forum	Local	Awareness on biodiversity conservation	Implementation
Kangchenjunga Landscape Concern Group, Taplejung	Local	Bio-diversity conservation Mobilization of community-based anti-poaching operation unit	Implementation
Langtang Area Conservation Concern Society	Local	Bio-diversity conservation Mobilization of community based anti-poaching operation unit	Implementation
Hotel, lodge and camp site operators	Local	Tourism Management	Implementation
National Non-Governmental Organizations			
National Trust for Nature Conservation	National	Integrated conservation and development, biodiversity research, participatory conservation	Funding, Coordination, Implementation
Rural Reconstruction Nepal	National	Good governance, empowerment and poverty alleviation	Implementation
Local Initiatives for Biodiversity, Research and Development (LI-BIRD)	National	Empowerment, agro-biodiversity, natural resource management, poverty alleviation	Coordination/ Implementation
Federation of Community Forests Users	National	Community forestry, poverty alleviation	Coordination/ Implementation
Center for Rural Technology	National	Appropriate technology, biogas, renewable energy, and community empowerment	Coordination/ Implementation
REED Nepal	National	Capacity enhancement, educational support, and school building construction	Implementation
Sagarmatha Pollution Control Committee	Local	Environmental Pollution, Eco-tourism promotion	Implementation
Himalayan Nature	National	Biodiversity research and conservation	Implementation
Wildlife Conservation Nepal	National	Wildlife crime control	Implementation
International Centre for Integrated Mountain Development	Regional	Integrated water and hazard management, Environmental change and ecosystem services, Climate change, Integrated Knowledge Management, Policy Advocacy	Funding/Coordination
United Nation Development Program/GEF	Global	Natural resource governance, biodiversity conservation, climate change, Poverty alleviation,	Funding
United States Agency for International Development (USAID)	Global	Governance, Poverty Alleviation, climate change, sustainable livelihood development, environmental conservation, economic growth/education, health and family planning	Funding
Global Snow Leopard Ecosystem Protection Program	Regional	Snow leopard conservation	Coordination/ Funding
World Wildlife Fund	Global	Biodiversity conservation, livelihood security, climate adaptation, policy advocacy	Funding/ Coordination/ Implementation

Institutions	Spatial scope	Primary role relevant to EHL/N	Key influence
CARE	Global	Governance, policy, advocacy, economic empowerment, livelihoods improvement, biodiversity conservation	Funding/ Coordination/ Implementation
Swiss Development Cooperation (SDC)	Global	Rural infrastructure, occupational skill development, Natural resource management, governance and social inclusion, health promotion	Funding
The Mountain Institute	Regional	Livelihood security, biodiversity conservation, community-based tourism, NTFP Sacred sites preservation and management.	Funding
The Netherlands Development Cooperation	Global	Poverty alleviation and good governance, renewable energy/biogas, water sanitation and hygiene, micro-enterprise, pro-poor sustainable tourism	Funding
The World Conservation Union	Global	Environmental governance, ecosystem management, climate change and conservation learning	Funding/ Coordination/ Implementation
ZSL	Global	Biodiversity research and conservation	Funding/ Coordination/ Implementation
Kadoori (KAA)	National	Rural infrastructure development (Bridge construction, drinking water supply, solar set distribution)	Funding/ implementation
The Snow Leopard Conservancy	Global	Community based conservation, range-country environmental education, research and monitoring	Funding
Snow Leopard Trust	Global	Advocacy, Research and conservation	Funding
The Rufford Foundation	Global	Capacity development, research funding	Funding
Tribhuvan University	National	Capacity development and Research	Implementation
Kathmandu University	National	Capacity development and Research	Implementation
Nepal Academy of Science and Technology	National	Research	Implementation
Schools	Local	Conservation education, Eco-clubs	Implementation

Annex VII

Composition of National Biodiversity Coordination Committee (Adapted from GoN 2014, 2015)

SN	Designation and Organization	Position in NBCC
1	Honorable Minister, Ministry of Forests and Soil Conservation	Chairperson
2	Honorable Member, (Agriculture and Rural Development Portfolio), National Planning Commission	Member
3	Secretary, Ministry of Agricultural Development	Member
4	Secretary, Ministry of Science, Technology and Environment	Member
5	Secretary, Ministry of Federal Affairs and Local Development	Member
6	Secretary, Ministry of Water Resources	Member
7	Secretary, Ministry of Tourism and Civil Aviation	Member
8	Secretary, Ministry of Physical Infrastructure and Transport	Member
9	Secretary, Ministry of Finance	Member
10	Professor, Tribhuwan University*	Member
11	Professor, Agriculture and Forestry University*	Member
12	President, Federation of Nepalese Chamber of Commerce and Industry	Member
13	Senior Official, National Foundation for Development of Indigenous Nationalities	Member
14	Chairperson, Nepal Federation of Indigenous Nationalities	Member
15	Country Representative, World Conservation Union (IUCN), Nepal	Member
16	Representative of a Conservation I/NGO*	Member
17	Chairperson, Federation of Community Forests Users Nepal	Member
18	Chairperson, National Federation of Buffer Zone Development Council	Member
19	Chairperson, National Federation of Private Forestry	Member
20	Representative from Farmer Groups/Associations*	Member
21	Five independent experts comprising mountain biodiversity, snow leopard, mountain livelihood, hydrology and climate science (at least one woman)*	Member (5)
23	Secretary, Ministry of Forests and Soil Conservation	Member Secretary

*As nominated by the NBCC Chairperson

Annex VIII

Cost estimates and activities for EHL/N management plan

Strategies/Activities	Unit	Quantity	Rate (USD)	Total cost (USD)
1. Land use planning and habitat management				
Field verification of potential corridors and critical conservation sites	Corridors	14	2000	28000.00
Identification and protection of climate refugia through further research and monitoring	Study	1	15000	15000.00
Promotion of traditional rotational grazing management systems, in conjunction with climate science, to help transhumance herders adapt to climate change impacts	Rural/ Municipalities	50	10000	500000.00
Prepare and implement a science-based workplan for prey population restoration in SNP and LNP	Event	1	75000	75000.00
Update Protected Area management plans in consistent with the landscape vision map	Number	5	1000	5000.00
Undertake climate smart management of pasture lands and local fresh water systems including improving access and development of water holes/conservation ponds	Rural/ Municipalities	25	50000	1250000.00
Prepare a climate integrated landscape vision map for habitat complexes identified in this management plan by highlighting the conservation value, economic development and the climate adaptation in the critical conservation sites and potential corridors.	Number	1	20000	20000.00
2. Mitigating human-snow leopard conflict				
Review, update and simplify existing relief guidelines and community-based livestock insurance schemes	Study	1	5000	5000.00
Launch the community based livestock insurance schemes in three Protected Areas	Protected Areas	3	30000	90000.00
Capacitate herders for the efficient management of livestock herds including improved guarding, supplementary feeding, improved veterinary services, etc.	Rural/Municipalities	50	1500	75000.00
Adopt 'Safe Systems Approach' (Brooks 2015) for snow leopards	Complexes	4	10000	40000.00
Apply innovative deterrents (predator-proof corrals, colour changing lights, etc.) in the conflict hotspots	Number	10	5000	50000.00
Train, sensitize and engage community leaders (including elected and religious leaders) in conservation	Rural /Municipalities	50	1500	75000.00
Facilitate rescue and handling of problematic animal	Number	300	500	150000.00
Provide emergency funds for immediate relief to conflict victims	Number of cases	120	250	30000.00
3. Improving people's livelihoods				
Promotion of eco-tourism in 10 major trekking routes in three sites across the landscape	Sites	3	100000	300000.00
Tourism management plan developed for five potential trekking destinations in the region (Kangchenjunga, Makalu Barun, Pathibhara, Khumjung and Solukhumbu)	Sites	5	10000	50000.00
Strengthening of NTFP enterprise, including regulating Yartsa Gumbu collection, and promotion of small scale enterprises for handicrafts and other productsacross critical snow leopard conservation sites	Schemes	10	3000	30000.00
Promotion of livestock product development through increased investment in livestock productivity including dairy production and marketing that reduces unsustainable use of ecosystem services (for e.g., livestock grazing, water and energy consumption, etc.)	Districts	10	8000	80000.00

Strategies/Activities	Unit	Quantity	Rate (USD)	Total cost (USD)
Provide training on alternative livelihood options to bring about economic diversificationand build household and community climate resilience	Rural /Municipalities	50	100	5000.00
Arrange soft-loans or micro-credits for poor and marginalized people including women, to invest in agro-biodiversity based enterprises.	Rural /Municipalities	50	1000	50000.00
Development and application of catchment-level climate-smart water management schemes	Complexes	4	25000	100000.00
Coordinate police and local government for safety of tourists visiting the area	Rural/Municipalities	36	1000	36000.00
Conduct nature guide training to the local people	Complexes	4	2500	10000.00
4. Strengthening institutions and engaging local communities				
Support institutional set up of the landscape responsive units/ section at the MoFSC, DNPWC, DOF, PAs, Rural/Municipalities	Number	70	1000	70000.00
Strengthen Management Information System (MIS) of MoFSC and database management capability of DNPWC, DoF, PAs and Rural/ Municipalities	Number	65	500	32500.00
Launch intensive conservation education and awareness campaigns focusing on biodiversity and climate change in the area	Number	50	1000	50000.00
Conduct training on natural resource governance and climate change adaptation focusing on women and indigenous groups, ensuring that it is consistent with the restructuring of the administrative units under the new constitution	Number	10	1000	10000.00
Formation of community-based organizations and provide orientation on their roles and responsibilities	Number	55	1000	55000.00
Provide training to the citizen scientists on field techniques to monitor snow leopard, their prey populations and habitat and climate change impacts in the region	People	600	100	60000.00
Update PA management plans in line with the national snow leopard and ecosystem conservation strategy, with emphasis on climate change adaptation	PAs	5	2000	10,000.00
Construct and equip check posts/camps inside Protected Areas	Number	24	20000	480000.00
5. Strengthening law enforcement				
Review and update wildlife conservation acts and policies of the Government of Nepal	Number	5	1000	5000.00
Establish and strengthen WCCB units, APOs, CBAPUs in all Protected Areas and district forest offices by enhancing security and safety, insurance, rewards and incentives for frontline staff	Rural /Municipalities	55	5000	275000.00
Train law enforcement officers for detecting, apprehending and prosecuting poachers and traders	Number	10	5000	50000.00
Develop a guideline document and train law enforcement officers to detect, apprehend and prosecute poachers and traders	Number/PAs	1/5	15000	75000.00
Application of cutting-edge surveillance tools and technologies such as SMART, UAVs, Sniffer Dogs, Trail Guard, and DNA barcoding.	Number	5	10000	50000.00
Conduct awareness raising programs to inform local people about wildlife acts and regulations	Number	10	1000	10000.00
Conduct joint patrolling by Protected Area, community and enforcement staff	Events	30	4000	120000.00
Orient frontline staff on CITES and other international and national wildlife policies	Events	20	5000	100000.00
6. Climate adaptation				
Identification of vulnerable communities and bio-physical resources in all the 14 critical conservation sites within the four habitat complexes identified in this plan	Survey	5	10000	50000.00

Strategies/Activities	Unit	Quantity	Rate (USD)	Total cost (USD)
Investments in improved weather monitoring to obtain fine-grained data associated with shifts in weather	Protected Areas	3	50000	150000.00
Development of early warning systems for hazard risks like landslides, flooding and extreme drought	Number	1	100000	100000.00
Trainings for national park and conservation area managers and staff in the principles of climate-smart conservation, including scenario planning exercises to plan for future climate changes	Protected Areas	5	5000	25000.00
Development and mainstreaming of climate change adaptation strategiesinto governance mechanism, strategic plans and policies of the line agencies	Study	1	10000	10000.00
Capacity building of relevant stakeholders including government, non-government and community based organizations/individuals	Rural/Municipalities	36	1000	36000.00
Community education and engagement to sensitize about changes in the landscape in the critical conservation sites	Sites	11	5000	55000.00
Implementation site-specific adaptation measures focusing on food, water and livelihood securityin all the critical conservation sites	Sites	11	10000	110000.00
7. Enhancing knowledge on snow leopard biology, behavior and its ecosystem				
Establish snow leopard conservation research station in KCA	Research Station	1	100000	100000.00
Undertake ground truthing and fine tuning of the geospatial analyses carried out for this plan	Sites	5	5000	25000.00
Population survey of snow leopards and their prey, and advocacy forjoint monitoring with India and China	Number	2	50000	100000.00
Conduct molecular genetic study and satellite telemetry of snow leopards to understand metapopulation dynamics and ecology of snow leopards in the EHL/N	Sites	10	12000	120000.00
Undertake exploratory surveys pertaining to livestock depredation, wildlife poaching, and human perceptions towards snow leopard conservation	Survey	5	5000	25000.00
Carry out study on interspecific interactions with other potential predators including wolf and common leopard	Study	1	30000	30000.00
Identification and intensive monitoring of climate change effects on grasslands and the prey base to keep track of the impacts of climate change	Complexes	3	10000	30000.00
Identify climate refugia and future corridors necessary to connect current with future viable habitat	Study	3	15000	45000.00
Intensive monitoring of biological corridors to assess the corridor functionality	Sites	14	5000	70000.00
Assess pasture quality, herding practices, and interactions between wild and domestic ungulates	Study	5	5000	25000.00
Intensive monitoring of critical habitats to keep track of humanfootprint and climate change impacts	Sites	11	2500	27500.00
Management effectiveness of the PA network assess through contemporary tools such as METT, CATs, etc.	PAs	5	10000	50000.00
8. International cooperation				
Review and update regional trans-boundary cooperation arrangement including bilateral agreements and MOUs	Number	1	2500	2500.00
Organize regular training on capacity building and information sharing at the transboundary and regional level	Number	5	10000	50000.00
Undertake periodic meetings to share intelligence information as well as the best practices	Number	10	5000	50000.00
Explore potential funding sources and prepare proposals for collaborative conservation initiatives	Number	5	2000	10000.00

Strategies/Activities	Unit	Quantity	Rate (USD)	Total cost (USD)
Advocate for joint patrolling to curb illegal wildlife trade along international border between Nepal, China and India	Number	10	5000	50000.00
Participate and contribute in international symposia, workshops and training program, to share and learn about the best practices in snow leopard conservation	Number	10	5000	50000.00
Total				5572500.00