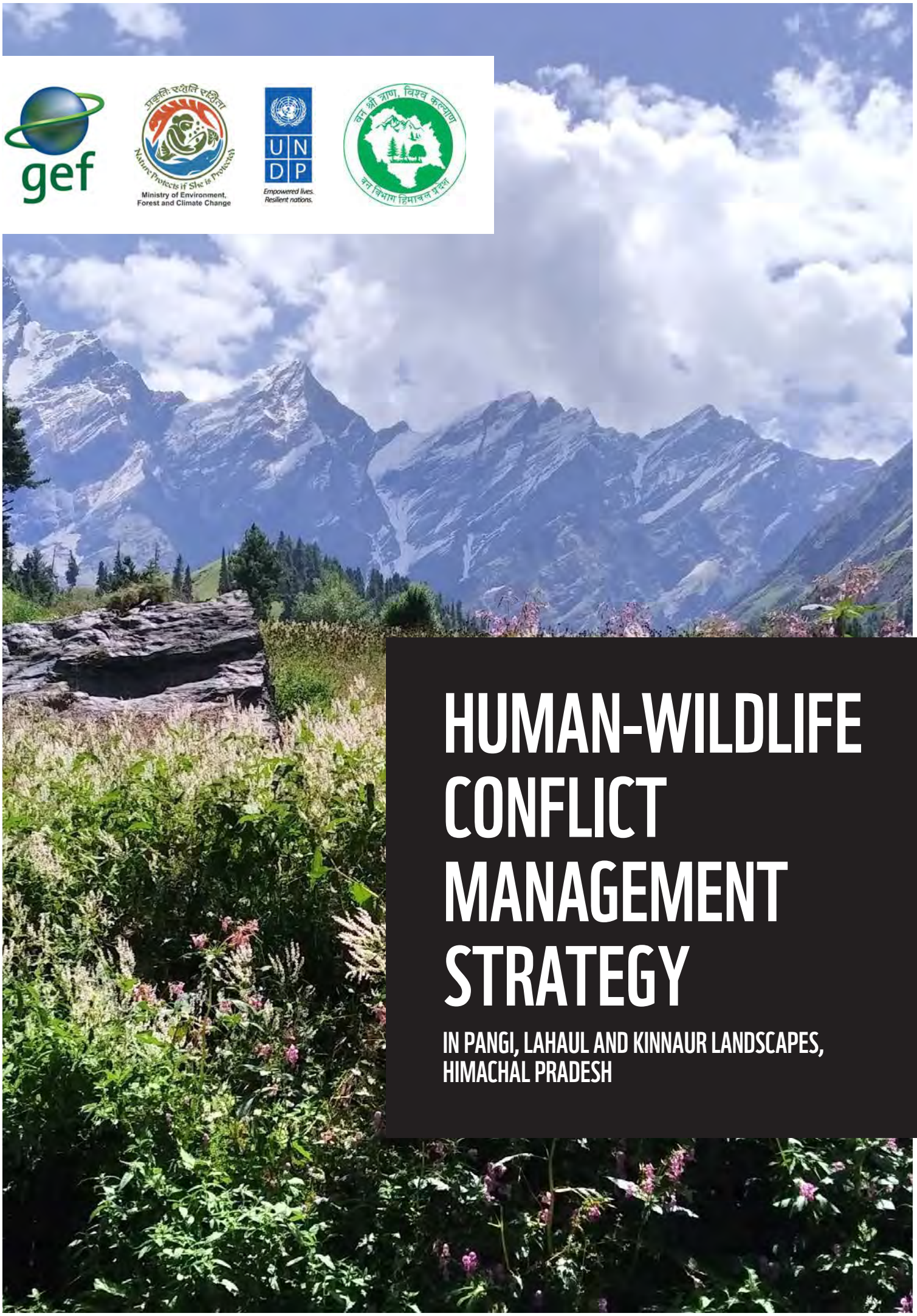

HUMAN-WILDLIFE CONFLICT MANAGEMENT STRATEGY

IN PANGI, LAHAUL AND KINNAUR LANDSCAPES, HIMACHAL PRADESH

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1. EXECUTIVE SUMMARY

The Himalayan region has a history of people and wildlife sharing space. The pastoralism in the region dates backs to at least three millennia and likely involved low intensity grazing with low livestock numbers and stocking densities to meet the sustenance needs of local communities. Less than 10 percent of the region is designated as protected areas, but wildlife populations occur across the region and are not restricted to protected areas alone. However, the region is witnessing an unprecedented socio-economic change due to, improved connectivity and integration with domestic and international markets, commercial production of livestock, development of linear infrastructure as well as a growing human population with different aspirations. Himalayan rangelands are facing increasing pressures to support a multitude of human enterprise and as human footprint and interface increases, so does the conflicts with the wildlife in the region. Loss of livestock due to predation by carnivores such as snow leopard, wolves and bears often causes severe economic losses to the local communities, imposes hidden costs, and increases vulnerability. Similarly, loss of crops to bears and wild ungulates also imposes cost on people sharing space with wildlife. However, the conflicts with wildlife need to be evaluated in the backdrop of the ongoing changes in the region. The wildlife in the Himalaya too is under tremendous pressure due to hunting and trapping for meat as well as commercial exploitation, degradation of habitat due to rapid and poorly planned infrastructure development, overstocking of rangelands by livestock and an increasing menace of free ranging dogs. Specifically, where production of commercial livestock and crops is involved, the tolerance of people towards wildlife appears to diminish. The human-wildlife conflicts have damaging consequences for both people and wildlife and therefore it is important to address the issue to safeguard the livelihood of vulnerable local communities as well as protect the wildlife populations. We examined multiple facets of human wildlife conflicts by examining social and ecological drivers of conflicts to develop a comprehensive human-wildlife conflict mitigation strategy.

A vast majority of respondents across Pangi, Lahaul and Kinnaur reported conflict with wildlife. Brown bear was the mostly frequently reported species causing conflict followed by black bear, rhesus macaque and wolf. Snow leopard was among the least reported conflict species in both Pangi and Lahaul whereas, in Kinnaur, most respondents reported snow leopard as the conflict species. Overall, the five primary species of conflict reported across the study landscapes were snow leopard, monkey, black bear, brown bear, and wolf. Crop depredation by wild animals was the most prevalent type of conflict followed by livestock predation which is expected in pastoral and agro-pastoral communities. The willingness of communities to co-exist with or tolerate wolves and macaques was particularly low in Pangi, low for brown bears and macaques in Lahaul as well as Kinnaur. Respondents across the three landscapes exhibited higher tolerance for snow leopards. Similarly, across the landscapes, most people were unwilling to retaliate in the instances of crop damage, but a large proportion deemed retaliatory killing as acceptable in case of livestock loss. Climate change emerged as an overarching issue and the predominant challenge to livestock rearing as well as agriculture followed by conflicts with wildlife. Affected communities reported the use of a range of mitigation measures with varying degrees of success, some of the measures being supported by state administration but none by any NGO's. Compensation for livestock loss was recognized as an effective tool, but communities perceived it negatively in its current form of implementation. Even the mitigation measures which were viewed favourably are distributed sparsely and do not match the scale of the conflict with just a few individuals within a village or few villages within a cluster receiving some form of support. The community in Pangi is particularly vulnerable to Human Wildlife Conflicts and requires focused attention.

We recommend a multi-pronged approach to mitigate human wildlife conflict that involves a genuine participation of affected communities in planning and implementing conflict mitigation strategies, a rigorous evaluation of the effectiveness of conflict mitigation measures, context specific scaling up of measures that are effective and use of multiple interventions for enhanced effectiveness. Convergence between multiple stakeholders to work towards mutually agreed upon and shared goals is a necessity in multiple use landscapes and needs to be facilitated. Long term studies that examine the carrying capacity of the rangelands, the vulnerability of people and wildlife to climate change effects, population and distribution of wildlife & livestock and factors that promote pro-conservation behaviours should be encouraged. Landscape scale management planning in multiple use landscapes through a social and ecological zonation approach that can help reconcile wildlife conservation with the needs and aspirations of local communities and should be implemented in earnest. Such a framework is envisioned in the Project Snow Leopard document of the Government of India and can play a pivotal role towards enabling long term co-existence between people and wildlife.

2. INTRODUCTION

The Himalaya can be visualised as multi-use landscapes in which human communities are primarily engaged in agricultural activities and livestock rearing for their sustenance. The local communities are also highly dependent on the natural resources available in their surroundings to meet their livelihood requirements. In such multi-use landscapes, anthropogenic activities such as agriculture, livestock grazing, and resource extraction overlap with the presence of wildlife (Moilanen et al., 2005). Even the wildlife reserves established in such landscapes lack well-defined physical boundaries and local communities have historically accessed natural resources in and around such reserves. Less than 8% of the Indian Himalayas is under formal protected areas (Rodgers, 2000) and large parts of several protected areas have little wildlife value though they are essential as glacial and permafrost areas. However, unlike other terrestrial landscapes where wildlife is usually restricted to protected areas, the wildlife occurrence in the Himalaya is pervasive as is the human dependence and use of these areas, although wildlife populations typically occur at lower population-densities outside the protected areas (Mishra et al., 2009). This proximity between people and wildlife across large swathes of Himalaya is prominently felt in the type of interactions between wild animals and human communities. These interactions can range from positive and uplifting to negative and damaging

The consequences of negative interactions tend to have damaging effects on both wild animals as well as humans. Predation on domestic livestock by carnivores, agricultural crop damage by herbivores, a decline in pastureland available for livestock grazing due to resource competition with wild herbivores, and human injury or fatality are all instances that disrupt human livelihood sources. Faced with financial loss, threat to food security and mental well-being, communities can be compelled to respond against wild animals by killing them, which in turn adversely affects wildlife populations and has conservation implications. Such situations have been termed as 'human-wildlife conflicts' (Bagchi & Mishra, 2006; Barua et al., 2013; Bhatnagar et al., 2006; Mishra et al., 2009; Morehouse & Boyce, 2017; P. J. Nyhus, 2016; Ogra, 2008; Redpath et al., 2015)

Given the consequences of Human-wildlife conflict (HWC) for people and conservation, it has been extensively studied across the globe and in India (Bhatia et al., 2019; P. J. Nyhus, 2016; Treves & Karanth, 2003). The Indian Himalayas have, however, been under-researched especially outside of protected areas or the studies have been limited to a few species of conflict. Even where such studies have been conducted, the focus of studies has been mostly on quantifying the conflict rather than examining the underlying causes and potential mitigation measures. In addition, studies on human-wildlife conflict have an ecological bias wherein the human dimensions and influence of social issues on conflict have received scant attention.

Some of the species from the Himalayan landscape reported to be damage or loss-inducing are snow leopard, leopard, black bear, brown bear, wolf, and lynx. These wildlife species are themselves facing a range of threats including habitat loss and degradation, poaching for illegal wildlife trade, increasing resource competion from people and their livestock and pressures induced by rapid infrastructure development in mountain regions. In addition, these species are also vulnerable to climate-change induced threats (Shrestha et al., 2012). The overarching influence of climate induced changes on the species habitat and livelihood of local communities is expected to exacerbate human-wildlife conflicts. In addition, human-wildlife conflict is identified as the most pressing problem for the conservation of carnivores worldwide (Morehouse & Boyce, 2017). It is in the best interest of both human communities and wildlife to address the pressing problem by reducing, and ideally mitigating, HWC in order to safeguard the livelihoods of the vulnerable, local communities as well as conserve wildlife populations across landscapes outside of protected areas. Therefore, research focusing on understanding multiple facets of human-wildlife conflict is critical for carefully developing mitigation or management plans that will inform decision and policymaking and enable a harmonious co-existence between people and wildlife. We aimed to integrate the ecological and social science disciplines to unravel the nuances of human-wildlife conflict, its impact on local communities and potential solutions that may help in developing and effective HWC mitigation strategy.

2.1. SCOPE OF THE PROJECT

The scope of our assignment in the study landscapes of Pangi-Lahaul and Kinnaur is to develop an incisive HWC mitigation strategy based on a comprehensive study of human-wildlife interactions and conflict. We aim to achieve this by understanding and integrating the two critical dimensions of human-wildlife conflicts viz. the social and ecological factors that drive conflict. The study will enable us to determine the extent and nature of HWC, assess the social factors that influence a communities' perception, attitude and tolerance towards conflict species, understand the distribution and occurrence of conflict species, examine the current state of awareness about rules, schemes, strategies, and effectiveness thereof and identify primary and potential stakeholders and their roles in the context of HWC in the study landscapes. We also aim to propose a framework for mitigation of human-wildlife conflicts in the study landscapes.

2.2. PROJECT GOAL AND OBJECTIVES

To develop a comprehensive strategy for human-wildlife conflict management in the study landscapes of Pangi-Lahaul and Kinnaur. The study is built on the following objectives:

1. To examine the nature and extent of human-wildlife conflict in the project landscapes.
    - To identify primary animal species of conflict and conflict hotspots in the study landscapes.
    - To examine the perceptions, attitudes, and tolerance of local communities towards wildlife
2. To study the distribution and occurrence of species of conflict in the study landscapes.
3. To identify stakeholders responsible in managing human-wildlife conflict in the landscapes.

GOAL

Development of strategies for a comprehensive and effective management plan to mitigate human-wildlife conflicts in the study landscapes

OBJECTIVES	ACTIVITIES	OUTPUTS
Identify primary conflict species and conflict hotspots	Village-level focus group discussions, Household-level questionnaires, Semi-structured interviews	Social dunamics of conflict w.r.t perception, attitude and tolerance towards conflict species; Heat map of HWC areas/locations
Study distribution and occurrence of species of conflict	Ecological sign surveys to determine occupancy of large mammals of study landscape	Occupancy maps for conflict species
Stakeholder analysis	Identification of various stakeholders and their roles in HWC	Mitigation and management plan involving the identified stakeholders

Figure 1.1. Overview of project assignment goal, objectives outputs.

1. STUDY AREA

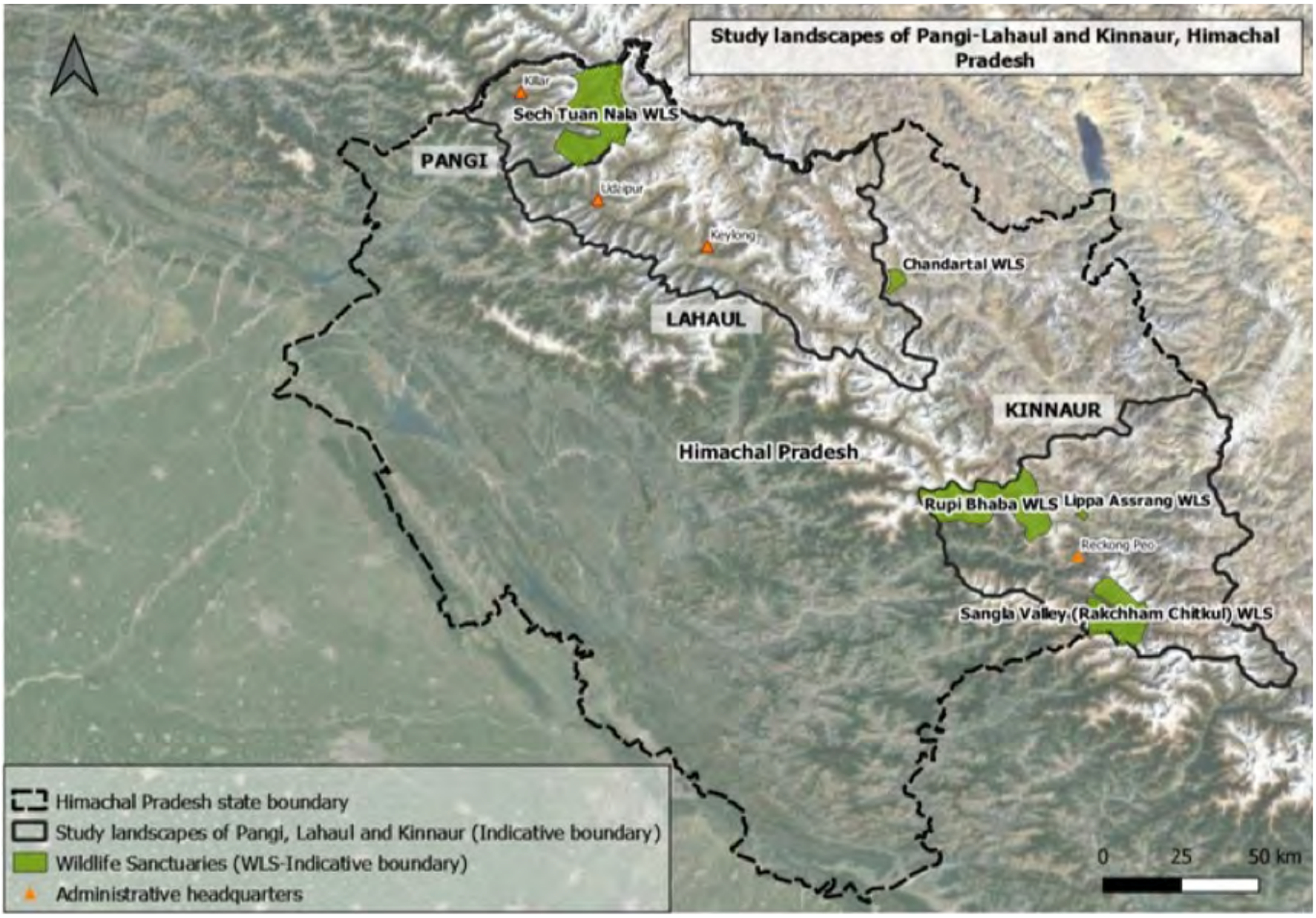
The project focuses on Pangi-Lahaul and Kinnaur landscapes that display a collective of variations with respect to their biogeography, culture as well as faunal and floral diversity.

3.1 LANDSCAPE

The Pangi region, a subdivision of Chamba district, nestles between the Trans-Himalayan Zanskar range in the north and the Himalayan Pir Panjal range in the south-west. The rugged topography across an area of 1601 sq. Km of the remotely situated Pangi valley makes access via the road challenging. The Chandrabhaga river flows for 85 km along the valley, dividing the region into two unequal parts, of which the larger right bank gradually meets with the Zanskar range, and the smaller left bank joins the Pir Panjal. The altitudinal extent of the valley ranges from 2000 m asl (above sea level) to 6000 m asl, making it a biogeographic representation of a transition zone between the Himalaya and Trans-Himalayan, with a composite of biodiversity from both the zones. Although the region is in a semi-arid area with a recorded estimation of 230-740 mm rainfall, it has received significant rain in the last two decades since 1994. Heavy snowfall in winters (300-470 mm) keeps the valley land-locked for about six winter months (Chaudhry, 1998; Rana et al., 2014; ZSI, 2013).

The Lahaul region is a subdivision of the Lahaul and Spiti district, part of the cold desert zone of the Indian Himalaya. The Lahaul valley is enclosed by the main Himalayan range from the north, the Pir Panjal range on south and the Kunzum range on the east, separating it from the Spiti subdivision. The Chandra and Bhaga river converge here to form the Chandrabhaga that progresses into the Pangi valley. Spread over an area of 6097 sq. Km, this cold desert region receives heavy snowfall of about 200-400 cm, with the temperature dipping down to -16 degree Celsius. The barricading mountain ranges allow scanty precipitation in the form of rainfall, regionally varying between 100-700 mm (Sharma et al., 2011; Singh, 2005).

The Kinnaur district spans an area of 6400 sq. Km and the region can be divided into three distinct physical units based on the three eco-climatic zones: i) the arid, Trans-Himalayan upper Kinnaur, ii) the dry middle Kinnaur, and iii) the wet lower Kinnaur zone. Three mountain ranges, namely,



Map 2: Study landscapes of Pangi-Lahaul and Kinnaur, Himachal Pradesh (indicative boundaries used)

Zanskar, Great Himalaya and Dhauladhar, run through this area giving it an altitudinal variation from 1500m to 6770 m asl. The rainfall level ranges from 45.5- 380 mm across the district from upper to lower Kinnaur (Chawla, Kumar, et al., 2012; Chawla, Parkash, et al., 2012; Sharma, P D; Minhas, 2015).

3.2 PEOPLE

Communities across the study landscapes are predominantly dependent on an agro-pastoral livelihood for their sustenance. The traditional agriculture system has transformed and moved towards cultivating economically lucrative cash crops like peas in Pangi, potato and peas in Lahaul, and apples in Kinnaur. These cash crops have become the primary economic resources for these tribal regions in recent years. Additionally, tourism has become a fast-blooming business and source of employment in Lahaul and Kinnaur. Owing to the relative ease of access to markets, Lahauli and Kinnauri people are economically more prosperous than Pangwalis. The two main religions of the study regions are Hinduism and Buddhism, with Pangi and Kinnaur comprising of a majority Hindu population. In contrast, Lahaul consists of Buddhist-dominant communities (Census of India - Himachal Pradesh, 2011). The Pangwali, Lahauli and Kinnauri people have culture and traditions unique to each of them.

Table 2 Landscape-wise census as per the District Census handbooks of Chamba, Lahaul & Spiti and Kinnaur, 2011.

LANDSCAPE	NO. OF INHABITED VILLAGES	TOTAL POPULATION	POPULATION DENSITY
Pangi	60	18,868	11 people per km sq.
Lahaul	198	19,107	2 people per km sq.
Kinnaur	241	84,121	13 people per km sq.

The Pangwalis have a unique traditional system of local governance known as the *praja* system which works concurrently with the Panchayat of the village. Every village has one *praja* to not only resolve social issues of the village but also implement rules and punishment with respect to natural resource use (Chaudhry, 1998). The *praja* system is recognised to be responsible for successfully maintaining sustainable extraction of natural resources, such as fuelwood, fodder and medicinal plants and herbs in the region (personal communication, Mr. Roop Singh, Pangi forest department). Similarly, in Lahaul, it is the *mahila mandal* of every village that ensures sustainable practice when it comes to resource and pasture use.

Other than the local resident communities, these landscapes are also visited by the Gaddi migratory pastoralists from Chamba and Kangra who use the high-altitude pasturelands in the summer months to graze their livestock (Ghoshal, 2018; ZSI, 2013).

3.3 WILDLIFE AND BIODIVERSITY

Pangi-Lahaul and Kinnaur landscapes harbour a diverse assemblage of biological elements from the Himalayan and Trans-Himalayan zones. The steep altitudinal variation divides the landscapes broadly into three types of vegetation: Himalayan temperate, sub-alpine and alpine type (Chawla, Parkash, et al., 2012; Rana et al., 2014; Sharma, P D; Minhas, 2015; Sharma et al., 2011).. The rich biodiversity is also represented in the host of flora and fauna of these regions. The large carnivores of the region include snow leopard (Panthera uncia), Himalayan brown bear (Ursus arctos isabellinus) and Tibetan wolf (Canis lupus filchneri) that range in areas beyond 3000m a.s.l., whereas common leopard (Panthera pardus) and Himalayan black bear (Ursus thibetanus) occur in areas below 3000m a.s.l. Other mammalian faunal diversity includes red fox (Vulpes Vulpes), blue sheep (Pseudois nayaur), Asiatic ibex (Capra sibirica), Himalayan serow (Capricornis thar), Himalayan goral (Naemorhedus goral), musk deer (Moschus leucogaster), Himalayan tahr (Hemitragus jemlahicus) and barking deer (Muntiacus muntjac) (Bhatnagar et al., 2008; Ghoshal, 2018). The four protected areas, namely, Sechu-Tuan Wildlife Sanctuary (WLS), Rupi Bhabha WLS, Sangla valley WLS and Lippa-Asarang WLS are a representation of rich biodiversity of the region.

3.4 HUMAN-WILDLIFE CONFLICT IN THE LANDSCAPES

The resident agro-pastoralists and migratory pastoralists in the landscape have frequent encounters with wild animals. Crop depredation and damage by wild animals like bears and monkeys, or livestock depredation by a snow leopard, wolf and bears are viewed in an antagonistic light as it causes significant financial loss as well as mental stress. There is an additional threat to human life because of bears in case of surprise encounters. However, personal injury and fatality due to wildlife are rare in the study region. Persistent negative encounters with wildlife can result in the retaliatory or preventative killing of wild animals by communities to safeguard their livelihood. In addition to such situations of conflict, the study region was also known for hunting by local people to obtain meat when resources were scarce in the winters. Moreover, poaching is another under-reported issue as detecting poaching and enforcement is difficult in this remote region. The migratory labourers are reported to hunt musk deer for meat and musk pod and black bear for bile (Bhatnagar et al., 2008; ZSI, 2013).

4. METHODS

Human-wildlife conflict depends on many social and environmental factors. Developing conflict mitigation strategies requires knowledge of the distribution of wildlife species in the landscape as well as the social, political and economic context of the people living in the area. To this end, ecological sign surveys and community-based social surveys were carried out by the project team and field assistants from July to November 2019, the details of which are in the following sections.

4.1. SOCIAL SURVEY

The study was designed, and primary data was collected in the landscape using mixed methods research tools. Primary data was collected in 17 villages across Pangi-Lahaul landscape and four villages around the Rakchham-Chitkul Wildlife Sanctuary in Kinnaur between July and November 2019 by five researchers.

The sampled villages were selected keeping in mind the following criteria that may influence the nature and intensity of conflict as well as attitudes towards the same:

- Spatial coverage: Areas and villages were selected to spatially cover the expanse of the study area
- Geomorphology: The study landscapes were divided based on a few broad physical geomorphological variations such as the left and right bank of the river or nallah, inside and outside a valley, dense forest land and open pasturelands, and altitude variations.
- Distance from highway as a measure of accessibility: Some sampled villages were closer in proximity to the highway and some were farther away from the highway or with no access to a motorable road. Villagers closer to the highway had easier access to amenities such as the market in terms of time, cost, and effort.
- Religious diversity: The communities in the study landscapes were either followers of the Hindu religion or Buddhism.
- Village size: Variation in the number of households of a village was also considered for selection. Village size was classified as small, medium, or large. Most of the sampled villages were either small or medium-sized owing to the availability of sampling time. However, to account for this gap, the small villages in proximity to the big village were selected as proxy. Moreover, a semi-structured interview was administered in the big village.
- Livelihood types: All the village communities of the study landscapes were agro-pastoral communities.

This was done to cover as much variation as possible in the vast study landscape. The selection of the villages was also made after consultative discussions with the staff of Forest Department. Several of the villages surveyed also feature in the indicative list of villages (that may be surveyed) which was provided by the department.

A combination of focus group discussion, household-level questionnaire and semi-structured interviews were employed to collect data in the sampled villages.

1. Focus group discussion (FGDs): Based on the availability of village members on the days of sampling, we held FGDs to ask them about issues related to wild animals, agriculture, and natural resources. During these FGDs we also encouraged the community members to draw a village map as well as resource map to gain insights about the village as well the surrounding areas that they frequently used. The village mapping exercise was an attempt to identify stratifications inside the village based on affluence (landholding, livestock-holding, physical appearance of houses), or caste. The next step, i.e., conducting household questionnaires- was to sample from these identified stratifications or strata.
2. Household-level questionnaires: This questionnaire was administered to 20-25% of the total no. of households in the village. Stratified random sampling was employed based the strata identified from the village mapping exercise. Only one member from a household was selected as a respondent for the questionnaire. We attempted to sample as many female respondents as possible. These questionnaires were used to gather information on socio-economic status, animal species of conflict, instances of conflict, tolerance, and willingness to co-exist, perceived causes of conflict, awareness of compensation rules and effectiveness of livestock/crop protection and mitigation measures. All questionnaires were recorded on an offline mobile application called KoBoCollect.
3. Semi-structured interviews: In-depth semi-structured interviews were also recorded in all sampled villages to gather more granular and intangible information to understand the historical and cultural contexts of human-wildlife conflict. These interviews were only conducted with those respondents who were able and willing to provide extensive details about the same.

Microsoft Excel and program R were used to generate summary statistics from the collated household-level data. Dedoose was used to code and analyse semi-structured interviews.

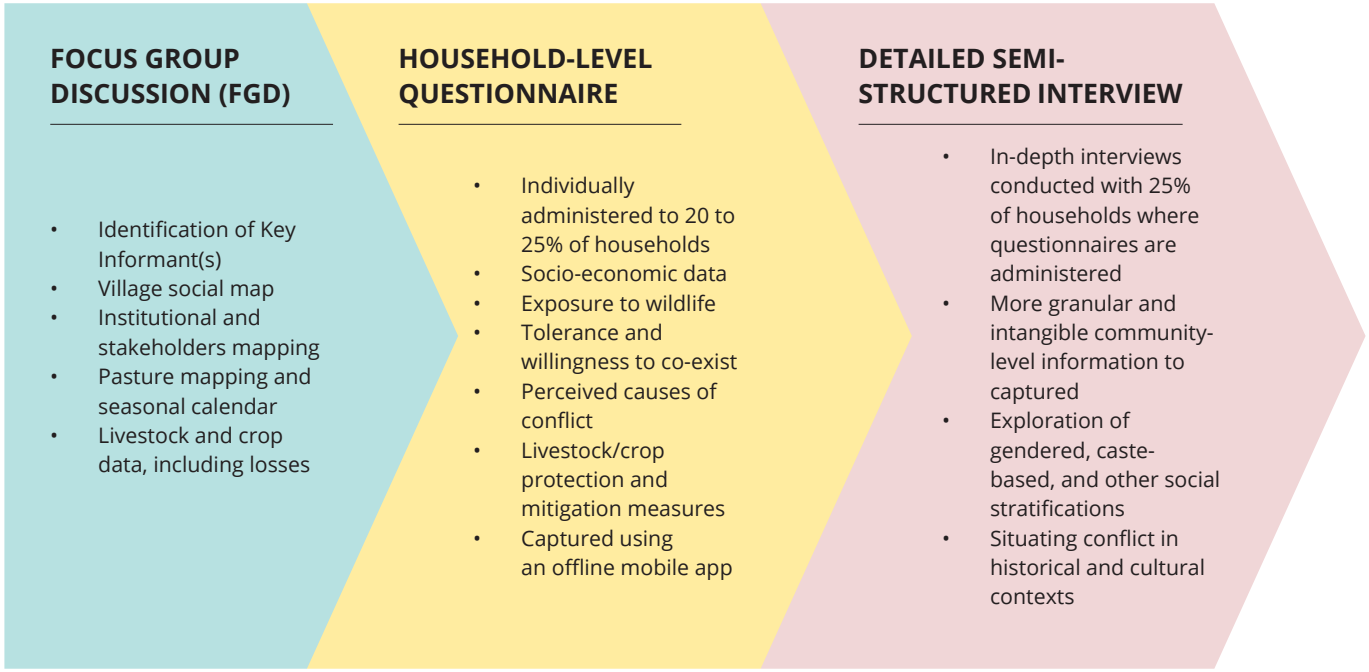


Figure 3.1 Primary data collection method employed in the study

Limitations of Study Design

The study was initially commissioned for eight months, and the study design was adopted to collect primary data in a short period.

Although mixed methods research tools were used to capture a reasonable representation of the communities residing in or using the study landscapes, and the conflict faced by them, each locale presents a unique set of issues. For instance, wildlife may be prevalent depending on the factors like topography, or anthropogenic influences, among others. Locales of varied scales might have distinctive economic, cultural, and political contexts or a combination of these, that may make their perspectives on exposure to wildlife unique. Size, accessibility, modes of available communication, and administrative and political representations among villages may further problematise the issue of finding confident representation in the relatively small set of the population surveyed from the landscapes.

Members of the Gaddi community experience conflict differently from other sedentary populations residing in the study landscapes because of their mobility and their semi-nomadic lifestyle. It is, however, essential to understand their experiences to assess the conflict in these landscapes comprehensively. We elaborate on the Gaddi-Wildlife relationships in a separate section.

A formal stakeholder workshop could not be organised so far to receive feedback and suggestions on the proposed mitigation strategies because of COVID-19 outbreak across India. However, we have reached out to key stakeholders over the phone to include their feedback.

This study aims to understand and decipher the more direct impacts of human-wildlife conflict. However, other more hidden impacts – prominently – psychological and social should be investigated further to comprehensively understand how conflict with wildlife manifests within these communities, and how it affects their well-being (Ogra, 2008).

3.2 ECOLOGICAL SURVEY

The objective of the ecological survey was to conduct occupancy modelling (MacKenzie et al., 2017)

for the different wildlife species in the landscape. Sign surveys were conducted to record direct and indirect wildlife signs as well as data on landscape and local factors which could affect the probability of occurrence of different wildlife species. As species identification from pellets of sympatric ungulates is error-prone (Ramón-Laca et al., 2014), occupancy analysis focused only on carnivores. Moreover, since it is hard to differentiate between brown and black bear solely based on indirect signs, the analysis was done at the family (Ursidae) level by clubbing both species together.

A team of 14 locals from the Lahaul, Pangi and Kinnaur landscape were engaged for 75 days as field assistants to carry out sign surveys. The study landscape was divided into grids of size 100 sq.km using QGIS (https://qgis.org/en/site/) and inaccessible grids were identified and excluded based on the local knowledge of the field assistants as well as the forest department. A new method of data collection using KoboToolbox and SW Maps was developed and implemented. A three-day training workshop was held at Keylong to familiarise the field assistants with identification of wildlife signs as well as data collection protocol.

Each sign survey was carried out by a two-member team. There was 1 team from Pangi, 3 teams from Lahaul and 3 from Kinnaur. The 102 grids shortlisted for the survey were assigned to the various teams based on geographic familiarity.

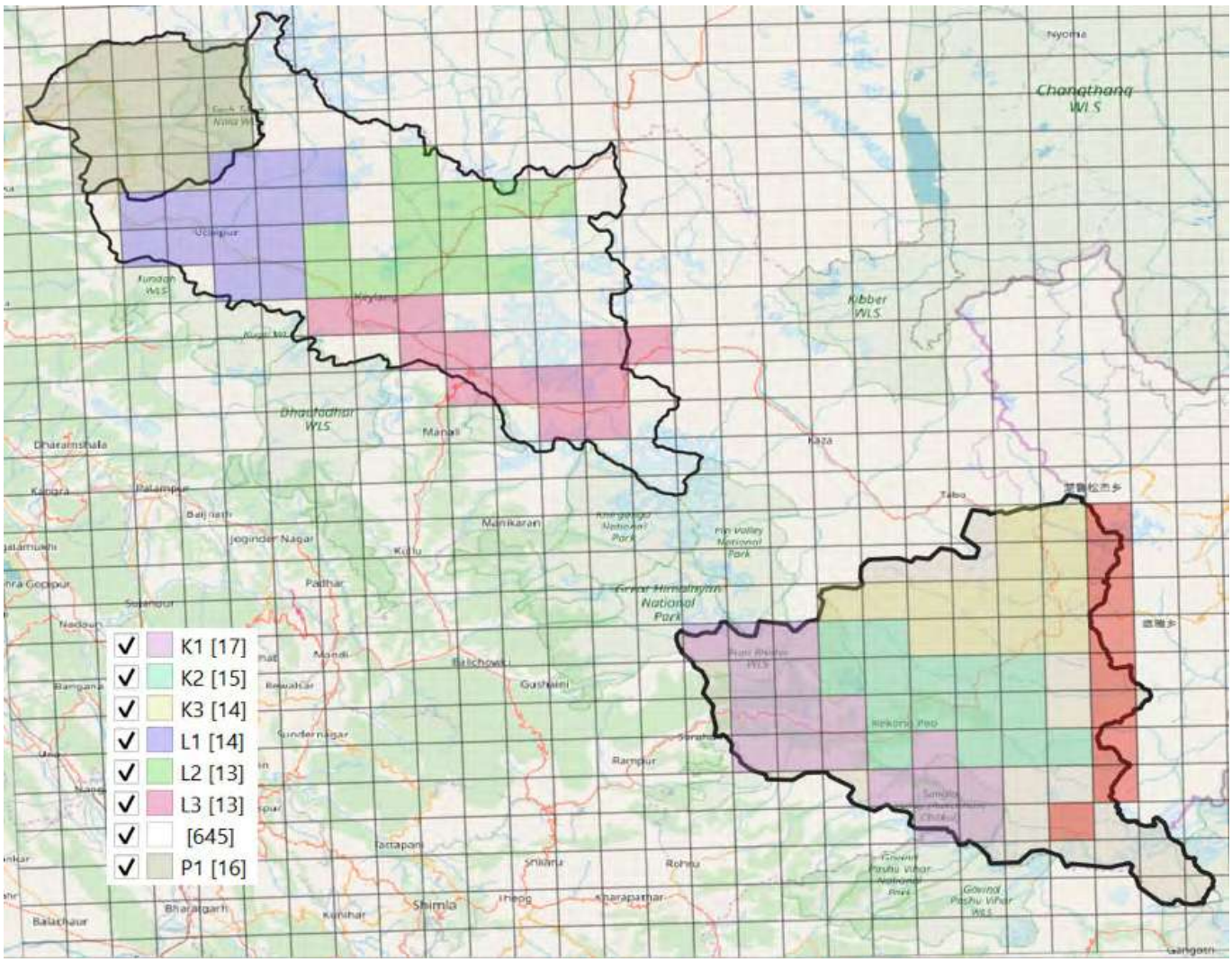


Figure.3.2.1 Map showing the division of study grids among field teams. Different colour codes depict grids assigned to different teams. (White, or unshaded region are either outside the study landscape or fall under inaccessible and/or uninhabited areas)

A map showing the multiple study grids and the teams they were assigned to is shown in figure 3.2.1. All sign surveys were carried out from mid-July to September 2019.

Limitations of Study

Owing to the short duration of the project, we needed more manpower to conduct and complete ecological surveys across the three vast study landscapes in the short window of time available for field work.

The three-day training workshop held for the FAs to teach them to use two mobile-based applications for survey data collection was perhaps not adequate for some of them to use the applications intuitively. Some of the field assistants faced issues with using the phone applications later during field work, however they were unable to contact the research team to timely resolve the issue due to connectivity and network problems in these remote landscapes. Moreover, the challenging weather conditions during last year's monsoons caused furthered interruptions in ecological data collection. Due to these unexpected complications the ecological data collected was not optimally robust.

5. FIELDWORK OUTPUT

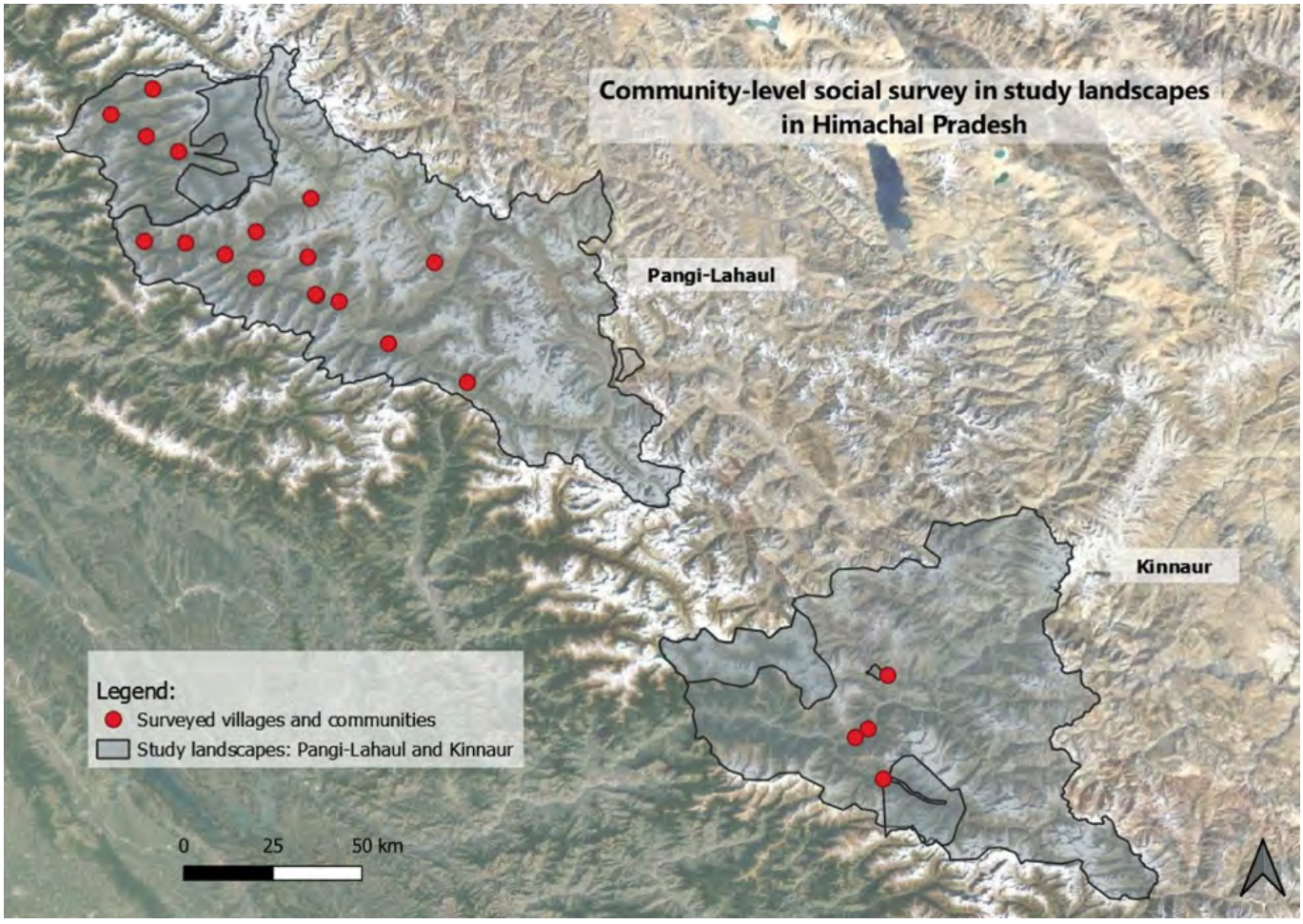
5.1. SOCIAL SURVEY EFFORT:

Community-level social surveys were conducted in a total 17 settled-villages or communities from Pangi-Lahaul and four villages from Kinnaur landscape (Map 4.1-1). These social surveys comprised of administering a total of 148 household questionnaires in the surveyed villages across the study landscapes (Table 4.1). Focus Group Discussions were organised for all the surveyed villages in Pangi to gauge community perception. In Pangi-Lahaul, a total of 32 semi-structured interviews were recorded. Additionally, village resource maps were drawn, guided by the village respondents, in all surveyed villages of Pangi-Lahaul landscape.

The project team also interfaced with officials from Forest departments in Killar and Keylong to assess the nature and extent of human-wildlife conflict reported in the respective landscapes. A compilation of cases of human-wildlife conflict and compensation claims submitted to the Forest departments in the last five years was retrieved for Pangi and Lahaul.

Table 4.1. Survey effort for community-level social survey across study landscapes.

LANDSCAPE	VILLAGES SURVEYED (NO. OF VILLAGES)	NO. OF HOUSEHOLD QUESTIONNAIRES
Pangi	Pregaraon, Gwari, Sural Bhatori, Micham (4)	27
Lahaul	Khanjar, Chimrat, Salpat, Arat, Nainghar, Salgaraon, Phura, Jobrang, Rawling, Jagla, Rarik, Bhujung, Koksar (13)	53
Kinnaur	Roghi, Batseri, Asrang, Yuvaringi (4)	68
Total	21	148



Map 4.1-1 Locations of villages sampled for community-level social survey in Pangi-Lahaul and Kinnaur landscapes

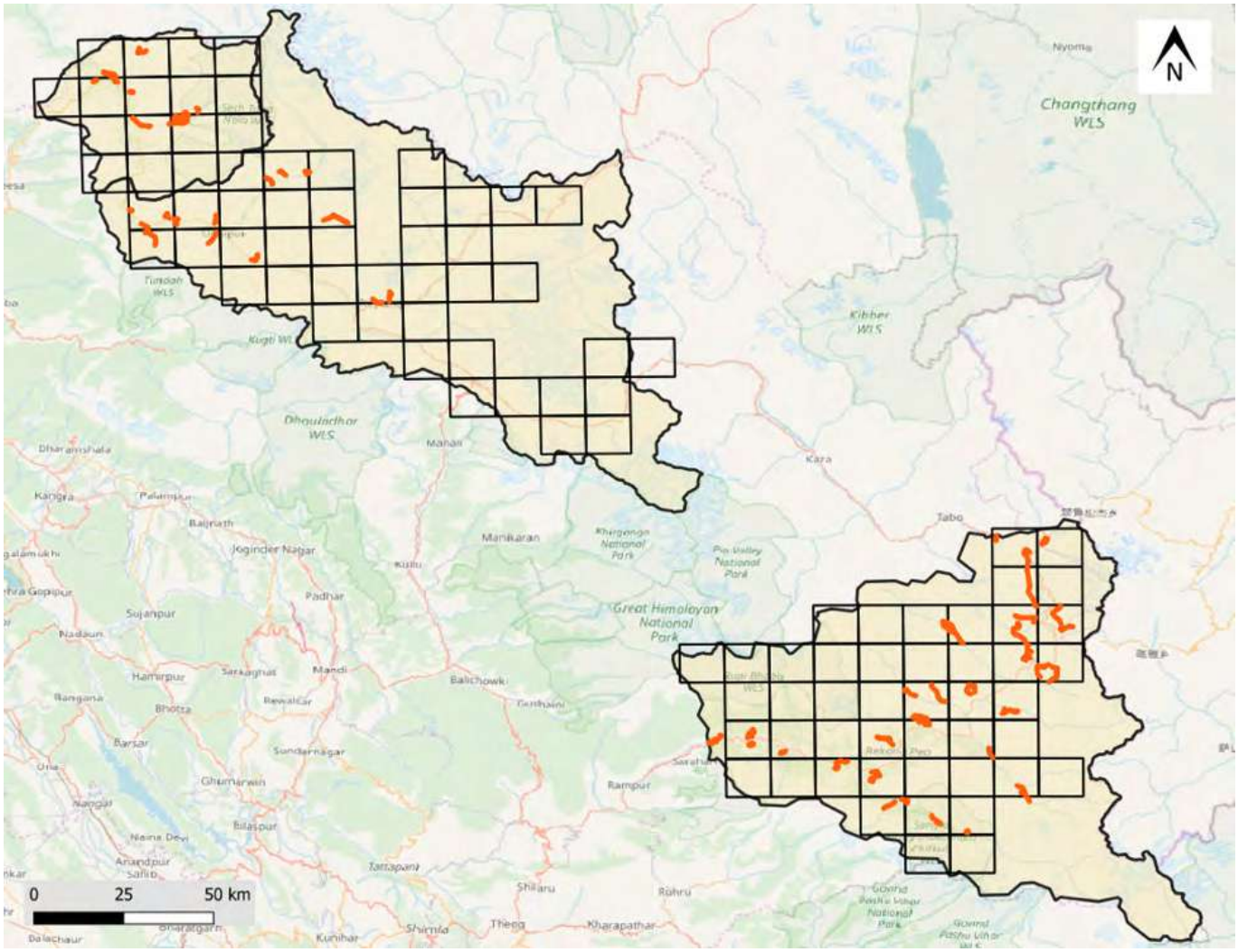


Figure 4.2.1 Map showing ecological surveys carried out across the study landscapes

5.2. ECOLOGICAL SURVEY EFFORT

A total of 82 sign surveys were carried out in 36 different grids. All the surveys were carried out between mid-July to September 2019. The total distance walked on ground by the field assistants and the research team comes to 399.35 km. A map showing the trails walked along with the shortlisted grids is shown in Figure 4.2.1

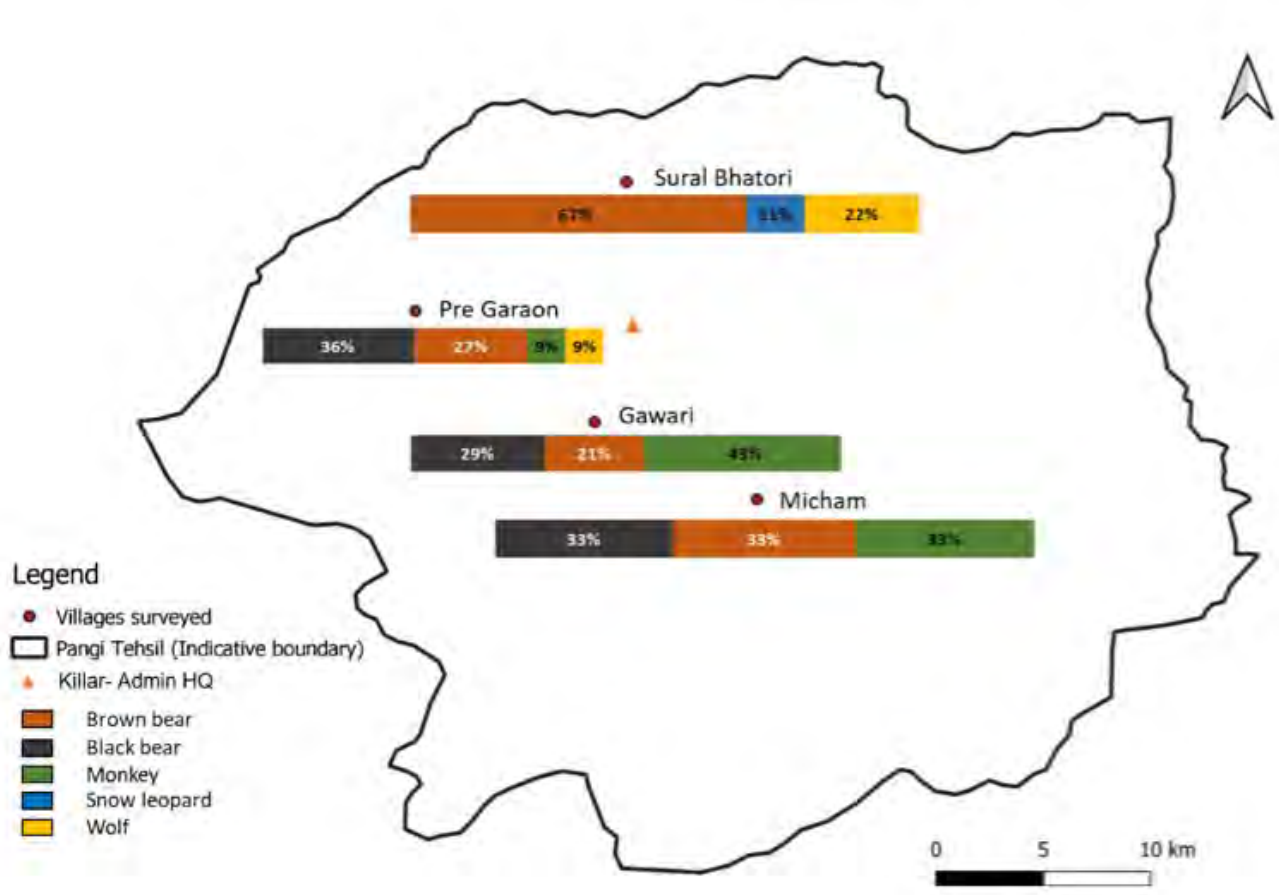
6 RESULTS AND DISCUSSION

6.1. SOCIAL SURVEY

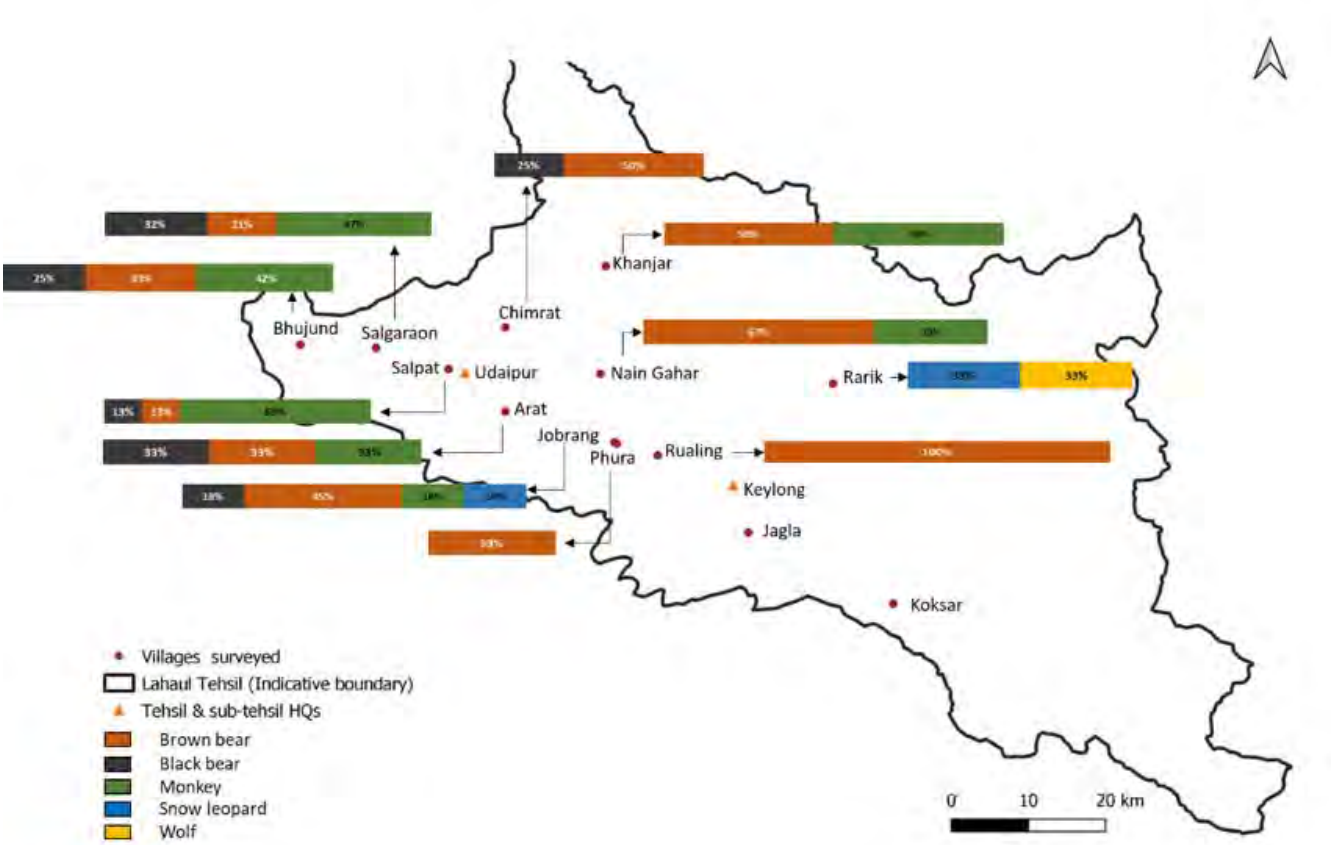
A total of 148 households were surveyed across the landscapes of Pangi, Lahul and Kinnaur. About 64% of the household-level questionnaires were administered to male respondents, while female respondents constituted 36% of the sample. About 68% of respondents followed Hinduism, while the rest 32% followed Buddhism.

i. Human-wildlife conflict prevalent in study landscapes

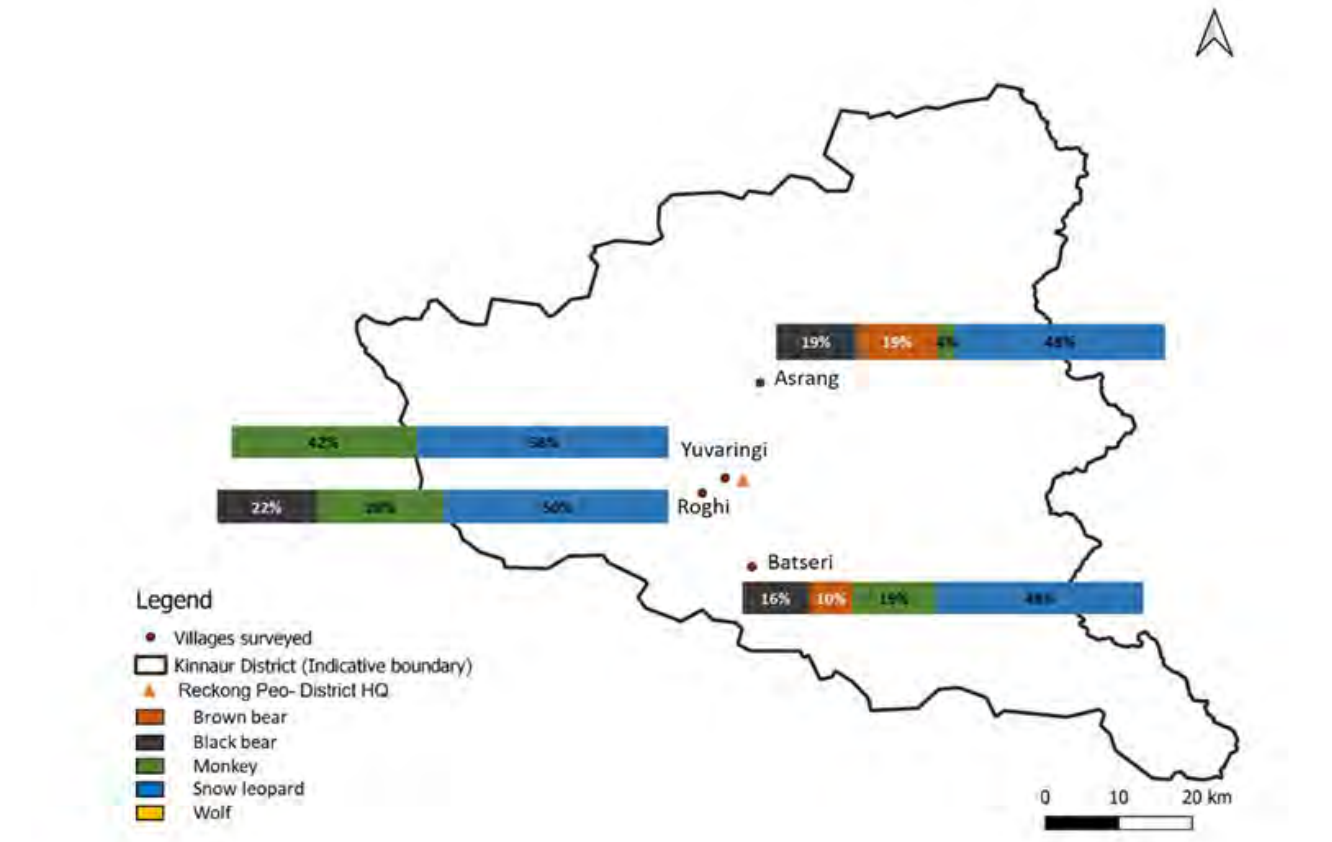
A majority of respondents (89.8% of total respondents, n=148) across each of the study landscapes of Pangi, Lahaul and Kinnaur reportedly faced conflicts with wild animals (Fig 5.1.1). Among the respondents who faced conflict in Pangi, the animal species of conflict reported the most frequently was the brown bear (42.2%), followed by black bear (20%), monkey (17.7%) and wolf (11.1%). In Lahaul, monkey was the most frequently reported conflict species (34.5%), followed closely by brown bear (32.7%) and black bear (20%). Snow leopard was among the least reported conflict species in both Pangi (4.4%) and Lahaul (5.4%). Whereas, in Kinnaur, a majority of 47.7% of respondents reported snow leopard as the conflict species, while some respondents also reported monkey (21.1%) and black bear (12.8%) (Fig 5.1.2). The five primary species of conflict reported across the study landscapes were snow leopard, monkey, black bear, brown bear, and wolf. Maps 5.1.1 – 3 reflect the HWC recorded in each of the surveyed village or community for the five most common conflict species across the three study landscapes.



Map 5.1.1 Spatial representation of human-wildlife conflict in Pangi



Map 5.1.1 Spatial representation of human-wildlife conflict in Lahaul



Map 5.1.1 Spatial representation of human-wildlife conflict in Kinnaur

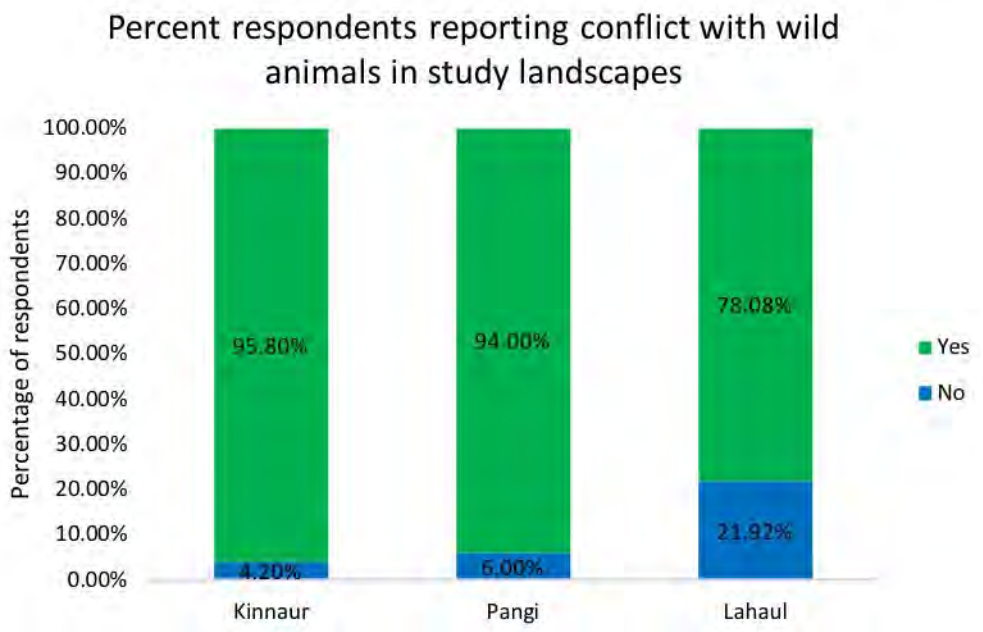


Figure 5.1.1 Prevalence of human-wildlife conflict as reported in the study landscapes

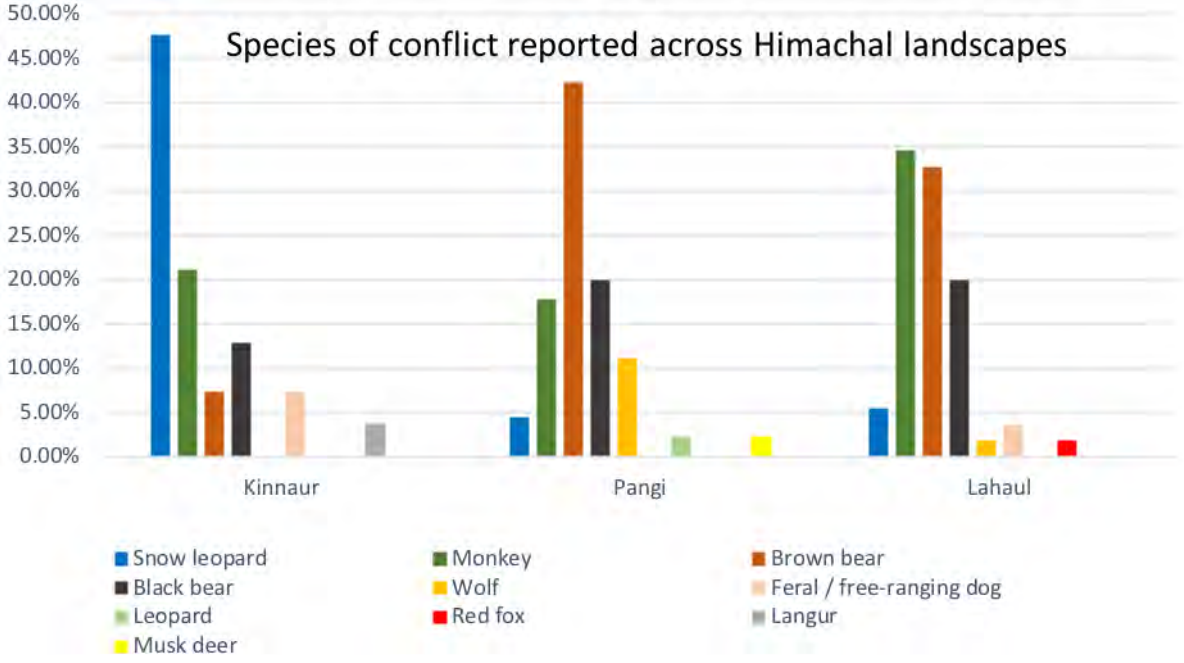


Figure 5.1.2. Animal species of conflict reported in the study landscapes.

ii. Nature of conflict

Crop depredation by wild animals was the most prevalent type of conflict faced by the respondents in the last one year. Monkey was reported to be the most prominent conflict species causing crop loss across Pangi, Lahaul and Kinnaur, at 66.67%, 68% and 52.38%, for respective landscapes. Brown bear was also reported for crop depredation by 25% of respondents in Pangi, 16% in Lahaul and 9.52% in Kinnaur. Black bear was the second most common species responsible for crop loss in Kinnaur (16.67%), and the species was also reported in Pangi (8.33%) and Lahaul (12%) (Fig 5.1.3).

Livestock depredation was the second type of conflict the respondents encountered in the last year. Livestock loss or depredation was caused most prominently by brown bear in Lahaul (75%) and Pangi (52.9%), while in Kinnaur snow leopard was reported by a majority of respondents (83.33%). Black bear was another livestock predator reported in Lahaul (25%) and Pangi (23.5%). While, wolf was responsible for livestock loss only in Pangi (17.6%) (Fig 5.1.4).

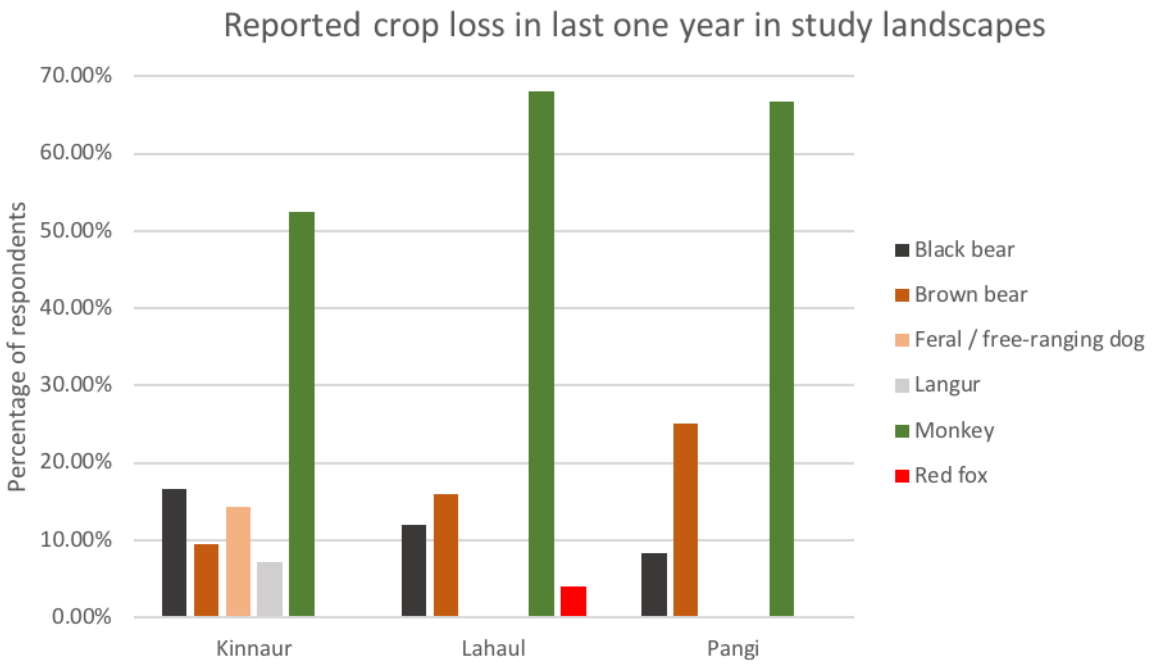


Figure 5.1.3 Nature of conflict: crop depredation in the last year.

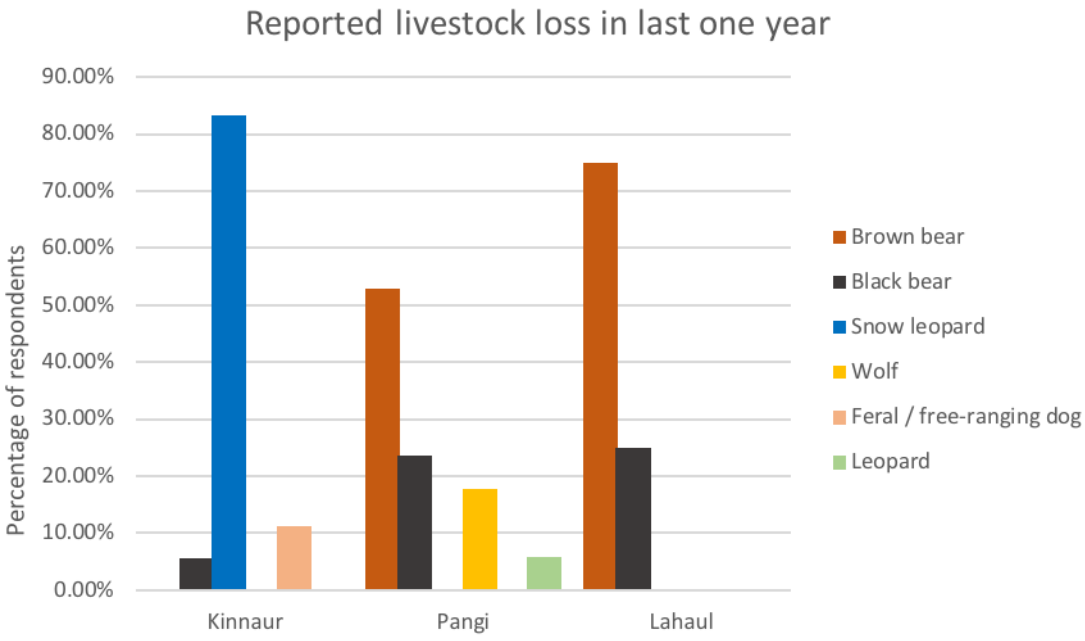


Figure 5.1.4 Nature of conflict: livestock depredation in the last year.

iii. Perception and attitude towards primary conflict species

Perception and attitude towards each conflict animal had been measured by scoring responses received from respondents from two questions:

1. A perception score for a reported conflict animal was an average calculated from the respondents' score on 'importance to conserve' that animal on a scale of 0 to 3 (0=not at all important, 1=moderately/somewhat important, 2=very important, 3=extremely important). Higher the score more positive the perception, and vice-versa.
2. An attitude score for a reported conflict animal was an average calculated from the respondents' score on 'willingness to co-exist' with that animal on a scale of 0 to 3 (0=not at all willing, 1=moderately/somewhat willing, 2=very willing, 3=extremely willing). Higher the score more positive the attitude, and vice-versa.

In Pangi (Figure 5.1.5), snow leopard had been reported as a conflict species by the least number of respondents (4.6% of respondents), and had scored highest on the perception (importance to conserve) score as well as attitude (willingness to co-exist) score. Although monkey related conflicts were reported by only 18.6 % of the respondents, people had

the highest negative perception about them and were least wiling to coexist with them. Similar was the case with wolf. In comparison, brown (44%) and black bears (21%) had much higher number of conflict cases, but people were more accommodating towards them. In general perception of the importance to conserve a species was correlated with people's willingness to co-exist with the species.

In Lahaul (Figure 5.1.6), snow leopard was reported as a conflict species by relatively few respondents (5.7%) and received the highest score for perception score (2.33) and second highest for attitude score (1.33). Respondents reporting black bear-related conflicts (21%) had a relatively positive perception (1.91) and highest willingness to coexist (1.82) with the species. Although conflict related to monkey and brown bear were comparable (36% and 34%, respectively), respondents perceived monkey most negatively (1.05) and were least willing to coexist (0.89) with them, whereas, their perception and willingness to coexist with brown bear was more positive (1.67 & 1.28, respectively). Surprisingly, wolf was perceived most negatively despite wolf-related conflict being least reported.

In Kinnaur, despite the highest number of snow leopard-related conflicts (53.6%), respondents' perception (2.54) as well as attitude (1.46) towards snow leopard was the most

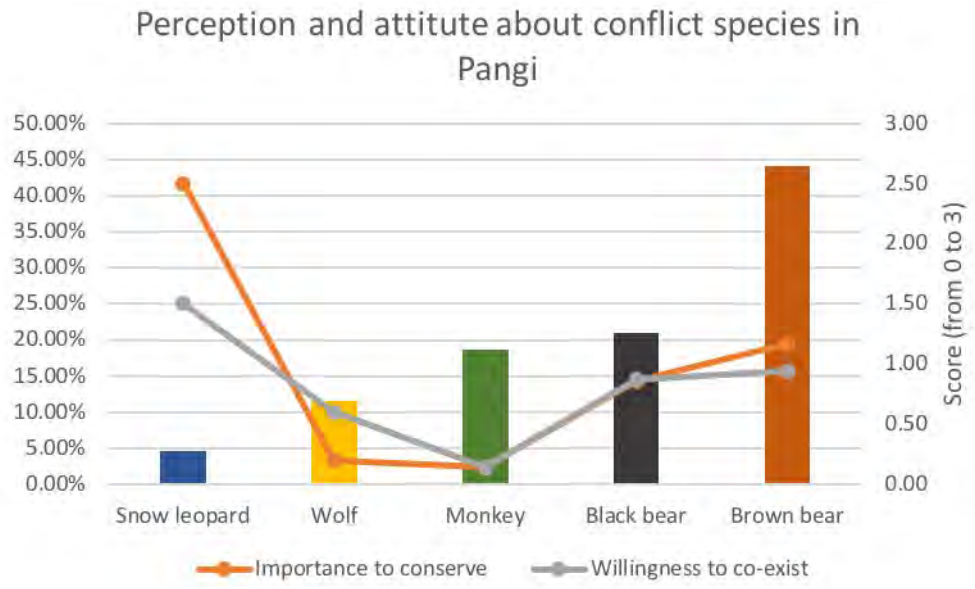


Figure 5.1.5 Level of conflicts (% respondents reporting conflicts), perception and attitude towards reported conflict species in Pangi (n=26)

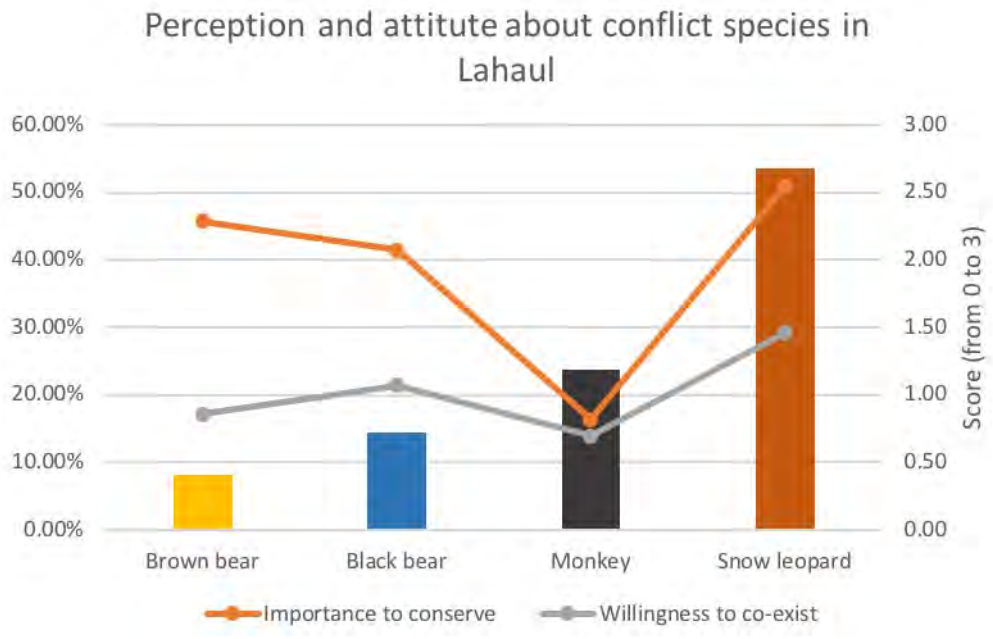


Figure 5.1.6 Level of conflicts (% respondents reporting conflicts), perception and attitude towards reported conflict species in Lahaul (n=42)

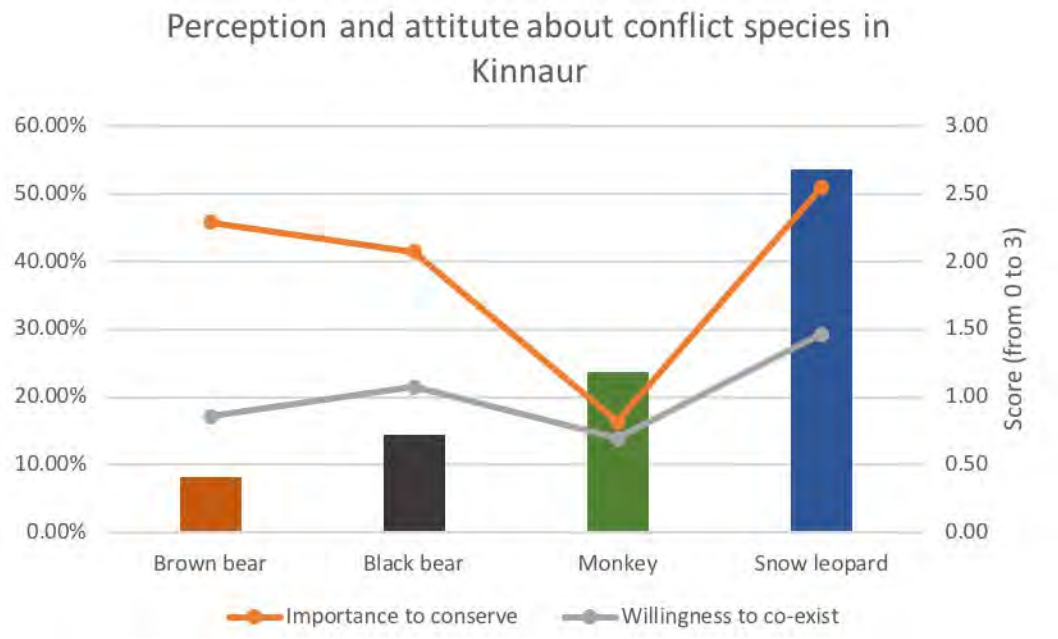


Figure 5.1.7 Level of conflicts (% respondents reporting conflicts), perception and attitude towards reported conflict species in Kinnaur (n=65)

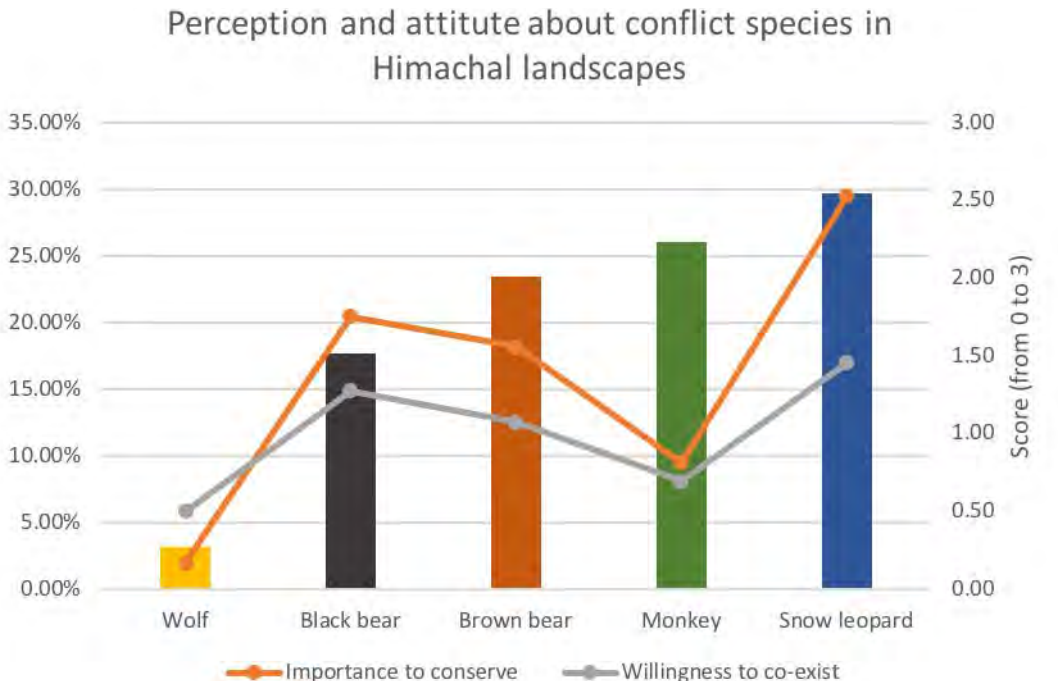


Figure 5.1.8 Level of conflicts (% respondents reporting conflicts), perception and attitude towards reported conflict species across Himachal study landscapes. Number of respondents reporting conflict (n=133)

positive compared to other species. Perception score for brown bear (reported by 8.2% respondents) and black bear (14.4% respondents) was relatively positive (perception score 2.29 & 2.07, respectively), but respondents were less willing to coexist with them (attitude score 0.86 & 1, respectively). Perception (0.8) and attitude (0.7) towards monkey was lowest (Figure 5.1.7).

For the study landscapes, snow leopard overall received the highest perception and attitude scores (2.52 & 1.45, respectively) despite being reported as a conflict species the highest number of times (29.7% respondents). A clear opposite trend was seen for wolf which received the lowest scores (0.17 & 0.50, respectively) despite being reported the least number of times (3.1% respondents) (Figure 5.1.8).

iv. Temporality of encounters with conflict species

In order to identify the temporal patterns in encounters with

conflict animals the respondents were asked a set of two questions: i) months of encounters grouped according to the four seasons (December- January, February- April, May- August; September-November); and ii) time of encounters (morning, day, evening and night).

Across the study landscapes of Himachal, encounters with crop-depredating conflict species like the monkey, black bear and brown bear were more frequent in the cropping and harvest season, i.e., in the months from May to November. While monkey was reportedly encountered during the day, as expected of a diurnal species, the brown bear was reported to be more frequently encountered in the evening and night.

On the other hand, encounters with livestock-predating species like snow leopard were higher during the winter months of December to January. This coincides with the snow leopard's descent to lower altitudes in winters, perhaps closer to human settlements. Moreover, encounters of conflict or predation by snow leopard was reported to usually occur at night or morning, perhaps, in the early morning hours. In contrast, encounters with wolf were more frequent in summer months of May to November, and most frequently during the day. This is on expected lines as wolf was reported to predate on livestock in the summer pasturelands when the livestock herds are taken for grazing during the daytime. It was noted that wolf was not encountered in Kinnaur (Figure 5.1.9 and 5.1.10).

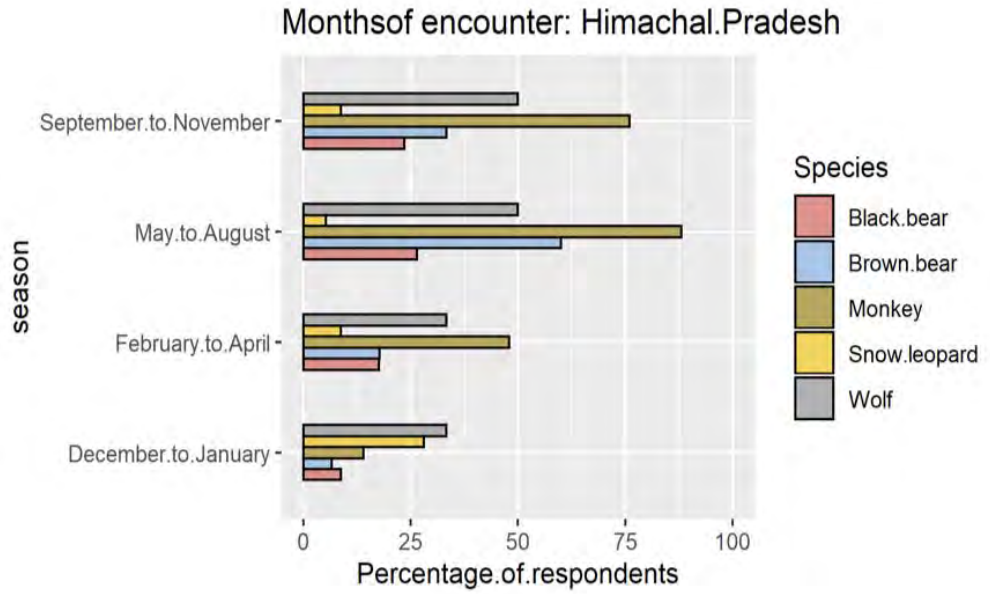


Figure 5.1.9 Months of encounter with reported conflict species in study landscapes

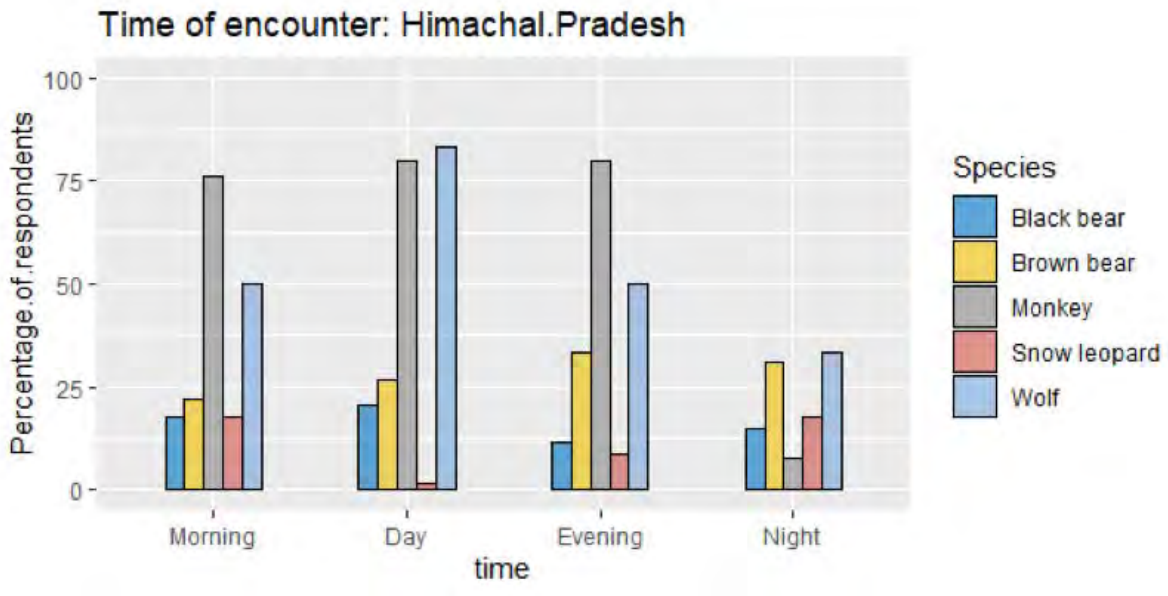


Figure 5.1.10 Time of encounter with reported conflict species in study landscapes (morning = 5 am to 10 am; day = 10 am to 3 pm, evening: 3 pm to 8 pm, night: 8 pm to 5 am)

v. Perception and attitude towards conflict species w.r.t instances of livestock and crop depredation

Respondents who reported livestock or crop loss at least once in the last one year for each of the conflict species were used for this assessment. (Annexure 8.1)

Respondents who faced no livestock loss by snow leopard, brown bear and black bear in the last one year attributed a much higher score for perception (of importance to conserve species) index and attitude (towards willingness to co-exist) index for each of the species. This pattern indicates that people's perception and attitude towards conflict species was significantly more positive if they did not experience livestock loss in the last one year. However, in stark contrast is the pattern that emerged for wolf. For respondents reporting zero instances of livestock depredation by wolves in the last year, their perception and attitude towards wolf is significantly lower and negative compared to that of respondents who experienced livestock loss to wolf in the last year. Similar pattern of negative attitudes towards wolves even when they were not responsible for livestock predation have been reported from the adjoining Spiti Valley (Suryawanshi et al., 2013). The aversion to wolves is widespread around the world (Dressel et al., 2015; Kansky et al., 2014) and probably results from their ecology and behaviour and from an inherent cultural bias that denigrates them (Kellert, 1991; Kellert et al., 1996; Kleiven et al., 2004).

For crop depredation, it was not possible to ascertain a pattern since all the respondents (100%) reported instances of crop loss in the last one year for each of the crop-predating species, namely, monkey, brown bear and black bear. On comparing perception and attitudes between these three conflict species, monkey had a lower score (0.76 & 0.61) than that for black and brown bear (1.82 & 0.82 for each). This can be explained by the behaviour of monkeys and their perpetual presence and dependence on human settlements for food. Crop-loss by large groups of monkeys was a daily affair for some villages in Pangi, and therefore, a negative perception and attitude for monkeys. Crop loss by black and brown bears, on the other hand, is frequent, but does not occur on a daily basis.

It is important to emphasise here that the results showed crop loss or predation to be a chronic issue or conflict faced by all the respondents.

vi. Retaliation against conflict species

The respondents were asked if retaliatory killing against the conflict species was acceptable by them, their fellow community members, family elders, religious leaders or religion. The responses were recorded as 'yes' for acceptance of retaliation; no for unacceptance of retaliation; and neutral for no opinion on retaliation; and 'not applicable' for respondents who did not own livestock or crops. The retaliatory killing scores (pie charts in Annexure 8.3) are derived by a composite index of responses about the acceptance of retaliation by them, their fellow community members, family elders, religious leaders, or religion.

For crop-raiding conflict animals: Interestingly, a majority of respondents in Kinnaur (75.6%) and Lahaul (50.8%) did not want to retaliate against crop losses, while in Pangi a lower proportion (42%) were of this opinion.

For livestock-predating conflict animals: A high majority of respondents (84%) in Kinnaur, and 39.9% from Pangi were of the opinion that retaliatory killing was acceptable. Whereas, in Lahaul 52.6% of respondents did not accept retaliation against animals.

vii. Places of maximum risk for conflict species

To ascertain if the conflict animals faced potential risk or danger from the villagers or community members, we asked the respondents to choose the place that according to them was the most dangerous for the conflict animals. The choices of places were agriculture fields, corrals, pasturelands, village proximity, and natural resource extraction sites. Another option was 'animal faces no risk' if the respondent believed that animals did not face any danger from villagers.

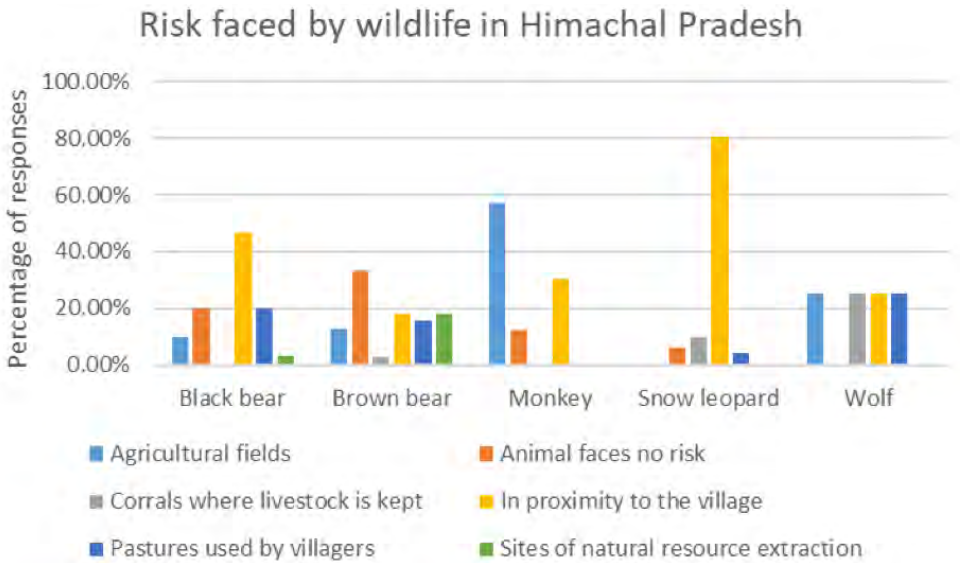


Figure 5.1.11 Places of maximum risk for reported conflict species in study landscapes

The graph (Figure 5.1.11) shows that snow leopard and black bear face the maximum risk in proximity to the villages, whereas for monkey the risk is highest in agricultural fields.

viii. Challenges faced by communities in livestock rearing and agriculture practice

For livestock rearing: Villagers across the three study landscapes of Pangi, Lahaul and Kinnaur faced maximum challenges in livestock rearing due to climatic conditions (28%, 37% and 30%, respectively), whereas, problems due to conflict with wild animals was a close second with 25%, 20% and 25%, respectively. Lack of inputs, logistic issues and lack of appropriate opportunities for sale of produce also emerged as important issues (Annexure 8.5).

For agriculture practice: In a similar pattern, climatic problems were reported as the most challenging across the three study landscapes. And issues due to wild animals was the second most reported challenge. (Annexure 8.5)

ix. Sources of livelihood

A majority of respondents across communities in the study landscapes were engaged in agro-pastoralism. Respondents also relied on daily-wages jobs under MNREGA, while some respondents had government jobs. Forest produce also came out to be a source of livelihood for some respondents (Figure 5.1.12). It may be noted that tourism related incomes were very low in all three areas.

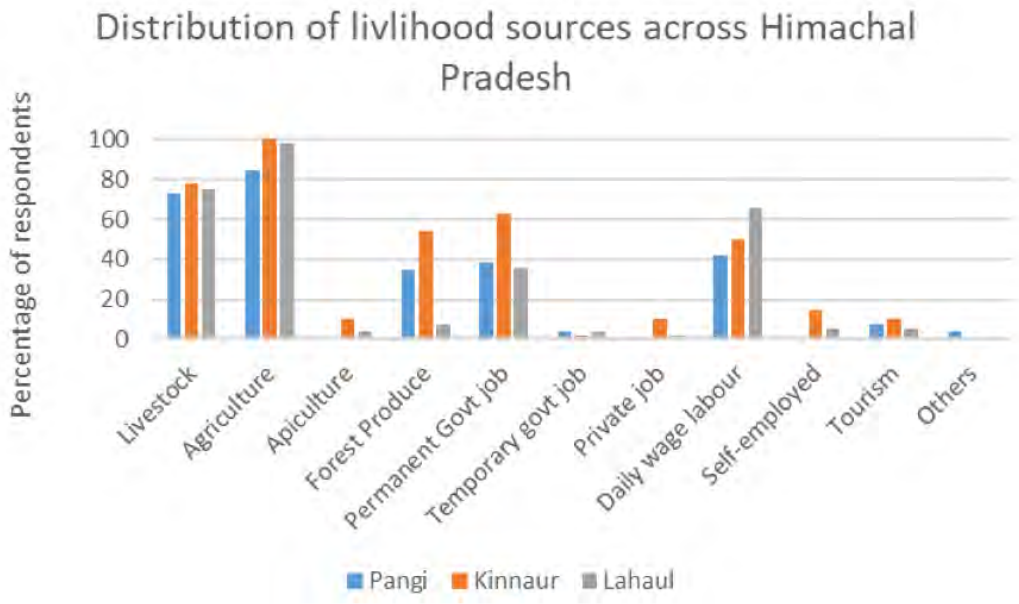


Figure 5.1.12 Sources of livelihood for communities across study landscapes (n=148)

x. Mitigation measures (as reported by communities)

The following measures were reported by the community in no order of preference and were collected and collated with the help of multiple instruments, viz. focus group discussions, household level surveys and semi-structured interviews.

Solar fencing was found to be a divisive mitigation measure amongst the community. While there is an optimistic aspiration to install these in places like Pangi, respondents were unsatisfied with these as conflict mitigation instruments due to poor design and implementation. It was reported that the these are easily damaged after moderate to heavy snowfall during winters. There was no mechanism of easy redressal to have the fencing repaired after sustaining damage. It may be important to thus look at models that can easily be maintained, removed and reinstalled.

Hunting to avoid conflict was widely regarded as an archaic mitigation measure that did not receive community's endorsement for moral, religious, and legal reasons. Most respondents opined that religious institutions and leaders, both local and regional, played an important role in ostracising hunting and hunters.

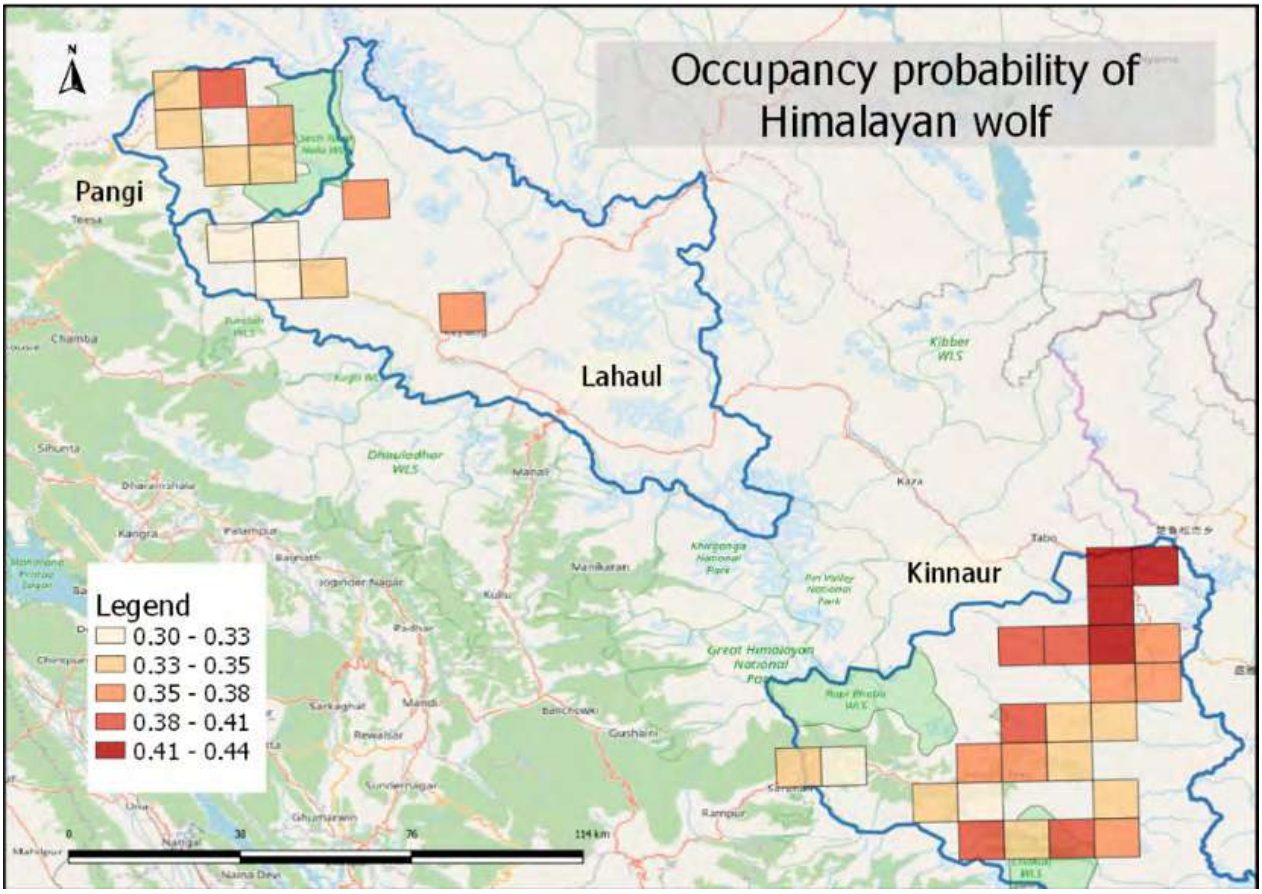
The community in Pangi is especially vulnerable to human-wildlife conflict due to reasons that have been discussed earlier in this report and is further put in perspective in subsequent sections. Respondents from this landscape reported no support from civil societies and NGOs, furthering their perception of negligence. There was substantial misinformation present in the community regarding immediate ways to deal with black and brown bear encounters.

MITIGATION MEASURES BY	COMMUNITY MEMBERS	CIVIL SOCIETIES / NGOS	ADMINISTRATION (STATE OR CENTRAL)
Livestock Conflict Management	• Increased vigilance/ guarding • Guard dogs • Making constant noise (whistling, shouting, singing songs) • Lighting fires • Enclosed livestock shelters • Corrals for livestock in pastures • Taking turns as graziers • Hiring migrant labour • Hunting (not presently) • Carrying guns and other weapons (not presently) • Intensive guarding (not presently)	None reported	• Subsidised solar fencing • Livestock insurance • Livestock shelters • Compensation for loss
Agriculture Conflict Management	• Increased vigilance/ guarding • Guard dogs • Light fires in the night • Bang metal containers to make loud noises • Firecrackers • Solar fencing • Scarecrows • Pelting stones	None reported	• 'Basic' fencing • Subsidised solar fencing • Disseminating best practices for farming • Crop insurance (reported only in Kinnaur)
Human safety	• Walking in groups in spaces where community members suspect bear encounters • Making noise (whistling, singing, shouting, etc.) • Playing dead • Climbing on a higher ground / running uphill • Carrying battery-operated torch • Carrying firearm, sharp tools, wooden stick • Hunting or shooting (not presently)	None reported	• Solar lights in the village • Compensation for injury or loss of life

6.2 ECOLOGICAL SURVEY

Snow leopard occupancy probability varied from 0.2 to 0.95 across the surveyed grids with most grids falling on either end of the spectrum. Overall, most of the grids surveyed had a high occupancy probability. Conversely, the estimated occupancy probability for Himalayan wolf varied only from 0.3 to 0.44. Despite lack of overall variation, the legend in the map has been calibrated to reflect the minute spatial differences. Black bear and brown bear were clubbed together for the purpose of this analysis as it is difficult to distinguish between indirect signs of the two species. Therefore, although the results show most areas having an overall high probability of occupancy for bear, their occurrences differed considerably. Black bear was more likely in the lower, forested valleys while the brown bear, in the alpine meadow and steppe areas. Red fox also had high values of estimated psi, i.e., probability of species presence at a site, in majority of the surveyed grids. This species appears to be ubiquitous throughout the study landscape and a lot of the villagers surveyed during community surveys reported occurrences of red fox as well (Figure 5.2.1 to 5.2.4)

To examine the effect of species occupancy on conflict, graphs were plotted for wolf, snow leopard and bear with average loss in the past year on the y axis and occupancy probability on the x axis (Figure 5.2.5). Each data point in the graph is a single village. Occupancy probability was calculated for each 100 sq.km grid surveyed in the landscape. The villages where social surveys were carried out was overlaid on this grid and each village was assigned the occupancy values of the grid it was located in.



igure 5.2.1 Map showing occupancy probability of Wolf

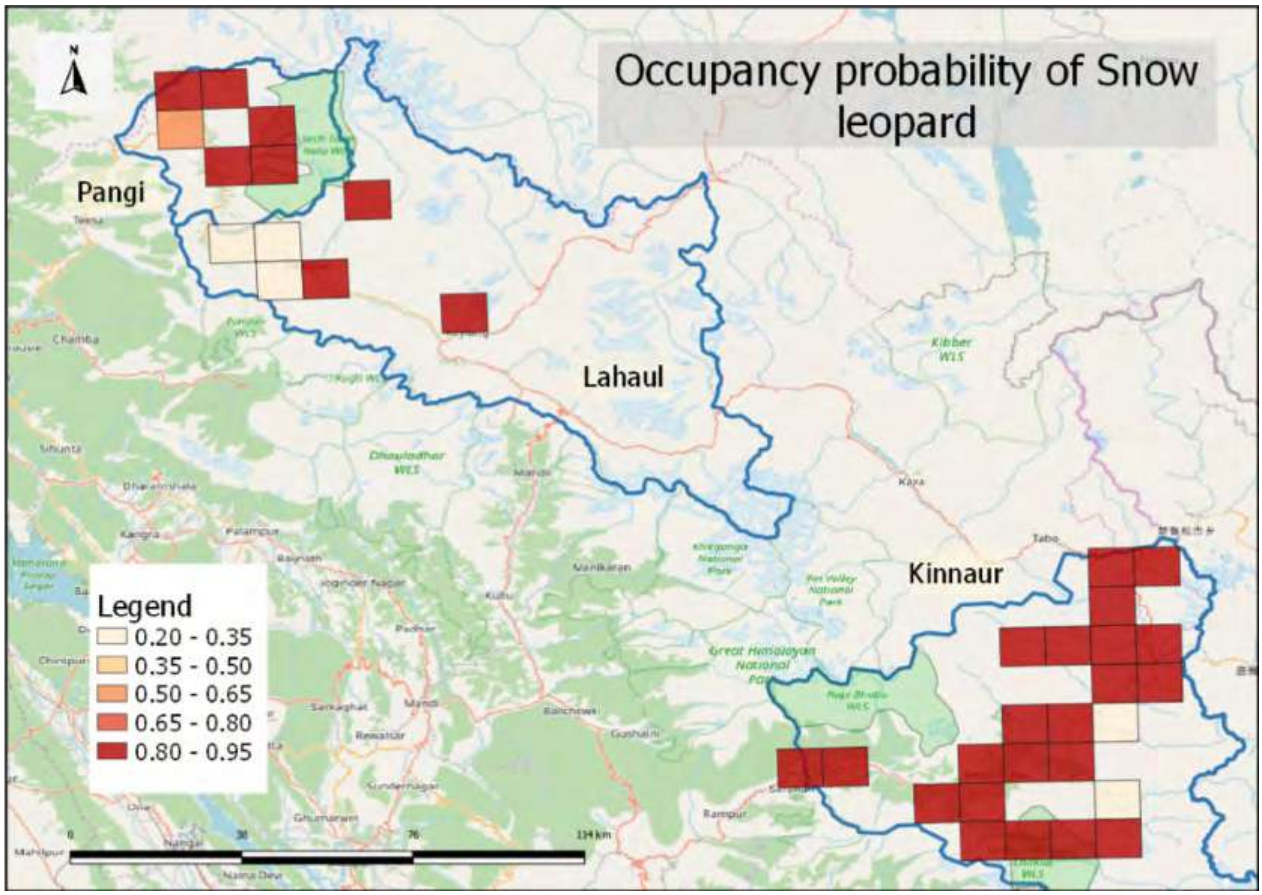


Figure 5.2.2 Map showing occupancy probability of Snow leopard

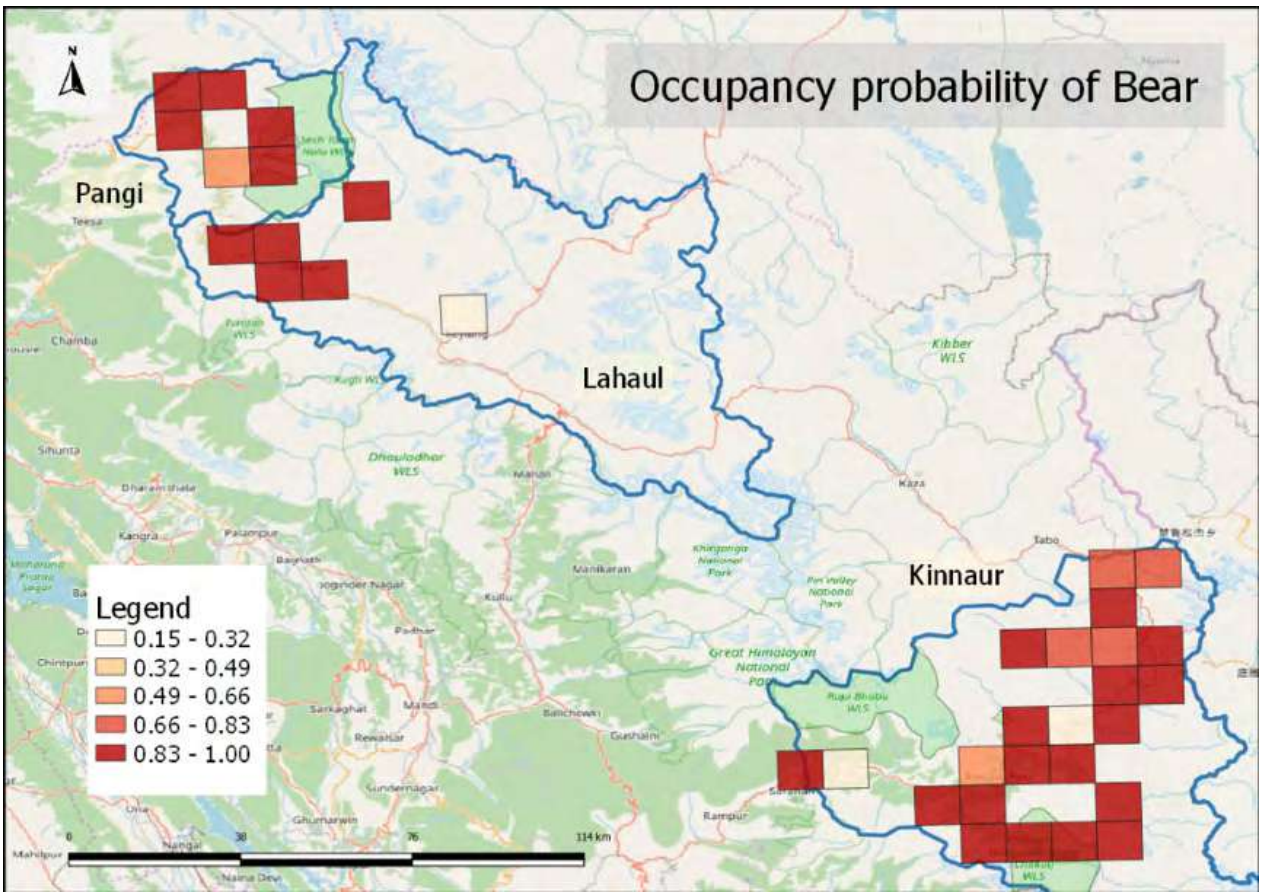


Figure 5.2.3 Map showing occupancy probability of Bear

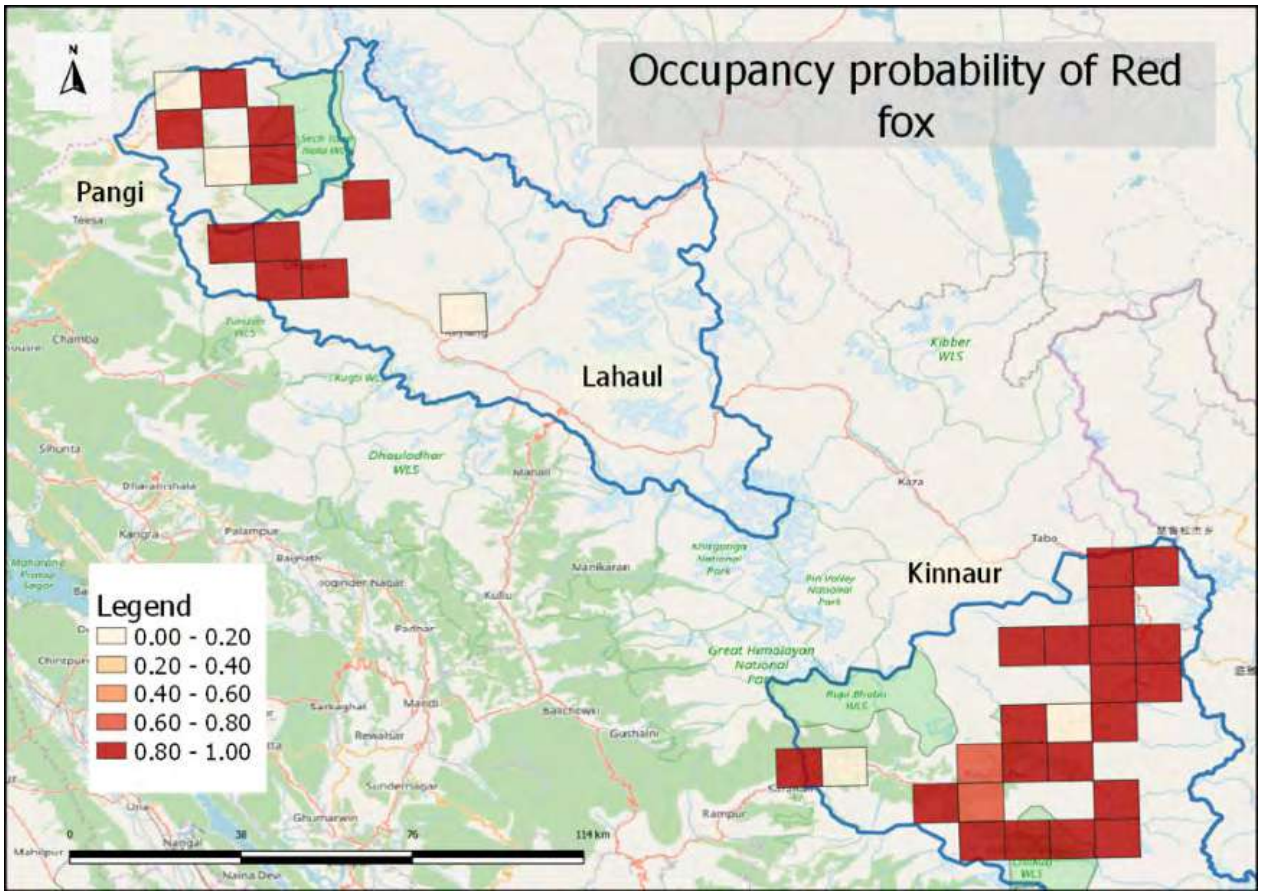


Figure 5.2.4 map showing occupancy probability of Red fox

The naïve expectation is that villages with high values of occupancy for a particular species will also show higher average loss due to that species, but we did not find any such correlation in our data. Occupancy probability of Himalayan wolf was low in the landscape as was livestock loss due to wolf. Both snow leopard and bear showed a large variation in the average cases of livestock loss for villages with high occupancy probability of these species. The same holds for average cases of crop damage due to bear as well. However, these results maybe because there are only twelve villages for which both occupancy and social survey data were available, and these may be too few data points to discern underlying patterns reliably. The variation in losses are more likely due to other factors related to vegetation, terrain, cropping or livestock husbandry patterns. This also highlights the key gaps in primary information on wildlife such as their occupancy, distribution and abundance. We would recommend a long-term conservation program that addresses these gaps in information for better conservation planning in the region.

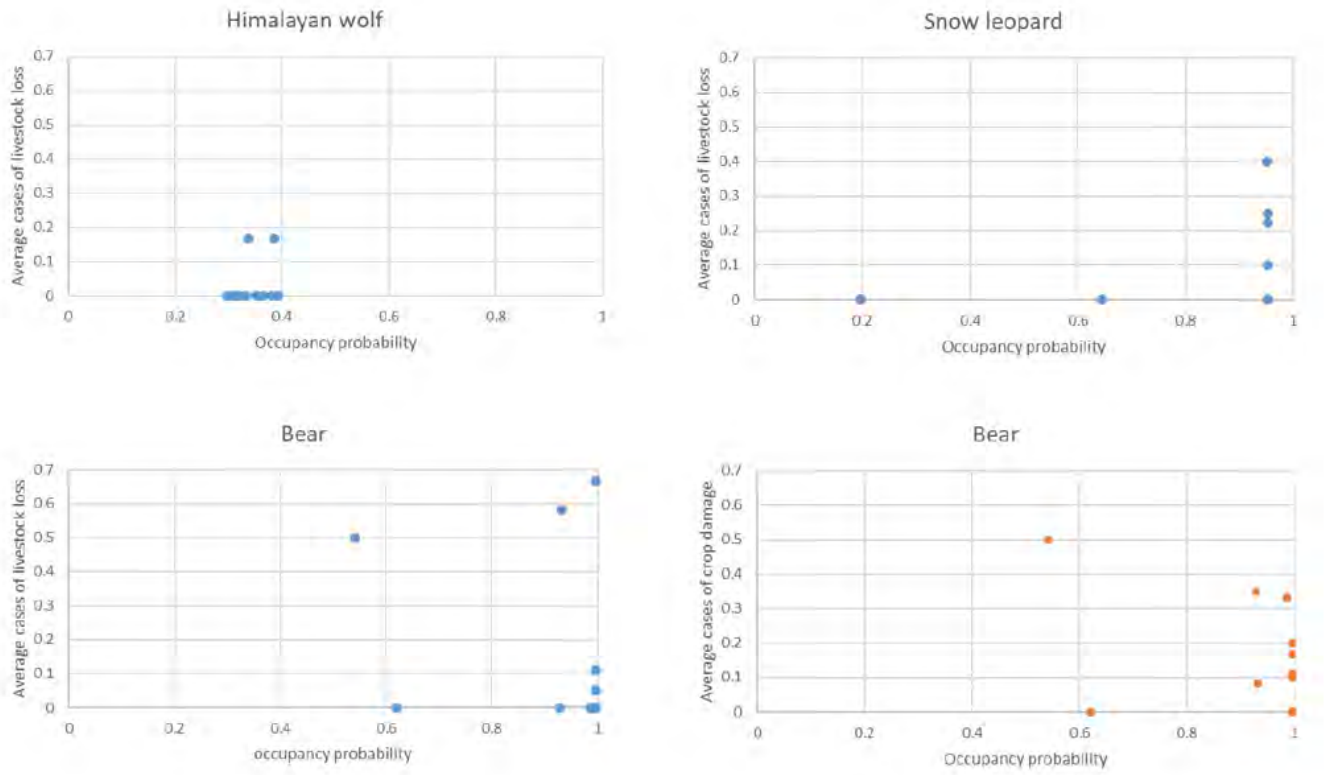


Figure 5.2.5 Graphs showing average instances of loss in the last one-year vs occupancy probability for three species. Only livestock loss was examined for wolf and snow leopard. Both crop damage and livestock loss were considered for bear (bottom row)

7. RECOMMENDATIONS FOR MITIGATION STRATEGY PLAN

The key conflict mitigation strategies are summarized below in Table 6.1 with a detailed explanation of each in the following paragraphs.

Table 6.1 Summary of suggested mitigation strategies along with possible convergences

CATEGORY OF MITIGATION	MITIGATION MEASURE	ACTIVITIES	SYNERGIES / CONVERGENCE
Gaps in knowledge about wildlife and socio-economy	Research and monitoring	Establishing comprehensive socio-ecological baselines from across the landscape Understanding spatio-temporal conflict patterns and processes Long-term wildlife monitoring	Forest Department, Academic institutions, Conservation NGOs
Prevention of losses	Predator-proof corrals	Predator-proofing of existing corrals in adhwaaris	Departments of Forest, Animal Husbandry, Agriculture; Conservation NGOs
		Building new corrals in *adhwaaris* and pastures accessed by Gaddis	
	Fox lights	Installation and training with local communities and Gaddis – for corrals and agricultural fences	
	Solar fencing	Designing localised solar fences adapted to local weather conditions	
		Building and/or subsidising solar/ electric fences in areas of high conflict	
	Temporary watcher	Hiring temporary watchers to reduce highly temporal conflict in agricultural fields and orchards	
Offsetting of costs	Compensation against livestock depredation	Creation of compensation task force after consultation with line departments, local administration, and local community representatives • Streamlining process of claiming compensation, • Increasing awareness of compensation, and • Interface/platform to facilitate this process of applying for and receiving compensation payments.	Departments of Forest, Animal Husbandry, Gram panchayat, Local institutions (*praja, mahila, yuva mandals)*, SHGs, NGOs
	Insurance for Crop Loss	Exploring adoption of crop loss due to wildlife as on add-on under PMFBY	Forest Department, State Government, Insurance cos.
Livelihood improvement and diversification	Agro-based, NTFP and MAP Produce	Value addition of local agricultural (especially in Pangi), NTFP and MAP produce at source	Department of Agriculture, HP State Agriculture Marketing Board and HP Horticulture Development Society, local cooperatives and social enterprises
	MNREGS	Continued financial support and timely disbursal of funds	Rural Development Department

7.1. COMPENSATION FOR LOSS: CURRENT STATUS AND ROAD FOR FUTURE

Providing compensation payments has been widely regarded as an effective measure to reduce economic impacts to the aggrieved community and increase their tolerance of the conflict species (Naughton-Treves et al., 2003; Schwerdtner & Gruber, 2007). Although there is some merit to ethical critiques of such instruments to promote conservation (Brockington, 2002; Guha, 1997), it is important to acknowledge the unique context of conflict faced in remote and frontier areas and the challenges that the accompanying geographical proclivities might portray. Besides, one could argue that ethical conservation requires that people wanting to conserve wild predators and ungulates should also support communities who share space with wildlife and face the resultant problems including but not limited to human-wildlife conflict.

Providing compensation payments not only facilitates tolerance of the species in conflict but also provides a critical safety net to the community when they face economic losses due to wildlife. Loss of a huge number, or a high proportion of livestock is not unheard of in these areas and merely livelihood diversification may not suffice to increase the resilience of the community from such losses.

As noted by Ogra and Badola, assessing these compensations might be a complicated and a problematic process. Bureaucratic inadequacies and practical barriers in filing complaints lead to additional transaction costs for the rural poor" (Ogra & Badola, 2008). This study tries to assess some of these issues that other researchers have teased out in their works, most notably Nyhus et al. (Philip Nyhus et al., 2003; Pj Nyhus et al., 2005) and Ogra and Badola (2008).

Compensation Task Force:

Almost all respondents opined during their interactions in their semi-structured interviews that they will not seek compensation if they lose a meagre number of livestock to depredation by a carnivore (unless these were large-bodied livestock). The reasons stated were:

- Lack of information or awareness about the existence of such scheme, the process of applying or misinformation about the 'rates' of compensation awarded.
- Distrust with governmental agencies and/or officials responsible for facilitating the process.
- Opportunity cost involved of going through with the process for seeking compensation.

Common issues that were manifested because of combinations of these problems were number of visits required to the nearest office, number of officials to be met including wildlife rangers, multiple agencies involved in the process of application and certifications required from them, amount of compensation awarded, uncertainty over whether compensation amount will come through and total monetary costs to the aggrieved superseding expected compensation amounts.

As per information provided by the Forest Department, between 2014 to 2019, there have been a total of 6 claims filed in Pangi and 28 claims in Lahaul. This indicates that only a very small percentage of people facing livestock loss are claiming compensation for the same (Himachal Pradesh Forest Department, 2019).

We propose institutionalising a compensation task force to overcome some of these pressing issues. This task force may be formed with following three objectives:

- Streamlining process of claiming compensation,
- Increasing awareness of compensation, and
- Interface/platform to facilitate this process of applying for and receiving compensation payments.

We propose that an exploratory and consultative meeting be held with other relevant departments led by the Forest Department in this regard. Such a task force should have representation from the Forest Department, Animal Husbandry Department, gram panchayats, *praja mandal* (in Pangi), yuva and mahila morcha (in Lahaul), local NGOs and self-help groups (SHGs) with prominent grassroots presence.

In Pangi, aggrieved community members must travel to Killar from across the valley to register a complaint for claiming compensation. Given the poor road infrastructure, and the transaction cost that it entails for an already economically vulnerable community, we propose at least two more centres for registering such complaints till a time the task force can bring these services to their villages. These may be located in Dharwas and Sach.

In addition to this, synergies may be developed with other relevant departments to overcome hurdles of lack of manpower and finances. The Forest Department may collaborate with the Sheep and Animal Husbandry department to provide immediate relief to the applicant by replacing the lost livestock until a time that a timely release of compensation payments cannot be ensured. The villages that face excessive conflict, or families that have suffered substantive economic losses, may specially be targeted as benefactors to this scheme.

7.2. CROP INSURANCE ADOPTION

We propose policy advocacy for inclusion of crop loss due to HWC as an optional add-on under the Pradhan Mantri Fasal Bima Yojana (PMFBY). This should be followed by an awareness campaign to increase enrolment under the scheme.

Under this basic scheme, farmers are required to pay 1.5% to 5% of the premium, and rest of the premium is subsidised under PMFBY, and is borne by the State and Central governments. The add-on coverage is optional for the farmers and applicable notional premium will be borne by the farmer, however the Government of Himachal Pradesh can consider providing additional subsidy on this coverage (Ministry of Agriculture and Farmers' Welfare - Government of India, 2018).

Widespread adoption of such an insurance scheme will have

twin-fold benefits: insurance from loses incurred because of animals such as bears and monkeys, and from climatic factors. As discussed in the results in this report, these comprise the two major problems faced by the community in agriculture.

It has been reported that substantial claim settlements have been pending for prior claims at country-wide level (state-wise data unavailable) (Dev et al., 2003); this strategy may only be considered if claim process – both amount of claim offered and time taken to settle the claim – can be ensured to be 'fair' to the claimants by the relevant governmental departments.

7.3. DEPREDATION DETERRING INFRASTRUCTURE

In Pangi and Lahaul, livestock depredation was predominantly reported to be in *adhwaaris* (pastures). Most of the sedentary population of this area keep their livestock in enclosed structures within the premises of their house once they are inside the village. Respondents from our interviews were positive about the effectiveness of the predator-proof corrals in adhwaaris, where their livestock face the maximum risk and they are unable to provide necessary vigilance. The Forest Department may consider providing financial and material assistance to the community in the following ways:

1. Providing or facilitating wire-mesh to secure the existing corrals in adhwaaris. These may be provided either free of charge, or at a subsidised cost on an as-needed basis. The benefactors and the extent of assistance may be identified with the help of the panchayat, *praja mandal* or by an on-ground survey. A pilot of this intervention may be initiated in Sural Bhatori.

2. Village-level training workshops may be organised to inform the community on best practices to use material like wire-mesh to make their corrals more secure to intrusion by carnivores.

3. Hotpots of chronic and acute conflict may be identified and collated after information is received by the Forest Department. In cases of disproportionately high loss, providing immediate relief may be strived by the department. Predator proofing of corrals and expedited compensation payments may be made in cases such as these to support the aggrieved community members, and to avoid deterioration of community's attitudes and tolerance to the animal in question. Other material interventions such as providing fox lights may be undertaken in these areas on priority.

4. Since members of the Gaddi community are highly mobile, providing them with fox-lights may be considered as a stop-gap method to reduce conflict.

7.4. MATERIAL INTERVENTIONS TO MITIGATE CROP LOSS

Electric fencing has been proposed as a possible infrastructural solution to reduce crop loss from wild herbivores. This has shown promise in several places, but like any other solution, is context based. The Horticulture Department has an existing programme under which the department subsidises the cost of fencing. According to our respondents, while this is a promising solution to reduce damage caused by species such as bears but may not be effective to reduce attacks by monkeys.

Another common grievance and concern of the respondents was faulty design of the fences installed so far. All respondents who suggested electric fencing as an effective strategy also flagged that these are not able to withstand heavy snowfall.

7.5. TEMPORARY WATCHER FACILITY

The biggest form of wildlife conflict faced by villages in Lahaul and Pangi is crop loss. However, there are no schemes in place to mitigate this kind of loss. The main species involved in this type of conflict are bears and monkeys. Crop raiding occurs primarily during the harvest months of August, September and October. A technique which is in use and has proven to be effective is patrolling the fields and using noise and fires to frighten away wildlife.

However, patrolling fields cannot be carried out extensively due to high opportunity costs. A person guarding his field against monkeys during the day cannot perform any other useful task during that time. Similarly, to prevent bears from venturing into crop fields, night patrolling has to be undertaken in a group. In the village of Jobrang, in Lahaul, locals patrol field in a group from 7 pm to 11 pm but are unable to spend further time as they need to sleep and do not have the necessary manpower to take turns throughout the night. Hiring people to patrol is an option which only wealthier families can afford.

As patrolling seems to be an effective solution, which is limited by lack of manpower and money, we propose that either the Forest Department, or a collective formed within the village may hire temporary crop guards during the harvest season for three months every year. The villagers can put in a request beforehand with details on number of people needed and the duration they are needed for. The maximum number of patrollers assigned to a village should be limited by the landholding size. The role of the forest department will be to consolidate all requests, hire the necessary number of people and coordinate with the villages for execution. This can be implemented as a pilot during the next harvest season in Pregaraon in Pangi and Jobrang in Lahaul. This scheme also has the added benefit of increasing employment opportunities.

7.6. PREVENTION OF CROP PREDATION BY WILD HERBIVORES LIKE BEAR

Some of the villages surveyed faced problem of crop depredation by brown and black bear. From the interviews, it was noted that the agricultural fields that were far away from the village or at the edge of the village boundary were most prone to crop loss due to bears. Many of the respondents abandoned agricultural fields that were too far for them to

guard. Although, the amount of damage caused by bear is not significant, it does create a negative perception about the animal.

Suggestion:

In this light, provision of fences at subsidised rates by the horticulture or agriculture department for agricultural fields that are spatially vulnerable to crop depredation by bear will help reduce both crop loss as well as the negative perception towards the species.

7.7. MONITORING OF WILDLIFE POPULATIONS

One of the goals of the UNDP Secure Himalaya project is to develop sustainable practices of land use which are beneficial to local people without being detrimental to wildlife. Therefore, it is vital that we have information on wildlife abundance and distribution. Currently, there is a lack of data on historical trends in wildlife populations and seasonal movement of wildlife.

The most encountered ungulate is ibex and carnivores are black bear at lower elevations and brown bear at higher elevations. Monitoring can start with sign surveys or interview-based occupancy surveys to assess the spatial distribution of these species. As there is a lot of difference between summer and winter in these landscapes, this activity needs to be done in both seasons in order to capture the inherent variation.

Long term monitoring of the abundance and distribution of wildlife is useful in a variety of ways. Data over the years is necessary to discern patterns and underlying causes of change. Spatial distribution of various species will help in delineating areas which are used by a majority of species and can help prioritise conservation efforts. This information also plays a crucial role in measuring the effectiveness of various incentives and schemes implemented on ground and whether they help in promoting healthy populations of wild fauna.

7.8. OTHER SUGGESTIONS TO INCREASE RESILIENCE OF THE COMMUNITY

- Improving market connections in Pangi: The Pangi landscape is rich in resources such as medicinal plants, herbs and nuts (hazelnuts and walnuts). Because of extremely poor access to markets, the communities are not able to market these commodities fairly and do not realise the full economic potential. A cooperative with representation from relevant governmental departments may be set up exclusively for Pangi to increase the value of these commodities at source.

- Transport and connectivity in Pangi: Because of poor road connectivity within the valley and from the nearest town, the community has to suffer from economic vulnerability. The difference of crop rates between a village in Pangi and on the other side of Sach Pass is often two times. Policy advocacy at various levels should be taken up to improve road connectivity in the area.

- The Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) provides sustenance and a safety net to the economically vulnerable rural poor. The critical role of Department of Rural Development of Himachal Pradesh in this context should be acknowledged. Constant monitoring of disbursal of funds on a timely basis should be ensured.

8. UNDERSTANDING HUMAN-WILDLIFE CONFLICTS FOR SEASONALLY MIGRANT GADDIS IN THE LAHAUL VALLEY, HIMACHAL PRADESH

In Himachal Pradesh, Gaddis and Gujjars are two major tribes that follow year around migratory system of transhumant. These pastoralists rely on natural resources found on rangelands for their livelihoods. Although there has been a considerable decline in numbers of pastoral nomads with time and increased diversity of occupations, they still form a major portion of Himalayan population (Dev et al., 2003). It is widely accepted that human-wildlife conflicts (HWC) are inevitable when humans and wildlife share the same habitat. However, a better understanding of the patterns and drivers of conflicts coupled with an understanding of the socio-psychological response of people to such situations can greatly help manage the conflicts. This section aims to achieve this for the Gaddi community through the following objectives

8.1. OBJECTIVES

Objective 1: Quantify the spatiotemporal patterns, extent and nature of human-wildlife conflict in Lahaul to understand:

- What are the losses and their primary causative agents?
- Where and when are the losses maximum
- What are the drivers of such losses?

Objective 2: Examine determinants of people's tolerance towards bears using a socio-ecological framework to understand

- Tolerance of people towards Bears
- The behavior of people towards bears
- The drivers of such attitudes and behaviors

Objective 3: Examine the prevalent human-wildlife conflict mitigation strategies and role of traditional ecological knowledge in conflict mitigation

- The interventions carried out by Gaddis for dealing with these conflicts

8.2. METHODS

1. Semi-structured questionnaires
2. Forest department records to check for patterns of conflict
3. Resource maps to provide us with a layout of the land and give spatial context to the questions

8.3. RESULTS

Quantifying HWC:

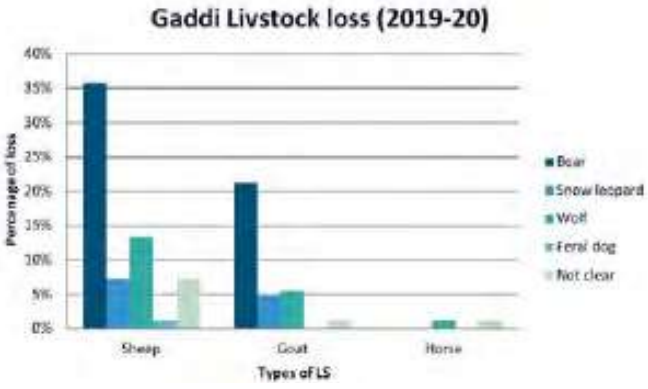


Figure 8.3.1 Livestock losses to different carnivores reported by Gaddi respondents (Number of respondents = 23)

The losses suffered by Gaddi people due to HWC involve losses to their sheep and goats. Some losses take place for pack animals like horses as well. Bears are the primary reason for the losses due to HWC followed by Wolves and Snow leopards. Some incidents were caused by feral dogs as well. In many of the instances the Gaddis were unsure of what caused the loss. This has been mentioned under a different category 'Not clear'.

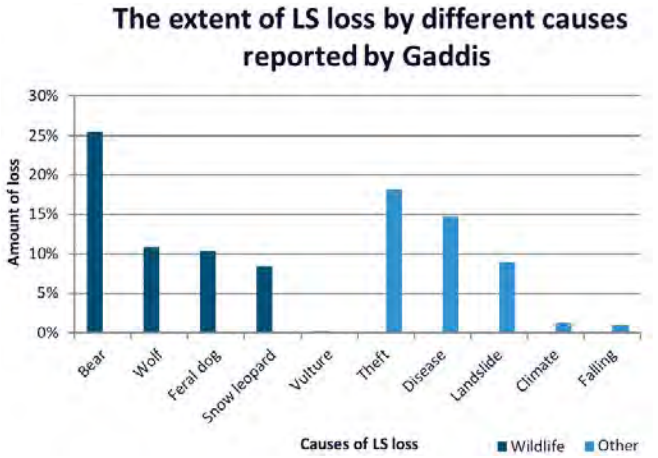


Figure 8.3.2. Multiple causes of livestock losses reported by the Gaddi community respondents.

Gaddis face losses due to non-wildlife reasons like theft, diseases to their livestock (like FMD), landslides, unusual climate (like now and cold), and accidents (e.g. livestock falling from cliffs). Theses also form a major part of the livestock losses that they face annually.

Mitigation methods and their effectiveness:

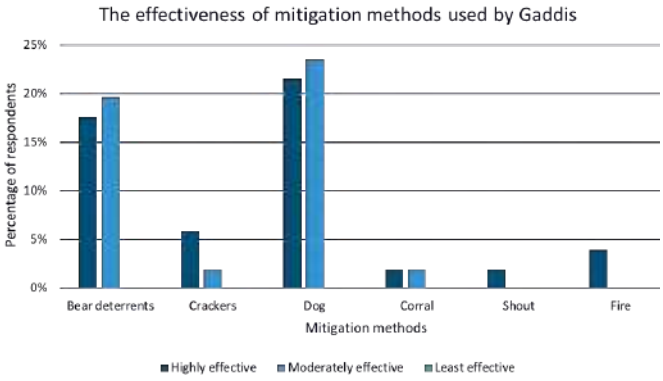


Figure 8.3.3 Shows the distribution of usage and effectiveness of the various mitigation methods used by Gaddis.

- Gaddis keep dogs for protection of their livestock. On facing an attack of wildlife on their livestock they also pelt stones, shout, and light crackers.
- They often build corrals and light fires to keep the predators away.

Compensation Issues

Among the reasons mentioned by Gaddis for not applying for compensation major hindrance came out to be insufficient knowledge about schemes and procedures. Many said that they can't leave their livestock for carrying out the procedure, insufficient amount of compensation, time lag and uncertainty of getting compensation, etc.

8.4. DISCUSSION:

Human-wildlife conflict is present with poor mitigation measures in the region. The annually migrant Gaddis face a lot of challenges in practicing transhumance due to wildlife as well as non-wildlife causes. Their main source of livelihood is their livestock which they often lose to forces like predators, theft, landslides, diseases, cold etc. Many of them do not avail the compensation scheme provided by government for livestock losses for a number of valid reasons. This further leads to discontent among the community for wildlife. Thus, there is a strong need to initiate better mitigatory actions using the best practices. Not only this, government needs to make the compensation schemes more efficient so that Gaddis can avail its benefits. It will require a good understanding, rapport and joint efforts by Gaddis as well as authorities to resolve this problem.

8.5. SPECIFIC RECOMMENDATIONS FOR GADDIS

1. Initiate a pilot using mobile based conflict recording program for Gaddis. The conflict incident, the geolocation, the signs/evidence for predator responsible can be easily recorded through a simple interface. The incidents thus recorded can be evaluated for a compensation program. The same program can also be used to engage Gaddis in wildlife conservation by getting

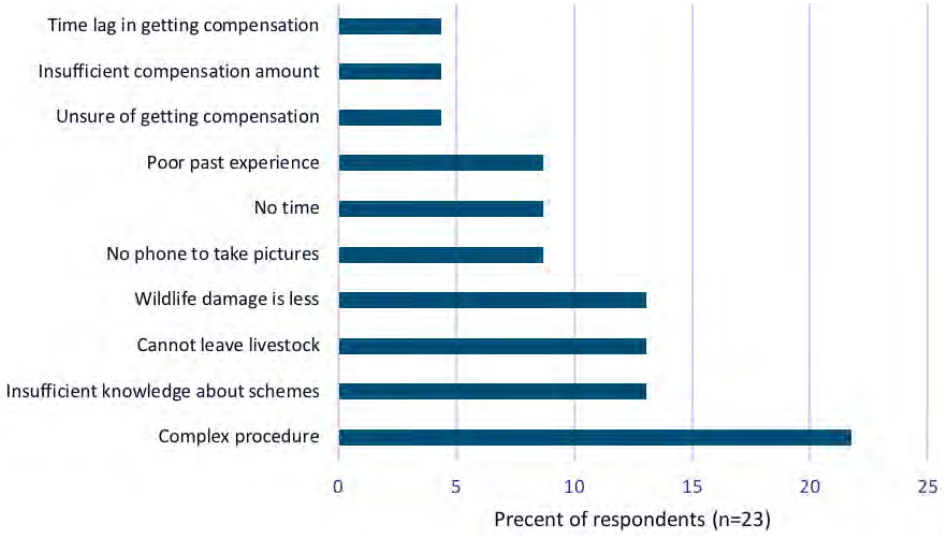


Figure 8.3.4. Reasons ascribed by respondents from gaddi community for not seeking compensation for livestock predation

them to record wildlife sightings, mark their migration and camping routes as well wildlife crime (such as snares and traps).

2. The compensation task force that we have recommended earlier can be responsible for examining livestock loss to wild predators by Gaddis and providing speedy compensation.

3. Livestock stocking density by Gaddis should be properly monitored and a vaccination program made part of that to enhance the resilience of the community to livestock loss, since a large proportion of livestock is killed due to disease. This also will be crucial to prevent the spread of diseases such as foot and mouth from domestic livestock to wild ungulates.

4. Since Gaddis are nomadic and predator proof corrals are unlikely to help, a pilot program with using FoxLights as deterrents towards predators should be initiated and evaluated for scaling up. The Gaddis should be trained to use the FoxLights appropriately so that their predator deterrence does not wear off.

5. An award program for good livestock herding practice that involves two aspects (1) following the appropriate rotational grazing (2) alert herding to minimize loss to predators can be initiated to recognize and encourage good herding and livestock management practice.

9. SITE-SPECIFIC IMPLEMENTATION PLAN

The broader context of site-specific interventions suggested below is provided in the section 7 of this report. Here we recommend site specific actions that should be run on a pilot basis, evaluated for their effectiveness and scaled up based on their performance.

SL.NO	PROPOSED ACTIVITY	PROPOSED LOCATION/ VILLAGE/AREA(GEO-COORDINATES IF POSSIBLE)	PROPOSED TENTATIVE BUDGET (IN LAKHS)	DURATION (IN YEARS)	INDICATOR TARGET TO WHICH IT WILL CONTRIBUTE	POSSIBLE CONVERGENCE/ CO-FINANCE I.E. NAME OF DEPARTMENT/ ORGANIZATION	REMARKS
1	Monitoring of animal populations	Lahaul and Pangi landscapes	Approx. 50 Lakhs for year 1 and 20 Lakhs/year for subsequent years (for snow leopard and wild ungulate surveys)	Long-term (At least 5 years)	Indicator 1.1 (Output 1.4)	NCF or WWF	
2	Creation of Compensation Task Force for awareness and timely settlement of claims	• Dharwas (33.1183138, 76.3686560) • Killar (33.0804585, 76.4014977) • Sach (32.9964086, 76.4428067)	INR 10.8 lakhs (One person per village paid at Rs. 30,000 per month)	1 year pilot	Indicator 4.1	Gram Panchayat and/ or Praja Mandal, Animal Husbandry Department (Veterinarian), Forest Department, local NGO(s) and SHG(s) with prominent grassroots presence	With three objectives: • Streamlining process of claiming compensation • Increasing awareness of compensation • Interface/platform to facilitate this process *Three villages have been chosen in Pangi to maximize spatial coverage and ease of access to facilitate process of compensation in the region*
3	Temporary watcher facility to prevent crop loss by wild ungulates	• Preygraon (33.0719288, 76.3258354) • Jobrang (32.6236518, 76.8704317)	INR 3.5 lakhs for six months every year for three watchers in each village	1-year pilot	Indicator 2.3 and 4.3	Gram Panchayat and/or Praja Mandal	• Crop damage in Preygaraon occurs a few weeks after sowing, and when the pods/fruits are ready. • Crop damage in Jobrang is seen when the crop is ready to be harvested (twice a year)
4	Predator proofing i corrals	Sural Bhatori (33.1626351,76.4533055)	INR 10 lakhs	Permanent structure	Indicator 3.3	Animal husbandry department, Sheep husbandry department.	2 nos. in the 'adhvaari' (pastures)

SL.NO	PROPOSED ACTIVITY	PROPOSED LOCATION/ VILLAGE/AREA(GEO-COORDINATES IF POSSIBLE)	PROPOSED TENTATIVE BUDGET (IN LAKHS)	DURATION (IN YEARS)	INDICATOR TARGET TO WHICH IT WILL CONTRIBUTE	POSSIBLE CONVERGENCE/ CO-FINANCE I.E. NAME OF DEPARTMENT/ ORGANIZATION	REMARKS
5	Fox lights (Pilot mitigation measure)	To be issued to 20 of the migratory Gaddi Pastoralists on a trial basis (similar system working well in Munsiyari region of Uttarakhand as part of WWF's Snow Leopard Conservation Program)	INR 10,000/unit, Total INR 2,00,000 for trial/ piloting	1-year pilot	Indicator 3.3	WWF	
6	ANIDER (Animal Intrusion Detection and Repellent System; Pilot mitigation measure)	• Preygraon (33.0719288, 76.3258354) • Jobrang (32.6236518, 76.8704317)	INR 12,000 per unit. Effective for one field/ family	1-year pilot	Indicator 3.3	WWF	
7	Awareness campaign to increase enrolment under Pradhan Mantri Fasal Bima Yojana (PMFBY) + coverage of damage resulting from HWC be included (add-on) - to mitigate conflict with monkeys	Pangi Tehsil	INR 2 lakhs for awareness campaign	Minimum of 2 years, followed by assessment	Indicator 2.2,	• Ministry of Agriculture and Farmers Welfare, GOI • State Departments, viz. Agriculture, Horticulture and Revenue, Forest	• Farmers are required to pay 1.5% to 5% of the premium, and the rest is subsidized under PMFBY (provisions already present under the scheme, borne by the State and Central governments) • Until at least 2016, damage resulting from HWC was not covered under this scheme in HP although other state(s) have adopted this recently. A pilot project can be initiated in Pangi Tehsil. • It has been reported that substantial claim settlements have been pending for prior claims at country-wide level (state-wise data unavailable); this may only be considered if claim process (amount of claim offered and time taken) can be ensured to be 'fair' to the claimants.

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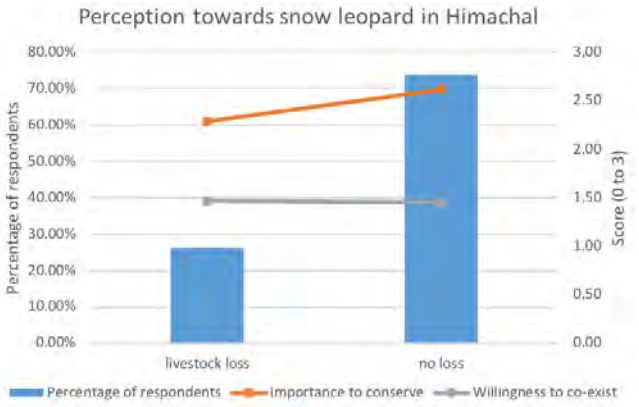
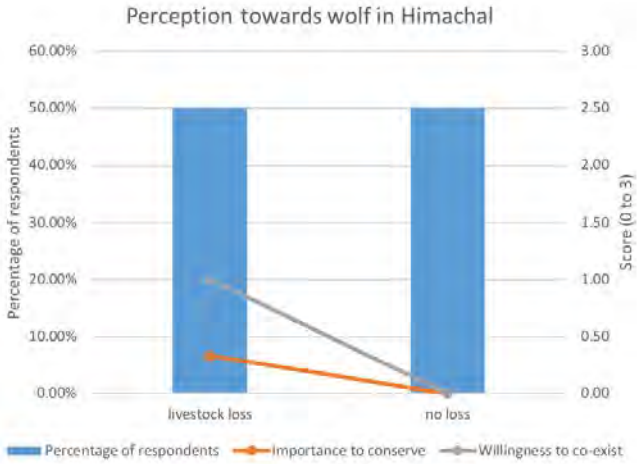
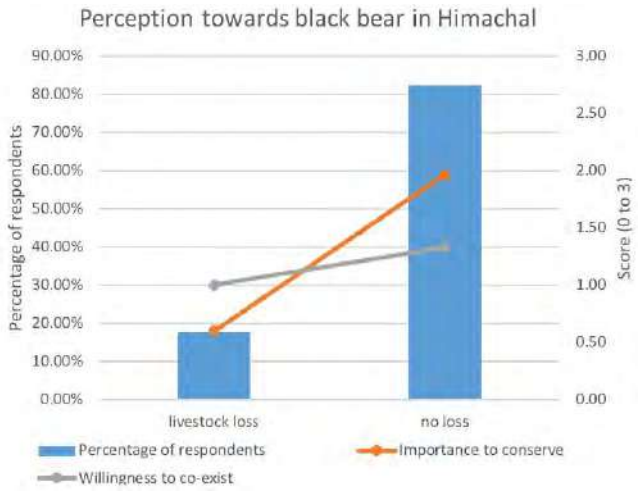
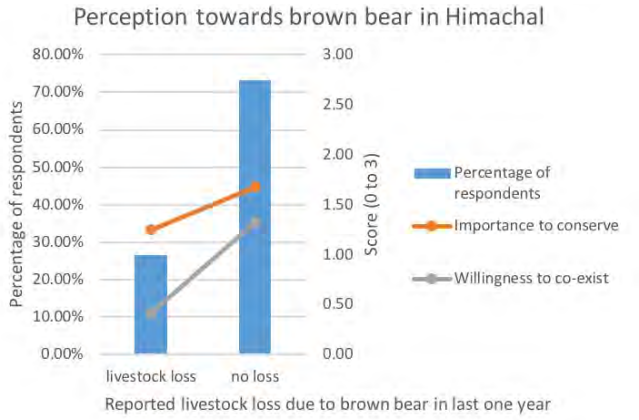
11. ANNEXURE

8.1 Graphs for livestock loss due to a species v/s perception and attitude about the species

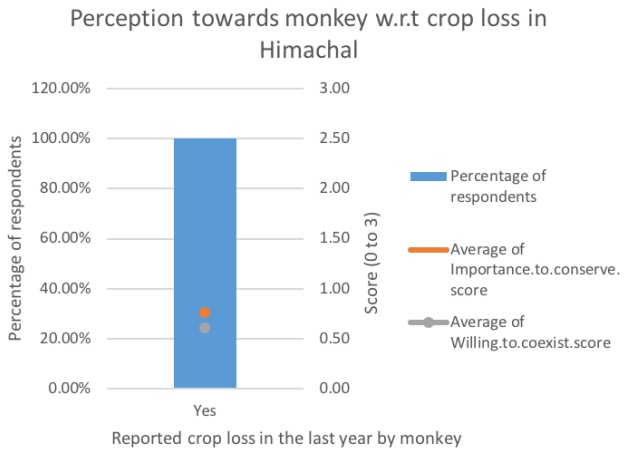


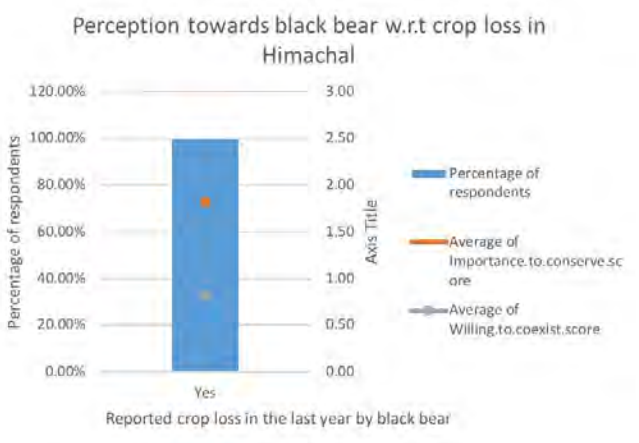


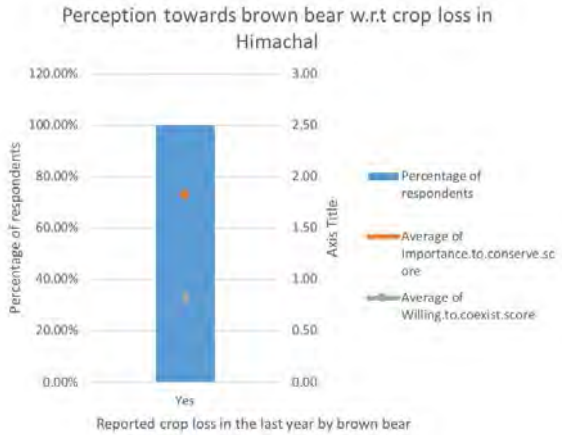




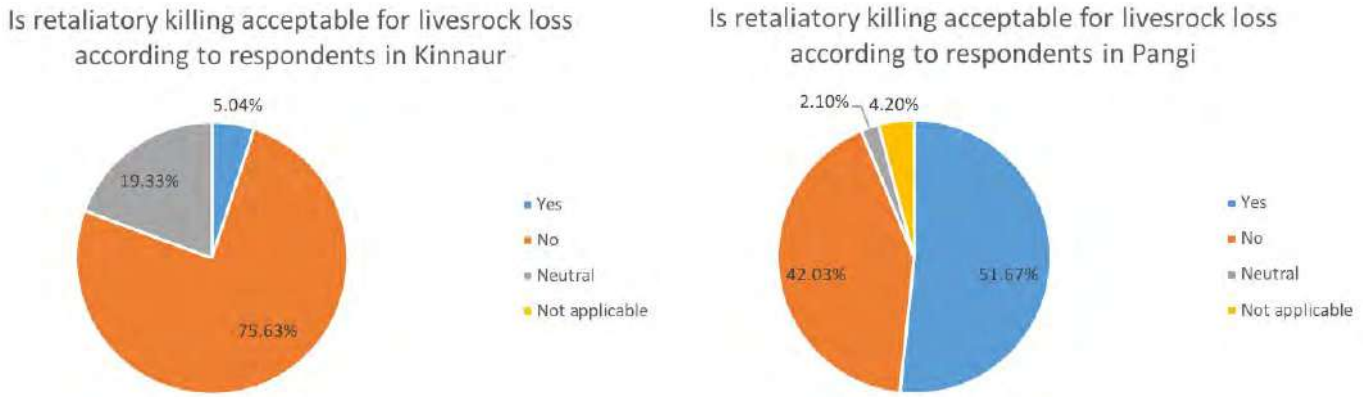
8.2 Graphs for crop loss due to a species v/s perception and attitude about the species



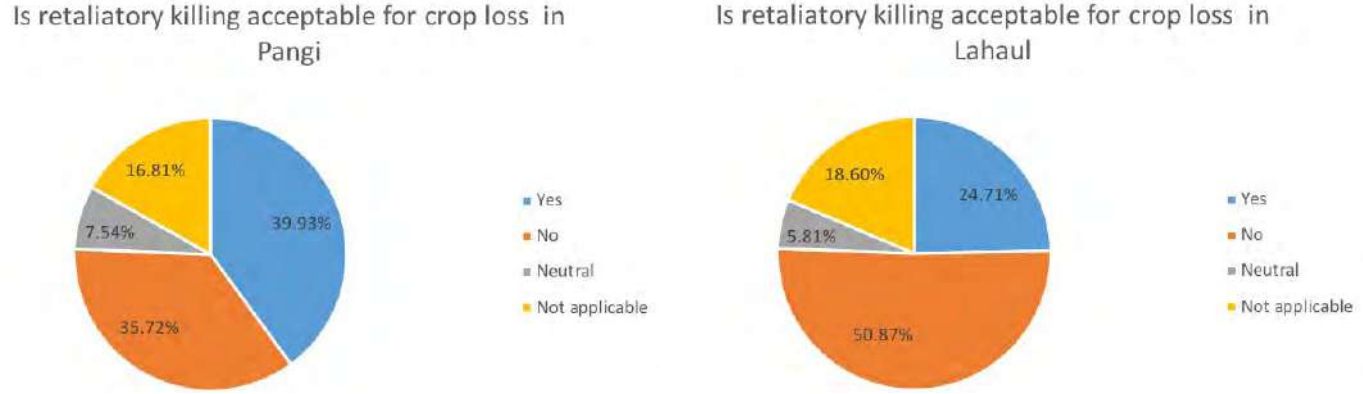


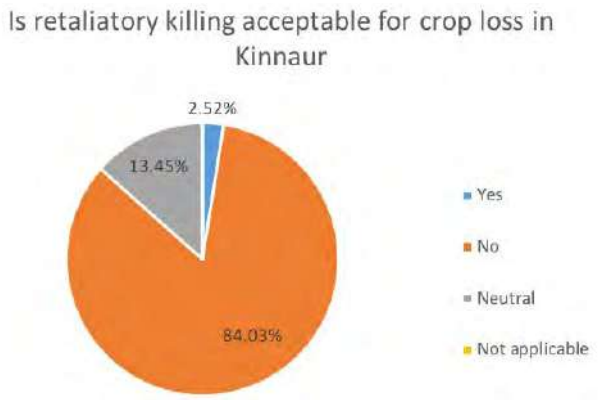


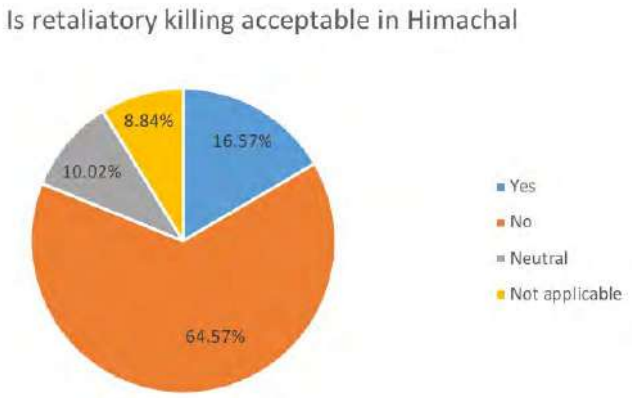
8.3 Pie charts showing respondents' acceptance of retaliatory killing for livestock-predating species in different regions of Himachal Pradesh.



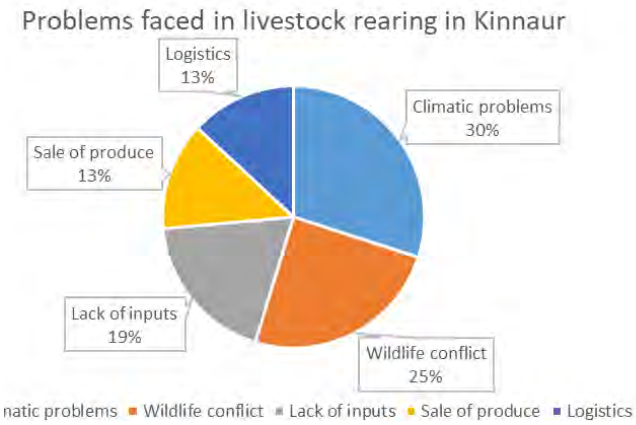
8.4 Pie charts showing respondents' acceptance of retaliatory killing for crop-depredating species in different regions of Himachal Pradesh

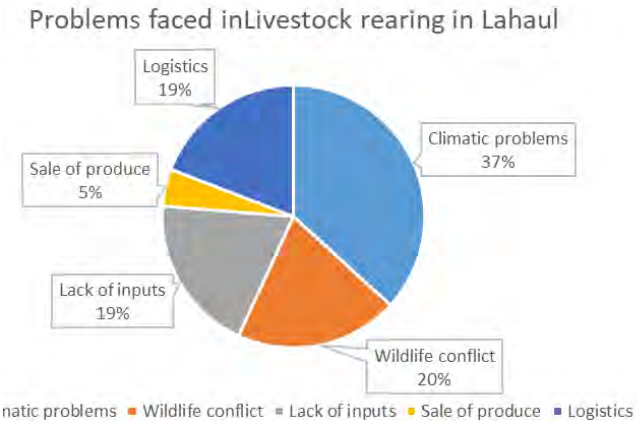


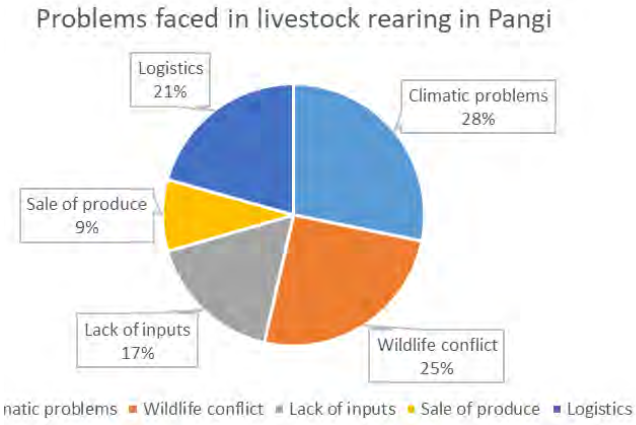


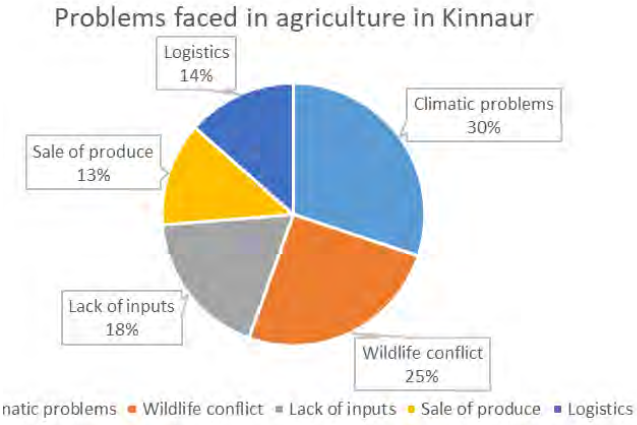


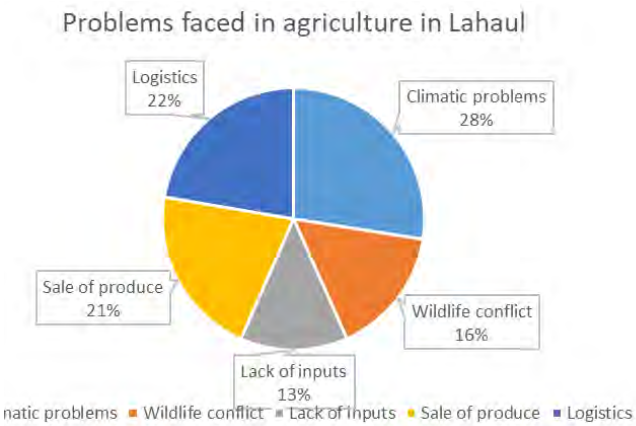
8.5 Pie charts showing challenges faced by respondents for livestock rearing and agriculture practices.

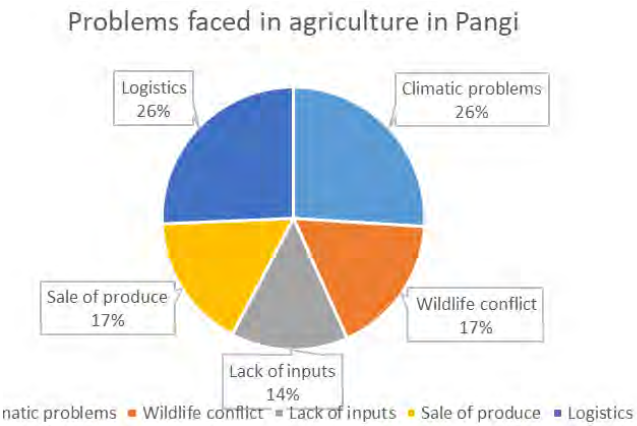












12. SELECT PHOTOGRAPHS

Preparing a village map with community members in Pregaraon village in Pangi during a focus group discussion in the village school

Study team interacting with community in Gwari village, Pangi

Preparing a village map with community members in Pregaraon village in Pangi during a focus group discussion in the village school

Workshop organised by study team in Keylong, Lahaul to train field assistants to carry out ecological sign surveys

Need to add caption

MNREGA is a secondary, but critical source of livelihood for community in Pangi. Although Lahaul and Kinnaur had comparable enrolments under this scheme, but better access to markets helps communities in these landscapes to build resilience. Captured in this photo: Community members from Sural Bhatori breaking stones to aid construction of a Gompa (monastery)

Conducting ecological sign survey near Sural Bhatori, Pangi

A grazier from the Gaddi community with their livestock near Sach Pass

13. TRAINING NEEDS ASSESSMENT

S.NO.	STAKEHOLDER	KNOWLEDGE/ SKILL	CURRENT STATUS AND GAP	NEED	CONVERGENCE
1	Forest Department	Processing and clearing compensation claims	Deceptively low amounts of compensation claims received; poor turnaround times, limited workforce to interface with aggrieved community members, especially at sites of conflict	• Creation of compensation task force with focussed roles and relevant training provided to the members to interface with concerned line departments and officials • Strict timelines notified and followed for disbursal of compensation claims - streamlining of roles, strong interface with the proposed compensation task force • Hiring of more workforce, especially at ground-level to amplify 'boots on the ground'	Animal Husbandry Department; Panchayat; other institutions of local self-governance (Praja, Mahila and Yuva mandals)
2	Forest Department	Monitoring of wildlife	Limited availability of baseline data of occurrence and abundance across the landscapes	• Training in conjunction with established and competent research institutions and/or organisations • Periodic monitoring of wildlife across both the landscapes be carried out. Established wildlife ecologists, research and conservation organisations may be consulted and collaborated with	Conservation and research institutions and organisations; established wildlife ecologists; regional colleges and universities
3	Forest Department	Rescuing of wild animals	Limited to no capacity to rescue injured or conflict animals due to limited exposure, training and availability of equipment	• Training with rescue professionals especially for relevant conflict species (as detailed earlier in this report) • Necessary and updated equipment be purchased to make the process of rescue safer for professionals and the animals	Other states' forest departments; experts within HPFD; Conservation organisations
4	Agriculture (& Horticulture) Departments	Barriers and deterrence for mitigating HWC-linked crop damage	Under Mukhya Mantri Khet Sanrakshan Yojana, up to 85% subsidy can be provided to install solar-powered fencing to reduce crop damage due to HWC. Existing designs do not fare well in snow.	The prevailing designs do not survive winters due to snowfall - we propose changes at two axes: • Design: removable solar fences that can be reinstalled after winters • Targeted beneficiaries: through socio-ecological baseline surveys, target communities and village clusters that may be more vulnerable, and thus should be prioritised.	Panchayat; SHGs; Local self-governance institutions; Conservation organisations; Development organisations
5	Agriculture (& Horticulture) Departments	Central crop insurance scheme	Pradhan Mantri Fasal Bima Yojana has the provision to include cover against crop damage due to HWC but states have to 'opt-in'	Inclusion of the aforementioned 'add-on' should be carefully considered by Forest, Agriculture and Horticulture Departments and a proposal may be sent to CMO.	Forest Department; Agriculture Department; Horticulture Department; Upper-level state bureaucracy

S.NO.	STAKEHOLDER	KNOWLEDGE/ SKILL	CURRENT STATUS AND GAP	NEED	CONVERGENCE
6	Agriculture (& Horticulture) Departments	Value addition of agricultural produce	Lahaul has well-formed market connections to sell cash crops at competitive rates but Pangi, despite experimenting with cash crops has not yielded commensurate benefits to the local community because of issues of storage, transport and connectivity	Work with local KVKs and agricultural scientists for training of farmers to facilitate the transition to organic agricultural practices, especially in Lahaul.	Agro-based cooperative societies, large-level buyers such as Dabur, Safal, McCain, PepsiCo.
7	Animal Husbandry Department	Livestock health, and treatment of injured livestock due to wildlife	Sparse availability of veterinary doctors due to remote areas and harsh weather.	Higher deployment ensuring more 'boots on the ground'; Faster resolution; Substantive stocks of medicines especially during winter months	
8	Animal Husbandry Department	Value addition of livestock produce	Low commercial viability of woollen products emanating from these landscapes	Markets with high return for artisanal woollen products can be explored; Interested community members can be given training through workshops to incorporate traditional and modern, contemporary, urban designs.	Animal Husbandry Department, Cooperatives; Wool Boards
9	Academic and Action-research institutions	Scientific knowledge around the thematics of wildlife and conservation; Preservation of traditional ecological knowledge systems	Low capacity of local educational and research institutions; Limited conservation organisations working in the two landscapes; Non-existent organised citizen science programmes	• Higher involvement of local schools and colleges in Lahaul and Pangi's ecology and environment; periodic field visits; projects; research. • Invite/collaborate with conservation organisations to initiate action-research • Citizen science projects such as eBird, MigrantWatch, SeasonWatch should be promoted as part of environmental education curricula	Forest Department; Local schools and colleges; National and international conservation organisations
10	Local community - Pangi & Lahaul	Claiming compensation for livestock loss or injury	Extremely poor uptake, especially those aggrieved in remote valleys; very few apply for compensation due to high opportunity costs involved, low levels of trust and lack of awareness	Awareness campaigns to inform community members about the compensation process; selecting a 'rotating' nodal person from the village to interface with the forest department and others till the compensation task force is formed	Forest Department; Animal Husbandry Department; Panchayat; SHGs; Local self-governance institutions
11	Local community - Pangi & Lahaul	Avoiding conflict with black/ brown bear	Pervasive misinformation on how to avoid and deal with human-bear confrontations due to lack of awareness, compounded by limited or no SOPs	Awareness campaigns (based on SOP) during panchayat meetings, and in local schools and colleges	Forest Department; Local schools and colleges; Panchayat; SHGs; Local self-governance institutions

S.NO.	STAKEHOLDER	KNOWLEDGE/ SKILL	CURRENT STATUS AND GAP	NEED	CONVERGENCE
12	Local community - Pangi & Lahaul	HWC mitigation measures/tools/ instruments	Predominantly guarding-based mitigation, especially in Pangi and households with low landholding and incomes due to low penetration of modern and design & technology-based preventative and mitigation mechanisms	Uptake and trial of modern forms of HWC management as proposed by Forest Department and endeavours like SECURE Himalaya. Traditional forms of management should be supported and scaled up, if effective.	Forest Department; SECURE Himalaya; Conservation organisations
13	Local community - Pangi & Lahaul	Agricultural produce - value addition	Low to meagre rates for agro-livestock-NTFP based produce in Pangi due to low market access, poor value addition at source, and poor road and cellular network connectivity. Good market linkages for agricultural produce in Lahaul, especially for potato, lettuce and green pea.	We will work with local KVKs and agricultural scientists for training of farmers to facilitate the transition to organic agricultural practices, especially in Lahaul.	Agriculture Department; Horticulture Department; Cooperatives; Krishi Vigyan Kendras; Large-scale buyers
14	Local community - Pangi & Lahaul	Livestock produce - value addition Other supplementary sources of income generation	Low demand and limited market for livestock-based produce due to limited demand and poor value addition at source • Skills to produce handicraft exist but has not been tapped yet to scale it at a commercial level. • Tourism has a huge potential after opening of the Atal Tunnel, but community members are not equipped with soft skills for this.	Interfacing with the relevant departments and institutions, community members can be trained to create woollen products with designs aligning with target markets Through the existing network of PM Kaushal Kendras, make use of the Skill India Mission to organise training workshops for interested local community members to incorporate skills such as those required in hospitality; local handicrafts and artisanship industries; and agro-livestock-NTFP produce-based entrepreneurships.	Animal Husbandry Department, Cooperatives; Social Enterprises; Wool Boards Skill India Mission - PM Kaushal Kendras, Social enterprises that are working or are willing to work in these landscapes
15	Migratory herders - Gaddis	Avoiding conflict with snow leopard, wolf and bears	High conflict faced, especially at higher altitudes. Livestock tended to per grazier has increased substantively.	Ensuring ample graziers accompany their livestock; use of fox-lights; becoming a part of campaigns to spread awareness on SOPs to mitigate conflict	Forest Department; SECURE Himalaya, Conservation organisations
16	Migratory herders - Gaddis	Claiming compensation for livestock loss or injury	Limited viability to apply for compensation because of their rampant mobility and (often) disparities in the number of livestock vis-à-vis their permit allowances	Realistic representation of numbers of livestock; interfacing with Forest Department for compensation claims	Forest Department

UNDP India, in partnership with the Ministry of Environment, Forest and Climate Change is implementing SECURE Himalaya project, supported by the Global Environment Facility. The project aims to strengthen Government of India's efforts in sustainable management of snow leopard habitats in India and is being implemented in the Union Territory Administration of Ladakh and states of Himachal Pradesh, Uttarakhand and Sikkim.

This report highlights the current state of Human-Wildlife Conflict in the Lahaul, Pangi and Kinnaur Landscapes in the state of Himachal Pradesh. A multi-pronged approach to mitigate human wildlife conflict that involves a genuine participation of affected communities in planning and implementing conflict mitigation strategies is presented.