# SECURE Himalaya

## Identifying, delineating and mapping areas with High Conservation Values (HCVs) and developing management recommendations / plans for the SECURE Himalaya landscapes in Himachal Pradesh



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UNDP

भारतीय वन्यजीव संस्थान
Wildlife Institute of India




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# EXECUTIVE SUMMARY


High Conservation Value Areas (HCVAs) is an emerging concept used to identify important areas based on a variety of parameters including biodiversity, landscape context, threatened or endangered ecosystems, provisioning of basic ecosystem services, and dependence of local communities. The assignment aims to Identify High Conservation Value (HCV) categories of areas in the project landscape of Himachal Pradesh, delineate their boundaries and map them, and suggest relevant recommendations with respect to the potential threats prevalent in the areas, specific for each HCV category.

The Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India along with UNDP has implemented a GEF funded project: SECURE Himalaya (Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems). The project aims to promote sustainable land management in alpine pastures and forests in Indian Himalayan ecosystems for conservation of snow leopard and other endangered species and their habitats and sustaining ecosystem services. The project SECURE Himalayas would be implemented over a period of six years in the high-altitude trans-Himalayan region, which covers an area of about 184,823 $km^2$ representing 5.62 percent of the total geographic area of the country. The selected landscape for the project is Lahaul-Pangi & Kinnaur Landscape in Himachal Pradesh.

The Himalayan ecosystem in India is of critical importance for its immense biological, socio-cultural, and hydrological values. The biodiversity and ecosystems that it harbours form an important life-support system for a large number of agro-pastoral communities that depend on it. However, these natural ecosystems are under severe threat from high dependence of local communities on natural resources. The major threats as identified in the landscape are intensive grazing of the pasturelands by domestic livestock, inter-specific competition between wild ungulates and domestic livestock, human-wildlife conflict resulting in crop destruction and depredation of livestock, over-harvesting and illegal extraction of medicinal and aromatic plants by intruders, over-exploitation of natural resources and uncontrolled conventional tourism interfering with the fragile ecosystems and the wildlife of the area.

The current assignment identifies and delineate the potential high conservation value areas in the landscape through a knowledge-based approach *i.e.* data compilation, remote sensing & GIS approach, and ground truthing. The information is presented through the appreciation and understanding of the study sites by short-listing of areas of high conservation value and their management regimes. We reviewed 101 documents (74 peer-reviewed and 27 unpublished) pertaining to the subject, and concept of high conservation value forests. Remote sensing and GIS data was used to generate various layers like digital elevation model (DEM), land-use land cover (LULC), drainage network, road network, protected areas network, distribution, occupancy maps of species, forest cover, slope and maps of villages in the landscape in concern. With the help of the secondary data and various GIS layers, potential high conservation value areas were identified and mapped in the remote sensing and GIS environment.

Through 'ground truthing' of the available data and stakeholder consultations followed by field visits to the potential areas, 28 villages were visited, 13 in Lahaul and 15 in Pangi valley. Village level meetings were organized and data were collected using semi-structured open-ended questionnaire, for validation of potential high conservation value areas (HCVAs).

Key informants were identified and interviewed for further validation and verification for HCVAs. A presence survey was conducted in the landscape to understand mammalian

species distribution by using a combination of direct and indirect methods. Direct methods were based on visual encounters of animals whereas indirect methods relied on quantification of indirect evidences such as animal feces (pellet groups, scats, droppings), tracks (pug marks, hoof marks, scrapes) and other signs (feeding/ digging). Since all the areas surveyed were located at higher altitudes on steep and uneven terrain, the trails in the forests and alpine regions were surveyed. A total of 79 trails (1 km each), were surveyed, 25 in Lahaul, and 54 in Pangi.

A total of 17 areas with high potential for conservation were identified in the entire landscape, 11 in Lahaul valley, namely, Miar valley, Naingar & Neelkanth lake, Billing-Istingri, Darcha-Jispa, Koksar, Kuruched, Hadsar, Chandratal lake, Mrikula Mata temple, Trilokinath temple, Kardang monastery; and 6 areas in Pangi, Sural Bhatori & Sural Gompa, Hudan bhatori, Kadu nallah, Sechu Tuan, Luj and Mindhal.

Consequent upon these consultations and ground verification, biodiversity values and associated threats to these biodiversity values have been identified for each of the short-listed area of high conservation value and relevant recommendations prepared. It is proposed that in order to conserve the integrity of each HCVA type the status of the land in concern needs to be ascertained. The key recommendations towards this end include-

1) Demarcation of critical areas within the short-listed areas of high conservation values to serve as important livelihood source for herder communities;
2) Integrated pastureland management regimes to reduce the pressure on the pastures, and provide some time for restoration;
3) Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended; also, the strategies suggested by the SECURE-HWC (human-wildlife conflict) project in Lahaul-Pangi landscape, shall be followed.
4) Enhanced training to the key stakeholders concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants;
5) Enhanced collaboration between the enforcement agencies (like the forest department and security forces) for improved surveillance to identify, monitor and prevent illegal activities.
6) Policy harmonization for potential HCVAs in the form of recognizing such areas as Community Conservation Reserve, Biodiversity Heritage Sites or Medicinal Plant Conservation and Development Areas.



**Image 1:** Snow leopard sighted in Miyar Valley, Udaipur Range, Lahaul Valley

*Shiv Kumar*

# LIST OF ACRONYMS

| | |
|---|---|
| ASI | Archaeological Survey of India |
| BHSs | Biodiversity Heritage Sites |
| DEM | Digital Elevation Model |
| ETM+ | Enhanced Thematic Mapper |
| FSC | Forest Stewardship Council |
| GEF | Global Environment Facility |
| HCVAs | High Conservation Value Areas |
| HCVRN | High Conservation Value Resource Network |
| HCVs | High Conservation Values |
| IIFM | Indian Institute of Forest Management |
| IRS | Indian Remote sensing Satellite |
| IUCN | International Union for Conservation of Nature |
| LISS | Linear Imaging Self-scanning Sensor |
| LoA | Letter of Agreement |
| LPK | Lahaul, Pangi & Kinnaur |
| LULC | Land Use Land Cover |
| MoEFCC | Ministry of Environment, Forest and Climate Change |
| MSS | Multispectral Scanner System |
| NASA | National Aeronautics and Space Administration |
| NTFPs | Non-Timber Forest Products |
| ORNL DAAC | Oak Ridge National Laboratory Distributed Active Archive Center |
| P&C | Principles & Criteria |
| PA | Protected Area |
| PSL | Project Snow Leopard |
| RET | Rare, Endangered & Threatened |
| SECURE | Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems |
| SRTM | Shuttle Radar Topography Mission |
| TM | Thematic Mapper |
| UNDP | United Nations Development Program |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| USGS | United States Geological Survey |
| UTM | Universal Transverse Mercator |
| WGS | World Geodetic System |
| WISA | Wetlands International South Asia |
| WLS | Wildlife Sanctuary |



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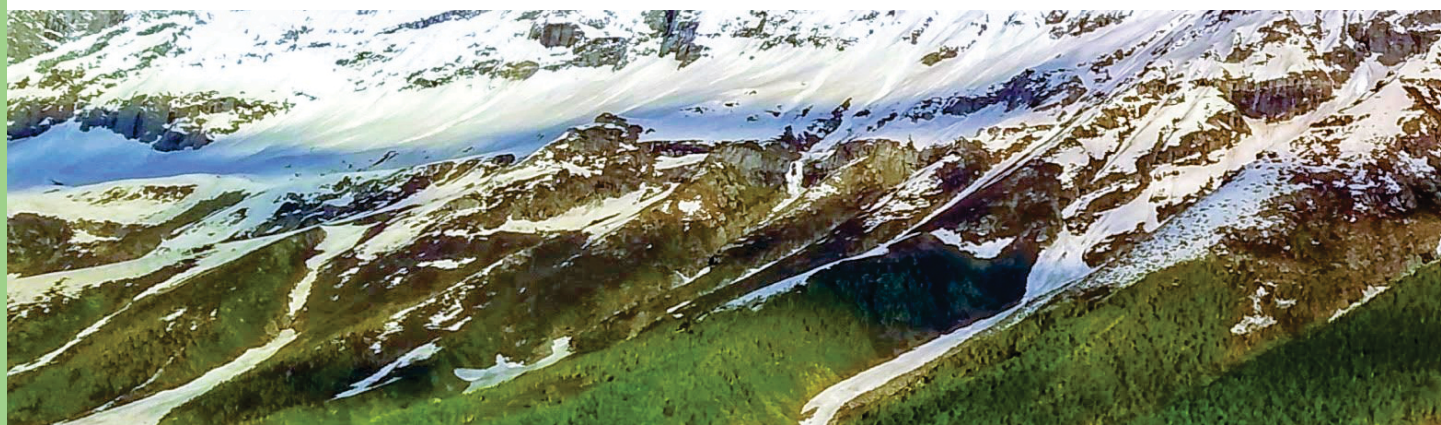





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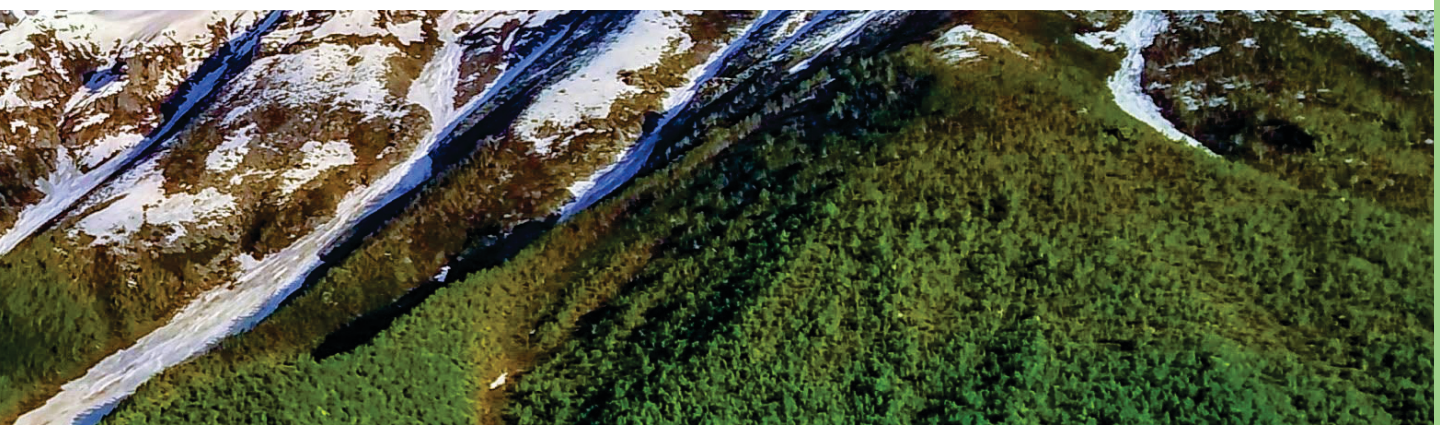






**Image 2:** Himalayan Marmot in Lahaul Valley

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# 01. BACKGROUND

The high range Himalayan ecosystem in India is of critical importance for the biodiversity and ecosystems of global significance. It forms an important life-support system for a large number of remote and agro-pastoral communities that depend on it (Ning *et al.*, 2013).Despite the immense biological, socio-cultural and hydrological values, these natural Himalayan ecosystems are under severe threat from high dependence of local communities on natural resources, pressures from economic development, selective removal of medicinal and aromatic plants, and the emerging threat of illegal wildlife trade and wildlife crime (Mishra *et al.*,2010; Ning *et al.*, 2013).

To address the existing threats, the project SECURE (Securing livelihoods, conservation, sustainable use and restoration of high range Himalayan ecosystems) Himalaya has tried to demonstrate a set of best practices in the Himalayan ecosystem mainly for snow leopard conservation. SECURE Himalaya is a GEF funded project that is being implemented by the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India along with UNDP. The project would be implemented over a period of six years in the high altitude trans-Himalayan region and has the following major outcomes:

(1) Improved management of high range Himalayan landscapes for conservation of Snow Leopard and other endangered species and their habitats and sustaining ecosystem services;

(2) Improved and diversified livelihood strategies and improved capacities of community and government institutions for sustainable natural resource management and conservation;

(3) Enhanced enforcement, monitoring and cooperation to reduce wildlife crime and related threats;

(4) Effective knowledge management and information systems established for promotion of sustainable management practices in the High range Himalayan ecosystems.

The project is based on the landscape approach of conservation which aims at achieving conservation goals over the whole landscape beyond the conventional Protected Area (PA). The task assigned to the Wildlife Institute of India aims to identify, delineate and map High Conservation Value (HCV) areas on the basis of the six categories of HCVs (as documented by FSC), and develop recommendations in the project landscape of Himachal Pradesh.




Kalzang

# 02. OBJECTIVES

The Objective and tasks associated with each of the objectives of the assignment are:

- Identify potential High Conservation Value (HCV) categories of areas in the trans-Himalayan landscape of Himachal Pradesh,

  *Task:* Information collection and preliminary assessment by compiling and analysing secondary data; and finalizing the approach and methods to be used in the landscape

- Map and delineate the boundaries of the HCV areas

  *Task:* Analysis and mapping by comprehensive analysis of secondary data, stakeholder consultations and field survey to understand the presence and distribution of HCVs using spatial dataset

- Suggest relevant recommendations for each HCV category

  *Task:* Listing out major threats to the identified HCVAs in each category and preparation of conservation management recommendations for every particular area


Kalzang



# 03. LITERATURE REVIEW



Himachal Pradesh is very rich in terms of biodiversity, primarily due to varied climatic conditions ranging from tropical in the foothills to arctic environments in the trans-Himalayan region. In recent years, the state has come under a strong threshold of development thereby natural ecosystems have been over-exploited and even destroyed by the rapidly increasing human population. Therefore, several endemic andrestricted range species found in the region are facing a threat to their existence (Negi *et al.*, 2015). The trans-Himalayan landscape is a high elevation land ranging from about 2,900m to over 6,000m peaks with an average altitude of about 4,000m. The area is characterized by extreme cold, low precipitation, and rugged mountainous terrain.

## 3.1 Status of Protected Areas in Himachal Pradesh

The state encompasses two bio-geographic zones *i.e.* 1 and 2, which are subdivided into A & B. The main bio-geographic subdivisions in the current scope of work are the North and North Western Himalaya (2A & 2B) in the Pangi and Kinnaur Complex and the Tibetan Plateau in the Lahaul complex (1B). The state of Himachal Pradesh is predominantly mountainous in the Western Himalayas. There are four distinct regions in the state, the Shivalik, the lesser Himalaya, the greater Himalaya and the trans-Himalayan region. The recorded forest area of the State is 37,003 $km^2$ making for about 66% geographical area of the state. At present, the state has 5 National Parks, 26 Wildlife Sanctuaries, and 3 Conservation Reserves. The wildlife sanctuaries in the landscape of Lahaul-Pangi and Kinnaur are listed below:

**Table 1:** List of Protected Areas in the Lahaul, Pangi & Kinnaur Landscape

| Protected Area | Landscape |
|---|---|
| Lippa Asrang Wildlife Sanctuary | Kinnaur |
| RupiBhaba Wildlife Sanctuary | Kinnaur |
| Sangla (Rakchham Chitkul) Wildlife Sanctuary | Kinnaur |
| Sechu Tuan Nala Wildlife Sanctuary | Pangi, Chamba |
| Chandratal Wildlife Sanctuary | Lahaul & Spiti |

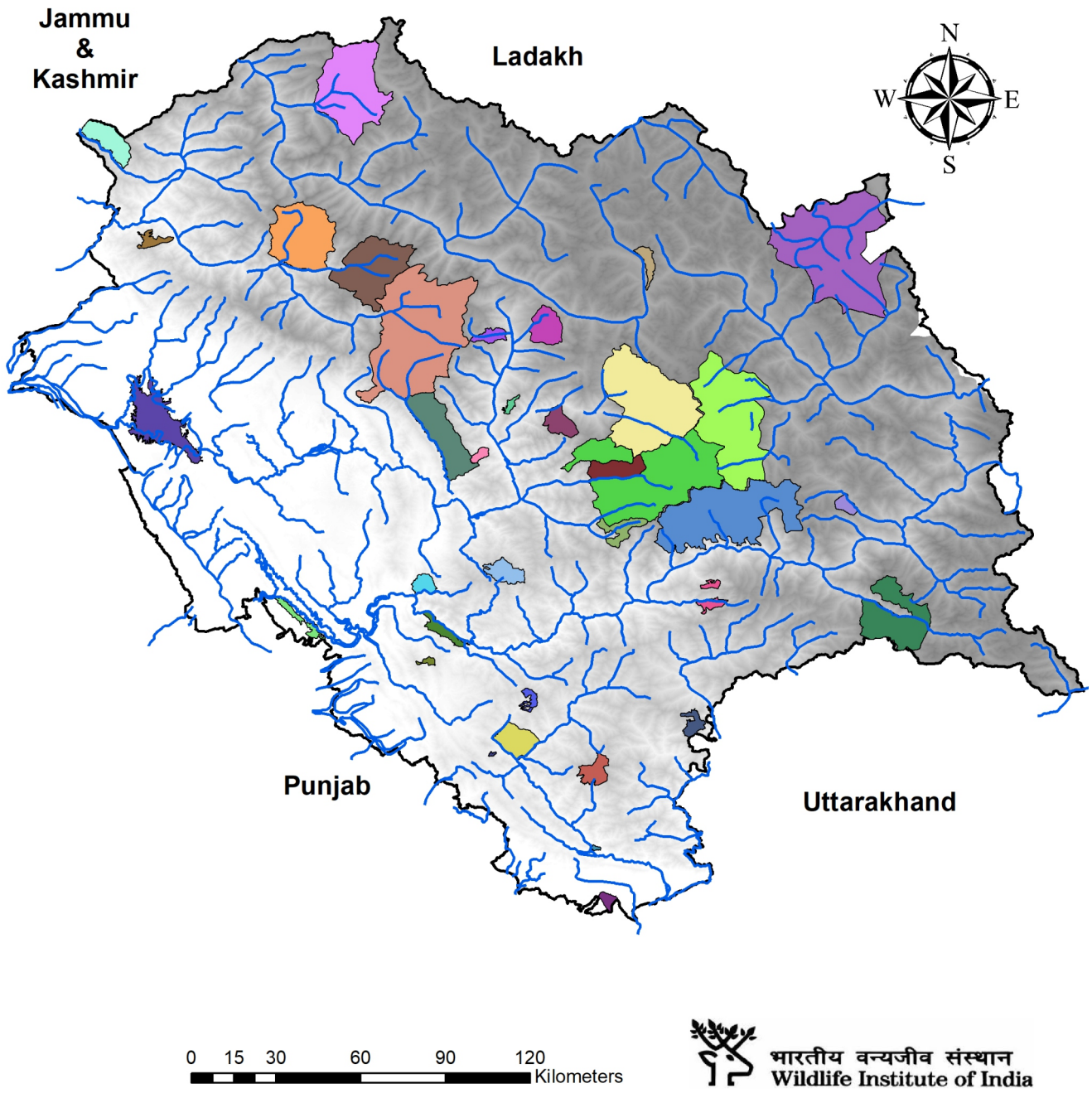



**Figure 1:**
Protected Areas in the state of Himachal Pradesh

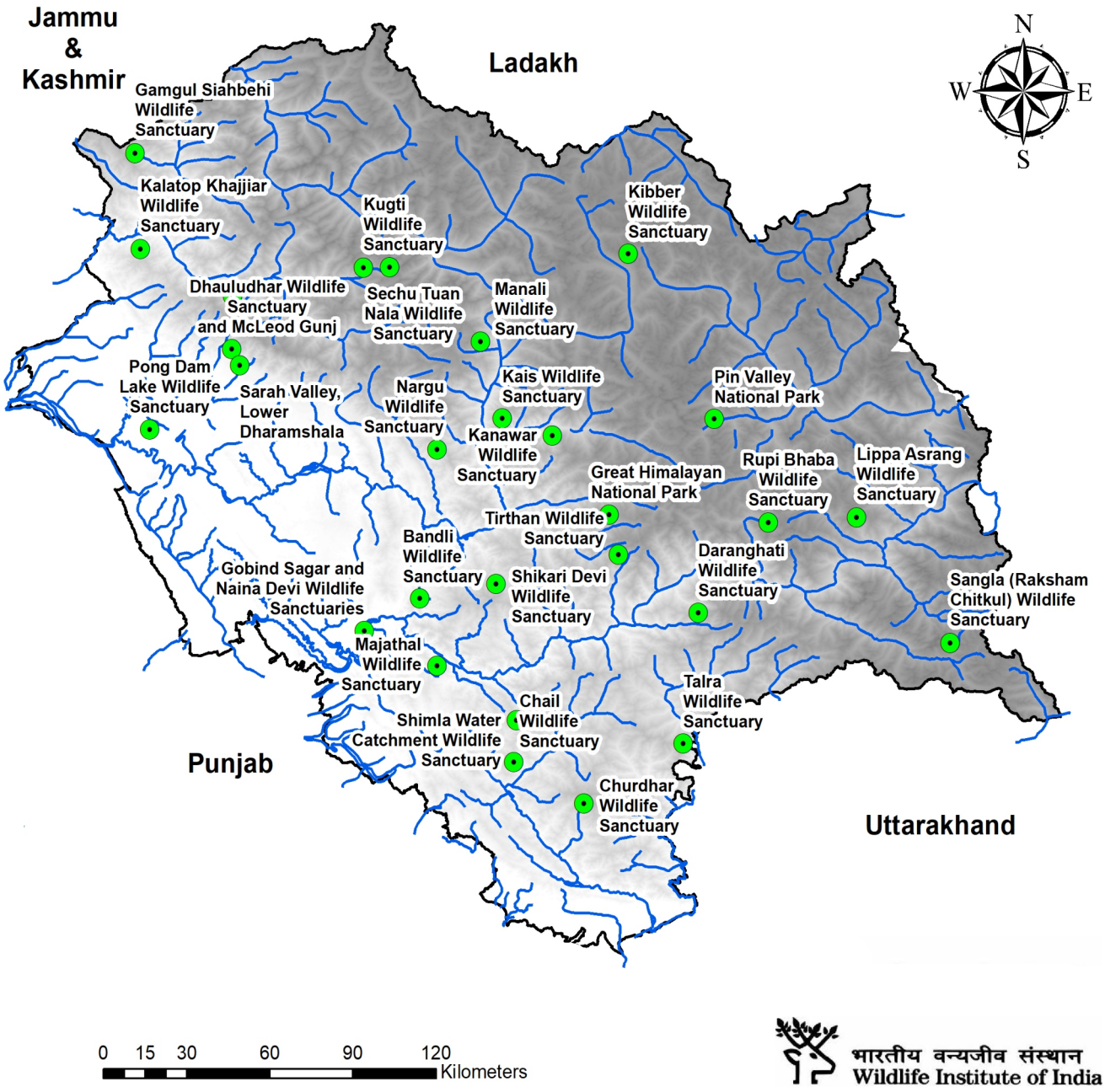



**Figure 2:**
27 Key Biodiversity Areas (KBAs) in the State of Himachal Pradesh
(Data source: ENVIS Centre on Wildlife and Protected Areas)

**Key Biodiversity Areas:** Apart from the Wildlife Sanctuaries and the National Parks, the state has a total of 27 Key Biodiversity Areas (KBAs). The term "Key Biodiversity Areas" (KBAs) is used to include areas that contribute to the global persistence of biodiversity, including habitat for threatened floral and faunal species in terrestrial, freshwater and marine ecosystems (ENVIS Centre of Wildlife and Protected Areas). Globally KBAs are designated based on five broad categories *i.e.* threatened biodiversity, geographically restricted biodiversity, ecological integrity, biological processes; and irreplaceability; and the criteria for designating a site as KBA have been formulated by International Union for Conservation of Nature (IUCN). The Key-Biodiversity Area present in the landscape of Lahaul-Pangi valley is Sechu-tuan Wildlife Sanctuary.

**Table 2:** List of KBAs in the state of Himachal Pradesh
(ENVIS Centre for Wildlife and Protected Areas)

| S.No. | Name of the Key Biodiversity Areas | S.No. | Name of the Key Biodiversity Areas |
|---|---|---|---|
| 1. | Bandli Wildlife Sanctuary | 15. | Majathal Wildlife Sanctuary |
| 2. | Chail Wildlife Sanctuary | 16. | Manali Wildlife Sanctuary |
| 3. | Churdhar Wildlife Sanctuary | 17. | Nargu Wildlife Sanctuary |
| 4. | Daranghati Wildlife Sanctuary | 18. | Pin Valley National Park |
| 5. | Dhauludhar Wildlife Sanctuary | 19. | Pong Dam Lake Wildlife Sanctuary |
| 6. | Gamgul Siahbehi Wildlife Sanctuary | 20. | Rupi Bhaba Wildlife Sanctuary |
| 7. | Gobind Sagar and Naina Devi WLS | 21. | Raksham Chitkul Wildlife Sanctuary |
| 8. | Great Himalayan National Park | 22. | Sarah Valley, Lower Dharamshala |
| 9. | Kais Wildlife Sanctuary | 23. | Sechu Tuan Nala Wildlife Sanctuary |
| 10. | Kalatop Khajjiar Wildlife Sanctuary | 24. | Shikari Devi Wildlife Sanctuary |
| 11. | Kanawar Wildlife Sanctuary | 25. | Shimla Water Catchment WLS |
| 12. | Kibber Wildlife Sanctuary | 26. | Talra Wildlife Sanctuary |
| 13. | Kugti Wildlife Sanctuary | 27. | Tirthan Wildlife Sanctuary |
| 14. | Lippa Asrang Wildlife Sanctuary | | |

## 3.2 Knowledge status of Biodiversity in the landscape

### *3.2.1 Floral Diversity*

Himalaya is one of the mega biodiversity regions of the world (Myers *et al.*, 2000). The northwesternHimalayan region consists of unique habitats to sustain several endemic and rare plant taxa. The vegetation comprises of almost pure stands of semievergreen to evergreen tree species like *Pinus roxburghii, Pinus wallichiana, Quercus sp., Cedrus deodara, Abies pindrow, Picea smithiana, Taxus wallichiana and Juniperus sp.* at different altitudes and aspects. The dry temperate and alpine regions comprising the project landscapes house many different species compositions making the valleys very rich in phytodiversity (Sharma *et al.*, 2011). Himachal Pradesh, which forms a part of the western Himalaya, is a repository of medicinal and aromatic plants and the traditional knowledge associated with these plants (Sharma *et al.*, 2005). 354 species of medicinal and aromatic plants belonging to 208 genera and 76 families have already been recorded from the Lahaul valley (Singh *et al.*, 2009; Chauhan *et al.*, 1989; Samant, 2007). About 45 different species of medicinal plants belonging to 20 different families have been reported from Pangi valley (Dutt *et al.*, 2014) and 103 species of medicinal value belonging to 79 genera falling in 39 families have been recorded from Kinnaur district(Negi *et al.*, 2009).

### *3.2.2 Avifaunal diversity*

Conserving the landscape integrity in Himachal Pradesh is extremely important for the protection of many species of pheasants and forest birds. A total of 669 species of birds have been identified till now from the state of H.P.(Passerines and Non-passerines) (Dhadwal, 2019). Around 150 species of birds have been reported from Lahaul valley including three threatened species, namely Himalayan griffon, bearded Vulture and orange bullfinch (Ebird: Cornell Lab of Ornithology); and 62 avifaunal species have been reported from Pangi region (Saikia *et al.*, 2008), threatened avifaunal species reported from the area are Himalayan monal, bearded vulture and Himalayan griffon. In Kinnaur, a diverse population of birds consisting of 73 species, belonging to 52 genera, spread over 24 families, and 9 orders has been recorded from Rakcham-chitkul WLS(Negi *et al.*, 2015). The IBAs in Kinnaur and Pangi landscapes are Lippa Asrang WLS, Rupi Bhaba WLS, and Sechu Tuan Nala WLS respectively (Rahmani *et al.*, 2016).

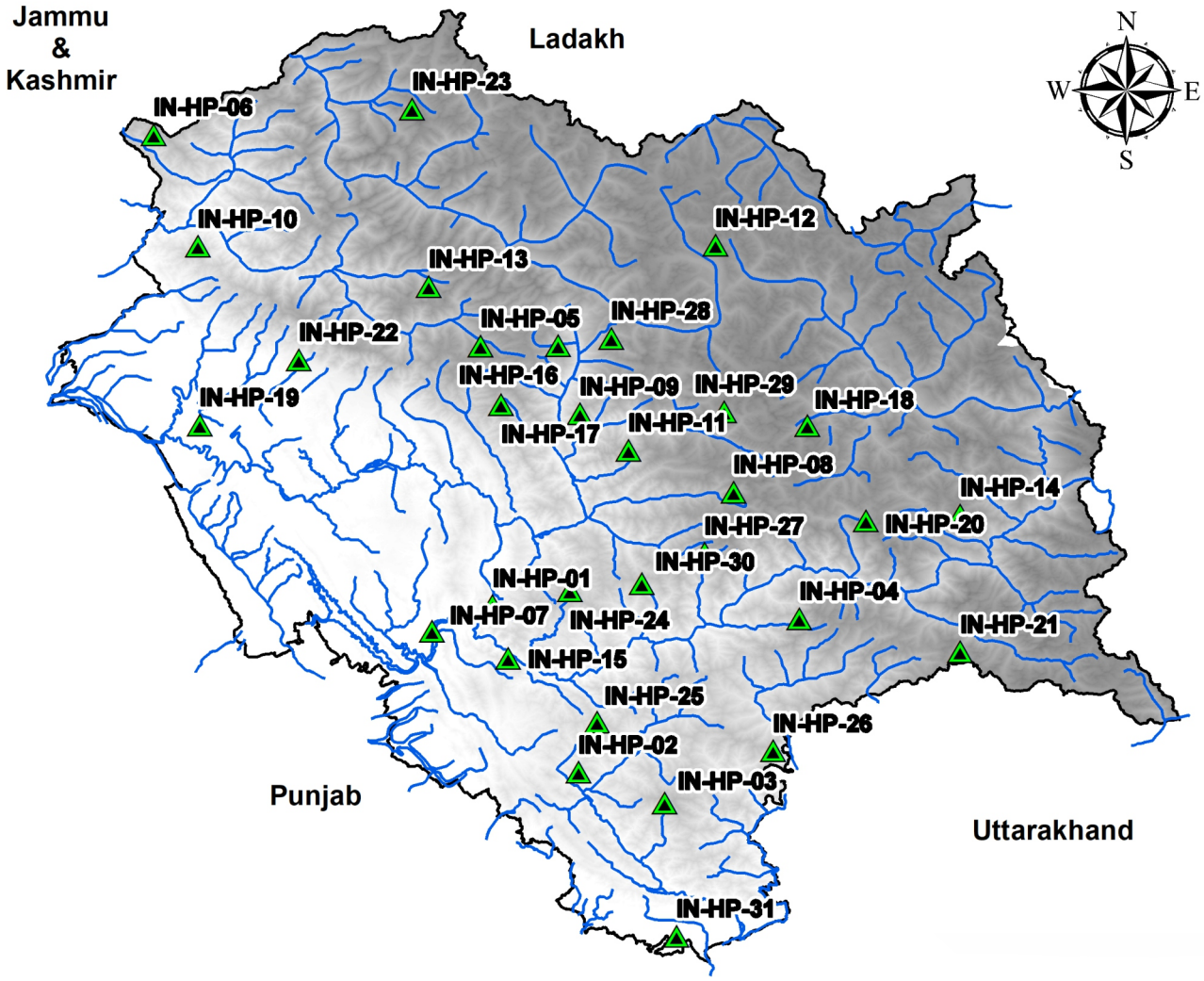



**Figure 3:**
Important Bird Areas of Himachal Pradesh
(Data source: Bombay Natural History Society)

### *3.2.3 Mammalian diversity*

The mountainous regions and alpine meadows of Himachal Pradesh form a remarkable habitat for many animals, herbivores, and carnivores alike. However, there is a need for further survey and long-term monitoring of the wildlife. Some of the major faunal species in the region, in addition to Snow Leopard, include Asiatic Ibex, Himalayan musk deer, blue sheep, Tibetan wolf, common leopard, Himalayan marmot, Asiatic black bear, Himalayan brown bear, ghoral, Himalayan serow, and Royle's pika (Sharma *et al.*, 2014). A total of 23 species of mammals have been reported from the Lahaul valley, out of which 6 species are threatened (CR: 1 species, EN: 2 species, VU: 2 Species, and NT: 1 species) (Joshi *et al.*, 2019). From Pangi (Chamba)19 species of mammals have been reported (ZSI, 2013) out of which 5 species are threatened (CR: 1 species, EN: 1 species,VU: 2 Species, and NT: 1 species). And in Kinnaur, the presence of 23 species of mammals, belonging to 20 genera, 11 families, and 5 orders have been reported from Sangla valley by Negi *et al.*, 2015.Livestock depredation by wild carnivores is an emerging serious issue in the landscape of Lahaul and Pangi, adversely impacting the conservation of wild fauna. Therefore, there is a need for developing strategies for enhanced enforcement, monitoring, and cooperation to reduce wildlife crime and human-wildlife conflict.

### *3.2.4 Riverine ecosystem*

There has been limited study on the catchment area of Lahaul-Spiti by Sharma and Dhanze (2013). The authors have documented benthic, zooplankton, and fish diversity along with various parameters in the region. The demographic and physiographic characteristics of the catchments area of this tributary are identical to that of the Tibetan Plateau. Rainfall is scarce in this area. Diatoms, flagellates, and algae normally constitute the bulk of the phytoplankton. A total of 27 species has been recorded. Zooplankton species found in the study area includes *Keratella monospina, Brachonus caudatus, Arcella sp.,* and *Colpidium colpoda*. The Ephemeroptera were found most abundant which indicates good water quality as well as is favorable for biotic communities.

## 3.3 Potential habitat of Snow Leopard and its prey species in the landscape

The landscape in concern encompasses three districts of Himachal Pradesh, and has a good Protected Area (PA) network. There are four Wildlife Sanctuaries and one Wetland Sanctuary, in the landscape. Lahaul-Spiti and Kinnaur constitute 73% of the potential snow leopard habitat in HP (Ghoshal, 2017). Close to 1/3$^{rd}$ geographical area of Himachal Pradesh, especially the greater and trans-Himalayan regions, is potential snow leopard habitat. Some of the key sitesthat have been identified for snow leopards in the state and that fall in the Lahaul, Pangi & Kinnaur landscapeare the Lippa Asrang WLS, Chandratal WLS, Rakcham Chitkul WLS, Rupi Bhaba WLS and Sechu Tuan Nala WLS (Bhatnagar *et al.*, 2016). An intensive study needs to be done to improve knowledge of high conservation value areas, the snow leopard's habitat, and its major prey species, Asiatic Ibex, and Blue sheep.

**Table 3:** Knowledge status Snow Leopards in PAs (Modified from Bhatnagar *et al.*, 2016)

| Protected Area | Landscape | Size km$^2$ | Potential Snow Leopard Area (%) | Knowledge status |
|---|---|---|---|---|
| Chandratal WLS | Lahaul &Spiti | 39 | 79 | Good |
| Lipa Asrang WLS | Kinnaur | 31 | 100 | Poor |
| Rupi Bhabha WLS | Kinnaur | 738 | 63 | Poor |
| Rakcham Chitkul WLS | Kinnaur | 304 | 81 | Poor |
| Sechu Tuan Nala WLS | Pangi | 103 | 86 | Poor |

## 3.4 Threat assessment in the Landscape

Degradation of vegetation and loss of habitat are two of the most critical consequences of human activities. Diverse disturbance factors including harvesting of fuel-wood and timber have been reported to greatly influence the diversity of forest communities (Sayer & Whitmore, 1991) leading to change in species composition and vegetation structure (Berkmuller *et al.*, 1990; Kouki, 1994). The disturbances have also become widespread in the upper-montane zones across the Indian Himalayan region, thereby impacting both composition and functioning of high elevation natural ecosystems (Gairola *et al.*, 2009; Rawal *et al.*, 2012; Singh & Singh, 1992). Potential threats to wildlife in IHR are primarily from the local communities, the migratory herders, the migratory intruders, and the tourists. In the Himalayan region, the chronic form of disturbances are those in which people even if remove only a small fraction of forest biomass in the form of grazing, lopping, surface burning and litter removal at a given time, but the process repeated unabated year after year givesecosystems no time for recovery (Singh, 1998).

### *3.4.1. Over-exploitation of medicinal and aromatic plants*

A large number of studies on medicinal plants have been carried out in the IHR (Jain 1991; Samant *et al.*, 1998; Rai *et al.*, 2000). However, in Himachal Pradesh, such studies are fragmentary and mainly focused on inventory (Chauhan, 1989; Jain, 1991; Samant *et al.*, 1998; Sood *et al.*, 2001; Bhattacharya and Uniyal, 1982). The landscape is rich with many rare medicinal plants including *Picrorhiza kurroa*, *Aconitum heterophyllum*, and *Fritillaria roylei* - all threatened species (Chauhan *et al.*, 2011). Estimates indicate that about 90% of medicinal plant species are extracted from the wild (Anonymous, 1997); and that 69% of the material is collected through destructive harvesting, which suggests that medicinal plants are significantly threatened (Dhar *et al.*, 2000). Excessive anthropogenic pressures have been identified as the main causes of the decline in the population and the availability of the medicinal plants in the Himalayan region (Samant *et al.*, 1998).A lot of pressure on medicinal plants has been created with the commercialization of MAPs and increased demand in the market (Maikhuri *et al.*, 2003).

### *3.4.2. Over-grazing in the landscape*

Apart from excessive and illegal extraction of medicinal plants, uncontrolled grazing by domestic livestock also directly impacts the regeneration processes of forests (Kelt & Valone, 1995; Saberwal, 1995). Overgrazing has an adverse effect on the vegetation - in the case of both alpine grasslands and forests as it leaves the ground bare and subsequently prone to soil erosion. Over-exploitation of natural resources and overgrazing in forest areas produces rapid and irreparable damage to the environment (Gupta, 1978). Seasonal and migratory pastoralism is commonly practiced in several parts of northern and western India. Numerous transhumant tribes graze livestock, mainly sheep-goats, in the snow leopard range during summer (Saberwal, 1996; Bhasin, 2011). It is particularly important as a source of revenue in the case of the high altitude ranges of the Himalaya. Livestock utilizes various grazing resources across altitudinal gradients and thus often comes into contact with wild animals (Naveh and Whittaker, 1980; Andren *et al.*, 1997). In the Lahaul, Pangi &Kinnaur landscapes, large tracts of the mountains are heavilygrazed by livestock adversely impacting the wild prey population even within the PAs (Bhatnagar *et al.*, 2008, Suryavanshi *et al.*, 2013 and Lyngdoh *et al.*, unpublished). Domesticated herbivores at high densities remove significant quantities of forage (Namgail, Fox & Bhatnagar, 2007) and cause inter-specific competition with wild ungulates leading to further decline in their population (Ghoshal, 2017). Gaddis and Gujjars are the two main herder communities which practice a long-standing tradition of moving up to alpine pastures for the summer and descending to lower reaches in the winter (Mehra *et al.*, 2001), and given that wildlife is pervasive in the snow leopard habitat in India, there is an extensive human-wildlife interface (PSL, 2009).

### *3.4.3. Tourism*

The landscape harbors a rich biodiversity including several threatened faunal species including Snow leopard, a critically endangered species; and increasing tourism in the landscape is a matter of concern. Mountain tourism in developing countries is becoming a growing environmental concern due to extreme seasonality, lack of suitable infrastructures and planning, and interference with fragile ecosystems and protected areas (Geneletti *et al.*, 2009). Infrastructure development, tourism, waste management, and changing lifestyles are some of the emerging threats that the Lahaul, Pangi &Kinnaur landscape faces (Bhatnagar *et al.*, 2016). There is certainly a need to understand patterns of tourism-induced environmental degradationfor further mitigation interventions.





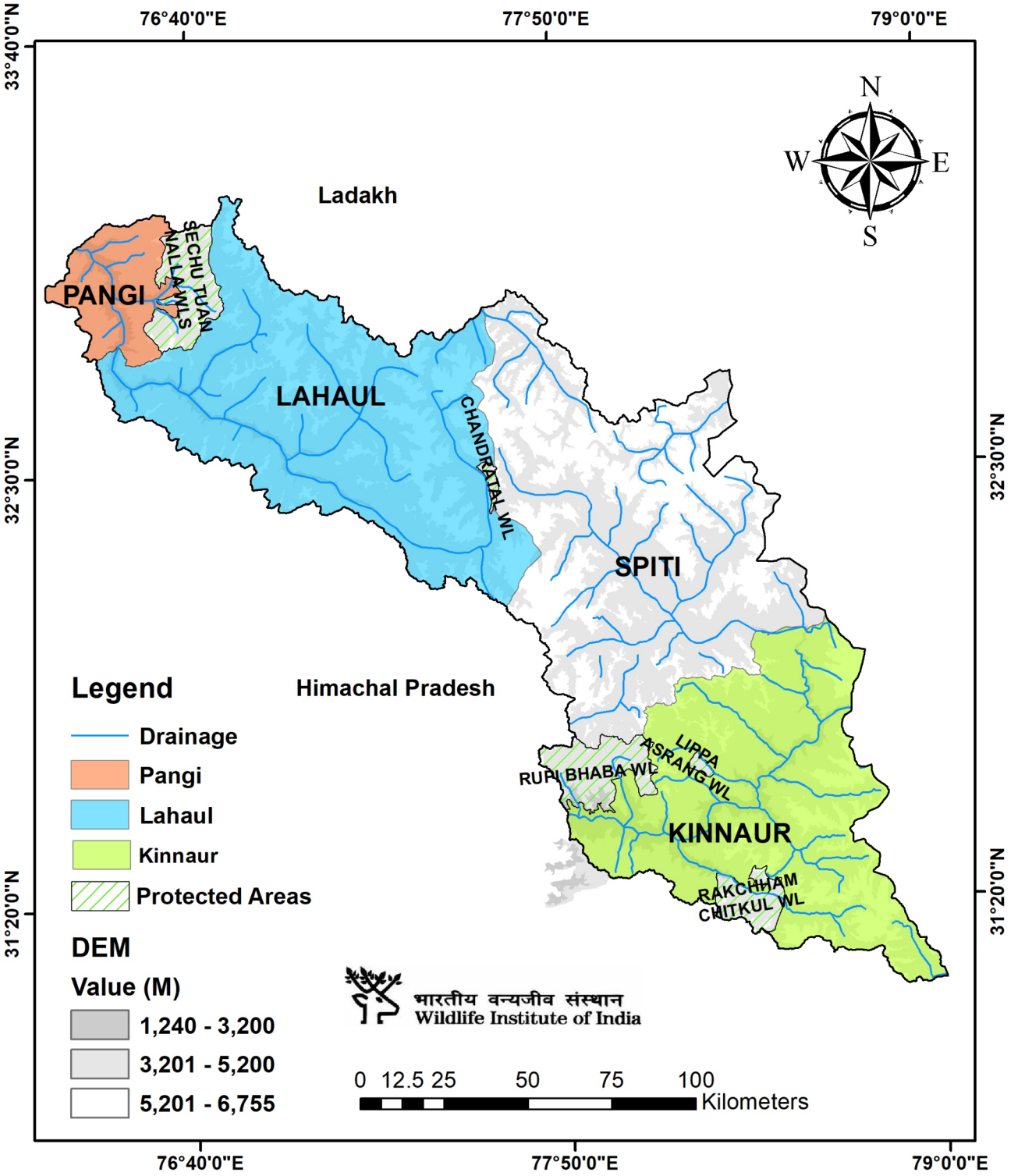

# 04. STUDY AREA: LAHAUL-PANGI LANDSCAPE AND KINNAUR LANDSCAPE, HIMACHAL PRADESH



The selected landscape for the project is Lahaul-Pangi & Kinnaur Landscape in Himachal Pradesh. The Lahaul – Pangi Conservation Landscape lies between the Dhauladhar – Pir Panjal and Zanskar ranges in Himachal Pradesh in the upper catchment of Chandrabhaga (Chenab) forming a transition zone between the greater and the trans-Himalaya. The landscape is contiguous with Doda and Zanskar region of Jammu and Kashmir in the North and spread over an area of nearly 8000 $km^2$. The Lahaul valley lies between 31°44'57'' and 32°59'57''N latitude and 76°46'29'' and 78°41'34''E longitude. The climate varies from dry temperate to alpine types. The area remains snow-covered for about six months and receives an average snowfall and rainfall of 120-400 cm per year and 10-300 mm per year respectively; and the temperature ranges between -19° to 32° C. The highest mountain peak in the valley is Mulkila (6,517 m) and the lowest point at Kadu nallah (2400 m), the entrance of Chenab into the Pangi valley, Chamba.

Pangi valley, biogeographically, falls in the transition zone of the Himalaya and the Trans-Himalaya. It is a remote, rugged and poorly developed area dominated by the indigenous communities of the Pangwala and Bhoti tribes, and lies between 32°11'30"-33°13'06"N and 75°45'-77°03'33"E. One of the reasons for its remoteness is rugged topography cut into a deep gorge by river Chenab that flows initially in the western and subsequently in the north-westerly direction. Much of the landscape lies in the rain shadow zone of Pir Panjal, having scanty rainfall (<800 mm) and relatively high snowfall.

Kinnaur surrounded by Tibet to the northeast, in the northeast corner of Himachal Pradesh, having the three high mountain ranges *i.e.* Zanskar, Greater Himalayas, and Dhauladhar, enclosing valleys of Sutlej, Spiti, Baspa and their tributaries. The district is spread over an area of 6,401 km2. The Kinnaur area is dominated by the Kinnar community and is one of the most sparsely populated places in the country. The district has three well-known sanctuaries (WLS) which are -Lipa-Asrang in the Pooh sub-division, Rupi-Bhabha in the Nichar sub-division, Rakcham-Chitkul sanctuary.



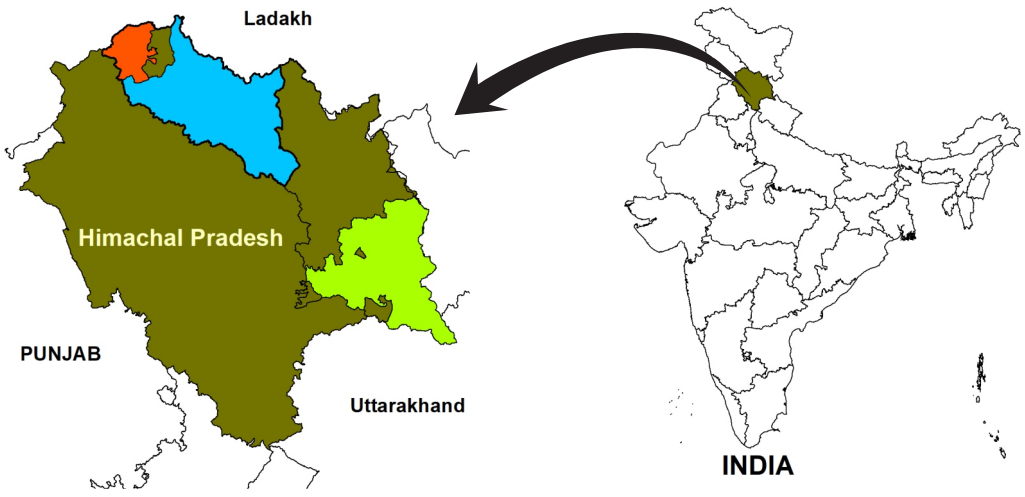




**Figure 4:**
Study area in the Landscape: Lahaul, Pangi and Kinnaur districts, HP



# 05. HIGH CONSERVATION VALUE AREAS: CONCEPT & RATIONALE



The concept of"High Conservation Value Forests" (HCVFs) was designed and proposed by Forest Stewardship Council (FSC) -an international non-profit multi-stakeholder organization, in 1999, for the forest-based industries in order to promote responsible and sustainable forest management (Rietbergen-McCracken, 2007). The concept is used to identify important forest areas based on a variety of parameters including biodiversity, landscape context, threatened or endangered ecosystems, provisioning of basic ecosystem services, and dependence of local community. However, in 2005,the newly established HCV Resource Network (HCVRN) adopted a simplified version of the HCV toolkit and widened its scope from High Conservation Value Forests (HCVFs) *i.e*. the concept of certifying a forest management as environmentally, socially and economically suitable and feasible, to High Conservation Value Areas (HCVAs), *i.e*. the areas which due to their high ecological, biological, social or cultural values are of utmost importance (Brown *et al.*, 2013;Areendran *et al.*, 2019).

## HCV 1 criteria: Species & Diversity

*Concentrations of biological diversity including endemic species, rare, endangered or threatened (RET) species which are significant at global, regional or national levels.*

Endemic species are thosenative to, and restricted to, a particular geographical region. Highly endemic species, those with very restricted natural ranges, are especially vulnerable to extinction if their natural habitat is eliminated or significantly disturbed (IUCN).

While, RET stands for Rare, Endangered and Threatened species. Among a set of ecologically similar species, those that are rare species will have a greater extinction risk than those that are common (Johnson, 1998; Matthies *et al.*, 2004).When used in the context of the IUCN Red List, a taxon is classified as "Endangered" when there is a very high risk of extinction in the wild in the immediate future (IUCN, 2001)and a "threatened" species is "likely to become an endangered species within the foreseeable future throughout all or a

significant portion of its range" (Flather and Sieg, 2007).

Any area that contains significant concentrations of HCV 1 species (RET or endemic), or which contains habitat critical to the survival of these species has been identified as HCV 1 area. It does not apply that any sighting of a RET species would qualify as HCV but only in areas where the species is found in a population large enough to qualify as a concentration. Where it is difficult to determine the presence or population status, suitable habitat for the species shall be used as a proxy (Brown *et al.*, 2013).Exceptionally, it may even be that a single species is considered important enough for an area to be an HCV on its own (Jennings *et al.*, 2003) if the species is listed in the IUCN Red List or on the National Protected Species list and is found in a population large enough to qualify as a concentration or significant in an area.

The following has been considered as HCV 1:

- A high overall species occurrence or diversity within a defined area; especially areas important for Snow leopard and its habitat and prey species.
- Sites supporting rich biodiversity of high value medicinal and aromatic plants in the landscape.

## HCV 2: Landscape-level ecosystems

*Large landscape- a repeating mosaic of repeating ecosystems that are sufficiently large and relatively undisturbed, enough to support viable populations of the great majority of the naturally occurring species.*

An ecosystem is defined as a set of organisms interacting with each other and their surrounding chemical and physical factors extant in a given space (Tansley, 1935).Landscape refers to a geographic mosaic of interacting ecosystems (or sub-components thereof) whose spatial arrangement and modes of interaction reflect the influences of climate, geology, topography, hydrology, soil, the biota and human activities (HCV Toolkit Indonesia, 2009). Large landscape-level ecosystems imply an ecosystem with an area large enough to maintain viable populations of large and wide-ranging species. It often also includes forests that contain important sub-populations of very wide-ranging species even though the sub-populations may not in themselves be viable in the long term (Jennings *et al.*, 2003).

In principle, the threshold size for HCV 2 should be related to the area needed to maintain viable populations, especially of large or wide-ranging species. Smaller area thresholds have been recognized in regions that have experienced substantial ecosystem and habitat fragmentation and degradation (Brown *et al.*, 2013).

The following rules have been adapted from Brown *et al.*, 2013 and HCV Toolkit Malaysia, 2009, and considered as HCV 2:

- Large areas that are relatively far from human settlement, roads or other access; areas with low levels of overall disturbance and high connectivity for species across the landscape.
- Areas that forms or is part of a linkage between larger forest complexes, and can thus provide connectivity between fragments for the movement of animals from one complex to another.
- Areas that are required to maintain a viable population of species; large or small, un-fragmented areas with higher potential to sustain a variety of species.

## HCV 3: Ecosystems and habitats

*Rare, threatened, or endangered ecosystems, habitats or refugia.*

It includes ecosystems, habitats or refugia of special importance because of their rarity or the level of threat that they face or their rare or unique species composition or other characteristics; an ecosystem that is common in one area or country may be scarce and fragmented (rare and threatened) in another country(Brown *et al.*, 2013).

An ecosystem is defined as a set of organisms interacting with each other and their surrounding chemical and physical factors extant in a given space (Tansley, 1935).Habitat refers to a distinctive set of physical environmental factors that a species uses for its survival and reproduction (Block and Brennan, 1993). Keppel *et al.*, 2012 proposed a habitat-based definition of refugia as sites to which biota retreat, persist in and potentially expand from under changing environmental conditions whereas Dobrowski's 2011 focused on identifying refugia as places where the local climate is decoupled from regional climate complements this approach. As described by Brown *et al.*, 2013, there are two types of refugia (or refuges) which may have an HCV:

- Ecological refugia: Isolated areas which are sheltered from current changes (e.g. human threats or climatic events), and where plants and animals typical of a region may survive; and
- Evolutionary refugia: areas where certain types or suites of organisms persisted during a period when climatic events (e.g. glaciations) greatly reduced habitable areas elsewhere.

The following rules have been adapted from Jennings *et al.*, 2003 & Brown *et al.*, 2013, and considered as HCV 3:

- Naturally rare ecosystems, facing higher risk of extinction and heavy dependency of local communitiesthat may have decreased or would lead to decline in its extent in near future.
- Threatened or endangered ecosystem consisting of one/more threatened species.
- Regions, where many natural ecosystems or habitats have been impacted due to anthropogenic pressure.

## HCV 4: Ecosystem services

*Supporting and Regulating ecosystem services that are necessary like protection of water catchments and control of erosion of vulnerable soils and slopes.*

Ecosystem services (ES) are the contributions of ecosystem structure and function (in combination with other inputs) to human well-being. This implies that mankind is strongly dependent on well-functioning ecosystems and natural capital that are the basis for a constant flow of these services from nature to society (Burkhard & Maes, 2017).

An ecosystem service is critical where disruption of that service poses a threat of severe, catastrophic or cumulative negative impacts on the welfare, health or survival of local communities, on the functioning of important infrastructure or other HCVs. The concept of critical situations relates to cases where the loss of or major damage to an ecosystem service would cause serious prejudice or suffering to recipients of the service either immediately or periodically (e.g. regulation of water provision during critical drought periods), or cases where there are no viable, readily available or affordable alternatives that can be relied on if the service fails (Brown *et al.*, 2013).

The following rules have been adapted from Jennings *et al.*, 2003, Brown *et al.*, 2013&HCVF Toolkit Bulgaria, 2016, and considered as HCV 4:

- Forests/Meadows that is necessary for maintaining terrain stability and controlling erosion.
- Forested areas critical to watershed protection *i.e.* when a particular forest area plays an important role in preventing flooding, streamflow regulation and controlling the water quality.
- Areas providing supporting & regulating services in the form of water catchments & alpine meadows.

*Note: In the current frame and scope of the assignment, we have only attempted to provisionally list such areas; these areas require detailed study and assessment which was beyond the time frame of the current assignment.*

## HCV 5: Community needs

*Sites and resources fundamental for satisfying the basic necessities of local communities or indigenous people identified through engagement with these communities or indigenous peoples.*

A site or resource is fundamental for satisfying basic needs if the services it provides are irreplaceable (*i.e.* if alternatives are not readily accessible or affordable), and if its loss or damage would cause serious suffering or prejudice to affected stakeholders (Brown *et al.*, 2013).This value is designed to protect the basic subsistence and security of local communities that are dependent on forests - not only for "forest-dwelling" communities but also for any communities that get substantial and irreplaceable amounts of income, food or other benefits from the forest (Jennings *et al.*, 2003).

HCV5 is determined by actual reliance of communities on any particular area (even when this reliance is only occasional, as in the case of forests providing food in times of famine), rather than a future or potential situation (Jennings *et al.*, 2003).

The following rules have been adapted from Brown *et al.*, 2013 &HCVF Toolkit Bulgaria, 2016, and considered as HCV 5:

- Areas where livestock raising is done on a small or subsistence scale and there is a presence of permanent or nomadic pastoralists for grazing their livestock.
- An area from where local communities obtain essential fuel-wood, food, fodder, medicines (medicinal and aromatic plants), or building materials.
- Remote and/or rural areas where people rely directly on natural resources to supply most of their needs, including water.

The full and active participation of local communities in consultations, and verifications of findings is just imperative to the validity of HCV5 (Colchester and Chao, 2013).

## HCV 6: Cultural values

*Sites, resources, habitats, and landscapes of global or national cultural, archaeological or historical significance, and/or of critical cultural, ecological, economic or religious/sacred importance for the traditional cultures of local communities or indigenous peoples, identified through engagement with these local communities or indigenous peoples.*

"Cultural identity" refers to the identity that emerges from a group of individuals (a community) occupying a specific area. This identity is based on shared background and history, as well as a shared interpretation of the local environment and natural resources. An area important for cultural identity is one to which the culture of local or traditional communities is tightly linked (HCV Toolkit Indonesia, 2009). HCV 6 has to be identified through engagement with local communities or indigenous peoples. Participatory consultations were carried out with all affected settlements and communities, with special attention to affected indigenous people (Brown *et al.*, 2013). It involves areas where there is clear evidence of a community agreement that certain sites or resources are culturally significant or critical for them (Jennings *et al.*, 2003).

The following rules have been adapted from Brown *et al.*, 2013 and considered as HCV 6:

- Sites recognized as having a high cultural value for the local communities of the region.
- Sites with the official designation by the national government and/or an international agency like Archaeological Survey of India/UNESCO.
- Religious or sacred sites with recognized and important historical or cultural values, even if they remain unprotected by legislation, that have importance to local or indigenous people like sacred groves, monastery and/or sacred lake.

The methodology used to delineate areas under various individual HCV criteria is attached in Appendix VII.

# 06. METHODOLOGY



The large landscapes have varying values for target wildlife species, species richness, ecosystem services and human dependence, and determining spatial values and prioritizing areas within the landscape is a key strategy for conservation. SECURE landscapes include existing wildlife protected areas but this project aims to zone the landscape beyond conventional Protected Area.

***Significance of HCV Concept on a Global Scale:***

On an international level, many countries like Indonesia, Papua New Guinea, Malaysia, Romania, Bulgaria, Ghana, China, have formulated their toolkits for identification and management of high conservation value areasbut there is no global agreement on them (Areendran *et al.*, 2019). The criteria in all the toolkits of various countries have been adapted from FSC's original document and modified according to the needs and conservation strategies of the landscape in concern.

***Significance of HCV Concept on a National Scale:***

The concept of HCVAs is new for India and no toolkit on identification/management of High Conservation Value Areas is available. However, a study, 'High Conservation Value Forests: An Instrument for Effective Forest Fiscal Federalism in India' was conducted in 2014 by Centre for Ecological Services Management at Indian Institute of Forest Management (IIFM), Bhopal, in collaboration with Forest Survey of India (FSI), Dehradun and Iora Ecological Solutions, New Delhi. The study mainly focused on Identification of parameters to define High Conservation Value forests with an aim to classify HCVFs across various states of the Country (HCVF-IIFM, 2014).

***Significance of HCV Concept on a Landscape Scale:***

The Trans-Himalaya has a large Protected Area (PA) coverage, with over 15,000 km2 (8.2 %) of the geographical area under the network, and in the Lahaul-Pangi landscape there are only two PAs *i.e.* Sechu Tuan WLS in Pangi and Chandratal WLS, in Lahaul-Spiti. The bulk of the large mammal populations are known to exist outside the PAs, which include highly endangered species (Bhatnagar *et al.*, 2001) such as snow leopard, brown bear, Asiatic black bear, Himalayan musk deer etc. The existing PAs themselves pose formidable conservation challenges and identification of areas of high conservation value in the landscape would serve as an alternative strategy for conservation of the Trans-Himalayan tracts based on a regional perspective.

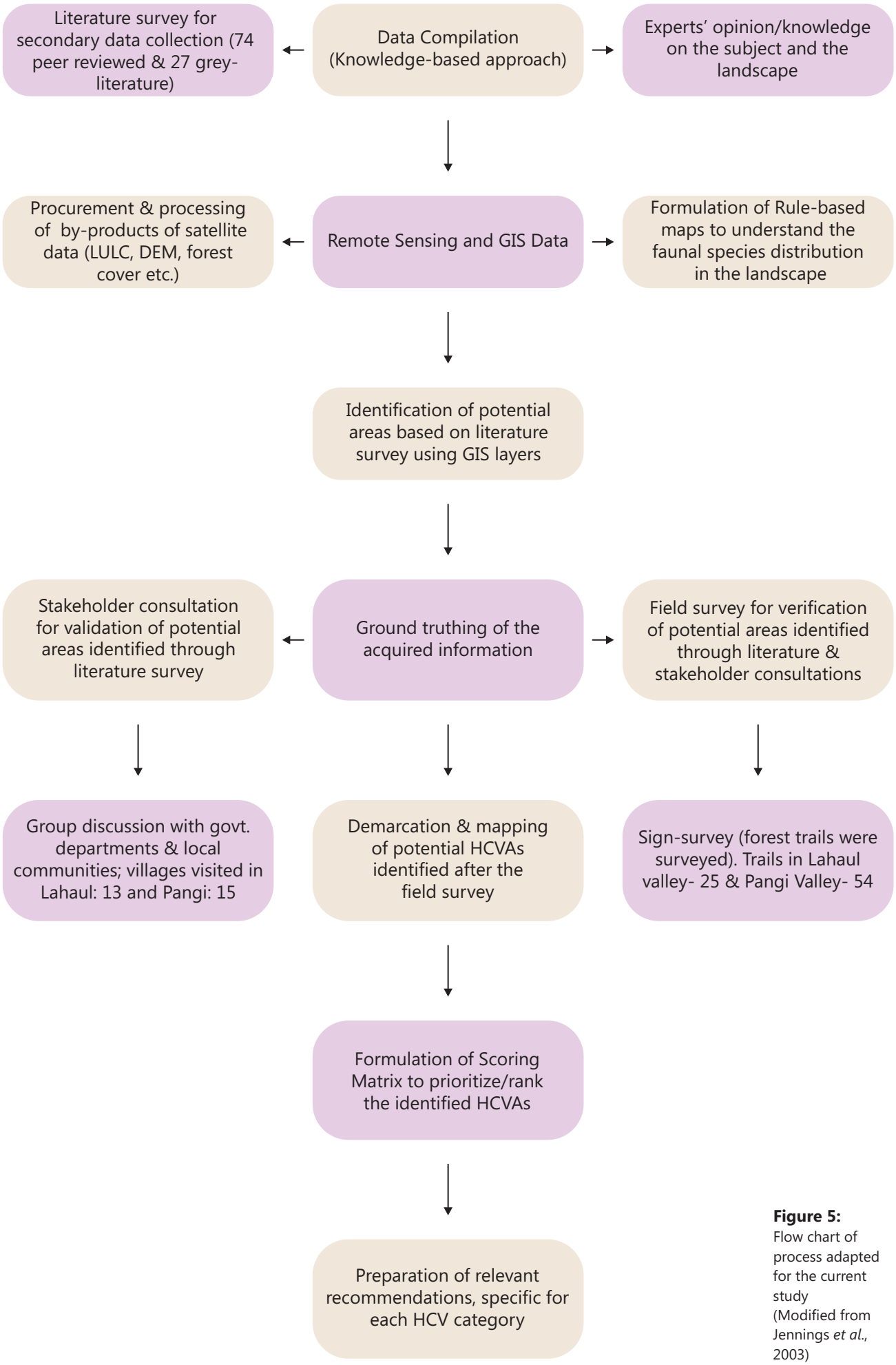



**Figure 5:**
Flow chart of process adapted for the current study (Modified from Jennings *et al.*, 2003)

## 6.1 Data Compilation: Secondary Data collection to understand the biodiversity and socio-cultural values of the landscape

Literature pertaining to the concept of high conservation value forests and areas was accessed and reviewed from Google scholar and grey literature such as dissertations and reports were also referred. Few of the keywords used include priority conservation areas, high conservation areas, biodiversity of trans-Himalayas, snow leopard and prey species, livestock grazing etc. A total of 101 (74 peer-reviewed and 27 unpublished) studies were found on high conservation value areas, ecosystem services, flora, fauna and avifauna of the Lahaul, Pangi and Kinnaur landscape (Appendix I). Data obtained from grey literature was utilized because these raw data were derived from standard, widely used analysis methods (species distribution modeling and mapping, quadrat method for vegetation sampling and line transect method) and no use of the other methods, conclusions or inferences drawn within those reports were used, and it is believed to be an appropriate use of grey literature and has been used previously as well (Lyngdoh et al., 2014).

## 6.2 Remote sensing & GIS data and layers used to delineate and map the potential High Conservation Value Areas

***6.2.1 Digital Elevation Model:*** In this study Shuttle Radar Topography Mission (SRTM) digital elevation model (DEM) was used with a spatial resolution of 90 meters. The DEM has been downloaded from the United States Geological Survey (USGS). The SRTM was flown on the mission of Space Shuttle Endeavour for 11 days in 2000. This Digital Elevation Data was globally released in 2015. The DEM was used in the present study to get the topographical information of the study area. It revealed an elevation range from 1240 to 6755 meters. The high altitude region of the study area is mostly covered with snow.

***6.2.2 Land Use and Land Cover:*** In this current study two set of Land Use Land Cover data has been used. One was acquired from ORNL DAAC. This dataset provides LULC classification at 100m resolution for India at decadal intervals for 1985, 1995 & 2005. This LULC data were derived from Landsat 4 & 5 Thematic mapper (TM), Enhanced Thematic Mapper plans (ETM+) and Multispectral (MSS) data, India Remote Sensing Satellite (IRS) Resourcesat Linear Imaging Self-Scanning Sensor-I or III (LISS I, LISS III) data.And another set was provided by WWF; this LULC has been prepared for the Lahaul-Pangi landscape. The dataset provides classification at 5.8 meters. And the satellite data used was from IRS LISS of the year 2018.

***6.2.3 Forest Cover:*** Forest cover utilized in the study was prepared by Forest Survey of India. This Forest cover data is available at 1:50,000 scale. The data used in this study is of the year 2014. This Forest cover data were derived from IRS P6 LISS III and IRS-Resoursat-2 LISS III. All the layers used have been presented in Appendix II.

**Table 4:** Dataset used for various layers used in mapping of the areas

| Data | Resolution | Data Source | Projection and Datum |
|---|---|---|---|
| Digital Elevation Model (DEM) | 90 m | United State Geological Survey (USGS) | Geographic WGS 84 |
| Land Use Land Cover (LULC) | 100 m | ORNL DAAC (NASA) | UTM, WGS 84 |
| Land Use Land Cover (LULC) | 5.8 m | WWF, India | UTM, WGS 84 |
| Forest Cover | 500 m | Forest Survey of India | UTM, WGS 84 |
| Road Network | -- | Open Street Map | UTM, WGS 84 |
| Drainage Network | -- | Generated by DEM | UTM, WGS 84 |
| Protected Area Network | -- | WII | UTM, WGS 84 |
| List of Villages | -- | Census 2011 | UTM, WGS 84 |
| Slope | -- | Generated from DEM | UTM, WGS 84 |
| Occupancy map for Blue sheep | -- | Ghoshal, 2017 | UTM, WGS 84 |
| Occupancy map for Asiatic Ibex | -- | Ghoshal, 2017 | UTM, WGS 84 |
| Occupancy map for Snow leopard | -- | Ghoshal, 2017 | UTM, WGS 84 |

***6.2.4 Rule-based Maps:*** For mapping and delineating the habitat of the major faunal species of the landscape, available scientific information on the distribution and habitat use (elevation range, aspect and habitat-type) of the species were compiled. The habitat-type was delineated using the LULC and forest cover maps. Expert knowledge and literature (Bhatnagar et al., 2008; Sathyakumar, 2001, Fox *et al.*, 1992 and Sathyakumar *et al.*,

2015) were used to identify and formulate rule-based potential distribution range maps for the selected wildlife species of Lahaul and Pangi Valley (Appendix III). The selected species include Asiatic Ibex, Himalayan musk deer, snow leopard, Himalayan brown bear and Asiatic black bears. Slope, aspect, elevation and habitat type based on LULC, are the layers, which have been used to generate the maps.

**Table 5:** Criteria used for identification of potential range of various species in the landscape

| S.No. | Species Name | Elevation | Habitat Type |
|---|---|---|---|
| 1. | Himalayan musk deer | 2800-3800m | Alpine scrubs & forested areas > 2800m |
| 2. | Himalayan brown bear | 3000-4000m | Sub-alpine and alpine areas |
| 3. | Asiatic black bear | 1200-3000m | Open forested areas |
| 4. | Asiatic Ibex | 3200-5400m | Slopes >30 degrees, rugged terrains, cliffs |
| 5. | Snow leopard | 3200-5400m | Alpine regions & snow bound areas |
| 6. | Common leopard | 1800-3000m | Forested tracts |

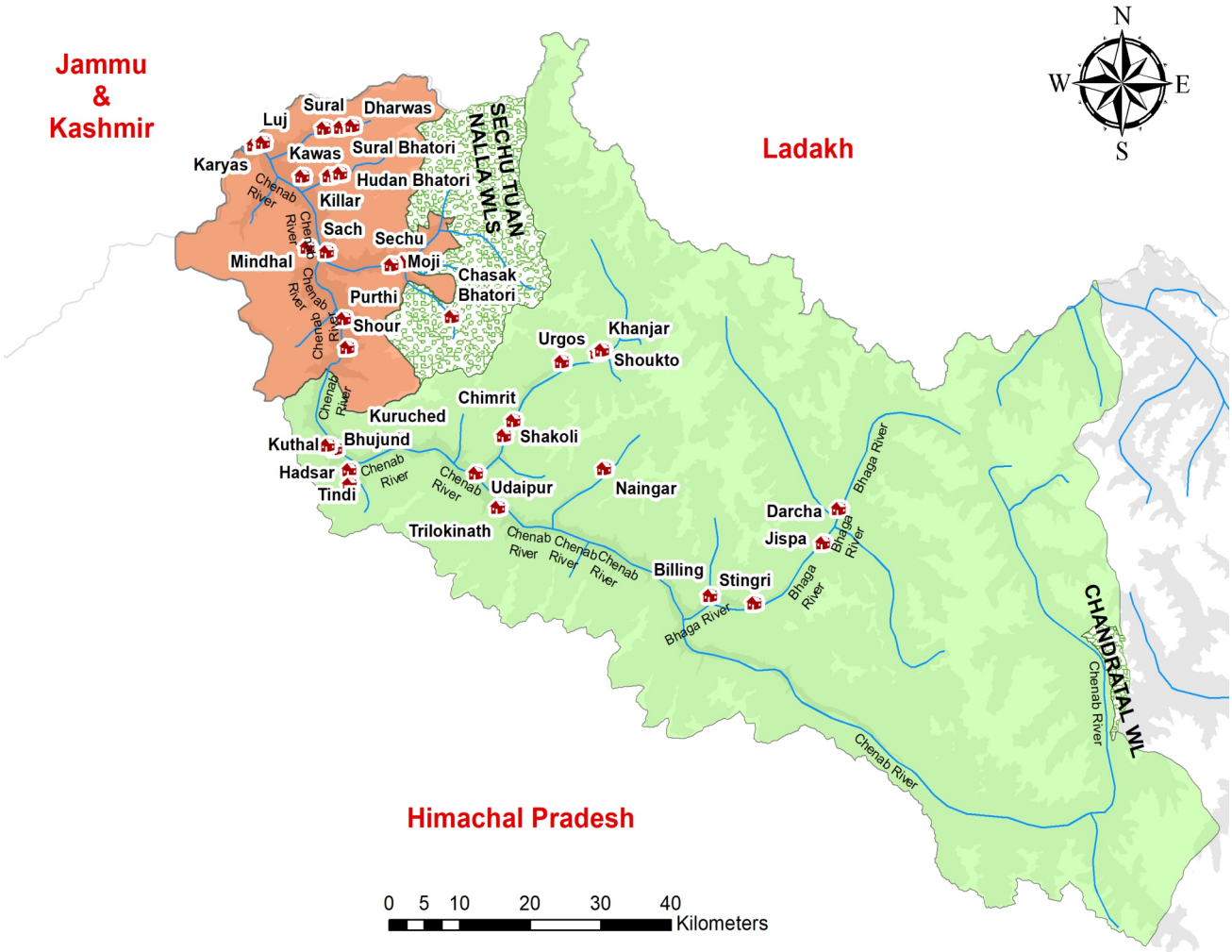
***6.2.5 Boundary Delineation:*** The boundaries of the HCV areas have been demarcated according to each individual HCV category. Digitization scale was maintained according to the criteria as mentioned by Stewart & Rayden, 2006, in "Mapping High Conservation Values at large scales for effective site level management" and based on several natural and physical features as stated in "Landscape demarcation systems" by Libecap and Lueck, 2011, such as ridge lines, rivers, roads, LULC, contour lines and pre-existing boundaries in landscape.

## 6.3 Ground truthing

Method & Approach for validation of High Conservation Value Areas identified in the landscape

### *6.3.1 Stakeholder consultation*

The potential of traditional and local ecological knowledge to contribute to biodiversity conservation has been widely recognized (Charnley *et al.*, 2007). Village level meetings were organized and data were collected using semi-structured open-ended questionnaire, for validation of potential high conservation value areas (HCVAs) identified through the literature survey. The information requested in the questionnaire (Appendix IV) included knowledge about flora (including medicinal and aromatic plants), fauna, avifauna of the landscape, areas that fulfill the basic needs of the local communities (fuel-wood extraction, livestock grazing and water resources) and religious sites or areas of cultural importance. In total, 28 villages were visited, 13 in Lahaul and 15 in Pangi valley, in the entire landscape (Appendix V). In Lahaul and Pangi, on an average25 and 30 people, including gram pradhans, mahila mandals, local communities and various government departments, participated in each group discussion session respectively, which was conducted with the support of UNDP volunteers. The information about biodiversity values in different areas, as stated in the results section, has been procured through consultation with key-informants. All the potential areas as suggested by the key informants were visited for further validation and verification for HCVAs.




**DEM**

**Value**

- 1,240 - 3,200
- 3,201 - 5,200
- 5,201 - 6,755

**Figure 6:**
A map representing the total number of villages visited for questionnaire survey during the field visit in the Lahaul-Pangi Landscape

### *6.3.2 Field data collection & validation*

The landscape of Lahaul and Pangi was systematically surveyed between 2019 and 2020. The potential areas were visited and rapid surveys were conducted for covering maximum areas. The surveys were coupled with expert knowledge from local informants, encounter trails, interview based data collection and available published or grey literature. The areas surveyed were observed for the presence/absence of rare and threatened medicinal plants found in the valley.

The presence/absence survey was conducted to understand the mammalian species distributionin the landscape by using a combination of direct and indirect methods. The direct methods were based on visual encounters of animals whereas indirect methods relied on quantification of indirect evidences such as animal feces (pellet groups, scats, droppings), tracks (pug marks, hoof marks, scrapes) and other signs (feeding/ digging). Since all the areas surveyed were located at higher altitudes on uneven terrain, the trails in the forests and alpine regions were surveyed (Silori, 2001). A total of 79 trails (1 km each), were surveyed, 25 in Lahaul and 54 in Pangi. A list of all the signs recorded in the field during the survey, are presented in a table in Appendix VI. Trails were walked and monitored with the help of a team of local villagers who scanned either side to detect animals, and data sheets were used to record the findings.

## 6.4 Prioritization of HCVAs using scoring matrix

In this assignment, potential areas distinguished as regions with High Conservation Value were scored with respect to a set of biodiversity values, and then the cumulative scores for each region were determined to prioritize the areas further for conservation.The framework wasdeveloped for the areas under the criteria of "Species & Diversity" and the "Ecosystem Services- Supporting, Regulating & Provisioning Services".

### *6.4.1 Scoring matrix used for prioritization of areas under HCV criterion 1*

Literature survey of secondary information, followed by stakeholder consultation was conducted to identify the habitat and distribution of major faunal species, and to further prioritize/rank the areas demarcated as an HCVA.

The broad categories of respondents interviewed included livestock herders, former hunters, medicinal plant collectors, forest department official and tourist guides. The stakeholder consultation was conducted using an open-ended questionnaire which was further followed by field visits to the potential areas for validation. In total, 28 villages were visited in Lahaul-Pangi landscape and in each village around 20 key-informants were interviewed.These respondents were shown images of various carnivore and mountain ungulate species that are known to occur in the landscape, such as Asiatic ibex, Himalayan brown bear, snow leopard, Asiatic black bear, Himalayan tahr, and Himalayan musk deer. Respondents who failed to identify species from the images and unable to provide reliable information on location/area of species detection were not considered. The methodology to score various areas in HCV criteria 1 and 2 has been adapted, from Ghoshal, 2017 and Jamwal *et al.*, 2012.

**Table 6:** Scoring criteria for HCV 1 criterion

| No. of respondents confirming occurrence/detection of a species/biodiversity value | Score |
|---|---|
| No one | 0 |
| Less than 8 (< 8) | 1 |
| 8-15 | 2 |
| More than 15 (> 15) | 3 |

Of all the key-respondents interviewed in each area, 20 reliable respondents, who were able to identify the species and provide information on area/location, were considered. The scoring technique adopted is as follows: if less than 8 respondents confirmed the presence of any particular value at the site, then a score of '1' was assigned. Similarly, if eight to fifteen respondents and more than fifteen respondents confirmed the occurrence of a value, then scores '2' and '3' were assigned, respectively. If no one confirmed the presence of the species/values a score of zero was assigned to the site/area.

The areas with the highest score, for HCV 1 criteria, are Miar and Naingar in Lahaul Valley; and Sural Bhatori and Kadu Nallah in Pangi Valley.The matrix, for both the landscapes of Lahaul and Pangi, has been attached in the Appendix VIII (Table no. 1 & Table no. 7) section of the report.

### *6.4.2 Scoring matrix used for prioritization of areas under HCV criteria 4 and 5*

The ecosystem services' (supporting & regulating services and provisional services) classification system used in the assignment has been adapted from Burkhard *et al.*, 2009. The classification system developed, derived a

general set of ecosystem services basedon the list of ecological integrity components described by Müller & Burkhard, 2007 and Müller, 2005andthe ecosystem services lists provided by deGroot, 2006, MA, 2005 and Costanza *et al.*, 1997. The available land cover data were linked to expert judgments about the different land cover types' capacities to provide various ecosystem services. Two focal groups were considered and interviewed for scoring the areas with respect to the important ecosystem services in the landscape. The first group involved experts and subject matter specialists who have worked in landscape in the past or are currently working; and the second group involved regional stakeholders *i.e.* local communities and various government departments like forest department, agriculture department etc. The stakeholder consultation was conducted using an open-ended questionnaire which was further followed by field visits to the potential areas for validation.In total, 28 villages were visited, 13 in Lahaul and 15 in Pangi valley, in the entire landscape (Appendix V). In Lahaul and Pangi, on average, 25 and 30 people, including gram pradhans, mahilamandals, local communities and various government departments, participated in each group discussion session respectively.

The basic idea of this assessment strategy was the analysis of existing landscape data to evaluate their capacities to provide ecosystem services in a spatial manner. In this study, available land cover data were linked to stakeholder consultations about the different land cover types' capacities to provide various ecosystem services for various potential HCVAs identified in the landscape of Lahaul-Pangi. The individual services, that have been considered, are grouped in the categories namely, supporting and regulating services and provisioning services.

To assess different land cover types' capacities to provide ecosystem services, in the Lahaul-Pangi landscape, a matrix was created. On the y-axis of this matrix, the 10 land use land cover types are placed and on the x-axis, the ecosystem services (8 for criteria HCV 4 and 7 for criteria HCV 5). Originating from remote sensing data, these land cover units provide a logical combination of land cover and land use as it can be found in the real landscapes.

At the intersections different land cover types' capacities to provide the individual service were assessed on a scale consisting of: 0 = no relevant capacity, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity (Burkhard *et al.*, 2009).

**Table 7:** Scoring criteria for HCV 4 and 5 criteria

| Capacity of the Land-type to support an ecosystem service | Score |
|---|---|
| no relevant capacity | 0 |
| low relevant capacity | 1 |
| relevant capacity | 2 |
| medium relevant capacity | 3 |
| high relevant capacity | 4 |
| very high relevant capacity | 5 |

The areas with the highest score in Lahaul Valley, for HCV 4 & 5 criteria, are Miar and Naingar. In Pangi Valley the areas with the highest score are Sural Bhatori and Luj, for HCV 4 criterion, Sural Bhatori and Kadu Nallah, for HCV 5 criterion.

The matrix, for both the landscapes of Lahaul and Pangi, for HCV 4 & HCV 5, has been attached in the Appendix VIIIof the report. The Land type and ecosystem services considered to score the identified HCVAs are specific to the areas delineated under various categories.


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# 07. DEMOGRAPHY



The residents of Pangi and Lahaul are commonly known as Pangwalis and Lahaulis respectively. Two main religions of the study area are Hinduism and Buddhism, with Pangi comprising of a majority Hindu populations and Lahaul with both Hindu and Buddhists. Across the landscape, communities are dependent on pastoralism livelihood for their sustenance, along with agriculture. Majority of households maintain sheep for wool as well as for manure for the fields. Besides sheep, they also keep cows for milk. The agriculture is primary occupation of many individuals in the region; however, the farming is mostly limited to cash crops like peas and potatoes along with apples.

## Pangi Landscape:

As per Census 2011, the Pangi tehsil in Chamba has a total of 3,952 households, with population of 18,868 of which 9,579 are males and 9,289 are females; and population of children between age 0-6 is 2,299 (12.18% of the total population). The literacy rate in the valley is 62.37% *i.e* 11,768 individuals of which 6,913 are males and 4,855 are female. The total area is 1600.52 km2 with population density of 11 km2. There are 6.6% Scheduled Caste (SC) and 90.18% Scheduled Tribe (ST) of total population in Pangi Tehsil.

**Table 8:** Census data for the Pangi landscape as per the District Census handbooks of Chamba, 2011.

| | |
|---|---|
| Number of Households | 3,952 |
| Population | 18,868 |
| Male Population | 9,579 (50.77%) |
| Female Population | 9,289 (49.23%) |
| Children Population | 2,299 |
| Area | 1,600.52 km2 |
| Population density/km2 | 11 |
| Literacy | 11,768 (62.37%) |
| Scheduled Tribes (ST) % | 17,016 (90.18%) |
| Scheduled Caste (SC) % | 1,246 (6.6%) |

**Table 9:** Area-wise census data for the Pangi landscape as per the District Census handbooks of Chamba, 2011.

| Delineated HCV Area | Villages near the identified HCV Areas | Number of Households | Total Populations (including institutional and houseless populations) | Populations in the age group between 0-6 |
|---|---|---|---|---|
| Sural Bhatori | Sural Bhatori | 41 | 228 | 24 |
| | Rusmos | 63 | 319 | 24 |
| | Tai | 41 | 216 | 37 |
| Hudan Bhatori | Hudan | 76 | 408 | 69 |
| | Tundroo | 34 | 157 | 19 |
| | Takwas | 39 | 165 | 21 |
| | Seri Bhatwas | 37 | 162 | 21 |
| Kadu Nallah | Shour | 151 | 727 | 89 |
| | Purthi | 105 | 517 | 62 |
| Mindhal | Mindhal | 91 | 397 | 41 |
| Luj | Luj | 130 | 625 | 72 |
| | Dharwas | 129 | 718 | 85 |
| Sechu | Sechu | 78 | 417 | 46 |
| | Chasak | 73 | 294 | 37 |
| | Moji | 15 | 78 | 17 |

## Lahaul Landscape:

As per Census 2011, the Lahaul valley in Lahaul-Spiti has a total of 4091 households, with population of 19,107 of which 9,897 are males and 9,210 are females; and population of children between age 0-6 is 1,609 (8.4% of the total population). The literacy rate in the valley is 68.6% *i.e.* 13,119 individuals, of which 7,715 are males and 5,404 are female. The total area is 6739.89 km2 with population density of 2 people/ km2. There are 8.8% Scheduled Caste (SC) and 79.3% Scheduled Tribe (ST) of total population in the valley.

**Table 10:** Census data for Lahaul landscape as per the District Census handbook of Lahaul-Spiti, 2011.

| | |
|---|---|
| Number of Households | 4,091 |
| Population | 19,107 |
| Male Population | 9,897 (51.7%) |
| Female Population | 9,210 (48.3%) |
| Children Population | 1,609 |
| Area | 6,739.89 km2 |
| Population density/km2 | 2 people/ km2 |
| Literacy | 13,119 (68.6%) |
| Scheduled Tribes (ST) % | 15,163 (79.3%) |
| Scheduled Caste (SC) % | 1,699 (8.8%) |

**Table 11:** Area-wise census data for Lahaul landscape as per the District Census handbook of Lahaul-Spiti, 2011.

| Delineated HCV Area | Villages near the identified HCV Areas | Number of Households | Total Populations | Populations in the age group between 0-6 |
|---|---|---|---|---|
| Miyar Valley | Ghari | 24 | 130 | 11 |
| | Chimrit | 29 | 152 | 16 |
| | Karpat | 36 | 224 | 32 |
| | Tingrit | 73 | 324 | 42 |
| | Chaling | 28 | 141 | 6 |
| | Khanjar | 15 | 66 | 7 |
| Billing-Istingri | Billing | 46 | 160 | 8 |
| | Istingri | 76 | 537 | 23 |
| Darcha-Jispa | Jispa | 51 | 202 | 11 |
| | Darcha-sudmo | 38 | 172 | 13 |
| | Darcha-dangma | 34 | 166 | 12 |
| Pattan Valley (Naingar) | Thirot | 31 | 117 | 9 |
| | Naingar | 12 | 52 | 5 |
| | Chhogzing | 6 | 30 | - |
| | Chowkhang | 28 | 114 | 16 |
| | Gwari | 2 | 11 | 2 |
| Koksar | Koksar | 18 | 78 | 4 |
| Kuruched | Kuruched | 15 | 67 | 15 |
| Hadsar | Hadsar | 1 | 2 | - |



# 08. THREAT ANALYSIS



All the major threats prevalent in each identified HCV area were derived from the four broad approaches *i.e.* literature survey, village level questionnaire surveys, stakeholder workshops, and field visits to the potential sites. These threats were assessed on the basis of two criteria – Extent and Intensity, through the matrix given below:

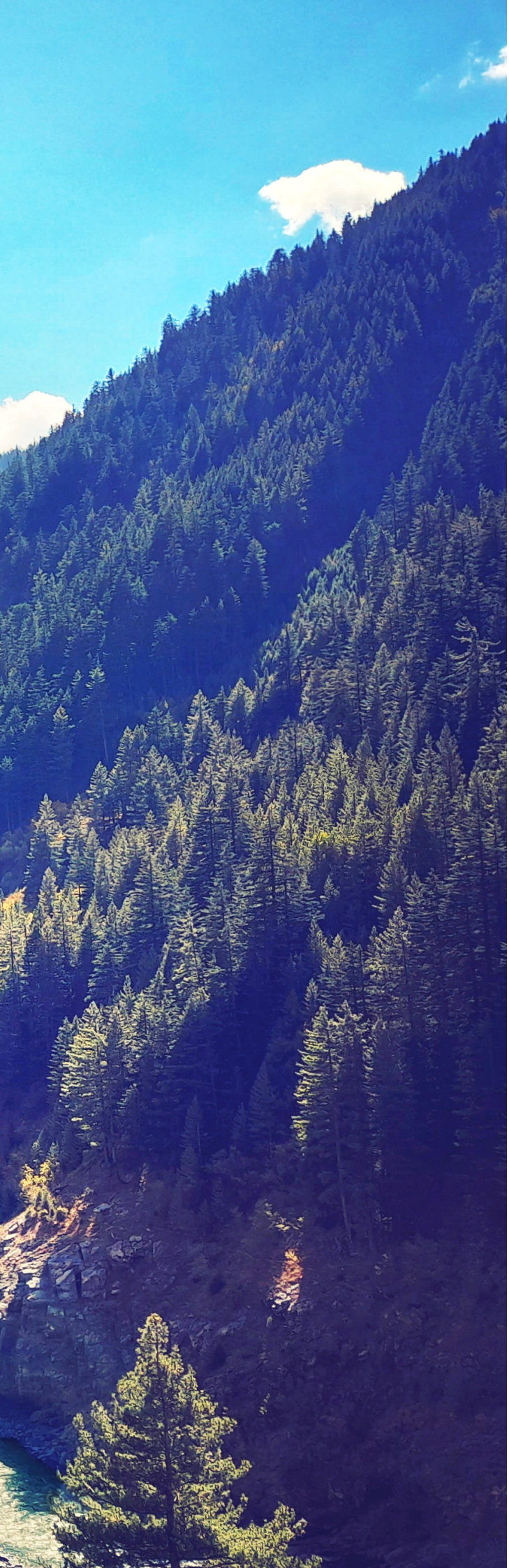
**Table 12:** Criteria for analyzing extent and intensity of the threats in the landscape

| Extent | Intensity |
|---|---|
| Large | High |
| Moderate | Medium |
| Small | Low |

- **Extent:** A threat of a "large" extent is the one which is found to be extremely pervasive throughout the identified HCV area. "Small extent" of threat has been assessed where a small part of the area or a very few villages of a large valley are facing a particular threat. "Moderate extent" has been observed where the threat is mostly limited to/distributed in one part of the area, and not the entire region.
- **Intensity:** It refers to the severity of the threat. In the landscape, intensity for Human-wildlife conflict has been assessed on the basis on number of species involved in conflict in the area, and various kinds of conflict as reported by stakeholders; for medicinal plants, it is based on areas rich with medicinal plants and the most exploited regions by the key informants; and for grazing it has been done on basis of livestock visiting the pastures, and the cases where number of livestock is known to exceed the permissible limit of the grazing permit.

The threat analysis for Lahaul and Pangi landscape has been represented in tabular format in Table 1 and Table 2 of Appendix IX, respectively. The threat intensity for the landscape has also been mapped in the GIS environment; the methodology and the map for the same have been attached in Appendix IX.


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# 09. RESULTS

## 9.1 Potential High Conservation Value areas in Lahaul Landscape

In the Lahaul valley, survey for identification was conducted in four ranges, namely, Tindi range, Udaipur range, Pattan range and Keylong range. In total 13 villages were visited in the valley and stakeholder consultation was carried out using a semi-structured questionnaire. The identification of areas was based on stakeholder consultation and field visits to the potential areas. Across the landscape, 12 potentialareas were identified and delineated under six different criteria of High Conservation Value Areas. The areas identified include areas rich with medicinal and aromatic plants, regions serving as habitat for key species in the landscape like dry alpine pastures, alpine scrubs, and forested area, RET ecosystems and habitat, areas and sites important for fulfilling basic needs of the local communities and sites important from cultural and religious view point for the indigenous people. For each of the areas identified as HCVAs, potential threats and conservation recommendation has also been formulated. Table 8 represents all the areas identified in the Pangi valley landscape and different criteria under which they have been classified. For each of the areas identified as HCVAs, potential threats and conservation recommendation has also been formulated. The biodiversity values, general threats across the valley and relevant conservation recommendations have been stated below:

- 23 species of mammals have been reported from Lahaul valley, out of which 6 species are threatened (CR: 1 species, EN: 2 species, VU: 2 Species, and NT: 1 species) (Joshi *et al.*, 2019).
- 354 species of medicinal plants have been reported from the Lahaul valley (Singh *et al.*, 2009; Chauhan *et al.*, 1989, Samant., 2007).
- Of 150 species of birds that have been reported from Lahaul valley, 3 species *i.e.*Himalayan griffon(*Gyps himalayensis*) and bearded Vulture (*Gypaetus barbatus*)and orange bullfinch (*Pyrrhula aurantiaca*) (Ebird - Cornell lab of ornithology) have been assessed as threatened.

***Resident livestock population in Lahaul Valley***

The following data was retrieved on the livestock population in the Lahaul-Spiti district as per the census conducted in the given years:

**Table 13:** Species-wise data of livestock census of Lahaul-Spiti district, H.P.

| Species | Cattle | Buffalo | Mithun | Yak | Sheep | Goat | Horse & Ponies | Mule | Donkey | Camel & Pig | Total Population |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 18th Livestock Census (2007) | 12280 | 0 | 2 | 1290 | 37004 | 8443 | 972 | 0 | 2007 | 0 | 61998 |
| 19th Livestock Census (2007) | 13197 | 3 | 0 | 1267 | 36014 | 8196 | 1028 | 14 | 1803 | 50 & 6 | 61578 |
| 20th Livestock Census (2007) | 11678 | - | - | - | 23380 | 3078 | - | - | - | - | 38136 |

In order to determine the change in resident/local livestock's population in the landscape, an Anovatest has been performed. Mean of available livestock census dataof 18th and 20th census of Lahaul-Spiti district was compared to verify if there is a statistically significance difference in two different time period data. As per the test, the F-value is 0.28, P-Value is 0.59 and F critical is 4.35; in Lahaul-Spiti district there is no significant difference in livestock data of different time periods.

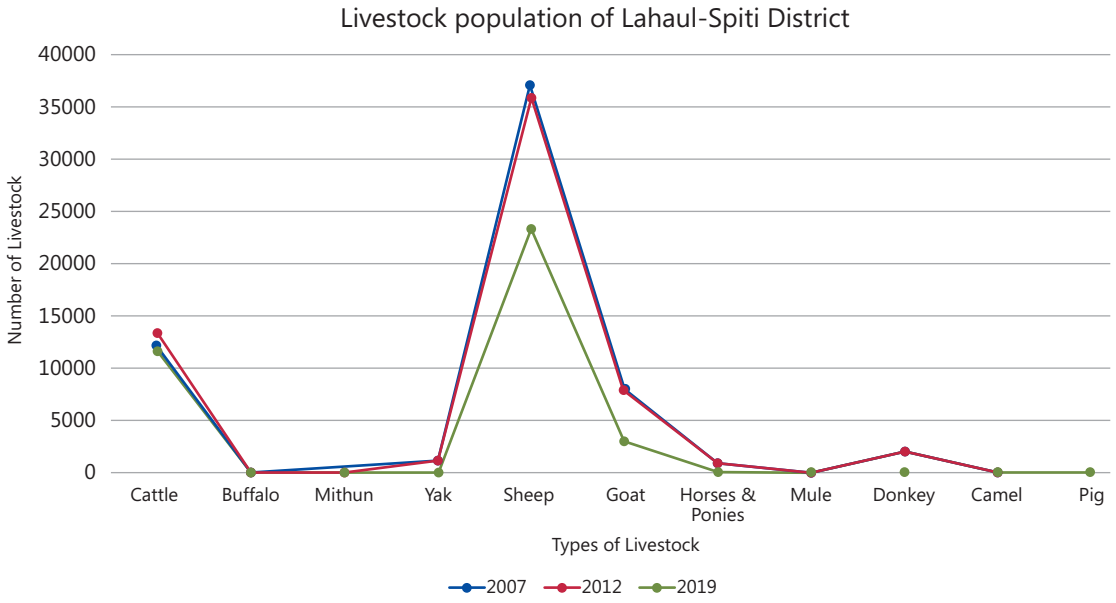



**Figure 7:** Comparison of resident livestock data of 18th, 19th and 20th livestock census of Lahaul-Spiti District

Migratory herders' livestock population in Lahaul Valley

The data on migratory herders' grazing permit was retrieved from the Forest Department officials in various beats of the landscape. In order to determine the change in livestock number, an independent t-test has been performed. Mean of 2017-18 migratory herders data was compared with the mean of 2018-19 migratory herders of Lahaul landscape to see if there is a statistically significance difference in two different time period data. As per the test the P(T<=t) two-tail value is 0.36 and t Critical two-tail value is 2.22; no significant difference in livestock data of 2 different time period was detected.

***General threats:***

1. Pastureland degradation due to grazing by livestock leaves the ground bare and subsequently prone to soil erosion (Apollo *et al.*, 2018).And intensive grazing in the pastures by livestock has led to removal of significant forage, and caused over-exploitation of rangeland resources.
2. Due to the presence of numerous domestic livestock in the region, the probability of contact, and the

transmission of infectious diseases between wild and domestic animals is an issue of concern (Johnsingh *et al.*, 1999).

3. Over-exploitation of natural resources, rare and valuable medicinal plants from the wild and grazing pressure in high altitude rangelands, threatens the survival of these species. If these conditions continue, many important medicinal plant species may completely disappear from the area.
4. Depredation of livestock of both, the migratory herders and local communities, by snow leopard, Tibetan wolf and the Himalayan brown bear have been reported in the valley. If no corrective measures are taken in the foreseeable future, the conditions would turn worse.
5. Conflict amongst the wildlife and the people in the region has also been observed in all the villages of the valley in form of crop destruction by the Asiatic black bear, brown bear and monkeys.
6. The working conditions are harsh, and time available to work in the landscape is short. Unavailability of facilities, funds for undertaking management related activities, and insufficient staff strength in the tough terrain is a matter of concern.
7. Mountain tourism in developing countries is becoming a growing environmental concern due to extreme seasonality, lack of suitable infrastructures and planning (Geneletti *et al.*, 2009); and uncontrolled conventional tourism in the valley interfering with the fragile ecosystems and the wildlife of the area.

***General conservation recommendations:***

1. As per consultation with the key informants; number of livestock allowed on each grazing permit, provided to migratory herders, is known to exceed its permissible limit, leading to intensive grazing in the valley.
2. Detailed study and assessment on grazing impacts and its control is suggested. Demarcation of critical areas within the pastures for migratory livestock grazing, to avoid competition with wild-herbivore, and also to maintain sufficient distance with the wild ungulates to avoid spread of diseases from infected livestock, if any.
3. Implementation of integrated pastureland management regimes/systems with the support of the forest department and local communities to reduce the anthropogenic pressure on the pastures.
4. By 'integrated pasture management systems' we imply that all aspects of pasture management that include, maintaining the quality of pasture, livestock health and nutrition, and maintenance of native wildlife are sustainably maintained. These envisages (a) putting in place community-based mechanisms towards sustainable management of fodder resources and grazing lands, (b) enhancing the productivity/ carrying capacity of the grazing lands, and (c)monitoring of livestock diseases and timely treatment (d) ensuring that wild herbivores are accommodated (e) effectively managing any conflicts with carnivores and (f) partnering with research organizations is established, which can provide technical backstopping on key issues (e.g. level of degradation, carrying capacity, health, etc.).
5. It is also suggested that a comprehensive grazing and pasture development policy should be discussed at the state level that can provide better direction to the development and sustenance of this sector in a manner that both herder livelihoods and wildlife conservation goals can be maintained.
6. Few of the practices that could be incorporated for pastureland management are: (i) Formulation of a policy on grazing and pastureland development/improvement in consultation with the local communities and domain experts, (ii) Identification of a suitable organization/agency to coordinate various research programs for pastureland management and development, (iii) Delineation and mapping of ecologically sensitive pastures across the landscape, and development of appropriate rehabilitation models, and, (iv) Promote incorporation of fodder trees with agricultural practices towards agro-forestry initiatives.
7. Also, the management strategies for reducing pasture pressure as suggested by SECURE-Participatory and integrated landscape-level management strategy project, in the landscape of Lahaul-Pangi, could be followed.
8. Establishment of medical camps in the villages near by pasturelands, for migratory herders, for disease surveillance with an aim of identification of the presence/absence of any disease, determination of the occurrence or distribution of disease/infection, while also detecting any emerging diseases.
9. Enhanced training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders
10. Collaboration of a well-trained conflict management team including forest department, veterinarians and staff of wildlife based NGOs or organizations to respond to conflict situation like animal rescue, treatment, translocation/monitoring.

11. Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended; also, the strategies suggested by the SECURE-HWC (human-wildlife conflict) project in Lahaul-Pangi landscape, could be followed.
12. Community-based protection measures (solar fences and other barriers), to avoid crop losses, and spreading awareness about the subsidies provided by the government is suggested.
13. Enhanced collaboration between enforcement agencies (forest department and the security forces) and the local communities, for improved surveillance to identify, monitor and prevent the illegal activities prevalent in the region is suggested.
14. Continued on-job training on fronts like wildlife monitoring (for proper identification of wildlife evidence), wildlife law and legislation (for taking appropriate measures when recording wildlife crime) is recommended.
15. Capacity building of the staff is suggested; infrastructure and capacity enhancement is required on the fronts of skill development and manpower. Development of capacity of the staff to carry out patrolling throughout the landscape is required. Increasing the field staff strength and providing them with necessary field gears and/or vehicles for patrolling needs to be considered.
16. Community participation to promote eco-development and evaluation of tourist carrying capacity for the sanctuary area is recommended.

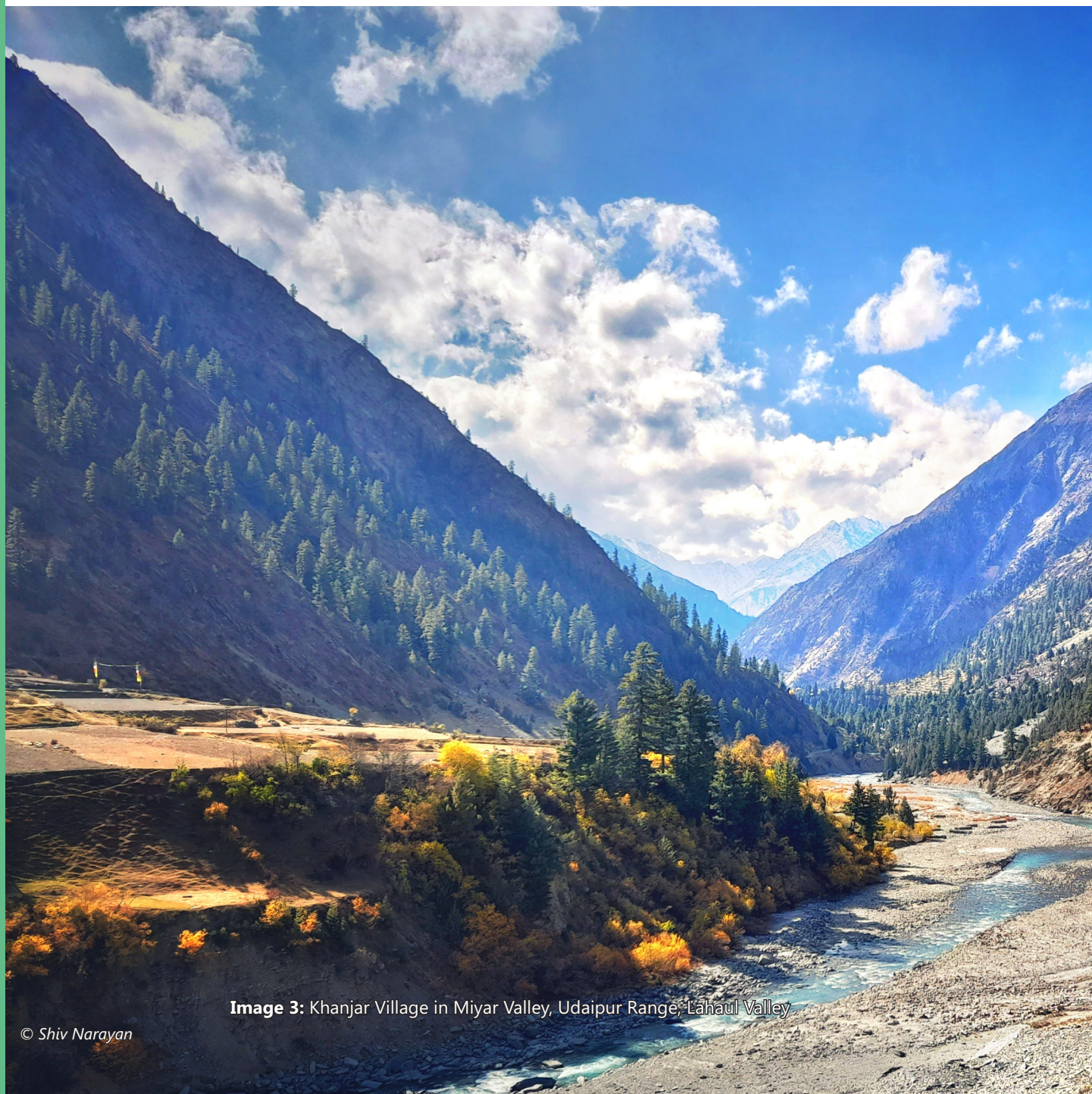


**Image 3:** Khanjar Village in Miyar Valley, Udaipur Range, Lahaul Valley

© *Shiv Narayan*

**Table 14:** List of Potential High Conservation Value Areas as identified under various criteria in the Lahaul Valley, H.P.

| S.No. | Area | HCV Criteria | | | | | |
|---|---|---|---|---|---|---|---|
| | | HCV 1 | HCV 2 | HCV 3 | HCV 4 | HCV 5 | HCV 6 |
| | | **Lahaul Landscape** | | | | | |
| 1. | Miar Valley | ✓ | ✓ | ✓ | ✓ | ✓ | |
| 2. | Billing & Istingri | ✓ | | | | ✓ | |
| 3. | Darcha & Jispa | ✓ | | | | ✓ | |
| 4. | Pattan Valley (Naingar) | ✓ | | ✓ | ✓ | ✓ | ✓ |
| 5. | Hadsar | ✓ | | | | | |
| 6. | Kuruched | ✓ | | | | | |
| 7. | Koksar | | | ✓ | | | |
| 8. | Chandratal ESZ | ✓ | | | ✓ | ✓ | ✓ |
| 9. | Mrikula Mata Temple | | | | | | ✓ |
| 10. | Trilokinath Temple | | | | ✓ | | ✓ |
| 11. | Kardang Monastery | | | | | | ✓ |



17. Demarcation of trek routes and scenic viewpoint to identify the tourism affected zone in order to regulate tourist movement; and appointment of a local tourism officer for monitoring and evaluating annual tourist activity in the designated tourism zone is suggested.

18. The area is vast and requires adequate trained manpower and staff. This has been the most pressing issue concerning the conservation of these landscapes. There is an urgent need to train and depute able personnel with local background to ensure long term survival of the integrity of the landscape. Furthermore, infrastructure with respect to the forest department in the region needs to be enhanced to aid in timely monitoring as well as enforcement.

**Detailed Listing of High Conservation Value Areas in Lahaul Valley**

## AREA 1: MIAR VALLEY

It is situated in the Trans-Himalaya region between the Pir Panjal and Zanskar ranges in Lahaul-Spiti district of Himachal Pradesh. Itis situated between 32° 45' 23.14" N-33° 15' 26.55" N latitude and 76° 40' 0.51" E-77° 0' 36.90" E longitudes at an elevation range from 2838-6080 meters. More than 50% (568 km2) of the area of the Miar Valley is covered by glaciers (Apollo *et al.*, 2018).

**HCV-1 (Species and Diversity)**

- Faunal species, as reported by key informants, in the area are snow leopard, Asiatic ibex, Himalayan musk Deer, Himalayan brown bear, Asiatic black bear, Himalayan ghoral, Tibetan wolf, Himalayan red fox and Royle'spika.
- Occupancy probability for snow leopard and Asiatic ibex in region 0.61-0.70 & 0.81-0.90 respectively (Ghoshal, 2017).
- Few of the important medicinal plant species recorded in the area beingPicrorhizakurroa, Dactylorhiza hatagirea, *Aconitum heterophyllum, Bunium persicum, Podophyllum hexandrum, Saussurea costus (cultivated), Inula racemosa (cultivated), Jurinea dolomiaea, Juniperus communis, Hippophae rhamnoides.*
- Himalayan griffon (*Gyps himalayensis*) and bearded Vulture (*Gypaetus barbatus*) are the two avifaunal species that have been assessed as threatened in the region.

**HCV-2 (Large landscape-level Ecosystems)**

- Thanpattan is the largest grazing patch of Lahaul-Spiti district, and it lies in the northern extent of the Miar Valley, far from human settlement, roads or other access.
- The Miar valley shares its boundary with Sechu Tuan Wildlife Sanctuary of the Pangi valley, and is critical for maintaining connectivity of home ranges for snow leopard and associated key species.

**HCV-3 (Ecosystem and Habitat)**

- It lies adjacent to the Sechu Tuan Wildlife Sanctuary and serves as a habitat for top-predator species including threatened species like snow leopard, Himalayan brown bear and Asiatic black bear.
- The large areas of sub-alpine scrubs and forested tracts serve as a habitat for wild-prey species including an endangered species *i.e.* Himalayan musk deer &the undulated terrain around the villages of Miar support substantial populations of Asiatic ibex.
- The region has been identified as an important and potential breeding area for musk deer and Asiatic ibex.

**HCV-4 (Ecosystem Services)**

- The forested areas in and around the villages of the valley (Shakoli – Demarcated Protected Forest (DPF), Chimrit, Urgos, Tingrit, Shukto, Khanjar (DPF) etc) and alpine meadows of Thanpattan provide supporting and regulating services.
- In Thanpattan, near Zardong, amidst the meadows lies a grove of around 120 Betula utilis trees (Dev *et al.*, 2003).
- They prevent natural hazards (floods and landslides) and help in carbon sequestration and storage, in biomass and soil.
- Forested areas help in regulating the flow of water within a catchment, prevent soil erosion and provide natural resources (e.g. fodder plants) for energy production and construction.

**HCV-5 (Community Needs)**

- There are a total of 14 villages in the Miar Valley, namely, Shakoli, Ghari, Chimrit, Shelling, Tamlu, Balgot, Karpat, Changut, Tingrit, Gompa, Urgos, Chhaling, Shukto, Khanjar.
- Extraction of fuel-wood from forested areas and utilization of pasturelands for livestock grazing in the valley, are two of the most pervasive land-use in the absence of better livelihood options for most of the local communities.
- Thanpattan, the largest grazing patch of Lahaul valley, is an area of high importance for herders of the Gaddi community of Chamba and Bharmaur districts.

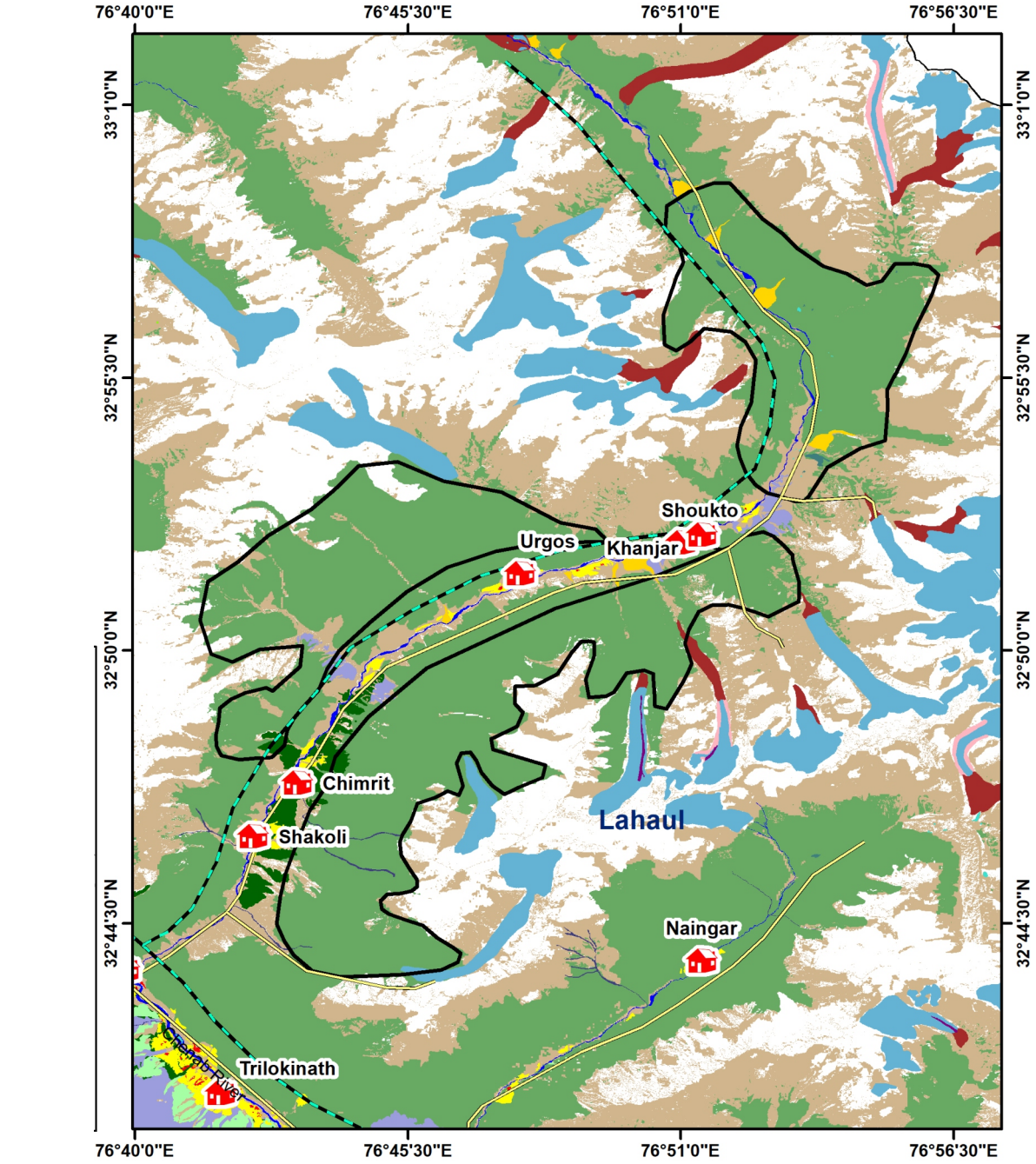
For each herder of the Gaddi community visiting the pastures of Thanpattan during the summers, these grazing permits are issued by the forest department for a span of three years. However, number of livestock on each permit is known to exceed its permissible limit.

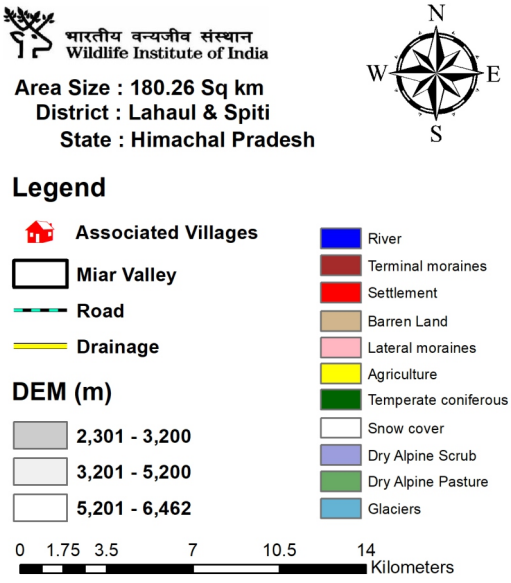
**Table 15: Potential threats and conservation recommendation for High Conservation Value Area Miyar Valley in Lahaul landscape of H.P.**

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | The domestic livestock in the Miar valley, mainly in northern part *i.e.* pastureland of Thanpattan (on left bank of Miar Nallah), has imposed pressure in form of intensive grazing on the resources and led to the issue of rangeland degradation.<br>The Gaddi community utilizes the pasture of Thanpattan for grazing their livestock; however, as reported by the key informants, the livestock number as allowed on each grazing permit to the Gaddi communities is sometimes known to exceed the permissible limit. | Demarcation of critical areas within the pastures of Thanpattan near the slopes of Gumba, Zardong and Khaigot for migratory livestock grazing.<br>Implementation of integrated pastureland management regimes with the support of the forest department and local communities, in Thanpattan, to reduce the anthropogenic pressure on the pastures is suggested. |
| 2. | Due to presence of numerous transhumant tribes in the region, the chances of contact between domestic and wild animals are higher. The spread of disease from domestic livestock to the wild ungulates in the region has not been reported from the Miar valley yet but it is a matter of concern as there have been cases in other part of Lahaul like near the pastures of Kuthal and Bhujund villages. | Establishment of medical camps in the villages of Khanjar, Shukto or Urgos, for the domestic livestock of herders, for disease surveillance with an aim of identification of the presence/absence of any disease, determination of the occurrence or distribution of disease/infection, while also detecting any emerging diseases |
| 3. | Depredation of livestock in the valley by brown bear, snow leopard and Tibetan wolf has been reported by the migratory Gaddi herders in the pastures of Thanpattan as well as the local herders of the Khanjar, Shukto, Chimrit, Urgos, Tingrit villages.<br>Conflict amongst the wildlife and the people in the region has also been observed in all the villages of the valley in form of crop destruction by the Himalayan brown bear and monkeys. | Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended.<br>Community-based protection measures (solar fences and other barriers), to avoid crop losses, and spreading awareness about the subsidies provided by the government is suggested. (Villages: Shakoli, Ghari, Chimrit, Shelling, Tamlu, Balgot, Karpat, Changut, Tingrit, Gompa, Urgos, Chhaling, Shukto, Khanjar). |
| 4. | Over-exploitation of rare and valuable medicinal plants from the wild and grazing pressure in high altitude rangelands of Thanpattan, threatens the survival of these species.<br>Also, the local communities in the valley and intruders are involved in extraction of medicinal plants from the pastures as well as forested areas around the villages. | Enhanced training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders *i.e.* the local communities of Miar valley (Villages of Shukto, Tingrit, Khanjar, Chimrit, Shakoli, and Urgos).<br>Increased studies on MAPs and grazing ecology for better management is suggested. |




**Image 4:** Snow leopard (*Panthera uncia*) sighted in Camera Trap in Miyar Valley, Udaipur Range, Lahaul Valley



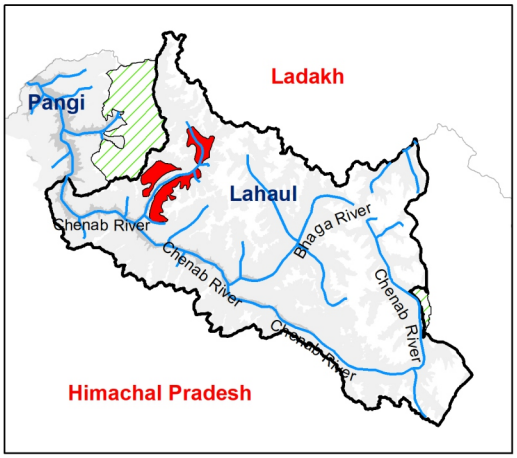
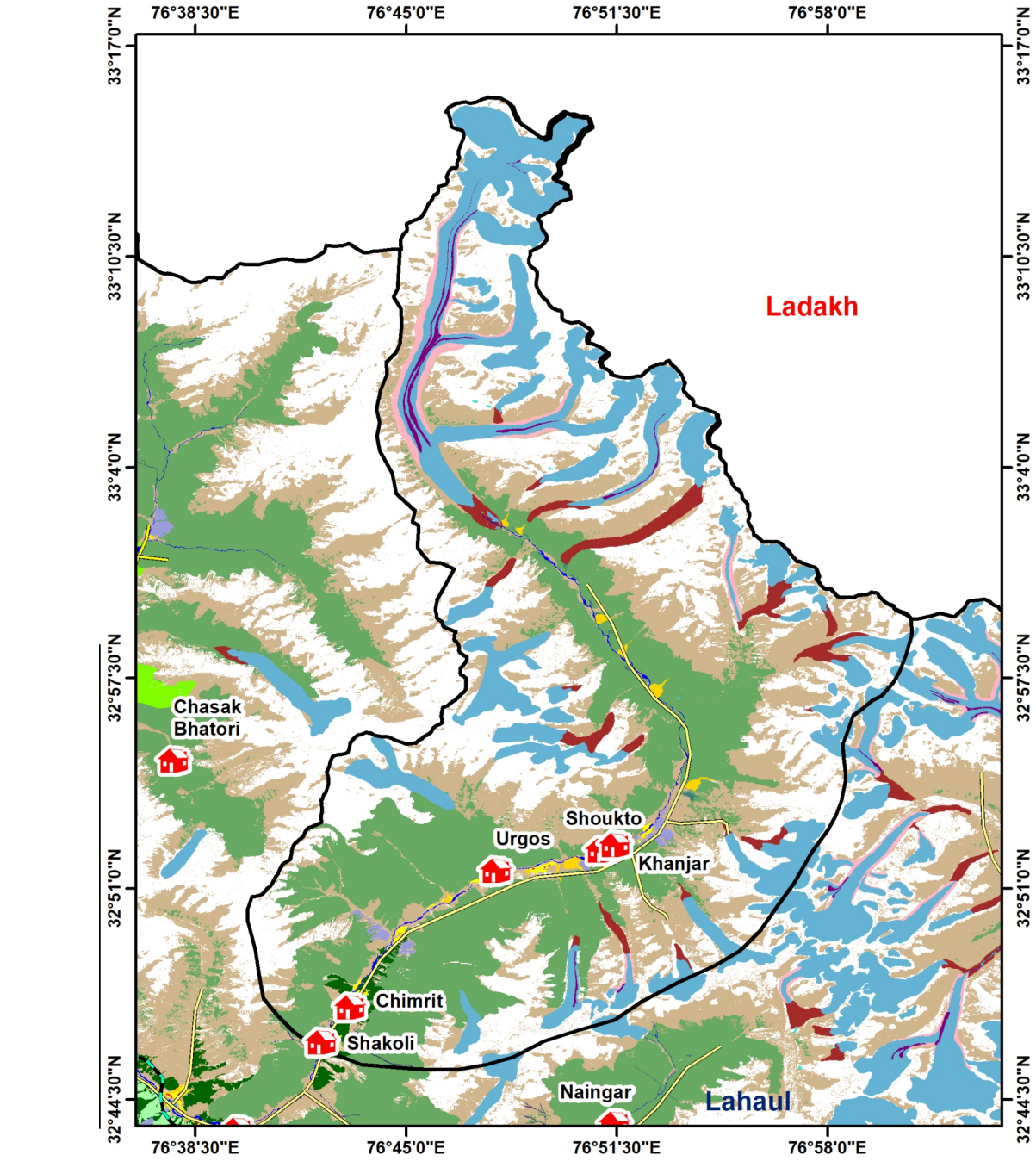
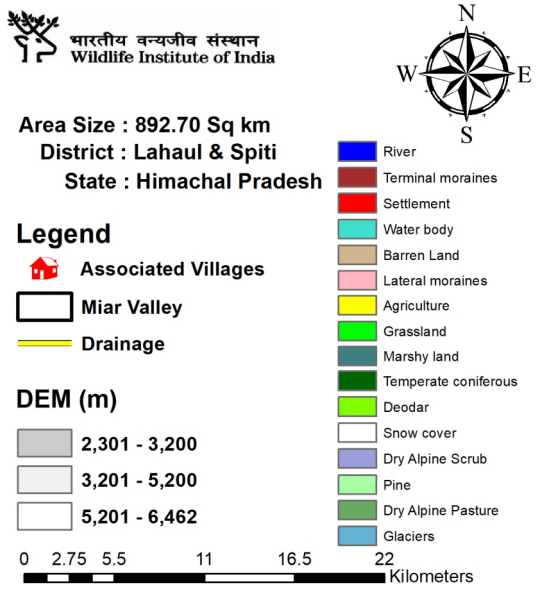




**Figure 8:** Miar Valley - Potential HCV Area in Lahaul Valley for criterion 1 (Species and Diversity)



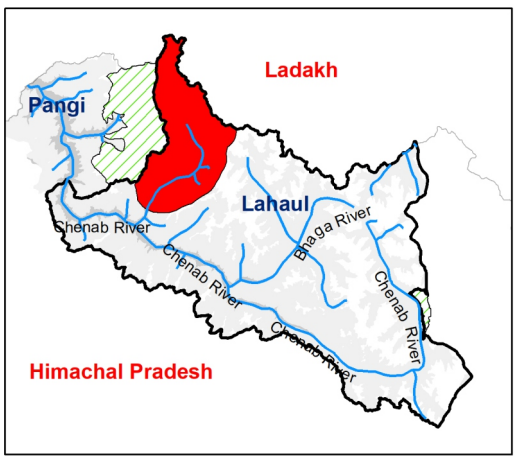




**Figure 9:** Miar Valley - Potential HCV Area in Lahaul Valley for criterion 2 (Landscape-level Ecosystems)

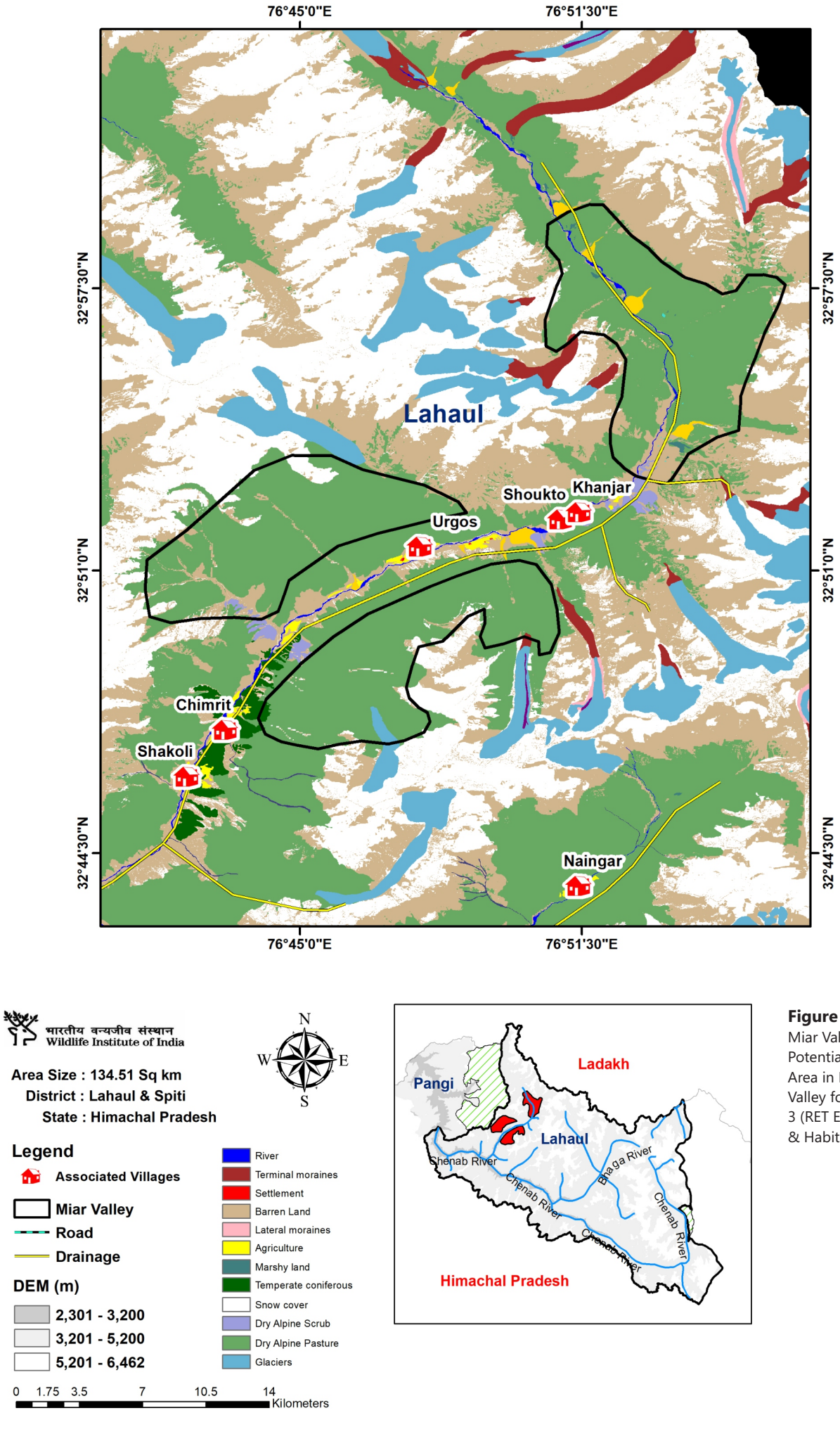
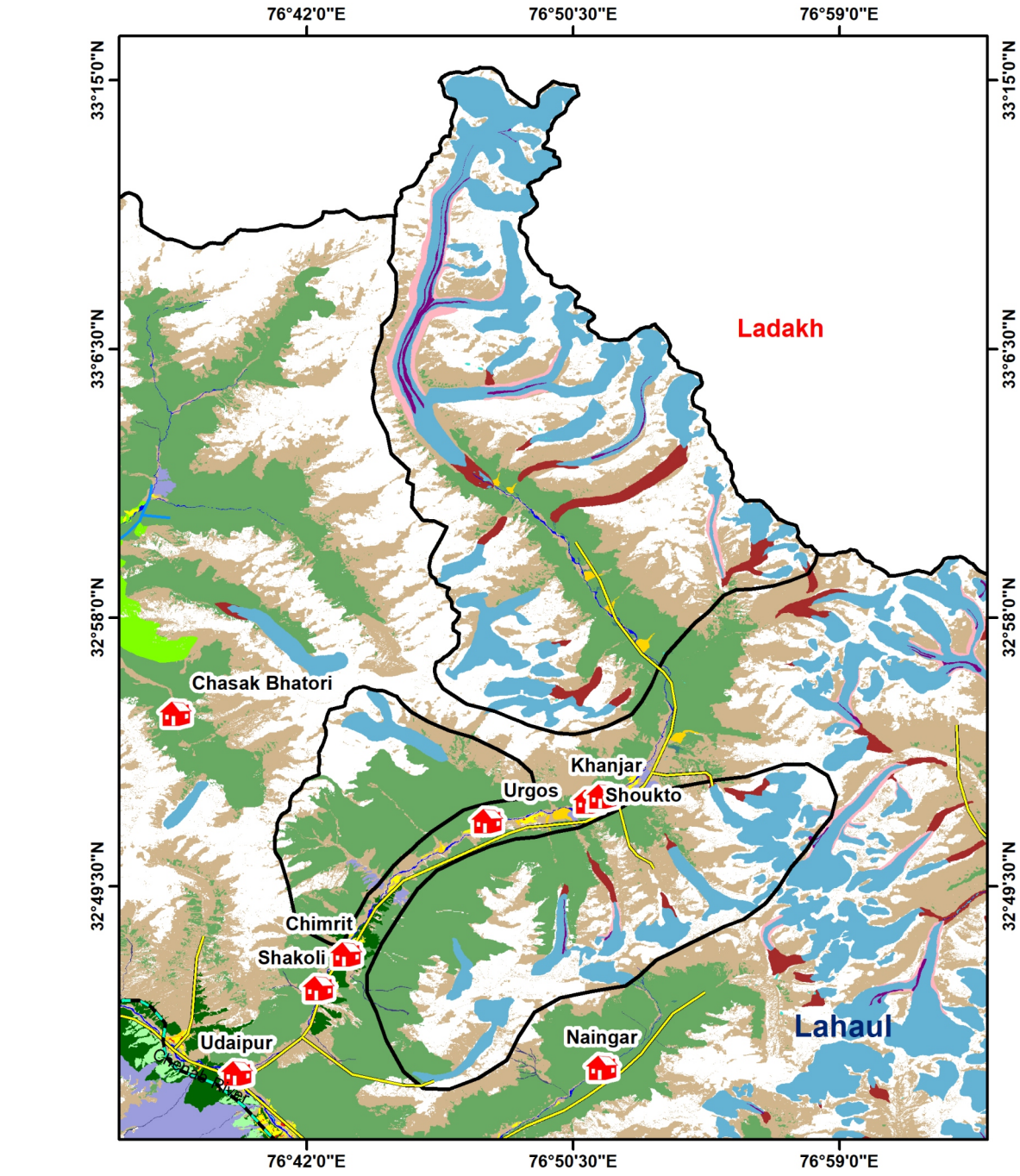



**Figure 10:** Miar Valley - Potential HCV Area in Lahaul Valley for criterion 3 (RET Ecosystem & Habitat)



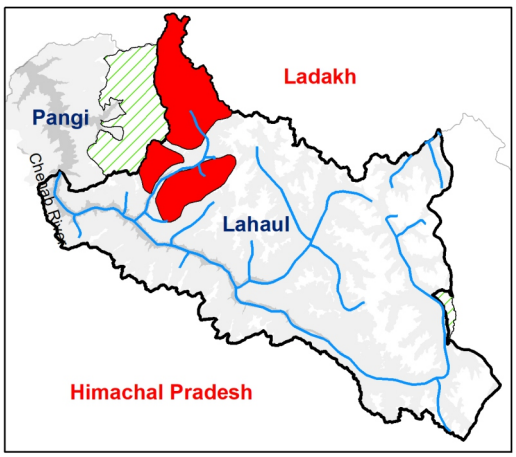




**Figure 11:** Miar Valley - Potential HCV Area in Lahaul Valley for criterion 4 (Ecosystem Services)

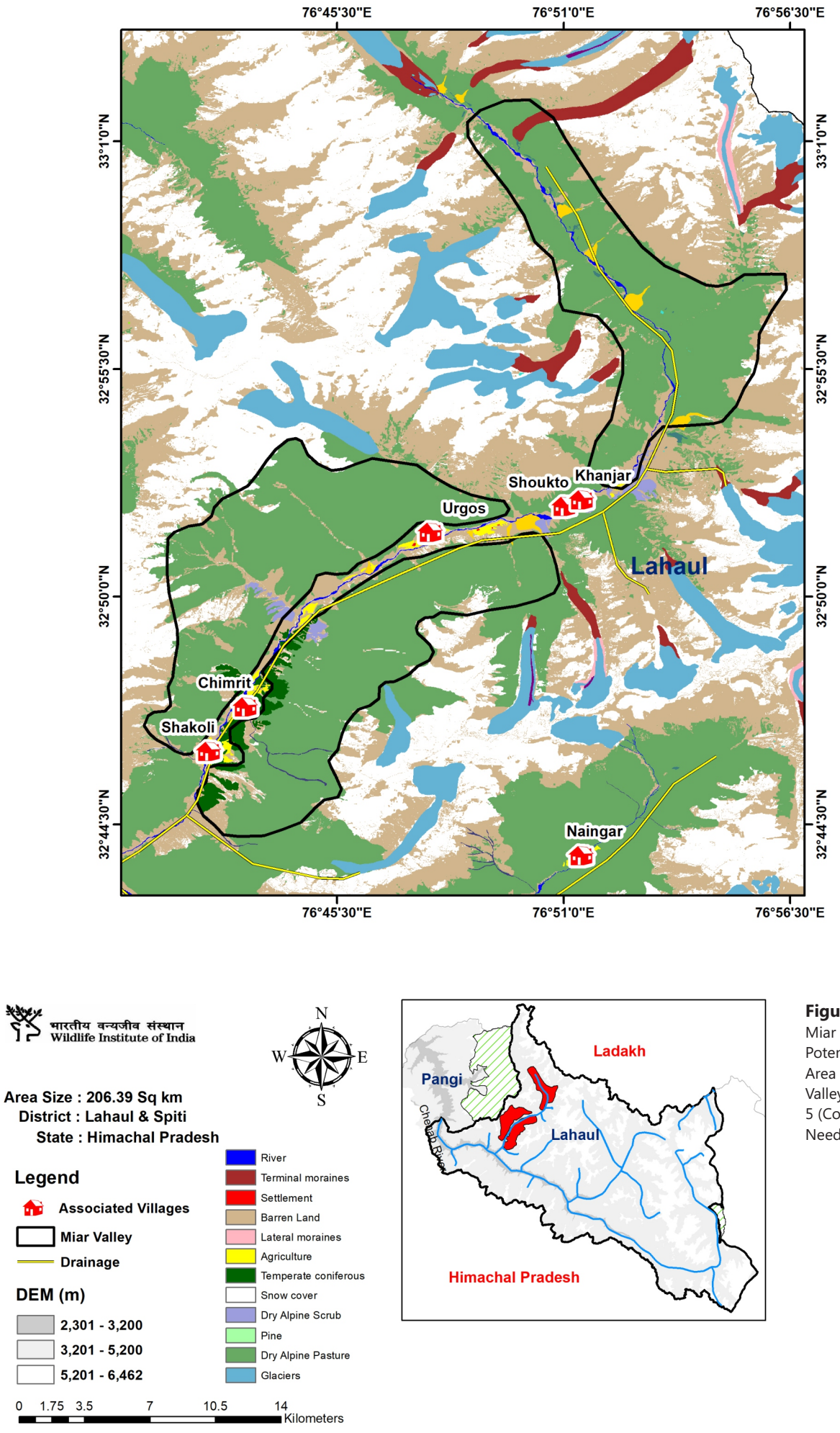



**Figure 12:** Miar Valley - Potential HCV Area in Lahaul Valley for criterion 5 (Community Needs)



Herders of Gaddi Community in Miyar Valley, Udaipur Range, Lahaul Valley

© Shiv Kumar



## AREA 2: BILLING & ISTINGRI

These are two small villages situated in the trans-Himalaya region of the Keylong Range of Lahaul-Spiti district. Itis situated between 32° 38' 13.66" N -32° 39' 47.03"N latitude and 77° 0' 17.95" E-77° 05' 11.28"E longitudes at an elevation range from 3208-5185 m. The area is mostly mountainous and barren with high rising snow peaks. Billing is located 4 km south of Keylong and Istingri is around 7 km north of Keylong, along the Manali-Leh highway.

**HCV-1 (Species and Diversity)**

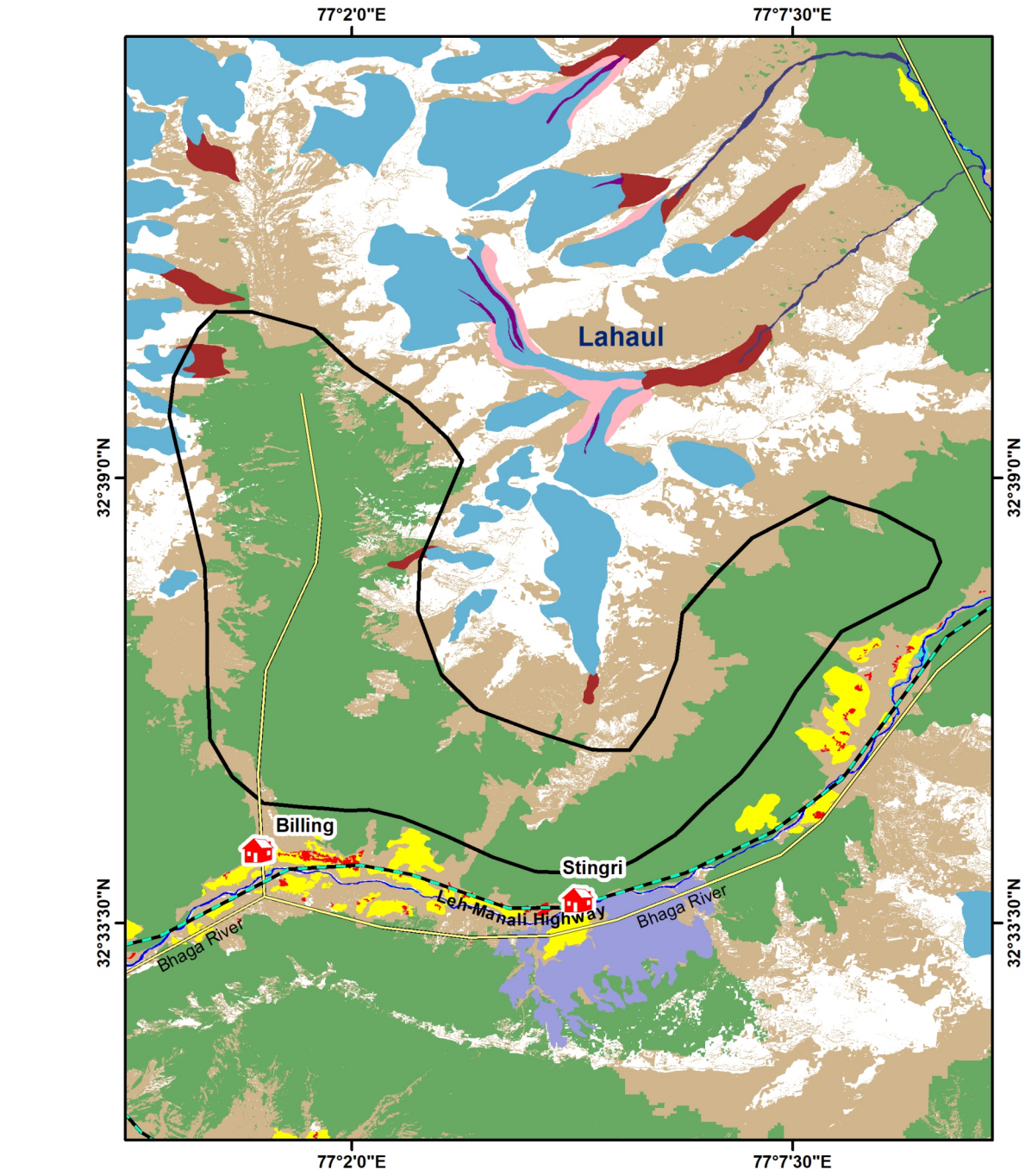
- Faunal species, as reported by key informants, in the area are snow leopard, Himalayan red fox, Tibetan wolf and Asiatic ibex.
- Occupancy probability for snow leopard and Asiatic ibex is 0.71-0.80 & 0.91-1.00 respectively (Ghoshal, 2017).
- Threatened avifaunal species reported from the area are Himalayan griffon (*Gyps himalayensis*) and bearded Vulture (*Gypaetus barbatus*).
- A variety of high value medicinal plants have been reported from the region including a *Hippophae rhamnoides, Aconitum heterophyllum, Hyoscyamus niger, Juniperus communis, Artemisia santolinifolia, Taraxacum officinale, Podophyllum emodi, Tanacetum mutellinum, Rosa macrophylla, Rhododerndron sp.*

**HCV-5 (Community Needs)**

- The alpine meadows are also a source of the livelihood of the communities; it fulfills the basic need of domestic livestock grazing of the local herders.The local communities of Billing and Istingri villages are dependent on the pastureland for grazing their livestock during the summer season for 2-3 months.

**Table 16:** Potential threats and conservation recommendation for High Conservation Value Area Billing-Istingri in Lahaul landscape of H.P.

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | The intensive livestock grazing in the pastures has imposed pressure on the limited resources, and has led to the issue of pastureland degradation due to intensive grazing.<br>Over-exploitation of rare and valuable medicinal plants from the wild due to grazing pressure threatens the survival of these species. | Demarcation of critical areas within the pastureland in southern extent for livestock grazing of local herders of the villages, to avoid competition with wild-herbivore.<br>Implementation of integrated pastureland management regimes with the support of the forest department and local communities, to reduce the anthropogenic pressure on the pastures is suggested. |
| 2. | Depredation of livestock by snow leopard and Tibetan wolf in the pastureland as well as in the village has been reported by the herders of Billing and Istingri villages. | Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended. |




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 81.45 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

N
W E
S

**Legend**

- Associated Villages
- Billing and Stingri
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Water body
- Barren Land
- Lateral moraines
- Agriculture
- Temperate coniferous
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 1 2 4 6 8 Kilometers

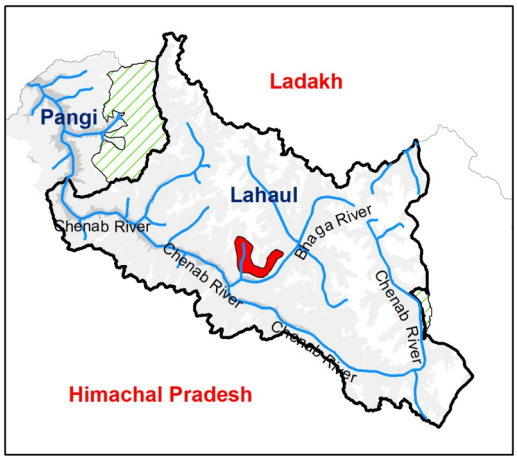
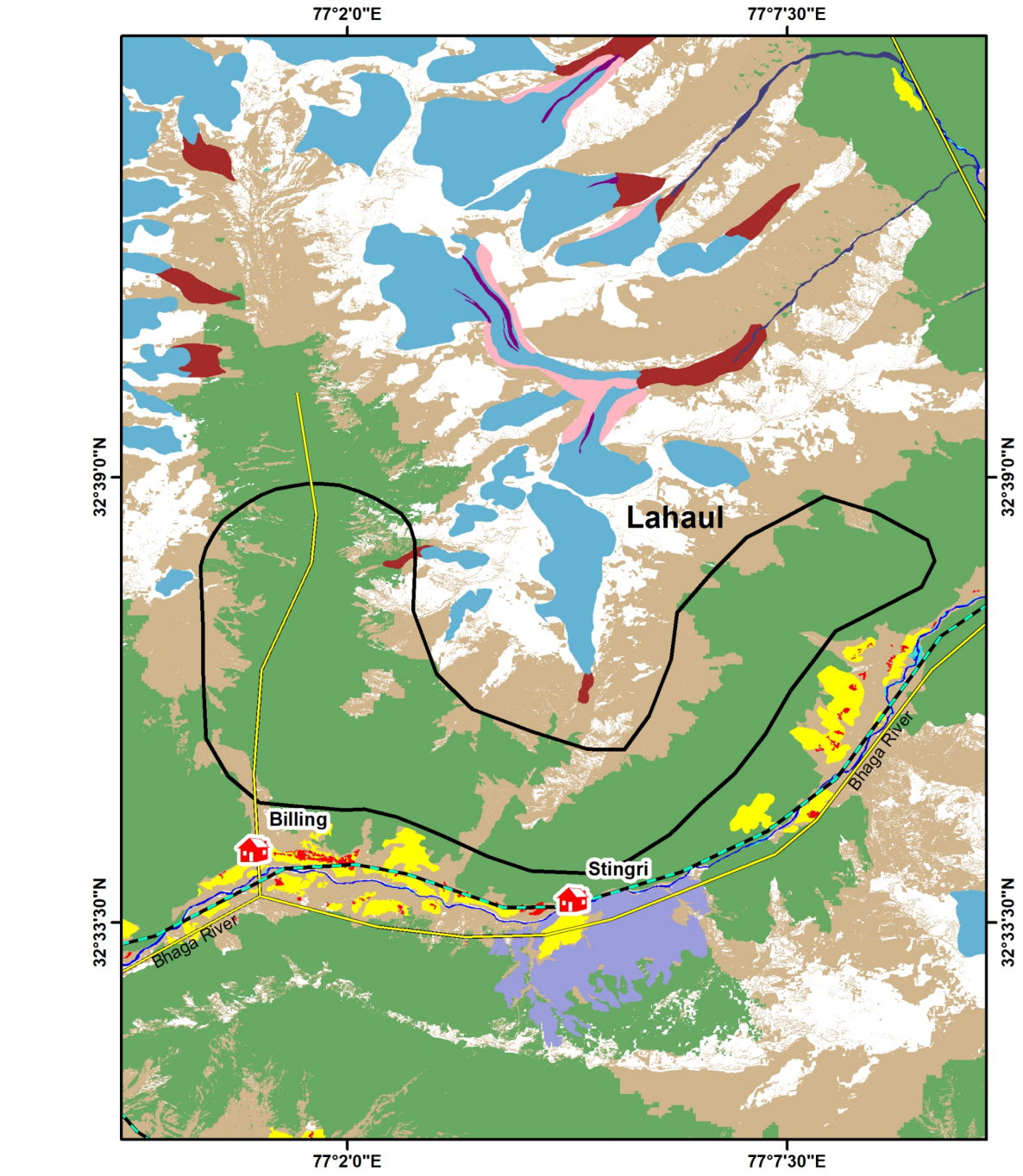



**Figure 13:** Billing & Istingri - Potential HCV Area in Lahaul Valley for criterion 1 (Species and Diversity)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 62.73 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

N
W E
S

**Legend**

- Associated Villages
- Billing & Istingri
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Barren Land
- Lateral moraines
- Agriculture
- Marshy land
- Temperate coniferous
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 1 2 4 6 8 Kilometers

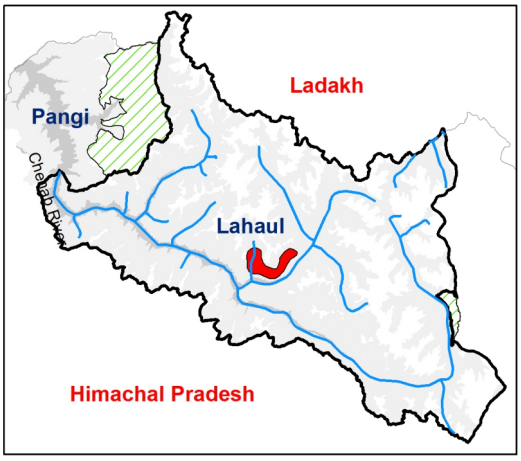



**Figure 14:** Billing & Istingri - Potential HCV Area in Lahaul Valley for criterion 5 (Community Needs)

## AREA 3: DARCHA & JISPA

These are two small villages situated in the trans-Himalaya region of the Keylong Range of Lahaul-Spiti district at an elevation of around 3500m. Darcha is situated at the junction of Yotche nallah and the Zanskar nallah which takes off from the Shinkun la. Jispa is located 20 km north of Keylong and 7 km south of Darcha, along the Bhaga River and Manali-Leh highway. Itis situated between 32° 42' 33.78" N-32° 45' 13.77" N latitude and 77° 15' 55.87" E-77° 17' 2.53"E longitudes at an elevation range from 3402-5450 meters.

**HCV-1 (Species & Diversity)**

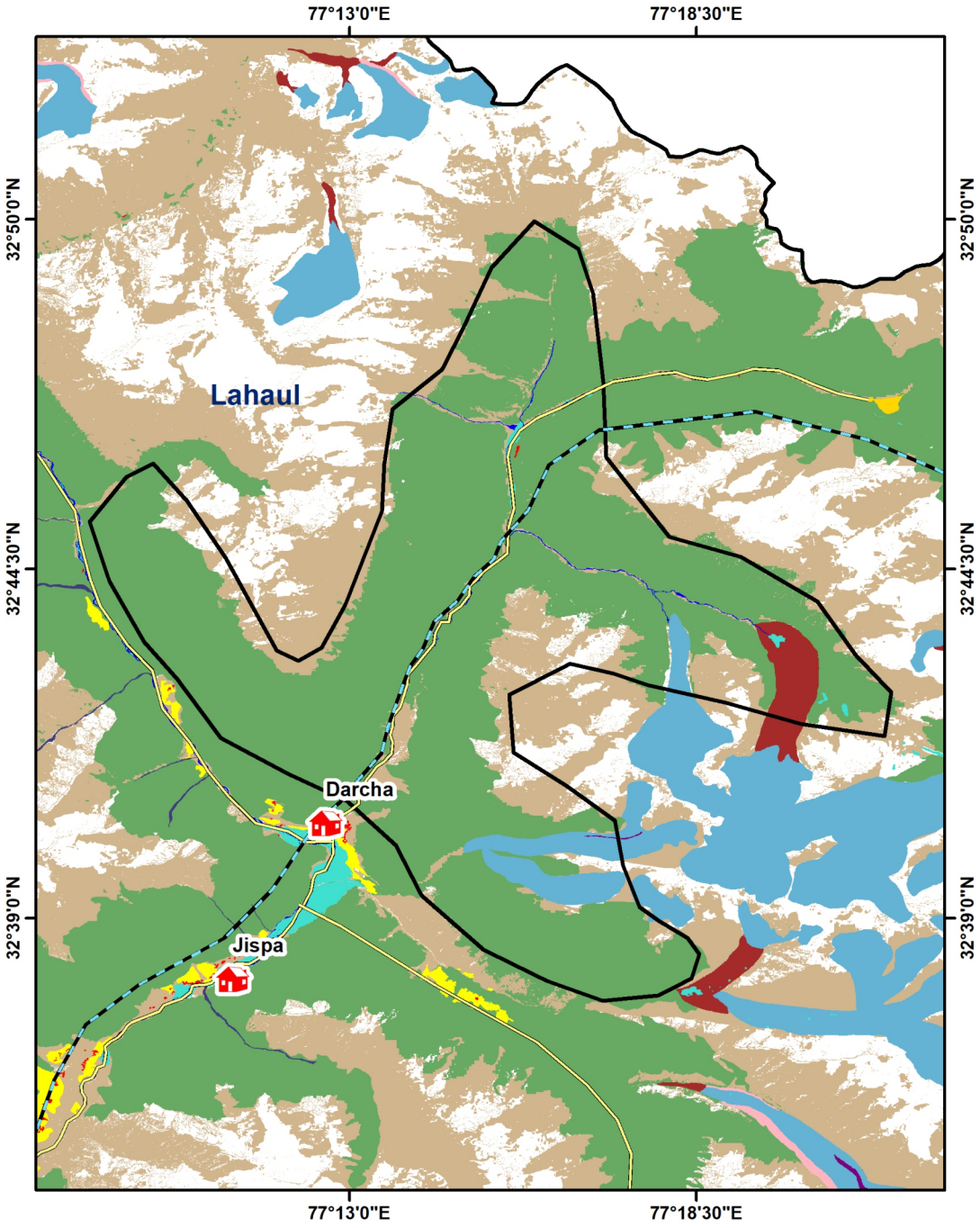
- Faunal species, as reported by key informants, in the area are snow leopard, Himalayan red fox, Tibetan wolf, and Asiatic ibex.
- Occupancy probability for snow leopard and Asiatic ibex is 0.71-0.80 & 0.91-1.00 respectively (Ghoshal, 2017).
- Threatened avifaunal species reported from the area are Himalayan griffon (*Gyps himalayensis*) and bearded Vulture (*Gypaetus barbatus*).
- Few of the important medicinal plants reported from the area are *Aconitum heterophyllum, Hyoscyamus niger, Pedicularis oliveriana, Juniperus communis, Hippophae rhamnoides, Artemisia santolinifolia, Taraxacum officinale, Podophyllum emodi, Melilotus officinalis, Rosa macrophylla, Rhododerndron sp.*

**HCV-5 (Community Needs)**

- The local communities of the villages of Darcha & Jispa are dependent on the pastureland for grazing their livestock during the summer season for 2-3 months.
- The alpine meadows are an important source of the livelihood of the communities in the region.

**Table 17:** Potential threats and conservation recommendation for High Conservation Value Area Darcha & Jispa in Lahaul landscape of H.P.

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | With intensive livestock grazing in the region, there has been inter-specific competition for resources between domestic livestock and wild-herbivores, and this has also led to over-exploitation of the alpine pastures.<br>Over-exploitation of rare and valuable medicinal plants from the wild due to grazing pressure threatens the survival of these species. | Demarcation of critical areas within a larger pastureland in south-western and south-eastern parts around the villages of Darcha and Jispa for livestock grazing, to avoid competition and over-exploitation of resources.<br>Implementation of integrated pastureland management regimes with the support of the forest department and local communities, to reduce the anthropogenic pressure on the pastures is suggested. |
| 2. | Depredation of livestock by snow leopard and Tibetan wolf in the villages of Darcha and Jispa has resulted in human-wildlife conflict in the region. | Anti-predatory livestock management through fences and other barriers, deterrents, human-accompanied herding of livestock to reduce livestock losses is recommended. |




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 163.38 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

N
W
E
S

**Legend**

- Associated Villages
- Darcha and Jispa
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Water body
- Barren Land
- Agriculture
- Marshy land
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 1.5 3 6 9 12 Kilometers

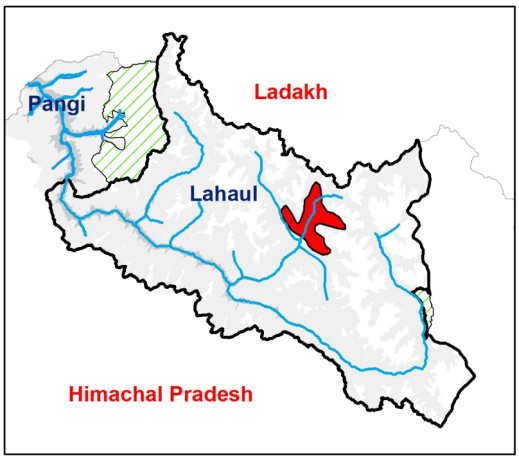
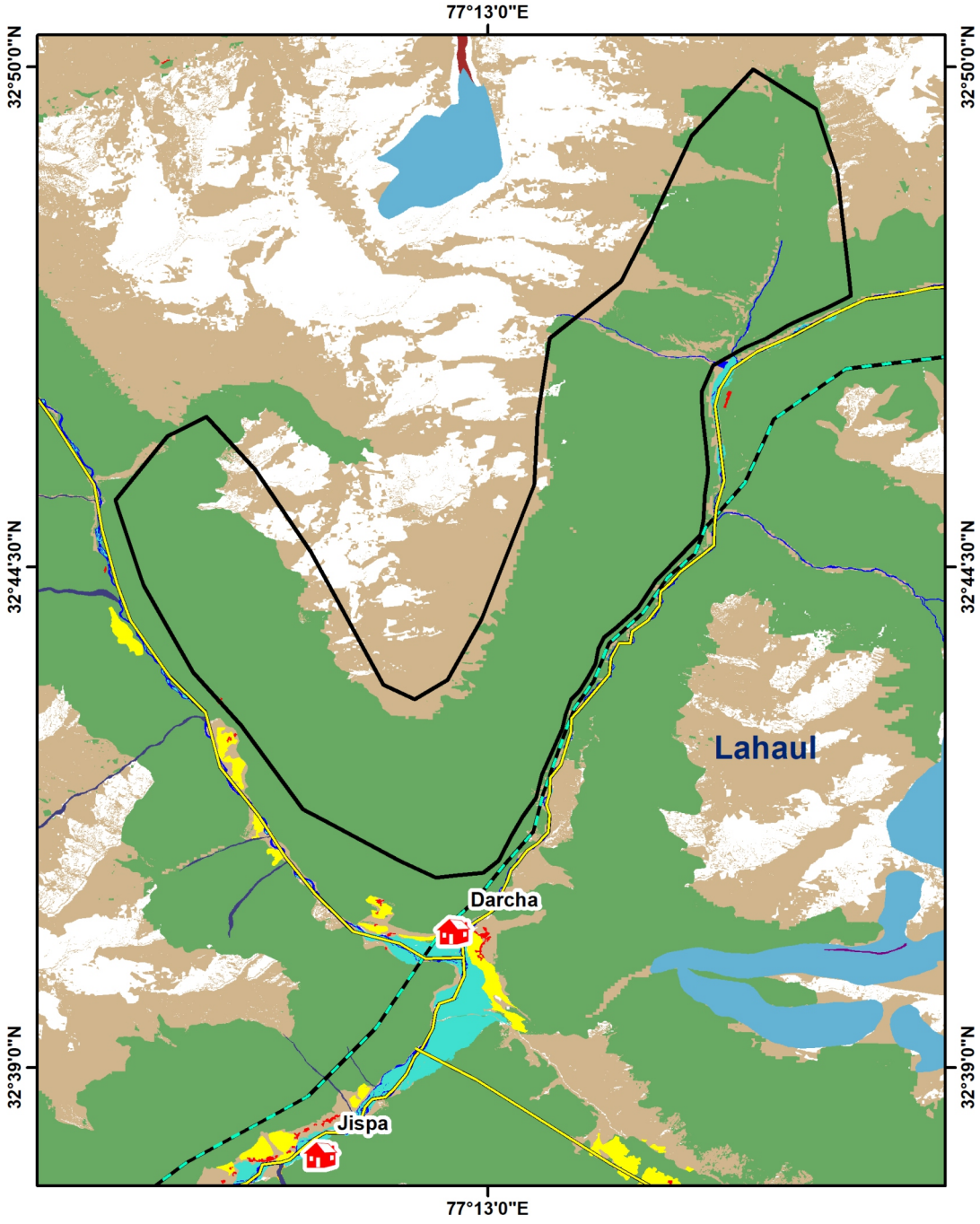



**Figure 15:** Darcha & Jispa-Potential HCV Area in Lahaul Valley for criterion 1 (Species & Diversity)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 66.29 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

N
W E
S

**Legend**

- Associated Villages
- Darcha & Jispa
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- River sediments
- Barren Land
- Agriculture
- Dry river
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 1 2 4 6 8 Kilometers

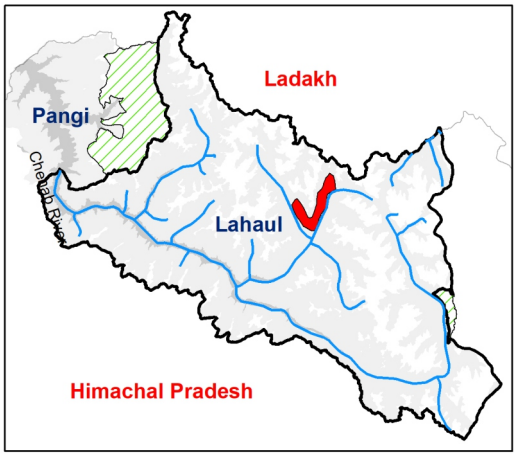



**Figure 16:** Darcha & Jispa-Potential HCV Area in Lahaul Valley for criterion 5 (Community Needs)

## AREA 4: PATTAN VALLEY (NAINGAR)

It lies in the Trans-Himalaya region of the Pattan Range of Lahaul-Spiti district. Itis situated between 32° 40' 53.06" N-32° 53' 26.88" N latitude and 76° 47' 03.68" E-77° 01' 44.27" E longitudes at an elevation range from 3090-5662 meters. It comprises catchment of both Chandra and Bhaga rivers, and tFIGURherefore also known as Chandrabhaga valley (Bajpai, 2002).

**HCV-1 (Species and Diversity)**

- Faunal species, as reported by key informants, in the demarcated area are snow leopard, Himalayan brown bear, Himalayan red fox, Tibetan wolf, Asiatic ibex, Himalayan musk deer and Royle's pika. Occupancy probability for snow leopard and Asiatic ibex is 0.61-0.70 & 0.81-0.90 respectively (Ghoshal, 2017).
- Few of the important medicinal and aromatic plants like *Picrorhiza kurroa, Dactylorhiza hatagirea, Aconitum heterophyllum, Podophyllum hexandrum, Saussurea costus (cultivated), Bunium persicum, Hippophae rhamnoides* are found in the valley.
- Threatened bird species, the Himalayan griffon (*Gyps himalayensis*) and bearded Vulture (*Gypaetus barbatus*) have been reported from the area.
- Ring species consists of two reproductively isolated forms of a species connected by a chain of intergrading populations (Irwin *et al.*, 2005). A ring species is one in which a chain of intergrading populations encircles a barrier and the terminal forms coexist without interbreeding. It also provides a situation in which variation in space can be used to infer variation in time (Mayr, 1999; Otte & Endler, 1989).
- Ticehurst, 1938 concluded that two forms of the greenish warbler, *P. t. viridanus* in the west and *P. t. plumbeitarsus* in the east, coexist in central Siberia without inter-breeding. These two forms are connected by a chain of inter-grading populations to the south through the Himalayas and the ring of populations encircles the Tibetan Plateau and other arid areas in central Asia.
- According to Trevor, 2019 (unpublished), Naingar's birch forest patch appears to be a point of meeting of Kashmir elements and Himalayan elements of avifaunal species, with at least two bird species forming hybrid zones there, namely, Greenish warbler, an important ring species, and Variegated laughing thrush (*Trochalopteron variegatum*).

**HCV-3 (Ecosystem and Habitat)**

- The area is critical for maintaining connectivity of home ranges for snow leopard and associated prey species; it lies adjacent to Miar Valley.
- The forested areas and scrubs around Naingar serve as a habitat for populations of Himalayan musk deer – an endangered species, and the undulating terrain support a substantial population of Asiatic ibex. The region has been identified as a potential breeding area for the two wild herbivore species.

**HCV-4 (Ecosystem Services)**

- The forested patch of birch trees near the Naingar and Chowkhang villages help in regulating the flow of water within a catchment, prevent soil erosion and provide natural resources (e.g. fodder plants, timber as renewable raw material) for energy production and construction.
- The alpine meadows of the region in the upper reaches of Thirot Nallah, and near Alias got, provides supporting and regulating services. They prevent natural hazards (floods and landslides) and help in carbon sequestration and storage, in biomass and soil.

**HCV-5 (Community Needs)**

- Basic community needs in the area are fodder and fuel-wood from forests around the village and pastureland for grazing their livestock.
- The land-use practices include extraction of high-value medicinal plants, extraction of timber and fuel-wood and livestock grazing by local communities and migratory herders of the Gaddi community in parts of the landscape.

**HCV-6 (Cultural Values)**

- Neelkanth Lake is a high-altitudinal lake situated at 32° 45' 30.12" N latitude and76° 57' 8.21" E longitude. It lies in the precincts of Naingar near Chokhang village which has become prominent as a holy place in the Lahaul valley of Himachal Pradesh.
- It is a high-altitudinal glacial lake situated in the upper reaches of Thirot nallah near in Pattan Valley, at an altitude of 5334 meters above mean sea level.
- A small temple of Lord Shiva has been established near the lake and the area is of cultural importance for the local communities (Sahni, 1994).





Bearded Vulture (*Gypaetus barbatus*) sighted in Keylong Range, Lahaul Valley

*Shiv Kumar*

**Table 18:** Potential threats and conservation recommendation for High Conservation Value Area Pattan Valley (Naingar) in Lahaul landscape of H.P.

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | Intensive grazing by the livestock in the valley, mainly in the northern part of the demarcated region has led to removal of palatable forage resulting in resource limitation and over-exploitation of pastureland.<br>The herders of the Gaddi community visit the pastures via Thirot, during summers for three to four months, for grazing their livestock. Intensive livestock grazing in the valley has led to the issue of pastureland degradation, mostly in northern extent of the pastures. | Demarcation of critical areas within the pastures of Naingar, in the north-eastern part of the demarcated region for migratory livestock grazing<br>Implementation of integrated pastureland management regimes with the support of the forest department and local communities, in the pastures of Naingar, to reduce the anthropogenic pressure on the pastures due to grazing is suggested. |
| 2. | Due to the presence of numerous domestic livestock in the region, the probability of contact, and the transmission of infectious diseases between wild and domestic animals is an issue of concern. | Establishment of medical camps in the villages of Chowkhang, Chhogzing or Naingar, for the herders of the Gaddi community, for disease surveillance with an aim of identification of the presence/absence of any disease, determination of the occurrence or distribution of disease/ infection, while also detecting any emerging diseases. |
| 3. | Depredation of livestock of the local communities and migratory herders, by the snow leopard, Tibetan wolf and the Himalayan brown bear has been reported from the villages of the valley, including Chowkhang, Chhogzing and near Naingar.<br>Human wildlife conflict in the region has also been observed in the form of loss of valuable cash crops by the Himalayan brown bear in the agricultural field around the settlements in the valley. | Anti-predatory livestock management through fences and other barriers, deterrents, human-accompanied herding of livestock to reduce livestock losses is recommended.<br>Community-based protection measures (solar fences and other barriers), to avoid crop losses, and spreading awareness about the subsidies provided by the government is suggested. |
| 4. | Reckless extraction of medicinal plants owing to high market demand has put the pressure on the existence of many species (Paul *et al.*, 2015).<br>Over-harvesting, illegal extraction and pressure due to intensive grazing have adversely affected the availability of the medicinal plants in the pastures of Naingar, and forested regions around the villages of Naingar and Chowkhang. | Enhanced training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders *i.e.* the local communities of Chowkhang, Gwari, Chhogzing and Naingar. |
| 5. | No threat near the Neelkanth lake was observed during the survey as site is of cultural importance to the local communities. | The recognition of the lake on such a vast level could be utilized as an opportunity to promote biodiversity conservation in the valley. |

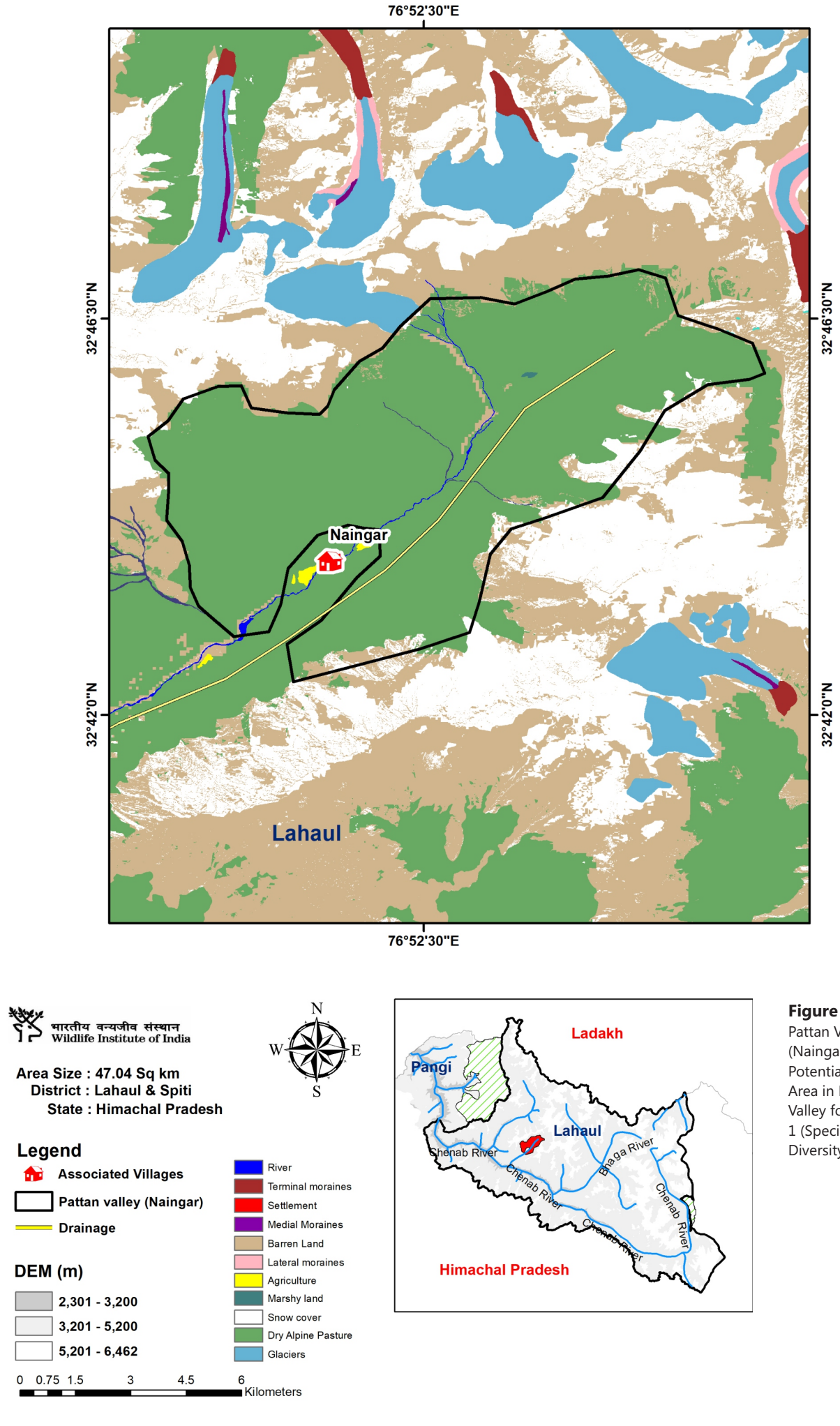
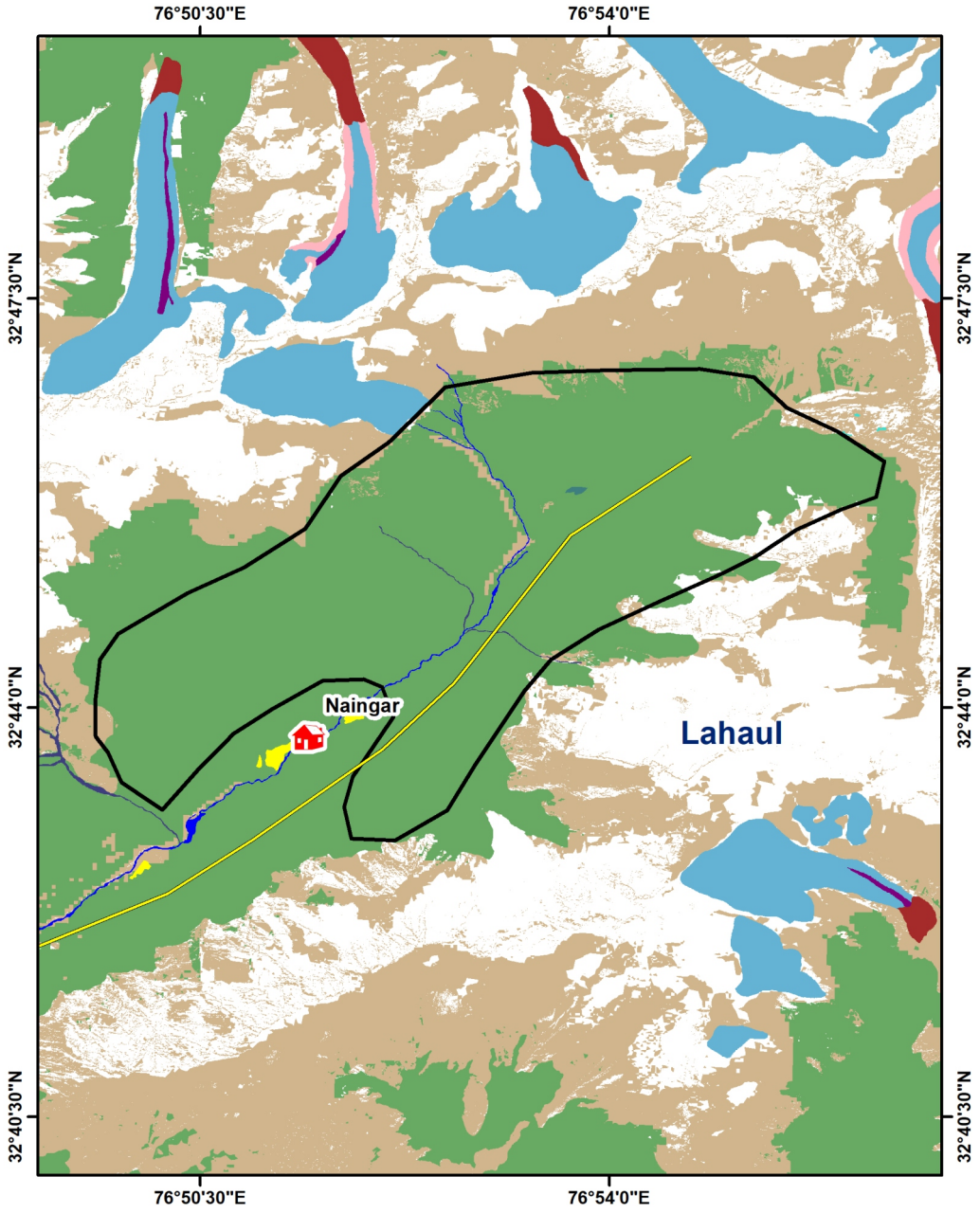



**Figure 17:** Pattan Valley (Naingar)-Potential HCV Area in Lahaul Valley for criterion 1 (Species and Diversity)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 37.32 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

N
W
E
S

**Legend**

- Associated Villages
- Pattan valley (Naingar)
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Barren Land
- Lateral moraines
- Agriculture
- Marshy land
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 0.75 1.5 3 4.5 6 Kilometers

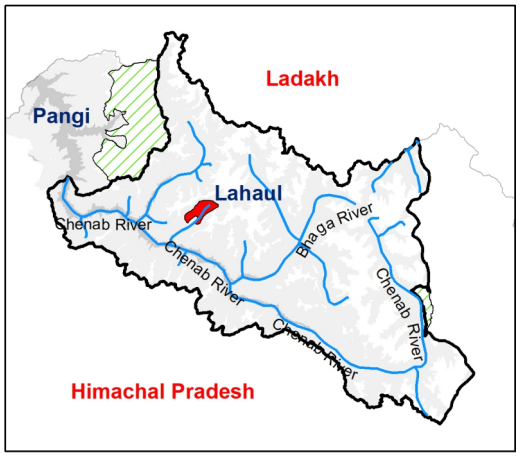
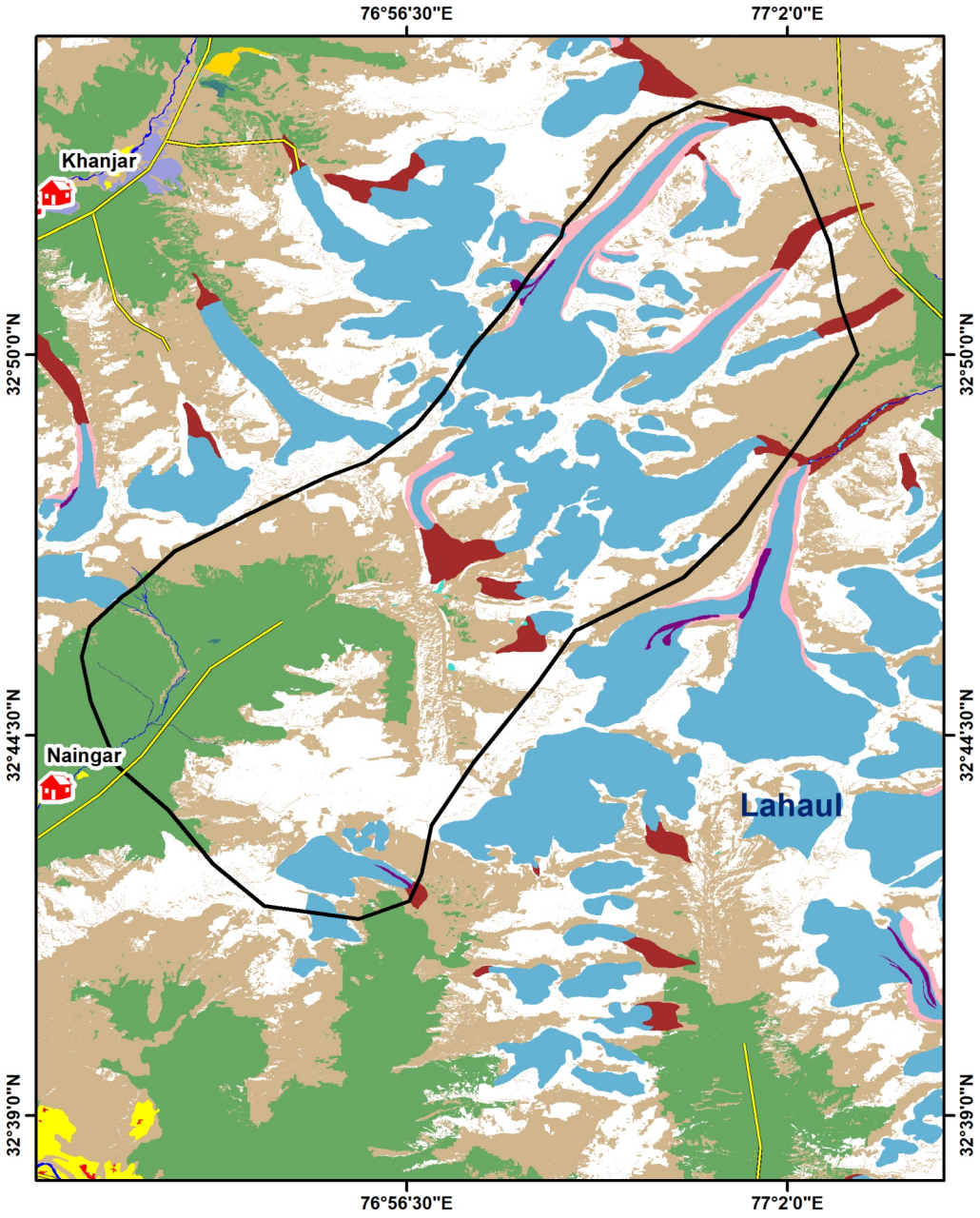



**Figure 18:** Pattan Valley (Naingar)- Potential HCV Area in Lahaul Valley for criterion 3 (RET Ecosystem and Habitat)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 170.78 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

N
W E
S

**Legend**

- Associated Villages
- Pattan valley (Naingar)
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Medial morains
- Barren Land
- Lateral moraines
- Agriculture
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 1.25 2.5 5 7.5 10
Kilometers

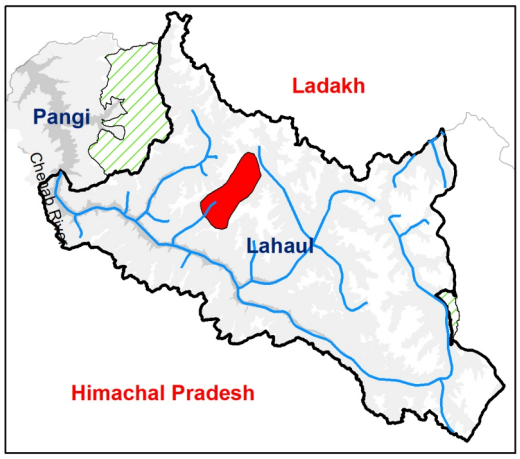
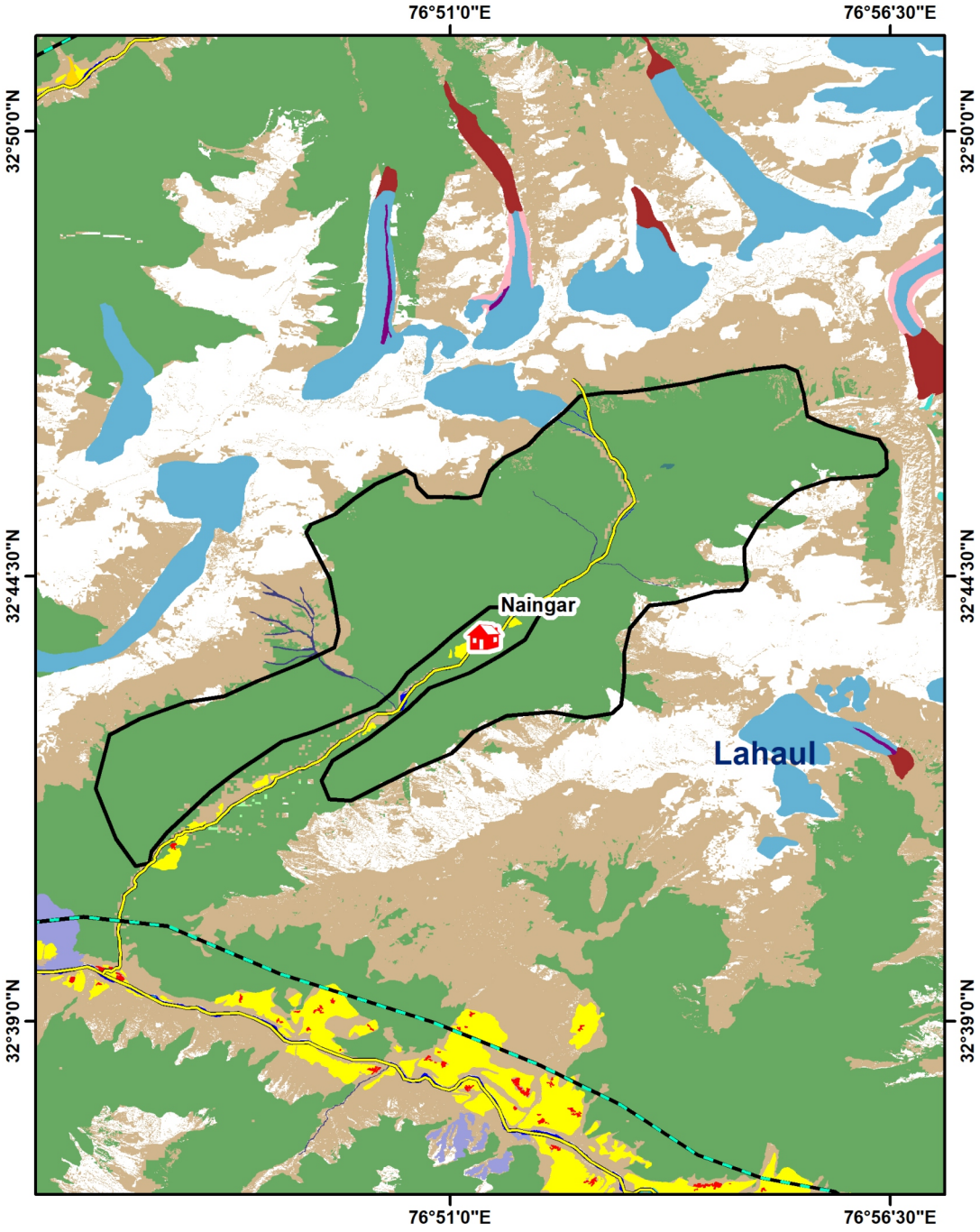



**Figure 19:** Pattan Valley (Naingar)-Potential HCV Area in Lahaul Valley for criterion 4 (Ecosystem Services)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 61.50 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

N
W E
S

**Legend**

- Associated Villages
- Pattan valley (Naingar)
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Water body
- Barren Land
- Lateral moraines
- Agriculture
- Marshy land
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 1 2 4 6 8 Kilometers

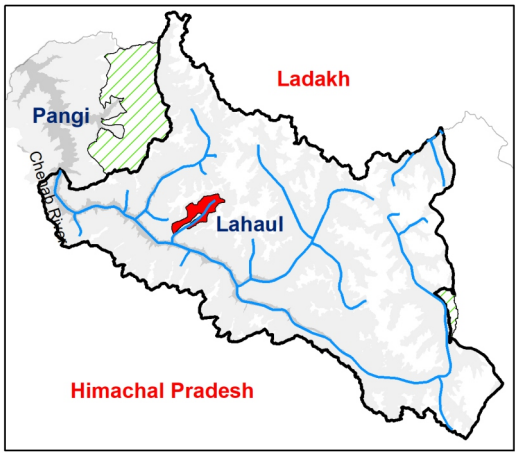
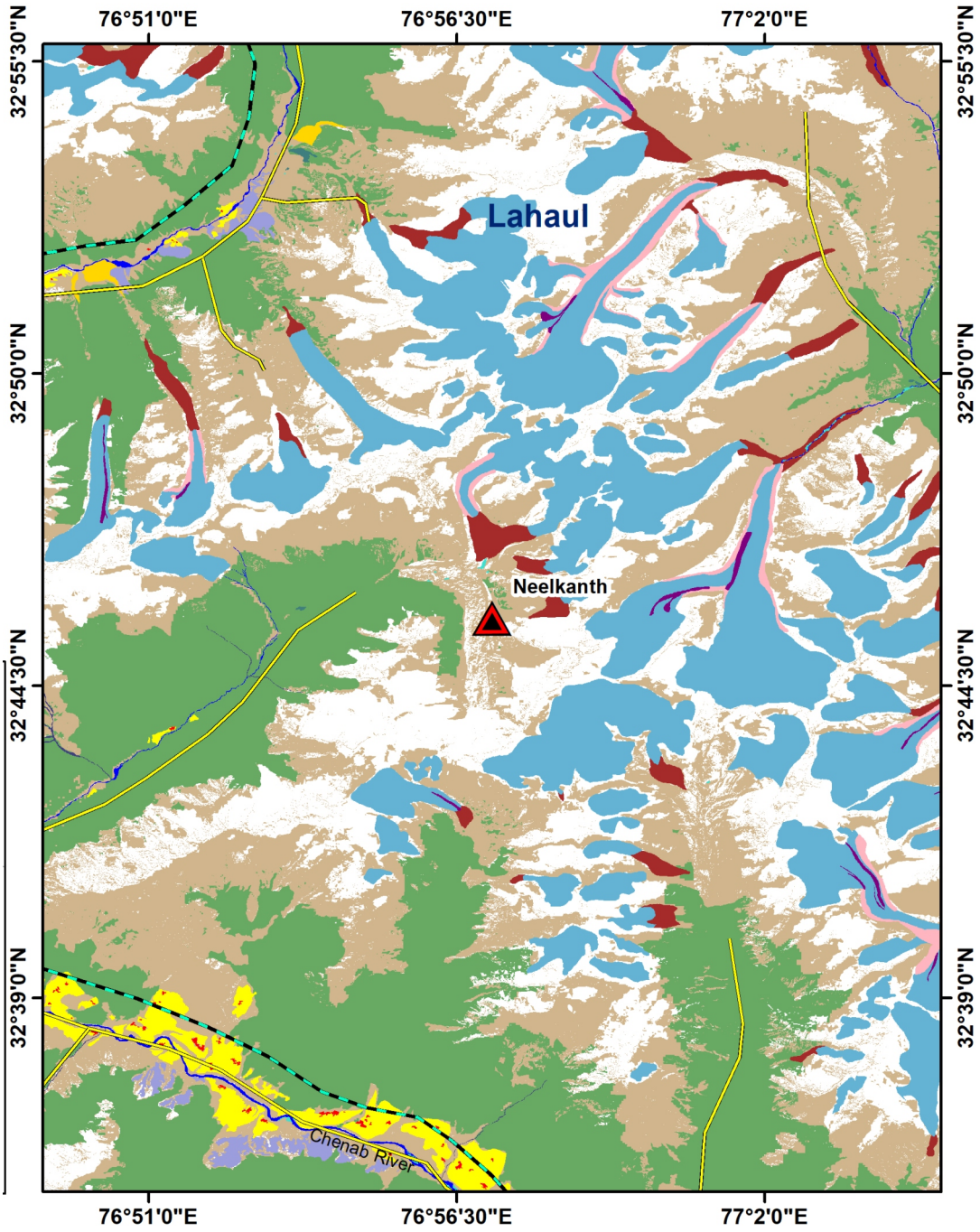



**Figure 20:** Pattan Valley (Naingar)-Potential HCV Area in Lahaul Valley for criterion 5 (Community Needs)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

N
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Area Size : 37.5 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

- Neelkanth
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Water body
- Barren Land
- Lateral moraines
- Agriculture
- Medial morains
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 1.5 3 6 9 12 Kilometers

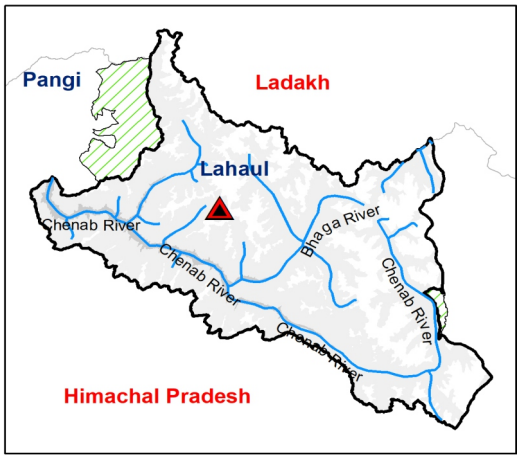



**Figure 21:** Pattan Valley (Neelkanth lake)-Potential HCV Area in Lahaul Valley for criterion 6 (Cultural Services)

## AREA 5: HADSAR

It is a small village, with only three settlements, situated in the upper reaches of Tindi range of Lahaul Valley, Lahaul-Spiti of Himachal Pradesh. Itis situated between 32° 40' 25.58" N -32° 43' 20.43" N latitude and 76° 24' 34.58" E -77° 26' 32.26" E longitudes at an elevation range from 2590-5165 meters, on the left bank of ChandrabhagaRiver. The area is known for a variety and rich diversity of high value rare medicinal and aromatic plants, and has been recognized as a Demarcated Protected Forest (DPF).



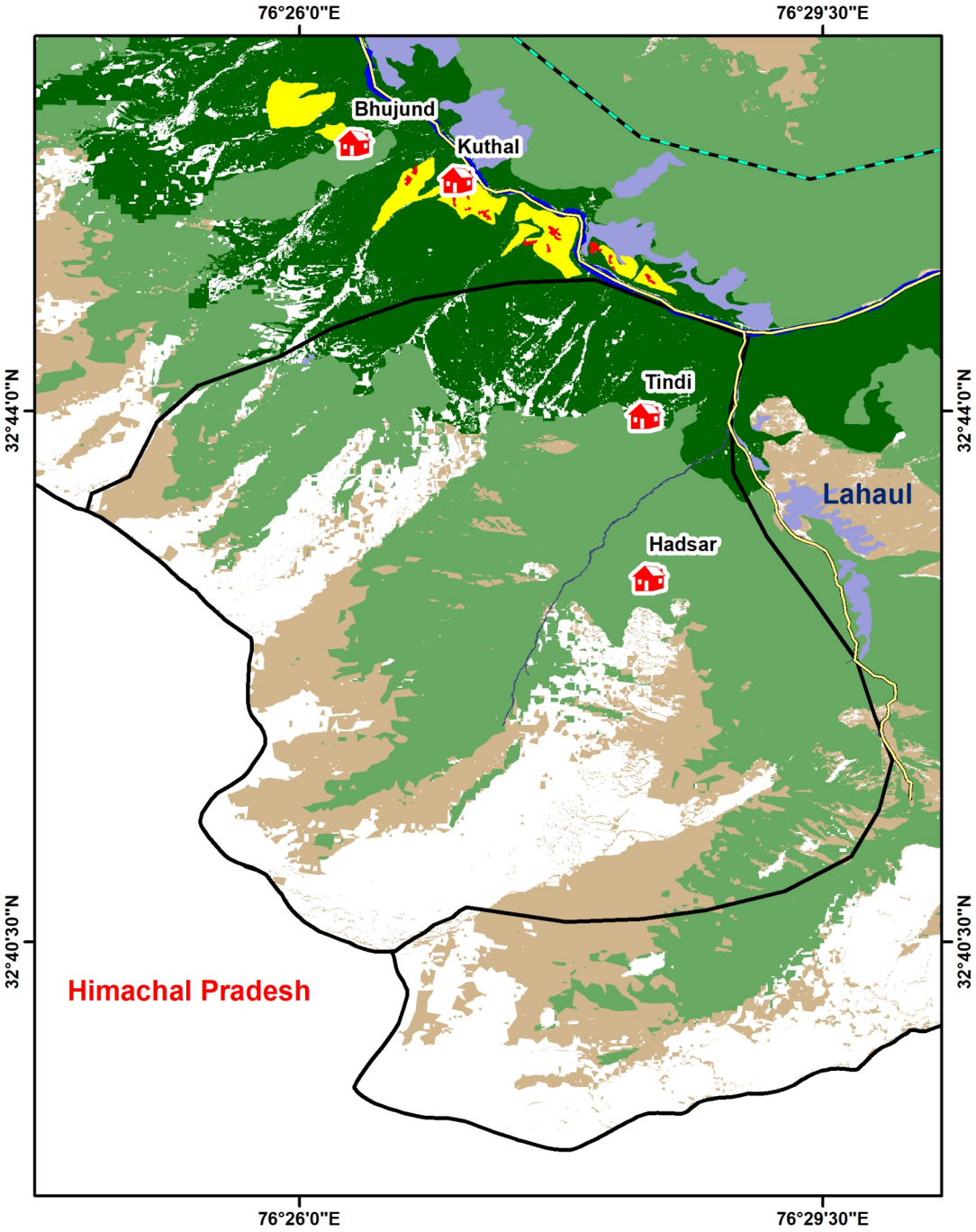

**Image 5:** Asiatic Ibex – an important wild herbivore found in the landscape

**HCV-1 (Species and Diversity)**

- Faunal species, as reported by key informants, in the area are Asiatic ibex, Himalayan Tahr, Himalayan brown bear and Asiatic black bear.
- The area, as reported by the forest department and the local communities, supports a thriving population of black and brown bears.
- A variety of high value medicinal plants have been reported from the region including *Picrorhiza kurroa, Dactylorhiza hatagirea, Aconitum heterophyllum, Saussurea costus(cultivated), Rheum australe, Inula racemosa (cultivated), Angelica glauca, Artemisia sp., Podophyllum sp., Medicago sp.*
- Also, near Hadsar, in Tindi range, lies a small patch of *Taxus wallichiana* – an endangered floral species in Himalayas.

**Table 19:** Potential threats and conservation recommendation for High Conservation Value Area Hadsar in Lahaul landscape of H.P.

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | Excessive anthropogenic pressures have been identified as the main causes of the decline in the population and the availability of the medicinal plants in the Himalayan region (Samant *et al.*, 1998).<br>Overharvesting, pre-mature harvesting and illegal extraction of rare and threatened medicinal and aromatic plants near and around the Hadsar village have been reported by the key informants. | Enhanced collaboration between the enforcement agencies (like the forest department and security forces) for improved surveillance to identify, monitor and prevent the illegal medicinal plant extraction around the pastures and forested regions around Hadsar village.<br>Continued on-job training on fronts like wildlife monitoring (for proper identification of wildlife evidence), wildlife law and legislation (for taking appropriate measures when recording wildlife crime) is recommended<br>Indepth studies on MAPs and their extraction is suggested. |




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 46.57 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

- Associated Villages
- Hadsar
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Agriculture
- Temperate coniferous
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture

N W E S

0 0.5 1 2 3 4 Kilometers

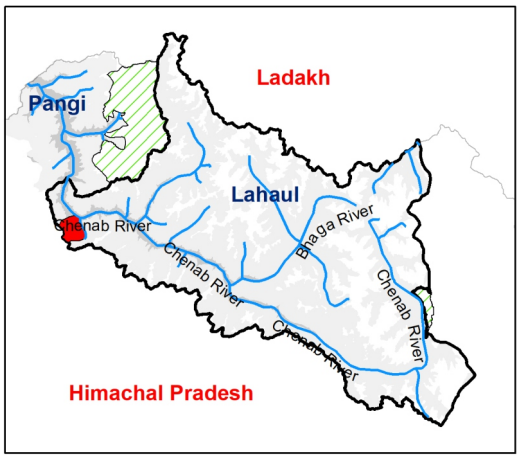
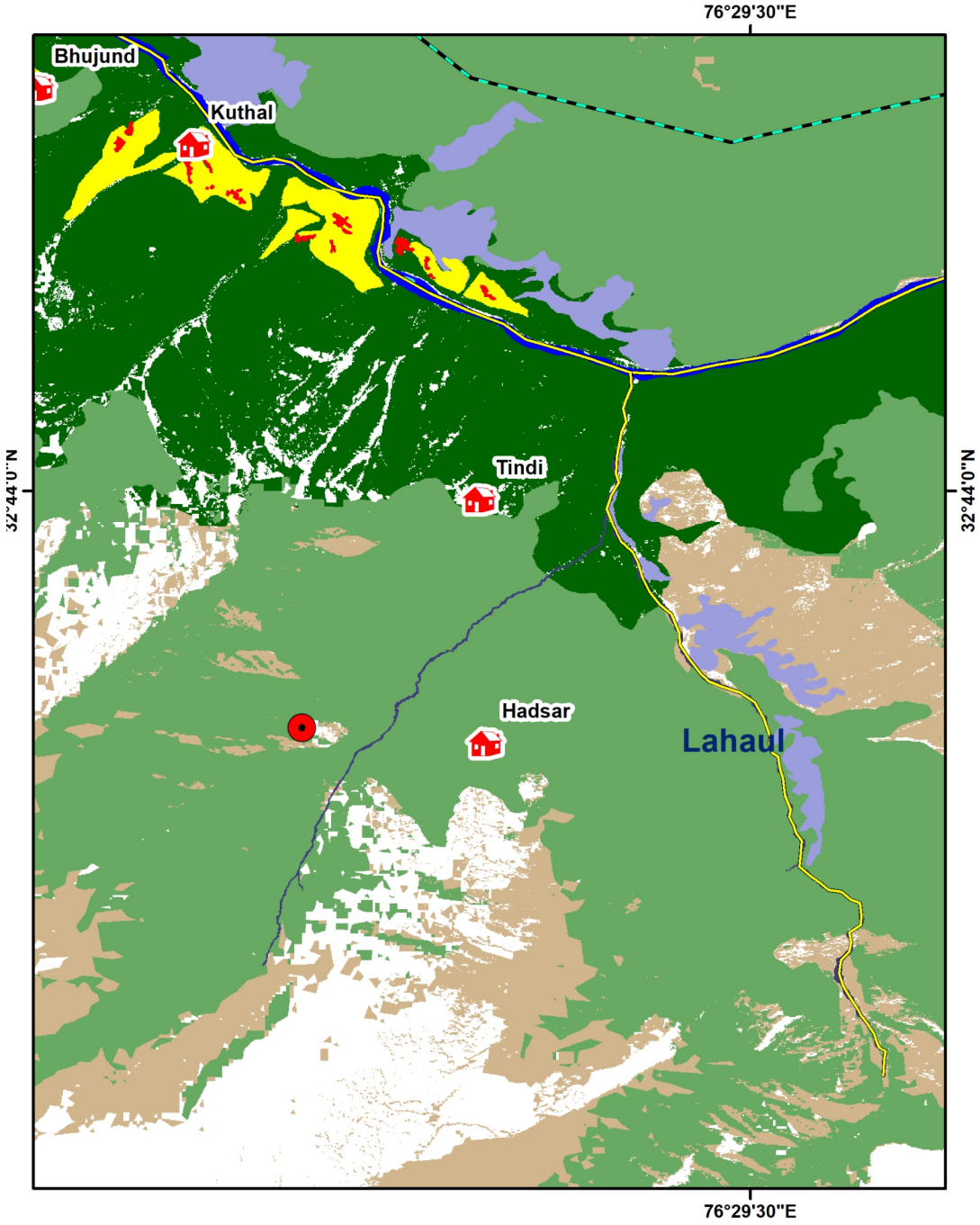



**Figure 22:** Hadsar - Potential HCV Area in Lahaul Valley for criterion 1 (Species and Diversity)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

N
W E
S

District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

- Associated Villages
- Taxus Wallichiana Location
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Water body
- Barren Land
- Agriculture
- Temperate coniferous
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 0.425 0.85 1.7 2.55 3.4 Kilometers

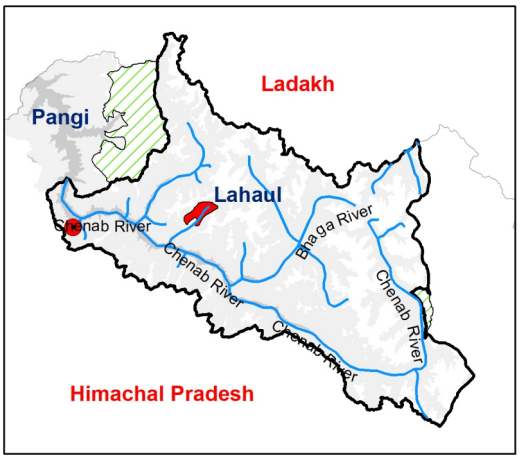



**Figure 23:** Potential HCV Area – a small patch of Taxus wallichiana (an endangered species), near Hadsar in Lahaul Valley

## AREA 6: KURUCHED

It is situated between 32° 44' 52.17" N -32° 40' 26.06" N latitude and 76° 29' 57.84" E -76° 32' 30.80" E longitudes, at an elevation range from 2925-4766 meters, in Keylong range of Lahaul-Spiti district of Himachal Pradesh. It is the only village of the valley which hasn't been connected with the roads yet. The area lies on the right bank of Chandrabhaga River.

**HCV-1 (Species and Diversity)**

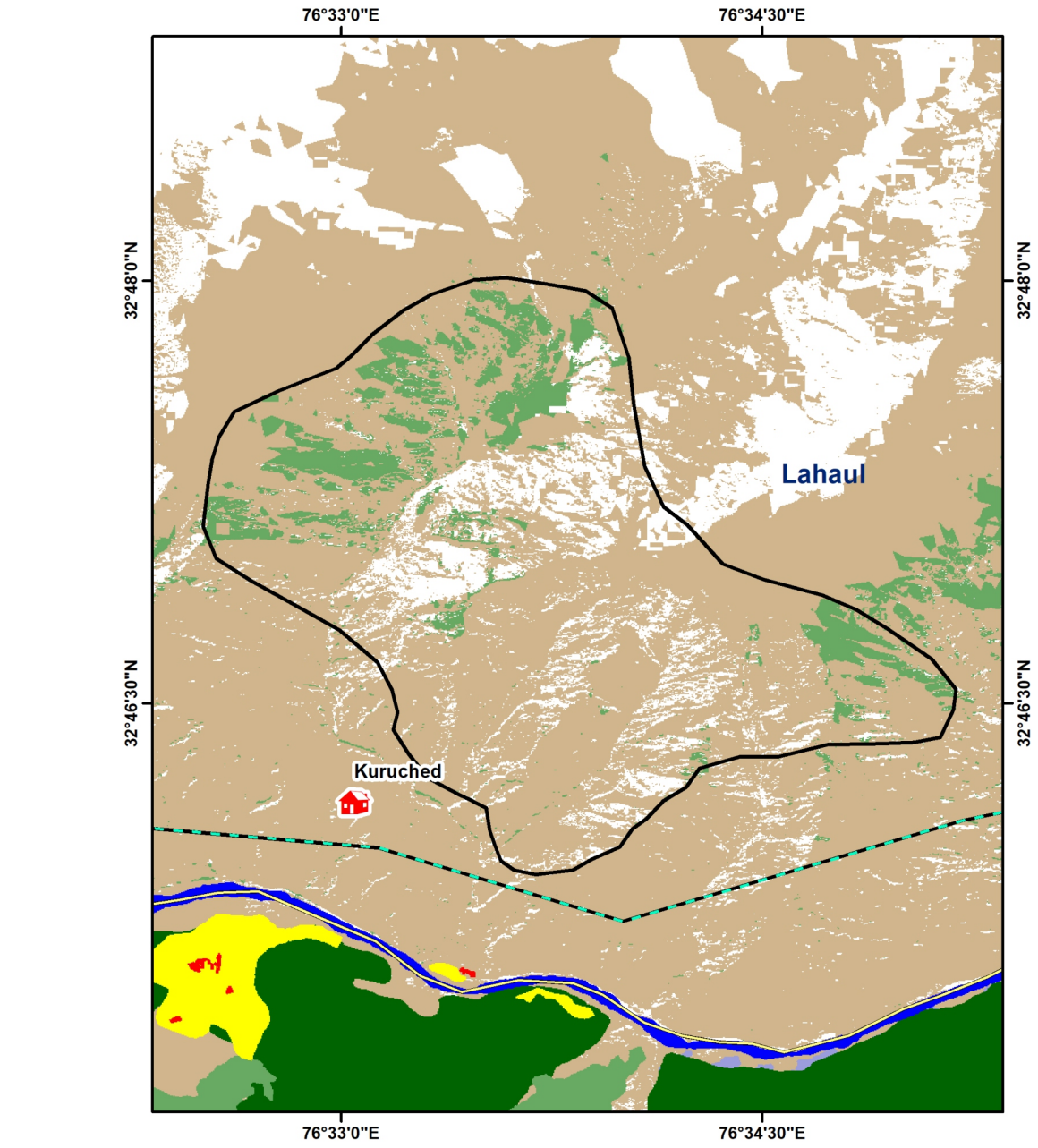
- Faunal species, as reported by key informants, in the area are snow leopard, Asiatic Ibex, Himalayan musk deer, Himalayan brown bear and Asiatic black bear.
- Occupancy probability for snow leopard and Asiatic ibex is 0.61-0.70 & 0.51-0.60 respectively (Ghoshal, 2017).
- The threatened avifaunal species reported in the area are Himalayan griffon (*Gyps himalayensis*) and bearded Vulture (*Gypaetus barbatus*).
- Few of the important medicinal plants found in the area include *Picrorhiza kurroa, Dactylorhiza hatagirea, Aconitum heterophyllum, Saussurea costus* (cultivated), *Rheum australe and Inula racemosa* (cultivated).




**Image 6:** *Dactylorhiza hatagirea*- a medicinal plant found in the pastures of Kuruched, Lahaul

**Table 20:** Potential threats and conservation recommendation for High Conservation Value Area Kuruched in Lahaul landscape of H.P.

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | Commercialization of many of the rare and threatened species in recent years has increased their demands and consequent exploitation (Rai *et al.*, 2000).<br>Overharvesting, pre-mature harvesting and illegal extraction of rare and threatened medicinal and aromatic plants on the left bank of Kuruched nallah by intruders have been reported. | Training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders of Kuruched Village.<br>Enhanced collaboration between the enforcement agencies (including the forest department and security forces) for improved surveillance to identify, monitor and prevent the illegal medicinal plant extraction around the pastures and forested regions around Kuruched village.<br>Continued on-job training on fronts like wildlife monitoring (for proper identification of wildlife evidence), wildlife law and legislation (for taking appropriate measures when recording wildlife crime) is recommended. |




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 8.32 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

N
W
E
S

**Legend**

- Associated Villages
- Kurched
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Agriculture
- Temperate coniferous
- Snow cover
- Dry Alpine Pasture

0 0.325 0.65 1.3 1.95 2.6 Kilometers

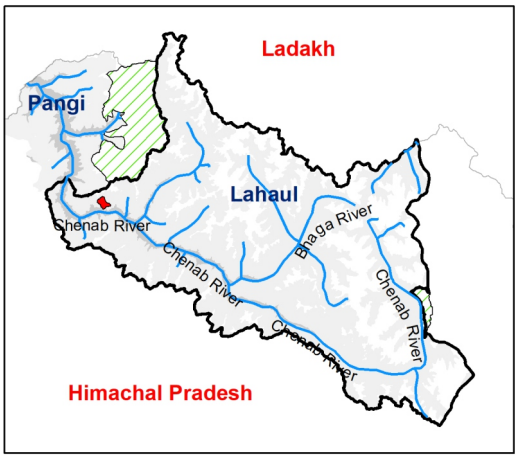



**Figure 24:** Kuruched - Potential HCV Area in Lahaul Valley for criterion 1 (Species & Diversity)

## AREA 7: CHANDRATAL LAKE

The Chandratal Wildlife Sanctuary (WLS) is an internationally known Ramsar site and Wetland of national importance. Itis situated between 32° 24' 3.62" N -32° 30' 50.87" N latitude and 77° 28' 31.43" E-76° 37' 16.29" E longitude, at an elevation range from 4090-6028 meters.

**HCV-1 (Species and Diversity)**

- Faunal species recorded in the area are Snow leopard, Asiatic ibex, Blue sheep, Himalayan tahr, Red fox, Tibetan wolf, Yak, Royle's pika and Himalayan marmot (Singh *et al.*, 2019).
- Occupancy probability for Snow leopard and Asiatic ibex is 0.61-0.70 & 0.71-1.80 respectively (Ghoshal, 2017).
- The area inhibits 20 avian species which are included under Schedule IV of Wildlife Protection Act, and Curlew sandpiper (Calidris ferruginea) (Management Plan 2018-28, Chandratal WLS) and Bearded Vulture (Gypaetus barbatus) are threatened.

**HCV-4 (Ecosystem Services)**

- It provides supporting & regulating services in the form of water catchments & alpine meadows that help in carbon sequestration and prevent soil erosion.
- It is nested in the upper catchment of river Chandra, at an elevation of 4,300m and is fed by snow and glaciers from Losar and Chandrabhaga mountain ranges (Verma, 2019).

**HCV-5 (Community Needs)**

- There is no permanent settlement in the area around the lake; however, the seasonal migratory herders in the valley are dependent on the pastures around the lake, and graze their livestock for two to three months during the summer season.

**HCV-6 (Cultural Values)**

- The Indigenous communities celebrate it through traditional folklores and festivals essentially making it a sacred wetland (Verma, 2019).
- It is also celebrated in Hinduism for its mention in the epic Mahabharata which adds to its spiritual relevance and makes it a great deal among Hindu pilgrims.

**Table 21:** Potential threats and conservation recommendation for High Conservation Value Area Chandratal in Lahaul-Spiti landscape of H.P.

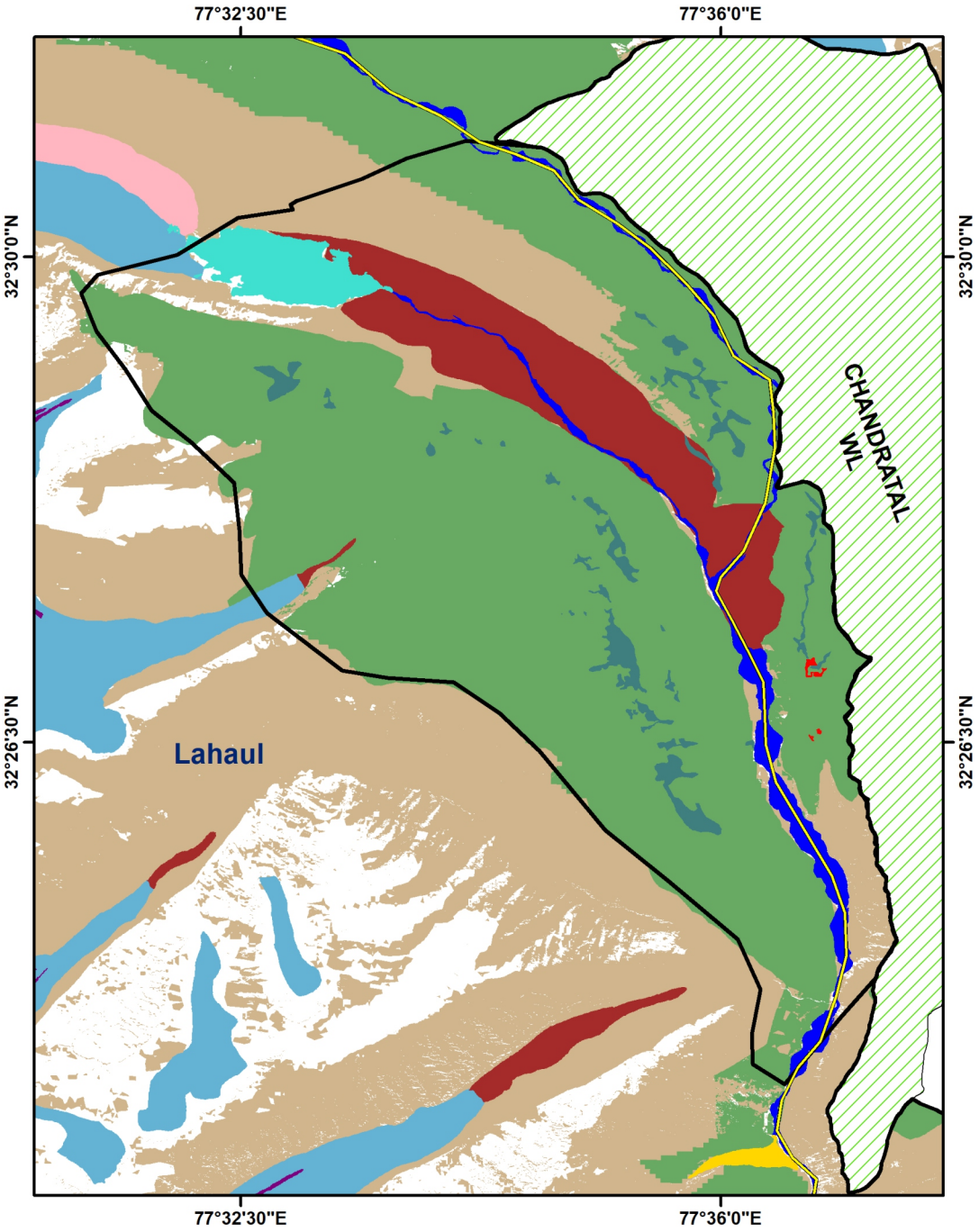
| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | The impact of livestock over-grazing on rangeland vegetation has been a longstanding conservation concern (Mishra *et al.*, 2004), and similar observations have been made in the landscape. Domestic livestock grazing in the valley has led to pastureland degradation due to over-grazing. | Demarcation of critical areas within a larger pasture in the western extent for livestock grazing; and implementation of integrated pastureland management regimes with the support of the forest department. |
| 2. | The influx of tourists rising to 40,000 has led to the emergence of problems such as solid waste, noise pollution, and infrastructure development (WISA, Annual report, 2018-19).<br>Uncontrolled conventional tourism near the premises of the Chandratal lake has been interfering with the fragile ecosystems and the wildlife of the area. | Community participation to promote eco-development and evaluation of tourist carrying capacity for the sanctuary area is recommended.<br>Demarcation of trek routes and scenic viewpoint to identify the tourism affected zone in order to regulate tourist movement; and appointment of a local tourism officer for monitoring and evaluating annual tourist activity in the designated tourism zone is suggested. |





Chandratal lake Lahaul-Spiti district

Meghma Ghosh




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N
W E
S

Area Size : 56.24 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

Chandratal
Drainage

**DEM (m)**

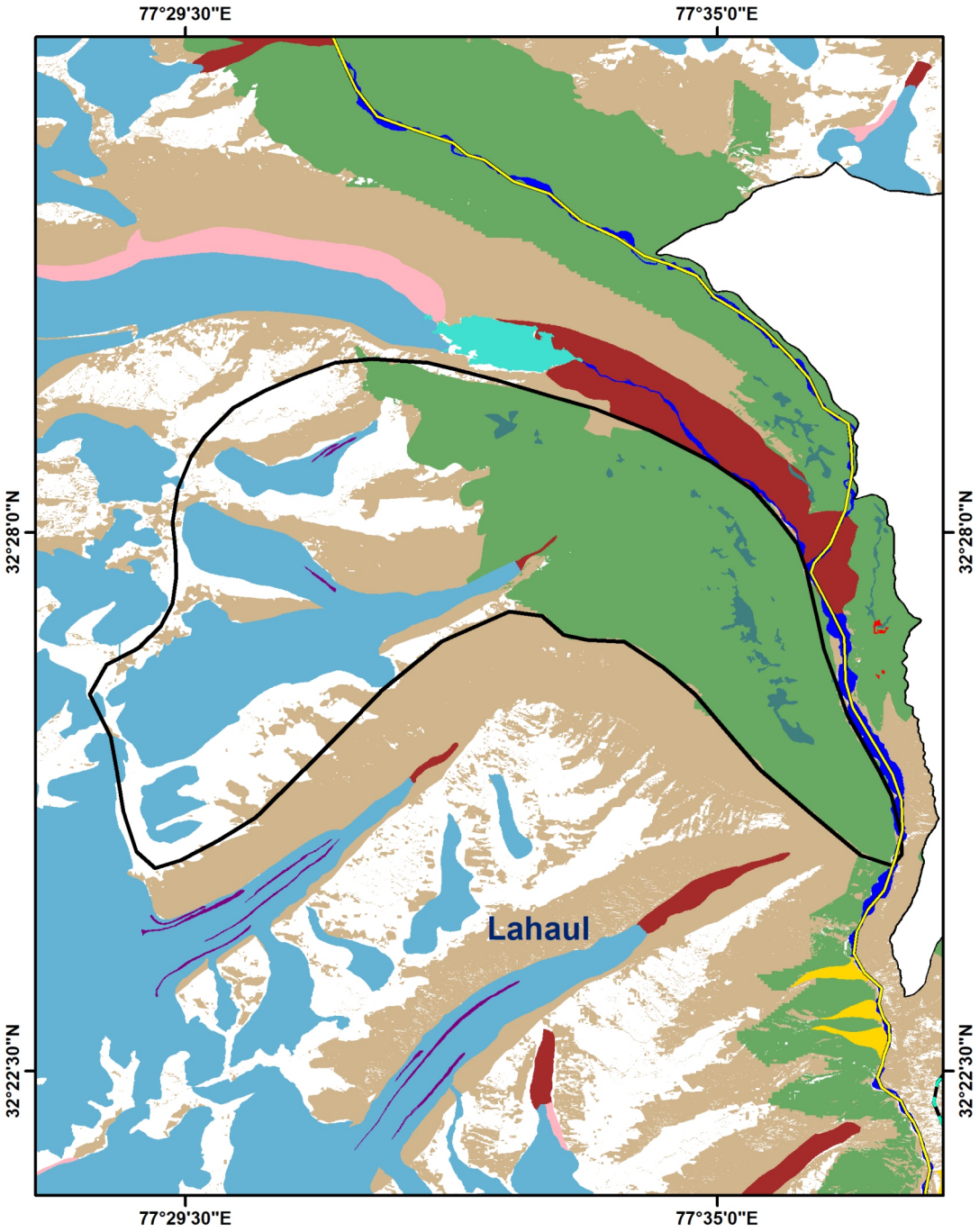
2,301 - 3,200
3,201 - 5,200
5,201 - 6,462

River
Terminal moraines
Settlement
Water body
Barren Land
Lateral moraines
Agriculture
Marshy land
Snow cover
Dry Alpine Pasture
Glaciers

0 0.5 1 2 3 4 Kilometers




**Figure 25:** Chandratal lake - Potential HCV Area in Lahaul Valley for criterion 1 (Species & Diversity)




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N
W
E
S

Area Size : 65.55 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

- Chandratal
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Medial moraines
- Water body
- Barren Land
- Lateral moraines
- Agriculture
- Marshy land
- Snow cover
- Dry Alpine Pasture
- Glaciers

0 1 2 4 6 8 Kilometers

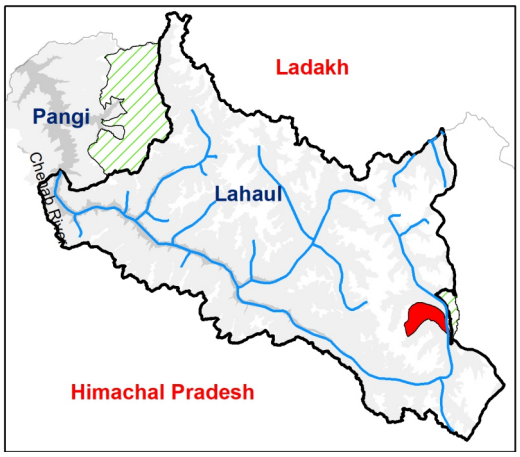
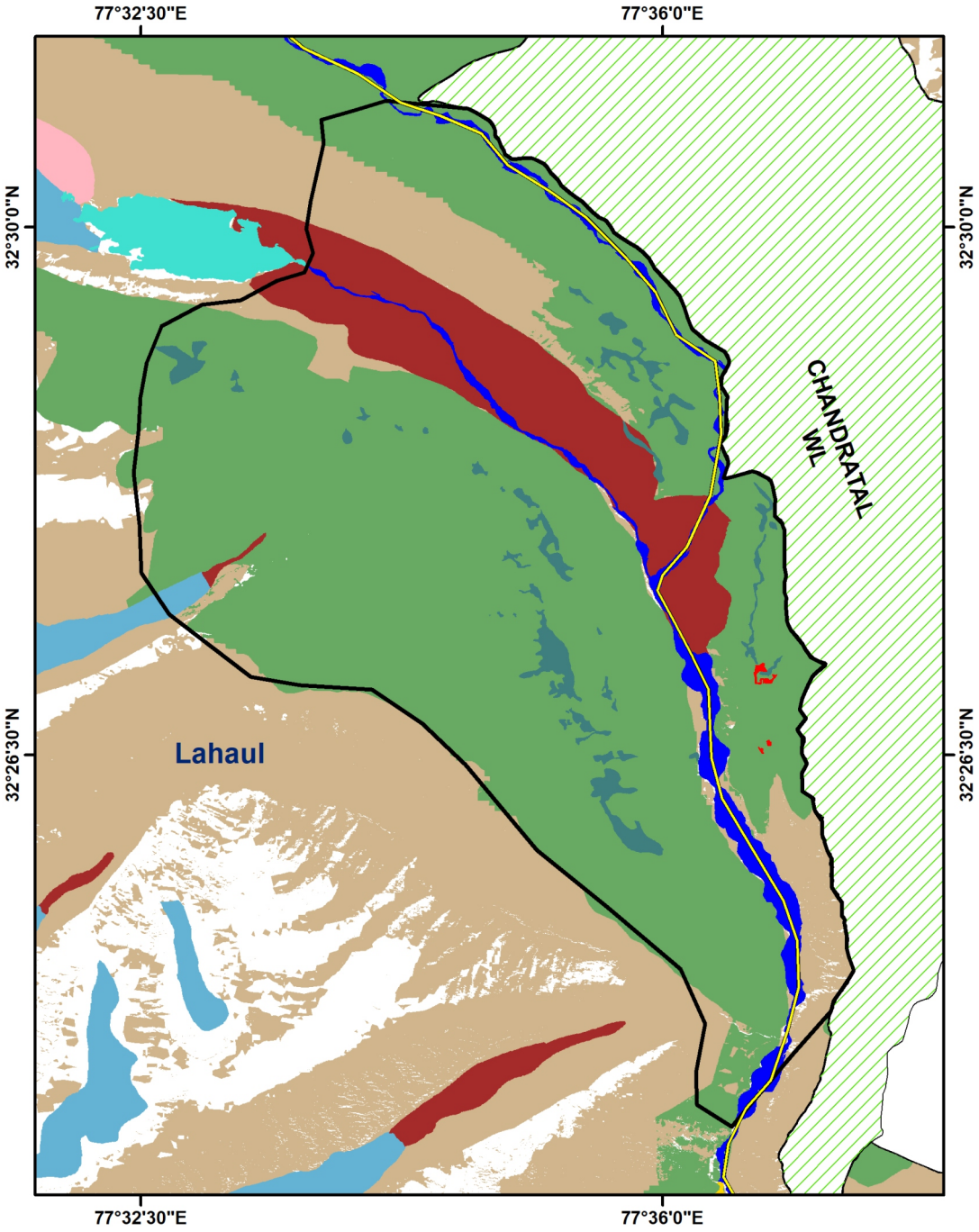



**Figure 26:** Chandratal lake - Potential HCV Area in Lahaul Valley for criterion 4 (Ecosystem Services)




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Wildlife Institute of India

N
W E
S

Area Size : 49.31 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

Chandratal
Drainage

**DEM (m)**

2,301 - 3,200
3,201 - 5,200
5,201 - 6,462

River
Terminal moraines
Water body
Barren Land
Lateral moraines
Marshy land
Snow cover
Dry Alpine Pasture
Glaciers

0 0.5 1 2 3 4 Kilometers

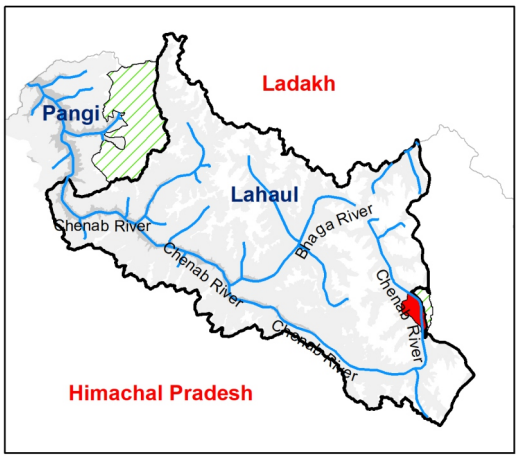
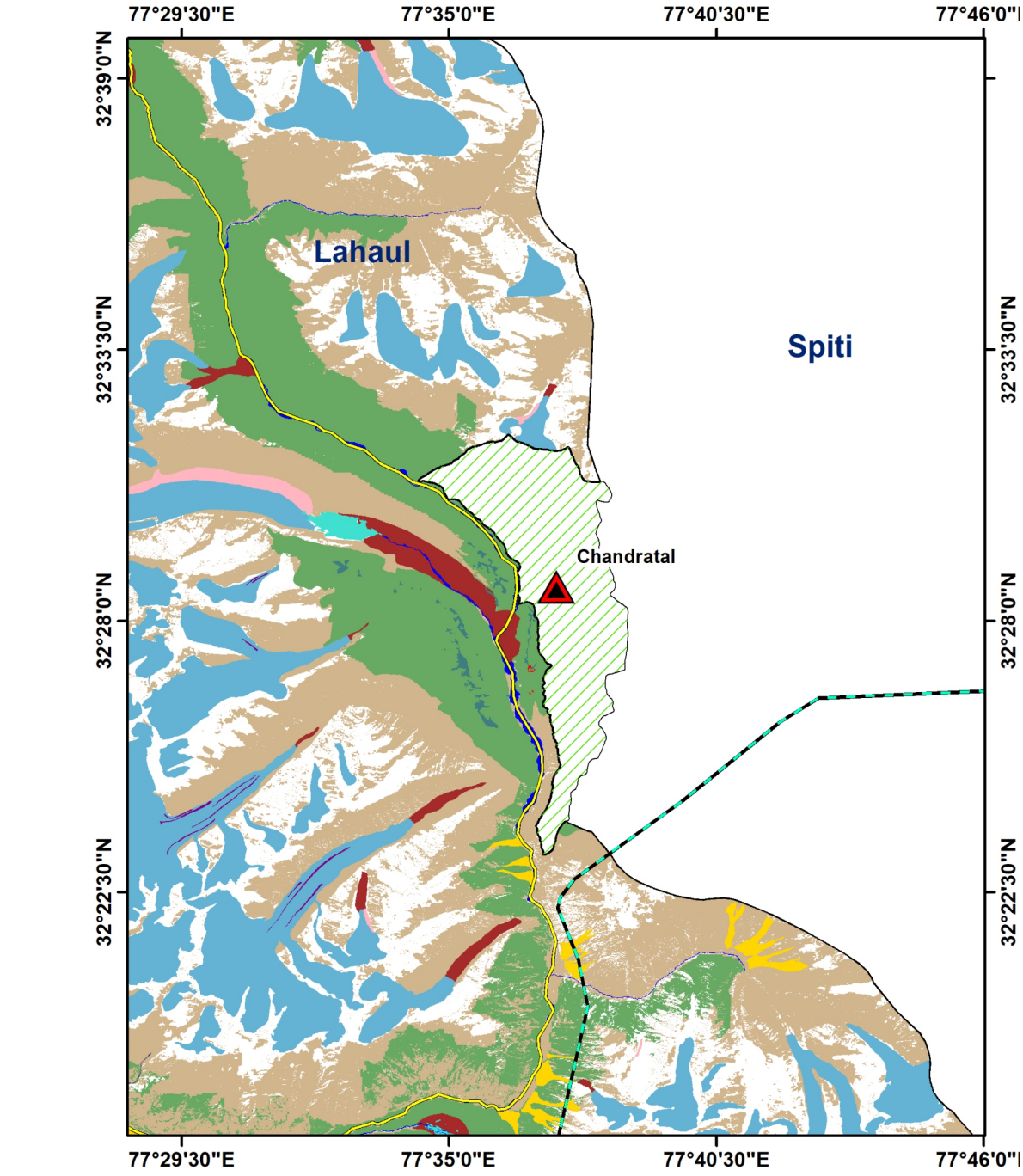



**Figure 27:** Chandratal lake - Potential HCV Area in Lahaul Valley for criterion 5 (Community Needs)




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N
W E
S

Area Size : 1.6 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

Chandratal
Drainage

**DEM (m)**

2,301 - 3,200
3,201 - 5,200
5,201 - 6,462

River
Terminal moraines
Settlement
Water body
Barren Land
Lateral moraines
Marshy land
Temperate coniferous
Snow cover
Dry Alpine Pasture
Glaciers
Fan Deposits

0 1.75 3.5 7 10.5 14
Kilometers

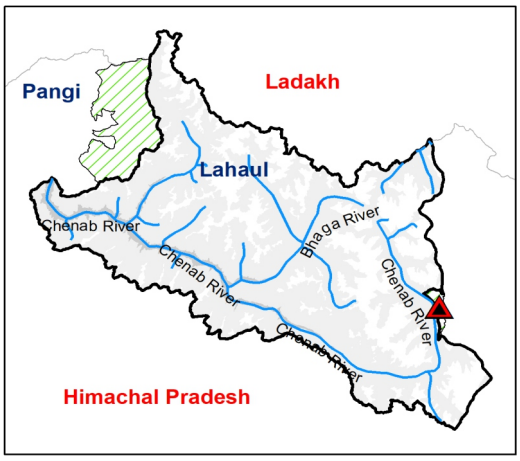



**Figure 28:** Chandratal lake - Potential HCV Area in Lahaul Valley for criterion 6 (Cultural Services)

## AREA 8: KOKSAR

It is the first village of Lahaul Valley around 19 km from Rohtang pass on the left bank of the river Chandra River. The area is is situated between 32° 21' 39.53" N-32° 22'46.24" N latitude and 77° 17' 31.50" E-76° 15' 43.50" E longitude, at an elevation range from 3524-4150 meters.

**HCV-3 (Ecosystem and Habitat)**

- The forested area consists of *Betula utilis* patch. These birch trees native to the Himalayas grow up to an elevation of 4500 meters and are heavily lopped for fodder, fuel-wood and medicinal purposes.
- Many chemical compounds are known to be extracted from the bark of *Betula utilis* for its use in the treatment of various diseases such as wound healing, skin disinfectant, bronchitis and diseases of the blood and the ear (Gorsi, 2002). It is also used in various antimicrobial, antioxidants, anti-inflammatory, anticancer, anti-HIV activities (Safdar *et al.*, 2017).
- The species is considered a threatened species by the local communities due to reduction in its numbers, due to utilization by local communities as informed by the key informants.

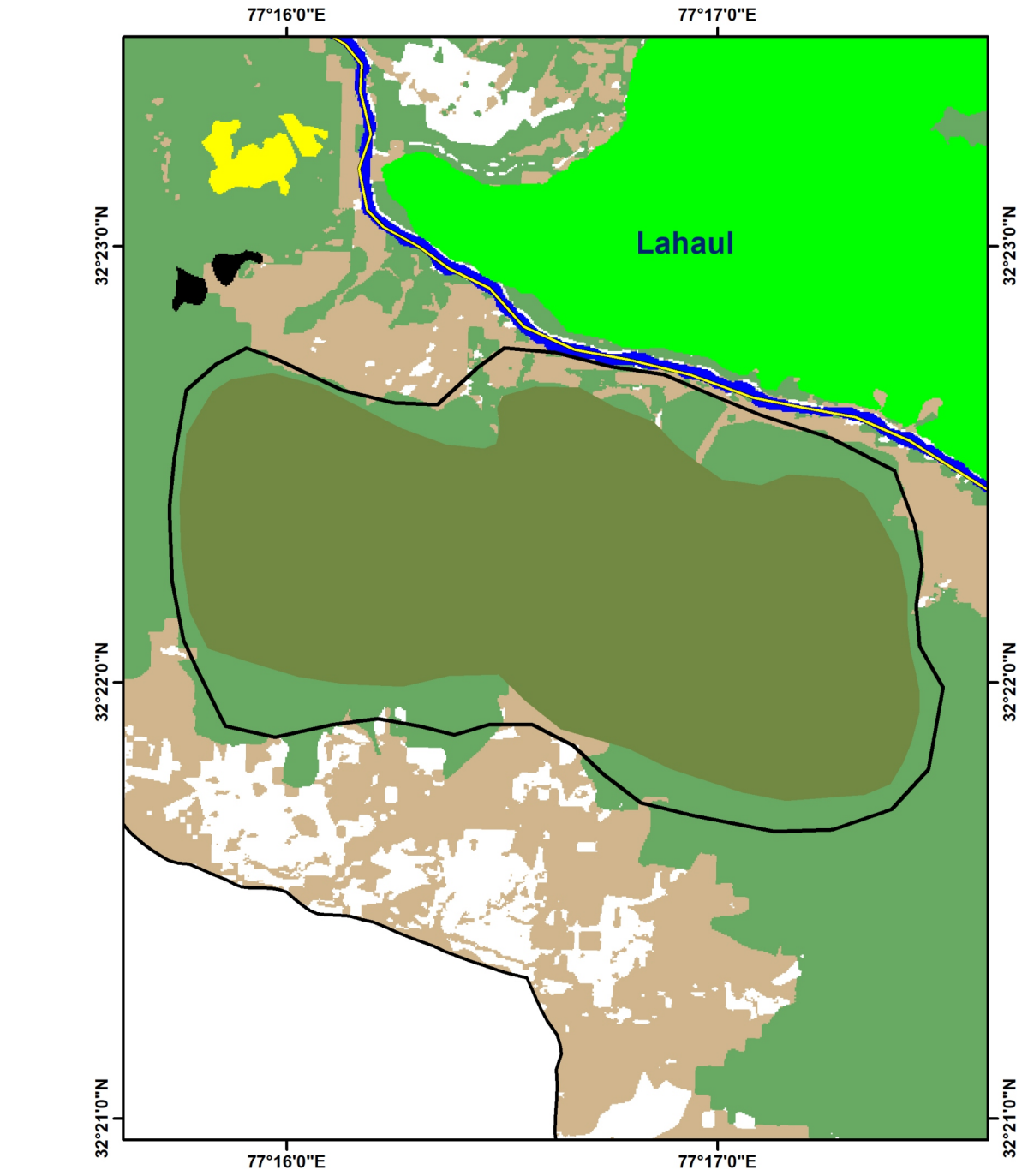
**Table 22:** Potential threats and conservation recommendation for High Conservation Value Area Koksar in Lahaul landscape of H.P.

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | Subsequent over-harvesting of Betula utilis over the years for fulfilling the needs of communities, in form of fuel-wood and other resources, has created a lot of pressure on its natural population (Kala, 2018) and with due course of time, the species would become locally endangered in parts of its distribution range (IUCN, 2017).<br>Over-exploitation of natural resources for timber wood, fuel-wood consumption and medicinal purposes from the forested areas. | Natural resource management by promoting sustainable utilization by promoting local involvement through participatory monitoring of forest resources like fuel-wood, fodder plants and medicinal plants is recommended<br>Studies on *Betula utilis* forests habitat for important species such a Musk Deer and other endangered wildlife species. |



**Image 7:** *Betula utilis* forest patch in Koksar, Lahaul Valley

*Dr. Gautam Talukdar*




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N
W E
S

Area Size : 4.29 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

- Koksar
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- Betula Utilis
- River
- Barren Land
- Agriculture
- Grassland
- Marshy land
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture

0 0.2 0.4 0.8 1.2 1.6
Kilometers

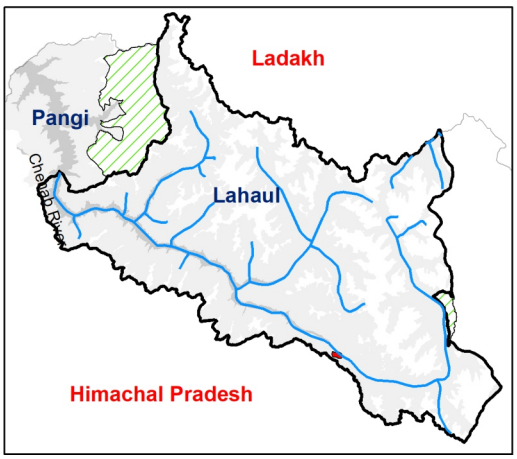



**Figure 29:** Koksar - Potential HCV Area in Lahaul Valley for criterion 3 (RET Ecosystem & Habitat)

## AREA 9: MRIKULA MATA TEMPLE

It is situated at 32° 43' 38.77" N latitude and 76° 39' 41.2" E longitudes, at an elevation of 2500 meters, on the right bank of the Chandrabhaga River in the Udaipur range of Lahaul Valley.

**HCV-6 (Cultural Values)**

- The temple was established in the 12th century (Sahni, 1994).
- It has been declared as a site of cultural importance by the Archaeological Survey of India (ASI); and is of high religious significance for devotees all across the district.
- The forest patch behind the temple mainly composed of trees of Blue pine, Juniper & willow sp. has been declared as a sacred grove by the local communities.

**Potential threats:**

1. As the site is of cultural importance for the local communities of Lahaul Valley, no activity is allowed in the sacred grove near the temple. However, waste management is major issue with respect to the waste generated due to temple activities as well as by tourists.
2. As the temple building is very old, it requires renovation owning to structural problems, so that it can be preserved.

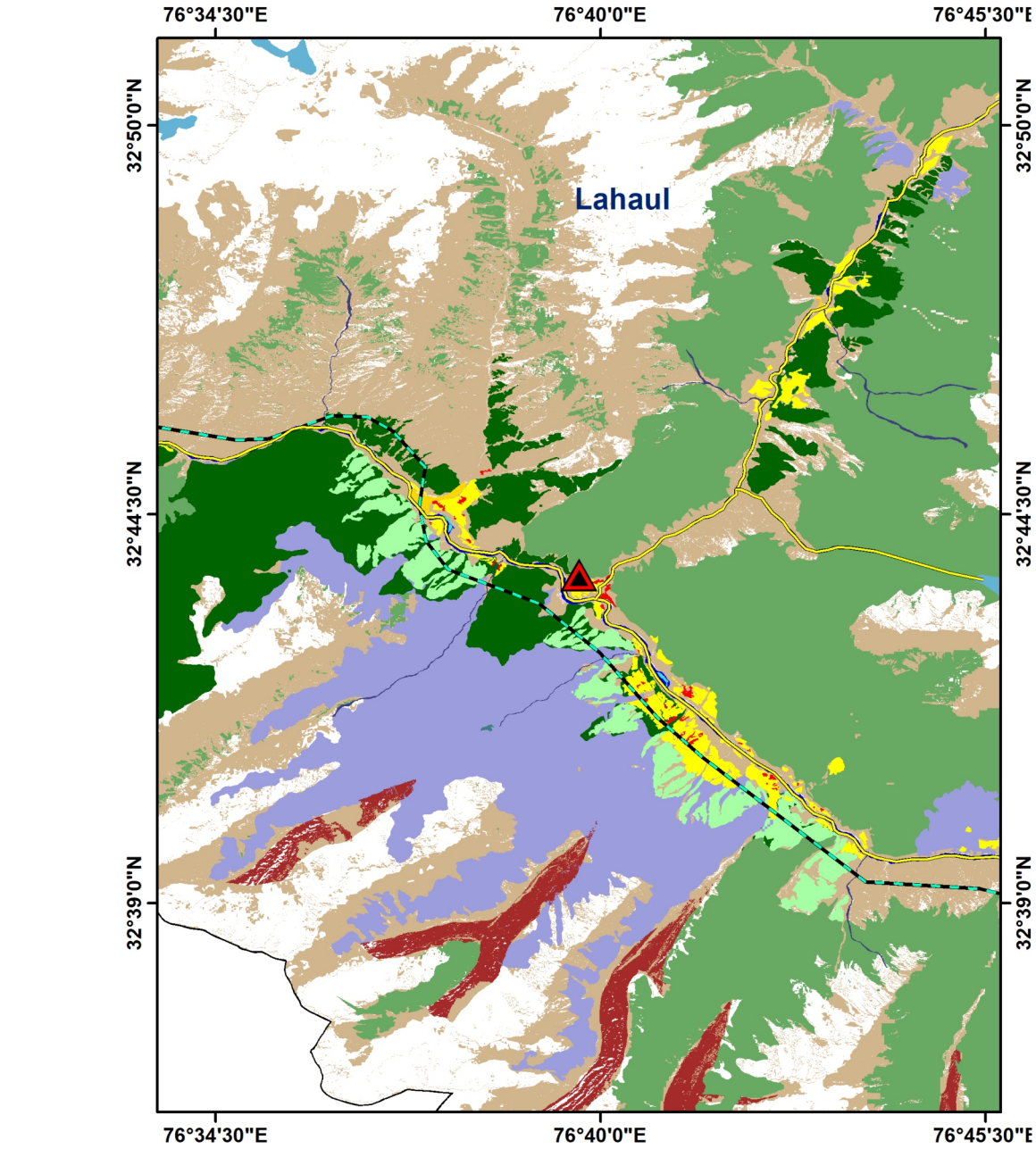
**Recommendation:**

1. The regulations on waste management as given by the Ministry of tourism for rural tourism areas – a zero waste approach, could be adopted for managing the waste in the region.
2. The temple is under the Archeological Department of Himachal Pradesh as a site of cultural importance, intimation and involvement of the officials of the department in renovation of the temple is recommended.
3. The recognition of the temple on such a vast scale could be utilized as an opportunity to spread awareness and promote community participation for biodiversity conservation with the help of the head priest of the temple.



**Image 8:** Mrikula Mata Temple, Udaipur Village, Lahaul Valley

Prateek Savita




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Wildlife Institute of India

N
W E
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Area Size : 0.27 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

Mirkula Mata
Road
Drainage

**DEM (m)**

2,301 - 3,200
3,201 - 5,200
5,201 - 6,462

River
Terminal moraines
Settlement
Barren Land
Lateral moraines
Agriculture
Marshy land
Temperate coniferous
Snow cover
Dry Alpine Scrub
Pine
Dry Alpine Pasture
Glaciers

0 1.25 2.5 5 7.5 10
Kilometers

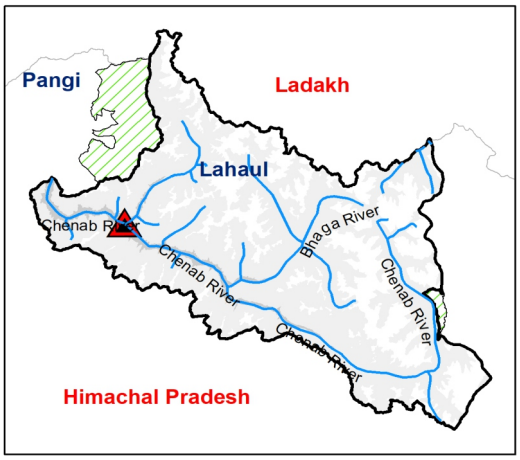



**Figure 30:** Mrikula Mata Temple - Potential HCV Area in Lahaul Valley for criterion 6 (Cultural Values)

## AREA 10: TRILOKINATH

The demarcated area is situated between 32° 33' 46.21" N - 32° 42' 21.65" N latitude and 76° 35' 29.67" E- 76° 44' 2.44" E longitude at an elevation range from 2884-5620 meters, in Lahaul valley of Himachal Pradesh.

**HCV-4 (Ecosystem Services)**

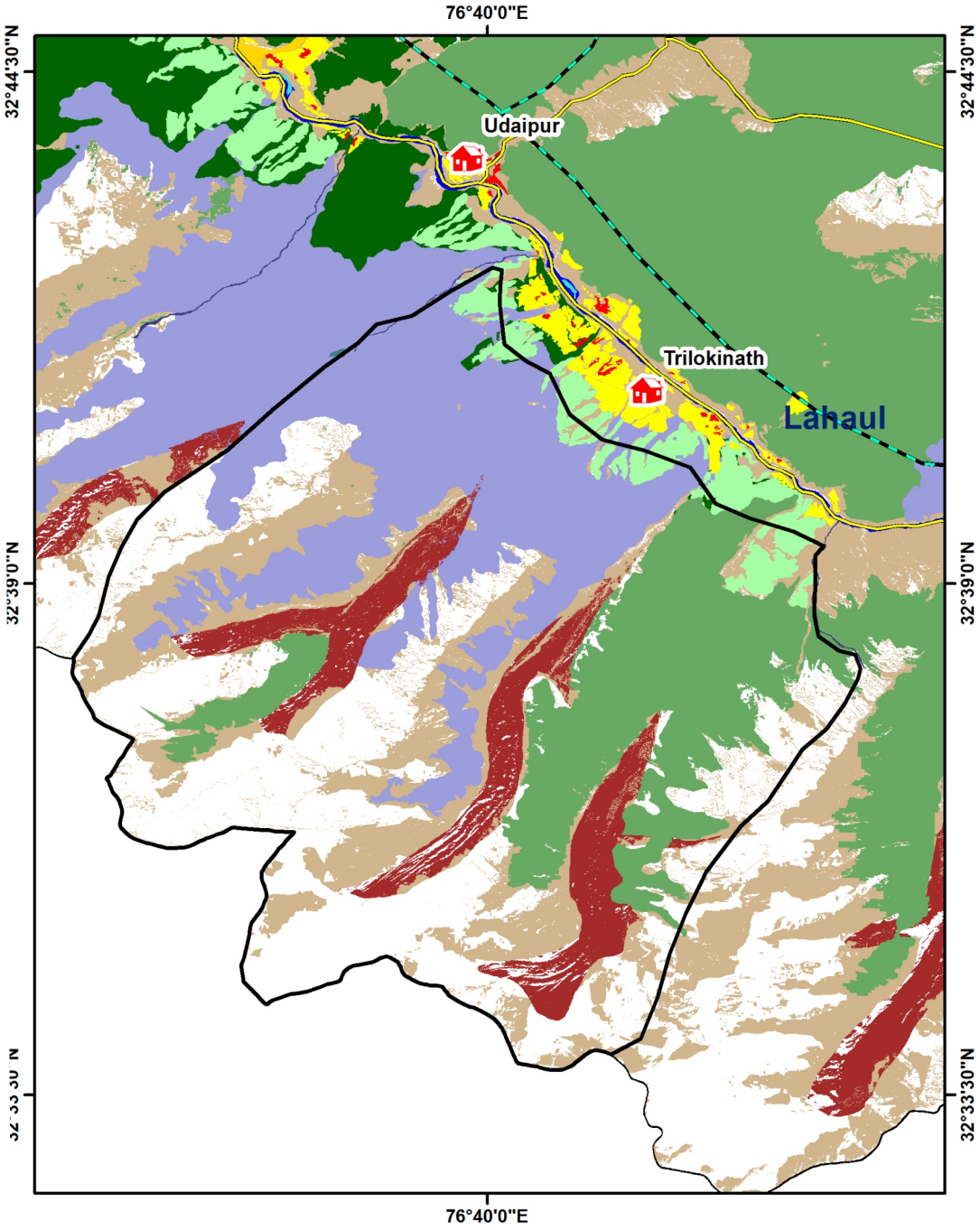
- The forested areas surrounding the temple and the village of Trilokinath not only provide resources for utilization of temple but also, provide supporting and regulating services; they help in regulating the flow of water within a catchment, prevent soil erosion and provide natural resources (e.g. fodder plants, timber as renewable raw material) for energy production and construction.
- They also prevent natural hazards (floods and landslides) and helps in carbon sequestration and storage, in biomass and soil.

**HCV-6 (Cultural Values)**

- The temple lies at 32° 41' 4.21"N latitude and 76° 41' 44"E longitudes, at an elevation of around 2700 m, and was established at the end of the 9th century and the beginning of the 10th century (District administration, Lahaul-Spiti).
- The site is of cultural importance for the local communities as it is one of the rare places which are worshipped equally by two different religions.
- The temple of Trilokinath, one of the holiest places in India, attracts flocks of sadhus (Hindu hermits) every year from all over India; and a large number of Buddhist pilgrims from Ladakh, Zanskar and other parts of the country (Sahni, 1994).

**Table 23:** Potential threats and conservation recommendation for High Conservation Value Area Trilokinath in Lahaul landscape of H.P.

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | Human wildlife conflict in the region has been observed in the form of loss of valuable cash crops and depredation of resident livestock by the Himalayan brown bear in the agricultural field around the settlements in the valley, and the village of Trilokinath. | Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended.<br>Community-based protection measures (solar fences and other barriers), to avoid crop losses, and spreading awareness about the subsidies provided by the government is suggested. |
| 2. | The temple has been constructed amidst the settlements in the village Trilokinath of Udaipur range. Waste management is a major issue with respect to the waste generated due to temple activities as well as by tourists. Littering is an issue as it is damaging the local landscape. | The regulations on waste management as given by the Ministry of tourism for rural tourism areas – a zero waste approach, could be adopted for managing the waste in the region.<br>Every summer, a fair is celebrated near the temple premises; people of all castes and creeds gather there and not only from Lahaul but Kullu and Chamba as well (Sahni, 1994).<br>This opportunity could be utilized to spread awareness amongst the local communities about conservation practices.<br>The area around Trilokinath temple is used by wildlife; this could be conserved for posteriety. Also many pilgrimage routes that are used need to be monitored for wildlife on a continual basis. |



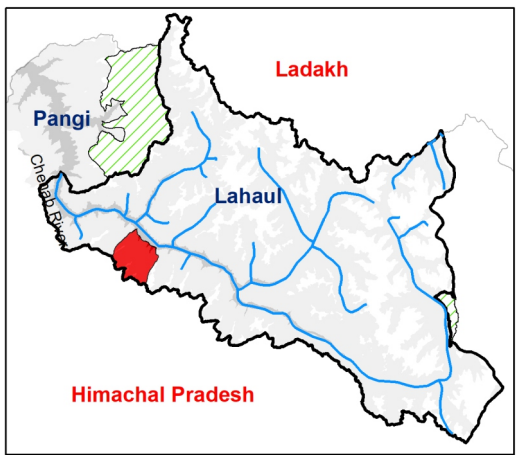
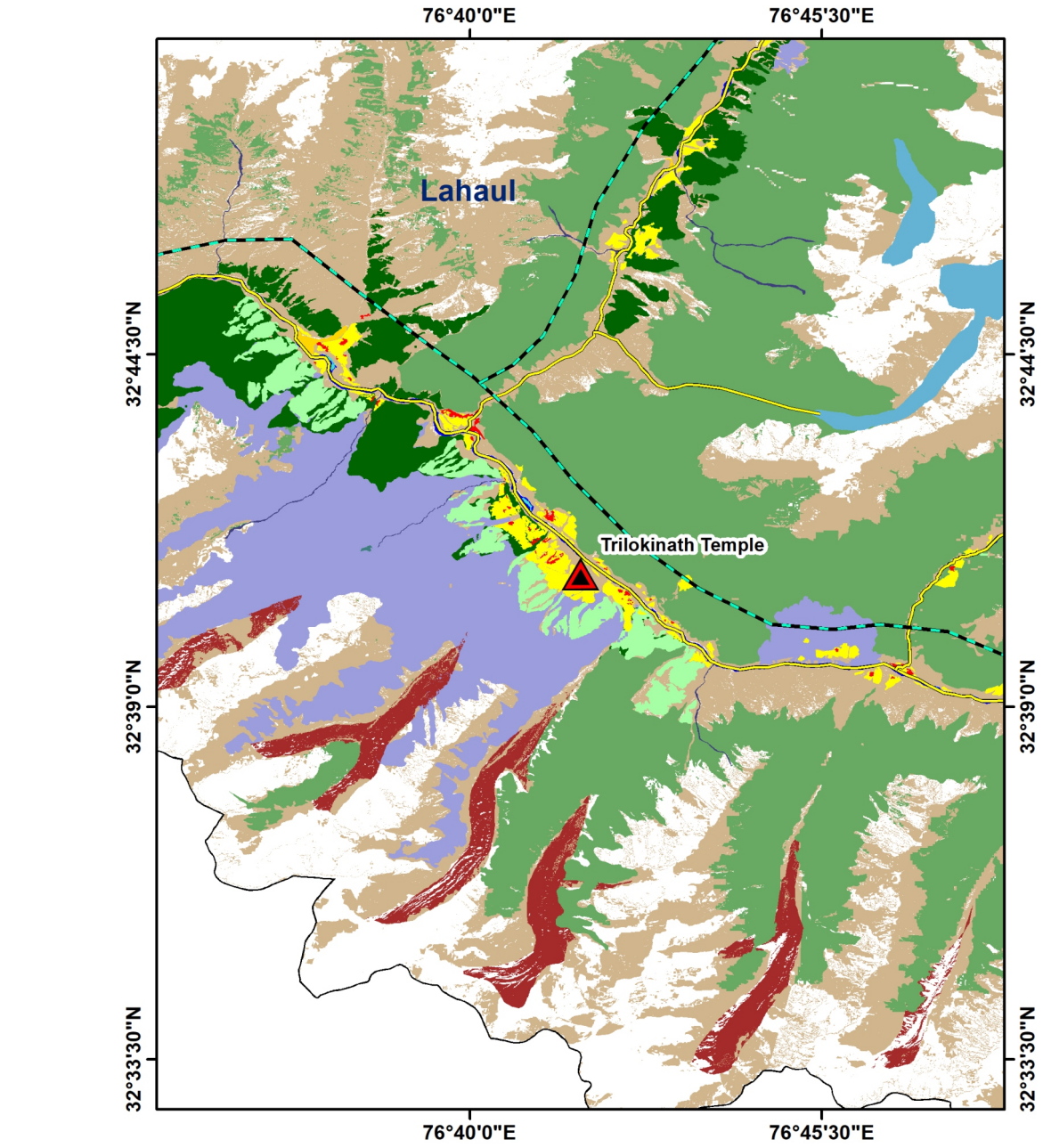




**Figure 31:** Trilokinath - Potential HCV Area in Lahaul Valley for criterion 4 (Ecosystem Services)




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N
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Area Size : 0.00097 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

- Trilokinath
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Barren Land
- Agriculture
- Marshy land
- Temperate coniferous
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture
- Glaciers

0 1.25 2.5 5 7.5 10 Kilometers

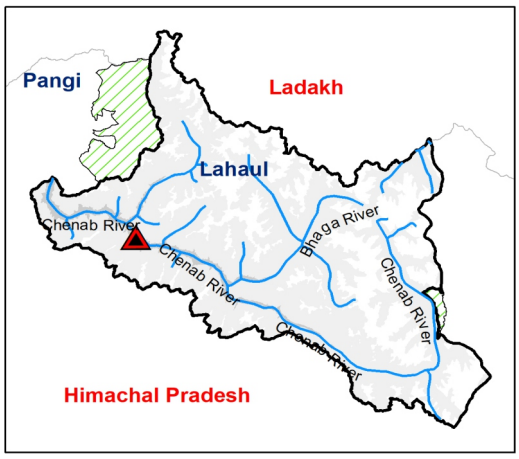



**Figure 32:**
Trilokinath Temple - Potential HCV Area in Lahaul Valley for criterion 6 (Cultural Values)

## AREA 11: KARDANG MONASTERY

It is situated at 32° 33' 42.37" N latitude and 77° 1' 14.51" E longitudes, at an elevation of 3400 meters, in Keylong range of Lahaul-Spiti district of Himachal Pradesh.

**HCV-6 (Cultural Values)**

- The monastery was established in the 12th century (Sahni, 1994).
- It is one of the largest monasteries of Lahaul and a famous center of Tibetan Buddhism today. The sect of Buddhism that this monastery is affiliated with is called the Drugpa sect, which is believed to have originated from Bhutan.

**Potential threats:**

1. As the site is of cultural importance for the local communities of Lahaul Valley, no threats to conservation, or otherwise, were observed during the survey.

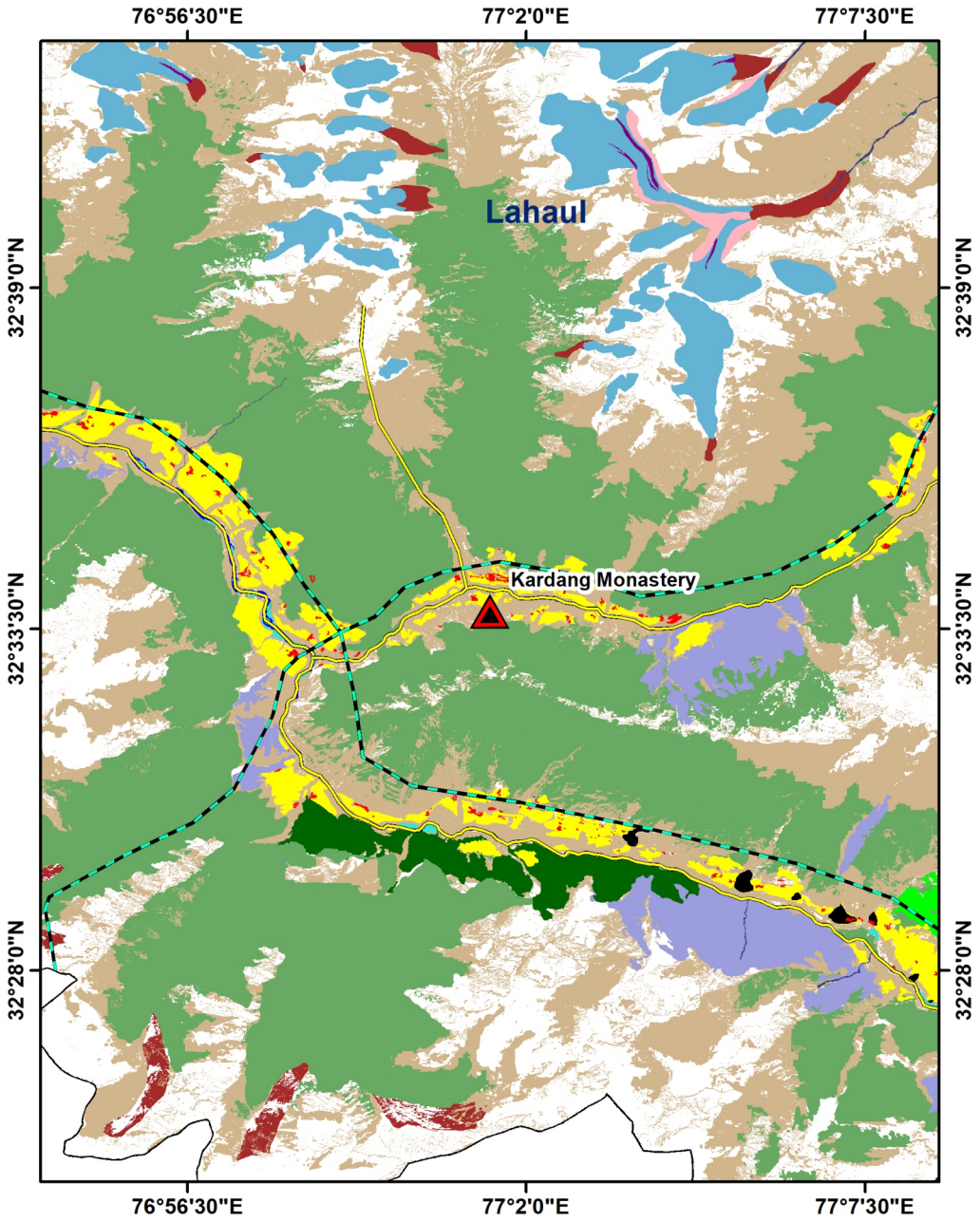
**Recommendation:**

1. The site is of high religious significance, in Keylong range of Lahaul-Spiti district, where devotees from across the district visit to pay obeisance to the local deity.
2. The recognition of the monastery on such a vast scale could be utilized as an opportunity to spread awareness and promote community participation for biodiversity conservation with the help of the head priest of the monastery.



**Image 9:** Kardang Monastery, Keylong, Lahaul Valley

Subhadra




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Wildlife Institute of India

N
W E
S

Area Size : 0.0059 Sq km
District : Lahaul & Spiti
State : Himachal Pradesh

**Legend**

- Kardang Monastery
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Barren Land
- Lateral moraines
- Agriculture
- Grassland
- Temperate coniferous
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 1.5 3 6 9 12 Kilometers

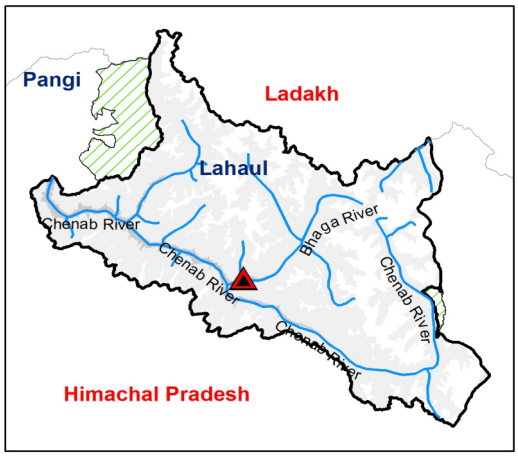



**Figure 33:** Kardang Monastery-Potential HCV Area in Lahaul Valley for criterion 6 (Cultural Values)

### 9.1.1 Resource availability and the extent of dependence of the local communities – Lahaul Valley

**Table 24: Resource availability and dependence of the communities in the HCVAs in Lahaul Valley**

| S.No | HCVAs | Resource availability & dependence of the local communities | | | | Extent of dependency |
|---|---|---|---|---|---|---|
| | | Livestock grazing | Medicinal plants/ NTFP extraction | Fuel-wood extraction | Fodder plants | |
| 1. | Miyar Valley | ✓ | ✓ | ✓ | ✓ | The local communities are highly dependent on the meadows and forested areas around the villages in the valley for livestock grazing, medicinal plants extraction, fuel-wood and fodder needs.<br>The pastures of Thanpattan in the northern extent of the Miyar valley, however, are not used by the local community but the migratory herders of Bharmour and Chamba districts during the summer season to graze their livestock, mainly the regions of Khaigot and Gumba. |
| 2. | Billing-Istingri | ✓ | | | | The pastures are the only source of livestock grazing for the local herders of the Billing and Istingri village in the Keylong range of the landscape; and the locals are highly dependent on the resources, mostly in the southern extent. |
| 3. | Darcha & Jispa | ✓ | | | | The pastures are the only source of livestock grazing for the local herders of the Darcha and Jispa village in the Keylong range of the landscape; and the locals are highly dependent on the resources, mainly in the south-eastern extent. |
| 4. | Pattan Valley (Naingar) | ✓ | ✓ | ✓ | ✓ | The local communities are highly dependent on the meadows and forested areas around the villages in the valley for grazing, medicinal plants extraction, fuel-wood and fodder needs.<br>The pastures of Alias got in the northern extent of the Pattan valley, is utilized by the migratory herders of the Gaddi communities for 2-3 months during summer, for grazing their livestock. |
| 5. | Hadsar | | ✓ | | | There are only three settlements in the village, mostly deserted for major part of the year. The area is well known for variety of high value medicinal plants, which are illegally exploited by intruders in the valley. Dependency of the locals on the resources is very low. |
| 6. | Kuruched | | | | | The area demarcated is known to harbor a variety of high value medicinal and aromatic plants, and lies across the Kuruched Nallah and the village. The dependency is local communities on the area is low, however, intruders are known to illegally extract medicinal plants from the area. |
| 7. | Chandratal | | | | | The area lies adjacent to the Chandratal WLS. The pastureland in the demarcated region is known to be utilized by migratory herders during summer seasons for 2-3 months, for livestock grazing. There are no settlements around and local communities are not dependent on the area for resources. |
| 8. | Koksar | | | | | The region demarcated is a patch of Betula utilis trees. There are no settlements around the area, and so, the local community is not dependent on the resources to fulfill their basic needs and necessities. |

***Note:*** *In the current frame and scope of the assignment, we have only attempted to list dependence of the communities on the various resources in the areas qualitatively; to understand the extent in detail the areas require further study and assessment which was beyond the time frame of the current assignment.*

## 9.1.2 Area-Statistics – Lahaul Valley

**Table 25: Area statistics of various High Conservation Value Areas (HCVAs) identified in Lahaul Valley**

| S.No. | Identified HCVA in Lahaul Valley | Size of the Area ($km^2$) | | | | | |
|---|---|---|---|---|---|---|---|
| | | HCV 1 | HCV 2 | HCV 3 | HCV 4 | HCV 5 | HCV 6 |
| 1. | Miyar Valley | 180.26 | 892.70 | 134.51 | 748.56 | 206.39 | - |
| 2. | Billing-Istingri | 81.45 | - | - | - | 62.73 | - |
| 3. | Darcha & Jispa | 163.38 | - | - | - | 66.29 | - |
| 4. | Pattan Valley (Naingar) | 47.04 | - | 37.32 | 170.78 | 61.50 | 37.5 |
| 5. | Hadsar | 46.57 | - | - | - | - | - |
| 6. | Kuruched | 8.32 | - | - | - | - | - |
| 7. | Chandratal | 56.24 | - | - | 65.55 | 49.31 | 1.6 |
| 8. | Koksar | - | - | 4.29 | - | - | - |
| 9. | Mrikula Mata Temple | - | - | - | - | - | 0.27 |
| 10. | Trilokinath Temple | - | - | - | - | - | 0.00097 |
| 11. | Kardang Monastery | - | - | - | - | - | 0.0059 |

## 9.1.3 Land use/tenure of the areas identified as HCVAs – Lahaul Valley

**Table 26:** Land use/tenure of various High Conservation Value Areas (HCVAs) identified in Lahaul Valley

| S.No. | HCVAs (Lahaul Valley) | Existing Provision | Land use/tenure |
|---|---|---|---|
| 1. | Miyar Valley | (Demarcated Protected Forest) DPF Khanjar/DPF Shelling, DPF Chimrit, DPF Shakoli, DPF Urgos, DPF Chhaling, DPF Karpat | The valley comprises of forested areas, settlements, agricultural lands and the largest pastureland of the valley, Thanpattan. The settlements and agricultural lands are private lands owned by the local residents. The pasture lands and the forested areas falls under State Forest Department, however, the local communities are allowed to extract resources from the forest and utilize pastures for grazing their livestock. The pastures of Thanpattan are majorly used by migratory herders of the Gaddi community. |
| 2. | Billing-Istingri | - | The local herders of the villages of Billing and Istingri, and Darcha and Jispa have grazing permissions/rights over the region to graze their livestock during summer; however, the area falls under the jurisdiction of the State Forest Department. The residents of Jispa, Khangsar and Kolang have rights over forested area for extraction of natural resources. |
| 3. | Darcha & Jispa | (Reserved Forest) RF Jispa | |
| 4. | Pattan Valley (Naingar) & Neelkanth lake | DPF Dulling, DPF Chhogzing, DPF Nalda, DPF Zobrang, DPF Jasrath, RF Lote, RF Mulling, RF Chewar | The valley comprises of alpine meadows, forested areas, settlements, agricultural lands and a high-altitudinal lake cultural significance for the local communities. The settlements and agricultural lands are private lands owned by the local residents; and the forested lands and pastures falls under State Forest Department. The locals (of Naingar, Chhogzing, Gwari, Chokhang villages), however, are permitted to utilize the forested area to fulfill their basic needs of fuel-wood and medicinal plants. |
| 5. | Hadsar | DPF Hadsar | The area is known for a variety of high value medicinal plants it supports and the land use includes forested tracts and alpine meadows. The area falls under the jurisdiction of the State Forest Department. The residents of Hadsar village have been given the rights to extract resources from the forested area, mainly to fulfill their need of fuel-wood. |

| S.No. | HCVAs (Lahual Valley) | Existing Provision | Land use/tenure |
|---|---|---|---|
| 6. | Kuruched | Protected Forest Kuruched | The area falls under the State Forest Department; and mainly comprises of alpine meadows. The demarcated area is on the left bank of the Kuruched Nallah, and the settlements and agricultural lands *i.e.* the private land of the local communities is on the right bank of the rivulet. The villagers of the Kuruched village have been given the rights to extract resources from the forested region. |
| 7. | Chandratal lake | Eco-sensitive zone of Chandratal WLS | The area of Chandratal Wildlife Sanctuary falls under the Spiti Wildlife Division of Himachal Pradesh Forest Department. |
| 8. | Koksar | (Un-demarcated Protected Forest) UPF Koksar | The area demarcated is a patch of Betula utilis trees near Koksar, alone the side of the road. The area falls under the jurisdiction of the State Forest Department. |
| 9. | Mrikula Mata Temple | Site under Archaeological Survey of India (ASI) | The temple has been declared as a site of cultural importance by the Archaeological Survey of India; and falls under the Archaeological Department of Himachal Pradesh. The sacred grove behind the temple is utilized to extract resources for temple related purposes/use. |
| 10. | Trilokinath Temple | DPF Trilokinath | The temple is under the control of the State government and is maintained by the temple committee which comprises of Sub Divisional Magistrate SDM Udaipur as its chairman and many officials and non-official members. |
| 11. | Kardang Monastery | Kardang | The monastery, affiliated with the Drugpa sect, is situated on the left bank of the river Bhaga just above the village Kardang. The monastery as reported belongs to the Red Hat Sect. Kardang Village & Kardang Gompa has been given special rights to extract resources from the forested region. |

### 9.1.4 Coordinates and Elevation Range of the areas identified as HCVAs – Lahaul Valley

**Table 27: Coordinates and Elevation range of High Conservation Value Areas (HCVAs) identified in Lahaul Valley**

| S.No | Area | Latitude | Longitude | Elevation |
|---|---|---|---|---|
| 1. | Miyar Valley | 32° 45' 23.14"N -33° 15' 26.55"N | 76° 40' 0.51"E -77° 0' 36.90"E | 2838-6080 m |
| 2. | Billing-Istingri | 32° 38' 13.66"N -32° 39' 47.03"N | 77° 0' 17.95"E -77° 05' 11.28"E | 3208-5185 m |
| 3. | Darcha & Jispa | 32° 42' 33.78"N -32° 45' 13.77"N | 77° 15' 55.87"E -77° 17' 2.53"E | 3402-5450 m |
| 4. | Pattan Valley (Naingar) | 32° 40' 53.06"N -32° 53' 26.88"N | 76° 47' 03.68"E -77° 01' 44.27"E | 3090-5662 m |
| 5. | Hadsar | 32° 40' 25.58"N -32° 43' 20.43"N | 76° 24' 34.58"E -77° 26' 32.26"E | 2590-5165 m |
| 6. | Kuruched | 32° 44' 52.17"N -32° 40' 26.06"N | 76° 29' 57.84"E -76° 32' 30.80"E | 2925-4766 m |
| 7. | Chandratal | 32° 24' 3.62"N -32° 30' 50.87"N | 77° 28' 31.43"E -76° 37' 16.29"E | 4090-6028 m |
| 8. | Koksar | 32° 21' 39.53"N -32° 22'46.24"N | 77° 17' 31.50"E -76° 15' 43.50"E | 3524-4150 m |
| 9. | Trilokinath | 32° 33' 46.21"N - 32° 42' 21.65"N | 76° 35' 29.67"E- 76° 44' 2.44"E | 2884-5620 m |

## 9.2 Potential High Conservation Value areas in Pangi Landscape

In the Pangi valley, survey for identification of HCVAs was conducted in three ranges, namely, Killar range, Purthi range and Sach range. In total 15 villages were visited in the valley and stakeholder consultation was carried out using a semi-structured questionnaire. The identification of areas was based on stakeholder consultation and field visits to the potential areas. Across the landscape, 6 potential areas were identified under six different criteria of High Conservation Values. The areas identified include areas rich with medicinal and aromatic plants, regions serving as habitat for key species in the landscape like dry alpine pastures, alpine scrubs, and forested area, RET ecosystems and habitat, areas and sites important for fulfilling basic needs of the local communities and sites important from cultural and religious view point for the indigenous people. For each of the areas identified as HCVAs, potential threats and conservation recommendation has also been formulated. Table 9 represents all the areas identified in the Pangi valley landscape and different criteria under which they have been classified.Various areas have been delineated under different categories, however for HCV 2 *i.e.* Landscape-level ecosystems, entire Pangi Valley is a potential conservation area, which needs to be managed and monitored.

- 19 species of mammals have been reported from Pangi valley (ZSI, 2013) out of which 5 species are threatened (VU: 2 Species, CR: 1 species, EN: 1 species and NT: 1 species)
- 45 different species of medicinal plants belonging to 20 different families have been reported from Pangi valley (Dutt *et al.*, 2014); and around 62 species of birds have been reported from Pangi region (Saikia *et al.*, 2008).

**Resident livestock population in Pangi Valley**

The following data was retrieved on the livestock population in the Pangi Valley as per the census conducted in the given years:

**Table 28: Species-wise data of livestock census of Pangi Block, H.P.**

| Species | Cattle | Buffalo | Mithun | Yak | Sheep | Goat | Horse & Pony | Mule | Donkey | Camel & Pig | Total Population |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 19th Livestock Census (2012) | 10905 | - | - | 195 | 22460 | 12155 | - | 374 | - | - | 54094 |
| 20th Livestock Census (2019) | 10640 | 0 | 0 | 96 | 20730 | 11689 | 23 | 379 | 31 | 0 | 44175 |

In order to determine the change in resident/local livestock's population in the landscape, an Anova test has been performed. Mean of available data of 19th (2012) livestock census was compared with the mean of 20th (2019) livestock census of Pangi landscape to verify if there is a statistically significance difference in two different time period data. As per the test, F-value is 0.005, P-Value is 0.94 and F critical is 4.35; in Pangi there there is no significant difference in livestock data of 2 different time period.

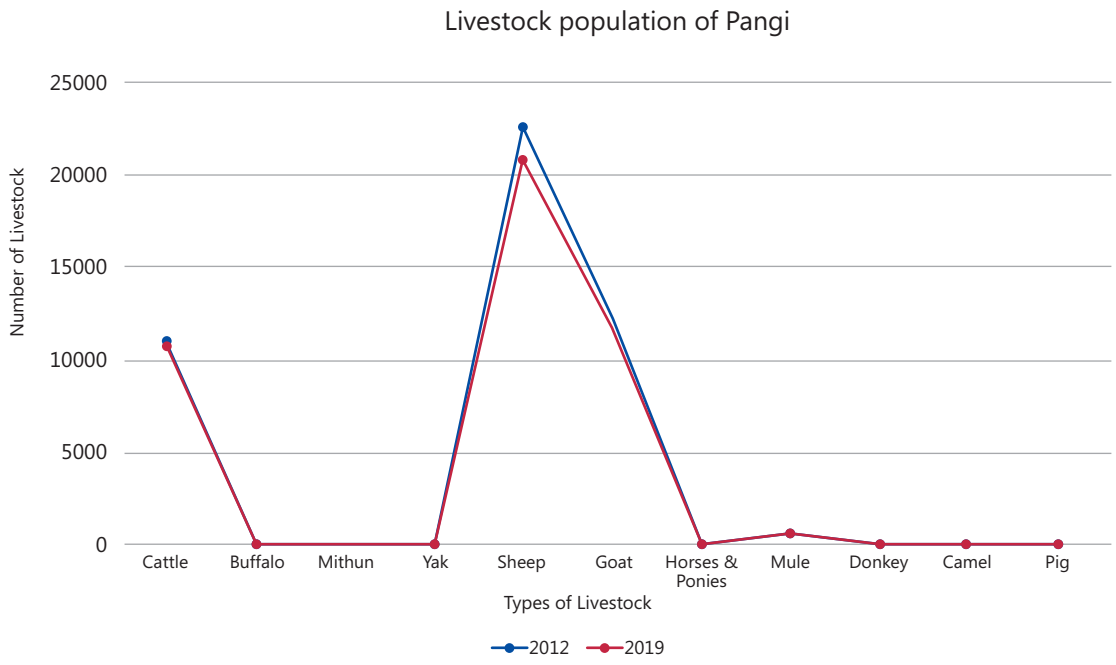



**Figure 34:** Comparison of resident livestock data of 19th and 20th livestock census of Pangi Valley

## Resident livestock population in Chamba District

The following data was retrieved on the livestock population in the Chamba district as per the census conducted in the given years:

**Table 29: Species-wise data of livestock census of Chamba district, H.P.**

| Species | Cattle | Buffalo | Mithun | Yak | Sheep | Goat | Horse & Pony | Mule | Donkey | Camel | Pig | Total Population |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18th Livestock Census (2007) | 317256 | 39409 | 0 | 220 | 316565 | 240564 | 818 | 4237 | 406 | 0 | 4 | 19479 |
| 19th Livestock Census (2012) | 313194 | 32465 | 73 | 643 | 254929 | 204511 | 1596 | 5418 | 279 | 10 | 1114 | 814232 |
| 20th Livestock Census (2019) | 261939 | 24795 | - | - | 242571 | 223558 | - | - | - | - | 137 | 753000 |

In order to determine the change in resident/local livestock's population in the landscape, an Anova test has been performed. Mean of available livestock census data of 18th and 20th census of Chamba district was compared to verify if there is a significance difference in two different time period data. As per the test F-value is 0.08, P-Value is 0.77 and F critical is 4.35; in Chamba district, statistically, no significant difference was observed.

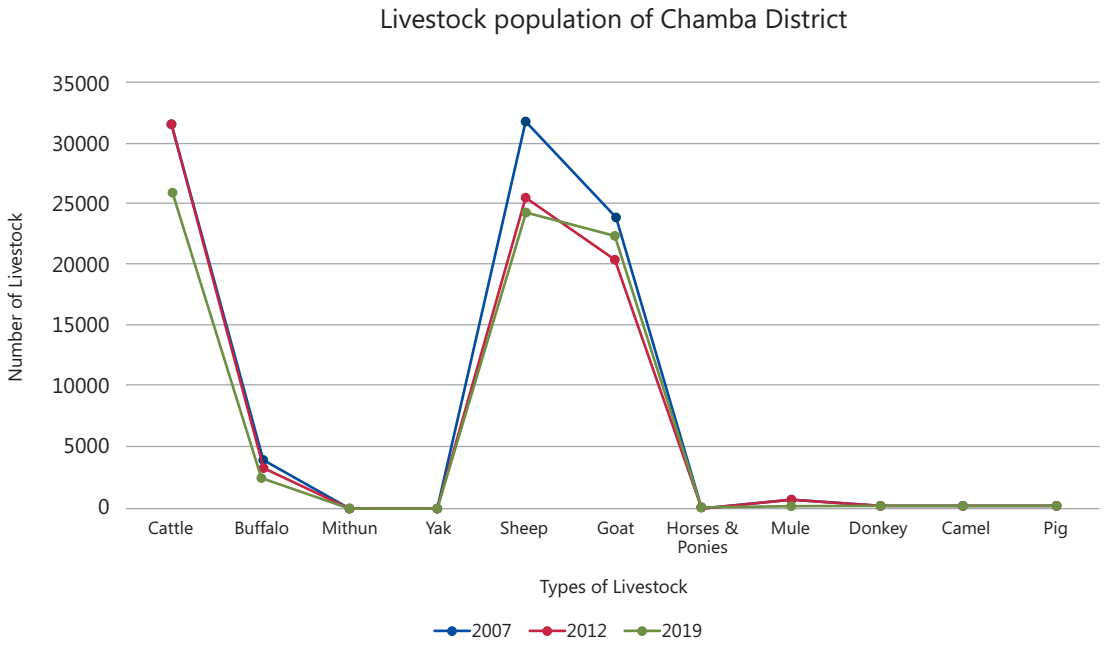



**Figure 35:** Comparison of resident livestock data of 18th, 19th and 20th livestock census of Chamba District

***General threats:***

1. Intensive livestock grazing has led to pastureland degradation and if no corrective measures are taken in the foreseeable future, the conditions would turn worse.
2. Excessive anthropogenic pressure in the Himalayan region in form of exploitation of resources, pressure due to grazing and overharvesting of medicinal and aromatic plant species from their natural habitats (Kala *et al.*, 1998; Rai *et al.*, 2000) has adversely affected the availability of several high-value medicinal plants.
3. Overharvesting, pre-mature harvesting, illegal extraction and over-exploitation of the pastures has threatened the status many of rare medicinal plants in the valley. Continuation of this trend, especially any further instances of over-harvesting, premature and illegal harvesting in the valley is likely to lead to further over-exploitation of these limited resources.
4. The coexistence between large carnivores and humans is difficult because of the threat these predator species pose to humans and their livestock (Linnell *et al.*, 2001).
5. Depredation of livestock of local communities, by snow leopard and the Himalayan brown bear have been reported in the valley. Conflict amongst the wildlife and the people in the region has also been observed in all

the villages of the valley in form of crop destruction by the Asiatic black bear, brown bear and monkeys. If these conditions continue, it will further affect the attitude of local communities towards the conservation of these species.

6. The working conditions are harsh, and time available to work in the landscape is short. Unavailability of funds, patrolling gears and vehicles for undertaking management related activities is a matter of concern.

***General conservation recommendations:***

1. Detailed study and assessment on grazing impacts and its control is suggested. Demarcation of critical areas within the pastures for migratory livestock grazing, to reduce pressure on pastures due to grazing.
2. Implementation of integrated pastureland management regimes/systems with the support of the forest department and local communities.
3. By 'integrated pasture management systems' we imply that all aspects of pasture management that include, maintaining the quality of pasture, livestock health and nutrition, and maintenance of native wildlife are sustainably maintained. These envisages (a) putting in place community-based mechanisms towards sustainable management of fodder resources and grazing lands, (b) enhancing the productivity/ carrying capacity of the grazing lands, and (c)monitoring of livestock diseases and timely treatment (d) ensuring that wild herbivores are accommodated (e) effectively managing any conflicts with carnivores and (f) partnering with research organizations is established, which can provide technical backstopping on key issues (e.g. level of degradation, carrying capacity, health, etc.).
4. It is also suggested that a comprehensive grazing and pasture development policy should be discussed at the state level that can provide better direction to the development and sustenance.
5. Few of the practices that could be incorporated for pastureland management are: (i) Formulation of a policy on grazing and pastureland development/improvement in consultation with the local communities and domain experts, (ii) Identification of a suitable organization/agency to coordinate various research programs for pastureland management and development, (iii) Delineation and mapping of ecologically sensitive pastures across the landscape and development of appropriate rehabilitation models, and, (iv) Promote incorporation of fodder trees with agricultural practices towards agro-forestry initiatives.
6. Also, the management strategies for reducing pasture pressure as suggested by SECURE-Participatory and integrated landscape-level management strategy project, in the landscape of Lahaul-Pangi, could be followed.
7. Enhanced training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders
8. Collaboration of a well-trained conflict management team including forest department, veterinarians and staff of wildlife based NGOs or organizations to respond to conflict situation like animal rescue, treatment, translocation/monitoring.
9. Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended; also, the strategies suggested by the SECURE-HWC (human-wildlife conflict) project in Lahaul-Pangi landscape, could be followed.
10. Community-based protection measures (solar fences and other barriers), to avoid crop losses, and spreading awareness about the subsidies provided by the government is suggested
11. Enhanced collaboration between enforcement agencies and the local communities, for improved surveillance to identify, monitor and prevent the illegal activities prevalent; and continued on-job training on fronts like wildlife monitoring, wildlife law and legislation is recommended.
12. Development of capacity of the staff to carry out patrolling throughout the landscape is required. Increasing the field staff strength and providing them with necessary field gears and/or vehicles for patrolling needs to be considered.

**Table 30: List of Potential High Conservation Value Areas as identified under various criteria in the Pangi Valley, H.P.**

| S.No. | Area | HCV Criteria | | | | | |
|---|---|---|---|---|---|---|---|
| | | HCV 1 | HCV 2 | HCV 3 | HCV 4 | HCV 5 | HCV 6 |
| | | **Pangi Landscape** | | | | | |
| 1. | Sural Bhatori (& Sural Gompa) | ✓ | ✓ | | ✓ | ✓ | ✓ |
| 2. | Sechu Tuan ESZ | ✓ | | | | ✓ | |
| 3. | Hudan Bhatori | ✓ | ✓ | | ✓ | ✓ | |
| 4. | Kadu Nallah | ✓ | ✓ | | ✓ | ✓ | |
| 5. | Mindhal (& Mindhal Mata Temple) | ✓ | | | ✓ | ✓ | |
| 6. | Luj | | | ✓ | ✓ | ✓ | |





**Image 10:** Resident livestock herder with livestock in Pangi Valley

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**Deatailed listing of High Conservation Value Areas in Pangi Valley**

## AREA 1: SURAL BHATORI

It is situated at 33° 07' 59.94" N-33° 12' 33.63" N latitude and 76° 24' 53.25" E -76° 37' 39.05" E longitudes at an elevation range from 2903-5397 meters. The main village of Sural is located at an elevation of about 3050 meters and Sural Bhatori is located at an elevation of about 3200 meters above the mean sea level.

**HCV-1 (Species and Diversity)**

- Major Faunal species, as reported by key informants, in the area are snow leopard, Himalayan brown bear, Tibetan wolf, Asiatic black bear, Himalayan red fox, Asiatic ibex, and Himalayan musk deer.
- Occupancy probability for snow leopard and Asiatic ibex is 0.61-0.70 & 0.51-0.60 respectively (Ghoshal, 2017).
- Few of the important floral species recorded in the area include *Picrorhiza kurroa, Dactylorhiza hatagirea, Aconitum heterophyllum, Podophyllum hexandrum, Fritillaria roylei, and Saussurea costus* (cultivated) and trees of *Betula utilis*.
- Threatened avifaunal species reported from Sural region area are Himalayan Monal (*Lophophorus impejanus*) and Himalayan griffon (*Gyps himalayensis*).
- According to Trevor, 2019 (Unpublished) well-preserved patch of Betula utilis forest extending down till Sural Nallah supports endemic bird species of tytler's leaf warbler (*Phylloscopus tytleri*), orange Bullfinch (*Pyrrhula aurantiaca*) and Kashmir flycatcher (*Ficedula subrubra*) as well.

**HCV-2 (Large landscape-level Ecosystems)**

Under criterion 2, entire Pangi valley encompassing an area of about 1600 $km^2$ has been identified as a potential area for conservation as per the definition of the criteria. However, within the landscape, Sural Bhatori has also been identified as crucial areas for supporting a variety of species and for maintaining connectivity of habitat.

- The area encompasses a huge patch of *Betula utilis* commonly known as Bhojpatra, up to an elevation of 3800m, interspersed with willow (salix sp.)
- It serves as a habitat for predator species as well as wild-herbivores and is known to support populations of Himalayan brown bear and Himalayan musk deer. The upper reaches of the region are undulated terrain and supports the population of Asiatic Ibex.
- The region has been identified as an important and potential breeding area for musk deer and Asiatic ibex.
- The demarcated area also includes meadows that are rich with various high value medicinal plants.

**HCV-4 (Ecosystem Services)**

- The forested areas dominated by Betula utilisinterspersed with medicinal plants and alpine meadows of the Sural Bhatori provide supporting and regulating services.
- They prevent natural hazards (floods and landslides) and helps in carbon sequestration and storage, in biomass and soil.
- Forested areas help in regulating the flow of water within a catchment, prevent soil erosion and provide natural resources (e.g. fodder plants, timber as renewable raw material) for energy production and construction.

**HCV-5 (Community Needs)**

- The *Betula utilis* forest on the left bank of Sural nalla is being used by the villagers to extract fuel-wood, fodder and medicinal plants from the upper reaches of the forest.
- The pastures are being utilized by the local communities for extraction of high-value medicinal plants and livestock grazing; Adhwari (temporary summer settlement) are used during such times.
- The Sural panchayat includes the villages of Kanwas, Ganmas, Tai, Rusmos, Bahrli, Andali, Sural and Sural Bhatori.

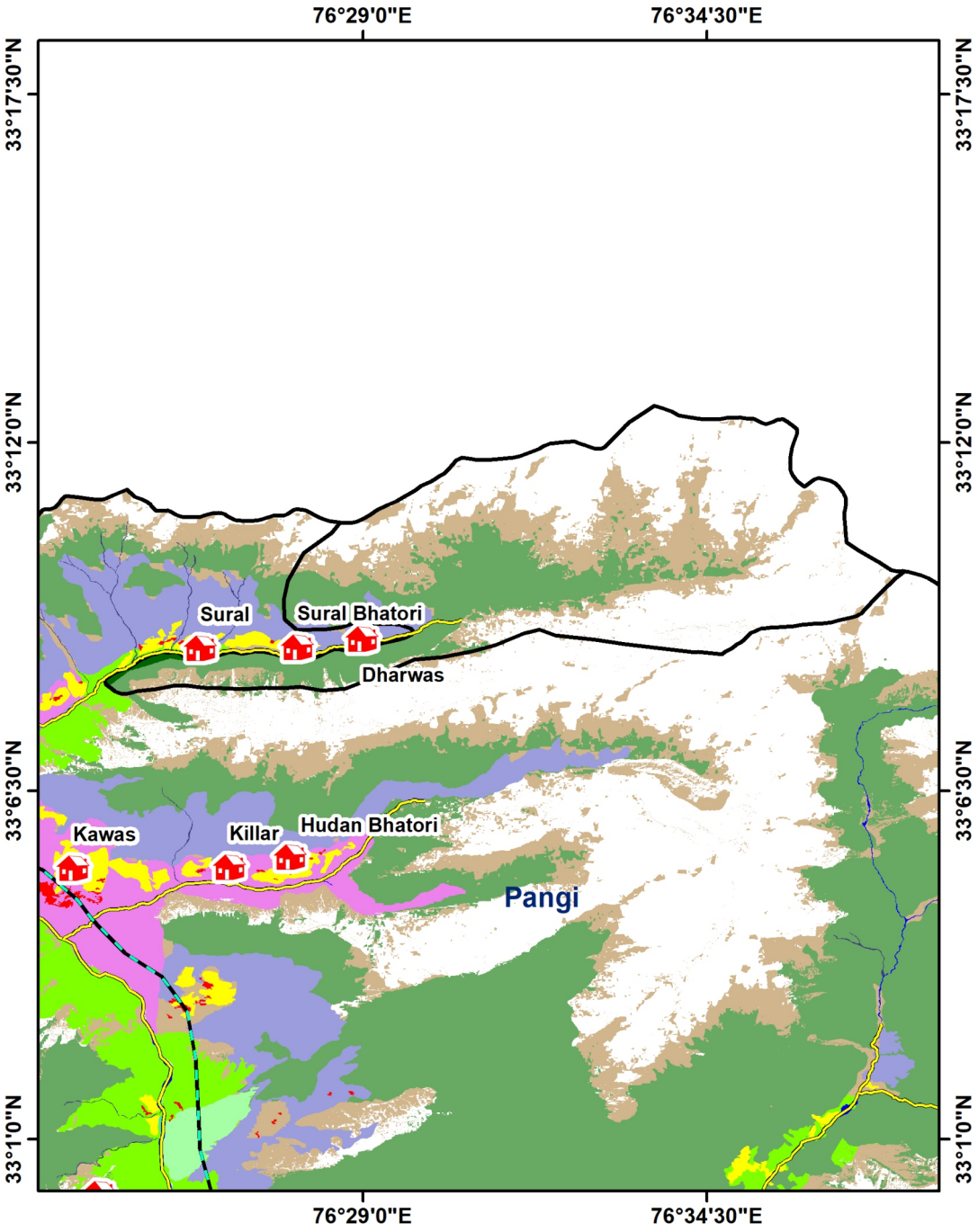
**HCV-6 (Cultural Values)**

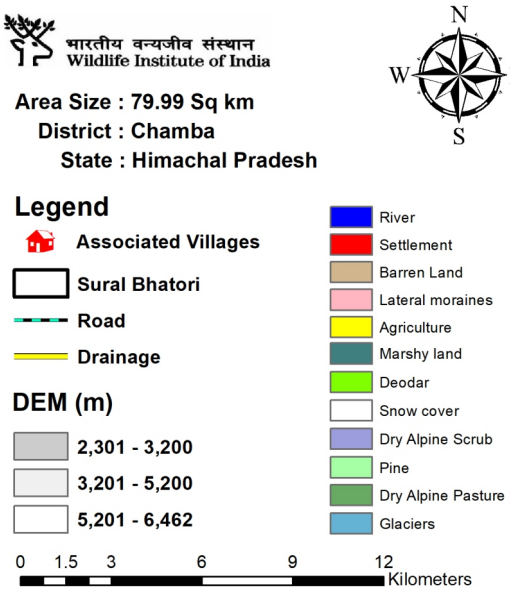
- The gompa or monastery in the Sural valley was established more than 200 years ago, and is situated at 33° 08' 48.16" N latitude and 76° 27' 49.74" E longitude at an elevation of about 3400 meters.
- The site is surrounded by trees of *Betula utilis* or Bhojpatrand because of its cultural importance for the local communities, it has been declared as a sacred grove (Chaudhary, 1998).

The collection of resources (fuel-wood or fodder) from the sacred grove is allowed only for utilization within the gompa premises.

**Table 31: Potential threats and conservation recommendation for High Conservation Value Area Sural Bhatori in Pangi landscape of H.P.**

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | Intensive grazing by domestic livestock has led to pastureland degradation, specifically on right bank of the Sural Nallah, in the pastures near *adhwari* behind the forest rest house and near *Chabbi* waterfall. | Demarcation of critical areas within a larger pasture for livestock grazing in the eastern/north-eastern region near the Chabbi waterfall; and implementation of integrated pastureland management regimes with the support of the local communities and the forest department.<br>Detailed study and assessment on grazing impacts and its control is suggested. |
| 2. | Depredation of livestock by snow leopard, Tibetan wolf and Himalayan brown bear near the villages of Sural Bhatori and near *adhwari* has been reported by the key informants of the area.<br>Conflict amongst the wildlife and the people in the region has also been observed in the valley in form of crop destruction by the Himalayan brown bear (villages of Sural, Sural Bhatori, Tai, Rusmos). | Anti-predatory livestock management through fences, barriers, human-accompanied herding of livestock to reduce livestock losses is recommended.<br>Community-based protection measures (solar fences and other barriers), to avoid crop losses, and spreading awareness about the subsidies provided by the government in villages of Sural, Sural Bhatori, Rusmos and Tai. |
| 3. | Indiscriminate collection of fuel-wood from the Betula utilis forests on left bank of Sural Nallah; pressure due to grazing, overharvesting & pre-mature harvesting of threatened medicinal plants from the forests and pastures (on the left bank of Nallah and around chabbi waterfall) has threatened the status of many species. | Enhanced training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders *i.e.* the local communities of Sural valley (Villages of Sural, Sural Bhatori, Rusmos & Tai).<br>*Betula utilis* patch could be conserved as a Conservation Reserve. |
| 4. | No threats to conservation, or otherwise, were observed during the survey in the area near Sural Gompa. | The recognition of the gompa by local communities could be utilized as an opportunity to spread awareness and promote community participation for biodiversity conservation. |



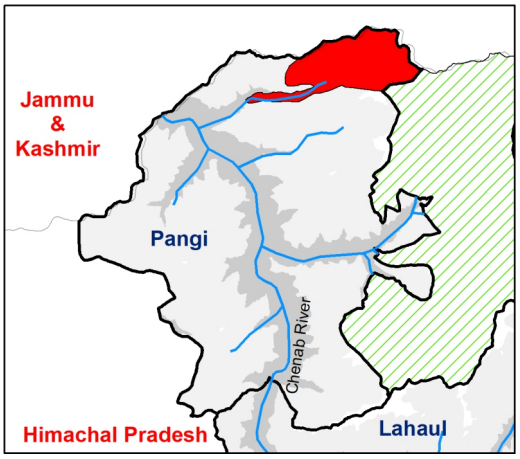
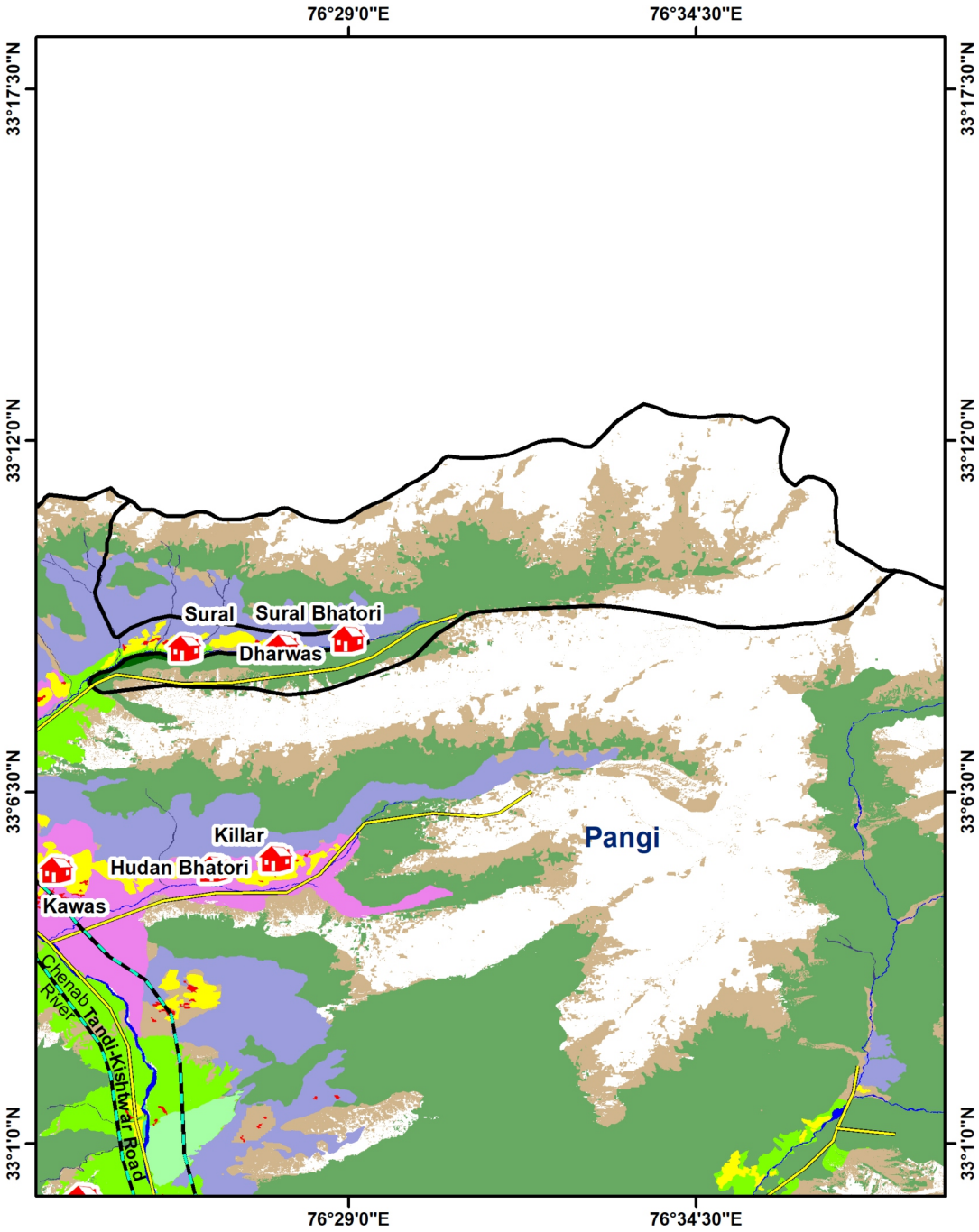
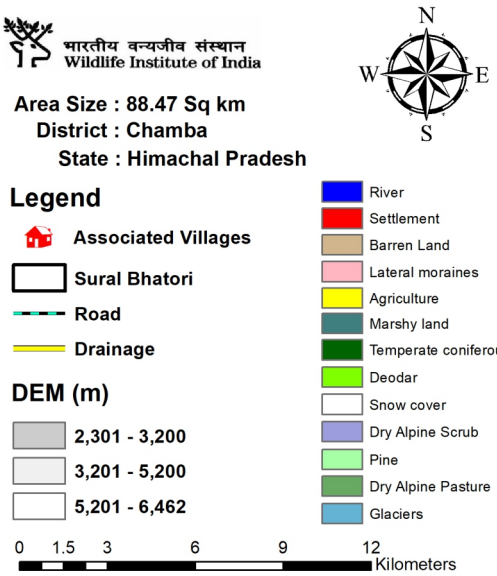




**Figure 36:** Sural Bhatori-Potential HCV Area in Pangi Valley for criterion 1 (Species and Diversity)



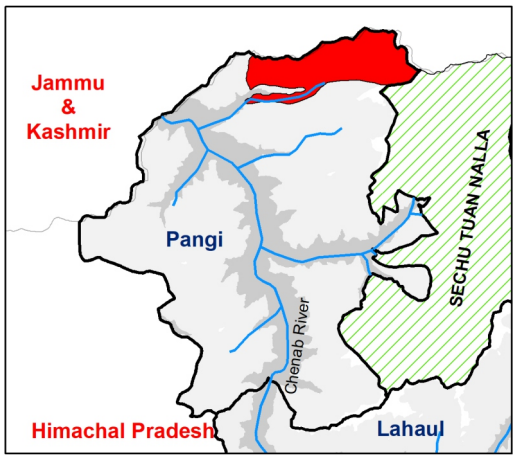
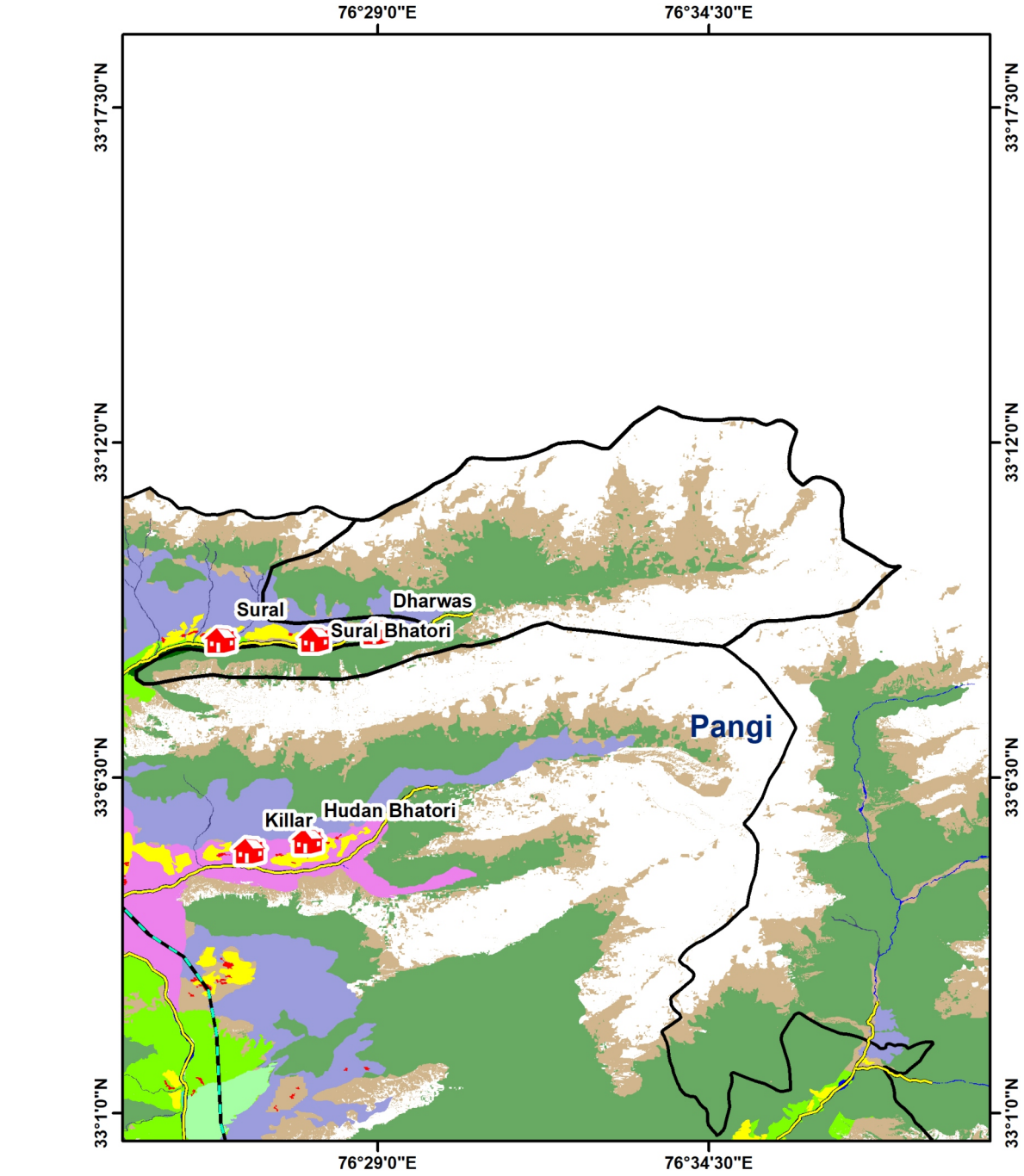




**Figure 37:** Sural Bhatori-Potential HCV Area in Pangi Valley for criterion 2 (Landscape level Ecosystems)




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N
W E
S

**Area Size : 81.14 Sq km**
**District : Chamba**
**State : Himachal Pradesh**

**Legend**

- Associated Villages
- Sural Bhatori
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Lateral moraines
- Agriculture
- Deodar
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture
- Glaciers

0 1.5 3 6 9 12 Kilometers

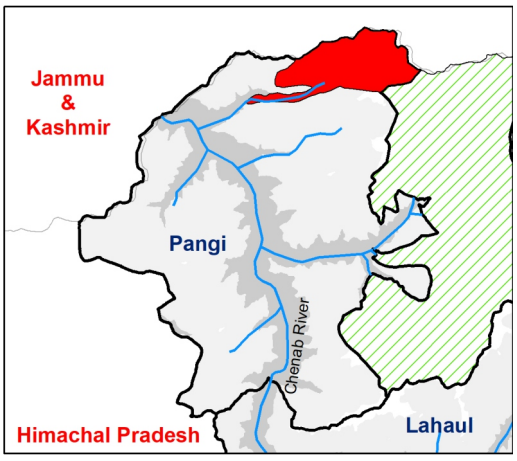



**Figure 38:** Sural Bhatori-Potential HCV Area in Pangi Valley for criterion 4 (Ecosystem Services)

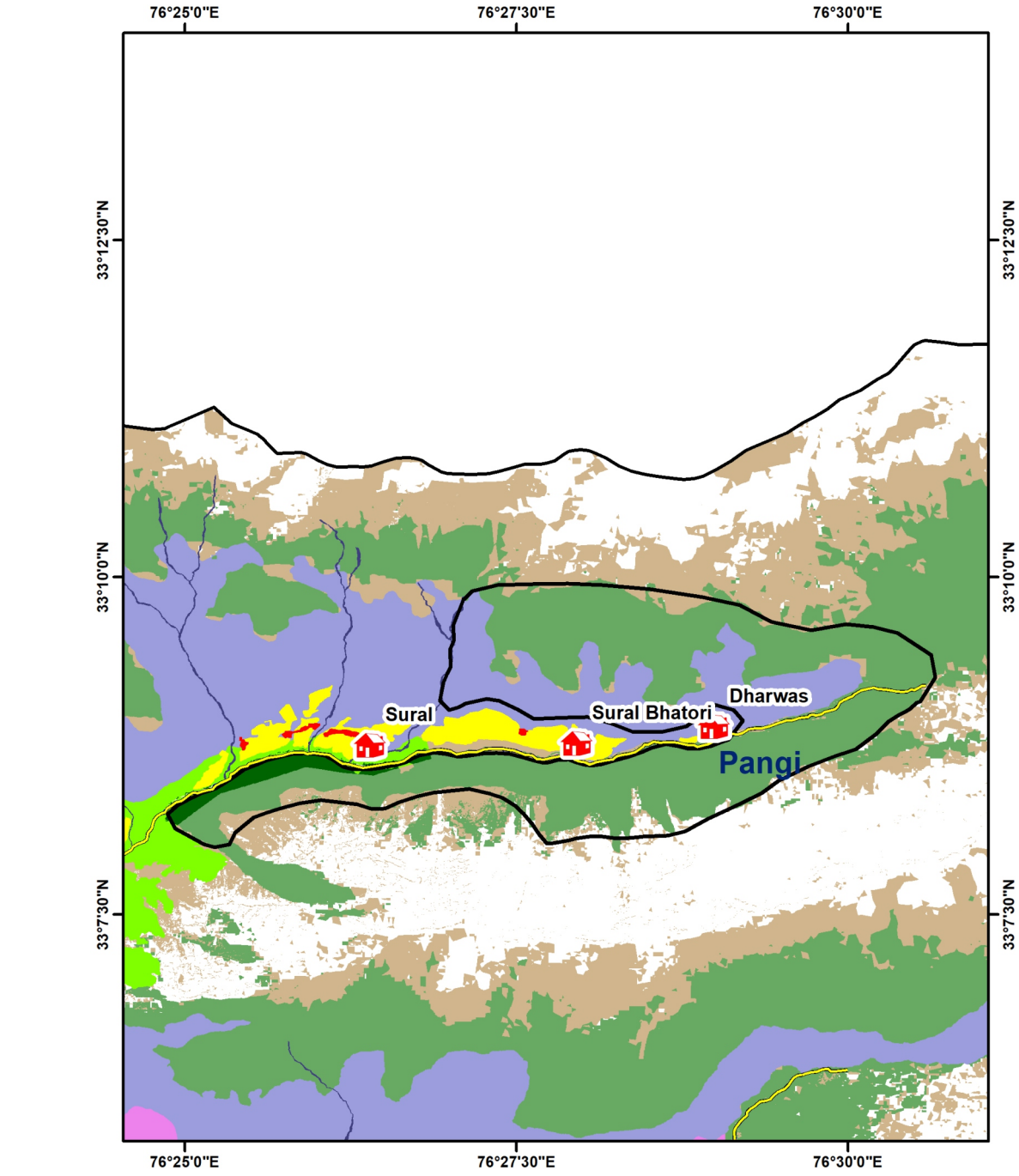
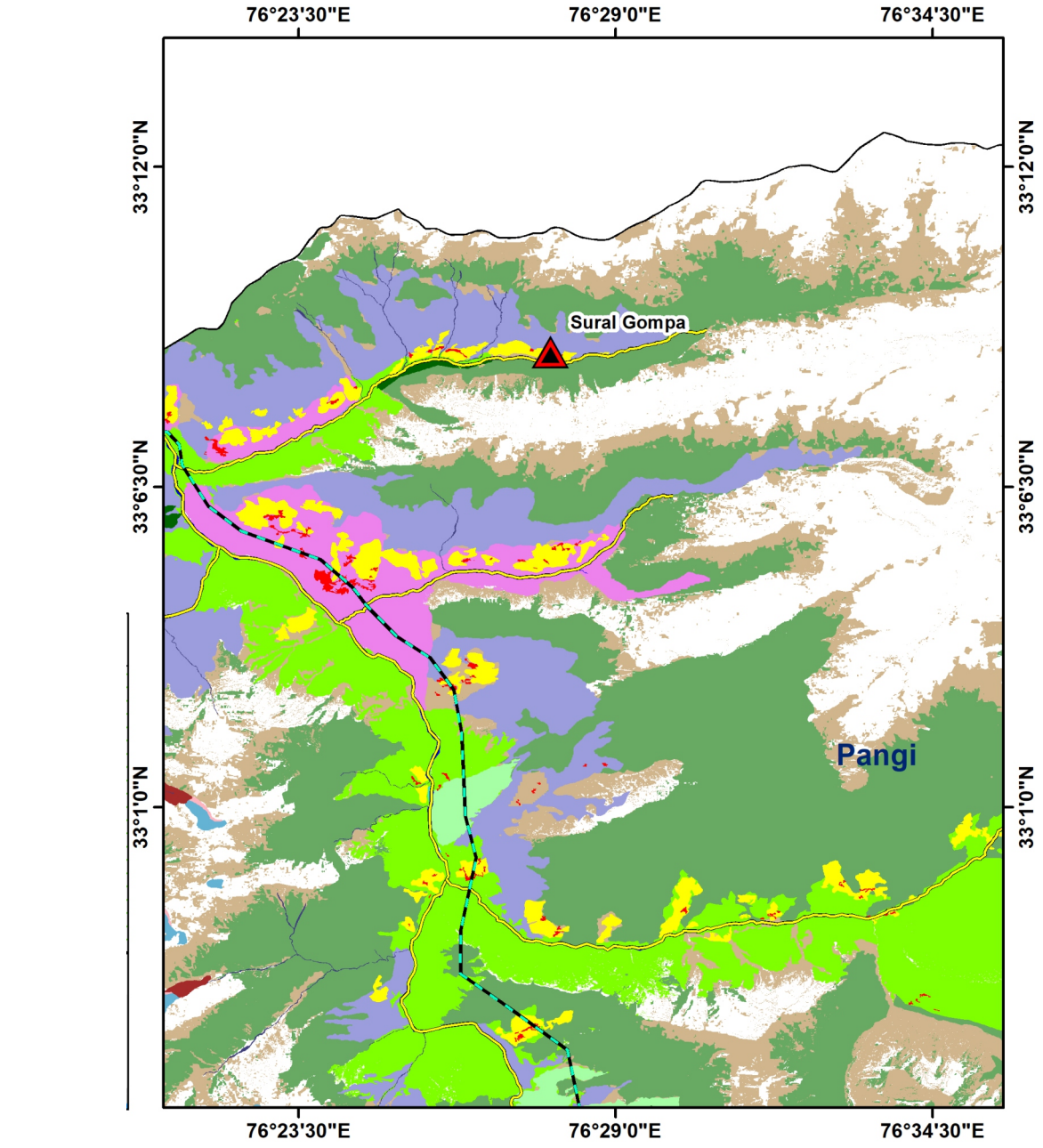



**Figure 39:** Sural Bhatori-Potential HCV Area in Pangi Valley for criterion 5 (Community Needs)




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Area Size : 0.0098 Sq km
District : Chamba
State : Himachal Pradesh

**Legend**

Sural Gompa
Road
Drainage

**DEM (m)**

2,301 - 3,200
3,201 - 5,200
5,201 - 6,462

0 1.5 3 6 9 12

N W E S

River
Terminal moraines
Settlement
Barren Land
Orchard
Agriculture
Marshy land
Temperate coniferous
Deodar
Snow cover
Dry Alpine Scrub
Pine
Dry Alpine Pasture
Glaciers

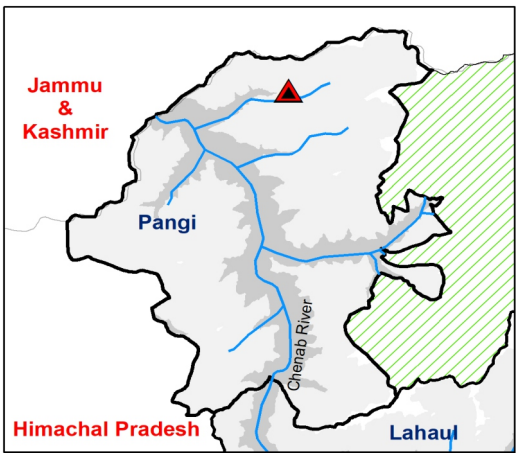



**Figure 40:** Sural Gompa - Potential HCV Area in Pangi Valley for criterion 6 (Cultural Values)

## AREA 2: SECHU TUAN

Sechu Tuan Nallah wildlife sanctuary is the only protected area in the entire Pangi valley and is a part of Chamba Wildlife Division, it encompasses an area of 390.29 $km^2$ and is at an elevation of 3600 meters. The demarcated area is situated at 32° 50' 48.09" N -33° 02' 38.18" N latitude and 76° 27' 36.48" E-76° 38' 44.20" E longitudes at an elevation range from 3110-5233 meters.

**HCV-1 (Species & Diversity)**

- Major Faunal species, as reported by key informants, in the area are snow leopard, Himalayan brown bear, Asiatic black bear, Tibetan wolf, Himalayan red fox, Asiatic ibex, and Himalayan musk deer.
- Occupancy probability for snow leopard and Asiatic ibex is 0.71-0.80 & 0.81-0.90 respectively (Ghoshal, 2017).
- Few of the important floral species recorded in the area include *Picrorhiza kurroa, Dactylorhiza hatagirea, Bunium Persicum, Aconitum heterophyllum, Podophyllum hexandrum, Fritillaria roylei, and Saussurea costus* (cultivated).
- Threatened avifaunal species reported from the area are Himalayan monal (Lophophorus impejanus) and Himalayan griffon (Gyps himalayensis).

**HCV-5 (Community Needs)**

- The pastures are being utilized by the local communities of Chasak and Chasak Bhatori villages to fulfill their basic needs of livestock grazing and extraction of medicinal plants.
- The villagers have constructed adhwaris (temporary settlement) in the pastures, where they graze their livestock for two to three months during the summer season.
- They are also involved in extraction of medicinal plants, mainly, *Bunium persicum* or Kala jeera, for both self-use and commercial purposes.

**Table 32: Potential threats and conservation recommendation for High Conservation Value Area Sechu in Pangi landscape of H.P.**

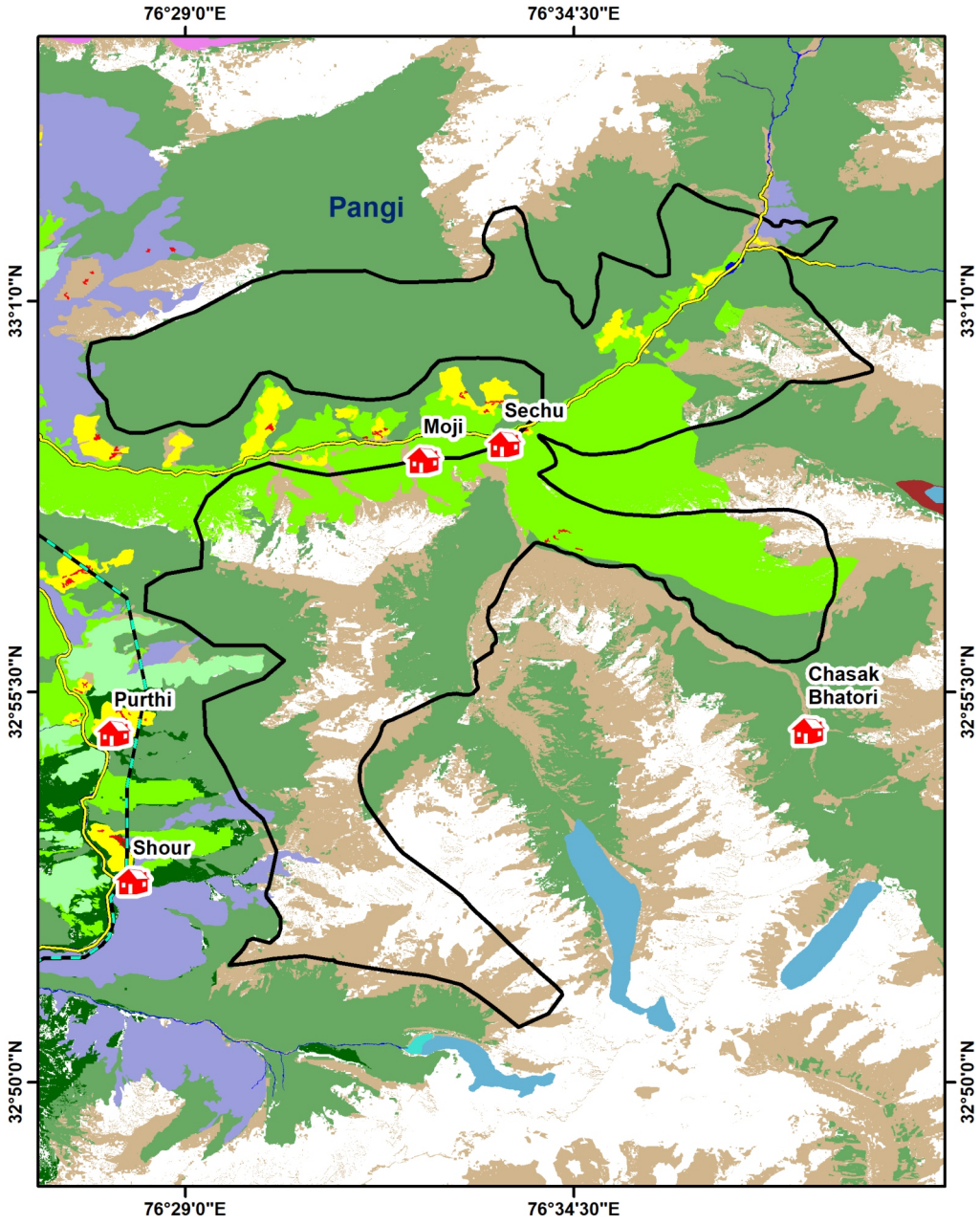
| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | Intensive livestock grazing in the alpine pastures in the northern region near the adhwaris, in the villages of Chasak and Chasak Bhatori, has led to the issue of pastureland degradation. | Demarcation of critical areas within a larger pasture for livestock grazing in Chasak Bhatori around the adhwari; and implementation of integrated pastureland management regimes with the support of the local communities of the villages of Chasak, Chasak bhatori and the forest department. |
| 2. | Human-wildlife conflict has been reported in form of depredation of livestock by the Himalayan brown bear in the region and crop destruction by Asiatic black bear and brown bear in the agricultural fields of Sechu, Moji, Chasak and Chasak Bhatori villages. | Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended.<br>Community-based protection measures (solar fences and other barriers), to avoid crop losses, and spreading awareness about the subsidies provided by the government in the concerned villages. |
| 3. | *Picrorhiza kurroa, Dactylorhiza hatagirea, Aconitum heterophyllum, Podophyllum hexandrum* are few of the most demanded medicinal plants in pharmaceutical companies (Uniyal *et al.*, 2002), overharvesting, pre-mature harvesting and illegal extraction of rare and threatened medicinal and aromatic plants in the areas like Sidhani Dhar and near meadows of Chasak Bhatori have been reported. | Enhanced training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders *i.e.* the local communities of Sechu, Moji, Chasak and Chasak Bhatori villages<br>Enhanced collaboration between enforcement agencies (forest department and the security forces) and the local communities, especially in Sidhani dhar; and continued on-job training on fronts like wildlife monitoring, wildlife law and legislation is recommended. |

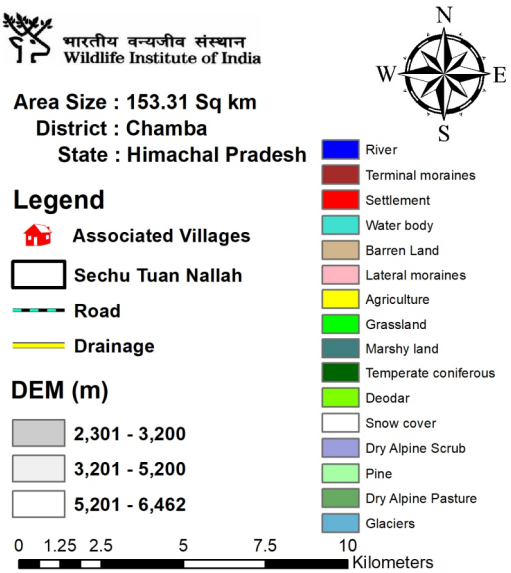
| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 4. | The area is covered in snow for almost six months in a year, and time available for monitoring/ patrolling related activities is short. Also, there is insufficient current staff strength and available facilities in form of field gears/vehicles for carrying out monitoring and management-related activities in the area. (Mohan *et al.*, 2020) | Capacity enhancement of the staff to carry out patrolling throughout the landscape is required. Increasing the field staff strength and timely availability of funds, patrolling gears/vehicles for carrying out patrolling and management activities in the landscape is required. |





**Image 12:** *Podophyllum hexandrum* – an important medicinal plant found in Sechu Tuan, Pangi Valley
© Prateek Savita



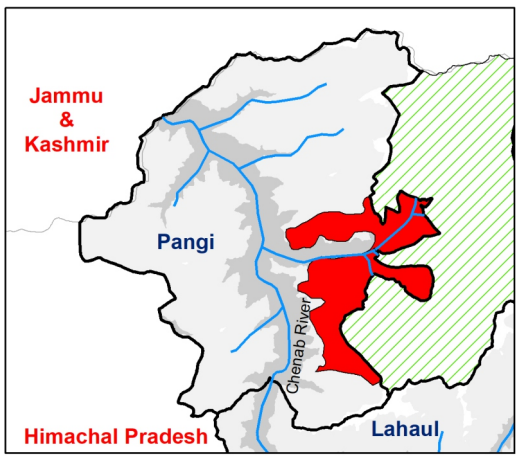
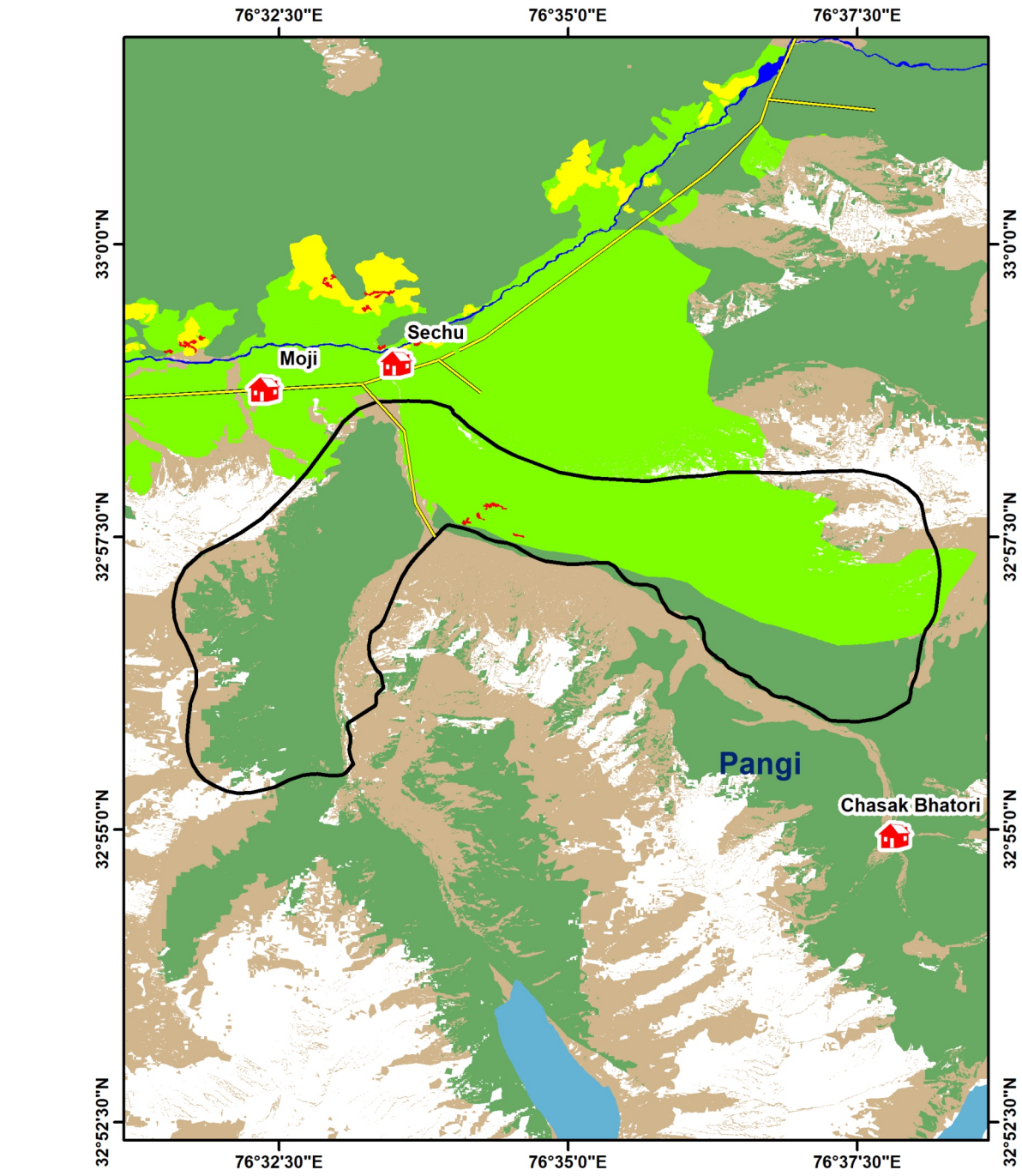




**Figure 41:** Sechu Tuan - Potential HCV Area in Pangi Valley for criterion 1 (Species and Diversity)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 30.26 Sq km
District : Chamba
State : Himachal Pradesh

N
W E
S

**Legend**

- Associated Villages
- Sechu Tuan Nallah
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Agriculture
- Deodar
- Snow cover
- Dry Alpine Pasture
- Glaciers

0 0.75 1.5 3 4.5 6
Kilometers

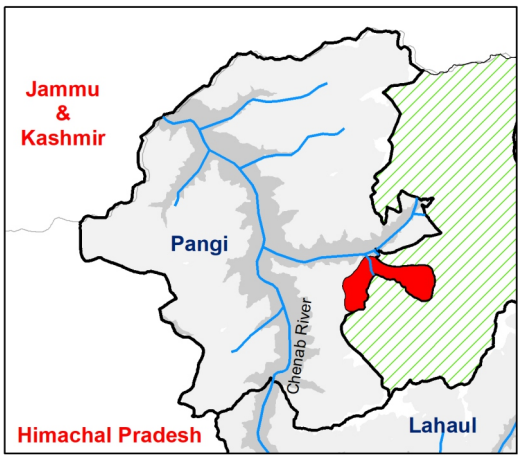



**Figure 42:** Sechu Tuan - Potential HCV Area in Pangi Valley for criterion 5 (Community Needs)



Chasak Bhatori landscape near Sechu Tuan, Pangi Valley

*Prateek Savita*

## AREA 3: HUDAN BHATORI

It is situated at 33° 04' 36.57" N -33° 08' 24.52" N latitude and 76° 27' 12.83" E-76° 35' 56.86" E longitudes at an elevation range from 3606-5605 meters. Hudan sub-valley is located at a distance of 13 km upstream Mahlu Nallah; and it includes Takwas Tundroo, Ichwas and Hudan villages, Hudan Bhatori being the last village (Chaudhary, 1998).

**HCV-1 (Species and Diversity)**

- Few of the important floral species recorded in the area include *Picrorhiza kurroa, Dactylorhiza hatagirea, Aconitum heterophyllum, Podophyllum hexandrum, and Saussurea costus* (cultivated).
- Major faunal species, as reported by the informants, in the region are Snow leopard, Brown bear, Tibetan wolf, Himalayan marmot, Ibex, and Royle's pika.
- Threatened avifaunal species reported from the area is the Himalayan griffon (*Gyps himalayensis*).

**HCV-2 (Large landscape-level Ecosystems)**

Under criterion 2 *i.e.* large landscape level ecosystems and mosaics of ecosystem, entire Pangi valley encompassing an area of about 1600 $km^2$ has been identified as a potential area for conservation as per the definition of the criteria. However, within the landscape, Hudan Bhatori has also been identified as crucial areas for supporting a variety of species and for maintaining connectivity of habitat

- The area encompasses the alpine meadows of Hudan bhatori, which supports rich biodiversity of high-value medicinal and aromatic plants.
- As reported by the key informants of the Hudan Bhatori, the area serves as a habitat for species like Snow leopard, Brown bear, Tibetan wolf, Asiatic Ibex, Himalayan marmot and Royle's pika.

**HCV-4 (Ecosystem Services)**

- The delineated area encompasses alpine meadows, rich with a variety of medicinal plants of the region, which provides supporting and regulating services.
- They assist in binding soil to control erosion and helps in carbon sequestration and storage, in soil.

**HCV-5 (Community Needs)**

- The basic need of the local communities in Hudan is livestock grazing and the local communities of the area practice seasonal pastoralism.
- The residents in and around the Hudan Village build temporary settlements(Adhwari) and move up to alpine pastures for 2-3 months in summer to graze their livestock.
- The local communities of the region also utilize and are involved in the extraction of high-value medicinal and aromatic plants.
- Hudan sub-valley is located at a distance of 13 km upstream Mahlu Nallah; and it includes Seri bhatwas, Takwas Tundroo, Ichwas and Hudan villages, Hudan Bhatori being the last village (Chaudhary, 1998).

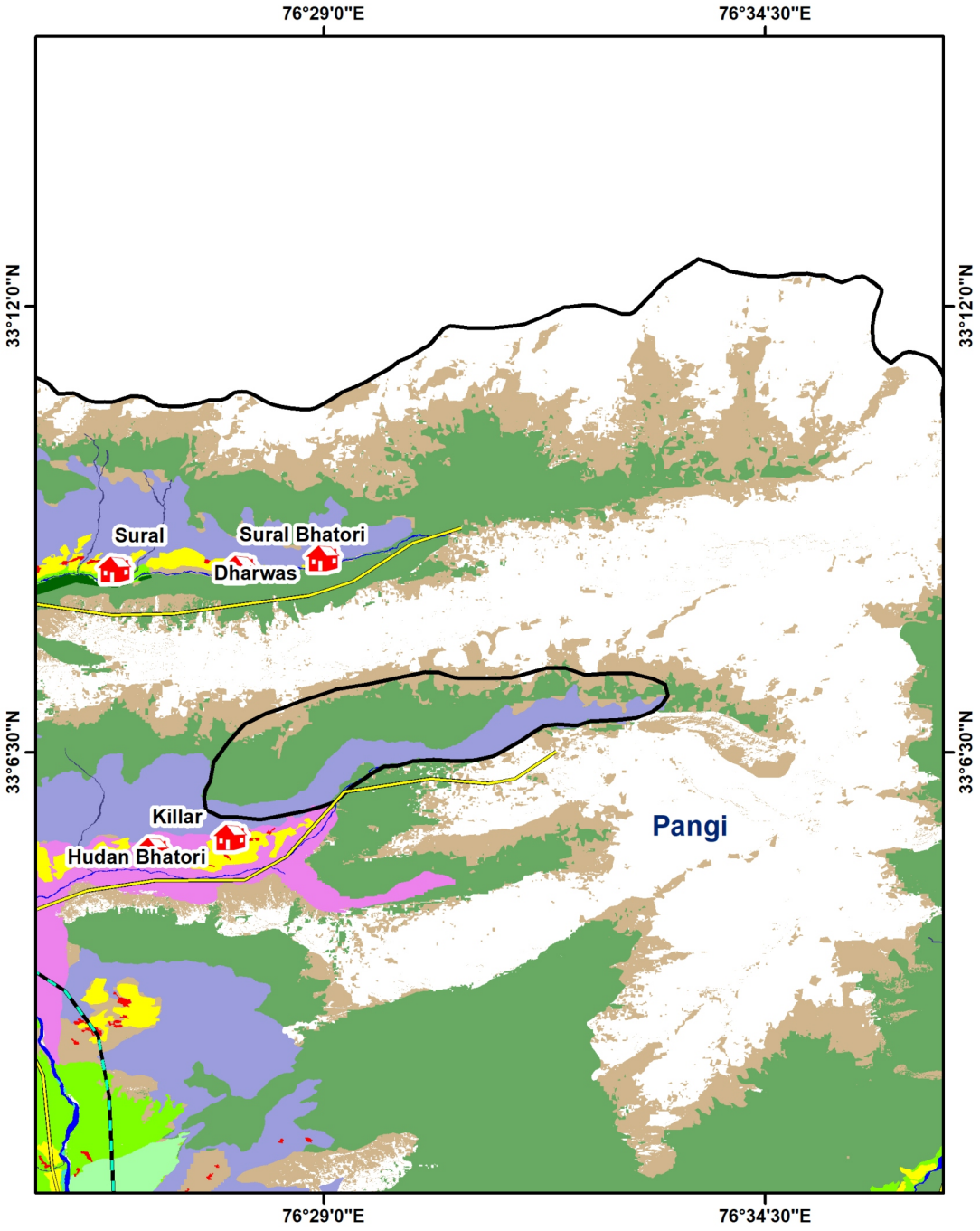
**Table 33: Potential threats and conservation recommendation for High Conservation Value Area Hudan Bhatori in Pangi landscape of H.P.**

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | In Hudan Bhatori, degradation of pastureland due to livestock grazing has led to the issue of over-exploitation of pastureland, specifically in the northern and western region of the pastures near the *adhwari*. | Demarcation of critical areas within a larger pasture for livestock grazing in the eastern/ north-eastern region around the *adhwari*; and implementation of integrated pastureland management regimes to reduce pressure on the pastures and also to prevent over-exploitation of a particular area, with the support of the local communities and the forest department. |
| 2. | Depredation of livestock in the valley by Himalayan brown bear and Tibetan wolf has been reported by the local herders of the Tundroo, Takwas, Hudan and Hudan Bhatori villages, mostly near the adhwaris (temporary settlement in pastures during summers). | Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended. |

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 3. | Excessive anthropogenic pressure in the Himalayan region in form of exploitation of resources, pressure due to grazing and overharvesting of medicinal and aromatic plant species from their natural habitats (Kala *et al.*, 1998; Rai *et al.*, 2000) has adversely affected the availability of several high-value medicinal plants.<br><br>Overharvesting, pre-mature harvesting, indiscriminate extraction and over-exploitation of the pastures has threatened the status many of rare medicinal plants in the northern extent of pastures of Hudan valley. | Enhanced training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders *i.e.* the local communities of Ichwas, Takwas, Tundroo, Hudan and Hudan Bhatori villages |








भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 15.61 Sq km
District : Chamba
State : Himachal Pradesh

N
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S

**Legend**

- Associated Villages
- Hudan Bhatori
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Lateral moraines
- Agriculture
- Temperate coniferous
- Deodar
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture
- Glaciers

0 1 2 4 6 8 Kilometers

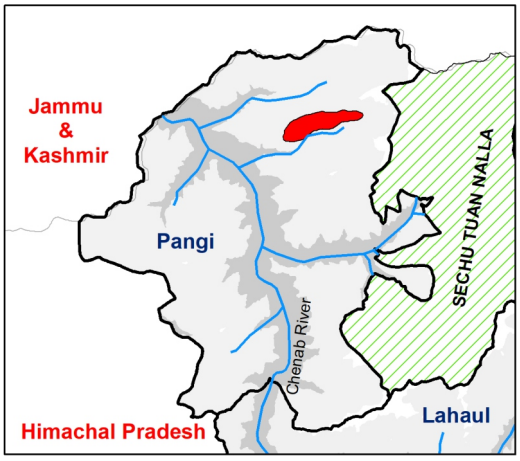
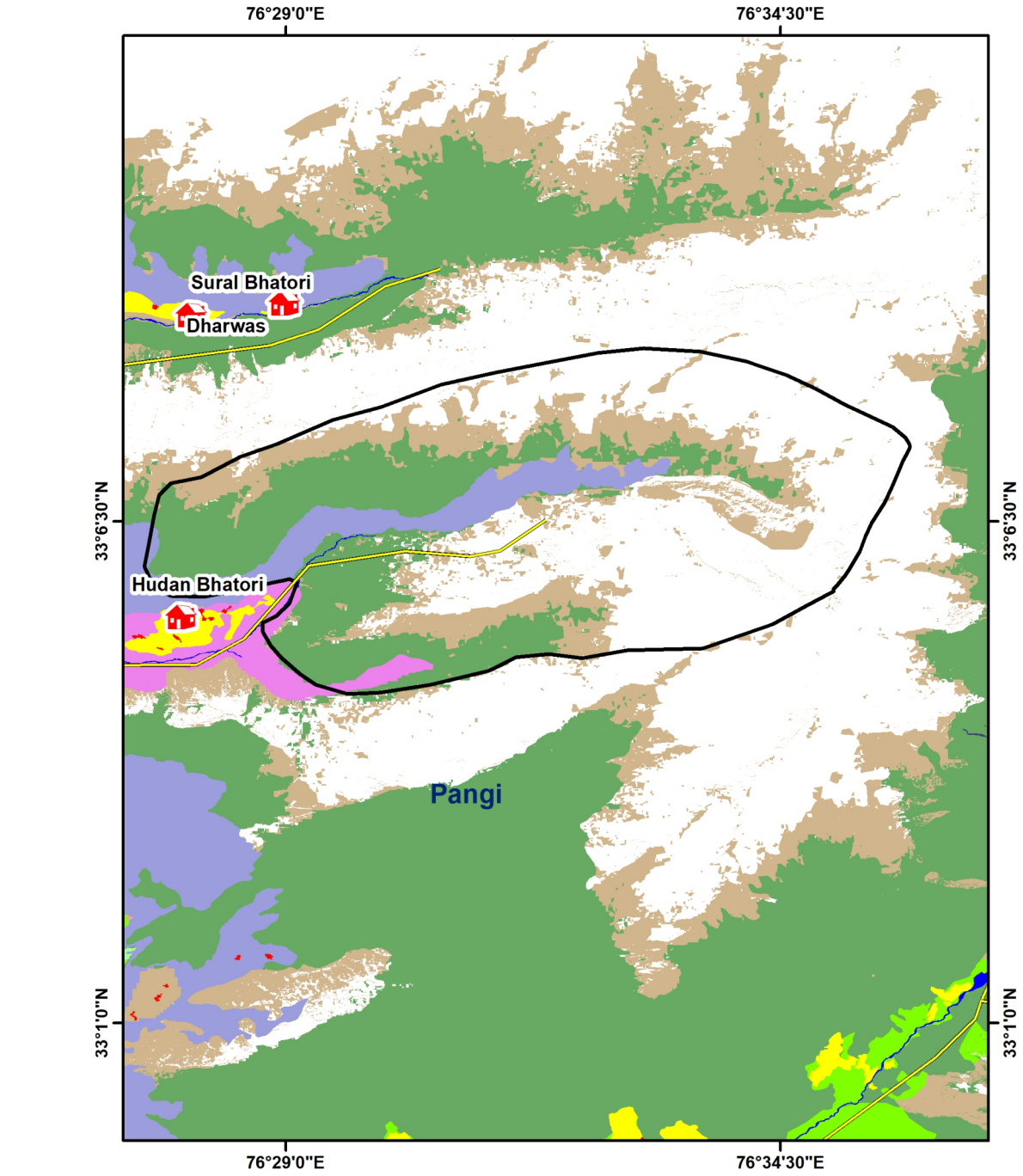



**Figure 43:** Hudan Bhatori - Potential HCV Area in Pangi Valley for criterion 1 (Species and Diversity)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

N
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Area Size : 62.88 Sq km
District : Chamba
State : Himachal Pradesh

**Legend**

- Associated Villages
- Hudan Bhatori
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Orchards
- Agriculture
- Marshy land
- Deodar
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture

0 1 2 4 6 8 Kilometers

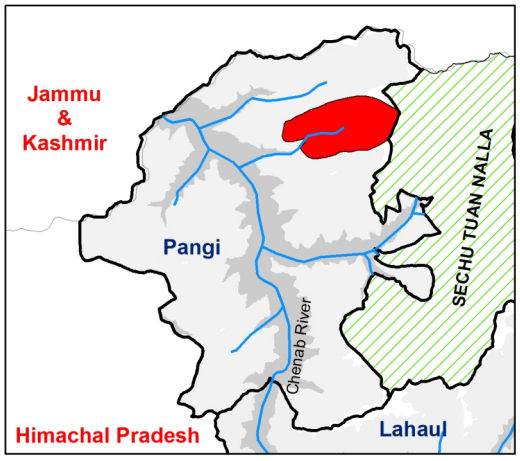
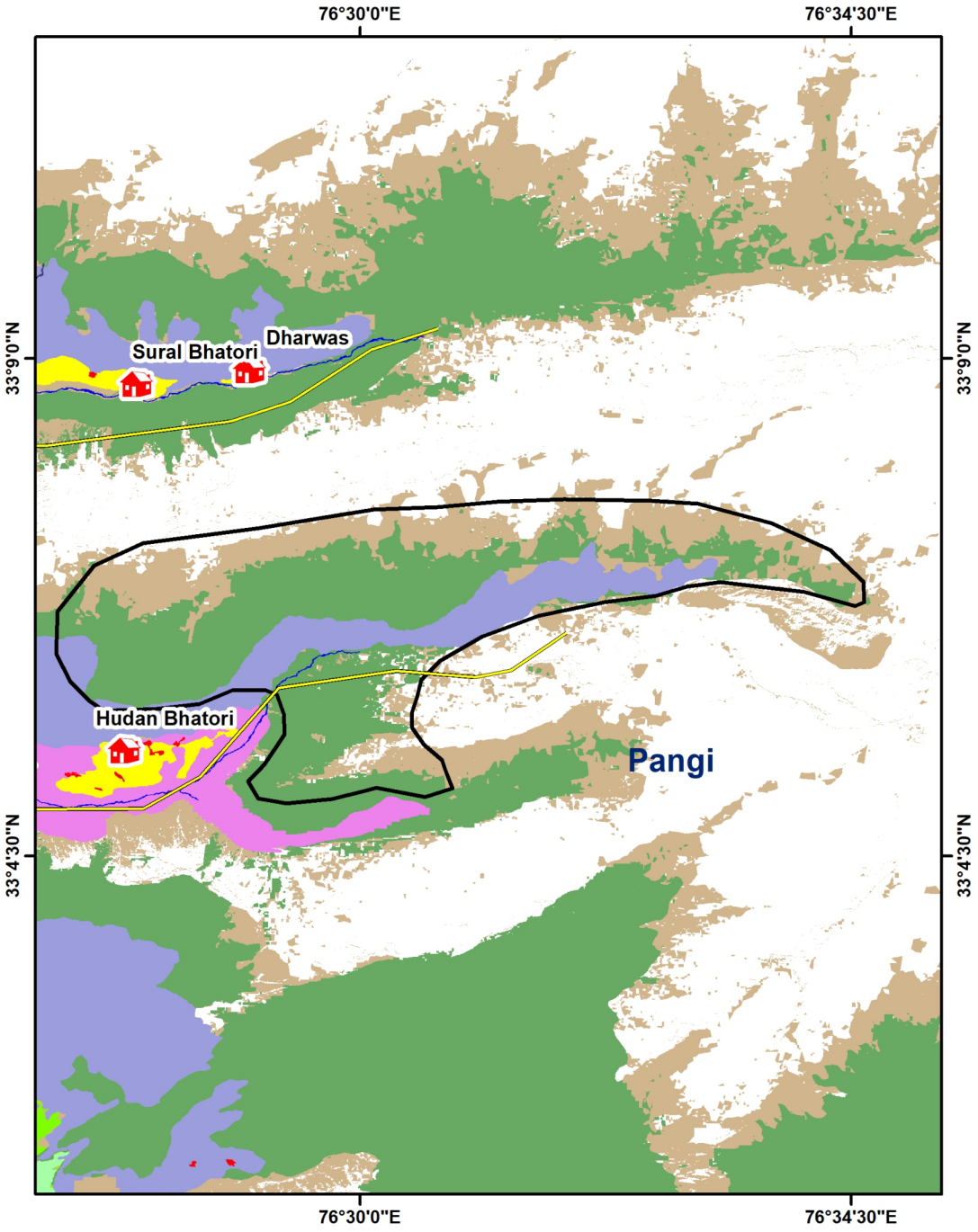



**Figure 44:** Hudan Bhatori - Potential HCV Area in Pangi Valley for criterion 2 (Landscape level Ecosystems)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 27.97 Sq km
District : Chamba
State : Himachal Pradesh

N
W E
S

**Legend**

- Associated Villages
- Hudan Bhatori
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Lateral moraines
- Agriculture
- Deodar
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture

0 0.75 1.5 3 4.5 6
Kilometers

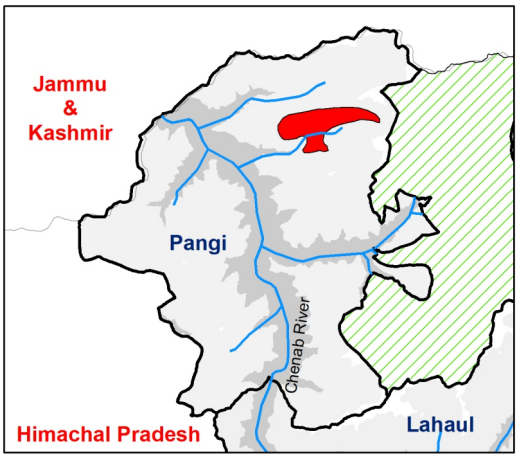
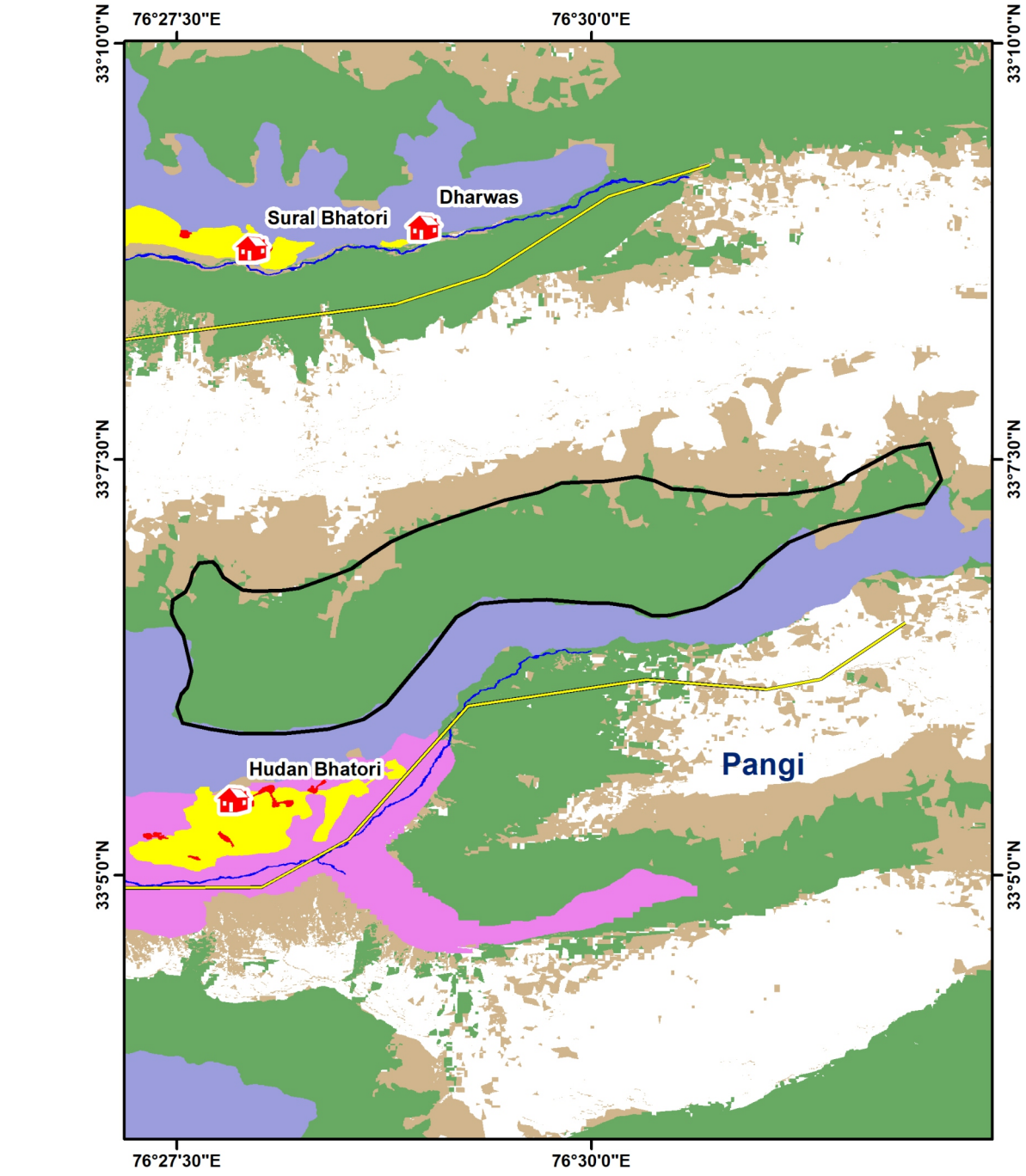



**Figure 45:** Hudan Bhatori - Potential HCV Area in Pangi Valley for criterion 4 (Ecosystem Services)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

N
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E
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Area Size : 8.68 Sq km
District : Chamba
State : Himachal Pradesh

**Legend**

Associated Villages
Hudan Bhatori
Drainage

**DEM (m)**

2,301 - 3,200
3,201 - 5,200
5,201 - 6,462

River
Settlement
Barren Land
Lateral moraines
Agriculture
Snow cover
Dry Alpine Scrub
Dry Alpine Pasture

0 0.5 1 2 3 4 Kilometers

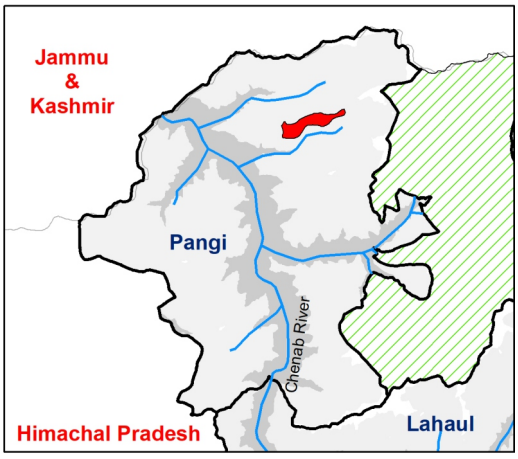
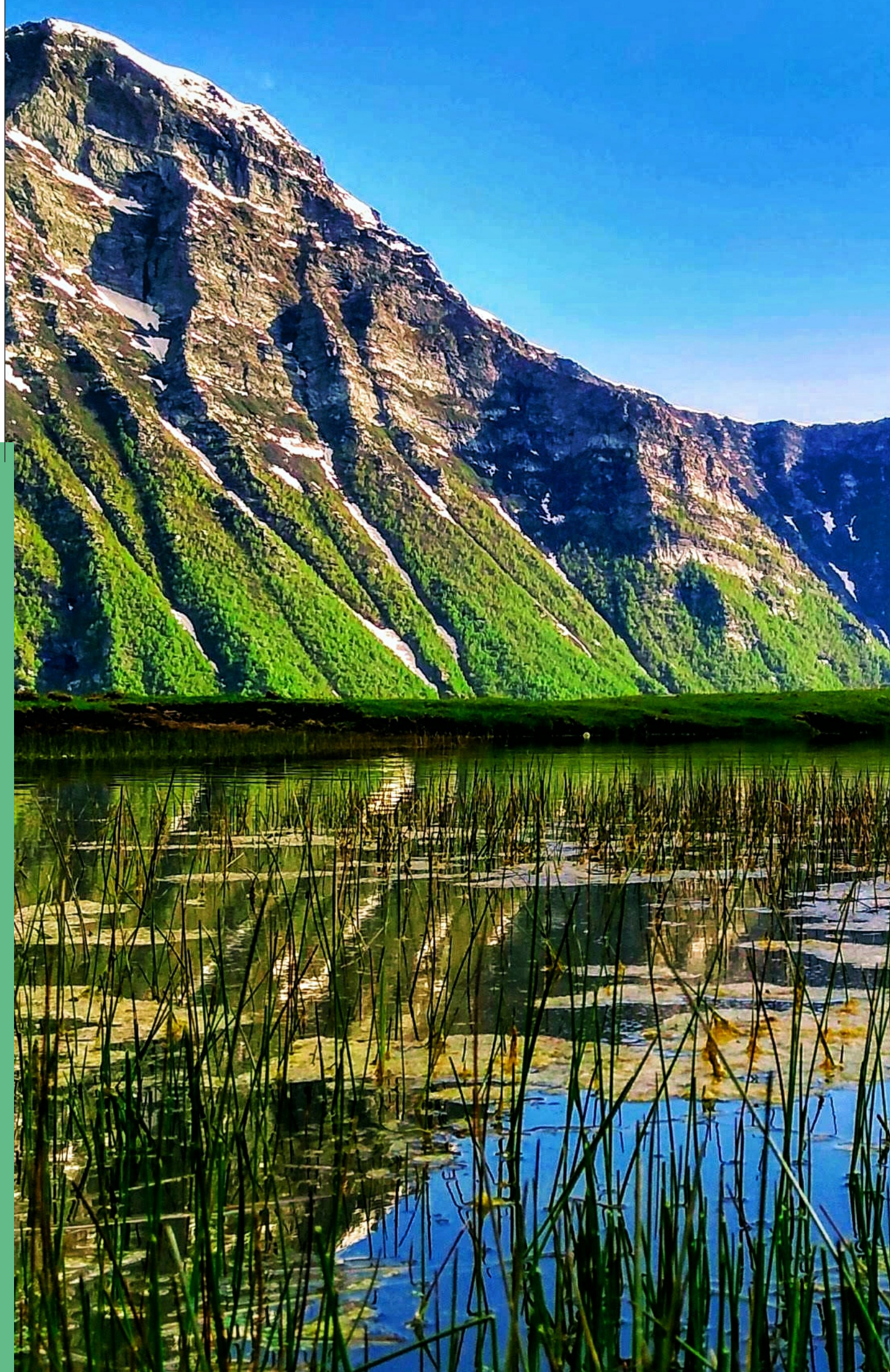



**Figure 46:** Hudan Bhatori - Potential HCV Area in Pangi Valley for criterion 5 (Community Needs)



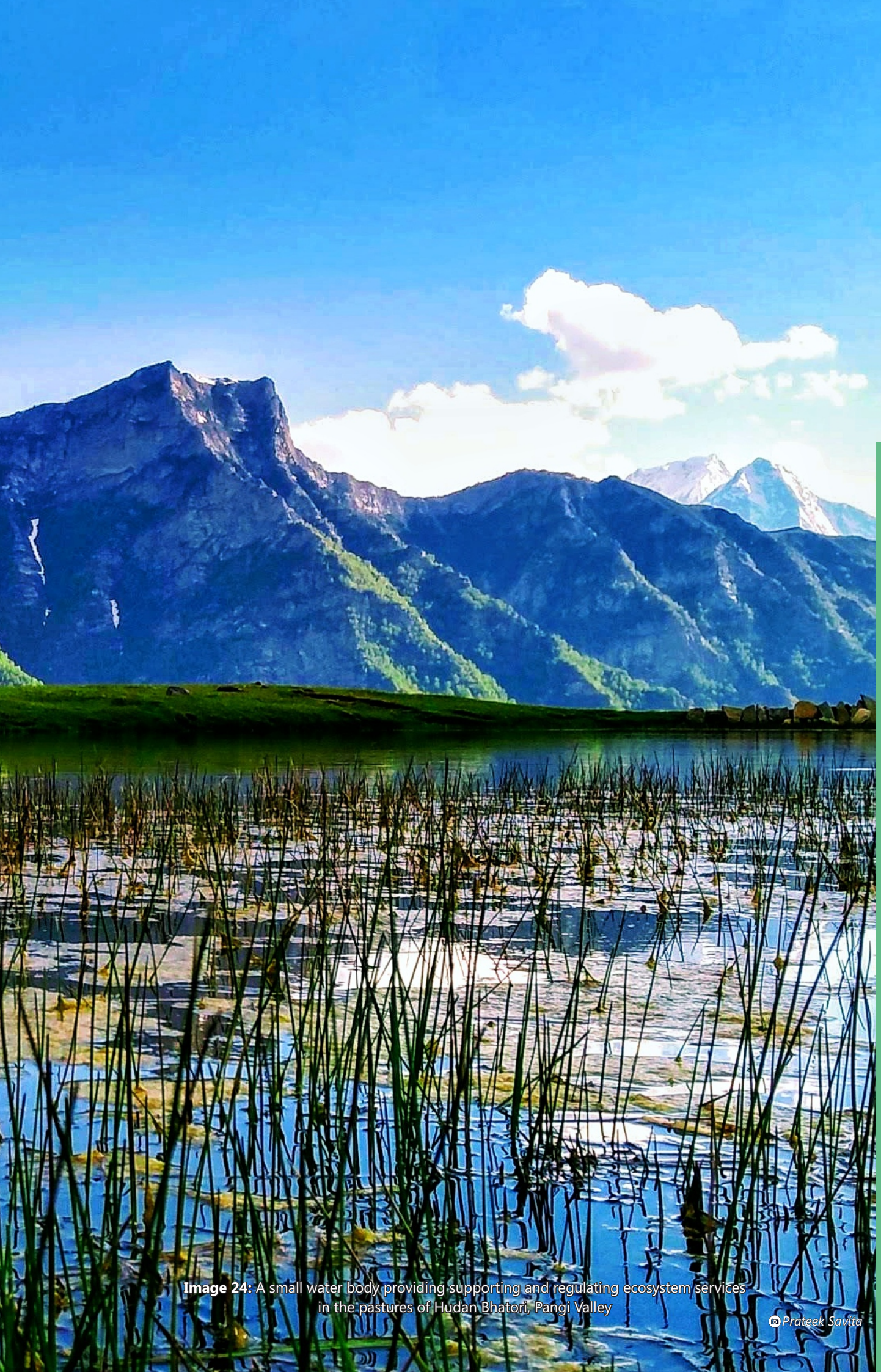


**Image 24:** A small water body providing supporting and regulating ecosystem services in the pastures of Hudan Bhatori, Pangi Valley

*Prateek Savita*

## AREA 4: KADU NALLAH

It is situated at 32° 49' 02.75" N -32° 52' 55.64" N latitude 76° 26' 17.82" E -76° 34' 15.38" E longitudes at an elevation range from 2337-4965 meters, at a distance of about 30 km from Killar, near the Shour village. Shour is the last village of Pangi towards Lahaul-Spiti. It has been designated as a Demarcated Protected Forest (DPF) in the Purthi Range.

**HCV-1 (Species and Diversity)**

- Major faunal species, as reported by key informants, in the area are snow leopard, Asiatic black bear, Himalayan brown bear, Tibetan wolf, Himalayan red fox, Asiatic ibex and Himalayan musk deer.
- Occupancy probability for snow leopard and Asiatic ibex is 0.61-0.70 (Ghoshal, 2017).
- Few of the important floral species recorded in the area includes *Picrorhiza kurroa, Dactylorhiza hatagirea, Aconitum heterophyllum, Podophyllum hexandrum, Saussurea costus (cultivated), Fritillaria roylei, Bunium persicum*.
- Threatened avifaunal species reported from the area are Himalayan monal (*Lophophorus impejanus*) and Himalayan griffon (*Gyps himalayensis*).

**HCV-2 (Large landscape-level Ecosystems)**

- Under criterion 2 *i.e.* large landscape level ecosystems and mosaics of ecosystem, entire Pangi valley encompassing an area of about 1600 $km^2$ has been identified as a potential area for conservation as per the definition of the criteria. However, within the landscape, Kadu Nallah has also been identified as crucial areas for supporting a variety of species and for maintaining connectivity of habitat.
- Kadu nallah, in Pangi valley is a large area comprising of forested area and pastureland far from human settlement, and it serves as a habitat for top predators with large home-range requirements.
- The area provides connectivity with Sechu Tuan WLS and is critical for maintaining connectivity of home ranges for species with large home range requirement.

**HCV-4 (Ecosystem Services)**

- The forested area of the region is "mixed type forest" with Deodar, Blue pine, Spruce, Fir and Juniper trees; and the alpine meadows of the area are rich with high-value medicinal plants.
- They provide supporting and regulating services by preventing natural hazards (floods and landslides) and helping in carbon sequestration and storage, in biomass and soil.
- Forested areas help in regulating



**Image 25:** *Fritillaria roylei* – a medicinal plant found in the pastures of Kadu Nallah, Pangi

Prateek Savita

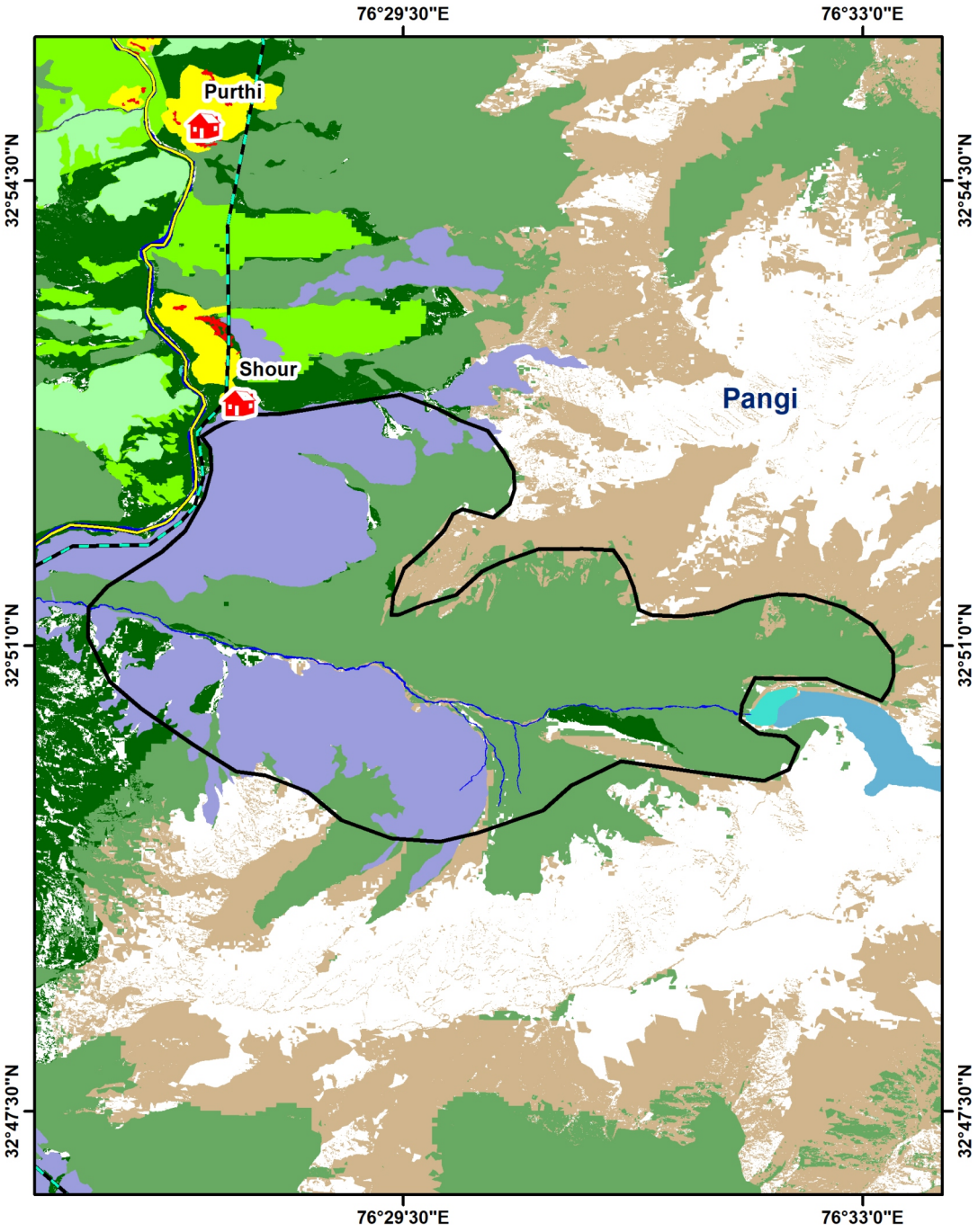
the flow of water within a catchment, prevent soil erosion and provide natural resources (e.g. fodder plants, timber as raw material) for energy production and construction.

**HCV-5 (Community Needs)**

- Local herding communities, from the villages of Shour and Purthi, practice a long-standing tradition of moving up to alpine pastures for the summers to graze their livestock.
- The temporary settlements built by the local herders, is known as Adhwari. And there are two such settlements present in the pasturelands of the Kadu Nallah.
- Apart from livestock grazing, the area is being utilized by the local communities for extraction of medicinal and aromatic plants, especially *Fritillaria roylei*.
- *Fritillaria roylei* commonly known as *Junglee lahsun*, being a rare species is one of the most exploited species of the area.

**Table 34: Potential threats and conservation recommendation for High Conservation Value Area Kadu Nallah in Pangi landscape of H.P.**

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | Overstocking of domestic livestock causes over-exploitation of the pastures and competitive exclusion of the wild ungulates if there is a high overlap in the habitat (Mishra *et al.*, 2001& 2002). Domestic livestock grazing mostly on northern part of the right bank of Kadu Nallah has caused over-exploitation of pastureland. | Demarcation of critical areas within a larger pasture for livestock grazing in the northern region near the adhwari; and implementation of integrated pastureland management regimes with the support of the local communities and the forest department to prevent over-exploitation of a particular area. |
| 2. | Human-wildlife conflict in the form of depredation of livestock by snow leopard, Tibetan wolf and the Himalayan brown bear has been reported by the local herders of the area in the pastureland mainly near the *adhwari* (temporary settlement in pastureland during summers). | Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended. |
| 3. | Excessive anthropogenic pressure and over-harvesting, loss of habitat by deforestation and pressure due to grazing (Phondani *et al.*, 2016) and high demand in market are few of the major reason for high exploitation of medicinal and aromatic plants.<br>Overharvesting, pre-mature harvesting and illegal extraction of rare and threatened medicinal and aromatic plants, especially *Fritillaria roylei*, in the pastures and forested areas of Kadu Nallah in the northern and north-eastern region respectively. | Enhanced training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders *i.e.* the local communities of Shour and Purthi villages. |




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 31.80 Sq km
District : Chamba
State : Himachal Pradesh

N
W
E
S

**Legend**

- Associated Villages
- Kadu Nallah
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Agriculture
- Temperate coniferous
- Deodar
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture
- Glaciers

0 0.5 1 2 3 4 Kilometers

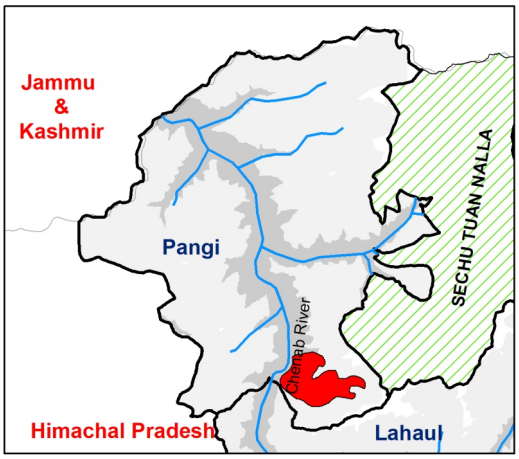



**Figure 47:** Kadu Nallah - Potential HCV Area in Pangi Valley for criterion 1 (Species and Diversity)

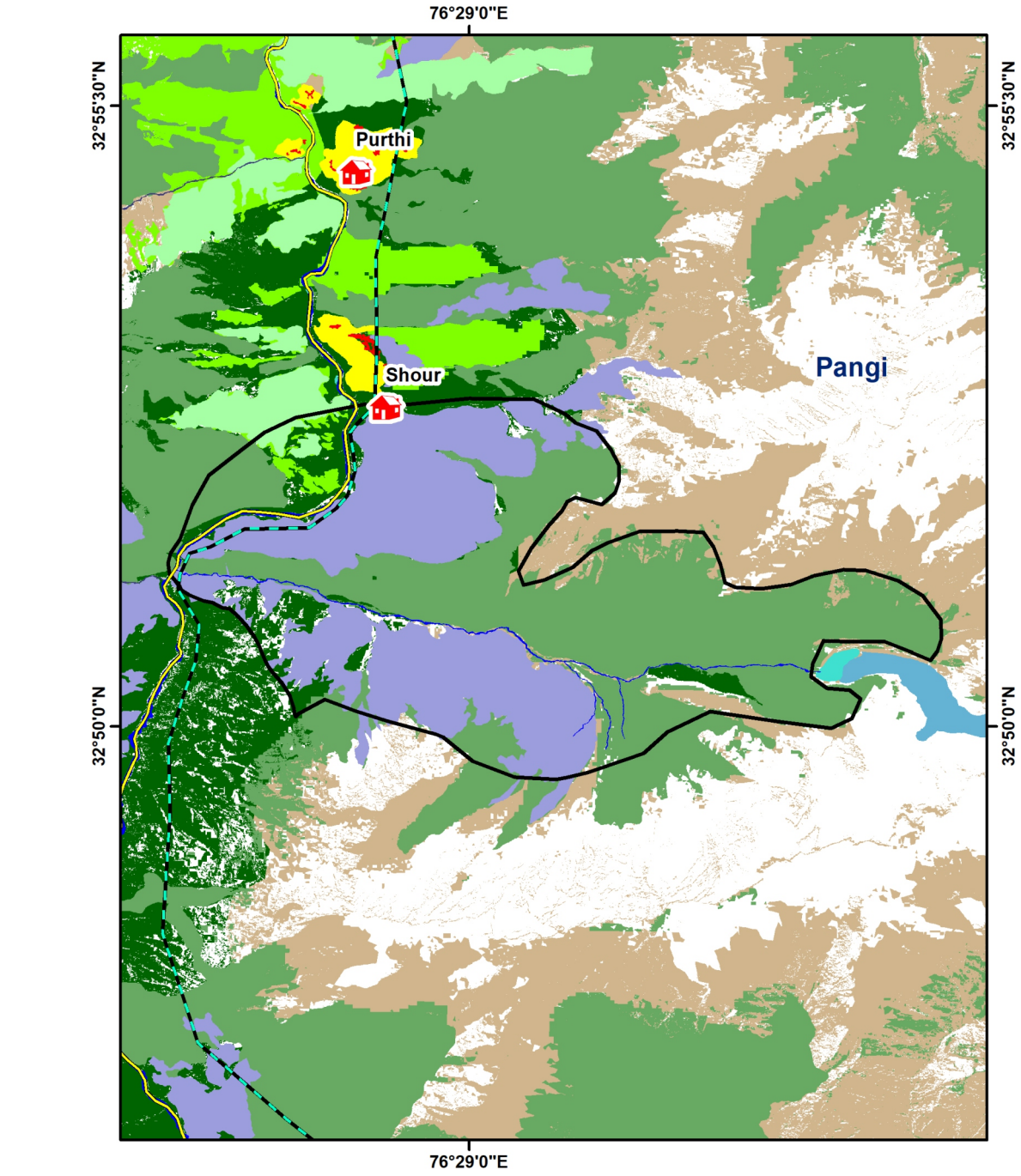



**Figure 48:** Kadu Nallah - Potential HCV Area in Pangi Valley for criterion 2 (Landscape level Ecosystems)

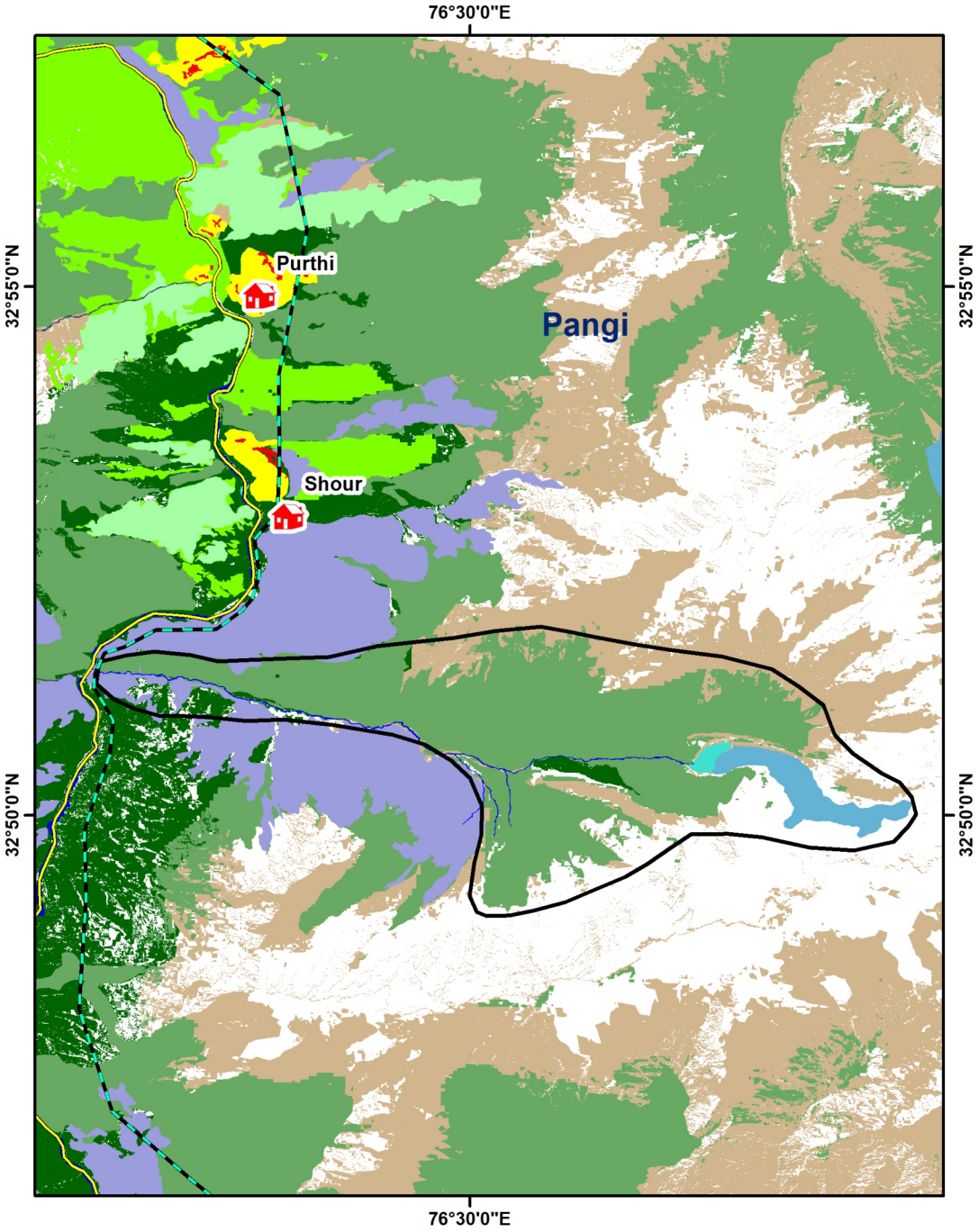
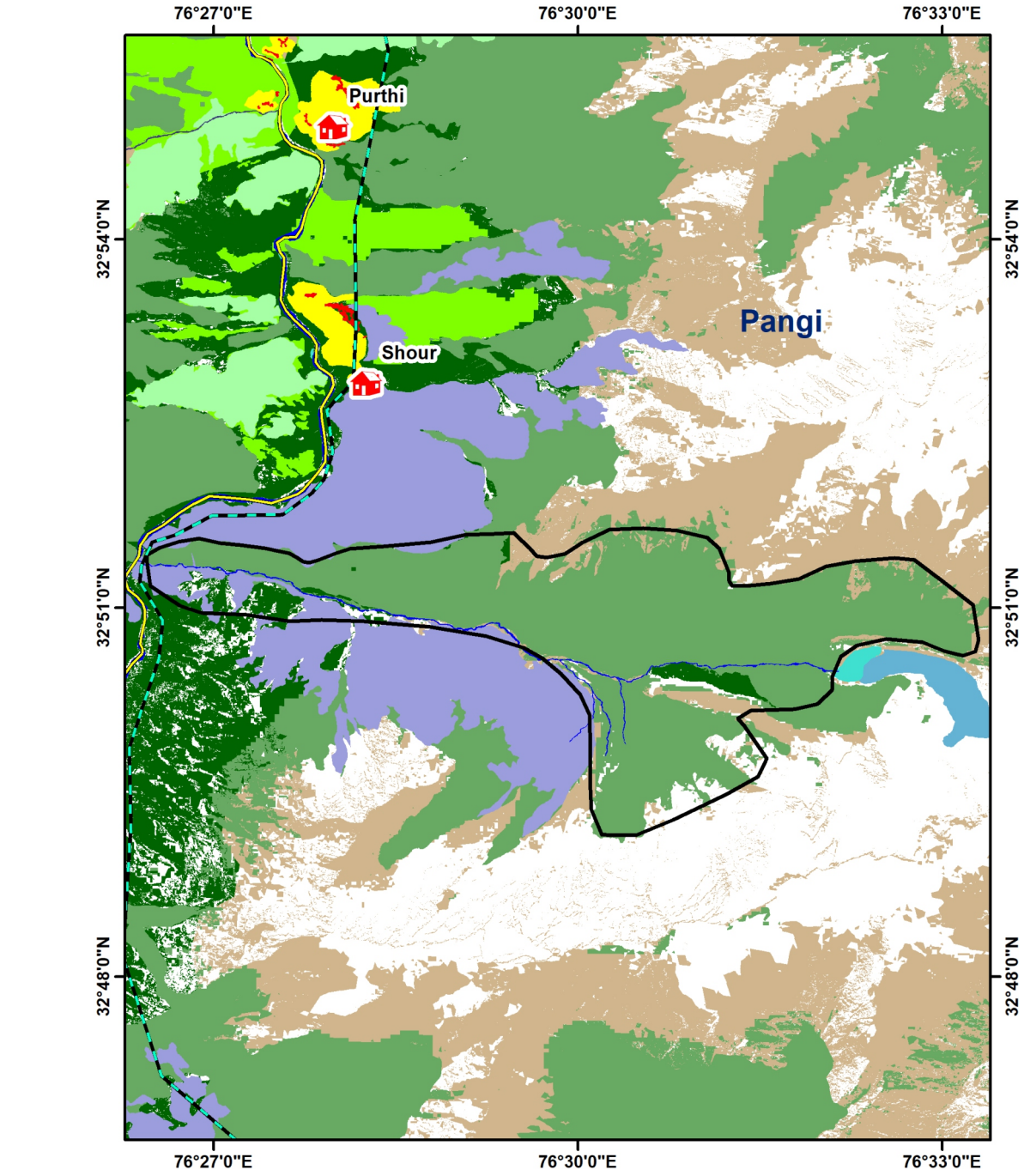



**Figure 49:** Kadu Nallah - Potential HCV Area in Pangi Valley for criterion 4 (Ecosystem Services)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

Area Size : 19.90 Sq km
District : Chamba
State : Himachal Pradesh

N
W E
S

**Legend**

- Associated Villages
- Kadu Nallah
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Water body
- Barren Land
- Agriculture
- Temperate coniferous
- Deodar
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture
- Glaciers

0 0.75 1.5 3 4.5 6 Kilometers

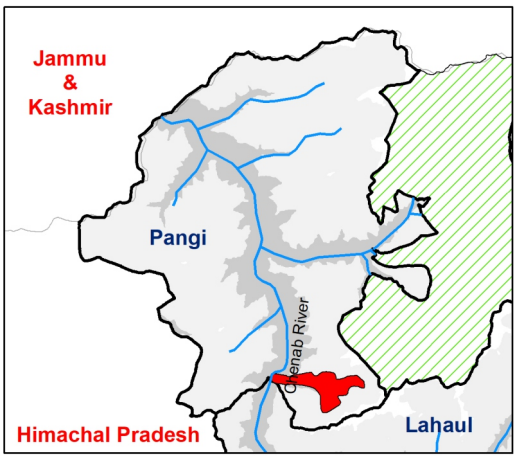



**Figure 50:** Kadu Nallah - Potential HCV Area in Pangi Valley for criterion 5 (Community Needs)

## AREA 5: MINDHAL

It is situated at 33° 01' 10.29" N -32° 57' 15.42" N latitude 76° 20' 39.10" E-76° 25' 51.71" E longitudes at an elevation range from 2183-4946 meters, at a distance of about 17 km from Killar. It has been recognized as a Demarcated Protected Forest (DPF) in the Sach Range. The area has been identified as a potential high conservation value area under 3 criteria of HCVAs. The biodiversity and socio-cultural values of the area have been stated below:

**HCV-1 (Species and Diversity)**

- Major faunal species, as reported by key informants, in the area are Asiatic black bear, Himalayan brown bear, Asiatic ibex, musk deer and Ghoral.
- Few of the important floral species recorded in the area includes *Picrorhiza kurroa, Dactylorhiza hatagirea, Aconitum heterophyllum, Podophyllum hexandrum, and Saussurea costus (cultivated).*

**HCV-4 (Ecosystem Services)**

- The forested area of the region mainly comprises of trees of *Betula Utilis*; and the alpine meadows supporta variety of medicinal and aromatic plants.
- They provide supporting and regulating services by preventing natural hazards (floods and landslides) and helping in carbon sequestration and storage, in biomass and soil.
- Forested areas help in regulating the flow of water within a catchment, prevent soil erosion and provide natural resources (e.g. fodder plants, timber as renewable raw material) for energy production and construction.

**HCV-5 (Community Needs)**

- Basic community needs in the area are the timber wood and fuel-wood from forests and pastureland for livestock grazing.
- As per the key informants, migratory herders of the Gaddi community also utilize the upper reaches of the pastures to graze their livestock during the summer season.
- The land-use practices by the local communities include extraction of high-value medicinal plants, livestock grazing and extraction of fuel-wood andfodder plants in parts of the region.

**HCV-6 (Cultural Values)**

- It is situated at 33° 0' 8.35" N latitude and 76° 24' 46.69" E longitude, at an elevation of 2400 meters above mean sea level. The village is famous for the Mindhal Mata Temple and local communities have great faith in the deity.
- The temple of Chamunda Devi or Mindhal Mata is believed to be 1000 years old and is one of the most sacred places in the valley; people of Pangi have great faith in the deity (Chaudhary, 1998).
- Two main fairs are held annually near the temple, Milyath and Sarjaat, and people from all across the valley take part in these events. Milyath is celebrated for a day in the month of Bhadra (August-September) and Sarjaat is celebrated on the day of Puranmashi in Asvina (September-October) every year (Chaudhary, 1998).

The site is of cultural importance for the local communities as they believe that the Devi brings good crops and fortune if worshipped otherwise crops fail and natural calamities strike.


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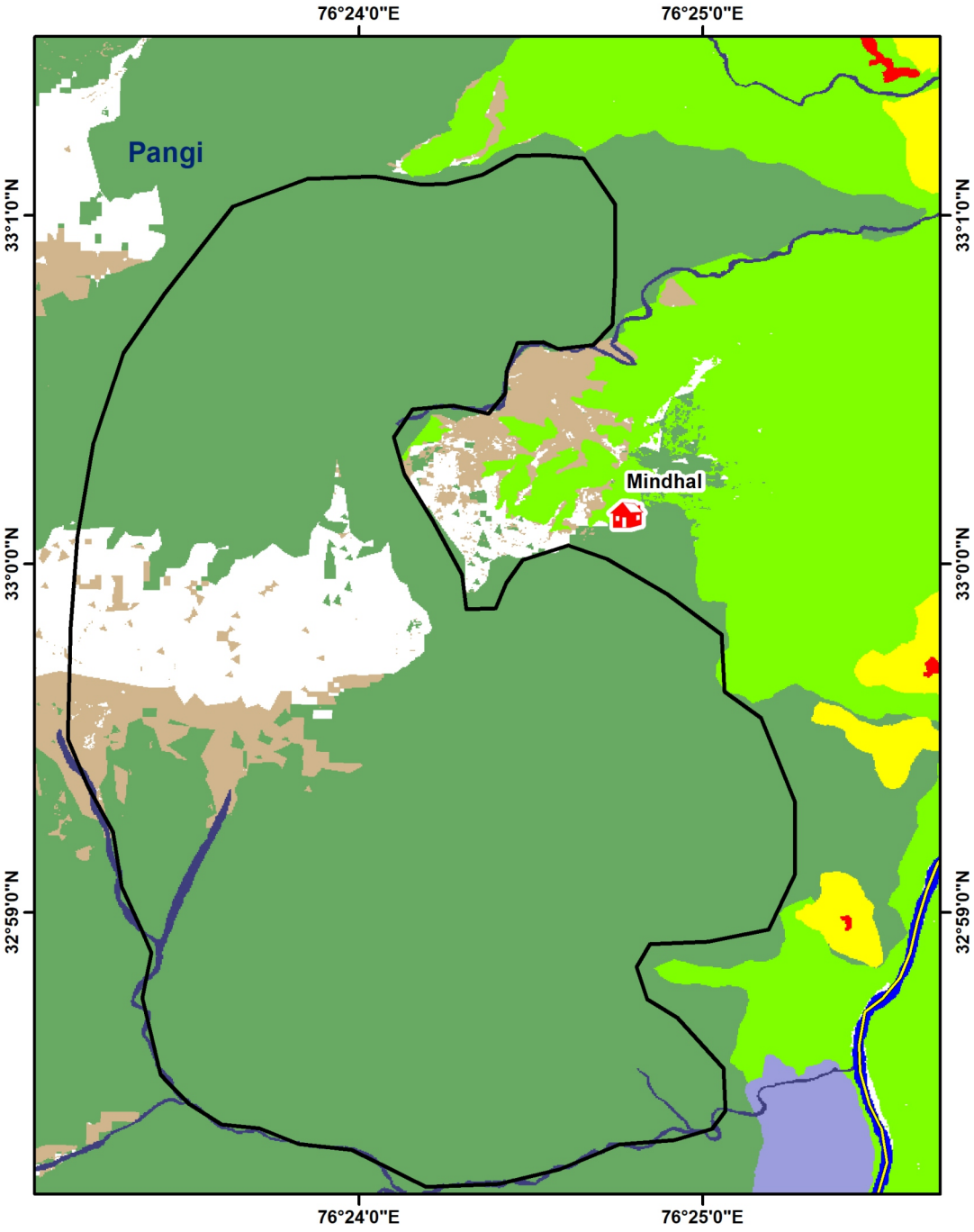


**Image 27:** *Saussrea costus* –
an important medicinal plant found in Mindhal, Pangi Valley

*Prateek Savita*

**Table 35: Potential threats and conservation recommendation for High Conservation Value Area Mindhal in Pangi landscape of H.P.**

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | The impacts of livestock over-grazing on rangeland vegetation and wild ungulate populations have been a longstanding conservation concern (Mishra *et al.*, 2004). In Mindhal valley, degradation of pastureland due to intensive grazing by livestock of both migratory and local herders, has led to the issue of pastureland degradation in the southern extent. | Demarcation of critical areas within a larger pasture for livestock grazing in the south-western part of the demarcated region; and implementation of integrated pastureland management regimes with the support of the local communities and the forest department to prevent over-exploitation of a particular area. |
| 2. | Due to presence of domestic livestock in habitat range of large carnivore species, conflict has been reported by the herders in form of depredation of livestock by Himalayan brown bear in the pastureland. | Anti-predatory livestock management through fences and other barriers, human-accompanied herding of livestock to reduce livestock losses is recommended. |
| 3. | With commercialization and large scale exploitation of medicinal plants for trade, there has been significant decline in the availability of the medicinal plants (Samant *et al.*, 1998; Ghimire *et al.*, 2004).<br>Overharvesting, pre-mature harvesting, illegal extraction of rare and threatened medicinal and aromatic plants has been reported from the forests of *Betula utilis* in the region and pastures in the northern/north-eastern extent. | Enhanced training concerning the extraction, harvesting and sustainable use of medicinal and aromatic plants needs to be provided to the key stakeholders *i.e.* the local communities of Mindhal villages. |
| 4. | No threats to conservation, or otherwise, were observed near the Mindhal Mata temple, during the survey. | The celebration of the fairs could be considered as an opportunity to spread awareness and promote community participation for biodiversity conservation with the support of the head priest of the temple. |



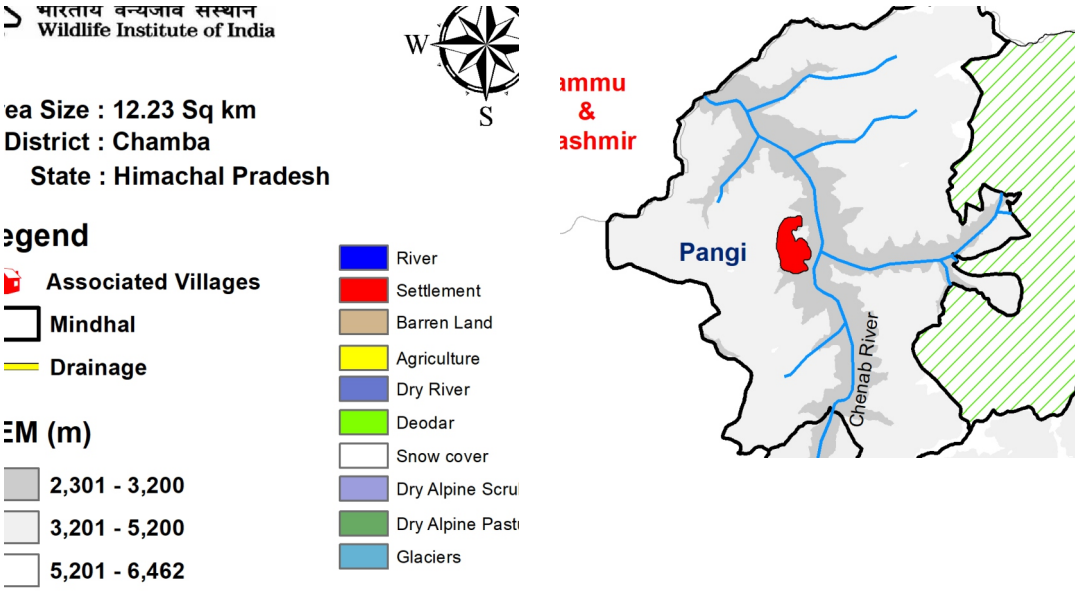
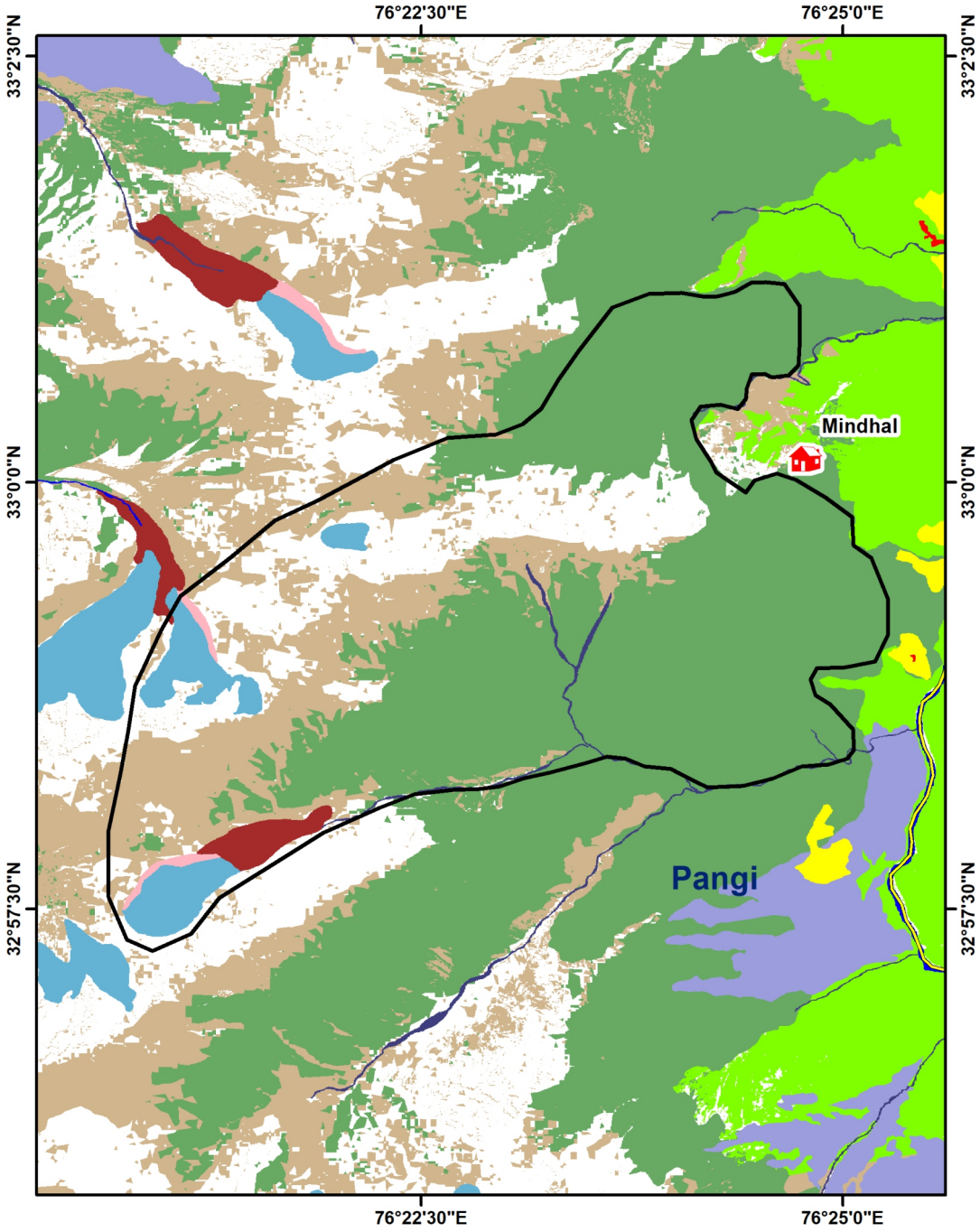




**Figure 51:** Mindhal-Potential HCV Area in Pangi Valley for criterion 1 (Species and Diversity)




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Area Size : 26.97 Sq km
District : Chamba
State : Himachal Pradesh

**Legend**

- Associated Villages
- Mindhal
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Barren Land
- Lateral moraines
- Agriculture
- Deodar
- Snow cover
- Dry Alpine Scrub
- Dry Alpine Pasture
- Glaciers

0 0.5 1 2 3 4 Kilometers

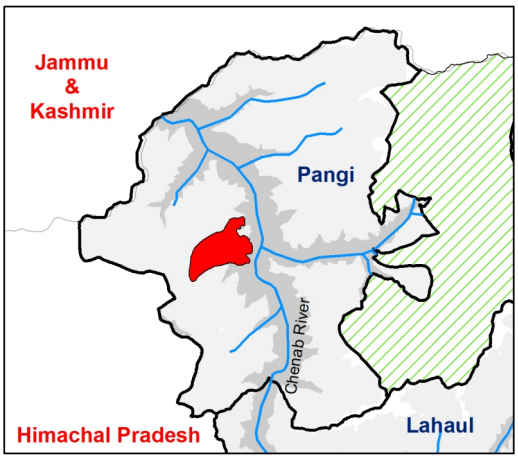
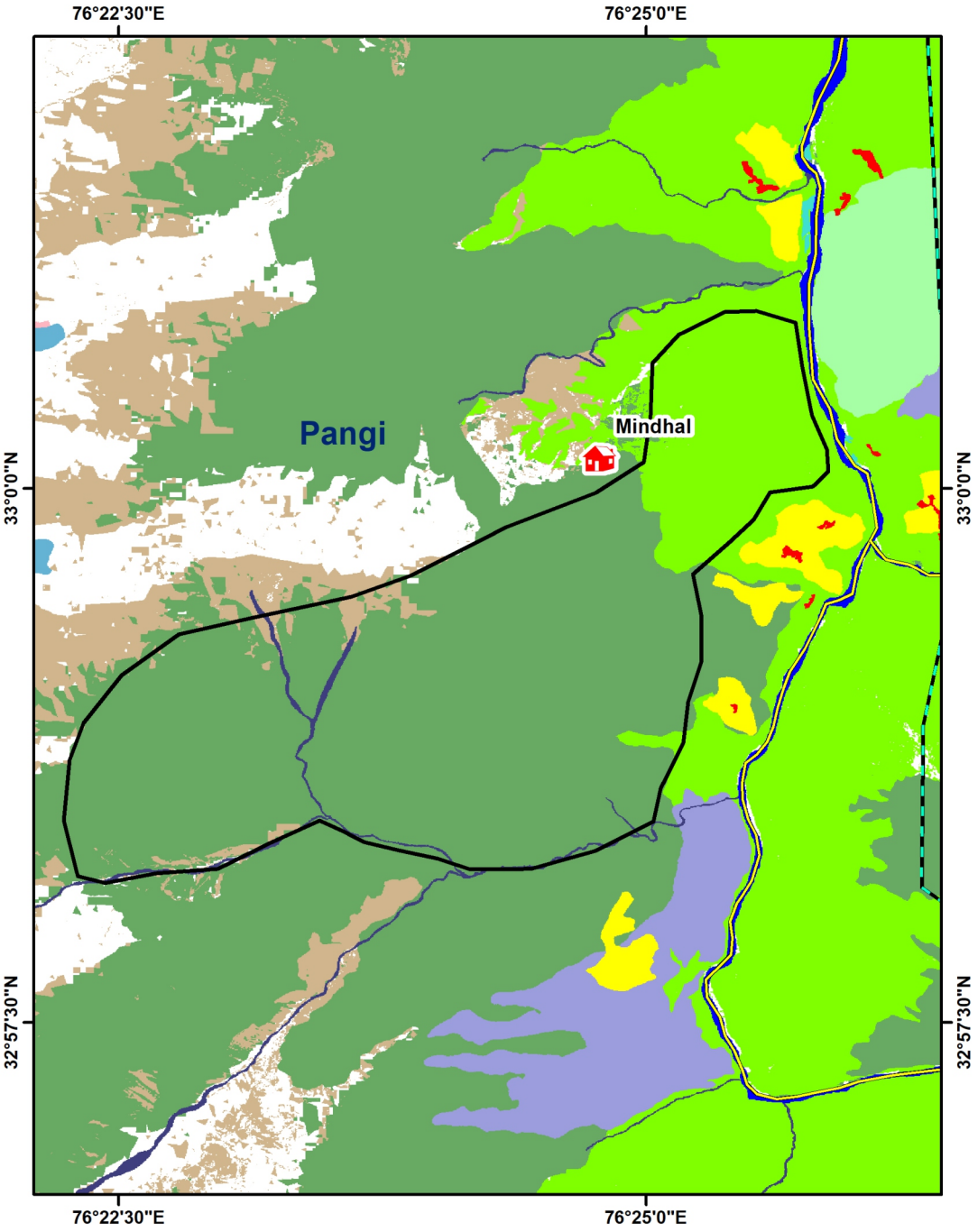



**Figure 52:** Mindhal-Potential HCV Area in Pangi Valley for criterion 4 (Ecosystem Services)




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Wildlife Institute of India

N
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Area Size : 12.88 Sq km
District : Chamba
State : Himachal Pradesh

**Legend**

- Associated Villages
- Mindhal
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Agriculture
- Deodar
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture
- Glaciers

0 0.45 0.9 1.8 2.7 3.6 Kilometers

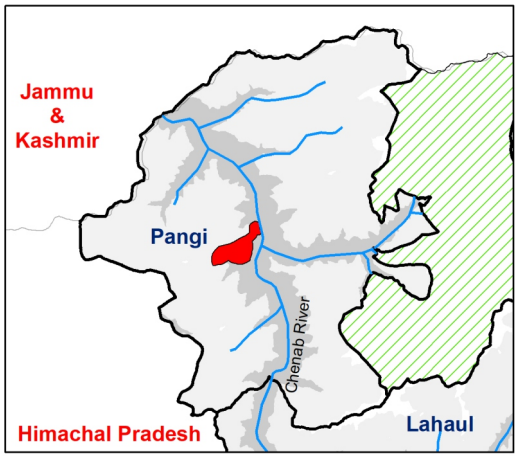
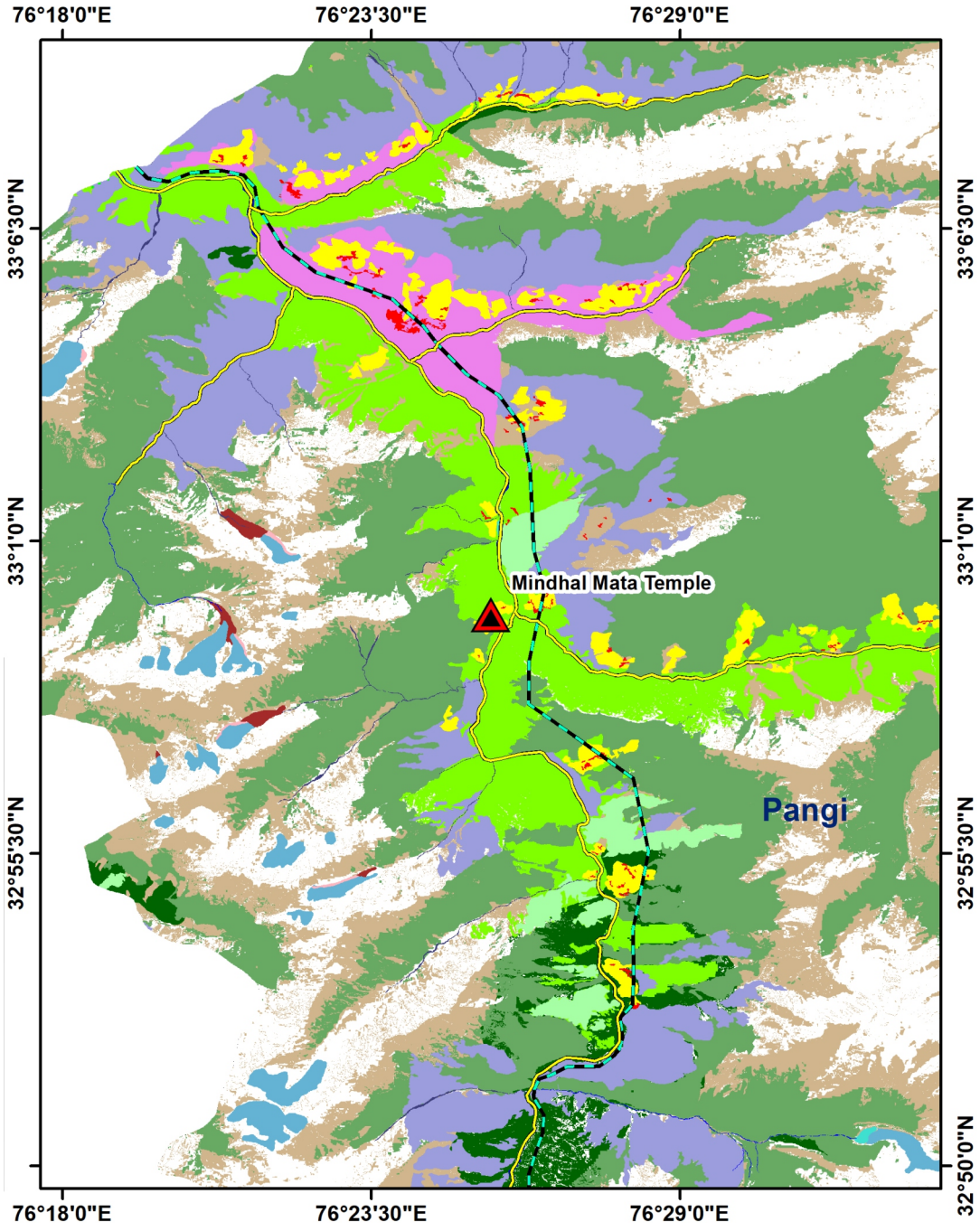



**Figure 53:** Mindhal-Potential HCV Area in Pangi Valley forcriterion 5 (Community Needs)




भारतीय वन्यजीव संस्थान
Wildlife Institute of India

N
W E
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Area Size : 0.0076 Sq km
District : Chamba
State : Himachal Pradesh

**Legend**

- Mindhal Mata Temple
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Barren Land
- Orchard
- Agriculture
- Temperate coniferous
- Deodar
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture
- Glaciers

0 1.5 3 6 9 12 Kilometers

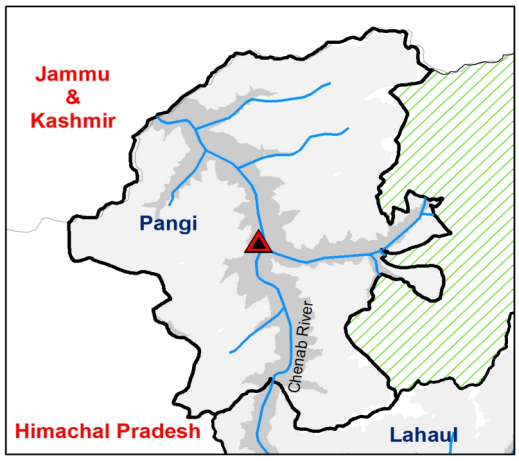



**Figure 54:** Mindhal Mata Temple- Potential HCV Area in Pangi Valley for criterion 6 (Cultural Values)



**Image 28:** Mindhal Mata Temple near Mindhal village, Pangi Valley

*Prateek Savita*

## AREA 6: LUJ

It is situated at 33° 8' 54.78" N-33° 5' 1.95" N latitude and 76° 18' 35.17" E-76° 22' 6.93" E longitudes at an elevation range from 2210-4188 meters, about 12 km from Killar.The area has been recognized as a Reserved Forest (RF) in Killar Range.

**HCV-3 (RET Ecosystem and Habitat)**

- The demarcated forest patch is dominated by *Pinus gerardiana*, interspersed with Spruce, Fir, Deodar, Blue pine and Hazelnut; also is confined to some dry and rocky spurs in Kanun reserve forests (Working plan for Pangi forest division, 2002-22).
- The species is facing a higher risk of extinction and therefore, categorized as endangered in the Himalayan region (Sehgal and Sharma, 1989) and also listed in Red Data Book (Dogra, 1964). It is commonly known as Chillgoza or Neoza, and is found only in the Luj region in the entire Pangi valley.

**HCV-4 (Ecosystem services)**

- The forested areas are dominated by *Pinus gerardiana*- an endangered species interspersed with deodar, blue pine, spruce, fir and hazelnut.
- Forested areas help in regulating the flow of water within a catchment, prevent soil erosion and provide natural resources (e.g. fodder plants, timber as renewable raw material) for energy production and construction.
- The demarcated area also includes the adjoining alpine meadows of Kanun and Pinchoo which provide supporting and regulating services.
- They prevent natural hazards (floods and landslides) and helps in carbon sequestration and storage, in biomass and soil.

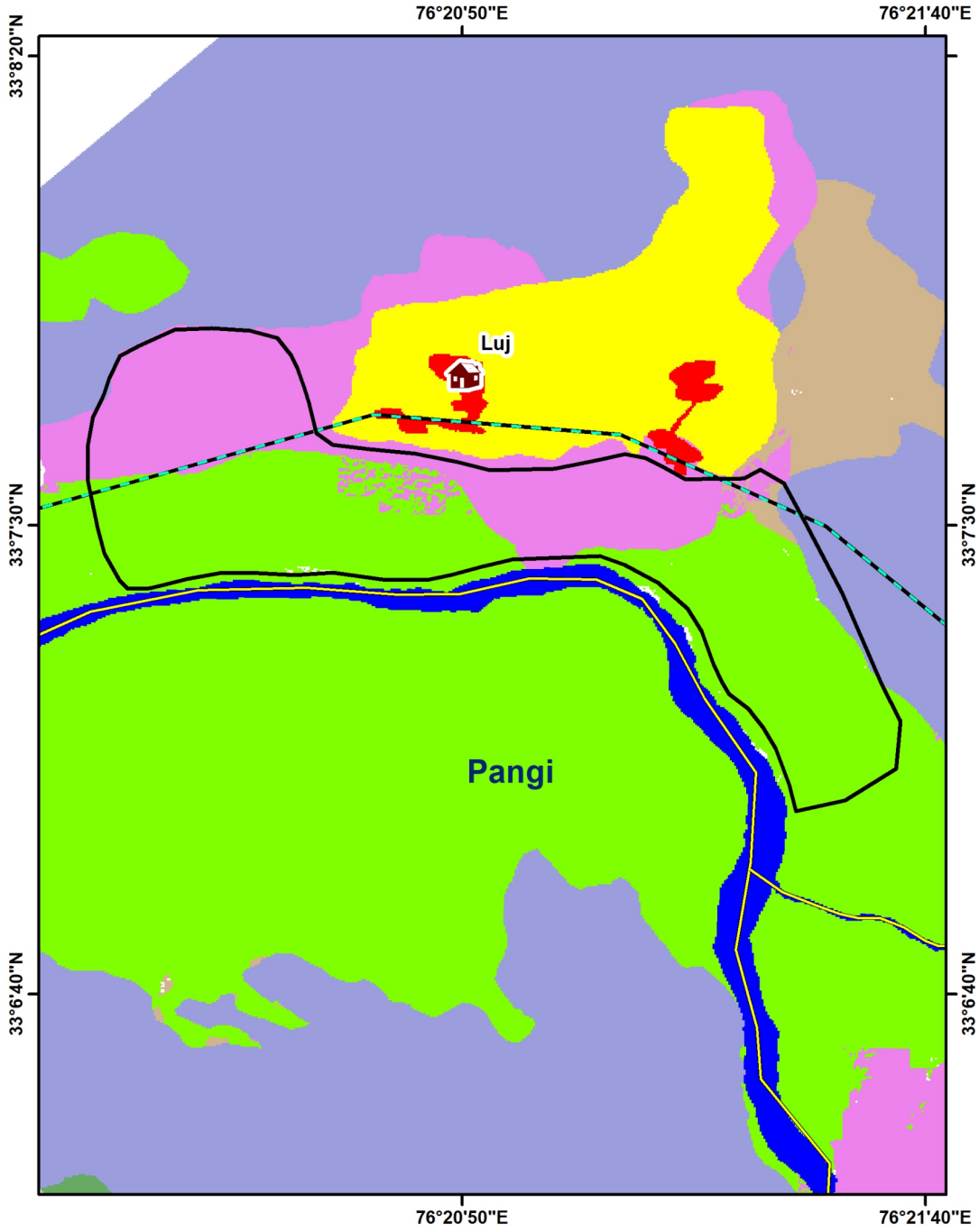
**HCV-5 (Community Needs)**

- The local communities of Dharwas & Luj villages are involved in collection of chillgoza nuts from the demarcated forested area, during the month of September.
- The migratory herders from Kistwar graze their livestock in the pastures of Kanun during the summer season in the valley.

**Table 36: Potential threats and conservation recommendation for High Conservation Value Area Luj in Pangi landscape of H.P.**

| S.No. | Potential Threats | Recommendations |
|---|---|---|
| 1. | The local communities and migratory herders from Kistwar graze their livestock in the pasturelands of the region which causes degradation due to intensive grazing by domestic livestock in the meadows of Dhar Kanun. | Implementation of integrated pastureland management regimes with the support of the local communities and the forest department in the western part of the meadows to reduce pressure on the pastureland and to prevent over-exploitation of a particular area. |
| 2. | Over-exploitation of natural resources in forest areas produces rapid and irreparable damage to the environment (Gupta, 1978); and chilgoza pine nuts fetch very high price in the markets due to its extensive demand (Malik, 2007).<br>Over-exploitation of fuel-wood and pine cones of *Chillgoza* from the forested areas by the local communities and intruders in the valley. | Natural resource management by promoting sustainable utilization of forest resources like fuel-wood, fodder plants, medicinal plants and chillgoza pines in Dharwas and Luj through local participation.<br>Artificial plantation of *Pinus gerardiana* could be promoted among the communities in and around the village regions. |


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Area Size : 1.24 Sq km
District : Chamba
State : Himachal Pradesh

N
W
E
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**Legend**

- Associated Villages
- Luj
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Settlement
- Barren Land
- Lateral moraines
- Agriculture
- Deodar
- Snow cover
- Dry Alpine Scrub

0 0.175 0.35 0.7 1.05 1.4
Kilometers

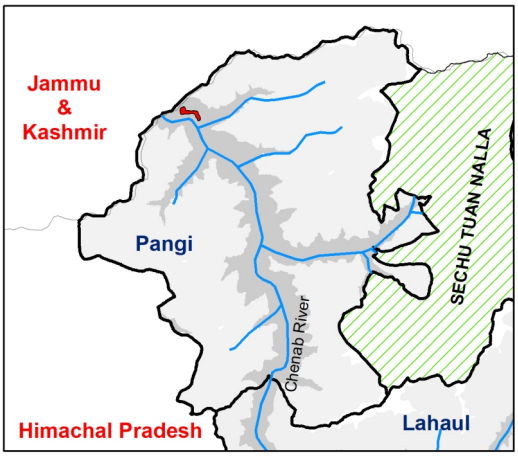
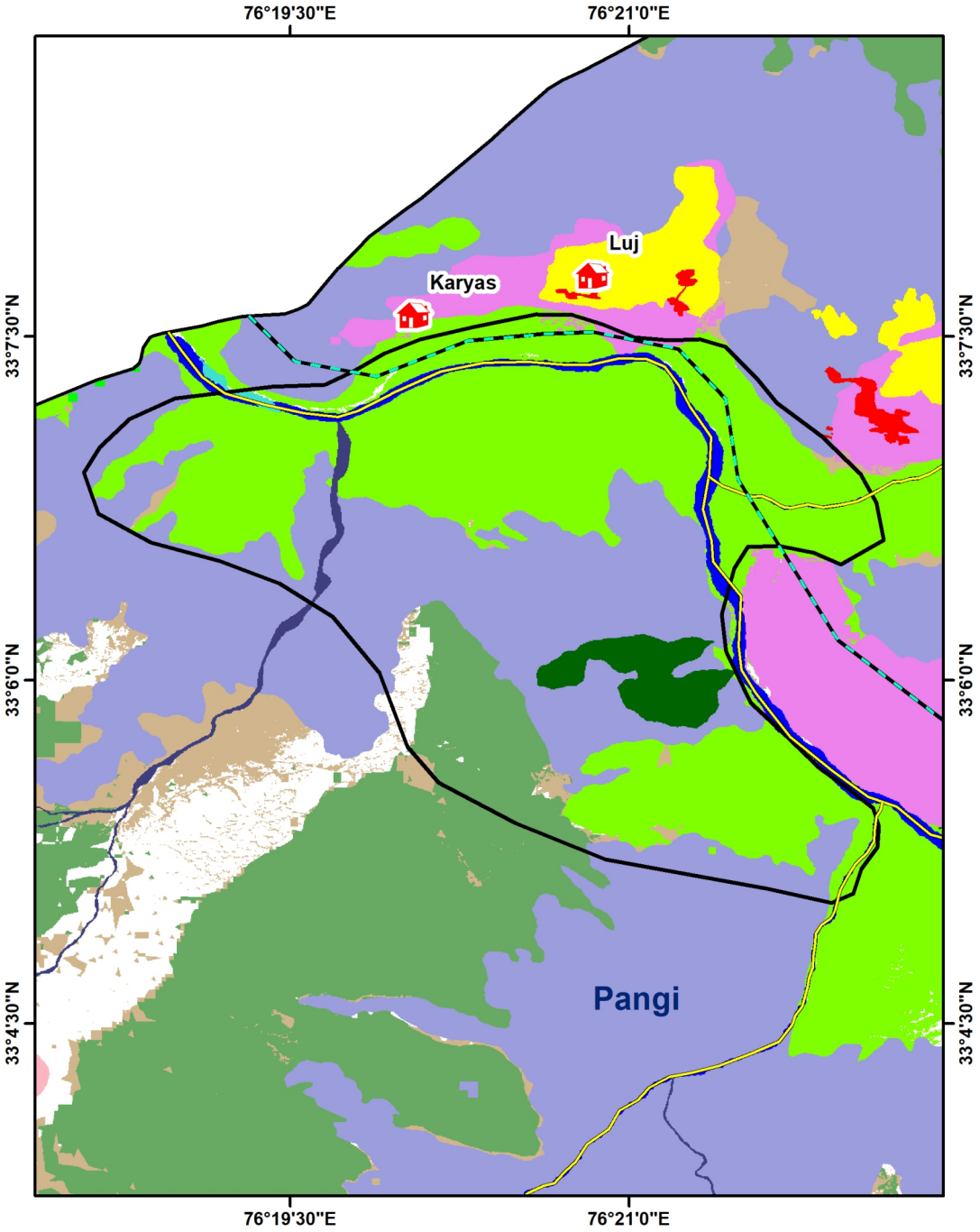



**Figure 55:** Luj - Potential HCV Area in Pangi Valley for criterion 3 (RET Ecosystem and Habitat)




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Wildlife Institute of India

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Area Size : 14.74 Sq km
District : Chamba
State : Himachal Pradesh

**Legend**

- Associated Villages
- Luj
- Road
- Drainage

**DEM (m)**

- 2,301 - 3,200
- 3,201 - 5,200
- 5,201 - 6,462

- River
- Terminal moraines
- Settlement
- Water body
- Barren Land
- Lateral moraines
- Agriculture
- Grassland
- Marshy land
- Temperate coniferous
- Deodar
- Snow cover
- Dry Alpine Scrub
- Pine
- Dry Alpine Pasture
- Glaciers

0 0.425 0.85 1.7 2.55 3.4
Kilometers

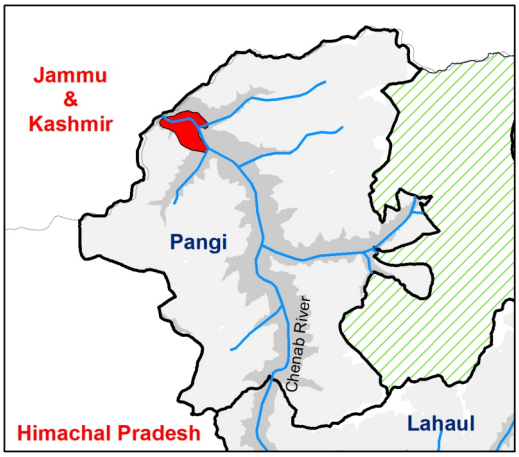



**Figure 56:** Luj - Potential HCV Area in Pangi Valley for criterion 4 (Ecosystem Services)

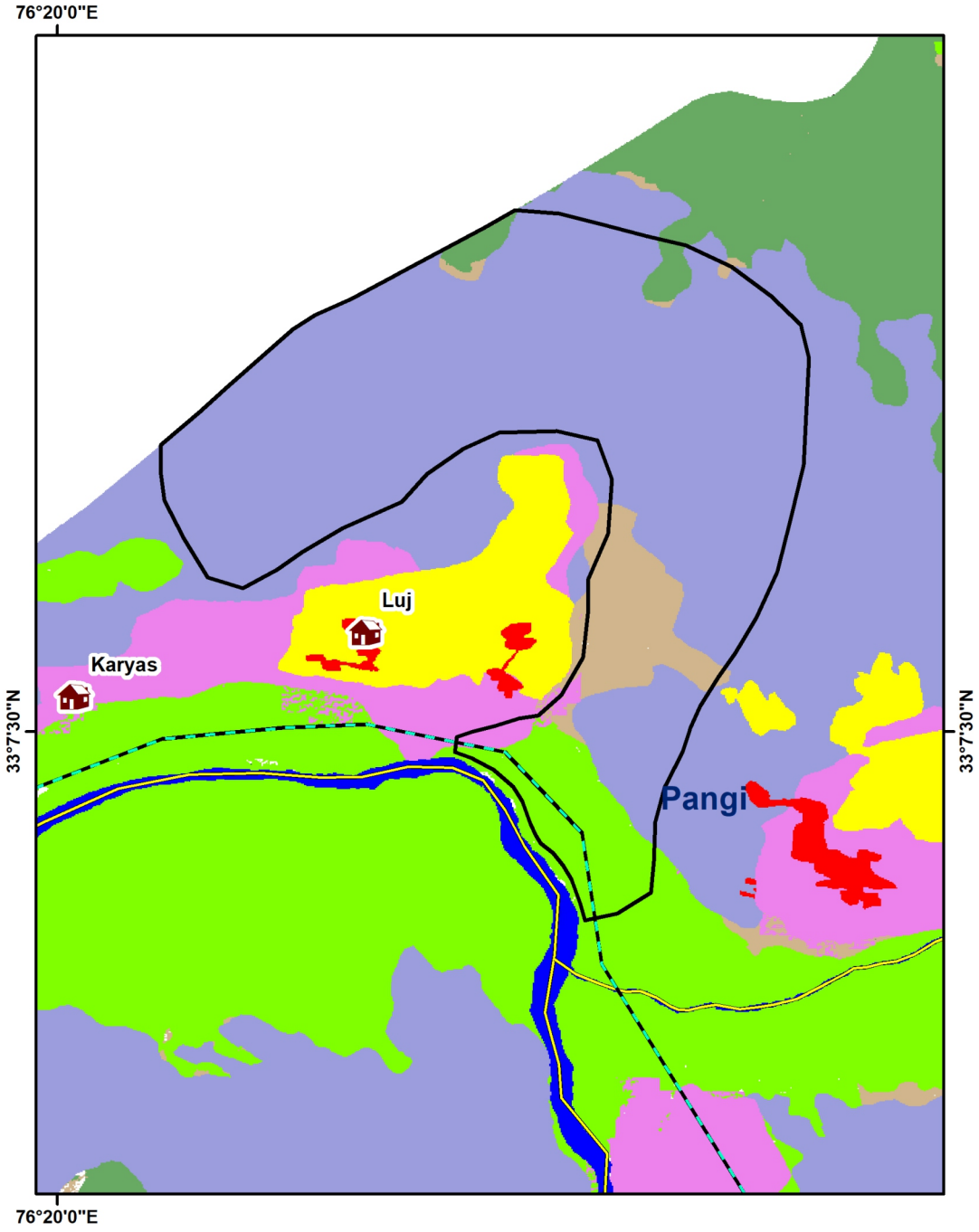



**Figure 57:** Luj - Potential HCV Area in Pangi Valley for criterion 5 (Community Needs)



**Image 30:** *Pinus gerardiana* forest patch near Luj Village, Pangi Valley

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### 9.2.1 Resource availability and the extent of dependence of the local communities Pangi Valley

**Table 37: Resource availability and dependence of the communities in the HCVAs in Pangi Valley**

| S.No | HCVAs | Resource availability & dependence of the local communities | | | | Extent of dependency |
|---|---|---|---|---|---|---|
| | | Livestock grazing | Medicinal plants/ NTFP extraction | Fuel-wood extraction | Fodder plants | |
| 1. | Sural Bhatori | ✓ | ✓ | ✓ | ✓ | The local communities of the villages of the Sural panchayat are highly dependent on the forested areas across the sural Nallah to fulfill their fuel-wood, fodder collection and medicinal plants collection, and on the pastures near the adhwari and ahead of the Chabbi waterfall to for local livestock grazing during summer season. |
| 2. | Sechu | ✓ | ✓ | | | The area demarcated lies adjacent to the Sechu tuan WLS.The local communities of the villages of Chasak and Chasak Bhatori graze their livestock in the nearby pastures, around the adhwaris. The locals are involved in extraction of medicinal plants, mostly, Bunium persicum, from the pastures for self-use as well as for commercial purpose. The locals are highly dependent on the meadows for their basic needs. The Sidhani dhar region is known to be highly exploited for medicinal and aromatic plants by the intruders in the valley. |
| 3. | Hudan Bhatori | ✓ | ✓ | | | The villagers/local communities of the Hudan and Hudan Bhatori villages are highly dependent on the pastures of the region for livestock grazing during the summer season, mostly in western and northern extent, as well as for extraction of medicinal plants for self-use from the meadows. |
| 4. | Kadu Nallah | ✓ | ✓ | | | The local communities of Shour and Purthi villages are highly dependent on the meadows and forested areas around the villages in the valley for grazing their livestock, in the northern extent near the adhwaris on right bank of Kadu Nallah.<br>The forested regions and pastures are also utilized by locals for medicinal plants extraction for self-use and by intruders for commercial purpose. |
| 5. | Mindhal | ✓ | ✓ | ✓ | ✓ | The local communities of the villages of the Mindhal are dependent on the forested areas for their fuel-wood, fodder collection and medicinal plants collection needs.<br>The migratory herders are known to utilize the pastures in the southern extent for livestock grazing during summer season for 2-3 months. |
| 6. | Luj | ✓ | ✓ | | | The villagers of Lujand Dharwas villages are involved and dependent on extraction of chillgoza nuts and medicinal plants from the demarcated forest region during the months of September and October.<br>The pasturelands near the Kanun slope/dhar are known to be utilized by the migratory herders of Kistwar during summer season for grazing their livestock. |

**Note:** *In the current frame and scope of the assignment, we have only attempted to list dependence of the communities on the various resources in the areas qualitatively; to understand the extent in detail the areas require further study and assessment which was beyond the time frame of the current assignment.*

### 9.2.2 Area-Statistics – Pangi Valley

**Table 38:Area statistics of various High Conservation Value Areas (HCVAs) identified in Pangi Valley**

| S.No. | Identified HCVA in Pangi Valley | Size of the Area ($km^2$) | | | | | |
|---|---|---|---|---|---|---|---|
| | | HCV 1 | HCV 2 | HCV 3 | HCV 4 | HCV 5 | HCV 6 |
| 1. | Sural Bhatori | 79.99 | 88.47 | - | 81.14 | 14.97 | 0.0098 |
| 2. | Sechu | 153.31 | - | - | - | 30.26 | - |
| 3. | Hudan Bhatori | 15.61 | 62.88 | - | 27.97 | 8.68 | - |
| 4. | Kadu Nallah | 31.80 | 58.16 | - | 29.31 | 19.90 | - |
| 5. | Mindhal | 12.23 | - | - | 26.97 | 12.88 | 0.0076 |
| 6. | Luj | - | - | 1.24 | 14.74 | 4.27 | - |

### 9.2.3 Land use/tenure of the areas identified as HCVAs – Pangi Valley

**Table 39: Land use/tenure of various High Conservation Value Areas (HCVAs) identified in Pangi Valley**

| S.No. | HCVAs (Lahual Valley) | Existing Provision | Land use/tenure |
|---|---|---|---|
| 1. | Sural Bhatori & Sural Gompa | Un-demarcated Protected Forest (UPF Sural Bhatori) | The demarcated area of the valley comprises of forested areas, settlements, agricultural lands and the alpine meadows. The settlements and agricultural lands are private lands owned by the local residents. The pasture lands and the forested areas falls under State Forest Department, however, the local communities (Villages of Sural, Sural Bhatori, Rusmos, Tai, Kanwas, Ganmas, Andali) are allowed to extract resources from the forest and utilize pastures for grazing their livestock. The *Betula utilis* forest on the left bank of Sural Nallah, is also protected by the Praza mandal of the village. |
| 2. | Sechu | (Reserved Forest) RF Sechu)/ (Demarcated Protected Forest) DPF Gajrahan, DPF Sechu/Eco-sensitive zone of Sechu Tuan WLS | A part of demarcated area lies in the eco-sensitive zone of the Sechu tuan Wildlife Sanctuary, and falls under the Chamba Wildlife Division of Himachal Pradesh Forest Department. The region, is being utilized by the locals of the villages of Sechu, Chasak, Chasak bhatori and Moji villages for extraction of medicinal plants (mainly from Sidhani Dhar), fuel-wood and grazing their livestock. Residents of Chasak Bhatori are limited to Chasak Dhar. |
| 3. | Hudan Bhatori | - | The area encompasses of alpine meadows, and falls under the jurisdiction of State Forest Department with local communities of Hudan, Hudan Bhatori villages having the right to utilize the pastures for medicinal plants extraction and livestock grazing during summer season. |
| 4. | Kadu Nallah | DPF Kadu Nallah | The region comprises of alpine meadows and forested areas, which falls under State Forest Department. The locals of Shour and Purthi, however, are permitted to utilize the pastures to graze their livestock. |
| 5. | Mindhal & Mindhal Mata Temple | DPF Mindhal | The area comprises of forested tracts, mainly comprising of Betula utilis trees, and alpine meadows. The area falls under the jurisdiction of the State Forest Department. The local herders of Mindhal as well as migratory herders of Gaddi communities are allowed to utilize the pastures. Locals of Mindhal village also utilize the forested area for extraction of natural resources, mainly fallen wood for fuel wood. |
| 6. | Luj | RF Luj | The demarcated area of the valley comprises of forested areas, agricultural lands and the alpine meadows. The agricultural lands are private lands owned by the local residents. The pasture lands and the forested areas falls under State Forest Department, however, the local communities of Luj and Dharwas villages are allowed to extract resources (NTFPs, fuel-wood, medicinal plants) from the forest and utilize pastures for grazing their livestock. |

## 9.2.4 Coordinates and Elevation Range of the areas identified as HCVAs – Pangi Valley

**Table 40: Coordinates and Elevation of High Conservation Value Areas (HCVAs) identified in Pangi Valley**

| S.No | Area | Latitude | Longitude | Elevation |
|---|---|---|---|---|
| 1. | Sural Bhatori | 33° 07' 59.94" -33° 12' 33.63"N | 76° 24' 53.25" -76° 37' 39.05"E | 2903-5397 m |
| 2. | Sechu | 32° 50' 48.09"-33° 02' 38.18"N | 76° 27' 36.48"-76° 38' 44.20"E | 3110-5233 m |
| 3. | Hudan Bhatori | 33° 04' 36.57"-33° 08' 24.52"N | 76° 27' 12.83"-76° 35' 56.86"E | 3606-5605 m |
| 4. | Kadu Nallah | 32° 49' 02.75"-32° 52' 55.64"N | 76° 26' 17.82" -76° 34' 15.38"E | 2337-4965 m |
| 5. | Mindhal | 33° 01' 10.29" -32° 57' 15.42"N | 76° 20' 39.10" -76° 25' 51.71"E | 2183-4946 m |
| 6. | Luj | 33° 08' 54.78"-33° 05' 01.95"N | 76° 18' 35.17"-76° 22' 6.93"E | 2210-4188m |

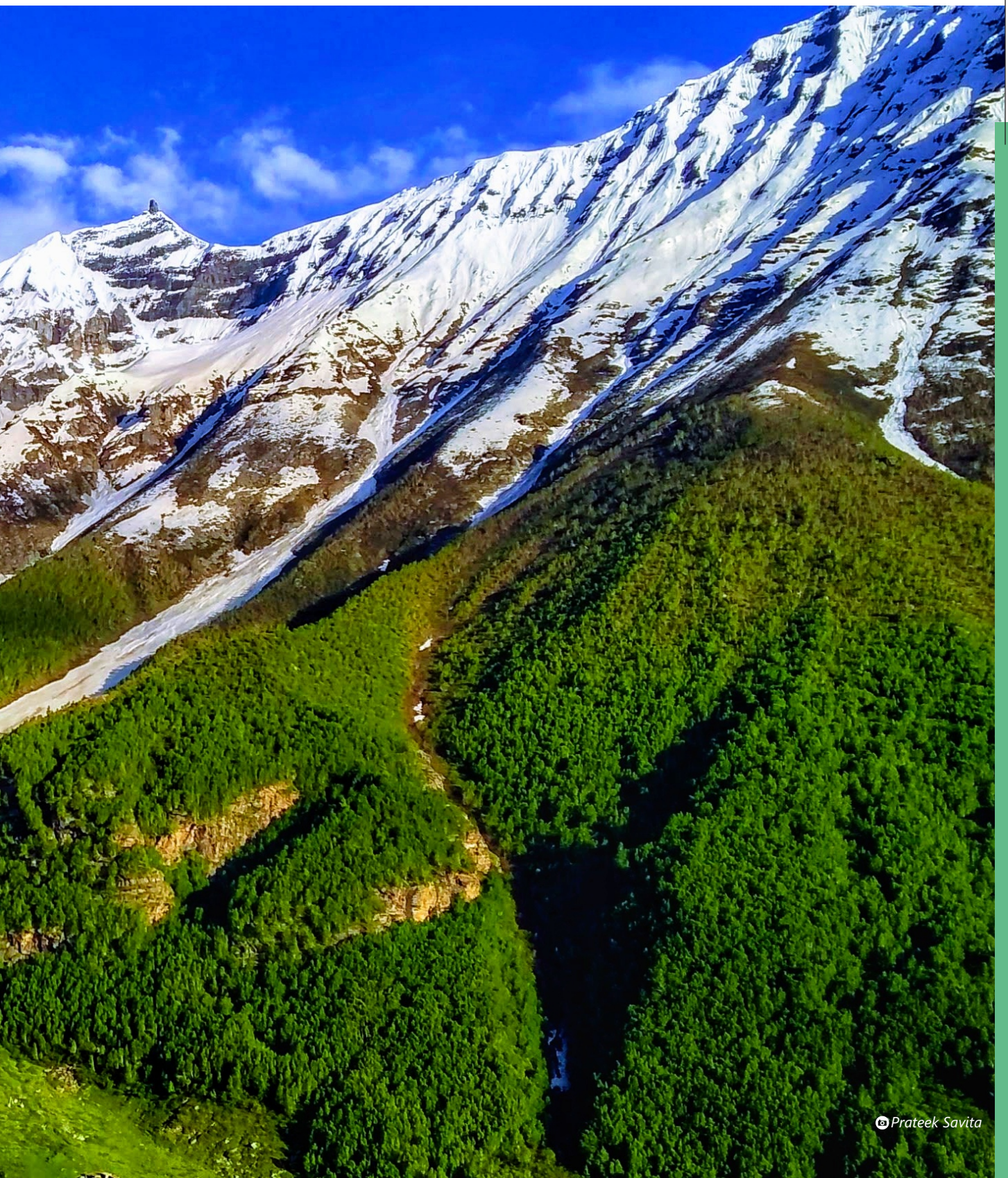




**Image 26:** Kadu Nallah landscape in Pangi Valley




# 10. HARMONIZATION OF POLICIES FOR IDENTIFIED HIGH CONSERVATION VALUE AREAS IN THE LANDSCAPE



Protection of wildlife and biodiversity involves policies and legislations to govern aspects like land use; and span a wide range from the local level to National to International level. The government of India has initiated many such schemes to protect the biodiversity and minimize the mortality of threatened species and degradation of ecosystems of the country.

In the SECURE landscape of Lahaul and Pangi, after the identification and mapping of high conservation value areas under various criteria, policy harmonization was carried out for the areas. Brief description of the policies that were considered in the assignment has been stated below:

**Conservation reserve & community reserve: concept and provisions as per WLPA 1972**

According to the Wildlife (Protection) Act 1972 (as amended up to 2003):

Section (36 A), the state government may, after having consultations with the local communities, declare an area owed by the government, particularly areas adjacent to National Parks and sanctuaries and those areas which link one protected area with another, as a conservation reserve for protecting the landscape, seascapes, flora and fauna and their habitat.

Section (36 C), the state govt. may, where the community or an individual has volunteered to conserve wildlife and its habitat, declare a private or community land not comprised within a National Park, sanctuary or a conservation reserve, as a community reserve, for protecting flora, fauna and traditional or cultural conservation values and practices. For further details on the sub-sections refer toAppendix X (1).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

CITES is an international agreement between governments. It aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Many species in trade are not endangered, but the existence of an agreement to

ensure the sustainability of the trade is important to protect these resources. The CITES secretariat is administered by UNEP and is located at Geneva, Switzerland, and it was drafted as a result of a resolution adopted in 1963 at a meeting of members of IUCN. The text of convention was agreed at a meeting in Washington D.C., on March 3rd 1973, with members from over 80 countries. CITES was enforced on July 1st 1975. Website: http://www.cites.org

**The Convention on the conservation of Migratory Species of Wild Animals (CMS)**

Also known as the Bonn Convention, it aims to conserve terrestrial, aquatic and avian migratory species throughout their ranges which often cross several national borders. It is an intergovernmental treaty, concluded under the aegis of the United Nations Environment Programme (UNEP). The decision making body of the convention is the Conference of the Parties (CoP). Migratory species threatened with extinction are listed on Appendix I of the Convention and those that need or would significantly benefit from international co-operation are listed in Appendix II of the Convention. The CMS complements and co-operates with a number of other international organizations, NGOs and partners in the media as well as in the corporate sector as it is the only global convention specializing in the conservation of migratory species, their habitats and migration routes. Website: http://www.cms.int

**The Convention on Biological Diversity (CBD)**

In 1992, governments, indigenous groups and non-governmental organizations (NGOs) from around the world gathered in Rio de Janeiro, Brazil, for the Rio Earth Summit. It was the largest international environmental meet, and CBD was one of the conventions that emerged during the summit. The convention is a comprehensive, binding, global agreement aiming at conservation and sustainable use of the various elements of biodiversity. The convention has three main goals: the conservation of biodiversity, the sustainable use of its components and the fair and equitable sharing of the benefits from the use of resources. Website: http://www.cbd.int

**The Biological Diversity Act, 2002**

On June 5, 1992, India signed the Convention on Biological Diversity at Rio de Janeiro which provides a framework for the sustainable management and conservation of our country's natural resources. In April 2004, the Ministry of Environment and Forests and Climate Change (MoEFCC) notified the Biological Diversity Rules 2004 under the Biological Diversity Act, 2002. The act was enacted to meet India's obligations under the CBD. The act contains provisions aimed at the preservation of biological diversity and has a unique system of governing access and benefit sharing (ABS) of resources and knowledge. In terms of delineating protected areas, the act gives powers to the state government under section 37 to establish Biodiversity Heritage Sites.

**Biodiversity heritage sites**

"Biodiversity Heritage Sites" (BHS) are well-defined areas that are unique, ecologically fragile ecosystems - terrestrial, coastal and inland waters and, marine having rich biodiversity comprising of any one or more of the following components: the richness of wild as well as domesticated species or intra-specific categories, high endemism, presence of rare and threatened species, keystone species, species of evolutionary significance, wild ancestors of domestic/cultivated species or their varieties, past pre-eminence of biological components represented by fossil beds and having significant cultural, ethical or aesthetic values and are important for the maintenance of cultural diversity, with or without a long history of human association with them (Biological Diversity Act, 2002). For further details regarding various criteria under Biodiversity Heritage Sites, refer to Appendix X (2).

**Medicinal Plants Conservation Development Areas**

The National Medicinal Plants Board (NMPB) has implemented a Central Sector Scheme on Conservation, Development and Sustainable Management of Medicinal Plants which includes a component for setting up Medicinal Plants Conservation and Development Areas (MPCDAs) in the forest areas. As per the guidelines, State Forest/Wildlife Department/National and State level Research Organization/ Universities/Non-Government/ Voluntary Organizations with expertise in the field are eligible to implement the projects on MPCDAs. Activities like artificial re-generation of local populations of medicinal and aromatic plant species are particularly to be focused on under the proposed MPCDAs, especially where wild populations of the species have dwindled on account of habitat degradation, and unsustainable/illegal harvest (Biswas *et al.*, 2017). For more information regarding the objectives and components of the scheme, refer to Appendix X (3).

**Reserved Forests (RF)/Demarcated Protected Forests (DPF)**

***Reserved Forests:***

The State Government may constitute any forest-land or waste-land which is the property of Government, or over which the Government has proprietary rights, or to the whole or any part of the forest-produce of which the Government is entitled, a reserved forest in the manner hereinafter provided.

(1) Whenever it has been decided to constitute any land a reserved forest, the State Government shall issue a

notification in the Official Gazette– (a) declaring that it has been decided to constitute such land a reserved forest; (b) specifying, as nearly as possible, the situation and limits of such land; and (c) appointing an officer (hereinafter called "the Forest Settlement-officer") to inquire into and determine the existence, nature and extent of any rights alleged to exist in favour of any person in or over any land comprised within such limits or over any forest-produce.

***Protected Forests:***

The State Government may, by notification in the Official Gazette, declare the provisions of this Chapter applicable to any forest-land or waste-land which, is not included in a reserved forest but which is the property of Government, or over which the Government has proprietary rights, or to the whole or any part of the forest produce of which the Government is entitled.

(1) The forest-land and waste-lands comprised in any such notification shall be called a "protected forest".

(2) No such notification shall be made unless the nature and extent of the rights of Government and of private persons in or over the forest-land or waste-land comprised therein have been inquired into and recorded at a survey or settlement, or in such other manner as the State Government thinks sufficient. Appendix X (4)

**Forest (Conservation) Act, 1980**

Deforestation had been taking place on a large scale in the country and the act seeks to check upon deforestation and de-reservation of forests. Section-2 of the Act deals with a restriction on the de-reservation of forests or the use of forest-land for non-forest purposes. It provides that anything contained in any other law for the time being in force in a state, no state government or any other authority shall make, except with prior approval of the central government, any order directing-a) That any reserved forest declared under any law for the time being in force in that state or any portion, shall cease to be reserved; b) That any forest land or any portion thereof may be used for any non-forest purpose; c) That any forest land or any portion may be cleared of trees which have grown naturally in that land or portion, for the purpose of using it for re-afforestation.The term 'non-forest purposes' implies the breaking up or cleaning of any forest-land or portion of forest land for-a) The cultivation of tea, coffee, spices, rubber, palms, oil-bearing, plants, or medicinal plants; b) Any purposes other than re-afforestation.

**Key Biodiversity Areas (KBAs)**

The overall goal of the KBA is to suggest universal standards for selecting sites of global significance for conservation through the application of quantitative criteria (Eken *et al.*, 2004). The term "Key Biodiversity Areas" (KBAs) is used to include areas that contribute to the global persistence of biodiversity, including habitat for threatened floral and faunal species in terrestrial, freshwater and marine ecosystems (ENVIS Centre of Wildlife and Protected Areas). Globally KBAs are designated based on five broad categories *i.e.* threatened biodiversity, geographically restricted biodiversity, ecological integrity, biological processes; and irreplaceability; and the criteria for designating a site as KBA have been formulated by International Union for Conservation of Nature (IUCN). A total of 11 criteria, with an additional 12 sub-criteria, that can be applied to determine whether a site is a KBA have been formulated by IUCN (KBA Secretariat, 2019).

**Important Bird Areas (IBAs)**

The concept of Important Bird Areas or IBA was introduced by Birdlife International with an aim to identify, monitor and protect a global network of IBAs for conservation of the world's birds and associated biodiversity. The IBAs serve as conservation areas for protection of birds at the global, regional or sub-regional level based on internationally agreed set of criteria. According to Birdlife International, designation of IBAs is based on standardized criteria, including (i) hold significant numbers of one or more globally threatened bird species, (ii) be one of a set of sites that together hold a suite of restricted-range species or biome-restricted species and (iii) have exceptionally large numbers of migratory birds(ENVIS Centre of Wildlife and Protected Areas).

**Ramsar Site**

The Ramsar Convention was the first of the modern instruments seeking to conserve natural resources on a global scale. It is a world-wide treaty concerned with one of the most threatened group of habitats, the wetlands. These are shallow open waters - lakes, ponds, rivers and coastal fringes - and any land which is regularly or intermittently covered or saturated by water - marshes, bogs, swamps, flood plains and the like (Mathews, 1993). The Convention on Wetlands of International importance especially as Waterfowl Habitat was adopted at the city of Ramsar, in 1971. The Ramsar convention is the only global environmental treaty that deals with a particular ecosystem. For more information regarding the associated criteria, refer to Appendix X (5). Website: http://www.ramsar.org

**UNESCO World Heritage Site**

The World Heritage Convention Concerning the Protection of the World Cultural and Natural Heritage was adopted by the General Conference of UNESCO in 1972. With 180 States Parties and 812 properties located in 137

countries on the World Heritage List, the Convention has become a key legal instrument in heritage conservation and plays an important role in promoting the recognition and management of heritage in many regions of the



**Table 41(a): Mechanism of Policy Harmonization for designation of identified HCVAs- Lahaul Valley**

| S. No. | Area | Status of the Land | Indicative provisions for conservation | Existing provisions | Remarks |
|---|---|---|---|---|---|
| 1. | Thanpatta Miar Valley | Government owned land, under the jurisdiction of State Forest Department. | Conservation Reserve | Demarcated Protected Forest (DPF Khanjar)/DPF Shelling, DPF Chimrit, DPF Shakoli, DPF Urgos, DPF Chhaling, DPF Karpat | Thanpattan, the largest pastureland of Lahaul, lies in the upper extent of the Miar Valley. The area supports significant number of threatened faunal and floral species (medicinal plants). The herders of the Gaddi community, mainly from Chamba and Bharmaur districts, utilize the pastures for 3-4 months every summer, to graze their livestock. The grazing permits are issued to these herders by the state forest department to use the pastureland. The meadows of Thanpattan share its boundary with Sechu Tuan WLS of Pangi Valley. As the area is under the jurisdiction of State Forest Department, it could be notified as a conservation reserve. |
| 2. | Pattan Valley (Naingar) | Government owned land, under the jurisdiction of State Forest Department. | Conservation Reserve/ Biodiversity Heritage Site | DPF Dulling, DPF Chhogzing, DPF Nalda, DPF Zobrang, DPF Jasrath, RF Lote, RF Mulling, RF Chewar | The area comprises of both pastureland and forested areas, which are being utilized by the local communities to fulfill their grazing and fuel-wood needs. The region lies adjacent to the Miar Valley, and during summers, few herders of the Gaddi Community visit the pastures of Naingar. The area supports significant number of threatened faunal and floral species. The region is under the jurisdiction of State Forest Department, and is only being utilized by the locals to extract resources; it could be notified as a conservation reserve. In the precincts of alpine meadows of Naingar, lies a high-altitudinal lake, Neelkanth, which has become prominent as a holy place; the region could be designated as a Biodiversity Heritage Site as it is significant from both biodiversity and cultural point of view. |
| 3. | Billing-Istingri | Government owned land, under the jurisdiction of State Forest Department. | Conservation Reserve | - | The area demarcated is dry alpine pastureland in the Keylong range of Lahaul Valley. As reported by the key-informants, major mammalian species in the area are ibex, snow leopard and Tibetan wolf. The area is utilized by the local herders of the nearby villages to graze their livestock. The herders have grazing rights, however, the land is government owned, thus, could be a potential Conservation Reserve. |

| S. No. | Area | Status of the Land | Indicative provisions for conservation | Existing provisions | Remarks |
|---|---|---|---|---|---|
| 4. | Hadsar And Kuruched | Government owned land, under the jurisdiction of State Forest Department. | MPCDA | DPF Hadsar and Kuruched forested area | Both the demarcated areas fall in the Tindi range of Lahaul valley. Major faunal species reported from Hadsar includes brown bear, Himalayan tahr, and black bear whereas snow leopard, ibex, musk deer, brown bear and black bear have been reported from Kuruched. As reported by key-informants of the range, both the region support a variety of medicinal and aromatic plants, including few of the most commercially used species in the landscape. Illegal extraction and overharvesting of medicinal plants have also been reported from both the areas. These areas, Kuruched and Hadsar, could be declared as potential MPCDAs. |
| 5. | Darcha-Jispa | Government owned land, under the jurisdiction of State Forest Department. | Conservation Reserve | Reserved Forest (RF Jispa) | The area demarcated is dry alpine pastureland in the Keylong range of Lahaul Valley. Asiatic ibex, snow leopard and Tibetan wolf are the major mammalian species in the region. The area is utilized by the local herders of the nearby villages to graze their livestock, mostly during summer, as they have grazing rights over the region. The land, however, is government owned, thus, could be a potential Conservation Reserve. |
| 6. | Chandra-tal | Government owned land | Conservation Reserve | Eco-sensitive zone of Chandratal WLS | The area lies adjacent to the eco-sensitive zone of Chandratal WLS. The area is important as it provides major supporting and regulating ecosystem services in form glaciers and alpine pastures. Few of the important faunal species like Tibetan wolf, Blue sheep and red fox. The area delineated is utilized during summers by few local herdercommunities; it could be a potential Conservation Reserve. |
| 7. | Koksar | Government owned land, under the jurisdiction of State Forest Department. | Reserved Forest | Un-demarcated Protected Forest (UPF Koksar) | The proposed area is a patch of trees of Betula utilis near the Koksar village of Lahaul Valley. The species is considered a threatened species by the local communities due to its reduction in population size over time as per consultations with the locals. The forested patch is small in size and could be a potential Reserved Forest. |

**Table 36(b): Mechanism of Policy Harmonization for designation of identified HCVAs- Pangi Valley**

| S. No. | Area | Status of the Land | Indicative provisions for conservation | Existing provisions | Remarks |
|---|---|---|---|---|---|
| 1. | Sural Bhatori | Government owned land, under the jurisdiction of State Forest Department. | Conservation Reserve/Biodiversity Heritage Site | Un-demarcated Protected Forest(UPF Sural Bhatori) | The forested area of Bhojpatr in Sural is known to support a significant population of many threatened faunal species, especially Brown bear. The meadows of the region support a rich diversity of a variety of high-value medicinal plants. The land-use practice by the local communities includes extraction of fuel-wood from the forested area and pastureland for |

| S. No. | Area | Status of the Land | Indicative provisions for conservation | Existing provisions | Remarks |
|---|---|---|---|---|---|
| | | | | | grazing their livestock. The region is under the jurisdiction of State Forest Department and could be notified as a conservation reserve. There is also a monastery or gompa in the region, which is believed to be around 200 years old. The monastery is surrounded by a sacred grove of Betula utilis trees. The region could be designated as a Biodiversity Heritage Site as it has both biodiversity and cultural values. Also, as per one of the BHSs' criteria, allkinds of legal land use whether government, community, or private land could be designated/considered under the policy. |
| 2. | Kadu Nallah | Government owned land, under the jurisdiction of State Forest Department. | Conservation Reserve/MPCDA | Demarcated Protected Forest (DPF Kadu Nallah) | The area gets its name from a medicinal plant "Kadu" also known as Picrorhiza kurroa and comprises of both forested area and pastureland. It lies adjacent to Sechu Tuan WLS and supports a variety of faunal and floral species. The herders from the villages of Shour & Purthi graze their livestock in the pastureland during summers. As the area is under the jurisdiction of State Forest Department, it could be notified as a conservation reserve. Also, it could be designated as a MPCDA due to presence of a variety of high value medicinal plants in the region which are facing threat because of illegal extraction and overharvesting. |
| 3. | Luj | Government owned land, under the jurisdiction of State Forest Department. | Conservation Reserve/Biodiversity Heritage Site | Reserved Forest (RF Luj) | Luj, in Pangi Valley, is the only area where Pinus gerardiana, an endangered species in Himalayan ecosystem, is found, interspersed with Spruce, Fir, Deodar, Blue pine and Hazelnut. The species is facing a higher risk of extinction and therefore, categorized as Endangered in the Himalayan region and also listed in Red Data Book. As the area is under the jurisdiction of State Forest Department, it could be notified as a Biodiversity Heritage Site or a Conservation reserve, with locals having rights to extract resources for basic needs. |
| 4. | Hudan Bhatori | Government owned land, under the jurisdiction of State Forest Department. | Conservation Reserve/MPCDA | - | The area encompasses the alpine meadows of Hudan bhatori, which supports rich biodiversity of high-value medicinal and aromatic plants. Also, the area serves as a habitat for species like Snow leopard, Brown bear, Tibetan wolf, Asiatic Ibex, Himalayan marmot and Royle's pika, and a threatened avifaunal species Himalayan griffon (Gyps himalayensis). The area is being utilized by the local herders to graze their livestock during the summer months for at least two months. As the area is important from both socio-cultural as well as biodiversity aspect, it could be a potential conservation reserve. The presence of a variety of high value important medicinal plants in the meadows also make it a potential MPCDA site. |

| S. No. | Area | Status of the Land | Indicative provisions for conservation | Existing provisions | Remarks |
|---|---|---|---|---|---|
| 5. | Mindhal | Government owned land, under the jurisdiction of State Forest Department. | Conservati-on Reserve | Demarcated Protected Forest (DPF Mindhal) | The pastures of Mindhal are known to be utilized for livestock grazing by both, local as well as migratory herders. The Betula utilis trees and pastures present at the higher elevations not only support a variety of faunal and floral species but also provide supporting and regulating eco-system services. Asiatic black bear, Himalayan brown bear, Musk deer, Himalayan ghoral and Ibex are few of the important mammalian species which have been reported from the region. Also, many high-value medicinal plants found in the region which are utilized by the locals of the area. The area provides ecosystem services, both, supporting-regulating and provisioning. It could be a potential conservation reserve as the locals have grazing rights, however, the land is government property. |
| 6. | Sechu | Government owned land | MPCDA | Reserved Forest (RF Sechu)/Demar cated Protected Forest (DPF Gajrahan, DPF Sechu)/Eco-sensitive zone of Sechu Tuan WLS | The area supports a number of mammalian species including the protected species like snow leopard, musk deer, brown bear and black bear. Dhar Sidhani and Chasak Bhatori, is known to be one of the richest regions for high value medicinal plants. Due to commercialization of medicinal plants the pressure over time has increased and as reported by key informants the region is highly exploited by intruders in the valley, who are involved in illegal extraction of medicinal and aromatic plants. The demarcated region falls adjacent to the eco-sensitive zone of the Sechu tuan wildlife sanctuary; the area could be a potential MPCDA. |

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# APPENDIX

# APPENDIX I - Secondary Literature

## List of secondary literature reviewed to identify HCVAs in the Landscape


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**Table 1: List of threatened mammalian species in the Lahaul-Pangi & Kinnaur**

| Faunal Species (Landscape) | Elevation(m) |
|---|---|
| Snow leopard | 3500-4200 |
| Asiatic ibex | 3200-4200 |
| Blue Sheep | 3200-4200 |
| Himalayan Tahr | 2500-3500 |
| Himalaya Musk Deer | 2800-3800 |
| Grey goral | <2500 |
| Himalaya Serow | 2500-3200 |
| Common leopard | <3000 |
| Himalayan brown bear | 3000-4000 |
| Himalayan black bear | <3000 |

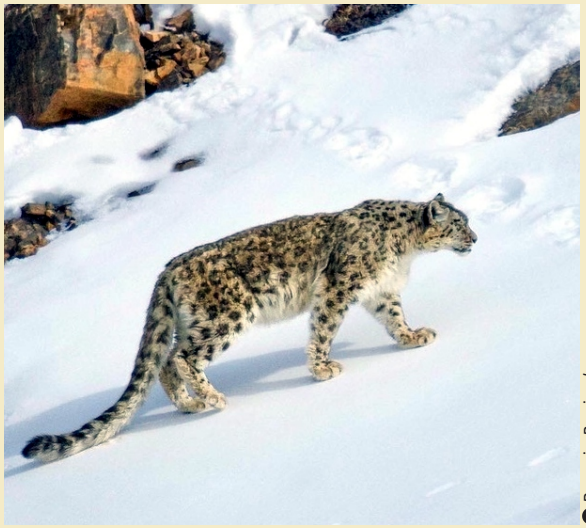


**Table 2: List of threatened Avifaunal species in the Lahaul-Pangi & Kinnaur Landscape**

| Species of concern | Conservation Status |
|---|---|
| Western Tragopan | VU & Endemic in Western Himalayas |
| Himalayan Griffon | NT (Near threatened) |
| Orange Bullfinch | Endemic in Western Himalayas |
| Egyptian Vulture | EN (endangered) |
| Cheer pheasant | VU (Vulnerable) |
| Lammergeier (Bearded Vulture) | NT (Near threatened) |

**Table 3: List of RET/Important Floral species in the Lahaul-Pangi & Kinnaur Landscape**

| Kinnaur | Lahaul | Pangi |
|---|---|---|
| *Betula utilis* | *Betula utilis* | *Betula utilis* |
| *Abiesspectabilis* | *Juniperusmacropoda* | *Corylus jaquemontii* |
| *Pinus gerardiana* | *Juniperusindica* | *Crataegussongarica* |
| *Fraxinus xanthoxyloides* | *Fraxinus xanthoxyloides* | *Fraxinus floribunda* |
| *Cedrusdeodara* | *Cedrusdeodara* | *Cedrusdeodara* |
| *Quercus baloot* | - | *Parrotiopsisjacquemontiana* |
| *Juglans regia* | - | *Juglans regia* |
| *Acer pentapomicum* | *Acer acuminatum* | *Acer caesium* |
| *Rhododendron campanulatum* | *Rhododendron campanulatum* | *Rhododendron campanulatum* |
| *Rhododendron anthopogon* | *Rhododendron anthopogon* | *Rhododendron anthopogon* |
| *Pinus wallichiana* | - | - |
| *Hippophaesalicifolia* | *Hippophaerhamnoides* | - |


© Romain Baujard

Snow Leopard (*Panthera uncia*)


© Peter Kennerly

Common Leopard (*Panthera pardus*)



© Sheikh Riyaz

Himalayan Black Bear (*Ursus thibetanus*)


© Dhritiman Mukherjee

Himalayan Brown Bear (*Ursus arctos*)
Mammalian species in the Lahaul-Pangi Landscape


© Surya Ramachandran

Tibetan Wolf (*Canis lupus*)


© Kaizar Bandukwala

Red fox (*Vulpes vulpes*)



© Rinzy Wangchuk

Blue Sheep (*Pseudois nayaur*)



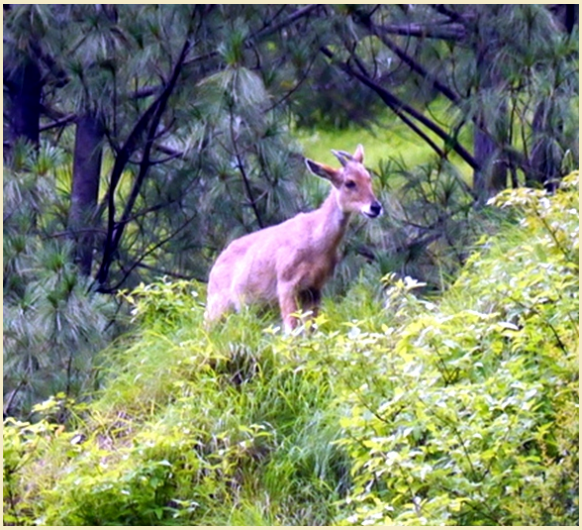
© Bishwarup Paul

Asiatic Ibex (*Capra sibirica*)



© Adithya Bhatt

Himalayan Serow (*Capricornis thar*)



© Dinesh Valke

Himalayan Goral (*Naemorhedus goral*)



© Pramod

Himalayan Tahr (*Hemitragus jemlahicus*)



© Dr. Sathyakumar

Musk deer (*Moschus leucogaster*)



© Mahesh

Himalayan Marmot (*Marmota himalayana*)



© Siddharth Machado

Royle's Pika (*Ochotona roylei*)



© Mahesh

Yellow throated Marten (*Martes flavigula*)



© Shiv Kumar

Bearded Vulture (*Gypaetus barbatus*)



© Mahesh

Himalayan Griffon (*Gyps himalayensis*)



Western Tragopan (*Tragopan melanocephalus*)

**Table 4: Floral species in the Lahaul-Pangi Landscape**



© Prateek Savita

*Dactylorhiza hatagirea* (Salam panja)



© Prateek Savita

*Fritillaria roylei* (Junglee lahsun)



© Devika Rathore

*Hippophae rhamnoides* (Sea buckthorn)



© Prateek Savita

*Bunium persicum* (Kala Jeera)



© Prateek Savita

*Rheum australe* (Himalayan rhubarb)



© Prateek Savita

*Rheum webbianum* (Indian rhubarb)



© Dr. Amit Kumar

*Pinus gerardiana* (Neoza)



© Dr. Gautam Talukdar

*Betula utilis* (Himalayan birch)



© Ayushvedah

*Aconitum heterophyllum* (Atish)



© Prateek Savita

*Podophyllum hexandrum* (Ban kakri)



© Prateek Savita

*Saussurea costus* (Kuth)



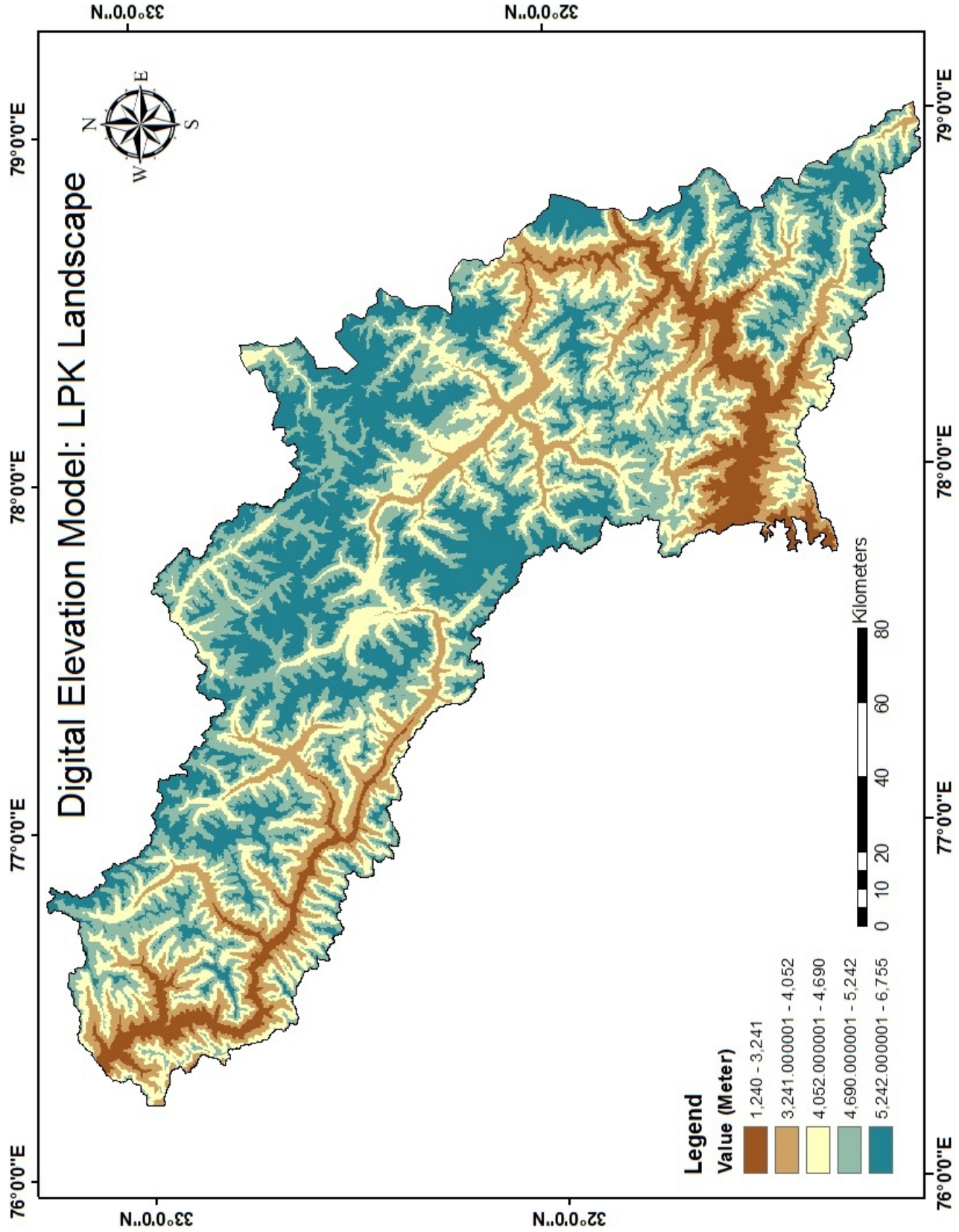
© Prateek Savita

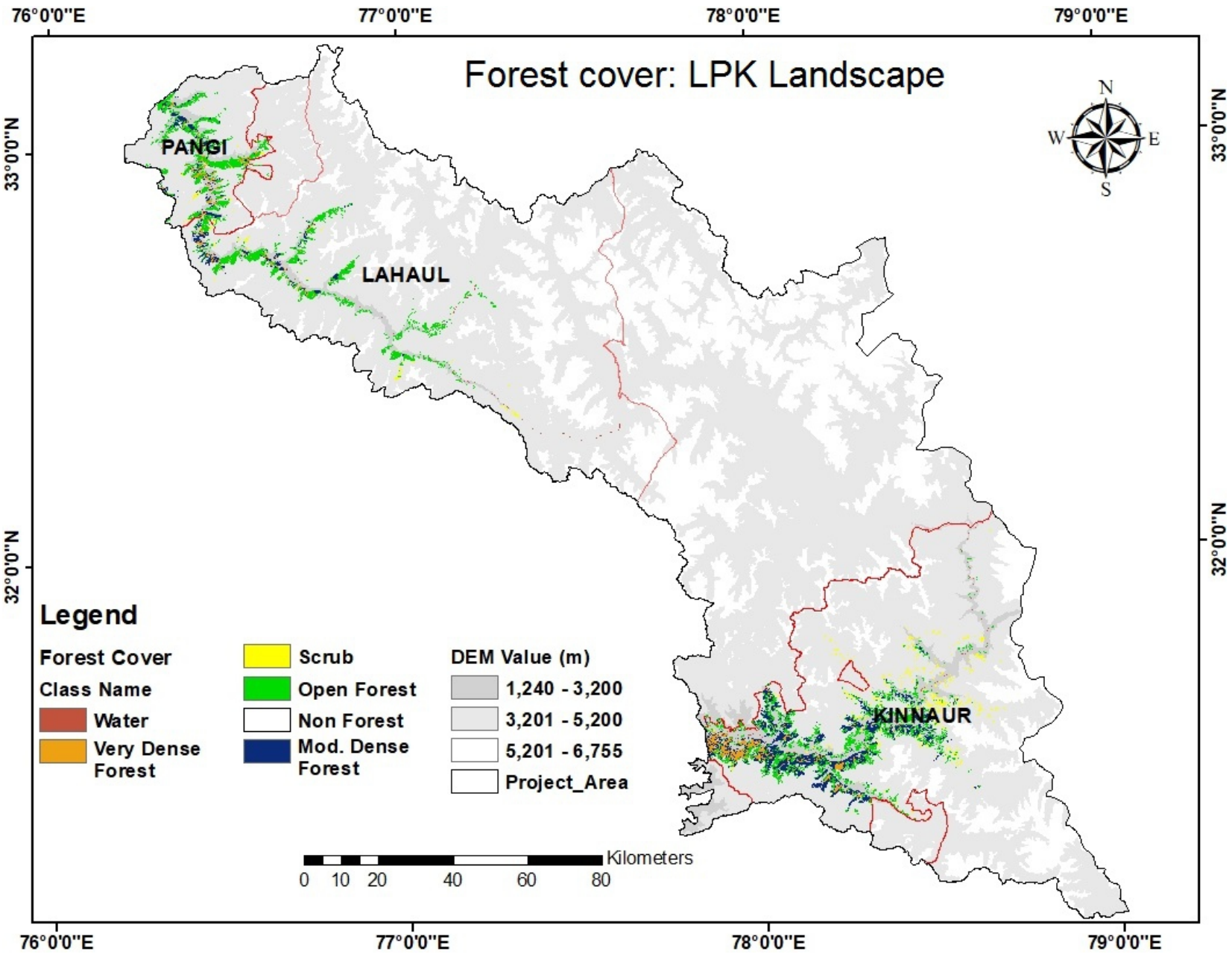
*Meconopsis betonicifolia* (Blue poppy)

# APPENDIX II - Maps of the Layers Used

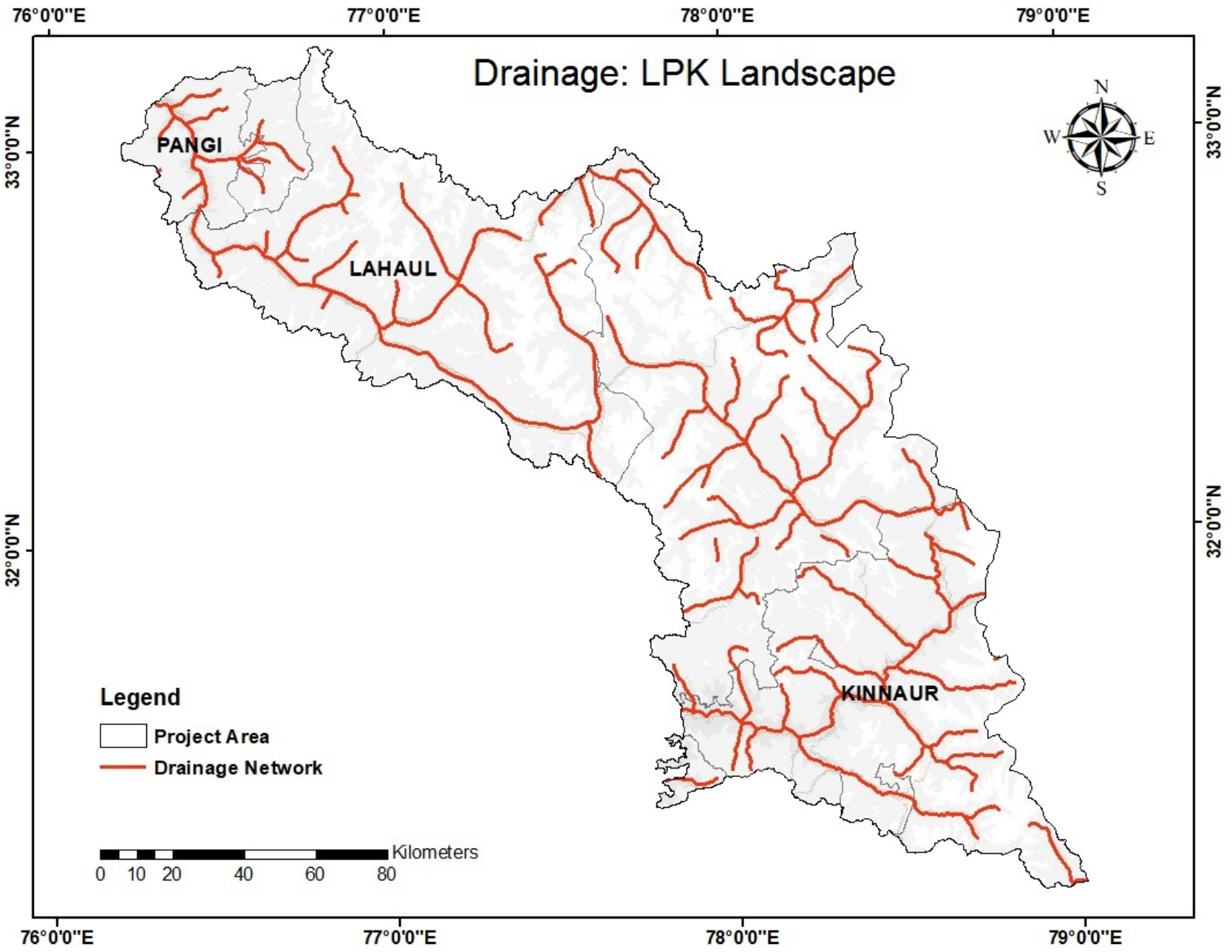
**Maps of all the layers used in demarcation of Potential HCVAs**

Map representing Digital elevation model of the Lahaul-Pangi Landscape

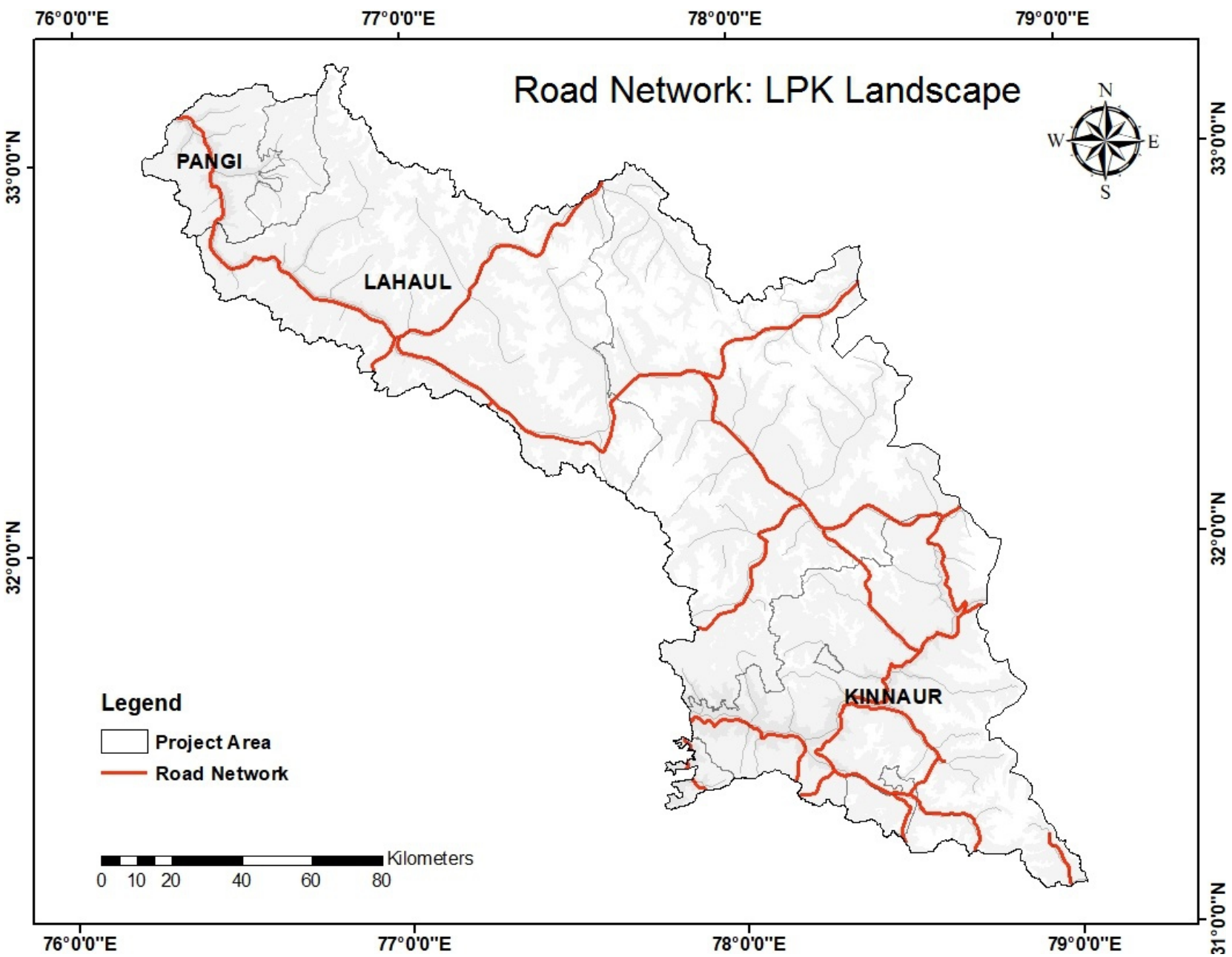




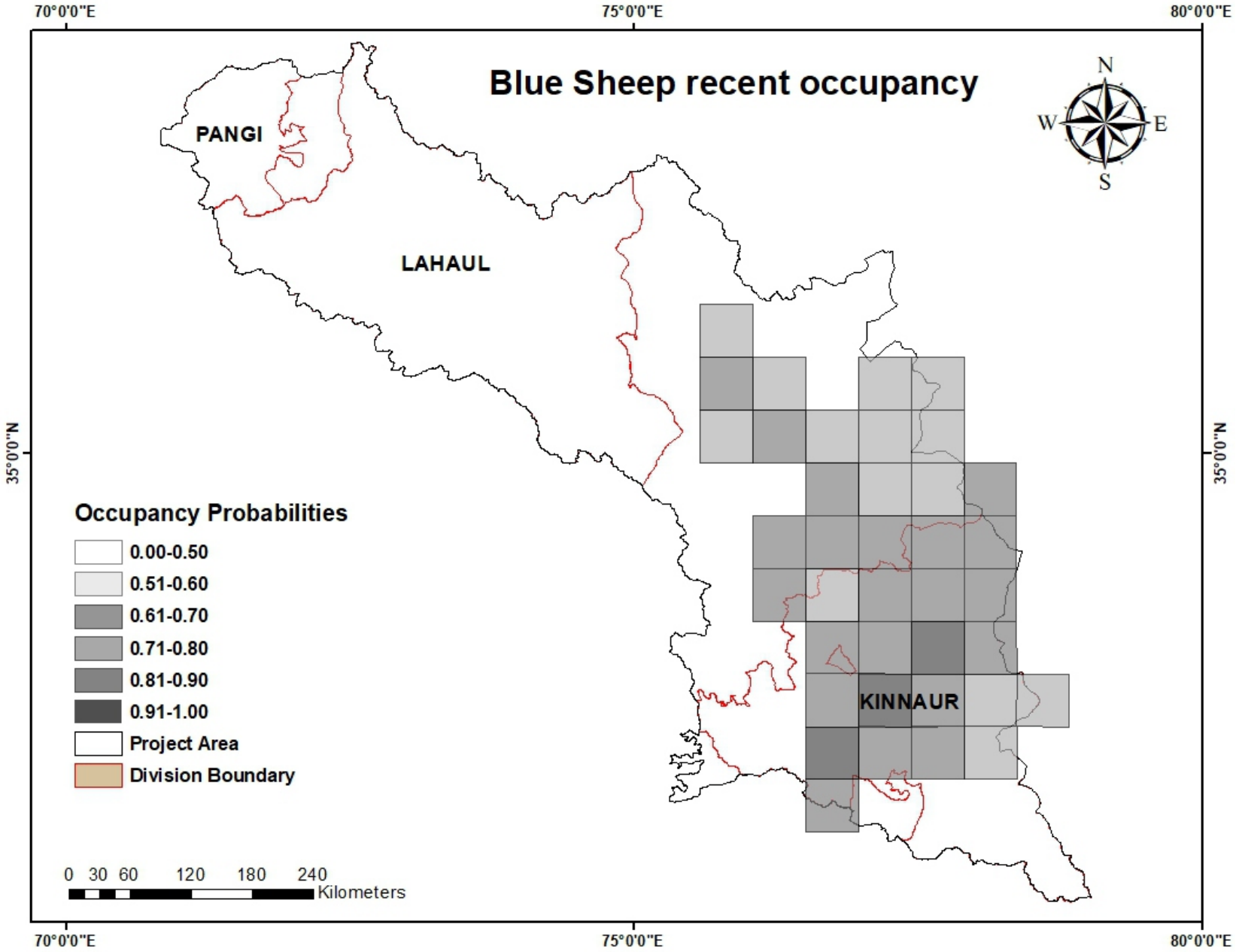

Map representing Forest Cover in the Lahaul-Pangi Landscape



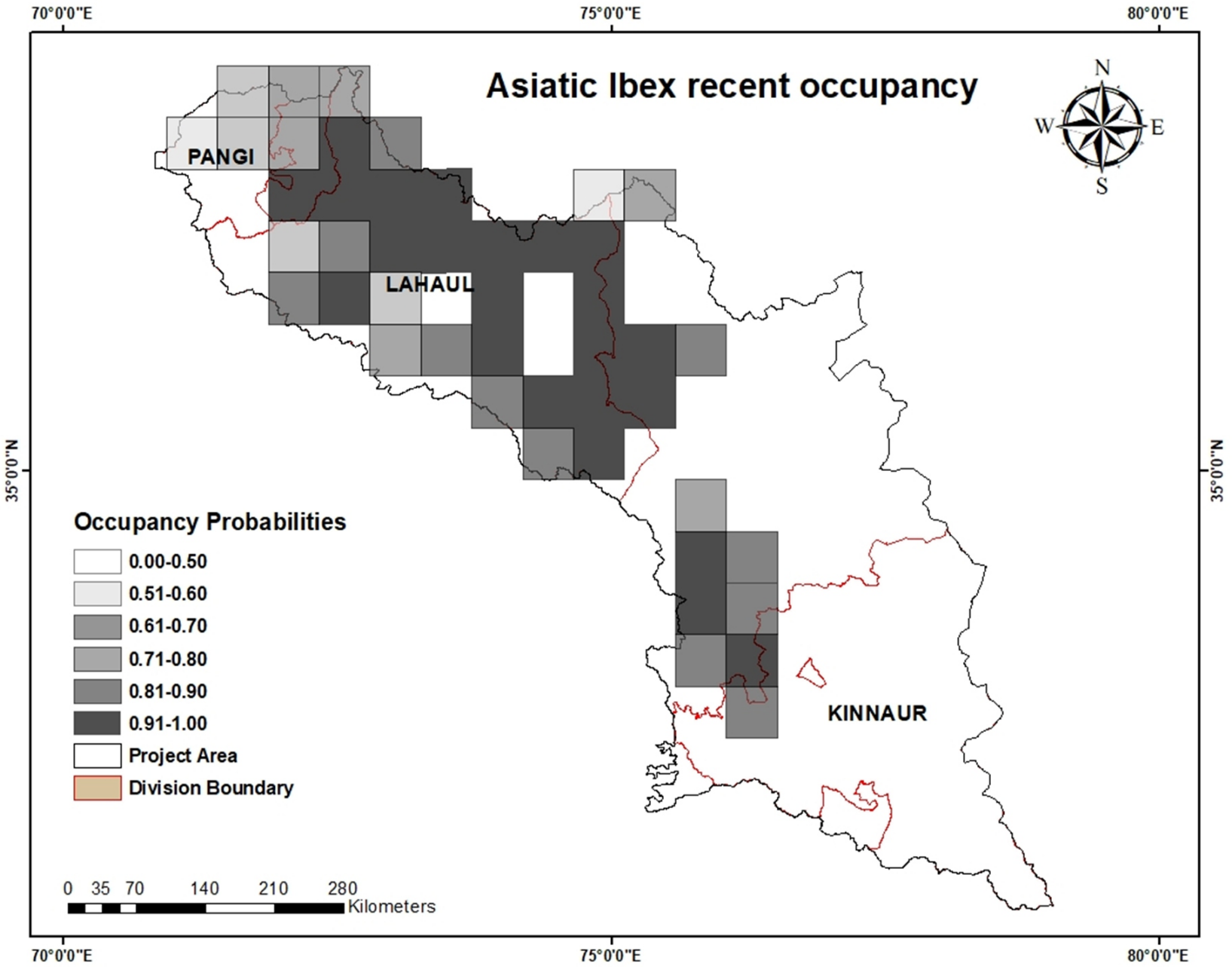

Map representing Drainage network in the Lahaul-Pangi Landscape



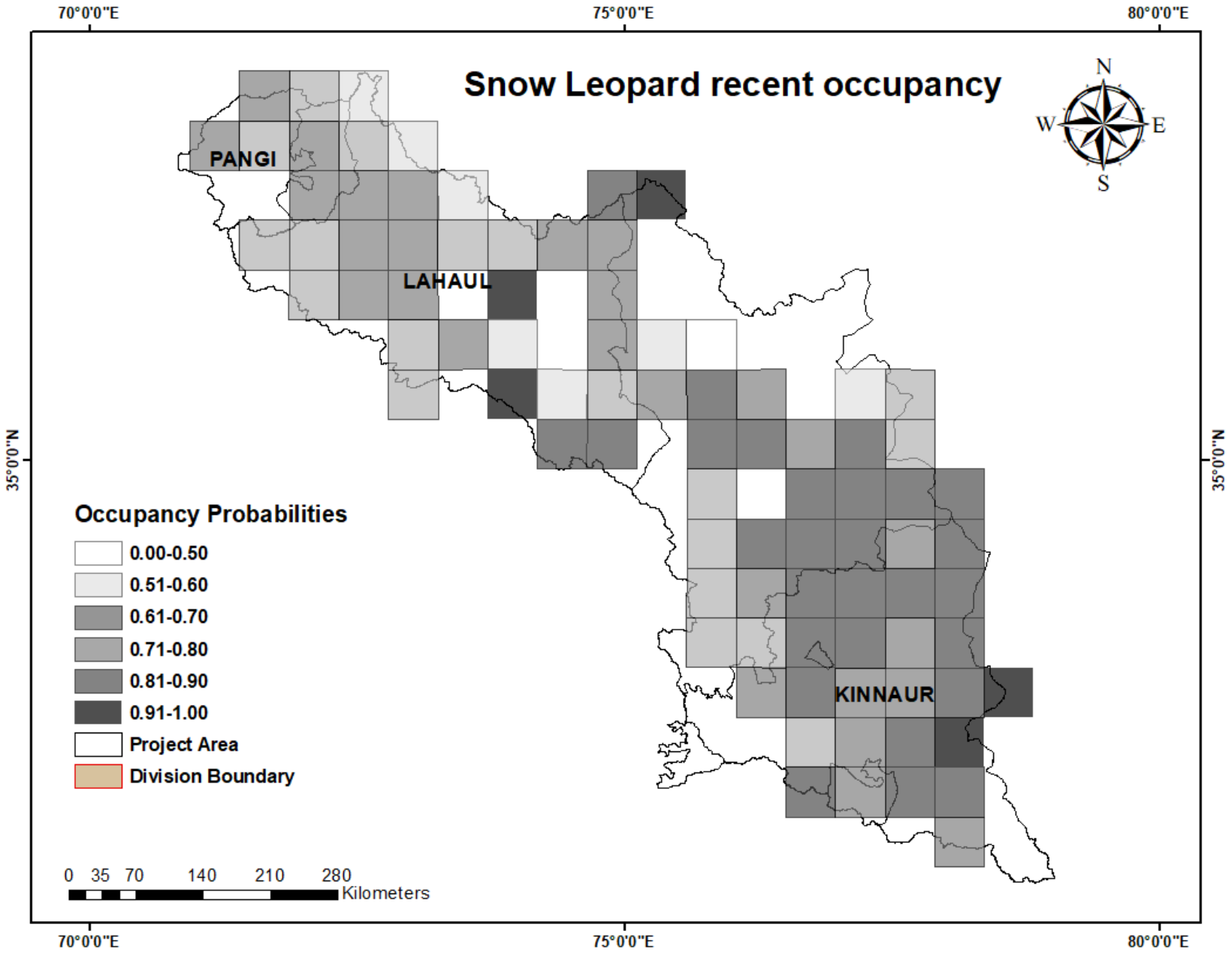

Map representing Road network in the Lahaul-Pangi Landscape



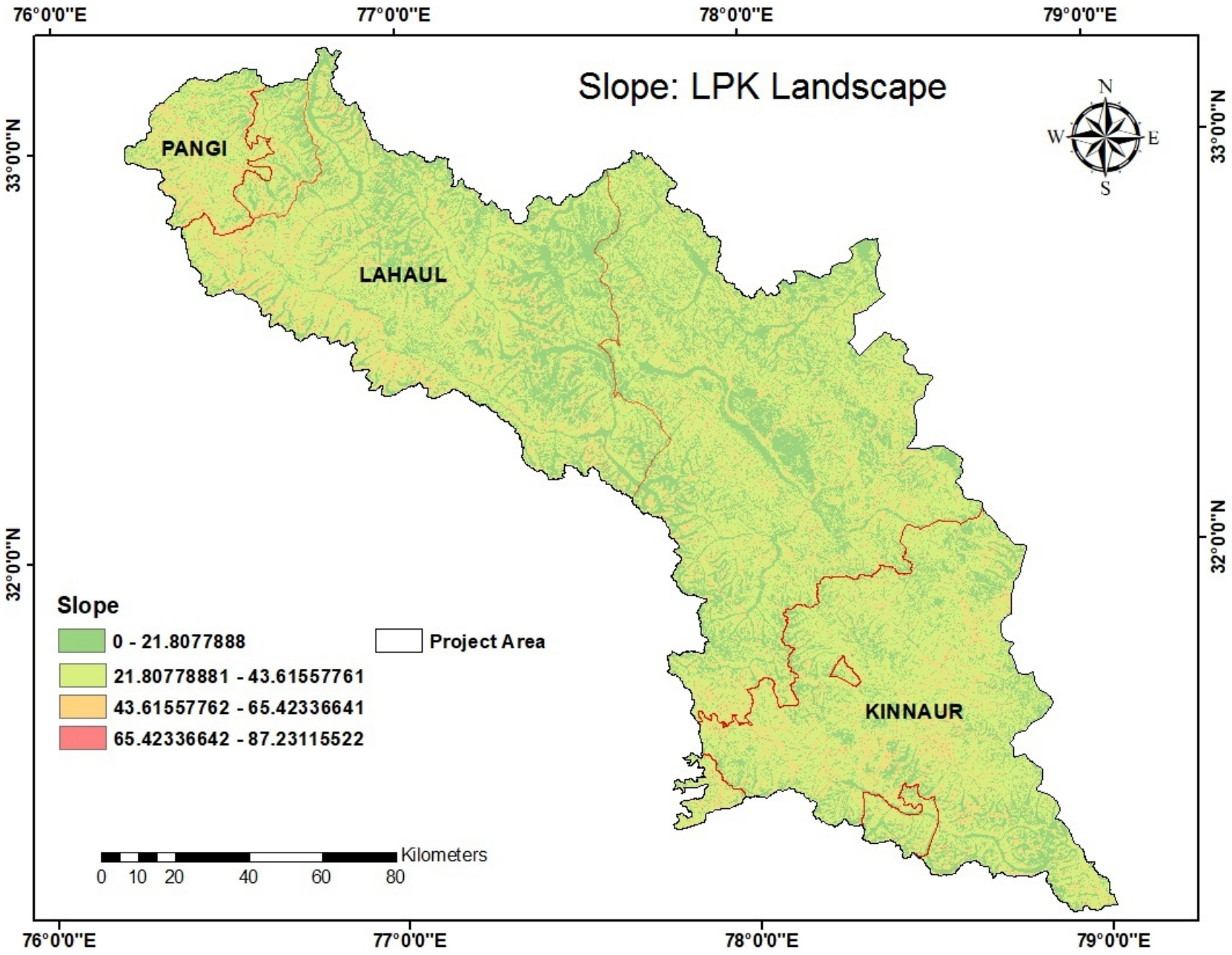

Map representing occupancy probability of Blue sheep in the Lahaul-Pangi Landscape (Ghoshal, 2017)



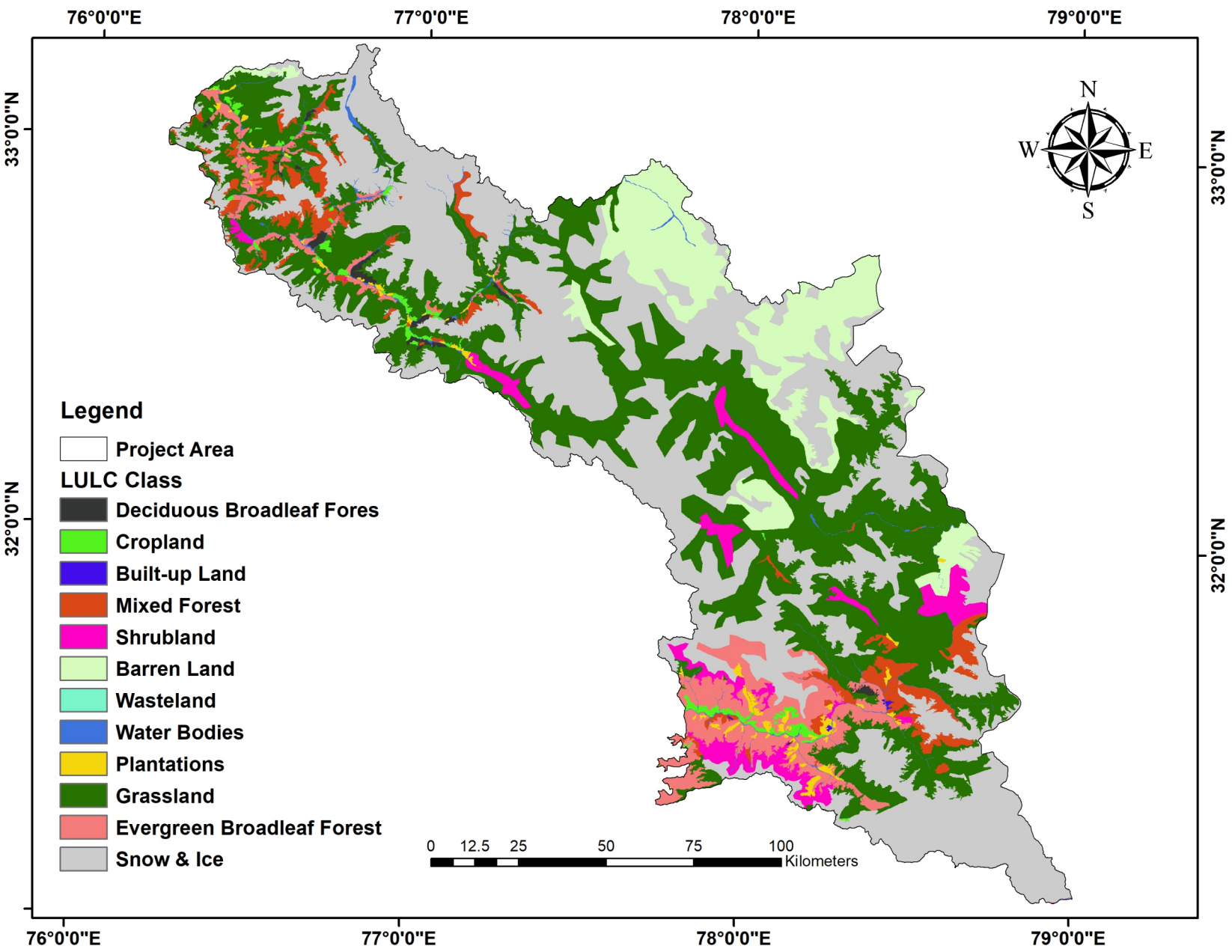

Map representing occupancy probability of Asiatic Ibex in the Lahaul-Pangi & Kinnar Landscape (Ghoshal, 2017)




Map representing occupancy probability of snow leopard in the Lahaul-Pangi & Kinnaur Landscape (Ghoshal, 2017)



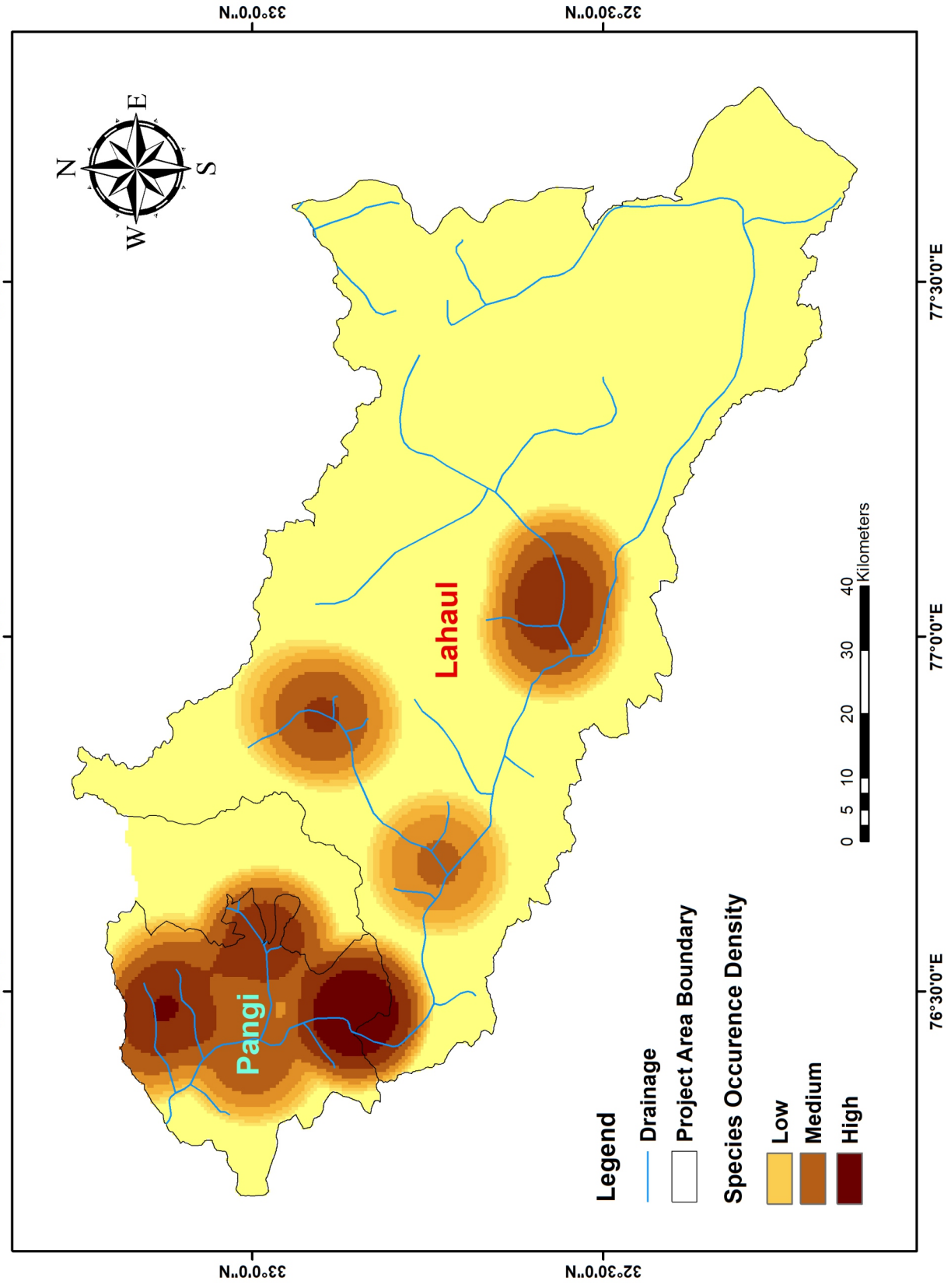

Map representing Slope of the Lahaul-Pangi & Kinnaur Landscape

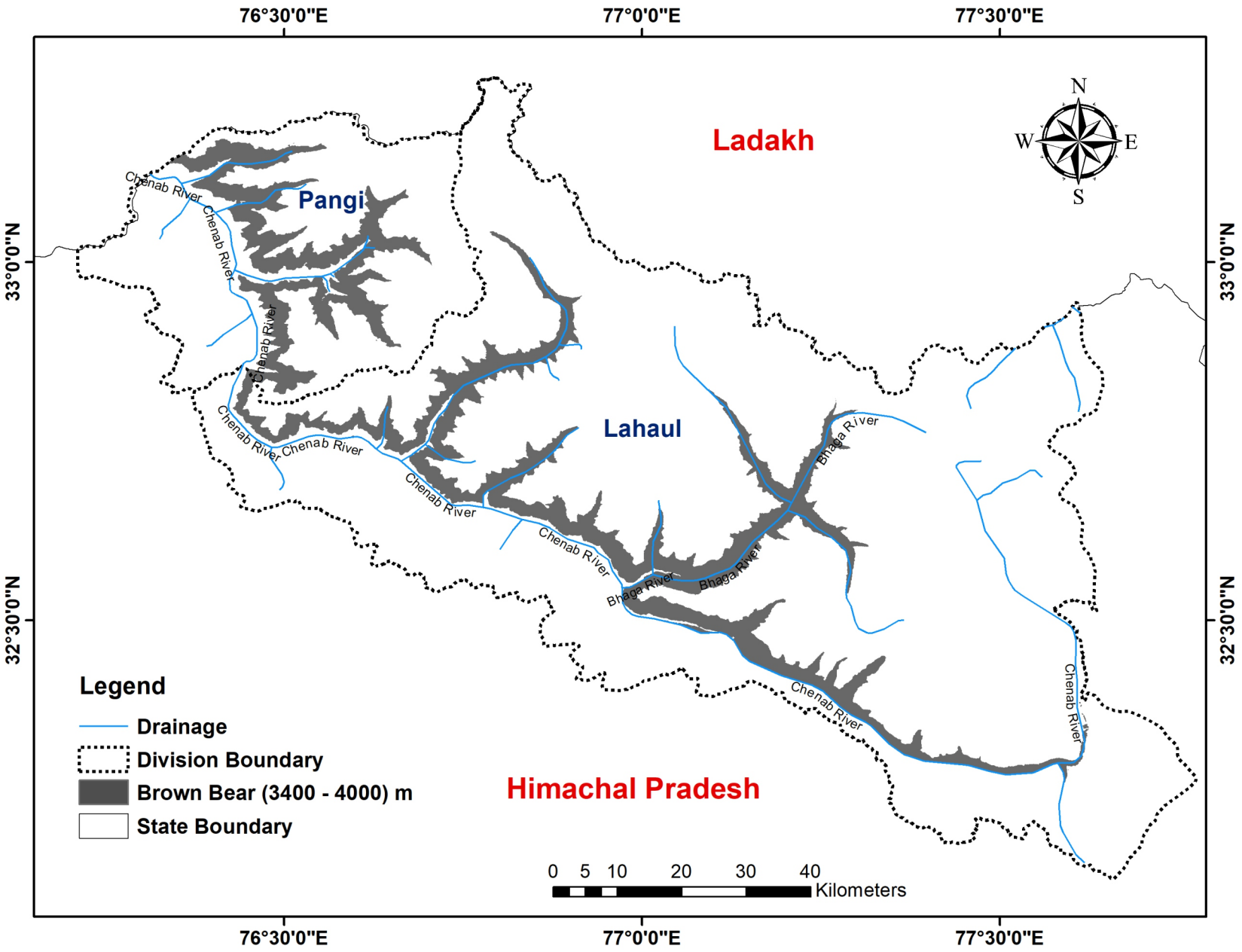



Map representing Land use land cover of the Lahaul-Pangi & Kinnaur Landscape

# APPENDIX III -
# Distribution maps for Faunal Species

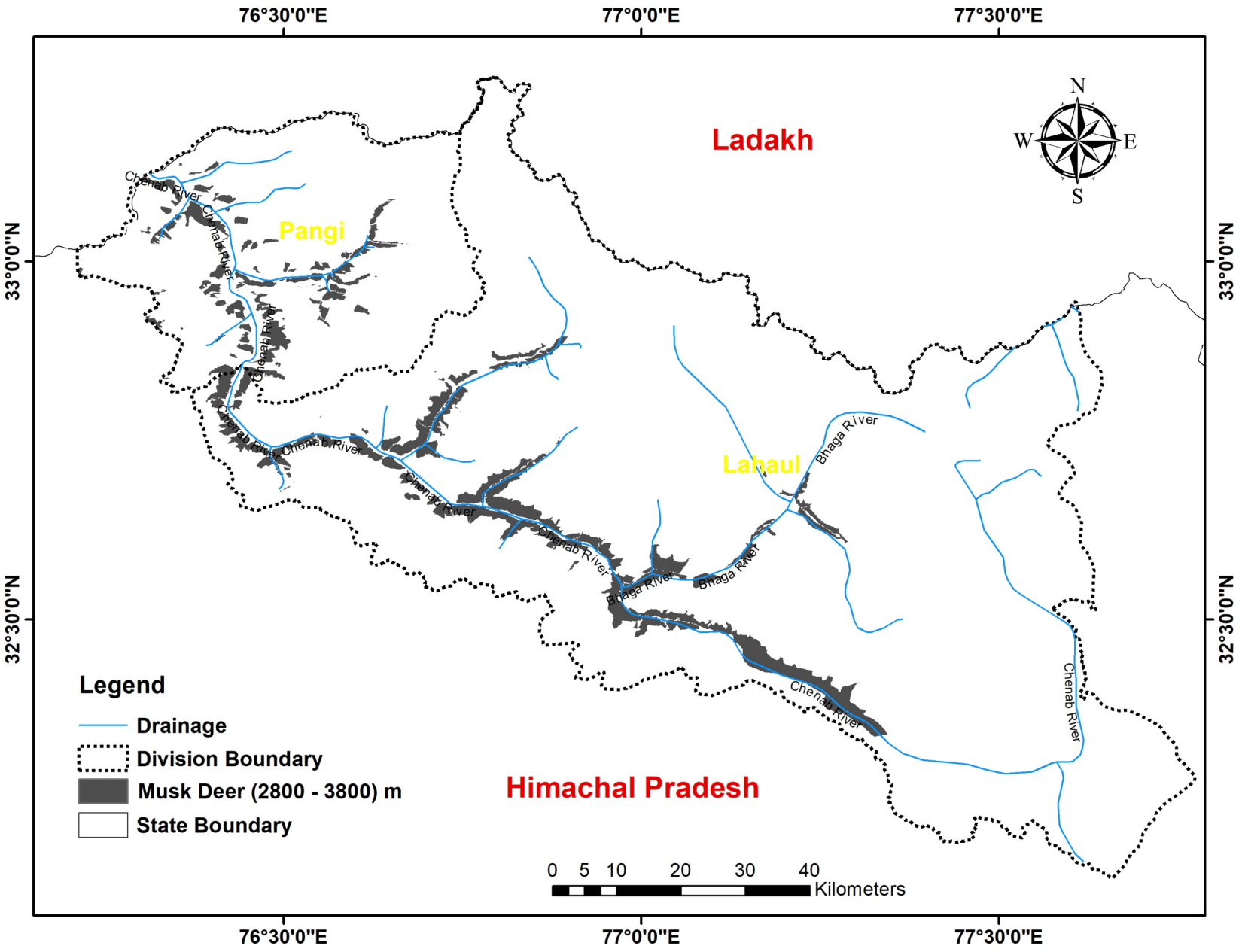
Kernel density map representing species occurrence density of mammalian species in the Lahaul-Pangi Landscape





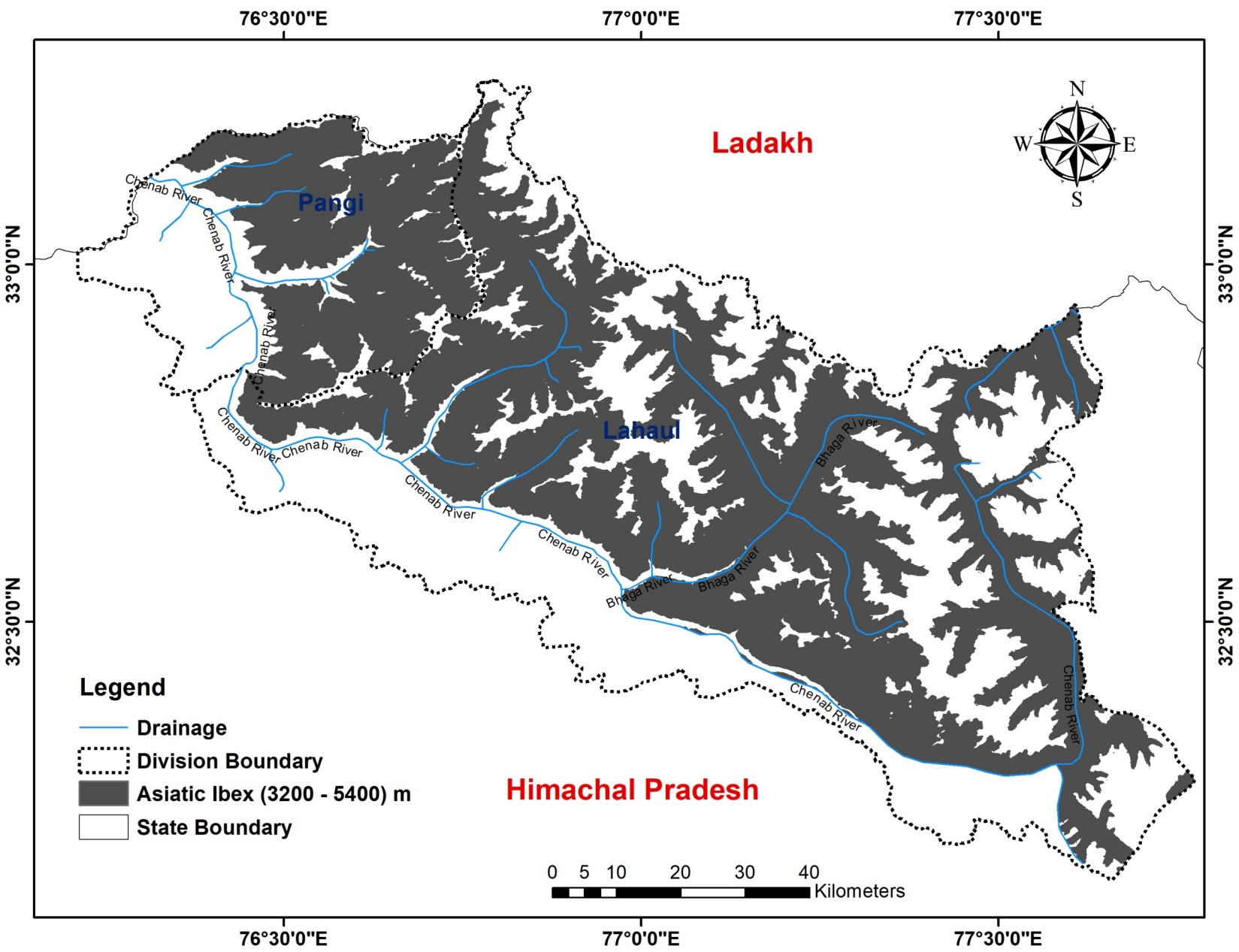

Rule-based map: Potential distribution of Brown bear in the Lahaul-Pangi Valley

(Data Source: Sathyakumar, 2001; Bhatnagar *et al.*, 2008)



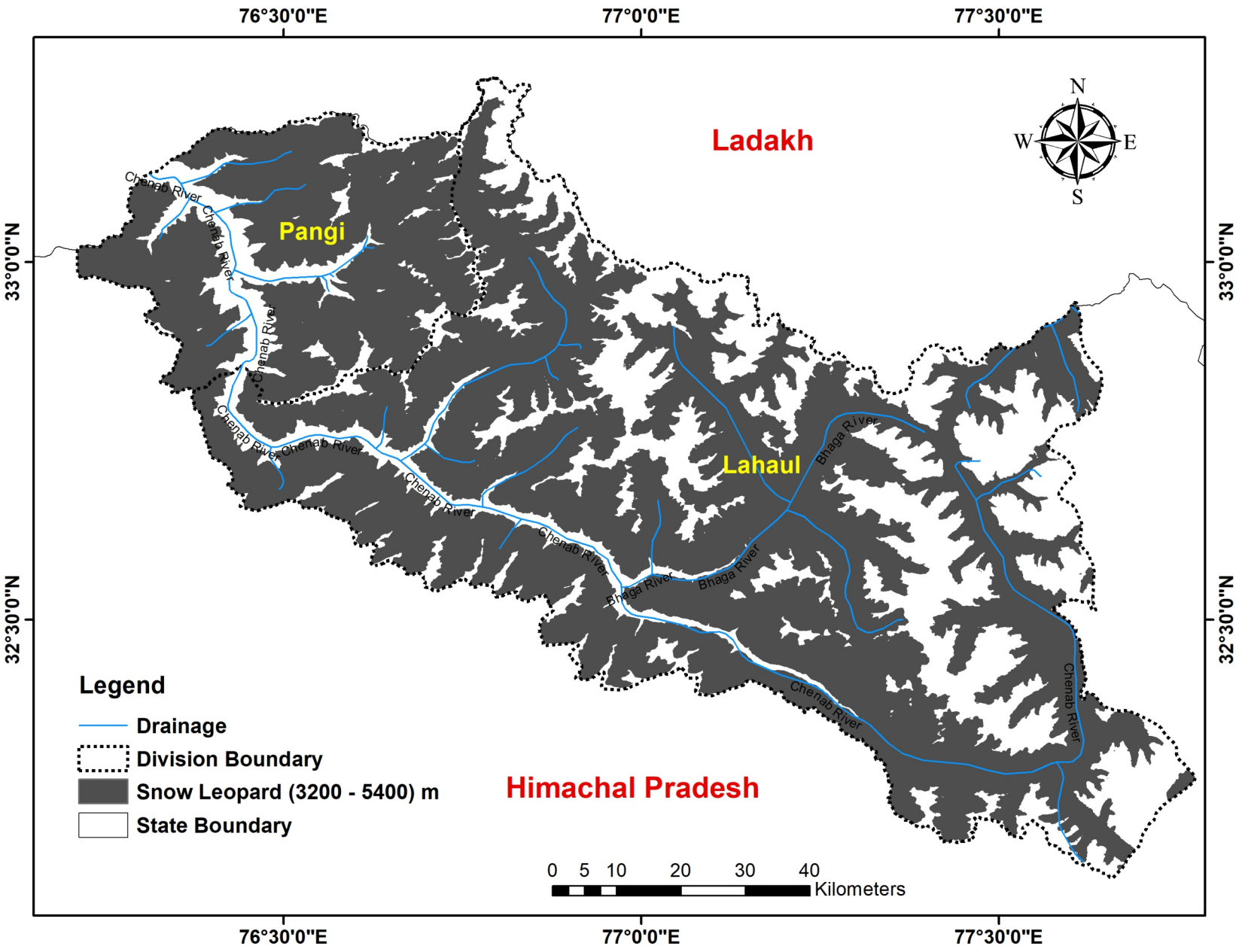

Rule-based map: Potential distribution of Musk deer in the Lahaul-Pangi Valley

(Data Source: Sathyakumar, 2001; Bhatnagar *et al.*, 2008)



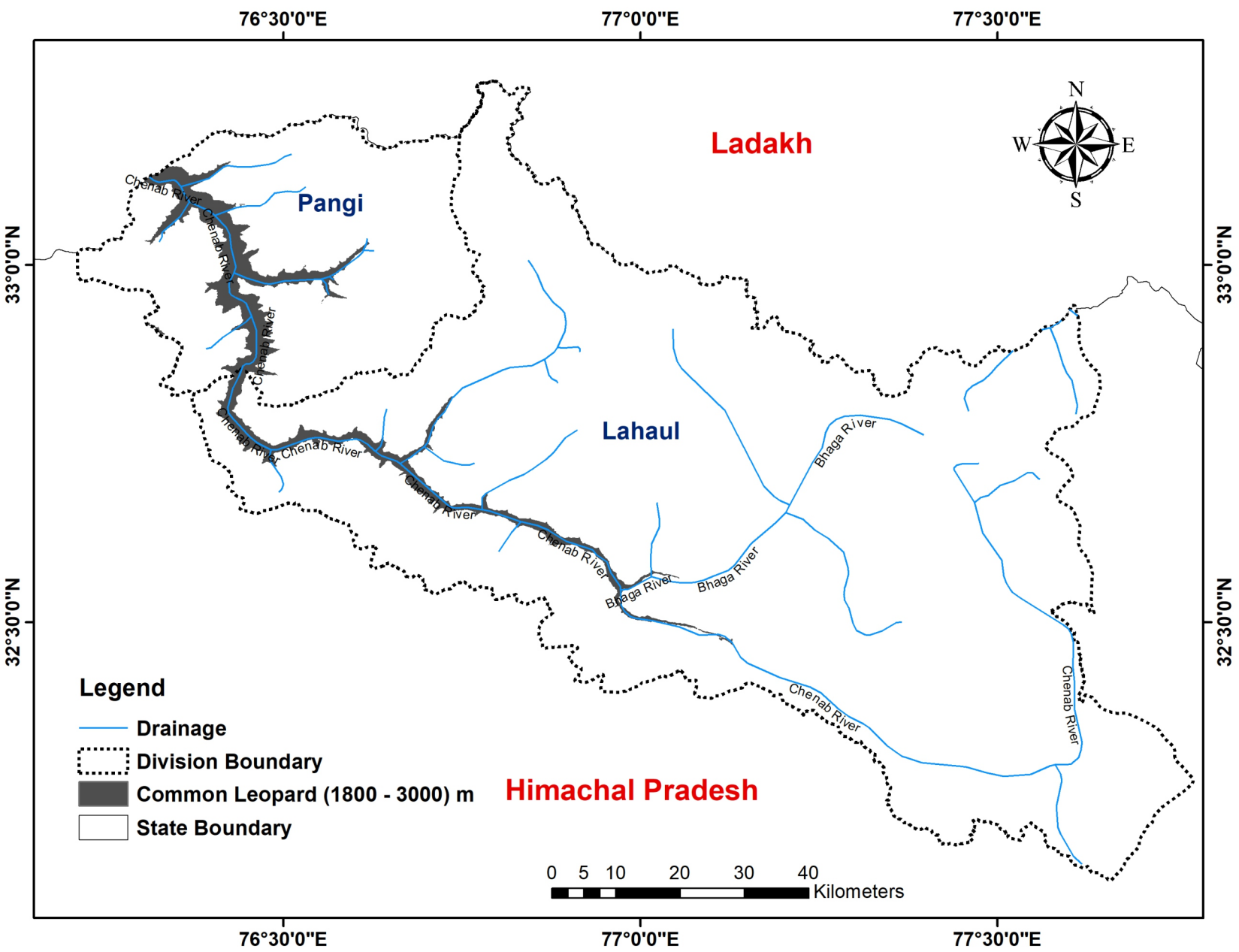

Rule-based map: Potential distribution of Asiatic Ibex in the Lahaul-Pangi Valley

(Data Source: Fox *et al*, 1992; Bhatnagar *et al.*, 2008)



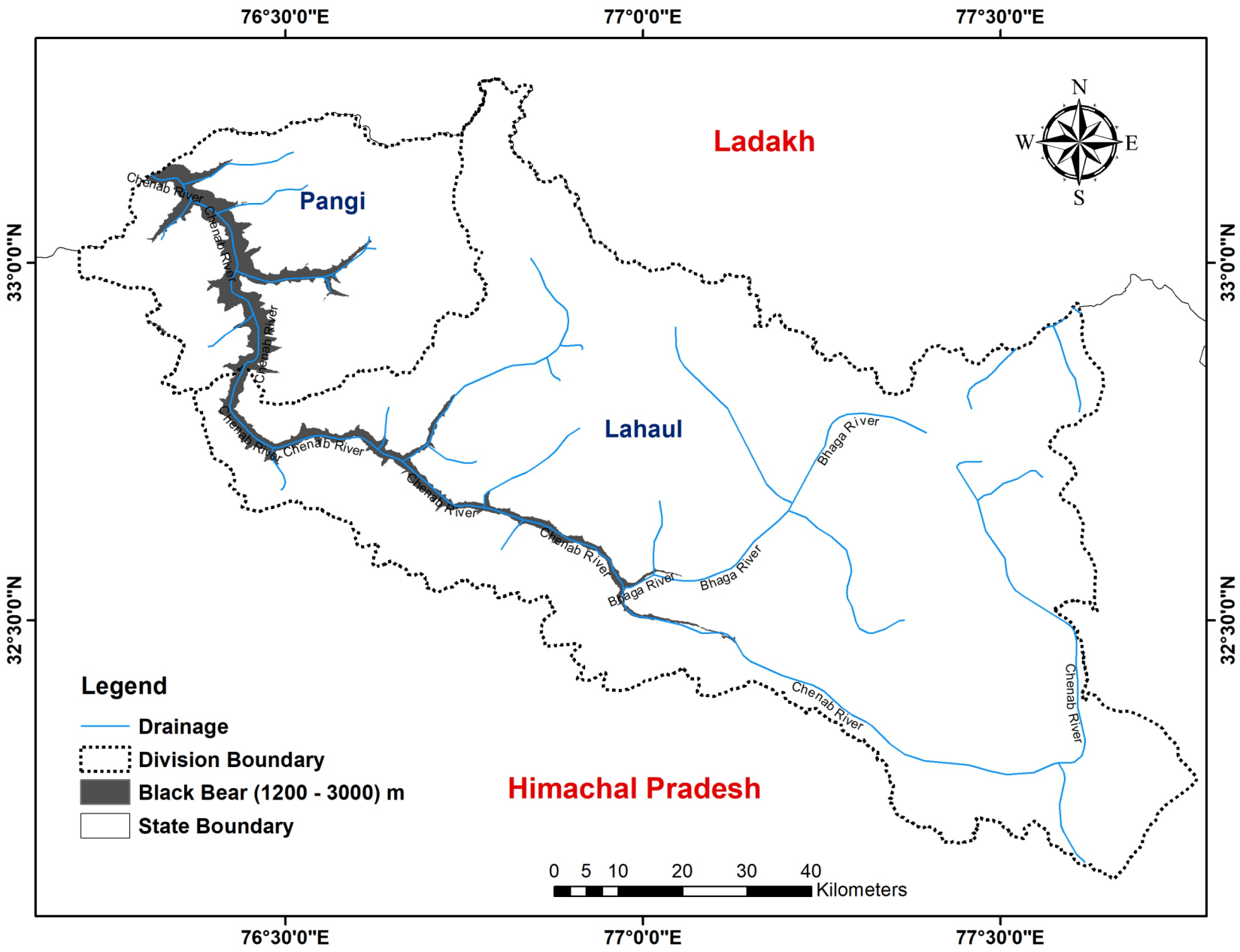

Rule-based map: Potential distribution of Snow leopard in the Lahaul-Pangi Valley

(Data Source: Bhatnagar *et al.*, 2008)



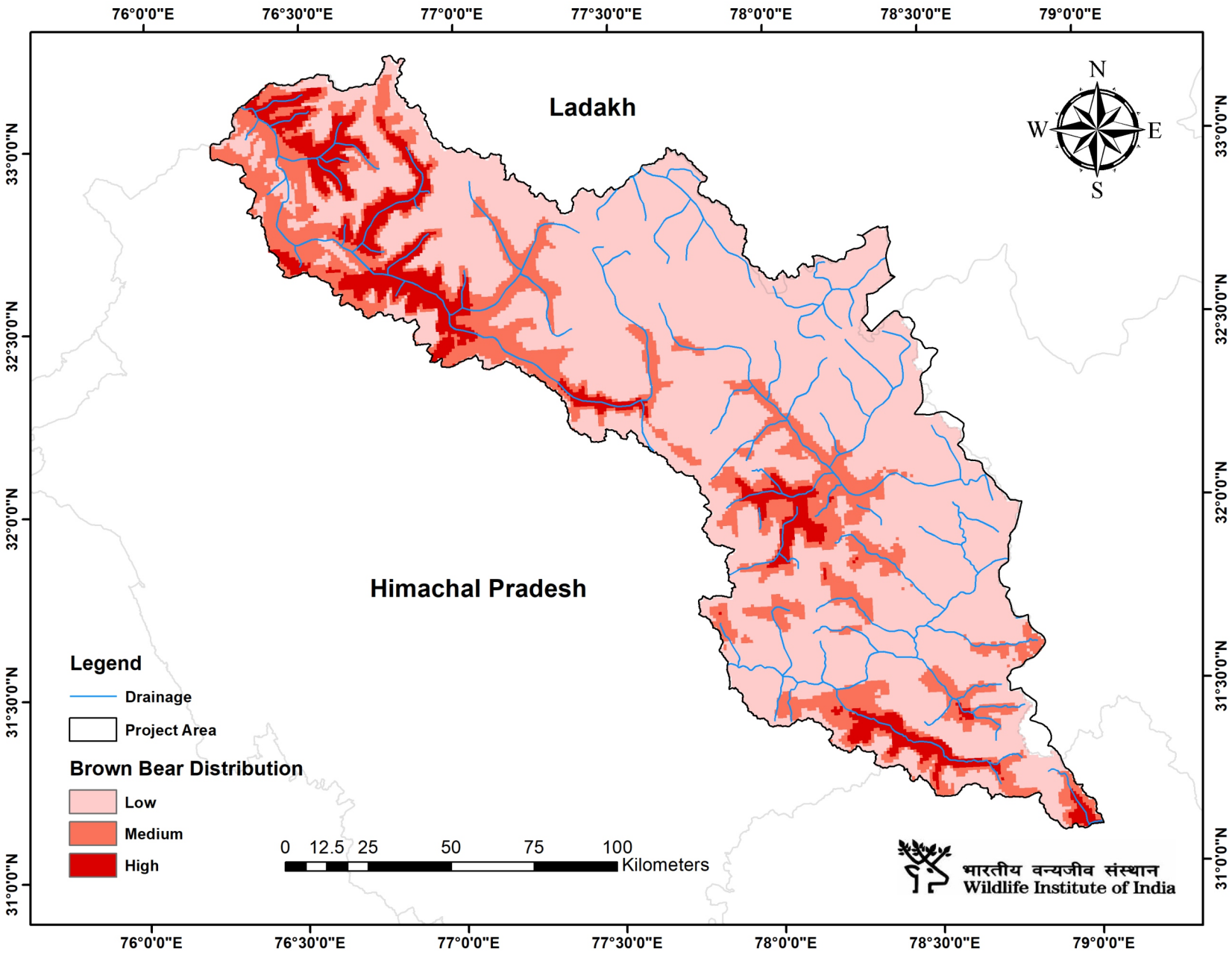

Rule-based map: Potential distribution of Common leopard in the Lahaul-Pangi Valley

(Data Source: Bhatnagar *et al.*, 2008)

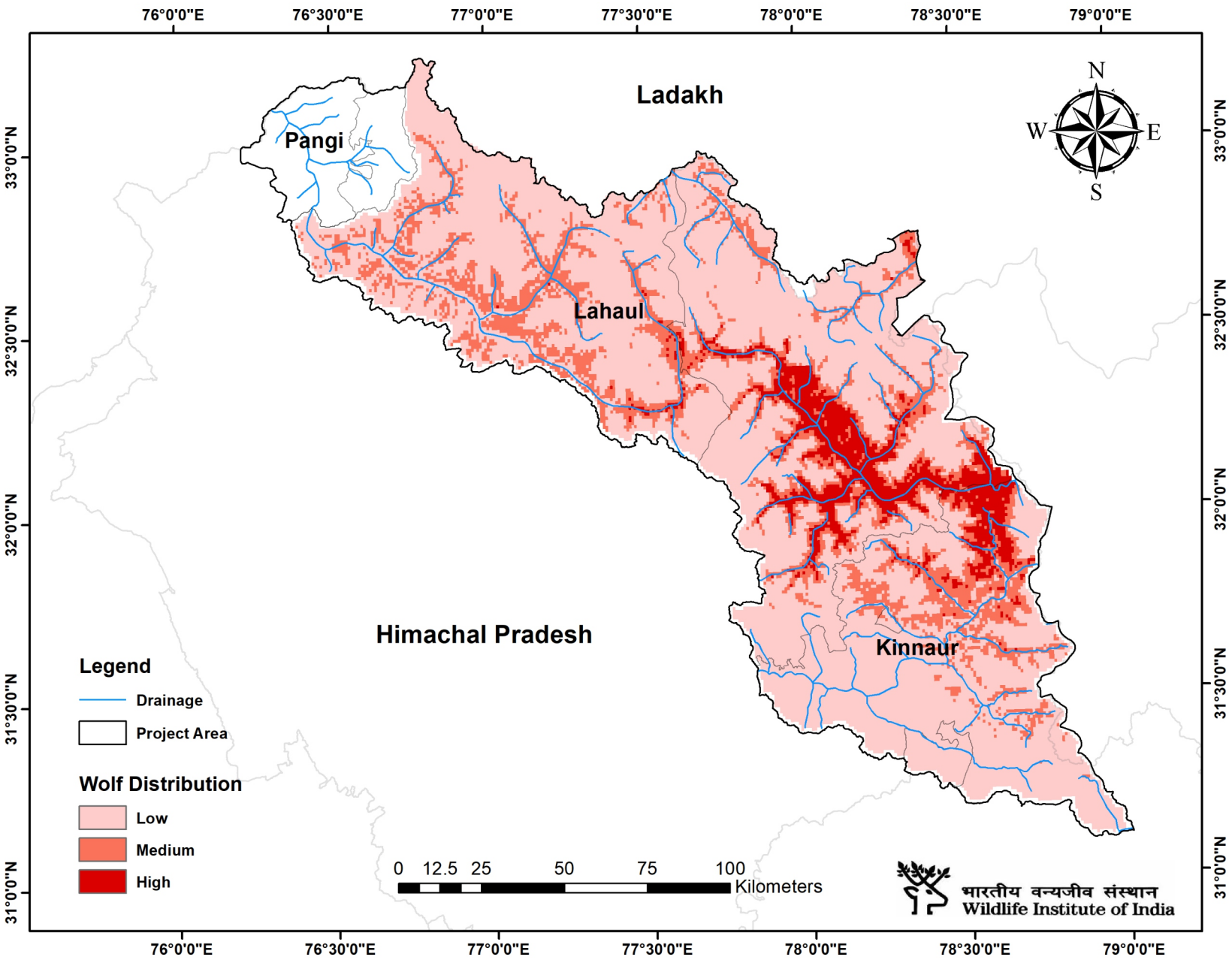



Rule-based map: Potential distribution of Black bear in the Lahaul-Pangi Valley

(Data Source: Sathyakumar, 2001; Bhatnagar *et al.*, 2008)




Species Distribution Modeling: Distribution Map of Brown bear in Lahaul-Pangi & Kinnaur Valley




Species Distribution Modeling: Distribution Map of Himalayan Wolf in Lahaul-Pangi & Kinnaur Valley

# APPENDIX IV - Questionnaire

**A. General Information about the Respondent:**

**(i)** Name of the Respondent: .....

**(ii)** Age: ....., **(iii)** Gender: M/F/T .....

**(iv)** Address/ House Number: .....

.....

**(v)** Occupation: Agriculture/Fishing/Dairy/Horticulture/ Private Job/Govt. Job/Wage Laborer*/Boatman/ Transportation/Own Business/Others (specify)

**(ix)** Land owned (if any):..... **(x)** Crops grown/other resources from the land: .....

**(xi)** Educational Qualification:

(a) Illiterate ☐ (b) Primary ☐ (c) Secondary ☐

(d) Graduation ☐ (e) Post-Graduate and above ☐

**B. Information about the Family:**

| S.No. | Family Members | Relation with Respondent | Age | Education | Occupation | Alternate Livelihood |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
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**C. Grazing Land**

1. How many grazing areas are around and where? **1)** ....., **2)** ....., **3)** .....
2. Are areas degrading? Yes ☐ / No ☐ . If, Yes then reason? .....
3. Mitigation Strategies suggested: .....
4. Contribution towards conservation: Yes ☐ / No ☐
5. Species preferred: .....

**D. Energy Source:**

**Heating :** Wood/Coal/Dung Cake/Electricity/Charcoal/Kerosene/Coil heater

**Cooking :** Wood/Coal/Dung Cake/Solar cookers/Charcoal/Kerosene/LPG/Biogas

**Lighting :** Solar lamp/Kerosene Lamp/Electricity/Solar Panel

**(i)** Number of forested areas near the village: .....

**(ii)** Reason for visit in each area: .....

**E. Water Resources**

**(i)** Distance of Water availability Area from the village:

**1)** For Human ..... , **2)** For Cattle .....

**(ii)** Type of water resources available: .....

**(iii)** Number of water resources: .....

**(iv)** Water quality: Good ☐ / Poor ☐

**(v)** Water supply from govt. if any and frequency.....

**F. Human Wildlife Conflict**

**(i)** Forested Land near Village? Yes ☐ / No ☐, **(ii)** Major vegetation: .....

**(iii)** Major faunal species present (and frequency): .....

**(iv)** Livestock loss due to conflict: Yes ☐ / No ☐, **(v)** Mitigation measures: .....

**(vi)** Hunting (if any):..... **(vii)** Major species hunted: .....

**(viii)** Other issues (if any): .....

**G. Collection of Medicinal and Aromatic Plants**

**(i)** Cultivation of medicinal plants by villagers? Yes ☐ / No ☐,

**(ii)** Major MAPs used: .....

**(iii)** Various species present and their extraction: .....

**(iv)** Collection of MAPs from wild: Yes ☐ / No ☐,

**(v)** Areas visited most frequently to collect MAPs: .....

**(vi)** Illegal extraction of MAPs (if reported any):.....

**(vii)** Other issues (if any): .....

# APPENDIX V - Villages Surveyed

**Table 1:** List of villages visited in Lahaul & Pangi Landscape

| S.No. | Latitude | Longitude | Village | No. of Respondents |
|---|---|---|---|---|
| **Landscape- Lahaul** | | | | |
| 1. | 32°45'30.99'' | 76°27'3.30'' | Kuthal | 41 |
| 2. | 32°45'45.75'' | 76°26'22.04'' | Bhujund | 26 |
| 3. | 32°43'34.10'' | 76°39'46.78'' | Udaipur | 24 |
| 4. | 32°46'8.86'' | 76°33'2.85'' | Kuruched | 15 |
| 5. | 32°51'33.04'' | 76°47'45.53'' | Urgos | 34 |
| 6. | 32°47'19.97'' | 76°43'15.98'' | Chimrit | 20 |
| 7. | 32°46'15.52'' | 76°42'22.86'' | Shakoli | 13 |
| 8. | 32°52'20.26'' | 76°51'25.70'' | Khanjar | 34 |
| 9. | 32°52'10.48'' | 76°51'0.32'' | Shukto | |
| 10. | 32°43'44.68'' | 76°51'25.44'' | Naingar | 19 |
| 11. | 32°33'46.94'' | 77°04'49.08'' | Istingri | 20 |
| 12. | 32°34'23.84'' | 77°0'49.71'' | Billing | 26 |
| 13. | 32°40'29.35'' | 77°12'37.26'' | Darcha | 34 |
| **Landscape- Pangi** | | | | |
| 14. | 33°05'17.49'' | 76°26'51.86'' | Killar | 42 |
| 15. | 33°07'35.55'' | 76°20'2.73'' | Karyas | 58 |
| 16. | 33°08'45.00'' | 76°26'23.76'' | Sural | 42 |
| 17. | 33°08'45.85'' | 76°27'57.17'' | Sural Bhatori | |
| 18. | 33°08'53.43'' | 76°28'59.27'' | Dharwas | 24 |
| 19. | 33°07'45.91'' | 76°20'50.22'' | Luj | 28 |
| 20. | 33°05'16.62'' | 76°24'21.92'' | Kawas | 26 |
| 21. | 33°05'27.12'' | 76°27'50.04'' | Hudan Bhatori | 25 |
| 22. | 32°59'46.62'' | 76°26'32.07'' | Sach | 32 |
| 23. | 32°58'58.89'' | 76°33'31.02'' | Sechu | 41 |
| 24. | 32°58'45.55'' | 76°32'22.44'' | Moji | 34 |
| 25. | 32°56'6.03'' | 76°37'40.65'' | Chasak Bhatori | 71 |
| 26. | 32°52'49.50'' | 76°28'15.26'' | Shour | 24 |
| 27. | 32°54'54.69'' | 76°27'59.07'' | Purthi | |
| 28. | 33°0'8.35'' | 76°24'46.69'' | Mindhal | 22 |

# APPENDIX VI - Sign Survey Data

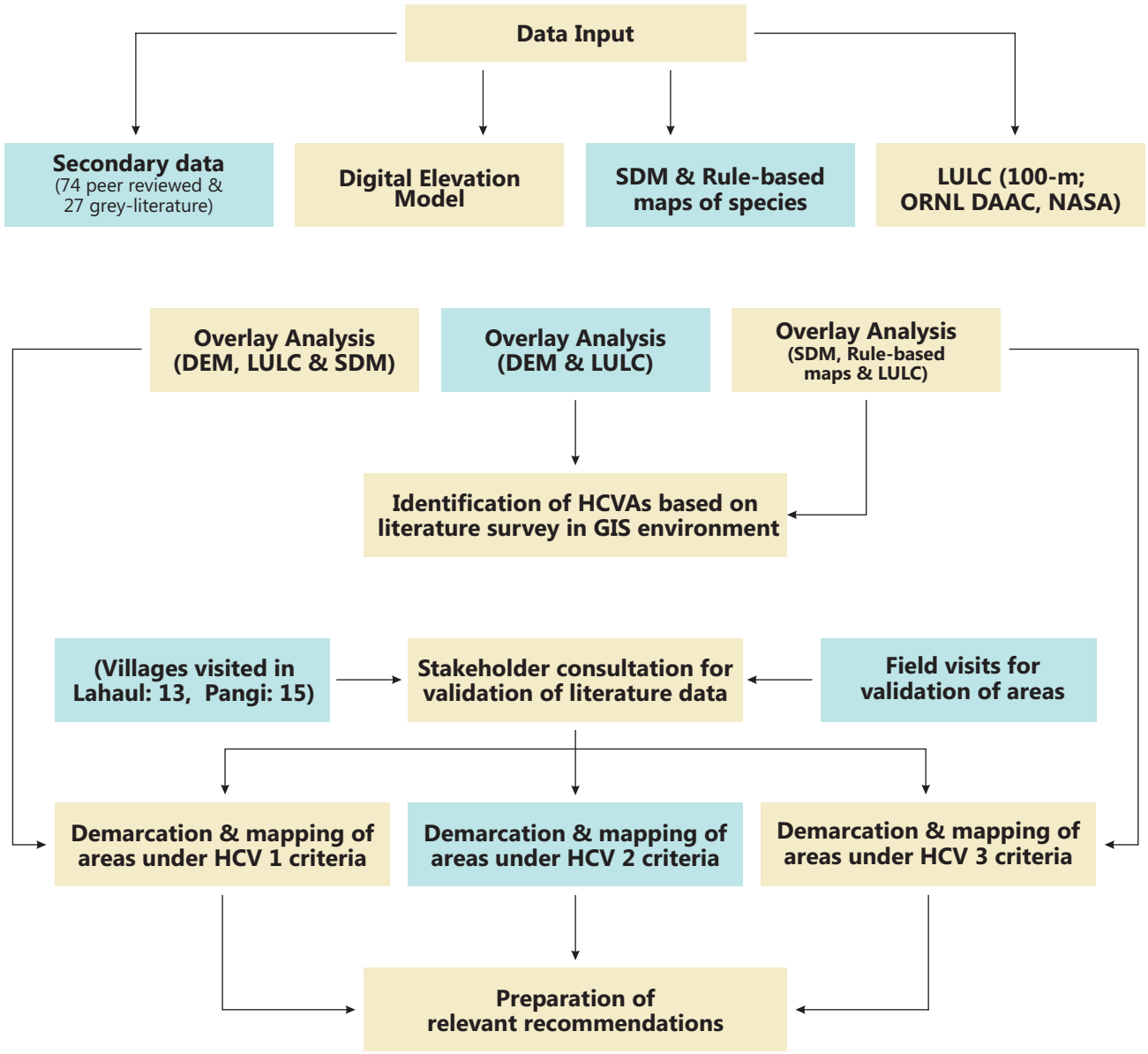
**Table 1: List of the signs recorded during the field survey in Lahaul & Pangi Landscape**

| S.No. | Latitude | Longitude | Elevation (m) | Sign | Species | Area | Landscape |
|---|---|---|---|---|---|---|---|
| 1. | 76°34'4.76'' | 32°59'6.28" | 2870 | Scent | Brown Bear | Sechu Tuan WLS ESZ | Pangi |
| 2. | 76°34'24.34'' | 32°58'44.04" | 3114 | Scat | Snow Leopard | Sechu Tuan WLS ESZ | Pangi |
| 3. | 76°34'18.58'' | 32°58'50.08" | 3071 | Scat | Leopard cat | Sechu Tuan WLS ESZ | Pangi |
| 4. | 76°34'17.83'' | 32°58'51.49" | 3066 | Scat | Brown Bear | Sechu Tuan WLS ESZ | Pangi |
| 5. | 76°34'15.06'' | 32°58'53.97" | 3062 | Pugmark | Brown Bear | Sechu Tuan WLS ESZ | Pangi |
| 6. | 76°34'14.23'' | 32°58'54.87" | 3063 | Pugmark | Leopard cat | Sechu Tuan WLS ESZ | Pangi |
| 7. | 76°34'12.61'' | 32°58'59.88" | 3011 | Pugmark | Brown Bear | Sechu Tuan WLS ESZ | Pangi |
| 8. | 76°34'12.61'' | 32°59'0.99" | 2997 | Pugmark | Brown Bear | Sechu Tuan WLS ESZ | Pangi |
| 9. | 76°34'10.48'' | 32°59'2.00" | 2965 | Sighting | Musk Deer | Sechu Tuan WLS ESZ | Pangi |
| 10. | 76°34'1.02'' | 33°59'9.06" | 2850 | Scat & Kill | Brown Bear | Sechu Tuan WLS ESZ | Pangi |
| 11. | 76°26'54.16'' | 33°08'41.20" | 3207 | Pugmark | Bear | Sural Bhatori | Pangi |
| 12. | 76°26'47.50'' | 33°08'40.16" | 3188 | Pugmark | Bear | Sural Bhatori | Pangi |
| 13. | 76°26'41.01'' | 33°08'35.91" | 3079 | Pellets | Musk Deer | Sural Bhatori | Pangi |
| 14. | 76°26'57.44'' | 33°08'42.36" | 3269 | Sighting | Royle's Pika | Sural Bhatori | Pangi |
| 15. | 76°26'36.84'' | 33°08'36.68" | 3356 | Pugmark | Wolf/fox | Sural Bhatori | Pangi |
| 16. | 76°27'57.68'' | 33°08'45.52" | 3524 | Sighting | Asiatic ibex | Sural Bhatori | Pangi |
| 17. | 76°27'36.36'' | 32°51'25.56" | 2890 | Scat | Red Fox | Kadu Nala | Pangi |
| 18. | 76°27'39.24'' | 32°51'23.36" | 2878 | Scat | Martin | Kadu Nala | Pangi |
| 19. | 76°27'40.44'' | 32°51'22.92" | 2890 | Scat | Unidentified | Kadu Nala | Pangi |
| 20. | 76°27'42.62'' | 32°51'20.55" | 2885 | Scat | Bear | Kadu Nala | Pangi |
| 21. | 76°28'4.08'' | 32°51'12.09" | 2845 | Scat | Unidentified | Kadu Nala | Pangi |
| 22. | 76°27'47.44'' | 32°51'18.25" | 2867 | Scat | Bear | Kadu Nala | Pangi |
| 23. | 76°27'47.52'' | 32°51'18.07" | 2871 | Scat | Bear | Kadu Nala | Pangi |
| 24. | 76°27'51.94'' | 32°51'15.76" | 2861 | Scat | Bear | Kadu Nala | Pangi |
| 25. | 76°28'0.62'' | 32°51'13.57" | 2854 | Scat | Bear | Kadu Nala | Pangi |
| 26. | 76°28'1.59'' | 32°51'13.21" | 2855 | Scat | Bear | Kadu Nala | Pangi |
| 27. | 76°28'2.20'' | 32°51'12.88" | 2851 | Scat | Bear | Kadu Nala | Pangi |
| 28. | 76°28'4.08'' | 32°51'12.09" | 2854 | Scat | Bear | Kadu Nala | Pangi |
| 29. | 76°28'4.72'' | 32°51'11.88" | 2849 | Scat | Bear | Kadu Nala | Pangi |
| 30. | 76°28'13.62'' | 32°51'6.33" | 2844 | Scat | Bear | Kadu Nala | Pangi |
| 31. | 76°28'18.84'' | 32°51'3.74" | 2847 | Pellets | Unidentified | Kadu Nala | Pangi |
| 32. | 76°28'26.68'' | 32°51'1.15" | 2860 | Scat | Bear | Kadu Nala | Pangi |
| 33. | 76°28'27.33'' | 32°51'0.21" | 2897 | Scat | Bear | Kadu Nala | Pangi |
| 34. | 76°28'48.57'' | 32°50'56.72" | 2869 | Scat | Unidentified | Kadu Nala | Pangi |
| 35. | 76°28'52.64'' | 32°50'54.34" | 3221 | Scat | Bear | Kadu Nala | Pangi |
| 36. | 76°28'52.93'' | 32°50'54.20" | 3221 | Scat | Bear | Kadu Nala | Pangi |
| 37. | 76°28'57.39'' | 32°50'53.80" | 3095 | Scat | Bear | Kadu Nala | Pangi |
| 38. | 76°28'52.28'' | 33°05'43.98" | 3597 | Sighting | Tibetan Wolf | Hudan bhatori | Pangi |

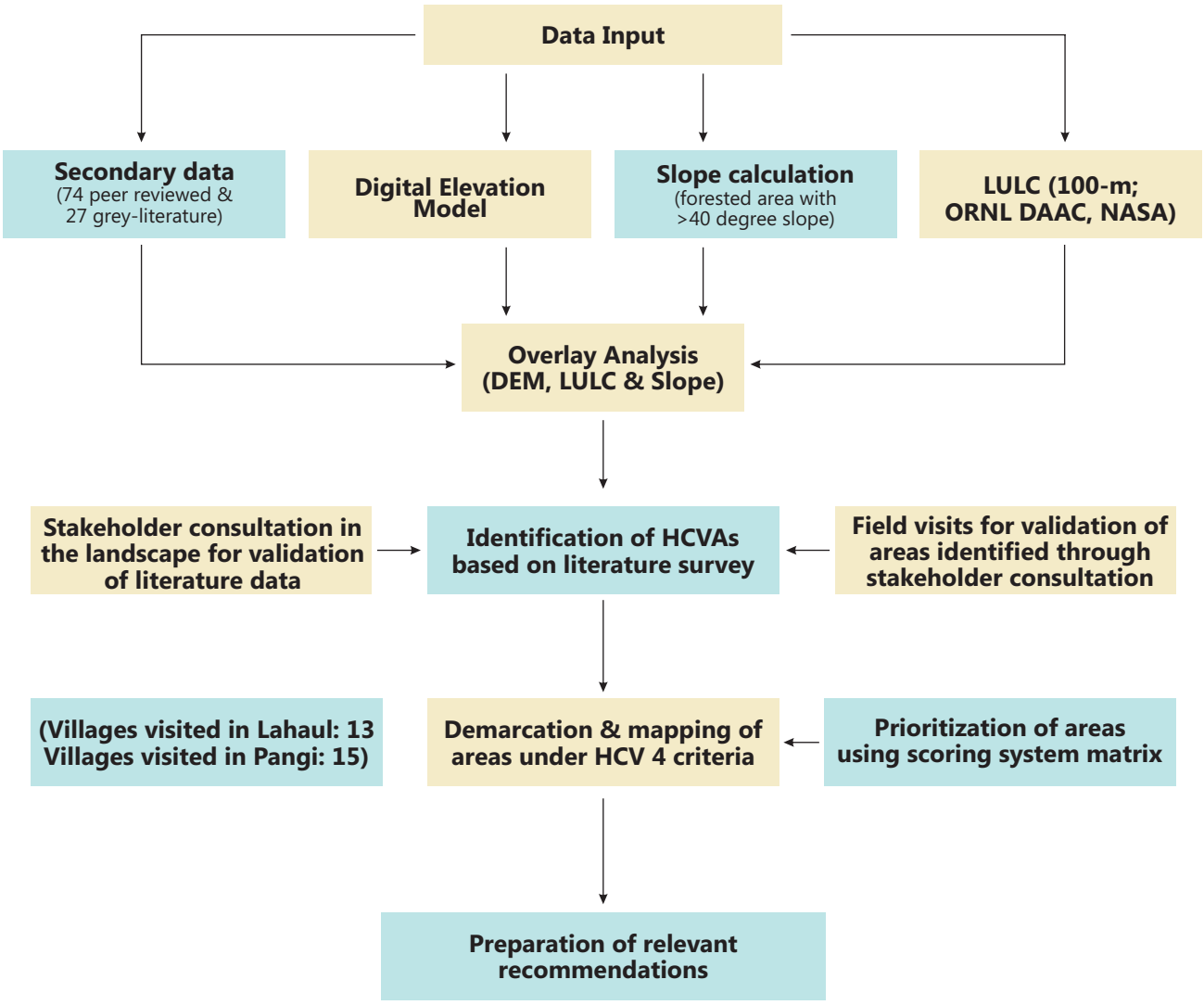
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 39. | 76°30'15.94'' | 33°06'37.40" | 3910 | Pugmark | Bear | Hudan bhatori | Pangi |
| 40. | 76°30'10.33'' | 33°06'36.72" | 3866 | Sighting | Marmot | Hudan bhatori | Pangi |
| 41. | 76°29'59.82'' | 33°06'27.68" | 3763 | Sighting | Asiatic Ibex | Hudan bhatori | Pangi |
| 42. | 76°29'52.72'' | 33°06'24.51" | 3730 | Burrows | Marmot | Hudan bhatori | Pangi |
| 43. | 76°29'44.08'' | 33°06'21.56" | 3698 | Sighting | Marmot | Hudan bhatori | Pangi |
| 44. | 76°30'43.41'' | 33°06'43.74" | 4092 | Hoof marks | Asiatic Ibex | Hudan bhatori | Pangi |
| 45. | 76°25'3.59'' | 33°00'9.27" | 3302 | Scat | Black bear | Mindhal | Pangi |
| 46. | 76°24'46.69'' | 33°0'8.33" | 3720 | Scat | Black bear | Mindhal | Pangi |
| 47. | 76°24'51.90'' | 33°0'17.21" | 3575 | Scat | Black bear | Mindhal | Pangi |
| 48. | 76°24'48.33'' | 32°59'30.85" | 3458 | Sighted | Ghoral | Mindhal | Pangi |
| 49. | 76°25'3.59'' | 33°0'9.27" | 3302 | Scat | Black bear | Mindhal | Pangi |
| 50. | 76°40'32.62'' | 32°43'55.09" | 3072 | Sighting | Asiatic Ibex | Miar Valley | Lahaul |
| 51. | 76°40'53.32'' | 32°44'9.52" | 3095 | Sighting | Asiatic Ibex | Miar Valley | Lahaul |
| 52. | 76°40'59.88'' | 32°44'13.30" | 3079 | Sighting | Asiatic Ibex | Miar Valley | Lahaul |
| 53. | 76°53'49.05'' | 32°55'32.95" | 3269 | Sighting | Asiatic Ibex | Miar Valley | Lahaul |
| 54. | 76°52'58.90'' | 32°53'17.59" | 3665 | Horns | Asiatic Ibex | Thanpattan | Lahaul |
| 55. | 76°53'4.12'' | 32°53'24.64" | 3680 | Pugmark | Bear | Thanpattan | Lahaul |
| 56. | 76°53'12.48'' | 32°53'30.40" | 3685 | Pugmark | Bear | Thanpattan | Lahaul |
| 57. | 77°04'49.06'' | 32°33'46.94" | 3194 | Pellets | Asiatic Ibex | Istingri | Lahaul |
| 58. | 77°04'40.20'' | 32°33'43.87" | 3160 | Pellets | Asiatic Ibex | Istingri | Lahaul |
| 59. | 77°04'42.08'' | 32°33'46.93" | 3211 | Pellets | Asiatic Ibex | Istingri | Lahaul |
| 60. | 77°04'55.51'' | 32°33'50.88" | 3208 | Hoof marks and Pellet | Asiatic Ibex | Istingri | Lahaul |
| 61. | 77°5'3.48'' | 32°33'53.10" | 3211 | Hoof marks | Asiatic Ibex | Istingri | Lahaul |
| 62. | 77°0'49.72'' | 32°34'23.83" | 3095 | Hoof marks and Pellet | Asiatic Ibex | Billing | Lahaul |
| 63. | 77°0'45.10'' | 32°34'20.10" | 3193 | Pellets | Asiatic Ibex | Billing | Lahaul |
| 64. | 77°0'40.64'' | 32°34'20.16" | 3185 | Hoof marks | Asiatic Ibex | Billing | Lahaul |
| 65. | 77°0'33.51'' | 32°34'17.28" | 3205 | Pellets | Asiatic Ibex | Billing | Lahaul |
| 66. | 77°0'49.89'' | 32°34'30.72" | 3115 | Sighted | Asiatic Ibex | Billing | Lahaul |
| 67. | 77°0'47.39'' | 32°34'42.37" | 3135 | Sighted | Asiatic Ibex | Billing | Lahaul |
| 68. | 77°04'49.06'' | 32°33'46.94" | 3194 | Pellets | Asiatic Ibex | Istingri | Lahaul |

# APPENDIX VII - Methodology for each HCV criteria

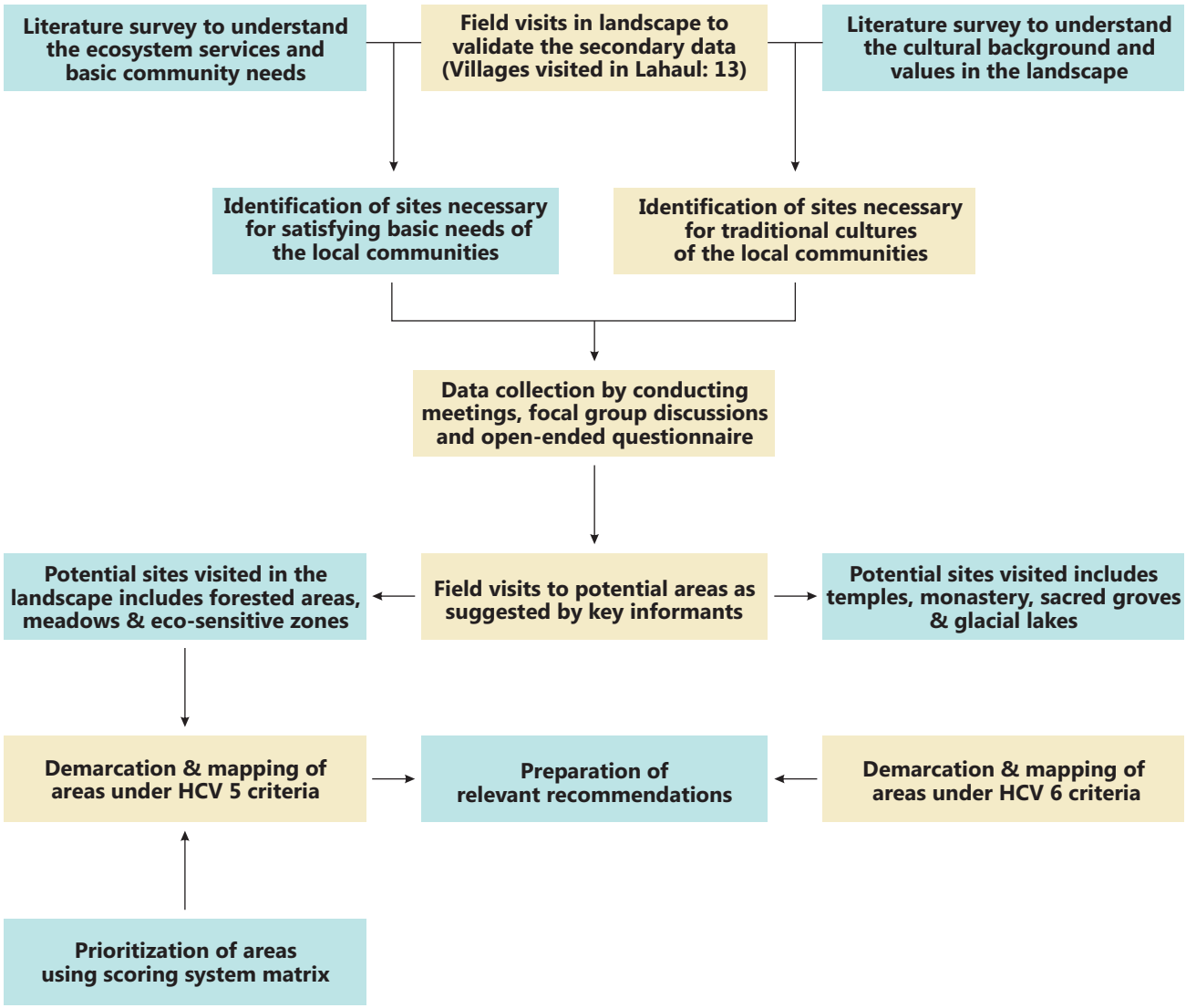
Methodology adopted to delineate potential area under criterion **HCV 1 (Species & Diversity), HCV 2 (Landscape-level ecosystems) and HCV 3 (RET Ecosystem & Habitat),** in the Lahaul-Pangi landscape.



Methodology adopted to delineate potential area under criterion **HCV 4 (Ecosystem Services)**, in the Lahaul-Pangi landscape



Methodology adopted to delineate potential area under criteria **HCV 5 (Community needs) & HCV 6 (Cultural Values),** in the Lahaul-Pangi landscape



# APPENDIX VIII - Scoring Matrix

### HCV 1: SPECIES & DIVERSITY – LAHAUL VALLEY

**Table 1: Scoring system matrix to prioritize the areas under HCV criteria 1 in Lahaul Valley. The scoring technique adopted is as follows: if less than 8 respondents confirmed the presence of any particular value at the site, then a score '1' was given. Similarly, if eight to fifteen respondents and more than fifteen respondents confirmed the occurrence of a value, then scores '2' and '3' were given, respectively.If no one confirmed the presence of the species/values score '0' was given.**

| Areas | | Miar Valley | Pattan Valley (Naingar) | Billing & Istingri | Darch & Jispa | Hadsar | Kuruched | Chandratal ESZ |
|---|---|---|---|---|---|---|---|---|
| **Values** | | **Score** | | | | | | |
| **Major Carnivore Species** | Snow leopard | 3 | 2 | 3 | 2 | 0 | 1 | 2 |
| | Black bear | 1 | 0 | 0 | 0 | 2 | 2 | 0 |
| | Brown bear | 3 | 3 | 1 | 0 | 3 | 2 | 0 |
| | Tibetan/ Himalayan wolf | 2 | 2 | 2 | 3 | 0 | 0 | 2 |
| | Red fox | 1 | 1 | 2 | 2 | 0 | 0 | 2 |
| **Wild Ungulates** | Asiatic Ibex | 3 | 2 | 3 | 3 | 0 | 3 | 2 |
| | Musk Deer | 2 | 3 | 1 | 1 | 0 | 2 | 1 |
| | Blue Sheep | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| **Threatened flora/MAPs** | | 3 | 3 | 1 | 1 | 3 | 2 | 1 |
| **Threatened Avifaunal Species** | | 2 | 1 | 2 | 1 | 1 | 1 | 3 |
| **Total Score** | | **20** | **17** | **15** | **12** | **9** | **13** | **16** |

### HCV 4: ECOSYSTEM SERVICES – LAHAUL VALLEY

**Table 2: Matrix for the assessment of the different land cover types' capacities to provide selected ecosystem services (HCV 4), in Miar Valley.The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009)**

| Area | Miar Valley | | | | | |
|---|---|---|---|---|---|---|
| Land-use type | Regulating and Supporting ecosystem services | | | | | |
| | Flood protection | Erosion regulation | Carbon Sequestration | Nutrient ragulation | Local Climate | Total |
| **Cropland/agriculture** | 0 | 2 | 3 | 3 | 2 | 9 |
| **Pasturelands** | 1 | 2 | 2 | 2 | 1 | 8 |
| **Agro-forestry** | 3 | 3 | 3 | 3 | 3 | 14 |
| **Forested Areas** | 4 | 4 | 4 | 2 | 4 | 18 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 4 | 4 |
| **Water bodies** | 2 | 0 | 0 | 1 | 2 | 5 |
| | | | | | | **Total=58** |

**Table 3: Matrix for the assessment of the different land cover types' capacities to provide selected ecosystem services (HCV 4), in Pattan Valley (Naingar). The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Pattan Valley (Naingar) | | | | | |
|---|---|---|---|---|---|---|
| Land-use type | Regulating and supporting ecosystem services | | | | | |
| | Flood protection | Erosion regulation | Carbon Sequestration | Nutrient ragulation | Local Climate | Total |
| **Cropland/agriculture** | 0 | 1 | 2 | 2 | 2 | 7 |
| **Pasturelands** | 1 | 1 | 1 | 1 | 1 | 5 |
| **Agro-forestry** | 2 | 3 | 2 | 2 | 2 | 11 |
| **Forested Areas** | 3 | 4 | 4 | 2 | 2 | 15 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 3 | 3 |
| **Water bodies** | 2 | 0 | 0 | 1 | 1 | 4 |
| | | | | | | **Total=45** |

**Table 4: Matrix for the assessment of the different land cover types' capacities to provide selected ecosystem services (HCV 4), in the Chandratal Eco-sensitive zone. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Chandratal Eco-sensitive zone | | | | | |
|---|---|---|---|---|---|---|
| Land-use type | Regulating and supporting ecosystem services | | | | | |
| | Flood protection | Erosion regulation | Carbon Sequestration | Nutrient ragulation | Local Climate | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 1 | 2 | 2 | 1 | 1 | 7 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 5 | 5 |
| **Water bodies** | 1 | 0 | 0 | 1 | 3 | 5 |
| | | | | | | **Total=17** |

## HCV 5: COMMUNITY NEEDS – LAHAUL VALLEY

**Table 5 : Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Miar Valley. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated.**

| Area | Miar Valley | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 5 | 2 | 0 | 0 | 3 | 0 | 0 | 10 |
| **Pasturelands** | 0 | 5 | 0 | 1 | 4 | 0 | 2 | 12 |
| **Agro-forestry** | 3 | 3 | 2 | 4 | 2 | 0 | 0 | 14 |
| **Forested Areas** | 0 | 1 | 4 | 3 | 3 | 3 | 3 | 17 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 |
| **Water bodies** | 4 | 4 | 0 | 0 | 0 | 0 | 5 | 13 |
| | | | | | | | | **Total=71** |

**Table 6 : Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Pattan Valley (Naingar). The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Pattan Valley (Naingar) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 5 | 1 | 0 | 0 | 2 | 0 | 0 | 8 |
| **Pasturelands** | 0 | 5 | 0 | 1 | 4 | 0 | 2 | 12 |
| **Agro-forestry** | 2 | 2 | 1 | 2 | 2 | 0 | 0 | 9 |
| **Forested Areas** | 0 | 1 | 4 | 3 | 3 | 2 | 3 | 16 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 |
| **Water bodies** | 4 | 4 | 0 | 0 | 0 | 0 | 4 | 12 |
| | | | | | | | | **Total=62** |

**Table 7: Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Billing-Istingri. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated.**

| Area | Billing-Istingri | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 0 | 5 | 0 | 2 | 3 | 0 | 2 | 12 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| **Water bodies** | 1 | 2 | 0 | 0 | 1 | 0 | 3 | 7 |
| | | | | | | | | **Total=22** |

**Table 8: Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Darcha-Jispa. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Darcha-Jispa | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 0 | 5 | 0 | 2 | 4 | 0 | 2 | 13 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| **Water bodies** | 1 | 2 | 0 | 0 | 1 | 0 | 3 | 7 |
| | | | | | | | | **Total=23** |

**Table 9 : Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Chandratal. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated.**

| Area | Chandratal | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 0 | 4 | 0 | 1 | 2 | 0 | 2 | 9 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 |
| **Water bodies** | 1 | 2 | 0 | 0 | 1 | 0 | 3 | 7 |
| | | | | | | | | **Total=21** |

## HCV 1: SPECIES & DIVERSITY – PANGI VALLEY

**Table 10 : Scoring system matrix to prioritize the areas under HCV criterion 1, in Pangi Valley. The scoring technique adopted is as follows: if less than 8 respondents confirmed the presence of any particular value at the site, then a score '1' was given. Similarly, if eight to fifteen respondents and more than fifteen respondents confirmed the occurrence of a value, then scores '2' and '3' were given, respectively.If no one confirmed the presence of the species/values score '0' was given.**

| Areas | | Sural Bhatori | Sechu Eco-sensitive zone | Hudan Bhatori | Mindhal | Kathu Nallah |
|---|---|---|---|---|---|---|
| **Values** | | **Score** | | | | |
| **Major Carnivore Species** | Snow leopard | 1 | 1 | 1 | 1 | 2 |
| | Black bear | 2 | 1 | 0 | 2 | 3 |
| | Brown bear | 3 | 3 | 3 | 2 | 2 |
| | Tibetan wolf | 1 | 1 | 2 | 0 | 2 |
| | Red fox | 1 | 1 | 0 | 0 | 2 |
| | Asiatic Ibex | 3 | 3 | 1 | 2 | 3 |
| **Wild Ungulates** | Musk Deer | 3 | 3 | 0 | 1 | 3 |
| | Blue Sheep | 0 | 0 | 0 | 0 | 0 |
| **Threatened flora/MAPs** | | 3 | 2 | 3 | 2 | 3 |
| **Threatened Avifaunal Species** | | 2 | 2 | 1 | 1 | 2 |
| **Total Score** | | 19 | 17 | 11 | 11 | 22 |

## HCV 4: ECOSYSTEM SERVICES – PANGI VALLEY

**Table 11 : Matrix for the assessment of the different land cover types' capacities to provide selected ecosystem services (HCV 4), in Sural Bhatori. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Sural Bhatori | | | | | |
|---|---|---|---|---|---|---|
| Land-use type | Regulating and supporting ecosystem services | | | | | |
| | Flood protection | Erosion regulation | Carbon Sequestration | Nutrient ragulation | Local Climate | Total |
| **Cropland/agriculture** | 0 | 2 | 3 | 3 | 2 | 9 |
| **Pasturelands** | 1 | 2 | 2 | 2 | 1 | 8 |
| **Agro-forestry** | 1 | 2 | 2 | 2 | 2 | 9 |
| **Forested Areas** | 4 | 4 | 4 | 2 | 4 | 18 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 4 | 4 |
| **Water bodies** | 1 | 0 | 0 | 1 | 2 | 5 |
| | | | | | | **Total=49** |

**Table 12 : Matrix for the assessment of the different land cover types' capacities to provide selected ecosystem services (HCV 4), in Hudan Bhatori. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated.**

| Area | Hudan Bhatori | | | | | |
|---|---|---|---|---|---|---|
| Land-use type | Regulating and supporting ecosystem services | | | | | |
| | Flood protection | Erosion regulation | Carbon Sequestration | Nutrient ragulation | Local Climate | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 1 | 3 | 3 | 2 | 2 | 11 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 5 | 5 |
| **Water bodies** | 1 | 0 | 0 | 1 | 3 | 5 |
| | | | | | | **Total=21** |

**Table 13 : Matrix for the assessment of the different land cover types' capacities to provide selected ecosystem services (HCV 4), in Kadu Nallah, Pangi. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Kadu Nallah | | | | | |
|---|---|---|---|---|---|---|
| Land-use type | Regulating and supporting ecosystem services | | | | | |
| | Flood protection | Erosion regulation | Carbon Sequestration | Nutrient ragulation | Local Climate | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 1 | 2 | 2 | 1 | 1 | 7 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 1 | 3 | 3 | 3 | 3 | 13 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 5 | 5 |
| **Water bodies** | 1 | 0 | 0 | 1 | 3 | 5 |
| | | | | | | **Total=30** |

**Table 14 : Matrix for the assessment of the different land cover types' capacities to provide selected ecosystem services (HCV 4), in Luj, Pangi. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Luj | | | | | |
|---|---|---|---|---|---|---|
| Land-use type | Regulating and supporting ecosystem services | | | | | |
| | Flood protection | Erosion regulation | Carbon Sequestration | Nutrient ragulation | Local Climate | Total |
| **Cropland/agriculture** | 0 | 1 | 2 | 2 | 1 | 6 |
| **Pasturelands** | 1 | 2 | 2 | 1 | 1 | 7 |
| **Agro-forestry** | 1 | 1 | 2 | 2 | 1 | 7 |
| **Forested Areas** | 2 | 3 | 3 | 2 | 3 | 13 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Water bodies** | 1 | 0 | 0 | 1 | 2 | 4 |
| | | | | | | **Total=37** |

**Table 15 : Matrix for the assessment of the different land cover types' capacities to provide selected ecosystem services (HCV 4), in Mindhal, Pangi. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Mindhal | | | | | |
|---|---|---|---|---|---|---|
| Land-use type | Regulating and supporting ecosystem services | | | | | |
| | Flood protection | Erosion regulation | Carbon Sequestration | Nutrient ragulation | Local Climate | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 1 | 3 | 3 | 1 | 1 | 9 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 1 | 2 | 2 | 2 | 2 | 9 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 3 | 3 |
| **Water bodies** | 1 | 0 | 0 | 1 | 1 | 3 |
| | | | | | | **Total=24** |

## HCV 5: COMMUNITY NEEDS – PANGI VALLEY

**Table 16 : Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Sural Bhatori. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated**

| Area | Sural Bhatori | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 5 | 3 | 0 | 1 | 1 | 0 | 0 | 9 |
| **Pasturelands** | 0 | 5 | 0 | 1 | 4 | 0 | 2 | 12 |
| **Agro-forestry** | 3 | 1 | 1 | 2 | 2 | 0 | 0 | 9 |
| **Forested Areas** | 0 | 1 | 4 | 2 | 4 | 2 | 2 | 15 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 |
| **Water bodies** | 3 | 3 | 0 | 0 | 0 | 0 | 4 | 10 |
| | | | | | | | | **Total=60** |

**Table 17 : Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Mindhal. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated.**

| Area | Mindhal | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 0 | 5 | 0 | 2 | 3 | 0 | 1 | 11 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 0 | 1 | 3 | 3 | 2 | 2 | 2 | 13 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| **Water bodies** | 2 | 2 | 0 | 0 | 0 | 0 | 3 | 7 |
| | | | | | | | | **Total=34** |

**Table 18 : Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Kadu Nallah. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Kadu Nallah | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 0 | 5 | 0 | 2 | 4 | 0 | 2 | 13 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 0 | 2 | 4 | 3 | 5 | 2 | 3 | 19 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 |
| **Water bodies** | 0 | 4 | 0 | 0 | 0 | 0 | 4 | 8 |
| | | | | | | | | **Total=45** |

**Table 19 : Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Hudan Bhatori. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Hudan Bhatori | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 0 | 5 | 0 | 2 | 4 | 0 | 2 | 13 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| **Water bodies** | 1 | 4 | 0 | 0 | 1 | 0 | 4 | 10 |
| | | | | | | | | **Total=26** |

**Table 20 : Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Luj. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Luj | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Pasturelands** | 0 | 5 | 0 | 1 | 2 | 0 | 1 | 9 |
| **Agro-forestry** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Forested Areas** | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 6 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| **Water bodies** | 0 | 2 | 0 | 0 | 0 | 0 | 4 | 6 |
| | | | | | | | | **Total=23** |

**Table 21: Matrix for the assessment of the different land cover types' capacities to provide selected provisioning services (HCV 5) in Sechu. The assessment scale reaches from 0 = no relevant capacity of the land cover type to provide this particular ecosystem service, 1 = low relevant capacity, 2 = relevant capacity, 3 = medium relevant capacity, 4 = high relevant capacity and 5 = very high relevant capacity. In the rows at the end, sums for the individual ecosystem services as per the land use class have been calculated (Modified from Burkhard *et al.*, 2009).**

| Area | Sechu | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Land-use type | Provisioning ecosystem services | | | | | | | |
| | Crops | Livestocks | Fuel-wood | Fodder plants | Medicinal plants/ wild food | Timber | Fresh water | Total |
| **Cropland/agriculture** | 5 | 2 | 0 | 1 | 1 | 0 | 0 | 9 |
| **Pasturelands** | 0 | 5 | 0 | 0 | 4 | 0 | 2 | 11 |
| **Agro-forestry** | 2 | 2 | 0 | 2 | 0 | 0 | 0 | 6 |
| **Forested Areas** | 0 | 1 | 4 | 2 | 2 | 2 | 1 | 12 |
| **Glacier & perpetual snow** | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 |
| **Water bodies** | 2 | 3 | 0 | 0 | 0 | 0 | 4 | 9 |
| | | | | | | | | **Total=52** |

# APPENDIX IX - Threat Analysis

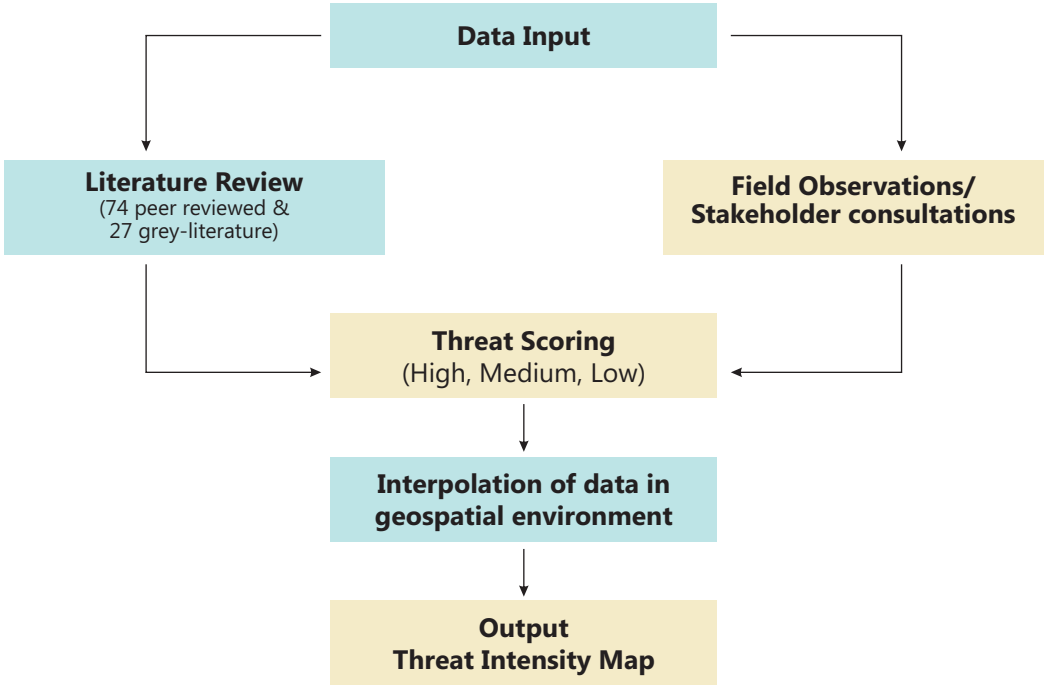
**Table 1: Threats identified in various HCVs of Lahaul Valley- Intensity & Extent**

| S.No. | Area | Threats | Intensity | Extent |
|---|---|---|---|---|
| 1. | Miar Valley | Grazing | High | Moderate |
| | | Human-Wildlife Conflict | High | Large |
| | | Premature & over-harvesting of Medicinal plants | Medium | Moderate |
| 2. | Billing & Istingri | Grazing | Medium | Moderate |
| | | Human-Wildlife Conflict | Medium | Small |
| 3. | Darcha & Jispa | Grazing | Medium | Moderate |
| | | Human-Wildlife Conflict | Medium | Small |
| 4. | Pattan Valley (Naingar) | Grazing | Medium | Moderate |
| | | Human-Wildlife Conflict | High | Large |
| | | Premature & over-harvesting of Medicinal plants | Medium | Moderate |
| 5. | Hadsar | Premature & over-harvesting of Medicinal plants | High | Small |
| 6. | Kuruched | Premature & over-harvesting of Medicinal plants | Medium | Small |
| 7. | Chandratal | Grazing | Medium | Moderate |
| | | Uncontrolled Tourism | High | Small |

**Table 2 : Threats identified in various HCVs of Pangi Valley- Intensity & Extent**

| S.No. | Area | Threats | Intensity | Extent |
|---|---|---|---|---|
| 1. | Sural Bhatori | Grazing | Low | Small |
| | | Human-Wildlife Conflict | High | Large |
| | | Premature & over-harvesting of Medicinal plants | High | Moderate |
| 2. | Hudan Bhatori | Grazing | Low | Small |
| | | Human-Wildlife Conflict<br>Premature & over-harvesting of Medicinal plants | Low<br>Medium | Small<br>Moderate |
| 3. | Sechu | Grazing | Low | Small |
| | | Human-Wildlife Conflict | Medium | Moderate |
| | | Premature & over-harvesting of Medicinal plants | High | Moderate |
| 4. | Kadu Nallah | Grazing | Low | Small |
| | | Human-Wildlife Conflict | Medium | Small |
| | | Premature & over-harvesting of Medicinal plants | High | Large |
| 5. | Mindhal | Grazing | Medium | Small |
| | | Human-Wildlife Conflict | Low | Small |
| | | Premature & over-harvesting of Medicinal plants | Low | Small |
| 6. | Luj | Grazing | Low | Small |
| | | Premature & over-harvesting of NTFPs/Medicinal plants | Medium | Small |

Methodology for mapping the threat intensity in the Lahaul-Pangi Landscape



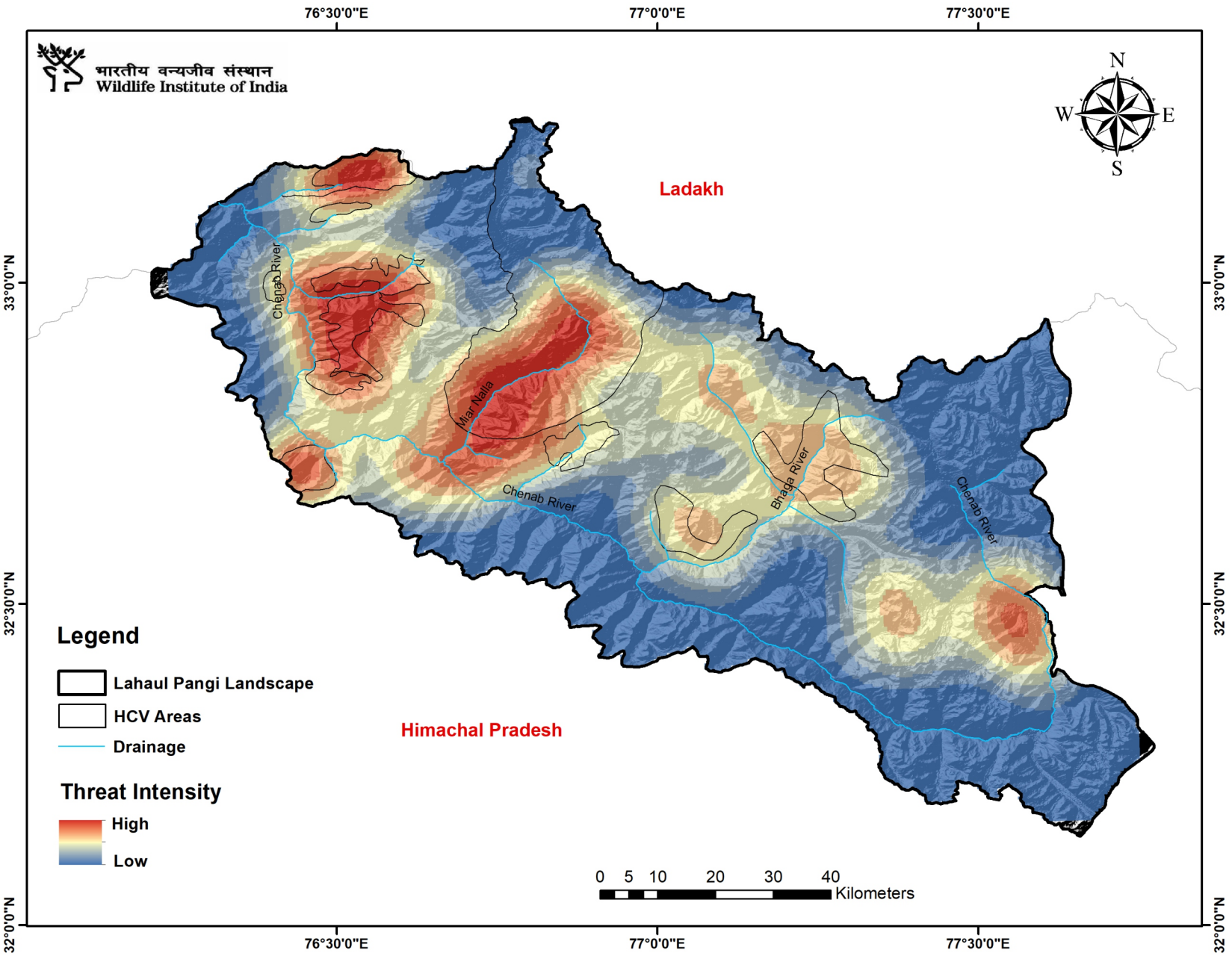



**Figure 1:**

Threat Intensity Map for Lahaul-Pangi valley interpolated based on the prevalent threats as identified in the landscape

# APPENDIX X - Policies

## 1. Conservation reserve & community reserve: concept and provisions as per WLPA 1972

According to the Wildlife (Protection) Act 1972 (as amended up to 2003):

Section (36 A), the state government may, after having consultations with the local communities, declare an area owed by the government, particularly areas adjacent to National Parks and sanctuaries and those areas which link one protected area with another, as a conservation reserve for protecting the landscape, seascapes, flora and fauna and their habitat.

Section (36 C), the state govt. may, where the community or an individual has volunteered to conserve wildlife and its habitat, declare a private or community land not comprised within a National Park, sanctuary or a conservation reserve, as a community reserve, for protecting flora, fauna and traditional or cultural conservation values and practices.

The provisions of sub-section (2) of section 18, sub-sections (2), (3) and (4) of section 27, sections 30, 32 and clauses (b) and (c) of section 3 shall, as far as may be, apply to a conservation reserve/ community reserve as they apply to a sanctuary.

***Section 18 in the WildLife (Protection) Act, 1972***

*18. Declaration of the sanctuary.*

*(1) The State Government may, by notification, declare its intention to constitute any area other than an area comprised within any reserve forest or the territorial waters as a sanctuary if it considers that such area is of adequate ecological, faunal, floral, geomorphological, natural or zoological significance, for the purpose of protecting, propagating or developing wildlife or its environment*

*(2) The notification referred to in sub-section (1) shall specify, as nearly as possible, the situation and limits of such area. Explanation. —For this section it shall be sufficient to describe the area by roads, rivers, ridges or other well-known or readily intelligible boundaries.*

***Section 27 in the WildLife (Protection) Act, 1972***

*27. Restriction on entry in the sanctuary.*

*(2) Every person shall, so long as he resides in the sanctuary, be bound—to prevent the commission, in the sanctuary, of an offence against this Act; where there is reason to believe that any such offence against this Act has been committed in such sanctuary, to help in discovering and arresting the offender; to report the death of any wild animal and to safeguard its remains until the Chief Wildlife Warden or the authorized officer takes charge thereof; to extinguish any fire in such sanctuary of which he has knowledge or information and to prevent from spreading, by any lawful means in his power, any fire within the vicinity of such sanctuary of which he has knowledge or information; and to assist any Forest Officer, Chief Wildlife Warden, Wildlife Warden or Police Officer demanding his aid for preventing the commission of any offence against this Act or in the investigation of any such offence.*

*(3) No person shall, with intent to cause damage to any boundary-mark of a sanctuary or to cause wrongful gain as defined in the Indian Penal Code, 1860 (45 of 1860), alter, destroy, move or deface such boundary-mark.*

*(4) No person shall tease or molest any wild animal or litter the grounds of sanctuary.*

***Section 30 in the Wild Life (Protection) Act, 1972***

*30. Causing fire prohibited. —No person shall set fire to a sanctuary, or kindle any fire, or leave any fire burning in a sanctuary, in such manner as to endanger such sanctuary*

***Section 32 in the Wild Life (Protection) Act, 1972***

*32. Ban on use of injurious substances. —No person shall use, in a sanctuary, chemicals, explosives or any other substances which may cause injury to, or endanger, any wildlife in such sanctuary.*

*Section 33 in the Wild Life (Protection) Act, 1972*

*33. Control of sanctuaries. —The Chief Wild Life Warden shall be the authority who shall control, manage and maintain all sanctuaries and for that purpose, within the limits of any sanctuary, —*

*(b) shall take such steps as will ensure the security of wild animals in the sanctuary and the preservation of the sanctuary and wild animals therein*

*(c) may take such measures, in the interests of wildlife, as he may consider necessary for the improvement of any habitat*

## 2. Biodiversity heritage sites

"Biodiversity Heritage Sites" (BHS) are well-defined areas that are unique, ecologically fragile ecosystems - terrestrial, coastal and inland waters and, marine having rich biodiversity comprising of any one or more of the following components: the richness of wild as well as domesticated species or intra-specific categories, high endemism, presence of rare and threatened species, keystone species, species of evolutionary significance, wild ancestors of domestic/cultivated species or their varieties, past pre-eminence of biological components represented by fossil beds and having significant cultural, ethical or aesthetic values and are important for the maintenance of cultural diversity, with or without a long history of human association with them (Biological Diversity Act, 2002).

As per the Biological Diversity Act 2002, section 37: -

(1) *Without prejudice to any other law for the time being in force, the State Government may, from time to time in consultation with the local bodies, notify in the Official Gazette, areas of biodiversity importance as biodiversity heritage sites under this Act.*

(2) *The State Government, in consultation with the Central Government, may frame rules for the management and conservation of all the heritage sites.*

(3) *The State Government shall frame schemes for compensating or rehabilitating any person or section of people economically affected by such notification.*

**The criteria for identification of BHS**

Areas having any of the following characteristics may qualify for inclusion as BHS.

a. *Areas that contain a mosaic of natural, semi-natural, and man-made habitats, which together contain a significant diversity of life forms.*

b. *Areas that contain significant domesticated biodiversity components and /or representative agro-ecosystems with ongoing agricultural practices that sustain this diversity.*

c. *Areas that are significant from a biodiversity point of view as also are important cultural spaces such as sacred groves/trees and sites, or other large community conserved areas.*

d. *Areas including very small ones that offer refuge or corridors for threatened and endemic fauna and flora, such as community conserved areas or urban greens and wetlands.*

e. *All kinds of legal land use whether government, community, or private land could be considered under the above categories.*

f. *As far as possible those sites may be considered which are not covered under the Protected Area network under the Wildlife Protection Act 1972 as amended.*

g. *Areas that provide habitats, aquatic or terrestrial, for seasonal migrant species for feeding and breeding.*

h. *Areas that are maintained as preservation plots by the research wing of the Forest department.*

i. *Medicinal Plant Conservation Areas.*

State Biodiversity Boards (SBB) may invite suggestions (or consider those already coming from communities) for declaration of BHSs, through BMCs and other relevant community institutions including gram sabhas, panchayats, urban wards, forest protection committees, tribal councils. SBB may undertake wide-spread dissemination of information related to the proposed BHS among rural communities, NGOs, farmer/fishermen/adivasi associations, urban groups, research institutions, the government agencies, and other organizations, regarding the provision of BHSs, through locally appropriate means. These could include local language newspapers, radio, holding meetings with the communities, letters to line departments, gram panchayats, local bodies, and others.

## 3. Medicinal Plants Conservation Development Areas

The National Medicinal Plants Board (NMPB) was setup under a Government Resolution notified on 24th November 2000 under the Chairmanship of Union Health & Family Welfare 5 Minister. The objective of establishing a Board was to establish an agency which would be responsible for coordination of all matters relating to medicinal plants. The Board has the function of coordinating with Ministries/Department/ Organizations/State/UT Governments for development of medicinal plants (Central Sector Scheme on Conservation, Development and Sustainable Management of Medicinal Plants – an Operational Guide, 2015).

In order to meet increasing demand for medicinal plants both domestic and from overseas markets; and to promote both ex-situ cultivation of medicinal plants as well as in-situ conservation, the Central Sector Scheme for conservation, development and sustainable management of medicinal plants was initially approved by the cabinet vide no. CCEA/21/2008 dated 26.06.2008.

The National Medicinal Plants Board (NMPB) has implemented this Central Sector Scheme on Conservation, Development and Sustainable Management of Medicinal Plants which includes a component for setting up Medicinal Plants Conservation and Development Areas (MPCDAs) in the forest areas. As per the guidelines, State Forest/Wildlife Department/Forest Development Corporation/Federations/National and State Level Research Organization/ Universities/Non-Government/ Voluntary Organizations with expertise in the field are eligible to implement the projects on MPCDAs (Biswas *et al.*, 2017).

The main objectives of the scheme are as follows:

- Promote in-situ conservation of medicinal plants which are important to the AYUSH and Folk systems of medicine. In situ conservation measures would involve survey, and documentation of important medicinal plants in their native/natural habitat coupled with resource augmentation in eco-systems where they form part of the naturally occurring biotic community, preventing degradation of such eco-systems in a holistic manner and reversing the onslaught of invasive alien weeds;
- Promote ex-situ conservation by supporting such programs in rural/ degraded forest/public/non-public/institutional lands/urban & peri-urban lands and waste lands.
- Engage the Eco-Task Force mechanism for reversing habitat degradation of medicinal plants.
- Promote R&D in all aspects of medicinal plants, development of agro-techniques, post-harvest management, storage and processing, developing molecular characterization tools etc. and promotion of IT.
- Enhance community mobilization and facilitate sustainable livelihood systems based on medicinal plants for farmers, collectors and other stake holders especially in forest fringe areas.
- Ensure Quality Assurance - Maintain Good Quality Gene Pool Sources of medicinal plants and aromatic plants having medicinal applications. Mapping, upgrading, modernizing of Medicinal Plants supply chain and creating/ optimizing market linkages and value addition.
- Quality standardization, Good Collection Practices and Good Agricultural Practices for Medicinal Plants.
- Information, Education and Communication - through seminars, trainings and exposure visits promote capacity building and human resource development through appropriate inter-state and international exposure. Promote publication of documents, monographs, technical bulletins, documentaries, brochures, posters, other publicity materials, etc.
- Strengthen NMPB so as to more efficiently co-ordinate all matters related to medicinal plants and function as a clearinghouse of information on medicinal plants including their occurrence, usage, ethno-botanical uses, cultivation practices, Post - harvest practices, markets etc. Institutional Strengthening of SMPBs and creating regional/facilitation centres/Centres of Excellence to optimize the strategic reach of the AYUSH systems.
- Promote main streaming of medicinal plants in climate change mitigation strategies & promote regeneration/afforestation of medicinal plant tree species towards carbon sequestration.
- Take steps to meet India's international obligations in the context of medicinal plant biodiversity and promote bilateral/international cooperation.

One of the components of the Scheme under In-situ Conservation is setting up of Medicinal Plants Conservation and Development Areas (MPCDAs)

Objective of the component: In-situ conservation of important medicinal plants in their natural habitats by setting up MPCDAs, as well as strengthening/up gradation of existing Medicinal Plants Conservation Areas (MPCAs) through survey inventory, documentation, protection, and main streaming medicinal plants in habitat management approaches.

**Activities proposed to fulfill the task:**

1. Setting up Medicinal Plants Conservation and Development Areas(MPCDAs) through survey, documentation of existing natural population of medicinal and aromatic plants, geo referencing. This would include:

- Certaining threat status of various medicinal plant species traditionally obtained from the wild.
- Identifying major causes of threat to the populations of threat ened species and possible remedy.
- Drawing up of action plan for conservation and sustainable utilization of important medicinal plant species.
- Stakeholders capacity building, documentation (including a good quality pictorial directory), hosting on website, conducting pilot research studies etc. for sustainable utilization, engaging services of qualified taxonomists and other necessary professionals for the purpose by the concerned State Agency/SMPB, preparation of case studies, promoting conservation values/ sustainability.

2. Revisiting/ Reviewing/ documentation in respect of previously designated 7 MPCAs (established 3 years ago) for further development like up gradation, improving protection, documentation,

Link: http://nbaindia.org/uploaded/Biodiversityindia/Legal/3.%20Indian%20forest%20act.pdf

## 5. Ramsar Site – Criteria

The Convention has established a number of measures to guide member states in carrying out this obligation to list and conserve wetlands of international importance. Among them are:

*The Criteria for Identifying Wetlands of International Importance*, which identify sites that could be included in the List; actual designation for the Ramsar List remains the prerogative of each Contracting Party concerned. The various categories of criteria, which have been developed over the years and are still evolving, cover: representative or unique wetland ecosystems; wetlands of value because of the diversity of their plant or animal life or because they support threatened or endemic species; and wetlands which are of particular value for waterfowl (high numbers of a range of species or 1% of the total numbers of one species, sub-species or population), or for fish.

These criteria have been used by Ramsar's NGO partner organization to compile regional directories of potential Ramsar sites for Africa, Asia, Europe, the Middle East, Oceania, South and Central America.

1) A simple, worldwide *Classification System for Wetland* Types which identifies 35 kinds of wetlands, together with a wetland data sheet, so that the entire world's Ramsar sites can be classified and described in a standard fashion. These descriptions are stored in the Ramsar Database, which can be used to analyse widely differing wetlands across the world, and as a basis for advice to wetland managers, drawing on experience at comparable sites in other corners of the world.
2) The *Montreux Record*, which identifies Ramsar sites whose biodiversity, is under particular pressure in the face of technological developments, pollution or other human interference, Inclusion on the Record is affected by member states, in consultation with the Ramsar Bureau and highlights sites where urgent action is need. As per records of 1996, the Montreux Records included 65 Ramsar sites, an indication of the difficulty of maintaining the ecological character of wetlands.
3) The *Management Guidance Procedure*, which enables Ramsar Bureau to organize missions to visit Ramsar sites, particularly those on Montreux Records, and to offer advice. The Procedure has been operated at more than 30 Ramsar sites and a number of notable successes in conservation of wetland biodiversity have been achieved (Halls, 1997).

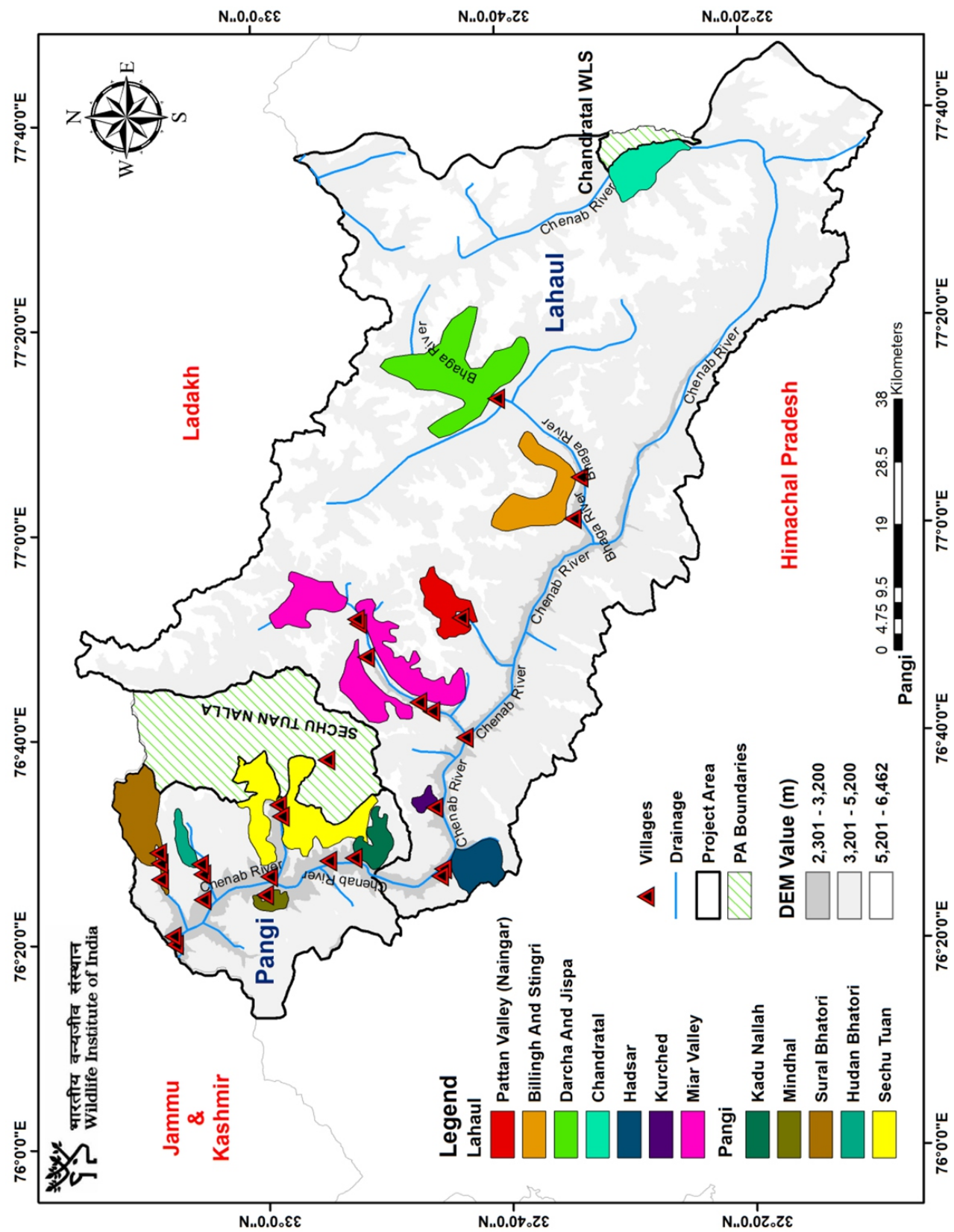
## 6. UNESCO World Heritage Sites

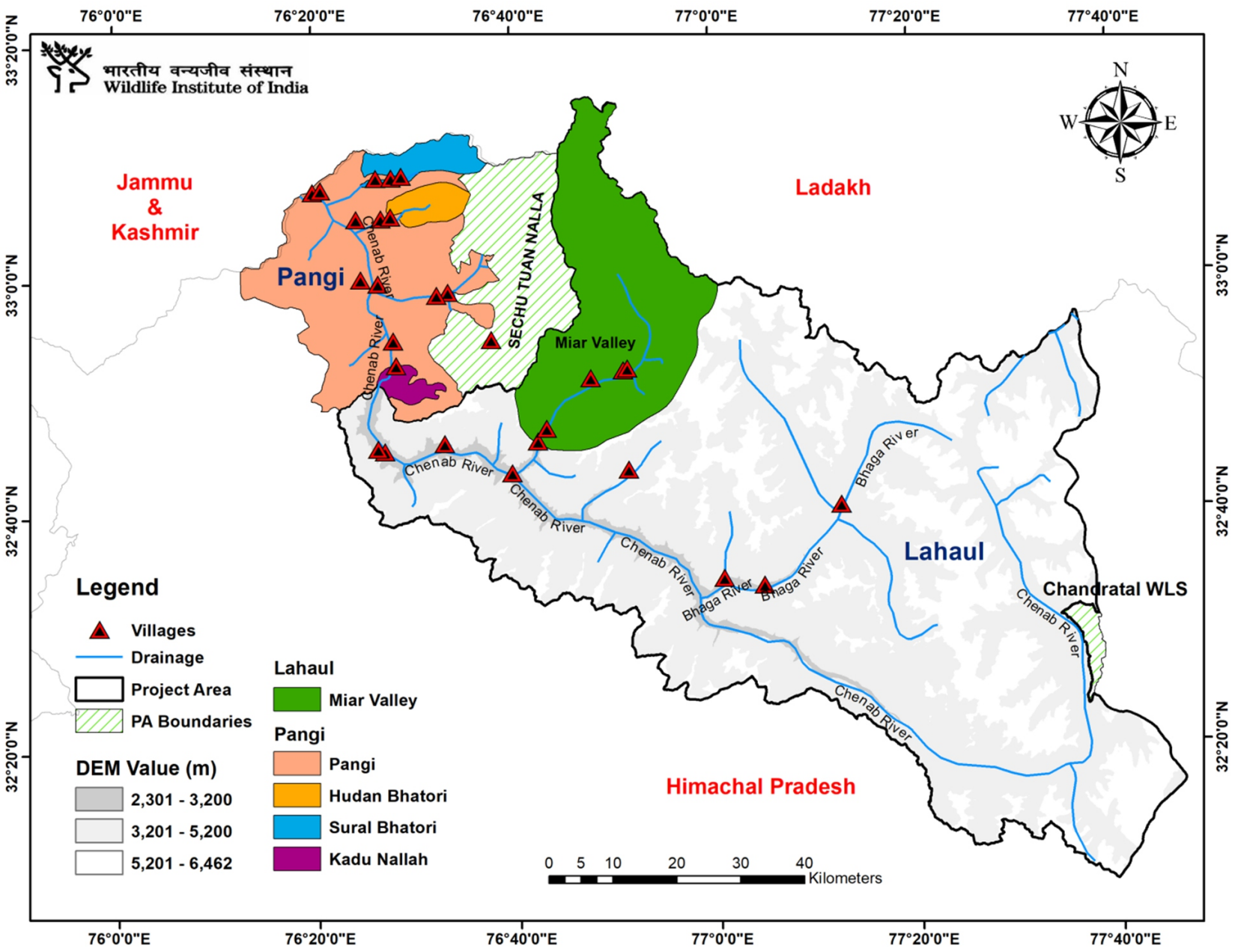
**Table 1: The three categories of World Heritage cultural landscapes in the Operational Guidelines 1992 – 2004**

| World Heritage Criteria | Cultural landscape category | Operational Guidelines for the Implementation of the World Heritage Convention (1992 – 2004) |
|---|---|---|
| Cultural criterion (i) | i | The most easily identifiable is the clearly defined landscape designed and created intentionally by man. This embraces garden and parkland landscapes constructed for aesthetic reasons which are often (but not always) associated with religious or other monumental buildings and ensembles. |
| Cultural criteria (ii), (iii), (iv), (v) | ii | The second category is the organically evolved landscape. This results from an initial social, economic, administrative, and/or religious imperative and has developed its present formby association with and in response to its natural environment. Such landscapes reflect that process of evolution in their form and component features. They fall into two subcategories:<br>1) a relict (or fossil) landscape is one in which an evolutionary process came to an end at some time in the past, either abruptly or over a period. Its significant distinguishing features are, however, still visible in material form.<br>2) a continuing landscape is one which retains an active social role in contemporary society closely associated with the traditional way of life, and in which the evolutionary process is still in progress. At the same time it exhibits significant material evidence of its evolution over time. |
| Cultural criterion (vi) | iii | The final category is the associative cultural landscape. The inclusion of such landscapes on the World Heritage List is justifiable by virtue of the powerful religious, artistic or cultural associations of the natural element rather than material cultural evidence, which may be insignificant or even absent. |

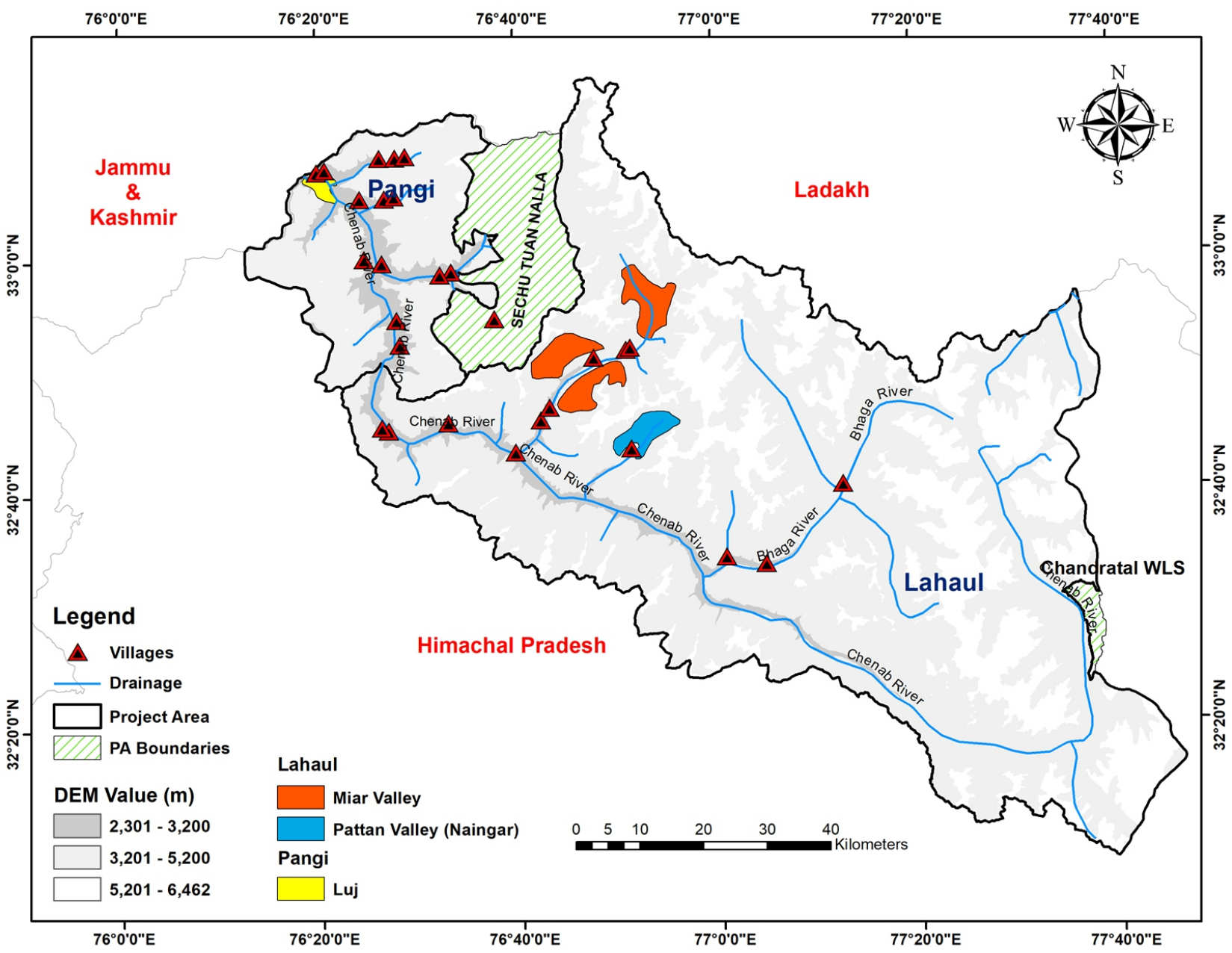
# APPENDIX XI -
# Integrated HCV Maps for Lahaul-Pangi

Potential High Conservation Value Areas in Lahaul-Pangi Landscape in HCV-1 (Species & Diversity)

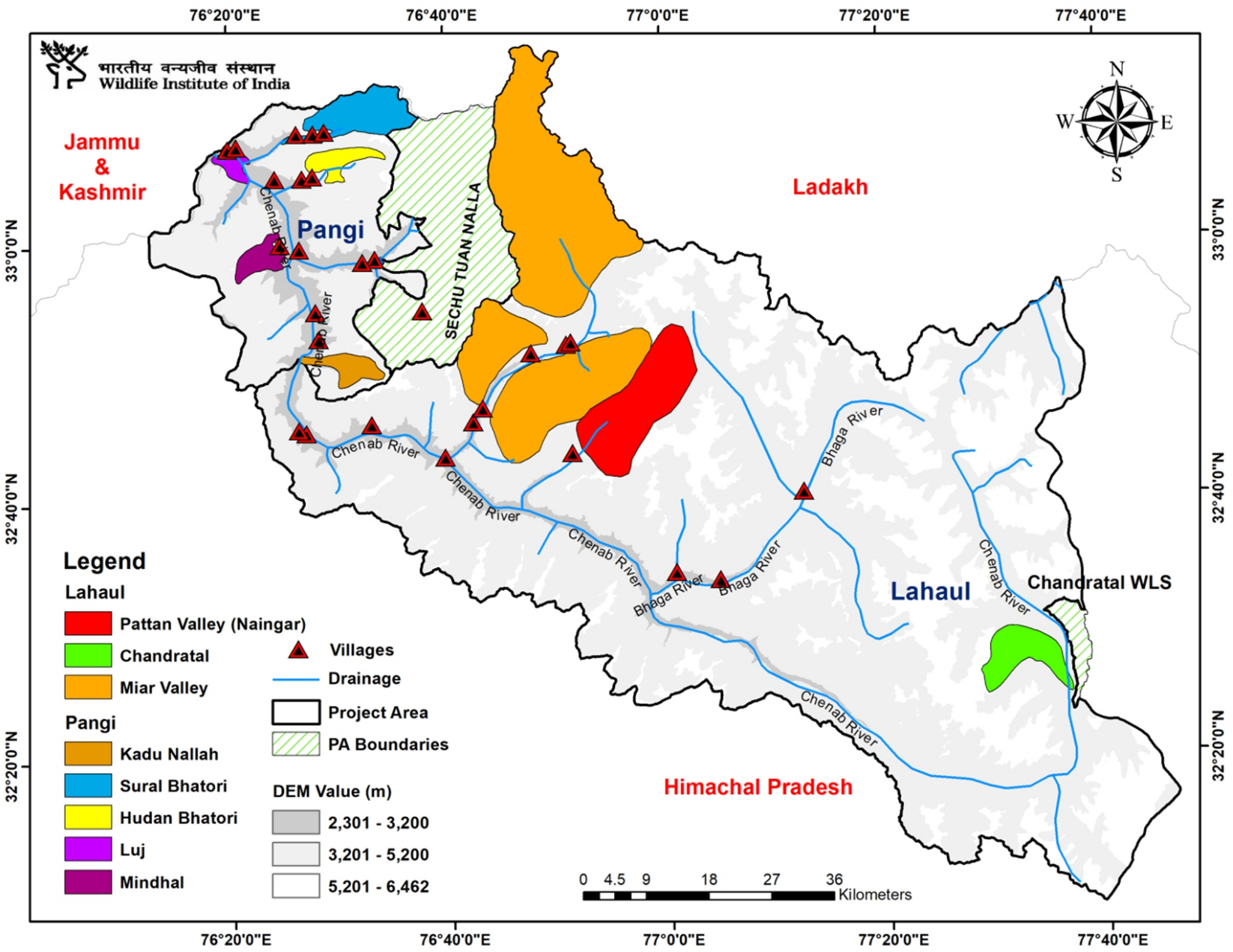




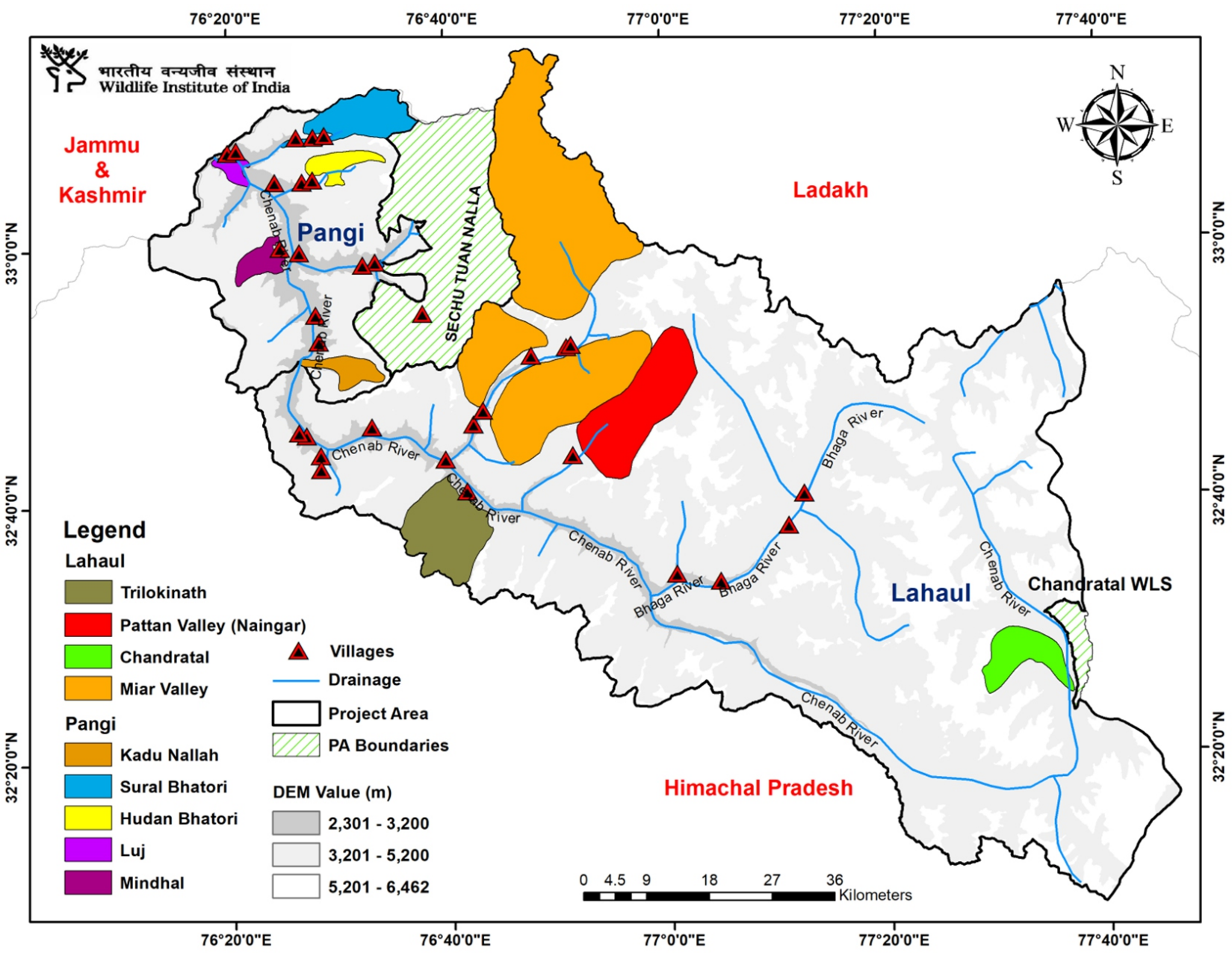

Potential High Conservation Value Areas in Lahaul-Pangi Landscape in HCV-2 (Landscape level Ecosystem)



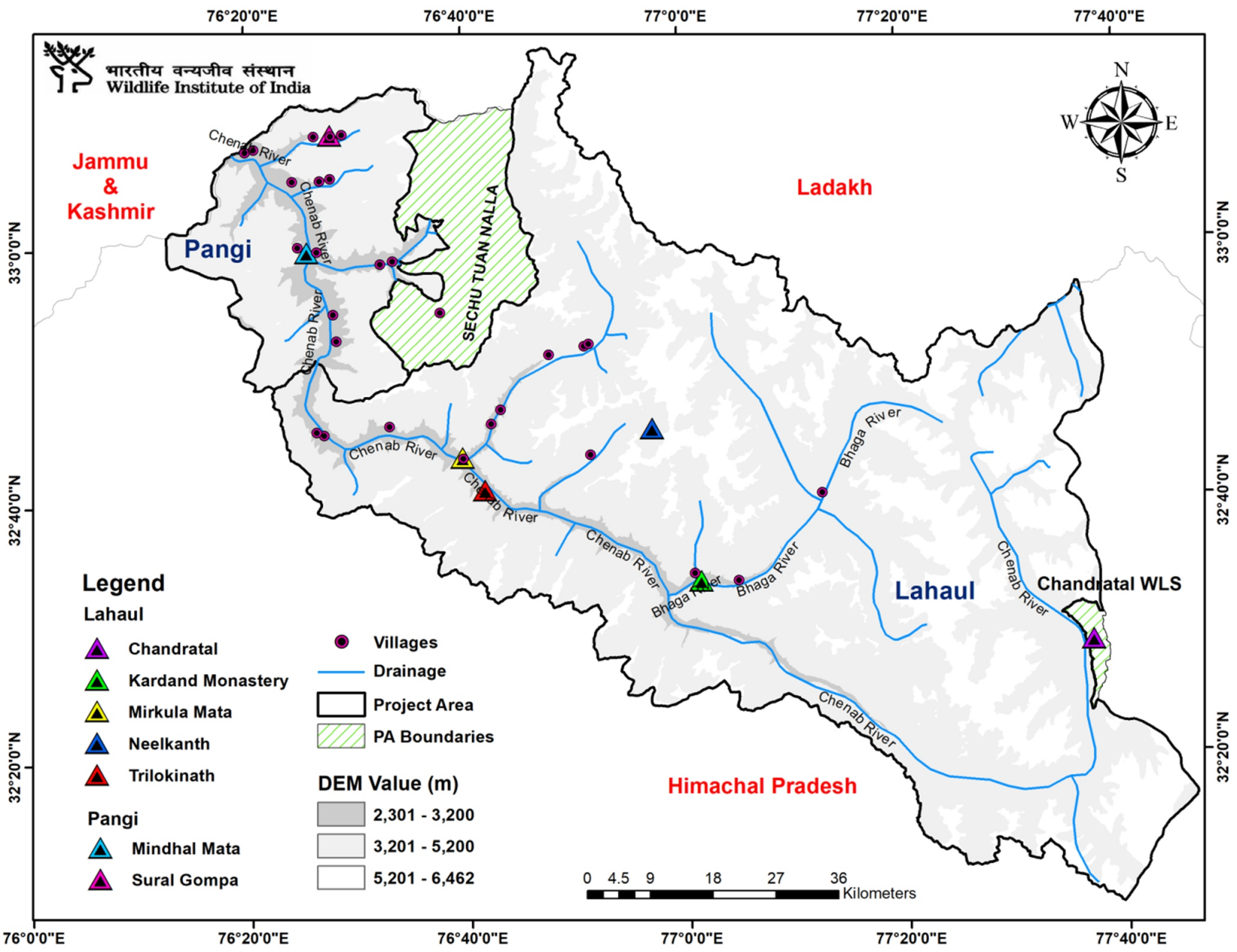

Potential High Conservation Value Areas in Lahaul-Pangi Landscape in HCV-3 (RET Ecosystem & Habitat)




Potential High Conservation Value Areas in Lahaul-Pangi Landscape in HCV-4 (Ecosystem Services)




Potential High Conservation Value Areas in Lahaul-Pangi Landscape in HCV-5 (Community Needs)




Potential High Conservation Value Areas in Lahaul-Pangi Landscape in HCV-6 (Cultural Values)


Prateek Savita

# FOLLOW UP

| Meetings/Workshops | Date | Suggestions given and incorporated |
|---|---|---|
| 1st State Level Technical Committee Meeting (Shimla) | 23rd January 2019 | The scope of finalization of HCVs will be as per the features of Landscapes and will not be confined to the conventional FSC standards and also shall be as per the features of Landscapes and will not be confined to the conventional FSC standards and also tie-up with different agencies was suggested as a lot of overlaps are there whether its mapping or other information. |
| Stakeholders Workshop (HFRI, Shimla) | 12th March2019 | It was suggested to focus upon the importance of landscape demarcation, species profiling and identification of areas that fall outside the protected areas but are important in terms of provision of ecological services. |
| State Level Technical Committee meeting (Hotel Marina, Shimla) | 17th May 2019 | Field-work shall lead to better results and needs to be started as soon as possible. |
| Landscape-level workshop in Killar, Pangi and Keylong, Lahaul, HP. | 24th Sept & 11th Oct 2019 | The identified areas shall be scrutinized once again for final results and formulation of relevant recommendations for the identified areas is necessary. |
| Meeting of review committee of MoEFCC | 11th& 12th Dec, 2019 | The committee suggested presenting a detailed version of methodology for all the criteria along with information on ground-truthing process. The comments have been addressed and incorporated in the report. |
| Meeting of technical review committee | 27th August, 2020 | The committee suggested that the threats and respective conservation recommendations for the identified areas should be more specific and not generalized. Also, addition of information on demographic profiles was suggested. The comments have been incorporated in the report. |
| Meeting of technical review committee | 24th December, 2020 | Final copy (hard and soft copy) of the report after incorporating all the comments of State and NPMU were suggested to be submitted to Ministry and State by January 15, 2021. |



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