SNOW LEOPARD

GENERAL GUIDELINES
FOR SNOW LEOPARD LANDSCAPE MANAGEMENT PLANNING



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The goal of the **Global Snow Leopard & Ecosystem Protection Plan** (GSLEP) is for the 12 range countries, with support from interested organizations, to work together to identify and **secure** 20 snow leopard landscapes across the snow leopard's range by 2020, or, in shorthand—"Secure 20 by 2020."

These snow leopard populations and landscapes to be secured under GSLEP are relatively large (range: 5,000 to 92,000 km2), and many of these share borders with neighbouring countries (Fig. 1).

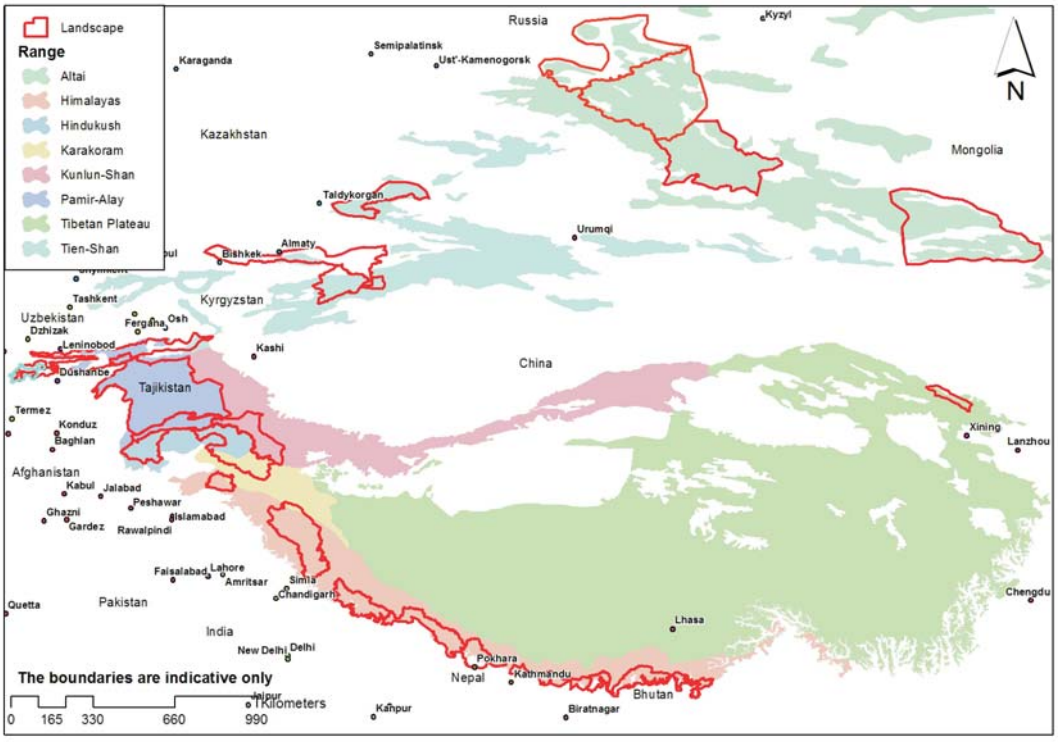

Fig 1. The 23 snow leopard landscapes identified to be secured by 2020 under the GSLEP program

Snow leopard landscapes include many features that require the development of special management plans for effective and integrative conservation and economic development:

The landscapes include **Protected Areas as well as** large tracts of habitat that lie **outside PAs** in multiple-use zones.

Snow leopards are landscape species and their populations will not be effectively conserved unless **conservation efforts take place beyond PA boundaries.**

Snow leopard landscapes provide **essential ecosystem services**, including **clean water for a third of world's human population** from the rivers that originate here and therefore, conservation efforts cannot be restricted to within PA boundaries.

Snow leopards and associated biodiversity continue to **co-exist with local human communities** who have rich and unique pastoral cultures and ways of life.



[Img1] Snow leopard landscapes extend beyond Protected Areas



[Img2] High altitude ecosystems provide water to a third of the world's human population

Snow leopard landscapes therefore need to be managed as 'Fragile Ecological Zones' where:

Important wildlife habitats and corridors in the landscape are identified and designated as **'Priority Wildlife Areas' (Core Zones)** within which ecologically damaging land use is minimized.

In the remaining **'Multiple Use Areas'**, sustainable economic growth using **green infrastructure** models is achieved while conserving the ecosystem services and biodiversity.

This will require:

Mapping of important wildlife habitats and corridors, human habitation, threats and existing and planned infrastructure and industry, and **zonation** into Priority Wildlife Areas and Multiple-use areas.

Based on the mapping exercise, **integrative and multi-sectorial conservation and economic development planning** and implementation are undertaken in snow leopard landscapes, guided by **landscape-level management plans**.

Management Plans will consist of various sections including but not restricted to the following:

PART A: Situation Analyses

Broad **goals** of the GSLEP and NSLEP

Mapping and delineation of landscape boundaries, geographical setting, description of landscape identification criteria and process

Mapping and zonation (Priority Wildlife Areas, Multiple Use Areas, others)

Description of **legal status and land tenure** of the various Priority Wildlife Areas, Multiple Use Areas, and others

Baseline knowledge (physiography, water resources, flora, fauna, human societies and activities, livestock composition and population, developmental activities)

Threats to biodiversity (traditional/upcoming) in the landscape/Priority Wildlife Areas/ Multiple Use Areas

Description of **stakeholders**, their capacity, and their actual and potential influence on conservation and governance

PART-B: Management

Management Plan **Vision, Goal, Objectives**

Framework for **multi-sectorial cooperation** and information sharing

Framework for **coordination** with relevant and key business and industry groups

Governance mechanism at various levels (National/ Landscape/Provincial /Community levels)

Addressing Threats – Specific Actions (for core, buffer, multiple resource use area, others)

Activity, Responsibility, performance criteria, funding, monitoring of **outputs/outcomes**

Funding Mechanisms

Part-C: Summary / References / Appendices

GENERAL WORK PLAN FOR MANAGEMENT PLANNING DATA COLLECTION

A thorough **literature review** is not only important for the planning of the survey but also to extract existing data. Some of the important **sources of information on the snow leopard landscape** are:

1. **Scientific reports/papers:** Scientific papers are an important source for information on the distribution of flora and fauna, geology, and socio-economics of the region.

2. **Previous survey reports:** Such reports could provide first hand information of the practical aspects of planning a survey, logistical difficulties and access to the region.

3. **Historical surveys:** Historical survey are often the only information available for remote areas and could help in creating a baseline.

4. **Mountaineering expedition reports:** These reports could be very helpful in providing information on access to remote areas.

5. **Land use and economic development plans, gazetteers, and existing protected area management plans.**

Scale of data collection

The information collected for these surveys will be limited to **two spatial scales**:

1. **Grid cell:** These are 100-500km2 cells primarily used to coarsely map species distributions and ecological variables. See the next section for details.

2. **Administrative regions:** These are the existing borders of administration such as counties or districts or village administration. Data on habitation, infrastructure, land use, land tenure and threats can mainly be collected at this scale. This is also an important scale as many

   of the conservation interventions, especially community-based efforts, are expected to be implemented at this scale.

Management Plans will consist of various sections including but not restricted to the following:

The primary objective of these surveys is to **identify the *distribution (and not abundance) of snow leopards and their prey,*** *and Priority Wildlife Habitats and corridors.*

1. Setting-up survey grids:

Snow leopard and prey distribution could be best assessed using a **grid-based sampling design** (fig. 2a).

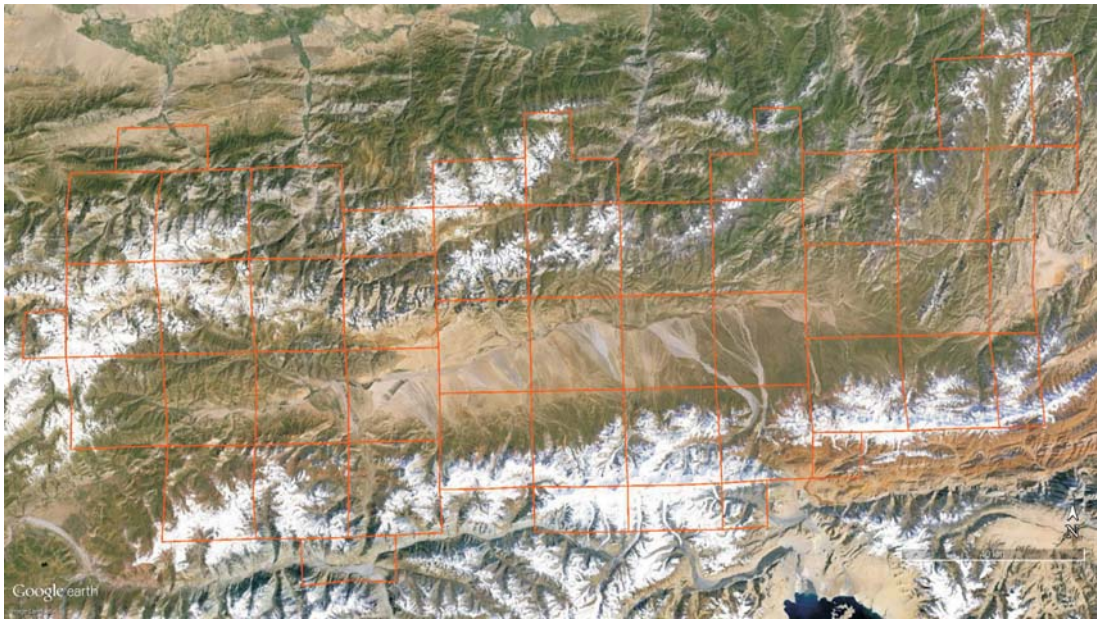

Fig. 2a Example of a grid based sampling design

Alternately, **relief based watersheds can be identified and blocks used as sampling units** (fig. 2b) if access to most of the grids becomes difficult. Depending on the details of the data available, the investigators are flexible in analysing the data as simple presence maps, or indicate grids with relative densities, or probability of site use covariate modelling to predict distribution in unsurveyed areas, as long as the surveyed sites are representative.

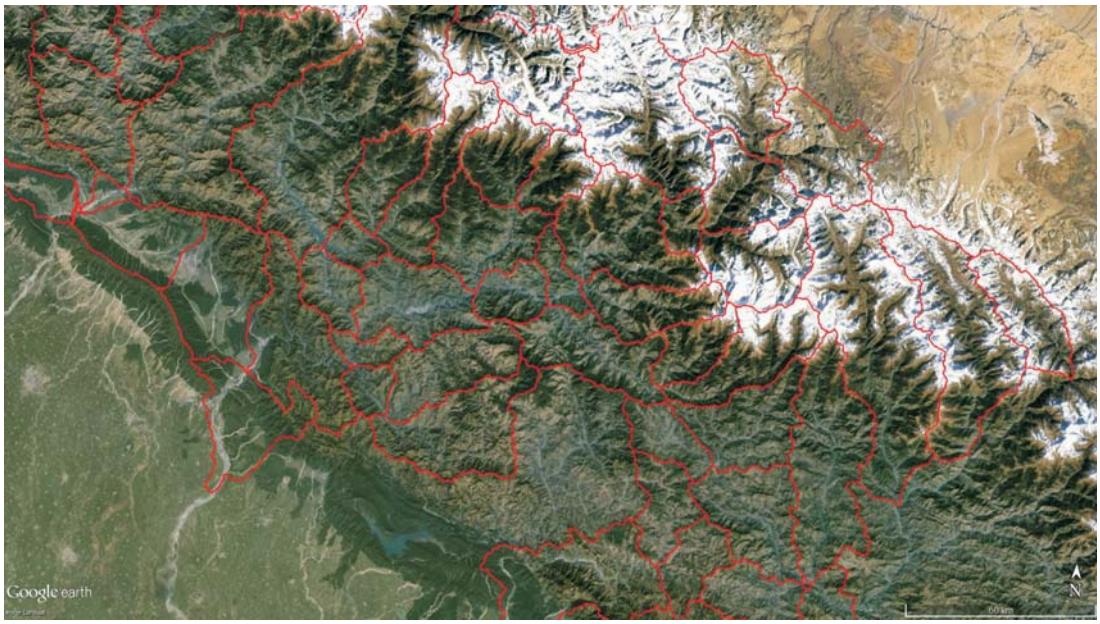

Fig. 2b Example of a watershed based sampling design

Surveys are best targeted towards an occupancy framework which can later be scaled down if the data cannot be collected at the necessary resolution.

- **Size of the survey grids: The size of the survey should be chosen based on the home-range size of the snow leopard**, logistic feasibility of surveying areas of a particular size, topography of the region and the total area to be surveyed. Snow leopards on average can range over areas from 100-1,200 km2.

  To estimate probability that each specific survey grid is used by snow leopards, the grid size is really not important as the assumption of population closure is relaxed when probability of site use is being estimated instead of probability of occupancy. **Preferably the total area needs to be divided into >50 grid cells**, though the dimensions may be decided based on total area, average size of administrative or ecological (e.g. sub-catchment) units.

  These grids could be laid out as uniform square grids or depending on the topology of the landscape, landscape features such as watersheds, ridgelines, rivers and gorges could be used to demarcate the sampling units. **It is preferable that all the cells are surveyed.**

2. Surveying the grids:

The grids could be surveyed using vehicular, horse-back or foot transect. It is also useful to gather information by interviewing local people. **Snow leopard presence in each grid can be confirmed using signs such as pug-marks and scrape-marks.** Scats are not recommended to confirm snow leopard presence. Snow leopards are often the only large felid in a landscape (unless the area in consideration overlaps with common leopard and/or tiger distributions) and the pug-marks and scrape-marks can usually be attributed to them easily.



[Img3] Snow leopard pugmarks in snow

Scats are not recommended as signs to confirm snow leopard presence because it is often very difficult in the field to distinguish between the scats of snow leopard, wolves and dogs. On the other hand, **suspected snow leopard scats may be collected for possible DNA-based analyses**.



[Img4] Snow leopard scrape

Presence of snow leopard prey could be recorded through direct sightings. Signs of prey species may be used if the signs are unique and identifiable from livestock and other ungulate signs. The total survey distance may be conditional on the size of the grid cell. A survey of 15-50 km should be adequate.



[Img5] Snow leopard cub captured on a camera trap

Occupancy framework needs **2 or more replicates of the survey in each grid** for estimating the detection probability. The number of replicates should be greater in areas where the probability of detection of evidence is lower. These replicates could be temporal or spatial. Spatial replicates could be achieved by conducting two or more spatially separated surveys of 5-15 km each. The survey distances provided here are indicative only.

3. Composition of the survey team:

- The **survey team could range between 10-20 members** including field experts, ecological survey team, Village interview team, and government and private stakeholder data collection team and a GIS expert.

- The survey team will need to be **experienced in navigating difficult mountain terrain**, experienced in identifying snow leopard signs and prey sightings, use of GPS and maps (toposheets). The survey team is expected to survey at least one grid per day. The number of team members and their field expertise as expected to match this intensive field schedule.

- The team will need **support of a GIS expert** for mapping the various layers of spatial information.

- The government and private stakeholder data collection team will need to include **people with an understanding of the administration structure of the region** who are capable of collecting relevant information from the relevant departments of the administrative hierarchy.

- The village and key-informant interview team is expected to have an **understanding of the local culture and socio-economics of the region**. Ideally the team will benefit from a basic understanding of methods in social sciences.

Land-use and infrastructure distribution in the landscape

1. Mapping land-use and infrastructure:

Location of all the villages and settlements in the landscape could be a starting point for the mapping of land-use and infrastructure. Location of all the villages is often available in existing maps of the region and can also be obtained from government census documents or even Google Maps.

In case of unavailability of these data with the relevant sources and departments, villages can be visited and their GPS locations recorded. Mapping of the roads could be conducted simultaneously, though roads and railway data can also be obtained from online resources of Arcmap online database, Open street map etc.

- *Village interviews and key informant surveys:*

  - **Group interviews and key-informant surveys** could be conducted in each village to map the land-use of each of the villages. Local people can easily point out surrounding area that they use for livestock grazing, fodder collection etc on a pre-printed map. These areas can later be digitized indicating local land-use system.

    Local people could be encouraged to indicate the finest details of local land-use. The village interviews and interviews with key-informants such as village elders, local herders and hunters, could be used to gather other information such as the total livestock holding of the village/settlement, extent of livestock predation by large carnivores such as snow leopards, wolves, bears and lynx.

    Important wildlife areas such as ungulate wintering grounds, patches of medicinal and rare plants, Cordyceps harvest area etc. should be recorded. **Villages and key informants could also be encouraged to list their perceptions of threats to their own livelihood and wildlife in the surrounding area.** Important local institutions and stakeholders, such as religious and cultural centres should be identified. The following information could be sourced from villages and key-informant interviews:

    - Local land-use such as pastures, biomass extraction area, other local land uses
    - Local grazing system i.e. grazing rotation policies, grazing land lease, supervised/unsupervised grazing practices etc.
    - Livestock population by species/category
    - Attitudes and perception towards snow leopards and other carnivores
    - Extent of livestock predation by carnivores
    - Important wildlife areas such as ungulate wintering and rutting areas, patches medicinal and rare plant, areas of Cordyceps harvest.
    - Threats to own livelihood and wildlife
    - Any other information regarding land-use
    - Local institutions and stakeholders
    - Any available information on infrastructure and other projects available with local people



[Img6] Interviewing key informants

- *Interviews and data collection with government and semi-government and private stakeholders:*

  Interview surveys need to be conducted with other stakeholders such as officials of the roads department, hydro-power and electricity department, mining department, army/other border security organizations, local police and administration to obtain information on existing and planned infrastructure.

  Each type of infrastructure should be recorded and mapped as existing and planned infrastructure separately. The offices of most such departments are clustered together in the administration centre so it is less time intensive but conditional on their relations with the conservation organizations.

  This information will ultimately assist listing of threats as well as assist in zonation.

  Such information could also be collected directly through the government documents available legally via laws for the access to information (such laws are present in some countries e.g. Right to information in India). Some of the important departments are:

  - Forest and wildlife department
  - Road and rail
  - Mining
  - Local administration
  - Agriculture and irrigation
  - Hydro-power and electricity
  - Alternate energy
  - Livestock husbandry and veterinary care
  - Army and local police
  - Local monastery, mosque and temple administration
  - Education



[Img7] Consultation with stakeholders

2. Threat assessment:

The perception of investigators can be developed based on the data collected through the animal distribution surveys, village and key-informant surveys and the information. **Ranking of these threats along their intensity, area covered and urgency can provide a table of relative importance of various threats**.

It is preferable that eventually, such threat tables be generated for all the administrative regions within the landscape, and for all Priority Wildlife Areas, and Multiple Use Areas. This is necessary as threats are expected to vary in their intensity and urgency across the different areas within the landscape (e.g. Mining could be a serious threat in one district of the landscape but not other).

Such threat tables could also be developed for grid cells to **indicate the distribution of threats along with snow leopard and prey distribution** in the landscape.

Mapping and reporting

1. Map of snow leopard and prey species distribution:

The primary information on the spatial distribution of the snow leopard and prey species will be the **grid-based surveys**.

A map depicting the probability of site use or relative abundance can be prepared indicating the grids with higher probability of site use or higher relative density of the snow leopard and prey species. Another map indicating important areas for the snow leopard and prey species can be prepared using the secondary information form the key-informant and village interviews and literature survey.

These will be qualitative maps highlighting important areas for the snow leopard and prey species as indicated by the different sources of information (Key-informant, literature review etc). **Use of satellite imagery (parameters such as NDVI) is encouraged** to create Normalized Differential Vegetation Index, digital elevation model, temperature regimes, glaciers, etc., effectively indicate pasture distribution, and the use of these pastures by wild and domestic ungulates.

2. Map of other flora and fauna:

A similar qualitative map of the **distribution of other flora and fauna** can be prepared using the secondary information from key informants and literature review.

3. Map of land-use and infrastructure:

A primary map of the **intensity of land-use and infrastructure** can be prepared by indicating these parameters on the grid-based map used for mapping snow leopard and prey distribution. Such a map helps visualize the interface of wildlife and human use of the various grids.

Various maps, each indicating the intensity of one form of land-use can also be prepared to **visualize the distribution of each land-use and infrastructure** across the landscape.

4. Map of distribution of threats:

The various threats are expected to vary in their presence and intensity across the landscape. A primary map indicating intensity of the threat on the grid-based map will help visualize the interface of snow leopard and threat distribution across the landscape.

Another important visualization is the distribution of the intensity of the threat along the administrative borders within the landscape (e.g. Indicate intensity of threats across the borders of the various districts). Such a map assists in planning the mitigation of the threats as interventions are expected to be implemented at the scale of administrative regions.

Fine scale data for future work

The proposed surveys are targeted for a coarse scale snap-shot of the snow leopard landscape, and for the first general version of a landscape plan. Based on the results of these surveys further intensive surveys of animal distribution and threat distribution can be undertaken at the scale appropriate finer scale, and the management plan updated.

Time line

The proposed surveys are designed get a coarse-scale understanding of the current situation within a three month (12 week) time period for landscapes ranging from 5,000-90,000km2. The following is an ideal time-line to achieve this target. However, investigators are encouraged to be flexible and responsive to the local conditions.

	Month 1	Month 2	Month 3
Grid-based survey for animal distribution	All 30 days	First 20 days	
Village and key-informant interviews	All 30 days (expected to be conducted in parallel with animal distribution surveys by dedicated members)	All 30 days	
Interviews and data collection with government and semi-government and private stakeholders	All 30 days (Expected to be collected by a dedicated team of people based around the offices of these departments)	All 30 days	First 15 days
Mapping		Last 10 days	All 30 days
Reporting		Last 10 days	All 30 days