CHAPTER - 1: INTRODUCTION

1.1. Mountains of Asia and the Himalaya

The Central and Southern Asian mountains provide an amazing array of essential ecosystem services to mountain inhabitants as well as to the people in the plain lands and around the globe. These services include the storage and release of fresh water, watershed protection, forest products and land for food production, habitat for flora and fauna of local and global significance, the regulation of natural hazards and climate, natural areas for leisure and recreational activities. Also, these mountains ranges are crucial to the maintenance of natural and agricultural global biodiversity and provide a profound sense of place, a source of inspiration and a rich cultural heritage. (Gurung et al., 2006;Sharma and Xu, 2007).

The main mountain range of Central and Southern Asia is the Himalaya and its adjacent mountain ranges such as Karakoram, Tien Shan, Kunlun Shan and Pamir. The Himalaya, the highest mountain range on Earth is an example of a continent-to-continent collision. This immense mountain range began to form when two large landmasses, India and Eurasia, driven by tectonic plate movement, collided. Because both landmasses have about the same rock density, one plate could not be sub ducted under the other. The pressure of the colliding plates could only be relieved by thrusting skyward. The folding, bending, and twisting of the collision zone formed the jagged Himalayan peaks (Gansser, 1979).Home to a wide diversity of flora and fauna, this mountain range has fostered human civilisations and cultures across ages. The Himalayaextends about 2500 km in length from Afghanistan in the west and Namcha Barwa in the east (Burga et al., 2004). The Himalaya encompass a number of unique features, including glaciers, wetlands, and the source of several rivers truly making it the water tower of south Asia. As such, it is imperative to conserve this unique range of mountain ecosystems for the future well-being of many natural species, including humanity.

In South Asia, the Himalaya separates the lowland plains of the Indian subcontinentand the highland Tibetan Plateau. In India, the Himalaya and its associated hill rangesspans across 12States namely, Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh, Meghalaya, Nagaland, Manipur,

Mizoram, Tripura, northern regions of West Bengal and hill ranges of Assam(Nandy et al., 2006).

The Himalaya comprises of three zones: the outer Himalaya (ranging from 900 to 1,500 m), the Middle Himalaya (up to 4,000 m) and the Greater Himalaya (up to 8,800 m) (Wadia, 1978; Jhingran, 1981). The Trans-Himalaya or the high altitude cold desert is situated north of Greater Himalaya and is represented by the Tibetan Plateau, Zanskar and Ladakh, Lahul and Spiti, very little portions in Uttarakhand, and north Sikkim. The Shiwaliks are uplifted glacial debris that extend up to about 1,000m at some places run parallel to the Outer Himalaya on the southern side and to the north of the Indo-gangetic plains. The Middle Himalaya is represented by the Pir Panjal in Jammu and Kashmir, and Dhaula Dhar in Himachal Pradesh and are characterised by undulating hills that are cut steeply by flowing torrents and rivers. The Greater Himalayan range consists primarily of igneous formations with patches of sedimentary rocks and bulk of this region is covered with huge glaciers and peaks, with relatively arid, cold valleys in their fold (Sathyakumar and Bhatnagar, 2002).

The Biogeographic classification of India by Rodgers and Panwar (1988) and later modified by Rodgers et al.(2000) demarcates the Himalaya into two Biogeographical zones, viz. the Trans-Himalaya (Zone 1) and the Himalaya (Zone 2). These two Zones are further categorized into Biotic Provinces, viz. Ladakh Mountains (1A), Tibetan Plateau (1B), North-West Himalaya (2A), Western Himalaya (2B), Central Himalaya (2C) and Eastern Himalaya (2D).

The West Himalaya ranges from Sutlej to the Gandak in Nepal, with generally drier climate and harsher winter (Rodgers and Panwar, 1998). Though less diverse, it too has an interesting vegetation zonation along the altitude, demarcated as Temperate, Subalpine and Alpine. The Temperate zone (2,500 to 3,000m) comprises of conifer and broad-leaved forests mainly oak and associated species (Singh and Singh, 1987). The Subalpine zone (3,000 to 3,350m) consists of high altitude oak, birch and *Rhododendron* forests below the ‘tree line’ and fringing the alpine meadows (Mani, 1974). The Alpine zone (3,300 to 4,500m) is characterized by dwarf *Rhododendron* and juniper scrub that grades into alpine meadows, rock and perpetual snow (Rawat, 1998).

1.2. The Snow leopard as Flagship Species of Central and South Asian Mountain Ecosystem

The snow leopard (*Panthera uncia*) is an Endangered Asian big cat found in high altitude ecosystems of Asia across 12 range countries (Figure 1.1).The species like other large predators is intrinsically rare, and even though it inhabits a large geographical range (almost 1.8 million km^2), its global population is estimated at 3,920-6,390 (Snow leopard working Secretariat, 2013, Table 1.1). However, these population estimates are not robust and are based on approximations. The secretive nature of the animal, rugged mountain topography and inherently low density of snow leopards make estimation of abundance and density using robust mark-recapture methods particularly challenging (Jackson et al., 2006; McCarthy et al., 2008).

Positions at the top of food chains make predator species, such as snow leopard, good indicator of the health of high altitude ecosystems in central and southern Asia. Wide diversity, high abundance and regular presence of predators are sure signs of good availability of broad range of prey species and other biodiversity within ecosystems. The snow leopard serves as an indicator species for Asia's high mountain ecosystems and, requires large home ranges. Therefore, by protecting the snow leopard, entire high altitude ecosystem can be protected (Snow Leopard Working Secretariat, 2013)

The fact that the snow leopard has a wide distribution in the Trans-Himalaya and that it is the apex predator in most of this region enables the species to be used as a 'flagship species' and an 'umbrella species' to guide conservation efforts in the region, as was recognized by the Government of India in the 1980's (Anon. 1988).As a 'flagship' species the elusive snow leopard can be a unifying biological icon that can rally the regional players in the conservation arena, and become a symbol for international cooperation in regional conservation (Bhatnagar et al., 2002). As an 'umbrella' species, the ecological and behavioral requirements of snow leopards will also help to conserve the other facets of biodiversity in the alpine eco-regions of the highest mountain ranges in the worldSnow Leopard Working Secretariat, 2013.

The snow leopard can be a focal species for landscape conservation planning in the Central and South Asian mountain ecosystem including high altitude Himalaya, as elephants (*Elephas maximus*), rhinos (*Rhinoceros unicornis*), and tigers (*Panthera*

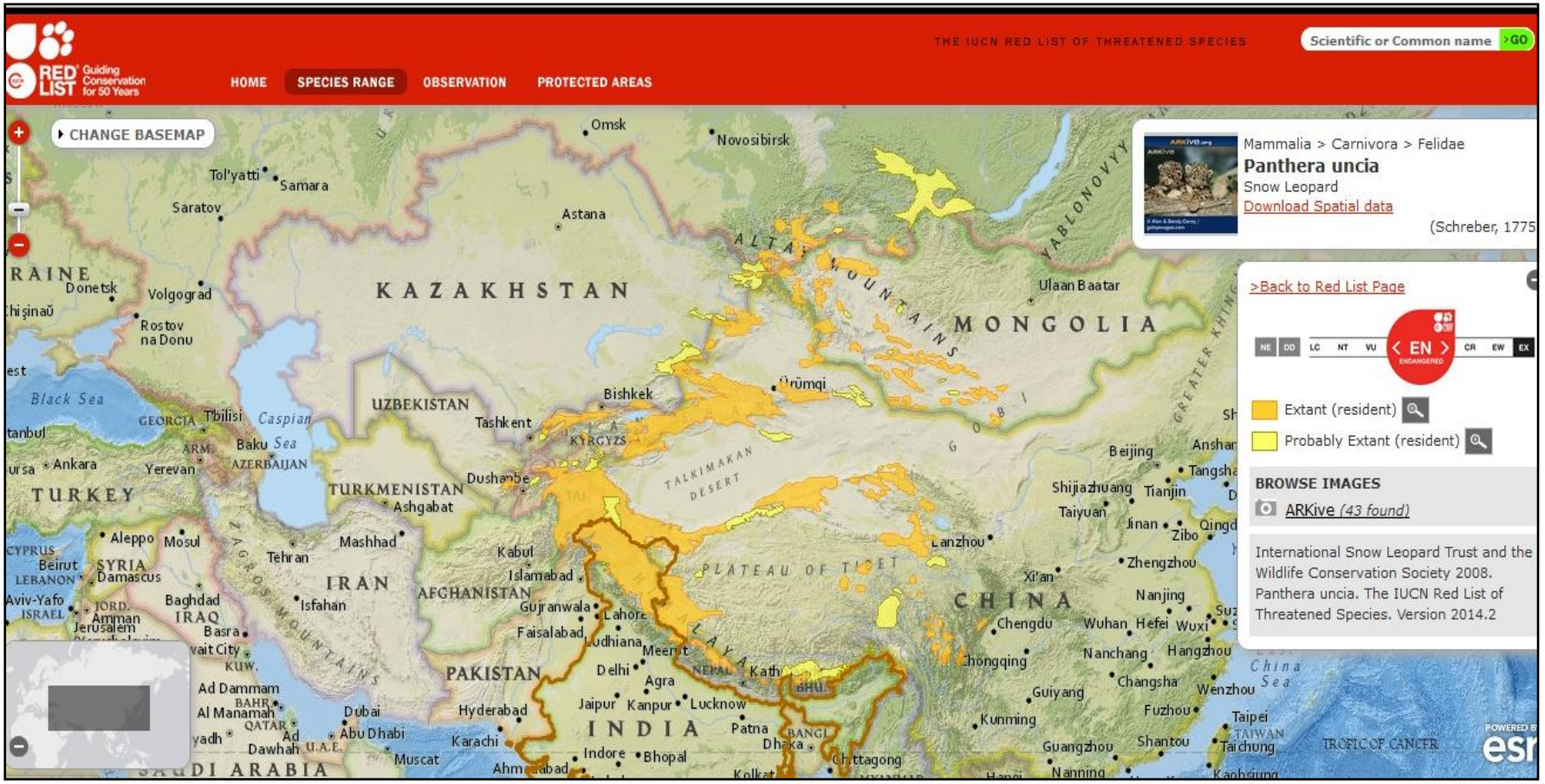
tigris) have done for other landscapes elsewhere in South and Southeast Asia (Bhatnagar et al., 2002).

Table 1.1. Estimated area inhabited and population size of snow leopards in the 12 range countries

Range Country	Estimated Area (km^2)	Estimated Population	Year of Evaluation
Afghanistan	50,000	100—200	2003
Bhutan	15,000	100—200	1994
China	1,100,000	2,000—2,500	2003
India	75,000	200—600	1994
Kazakhstan	50,000	100—110	2001
Kyrgyz Republic	105,000	150—500	2001
Mongolia	101,000	500—1,000	2000
Nepal	30,000	300—500	2009
Pakistan	80,000	200—420	2003
Russia	60,000	70—90	2012
Tajikistan	100,000	180—220	2003
Uzbekistan	10,000	20—50	2003
Totals	1,776,000		3,920-6,390

Source: Snow Leopard Working Secretariat, 2013

Figure 1.1. Map showing the global distribution of snow leopard.



Source: IUCN/SSC 2014

1.2.1. Literature Review on the Snow leopard

The snow leopard, up to 1970's remained unstudied in the wild. Then information concerning snow leopard in the wild were accrued from anecdotal observations, often made by big game hunters roaming remote areas in search of wild sheep and goat trophies (Hemmer, 1972; Guggisberg, 1975; Roberts, 1977; Schaller, 1977). Schaller (1977) carried out surveys in the Himalaya and summarized natural history information in his book 'Mountain Monarchs'.

The first successful radio – telemetry ecological study was carried out by Jackson et al. (1988a and b) in Nepal. Subsequently, radio –telemetry studies were conducted by Oli et al. (1994) in Nepal; Chundawat (1989, 1990, 1992) in India; Schaller et al. (1994) and McCarthy (2000) in Mongolia. Furthermore, studies were also carried out on the status and distribution, identifying conservation actions and snow leopard – human conflicts by Mallon, 1984; Koshkarev, 1984; Schaller et. al., 1987; Schaller and Junrang, 1988; Schaller et al., 1994; Fox, 1989; Buzurukov and Muratov, 1994; Chundawat, 1989 and 1990; Fox, 1994; Jackson and Ahlborn, 1984; 1988a and b; Jackson et al., 2006 and 2008; Oli et al.,1994; Hussain, 2003; McCarthy, 2000 and McCarthy et al., 2005; Bischof et al., 2013; Li et al., 2013a and b; Lovari et al., 2013; Suryawanshi et al., 2012, 2013 and 2014; Sharma et al., 2014 and Lyngdoh et al., 2014.

In India, studies on snow leopard had been carried out on habitat selection, camera trapping, food habits, associated co – predators, prey species, large carnivore – human conflicts as well status and anecdotal notes by Dang, 1960 and 1961; Nath, 1982; Mallon, 1984 and 1991; Green, 1982;Chundawat, 1989 and 1990; Chundawat et al.,et al., 1988; Chundawat and Qureshi, 1999; Fox et al., 1991; Mishra, 1997 and 2000; Bhatnagar et al.,1999; Jayapal, 2000; Sathyakumar, 1993 and 2003a; Sathyakumar and Qureshi, 2002; Sathyakumar et al., 2009; Raghavan et al., 2003; Jackson et al., 2003 and 2005; Suryawanshi et al., 2013 and 2014; Maheshwari and Sharma, 2010a and b; Maheshwari et al., 2012;Lyngdoh et al., 2014.In India, snow leopard studies have been focused in the Trans-Himalayan region of Spiti Valley (Himachal Pradesh) and Ladakh region (Jammu and Kashmir).

With the exception of a few status surveys and anecdotal information (Green, 1982; Sathyakumar, 1993; Vinod and Sathyakumar, 1999), the Greater Himalaya of

Uttarakhand, Himachal Pradesh and Trans-Himalaya of Kargil have remained unexplored for snow leopard and other wildlife values due to inaccessibility and its location at near to the International border (particularly Kargil). The proposed study is the first effort for collecting the base-line information about snow leopard and other wildlife in Kargil and also extensive surveys in the Greater Himalayan regions of Himachal Pradesh and Uttarakhand. In mid 2015, the Uttarakhand State Forest Department and Wildlife Institute of India made an assessment of the status of snow leopard and its prey in the high altitude regions of the State (Habib et al.,2016).

1.2.2. Taxonomy

The snow leopard is a member of the Felidae subfamily Pantherinae (Schreber, 1776; Nowak and Paradiso, 1983). DNA evidence suggested that the Pantherinae subfamily, including lions (*Panthera leo*), jaguars (*Panthera onca*), tigers, leopards (*Panthera pardus*), snow leopards and clouded leopards (*Neofelis nebulosa*) (big cats), diverged from their nearest evolutionary cousins, Felinae, which included cougars (*Puma concolar*), lynxes (*Lynx lynx*) and domestic cats (*Felis catus*), about 6.37 million years ago (Tseng et al., 2013). A phylogenetic analyses place the snow leopard within the genus Panthera, and being most closely related to the tiger with the divergence time estimated around 2 million years (Johnson et al., 2006).

As in other Pantherinae, the diploid chromosome number in snow leopards is 38 and the fundamental number is 36. There are 17 metacentric and 2 acrocentric chromosomes (Soderlund et al., 1980). The karyotypic banding pattern is almost identical to that in other Pantherinae (Gripenberg et al., 1982). There had been virtually no fossil record of snow leopard, the only positive identifications being upper Pleistocene remains from Altay caves (Hemmer, 1972). Recently, a well-preserved 4 to 6 million years old skull of a previously unknown species of prehistoric snow leopard from Tibet is the oldest big cat fossil ever found, according to palaeontologists in a joint study from China, Canada and the United States (Tseng et al., 2013).

1.2.3. Physical Attributes

The snow leopard is a large felid, with adult males weighing 45–55 kg and females 35–40 kg, a shoulder height c. 60 cm and head-body length of 1.8–2.3 m (Hemmer, 1972). With its smoky-grey pelage tinged with yellow and patterned with dark grey,

open rosettes and black spots, the snow leopard is especially well camouflaged for life among bare rocks or patchy snow (Plate 1). It has a well-developed chest, short forelimbs with sizable paws, long hind limbs, and a noticeably long tail (75–90% of its head and body length), giving it an amazing agility for negotiating steep terrain or narrow cliff ledges (Sunquist and Sunquist, 2002). Adaptations for cold include an enlarged nasal cavity, long body hair with dense, woolly under fur (belly fur up to 12 cm in length), and a thick tail that can be wrapped around the body for added warmth while at rest. Mating occurs between January and mid-March, a period of intensified social marking and vocalization (Ahlborn and Jackson, 1988). In captivity, oestrous lasts 2–12 days, with a cycle of 15–39 days (Nowell and Jackson, 1996). One to five cubs are born after a gestation period of 93 to 110 days, generally in June or July. Age at sexual maturity is 2–3 years (Sunquist and Sunquist, 2002). There is no information on longevity in the wild. Litter size is usually two to three and exceptionally as large as seven. Dispersal is said to occur at 18–22 months of age, and sibling groups may remain together briefly at independence (Jackson, 1996). This may explain reported sightings of as many as five snow leopards in a group (Hemmer, 1972).

In general, snow leopard's average food requirement is estimated around 1.5-2.5 kg per day (Jackson and Ahlborn, 1984; Wemmer and Sunquist, 1988; Fox and Chundawat, 1988). Their most commonly taken prey consists of wild sheep and goats including blue sheep (*Pseudois nayaur*), ibex(*Capra sibirica*), markhor (*Capra falconeri*), argali (*Ovis ammon*) and urial (*Ovis orientalis*). Annual prey requirements are estimated at 20–30 adult ungulates, with radio-tracking indicating a large kill every 10–15 days (Jackson and Ahlborn 1984; Jackson, 1996). Domestic sheep and goats, donkeys and horses are also important constituents of snow leopard's diet throughout (Sathyakumar, et al., 2009; Maheshwari et al., 2010b; Lovari et al, 2013; Lyngdoh et al., 2014).

Snow leopards favour steep, rugged terrain well broken by cliffs, ridges, gullies, and rocky outcrops (Jackson and Ahlborn, 1989; Sunquist and Sunquist, 2002); however, in Mongolia and Tibet, they occupy relatively flat or rolling terrain when sufficient cover is available (Schaller, 1998; McCarthy, 2000). Home range size varies from 12 to 39 km² in productive habitat in Nepal (Jackson and Ahlborn, 1989) to 500 km² or more in Mongolia with its open terrain and lower ungulate density (McCarthy et al., 2005). Densities range from <0.1 to 10 or more individuals per 100 km², but current

knowledge is insufficient for generating a reliable range-wide population estimate. The four telemetry studies to date reveal largely overlapping male and female home ranges, but with use of a particular area usuallyseparated temporally.

Plate 1: Photograph of snow leopard

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1.2.4. Status and Distribution in India

The nationally approved Project Snow Leopard (Anon, 2008) estimated a total of about 1,27000 km² of Snow Leopard habitat in five States of India, namely, Jammu and Kashmir, Himachal Pradesh, Uttarakhand in the Western Himalaya (elevation ranges from 3000 to 5000 m) and Sikkim and Arunachal Pradesh in the Eastern Himalaya (elevation ranges from 4000 m to 5500 m; Table 1.2 and Figure 1.2). Within these states, coarse estimates suggest occurrence of 400 to 700 snow leopards in wild i.e. almost 10% of the total global snow leopard population.

Unfortunately, information on the distribution and abundance is as scanty as the animal itself. Snow leopard is less studied than any other large felid such as Bengal tiger (*Panthera tigris tigris*), Asiatic lion (*Panthera leo persica*) and common leopard (*Panthera pardus fusca*) in India. Its current range is poorly mapped due to the high and inhospitable terrain inhabited by snow leopard. Any attempt to study snow leopard in India started only in 1988 when Chundawat et al. (1988) estimated 95,000 km² as potential habitat for snow leopard in India, of which 72,000 km² was within Ladakh (includes about 20,000 km² within the disputed area between Pakistan and China). Hunter and Jackson (1997) estimated total potential habitat for snow leopard as 75,000 km² in India out of which only 14.4% area is protected.

Snow leopard has not been surveyed systematically in its range in India. Its presence is reported in Jammu and Kashmir and Himachal Pradesh (12 PAs in each State); out of which the status of the species in many protected areas is uncertain. Similarly, other states such as Uttarakhand with 06, Sikkim with 03 and Arunachal Pradesh with 01 PA have reported the presence of snow leopard.

In India, studies had been conducted in some of the protected areas of Jammu and Kashmir and Himachal Pradesh. But in rest of the States such as Sikkim and Arunachal Pradesh, the unprotected areas of snow leopard distribution range have been still unexplored. In Uttarakhand, wildlife surveys were conducted by Green, 1982; Sathyakumar, 1993 and 2003b; Rawat, 2005 and Kandpal, 2010. But specific surveys on snow leopard were lacking. Researchers documented snow leopard information while conducting other studies in various regions of Uttarakhand (Green, 1982; Sathyakumar, 1993 and 2003b; Rawat, 2005 and Kandpal, 2010). Though Uttarakhand has very little area under Trans-Himalayan Biogeographic zone i.e. ideal

habitat for snow leopard, there are many areas which fall in the transitional zone of Trans-Himalaya and Greater Himalaya. Similarly, the Trans-Himalayan zone of Himachal Pradesh, Lahaul-Spiti and Pangi Valley were studied for snow leopard and wildlife values by Bhatnagar, 1997; Bhatnagar et al., 1999 and 2008; Saberwal, 1996; Vinod and Sathyakumar, 1999 but some of the areas of Himachal Pradesh have poor information about snow leopard.

Similarly, from Kargil, Jammu and Kashmir there have been a few studies conducted on snow leopard in Zanskar by Spearing, 2002, on Himalayan brown bear by Sathyakumar and Qureshi, 2002 and Sathyakumar 2003a and livestock depredation by Jayapal (2000) in the Zanskar and Suru Valleys of Kargil District and in general, there was very poor information on the occurrence and distribution of snow leopard and associated species and human-wildlife conflicts in Kargil.

Therefore, realising gaps in the available information on snow leopard in Kargil (Jammu and Kashmir) Uttarakhand and Himachal Pradesh, this study was proposed to identify potential habitats for snow leopard conservation in three States of the Greater and Trans-Himalaya.

In India the potential snow leopard habitat is estimated at 128,757 km2: 92% is in the western Himalayan Mountains, which provide habitat for 400-700 snow leopards (Anon, 2008). Unfortunately the information available on distribution and suitable habitat for snow leopard in western Himalaya is very sparse.

Recently developed tools (i.e. Species Distribution Modelling; [SDM], geospatial tools) can be used to predict the potential distribution and suitable habitat of carnivore species which have large spatial requirements (Rodriguez et al., 2007; Singh et al., 2009). The output may be used in developing effective species conservation measures (Ferrier, 2002; Olsson and Rogers, 2009; Adhikari et al., 2012). Recently Phillips et al. (2004, 2006) developed Ecological Niche Modelling (ENM) tools based on Maximum Entropy (MaxEnt) is a machine learning technique for making predictions from incomplete information, as in using presence-only data for predicting potential distribution habitat of species with ecological and environmental variables such as topography, temperature, precipitation, soil, vegetation, and landcover (Phillips and Dudik, 2008; Elith et al., 2011; Razgour et al., 2011). Maxent has great promise and is ranked as the best performing algorithm, recently compared with

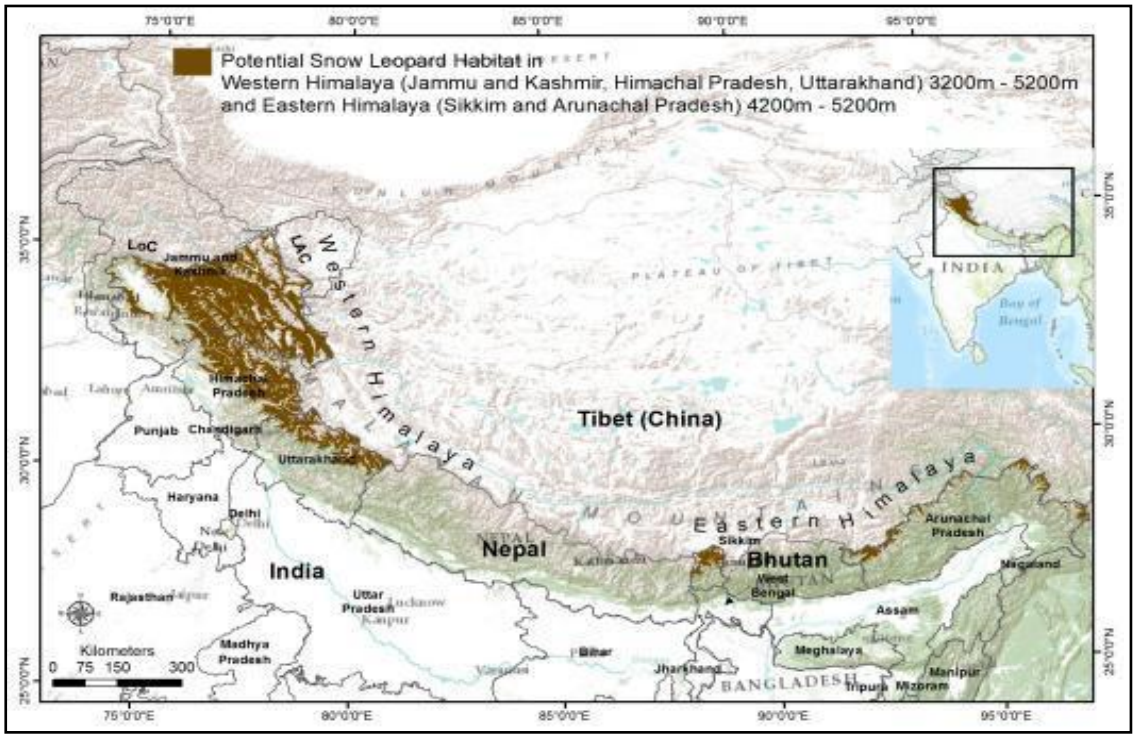
different SDM frameworks to predict distribution of rare species (Kumar et al., 2009; Elith et al., 2006). Therefore,Maxent modelling was adopted to predict the potential distribution of snow leopard in its native range in the western Himalayan region to identify key areas suitable for long-term survival of this species.

Table 1.2. Snow leopard range in the five Himalayan states* of India

State	State's Area(km^2)	Potential Area Under PSL (km^2)	% of total area of State
Jammu and Kashmir**	1,52,582	76,601	50
Himachal Pradesh	77,060	28,843	37
Uttarakhand	71,648	14,271	20
Western Landscape	3,01,290	1,19,716	
Sikkim	9,075	2,390	26
Arunachal Pradesh	1,05,173	4,736	05
Eastern Landscape	1,14,248	7,126	
Total	4,15,538	1,26,842	31

*The figures for the Western Himalaya include areas above 3,200 m and those for the Eastern Himalaya are above 4,200 m. Estimates are based on Digital Elevation Model from Shuttle Radar Topography Mission (SRTM). **Includes area only within the 'Line of Control' and the 'Line of Actual Control'.Source: Anon, 2008

Figure 1.2. Map showing the snow leopard distribution in India.



Source (table and map): Snow Leopard Working Secretariat, 2013

1.2.5. Threats to Snow leopard

Several factors are adversely affecting snow leopards throughout their ranges. These factors show regional variation and are sometimes inter-connected (Theile, 2003):

- Major threat to snow leopards is the increasing loss of their natural prey, which is partly due to hunting for meat and wild prey out competed by livestock graze in the snow leopard habitats.
- With less natural prey to feed on and with a rapidly growing numbers of domestic animals being grazed in their hunting territories, snow leopards have increasingly adapted to prey on livestock. This brings them into conflict with local people which lead to retaliatory killing of snow leopards and associated species.
- Snow leopards are also decimated by the trade related hunting for their fur, bones and other body parts, which are considered valuable in international illegal wildlife trade markets such as Asian traditional medicines and also used for some religious proposes.
- Possible impacts due to climate change.

Major threats to snow leopards and their habitat

Across the snow leopard range, threats are similar but their severity and magnitude vary county to country. Sometimes they are interlinked, which makes it a challenge to mitigate. For example, traditional hunting practices of wild ungulates for meat consumption eventually lead to loss of natural prey for snow leopard and killing of wild ungulates to reduce competition with domestic livestock also lead to depletion of natural prey base for snow leopards. Thirst for infrastructure development (primarily roads, hydroelectricity dams and mining industry) leads to unsustainable extraction of natural resources and heavy destruction of alpine and sub-alpine eco-zones with which Snow Leopards are closely associated.

The following major threats provide detailed information on each threat.

Increasing livestock and overgrazing: loss of natural prey base and retaliatory killing of snow leopards and associated species

Though human density in the snow leopard's habitat is relatively low but the communities residing in these habitats are primarily agro-pastoral and depends on the natural resources. With growing human population and rising demand for cashmere, milk and its products livestock herds have greatly increased in size. This is resulting overgrazing which leads to degradation of pastureland, wildlife habitats and serious soil erosion and the decrease in their regenerative capacity, along with a reduction in vegetation production and biomass, and depletion of soil fertility (Steinfeld and Wassenaar, 2007). On the Qinghai-Tibetan Plateau, excessive livestock grazing is reported to have caused vegetation degradation and created barren soils over some 70319 km² (Shang and Long, 2007).

Increasing livestock population also leads to killing of wild ungulates (ibex, blue sheep and markhor) to reduce competition between domestic and wild ungulates that impact loss of natural prey base for snow leopards. It altogether results into livestock depredation by snow leopards which eventually lead to protective or retaliatory killing of snow leopards. About 3 to 18% of local livestock holdings are reportedly lost to snow leopards annually (Oli et al., 1994; Mishra, 1997; Jackson and Wangchuk, 2001; Namgail et al., 2007; Maheshwari et al., 2010a and b). These damages could amount to upto 56% of the local average per capita income (Mishra, 1997; Ikeda, 2004). Large losses sometimes create such level of hatred towards the snow leopard that

local communities lose complete tolerance of the cat and view total extermination of this cat as the only solution to the conflict (Oli et al., 1994; Suryawanshi et al., 2013).

Habitat fragmentation and degradation

Habitat fragmentation and degradation has emerged as one of the most significant threat to the snow leopard and its habitat in the previous decade. The recent developmental activities such as resource extraction (especially precious mineral and fossil fuels) in the snow leopard central Asian range counties, building road network and hydroelectricity power facilities across most of the snow leopard's range are increasingly fragments the historic range of the species (Snow leopard Working Secreteriat, 2013). Even urbanization is rapidly increasing in the remote locations of the snow leopard's range. Altogether these human encroachments may restrict snow leopard's historic movements.

Lack of Awareness

Snow leopard is less studied and lesser known Pantherinae amongst lion, tiger, jaguar, leopard. Across most of the snow leopard's range indigenous communities are not even aware about their ecological importance, national wildlife protection laws and legislation which hamper the conservation efforts. Even in general, all levels of society within and outside the snow leopard range countries, from local people to leaders of governments and from the private sector to the general public have poor knowledge about Snow Leopards which restricts general attention and understanding about this elusive cat.

Weak Trans-Boundary Cooperation

Snow leopard cover large distances and data from camera trapping and radio collaring have provided substantial evidence of snow leopard crossing International borders. Therefore, without trans-boundary cooperation amongst snow leopard range countries, conservation goals cannot be achieved. Also, for a landscape conservation approach and providing protection to the snow leopard and associated species, strong trans-boundary policy and political will is crucial. For example, snow leopard covers both India and Pakistan and the Siachen and Kargil is in the species' core area (Jackson, 2002). Therefore, promotion of the snow leopard as a 'flagship species' could become an important symbol representing fragile trans-boundary mountain ecosystem across central and southern Asia.

Trade and Poor Law enforcement

Pelt appears to be the main snow leopard product in demand, whereas other body parts, found in trade, include bones, nails, meat, and sexual organs of male cats. There is also evidence of demand for live animals for private zoos and circuses. Snow leopard bones are known to be valued for traditional Asian medicine similar to those of tiger bones. Evidence of trade in snow leopard bones has been reported from China and Nepal. Nevertheless, it is not clear if bones are sometimes the primary incentive for killing snow leopard or a by-product of the skin trade. Demand for snow leopard products is at the national and international level and consumers are reported to have included powerful and privileged in the central Asian range countries, Mongolia, Pakistan and Russia, while the Middle East and Europe were cited as destinations for skins outside the snow leopard's range.

1.3. Aim of the Study

The study aims to investigate occurrence, distribution of snow leopard, co-predators and their prey in Kargil, and some gaps areas in Greater Himalayan region of Himachal Pradesh and in Greater Himalayan and Trans Himalayan regions in Uttarakhand.

1.4. Objectives

Considering gaps in the knowledge on snow leopard in the Western Himalaya, this study focused on the following objectives

1. Determine conservation status and distribution of snow leopard and co-predators in Kargil, Uttarakhand and Himachal Pradesh
2. To assess occurrence and estimate density of prey species in Kargil
3. To asses food habits of snow leopard in Kargil, Uttarakhand and Himachal Pradesh
4. To assess snow leopard-human conflicts in Kargil, Uttarakhand and Himachal Pradesh
5. To Predict habitat suitability of snow leopards in the western Himalaya.