

**Habitat monitoring of the Snow leopard *Uncia uncia* in Api Nampa  
Conservation Area Nepal**

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## 1. INTRODUCTION

### 1.1 Background

Nepal is a country of great natural beauty and of a rich cultural heritage. Nepal has always been a source of great attraction for her beautiful gifts mountains, landscapes, lakes, waterfalls, hillsides and green villages serrated in the form of an endless series of terraces. The entire northern border has silvery peaks of Himalayas and the country is the home of perpetual snow (Majupuria and Majupuria 1999) while southern flank is green mountains of Mahabharata with different size valleys and river duns. Even further south lays fragile lower mountains of Churiya and a little Bhavar and Tarai flat land adjoining to India.

Nepal, a country having peculiar diverse fauna and flora lies between China on the north and India on the east, west and south. It stands on latitude 26°22' to 30°27' N north and its longitude is between 80°4' to 88°12'E east. Its altitude varies from 60 - 220 m in the south rising to north up to world highest peak of Sagarmatha (Mt. Everest) 8848 m. Nepal covers of 141,577 sq km land mass with a mean breadth of 200 km provides an opportunity of diverse climate zones from subtropical to nival with sharp microclimatic condition due to its topography. Within this small area, the country has all possible landform features of the earth except the volcanic and coral islands and marine (Sharma 1999). The country experience difference in climate, wild flora and fauna as variation bestowed to physiographic condition.

Nepal lies at the transition between the Palearctic and Indo-Malayan biogeographical realms that contributed a large biological diversity in the country. More than 144 species of spiders, 5052 species of insects, 635 species of butterflies, 2,253 species of moths are on the record. The vertebrates fauna also in diverse form; 184 species of fishes (31 families and 11 orders); 43 species of amphibians (one salamander, four toads and 38 frogs Species); 100 species of reptiles (24 lizards, 4 turtle, two crocodiles and 60 snakes species); 861 species of birds (18 orders); 181 species of mammals (12 orders and 39 families) (BPP 1995 (h), Chaudhary 1998, Majupuria and Majupuria 1998, Shrestha 2003).

### 1.2 Snow Leopard (*Uncia uncia*)

The snow leopard stands about 60 cm high at the shoulder, with a head to body length of 100 to 130 cm and a long, thick tail three-fourths as long as the body. Females weigh 35 to 40 kg and males 45 to 55 kg. The luxuriant spotted pelage is whitish-gray tinged with yellow and contains dark, open, or otherwise indistinct rosettes and spots. Other adaptations for mountain life include large forepaws, short limbs, well-developed chest muscles, long hair with dense under fur, and the long tail that can be used to keep the animal warm while at rest (see frontispiece illustration). It is generally solitary, although groups of up to six snow leopards have been reported –presumably these groups consist of a female and her nearly independent young, and possibly a male. One to five cubs are born after a gestation period of 93 to 110 days, generally in June or July.

The Snow Leopard (*Uncia uncia*, formerly *Panthera uncia*), is rare and thinly populated through the Himalayas and mountains of central Asia (Kattel and Bajimaya 1995, Jackson 1996). This beautiful and shy species is a striking symbol of the world's highest places and good indicator of the mountainous ecosystems (Shrestha 1997, Shrestha 2003, Jackson 1996). It is considered and ranked as a top-level species of the food chain in the Himalayan range. Because of its rarity and extremely harsh and often impassable terrain where it is found, little is known of its behavior in the wild state (Yaksha 1999).

If the Lion is the 'King of the Beasts' and the Tiger the 'King of the Jungle', the Snow Leopard is surely 'Queen of the high mountains of Asia'. Queen ? Somehow that title seems more appropriate than 'King' when applied to the Snow Leopard. The Lion and the Tiger evoke power and ferocity. But the Snow Leopard's image is gentler. Its ethereal beauty has attracted the admiration of people from all over the world and around their interest in its homeland and varied cultures who live there (Jackson 1995).

### 1.2.1. Taxonomy

There is some difference as to the taxonomy of Snow Leopard in the so far published literature. Two scientific names have been given to the species e.g. *Uncia uncia* and *Panthera uncia* (Shrestha 2003). The Snow Leopard is the only member of the genus *Uncia*. Its classification in a separate genus from the other big cats is justified by its unique hyoid apparatus (Theile 2003). In different countries, the animal has got different names such as Ounce, Snow Leopard (English); Panthere des Neiges, Leopard des Neiges, Once (French); Schneelopard, Irbis (German); Leopardo Nival, Pantera Las Nieves (Spanish); Xue Bao (Chinese); Palang-i-berfy (Dari- Afghanistan); Bharal he, Barfani Chita (Hindi, Urdu, Pakistan); Shan (Ladakhi, India); Hiun Chituwa (Nepali); Irbis, Irvis (Russia, Mongolia); Chen (Bhutan), Sarken (Tibetan) (IUCN/SSC, Cat Specialist Group 1996).

<b>Classification of Snow Leopard</b> (Toriello 2002)	Kingdom	-	Animalia
Phylum	-		Chordata
Subphylum	-		Vertebrata
Class	-		Mammalia
Order	-		Carnivora
Family	-		Felidae
Sub Family	-		Pantherine
Genus	-		<i>Uncia</i>
Species	-		<i>uncia uncia</i>

### 1.2.2. Morphology

The Snow Leopard exhibits superb camouflage for its mountain environment of bare rocks, mosses and snow, being whitish-gray (tinged with yellow) in color and patterned with dark gray rosettes and spots. Further adaptations for high altitude life includes an enlarged nasal cavity, shortened limbs (adult shoulder height is about 60cm); well developed chest muscles (for climbing); long hair with dense, wooly under fur (belly fur grows as long as 12 cm) and a tail up to one meter long, 75-90% of head body length (IUCN/SSC Cat Specialist Group 1996, Jackson 1996, WWF 2001, Shrestha 2003). These adaptive features not only assist balancing in steep terrain movement but the thick tail can be wrapped around the body to protect the animal from the cold (Theile 2003).

Males are larger than female, with average weights between 45-55 kg as opposed to 35-40 kg for females (Jackson 1992, Fox 1994, Jackson 1996, Yaksha 1998, Shah 1998, WWF 2001, Theile 2003). The pugmarks of adults are 9-11 cm, in length and 7-9 cm in width, but variation in cubs (Jackson 1996, WWF 2001, Shrestha 2003).

### 1.2.3. Social Behaviour

Social behaviour of the Snow Leopard is generally solitary but it is a social animal. Male and female of the Snow Leopard have been hunting together. Generally, one chased the prey from one side while another Snow Leopard is waiting for the frightened prey in other end. They are found eating together their kill (Shrestha 1997, Shrestha 2003).

Snow Leopards are known to live up-to 21 years in captivity but are unlikely to reach half of this age in wild (Blomquist and Sten 1982, Theile 2003). Snow Leopards are sexually matured at 2 - 3 years (Prater

1993). In captivity, estrus has been observed to occur in late winter or early spring (Witt 1977, Jackson 1996, Jackson and Chundawat 1999, WWF 2001). Cubs are born in late spring or early summer. The litter size is usually 2 -3 (Witt 1977, IUCN/SSC Cat Specialist Group 1996, WWF 2001, Shrestha 2003). Cubs stay with their mother until they reach 18-22 months of age.

It is reported that home range size varies from 12 - 39 km<sup>2</sup> (WWF 2002) which is within the size range of winter season home range in Annapurna Conservation Area (Oli 1997). In Mongolia, it varies from 12-39 km<sup>2</sup> in prime habitat to 1000 km<sup>2</sup> in marginal habitat in Mongolia, which has lower prey densities (WWF 2001).

#### 1.2.4. Prey Species

The principal prey of the Snow Leopard is Blue Sheep (*Pseudois nayaur*) in many parts of Nepal and it also preys on Markhor (*Capra falconeris*), Serrow (*Capricornis sumatraensis*), Himalayan tahr (*Hemitragus jemlahicus*), Musk deer (*Moschus moschiferus*) (Chundawat & Rawat 1994, Jackson 1996, Shrestha 1997). Further more, the Snow Leopard preys on small mammals like Pikas (*Ochotoma* Sp.), Hares (*Lepus olustolus*) etc and birds like Chuckor Partridge (*Alectonnis chukor*), Tibetan Snowcock (*Tetraogallus tibetanus*) etc. Sometime, Snow Leopard makes their diet to domestic Goat, Sheep, Calves and sub-adult Yak, Colt and sub adult Horse (Jackson and Chundawat 1999, WWF 2001). An adult Snow Leopard kills 20- 30 adult Blue Sheep or Tahrs per year on average. It kills a large animal every 10-15 days or around twice a month (Shrestha 1997, WWF 2001).

#### 1.2.5. Status and Distribution

Snow leopards are found in the alpine and sub alpine habitats of the central Asian Mountains. They prefer to live in landscapes dominated by cliffs, rocky out crops, gullies, and vegetation mostly comprised by shrubs and grasses and devoid of large dense patches of forests. The highest part of their range is usually between elevations of 3,000 to 4,500 meter above sea level, while in their northern range limit, they are found at 900 to 2,500 meter above sea level.

Currently, snow leopards occupy nearly two million square kilometers of area spread across twelve countries including Afghanistan, Bhutan, China, India, Kazakhstan, the Kyrgyz Republic, Mongolia, Nepal, Pakistan, Russia, Tazikistan, and Uzbekistan. Despite their wide spread habitats, snow leopard numbers are known to be decreasing. For example, in the Kyrgyz Republic, snow leopards have become locally extinct in some places such as in the certain parts of Mongolia. At present, their numbers are estimated at 3,500 to 7,000 individuals in the wild. China has the largest extent of habitats and the greatest snow leopard numbers. We, however, do not have information on the exact status of snow leopard populations due to the lack of range-wide systematic studies.

Snow Leopards have extremely patchy distribution and although their range extends over a large area (more then 2-3 millions km<sup>2</sup>), their fragmented population occupy an area of no more than 1.6 million km<sup>2</sup> (Jackson and Hunter 1996). Eighth International Snow Leopard symposium 1995, held in Pakistan declared the habitat of Snow Leopard as follows –

Total potential habitat	:	30, 24,728 km <sup>2</sup>
Total Good Habitat	:	5, 49,706 km <sup>2</sup>
Total fair habitat	:	24, 75,022 km <sup>2</sup>
Total protected potential habitat	:	1, 81,547 km <sup>2</sup>
Percentage of potential habitat Protected	:	5.9%

Estimates of the total Snow Leopard population vary from 4500 to 7500 individuals (Jackson 1992, Fox 1994). Earlier lower estimates e.g. 1500 by Green 1988 and 4000 by Fox 1989 reflected a lack of field information from the large area of Snow Leopard range.

Estimates of Snow Leopard density ranges from 0.8 animals 100/km<sup>2</sup> to 10/100 km<sup>2</sup> (IUCN/SSC Cat Specialist Group 1996). In Nepal, its density is 5-7/100 km<sup>2</sup> (Oli 1991). Snow Leopards are generally found at elevations between 3000 to 4500m, although they occasionally go above 5,500m in the Himalayas and can be found between 600 to 1500 m of northern limit of their range (Jackson 1996, Theile 2003, WWF 2001).

Snow Leopards are thought to occur in about 120 Protected Areas located across their entire range in Central Asia (WWF 2001). In Nepal, the available habitat for snow leopard totals 30,000 km<sup>2</sup> suitable habitat, population estimated at 150 to 300 (Jackson 1979), an estimate recently increased from 350 to 500 (Jackson, personal communication), based on computer modeling using a map-derived Habitat Suitability Index system (Jackson and Ahlborn 1990). Snow leopards are distributed along the northern border of Nepal and Tibet, with the largest concentrations occurring in the western part (Mugu, Dolpo, and Humla districts) of Nepal (Jackson 1979). Snow leopards have been sighted north of the Annapurna Range, in the Langtang Himal, Rolwaling Himal, Makalu, Walunchung, and the Kanchenjunga massifs. Jackson and Ahlborn (1989) reported densities of 5 to 10 snow leopards per 100 km<sup>2</sup> in the remote Langu Valley of west Nepal, slightly higher than estimated densities for Nar-Phu located north of Annapurna (M. Oli, personal communication).

The largest Snow Leopard population is thought to exist in the Shey- Phoksundo National Park and Annapurna Conservation Area (Oli 1994, Jackson 1996, WWF 2001). Nepal's population is roughly estimated at 300-500 but this figure must be confirmed by field surveys, using standard methods like the Snow Leopard Information Management System (SLIMS) developed by the International Snow Leopard Trust (ISLT).

### **1.2.6. Legal Status**

The Snow Leopard is legally fully protected under the National Park and Wildlife Conservation Act 2029 (1973) of Nepal, which lists this animal in Appendix I of CITES since September 1975. A workshop/training session on "The implementation of CITES in Nepal" was held in Kathmandu in May 1995, it was attended and well received by senior law enforcement officials from ten different agencies. The Snow Leopard is listed on the IUCN's Red Data list and in Appendix I as an endangered and fully protected animal (IUCN 1994, Chapagain and Dhakal 2003).

### **1.2.7. Threats to Snow Leopard**

Historically, habitat remoteness served to insulate the species from human but Snow Leopards are no longer present in many areas that they formerly occupied. The species continues to suffer due to fragmentation across more disturbed mountain range habitat and its low population density (Fox 1994, Jackson 2000).

According to the survey of more than 60 Snow Leopard specialists, undertaken by the Snow Leopard survival strategy, direct killings of Snow Leopards and loss of their natural prey base are considered the most significant threats to the long-term survival of the species (McCarthy and Chapron 2003). It is difficult to identify baseline causes and effects in many cases due to the different types of threats are closely inter-woven and complexly related.

### **1.2.8. Poaching**

Until recently, the killing of Snow Leopards for their valuable fur represented the single most important threat to the species. On the black market, a furrier may get a high price from selling a good



quality coat. In Nepal, the fur trade is centered in Kathmandu, operating under the control of Kashmiri traders and sold under the counter at tourist stores and hotels (WWF 2001). The bones of the cat used for making ornaments by Himalayan dwellers.

### **1.2.9. Livestock Depredation and Conflict with Local Herders**

Domestic animals commonly far outnumbered natural mainstay food items such as Blue Sheep, Himalayan tahrs or Ibex and they are easier to kill. Livestock forms even higher proportion of the Snow Leopard's winter diet when marmots are hibernating (Jackson 2000). Oli et al (1994) found herders to have strongly negative feelings towards Snow Leopard and Wolf owing to loss of livestock. Historically herders suffering from excessive depredation solicited help from Shikaris and professional hunters, who were rewarded with gift, food, alcohol and livestock for trapping habitual stock predators (Jackson, Ahlborn, Gurung, and Ale 1995, Jackson 2000). For examples, over grazing by domestic livestock may lead to competition with and eventually loss of wild ungulates, a major prey source for Snow Leopard. In turn, such reduction of wild prey often leads Snow Leopards to prey on domestic livestock's, which sets up a negative perception of the cat among herders, who then become motivated to kill Snow Leopard in retaliation for or prevention of attacks on livestock (Theile 2003).

### **1.2.10. Loss of Natural Prey**

Wild ungulates, such as Argali, Himalayan tahr, Musk deer are adversely affected by overgrazing of land through increased with domestic livestock in parts of the Snow Leopard's range. In Nepal, livestock may compete with natural prey for forage and grazing space leading to overgrazing and rangeland deterioration. As habitat quality declines prey finds its easy way to kill livestock which are being poorly guarded by their owners (Oli et al 1994, WWF 2001, Theile 2003). Poaching of prey species reduces the amount of food available to Snow Leopard that might result the increase the predation on domestic livestock, which in turn may provoke herders to kill Snow Leopards (Mc Carthy and Chapron 2003, Theile 2003). Today, the situation has become more deadly for Snow Leopards because of erosion in traditional religious beliefs against the hunting or killing of wildlife (WWF 2001).

### **1.2.11. Habitat Loss and Fragmentation**

Habitat fragmentation, degradation and loss affect Snow Leopards but owing to the remoteness and inaccessibility of the preferred habitat, such influences Snow Leopards have been relatively limited until recently. Habitat alternations occur because of human encroachment into the species 'range'- for resource extraction, new grazing grounds living space excessive tourists flow or road building. Human conflicts may also contribute to habitat degradation or loss (Theile 2003, WWF 2001).

### **1.2.12. Impact of Tourism**

The impacts of tourism may be encapsulated in the following well-known phrases coined by reporters, visitors and Nepalese observers. 'Tourism is a goose that lays golden eggs, but it can also foul its own nest' (Gurung 1995). A phrase widely used to explain the present state of tourism in Nepal. Tourism leads to pollution and deforestation problems in Kathmandu and Pokhara valley and in Everest, Langtang and Annapurna regions. The pollution and deforestation to high land spoils the mountain habitat, which affects the survival of Snow leopard and its prey.

### **1.2.13. Lack of Awareness**

Local people depend upon animal husbandry and its extension through out the highland pasture for their livelihood. They will be happy if there is no loss of their livestock by the wild predator and population

increment of cattle naturally will enhanced their standard of livelihood. Thus, they might see no advantage to co- existing with Snow Leopards, which are a major source of their livestock remover and no means of their use too. Understandably, they are reluctant to support snow leopard conservation unless depredation losses are reduced or concern authorities for any livestock killed by predators compensate them (WWF 2001).

## **2. Objectives**

The main objective of this study is to monitor the status of snow leopards habitat and abundance in Api Nampa conservation area.

The specific objectives were

- i. To explore the present habitat and distribution of the Snow Leopard in Api. CA.
- ii. To find the abundance of prey species.

### **2.1 Limitation of the Study**

- \* The study was based on indirect survey method. (e.g. investigation from pugmarks, scrapes, scats, etc). It is very difficult to follow the signs of Snow Leopard to very steep Mountain, rocky and stony ground.
- \* Frequent heavy snowfall covered the signs and track of Snow Leopard.
- \* Flexible weather conditions of mountain ecosystem such as landslide, high velocity cold wind and unpredictable snowfall disturbed the study.
- \* Less information of the study area in previous literature.
- \* Short study to fulfill the Master degree does not allow doing continuous research. In between, we have to attend our university classes.

### **2.3 Significance of the Study**

1. There is no previous study on the Snow Leopard in Api CA, so, this exploration will establish status and availability of the species for Api CA.
2. This will help to the relevant governments, researchers the planners and associated agencies for conducting their research and plan about Snow Leopard conservation in that area.

## **3. STUDY AREA**

The Api-Nampa Conservation Area is a protected area situated in the Provence number 7. It was established in 2010 and covers 1,903 km<sup>2</sup> (735 sq mi) encompassing 21 Village Development Committees in the Darchula District. The western boundary is formed by the Mahakali River, and the northern by the international border with Tibet. Adjacent to the east are the Bajhang and Baitadi districts. It ranges in elevation from 518 to 7,132 m (1,699 to 23,399 ft) at the Himalayan peak Api, and is within the circumscribed area of the Kailash Sacred Landscape. Named after the two peaks Api and Nampa, it was established to conserve the unique biodiversity and cultural heritage of the area. It is inhabited by 54,358 people living in 8966 households. A grasslands plateau is at the center of the area. It is intermixed with various forest types.

## **4. METHODOLOGY**

### **4.1 Reconnaissance Survey**

The reconnaissance survey on Snow Leopard was conducted from May 17 to June 03, 2018 in Api Nampa Conservation area. During this period, general survey was done for Snow Leopard habitat its sign and prey species. Participatory Rural Appraisal (PRA) method was applied during the survey before starting the actual fieldwork.

### **4.2 Snow Leopard Sign Transect**

The Snow Leopard survey was done according to SLIMS (The Snow Leopard Information Management System) developed by ISLT (International Snow Leopard Trust). After selecting general survey areas for this study, a topographic map of 1:50000 was utilized to layout transect routes. Transects were placed along landforms where cats are most likely to cast sign, i.e. ridge lines, cliff bases, crest of cliff, streambed, human track, v-shaped valley, etc. Transects were 500m in length, 5m breadth in left and 5m in right from the centerline. The total area of each transect was 0.5 km<sup>2</sup>. The length of transect was measured by the pedometer and confirmed by the survey tape. Each transect was walked and searched for sign of the animal. At each detected Snow Leopard sign, site and the type of sign (Scrapes, Feces, Pugmarks, Scent Spray, etc) were recorded. The size of the sign was measured and the tentative date was estimated. For each site, habitat features were recorded based on the dominant condition. These included Longitude, Latitude, elevation, habitat type, rangeland use, landform ruggedness, dominant topographic feature and substrate. Altogether 25 transects were placed inside the 4 study blocks (B, C, D and E). Due to lack of signs of Snow Leopard, no transects were placed in Block A. Transects were not randomly distributed within Snow Leopard range rather these are placed in habitats where the Snow Leopard's signs were likely to find. In Block B 5 transects were laid down followed by 8 in Block C, 8 in Block D and 4 in Block E.

### **4.3 Identification of Pugmarks (Track Survey)**

To assess the Snow Leopard status in the study area, the pugmarks or tracks were surveyed on dusty footpath, muddy trail, sandy streambed and snow covered area. When the fresh and fine tracks or pugmarks were found, the pugmark total length (PML) and pugmark breadth (PMB) was measured by the help of survey tape and recorded digitally on photographs and by a still camera. Different set of tracks were examined based on measurement and individual Snow Leopard identified according to shape and size of pugmark.

### **4.4 Prey Species Survey**

#### **Blueship Survey**

The direct observation was done by searching in the slopes of the study area. Total herd count method was applied by using simple binocular. In every observation the altitude, location, time, date and GPS recording was noted down.

## **5. Data Analysis**

The primary data were collected from the fieldwork from May 2018 to June 2018. Secondary data were collected from Village Municipality Office, Api Nampa CA, DNPWC, Department of Hydrology and Meteorology, Babarmahal; different Journals; Newspapers and Books. The collected data have been processed by statistical methods. Microsoft Excel was used to analyze the data and the results were presented in tables and charts.

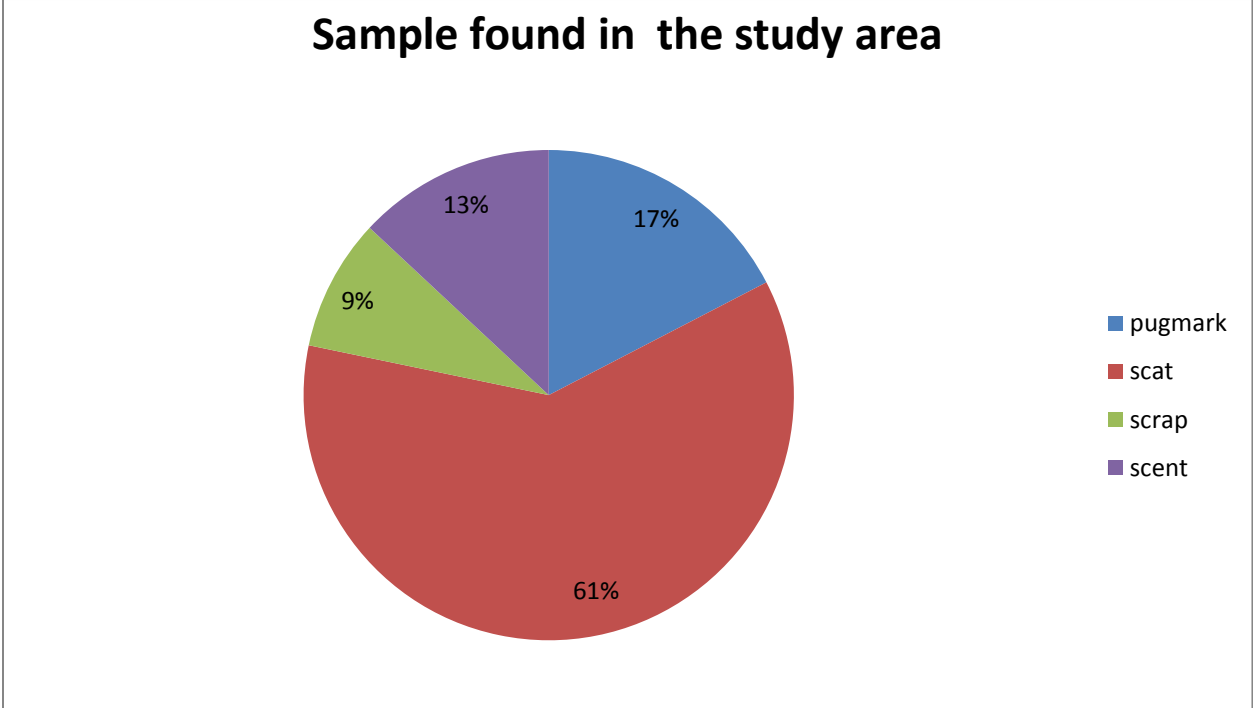
Schedule of field in Api CA study area (2018)

Date	8:00am	Ending time	working hour	Name of the Place	GPS Cordinates
19/05/2018	8:00am	4:30pm	8	Tinker village	498553/3333788
20/05/2018	8:00am	4:30pm	8	Putali Dada	500536/3333136
21/05/2018	8:00am	4:30pm	8	Gumba	502519/3331821
23/05/2018	8:00am	4:30pm	8	Rakang	493243/3332964
24/05/2018	8:00am	4:30pm	8	Gaga	489137/3332477
26/05/2018	8:00am	4:30pm	8	Changru	488760/3333140
28/05/2018	8:00am	4:30pm	8	Syankhar	502849/3329995
29/05/2018	8:00am	4:30pm	8	Check Post Tinkar	500673/3333405
31/05/2018	8:00am	4:30pm	8	Dhonghang	502040/3335141
01/06/2018	8:00am	4:30pm	8	Apinampa/Gaga Post	489493/3332200
02/06/2018	8:00am	4:30pm	8	Nampa	492763/3328337
03/06/2018	8:00am	4:30pm	8	Tipal Chyakti	487369/3332342

## 6. RESULT

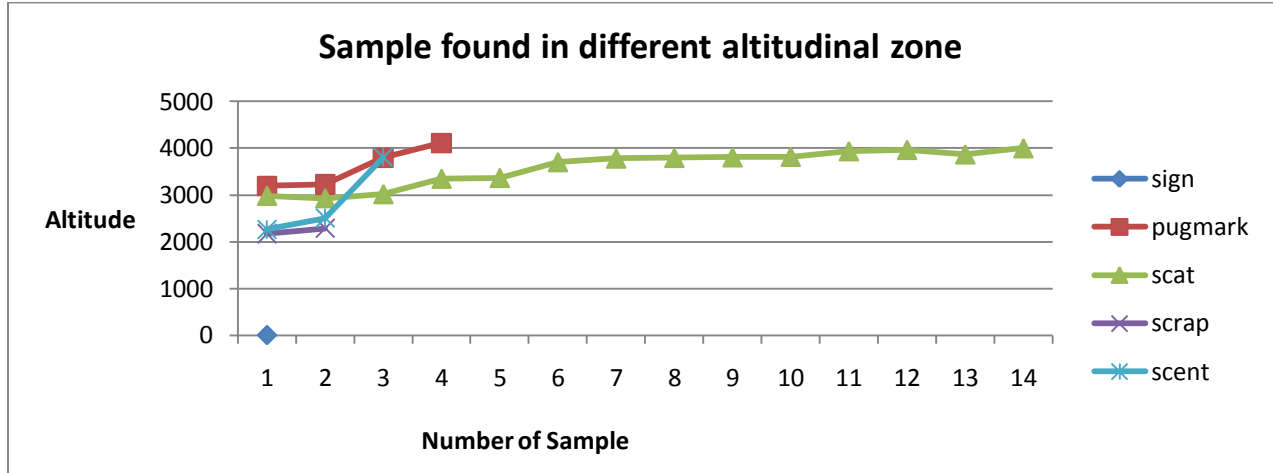
### 6.1. Sign distribution in the study area

Of the total sample collected from the study area, 61% were scat, 17% were pugmark, 13% were scent and 9% were scrap.



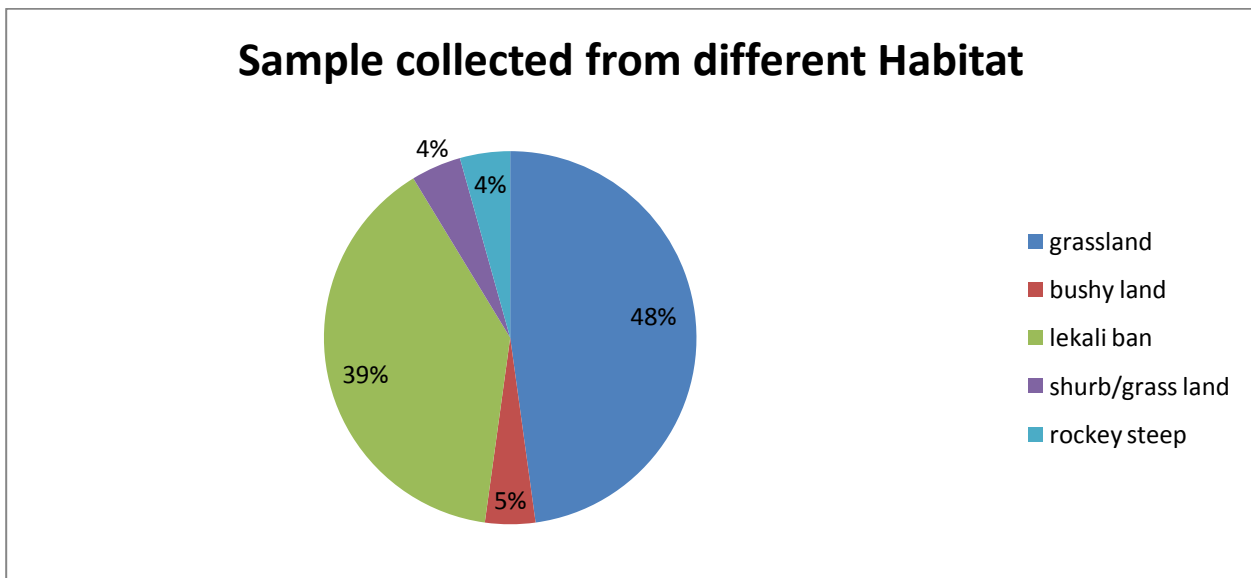
## 6.2 Sign Distribution According to Altitude

Most of sample collected from the study area were from 2100 m to 4400m altitude. Pugmark of the were found in the highest elevation. Scat were found in the range of 2900m to 4000m elevation.



## 6.3 Signs of snow leopard according to Habitat

Cats marked preference forwards the very broken and moderately broken land from or ruggedness in Api Nampa Conservation Area. More signs of the cats were observed in grassland.



Out of total signs collection from the study area , 11 signs were collected from the grassland and 9

signs were collected from the lekali ban. While in other habitat each beared the one sign of the snow leopard.

Due to availability of more prey species in grassland and scrubland, the Snow Leopard preferred these habitats in Api Nampa Conservation Area.

#### 6.4 Pugmark/Track Seen

Pugmarks were seen in the snowy surface as well as mud, sand and loose soil around the ground and river banks. During the field study, the different sizes of pugmark were recorded inside our study block.

##### Pugmark Recorded on Study Area

Sn.	Date	Location	Size of Pugmark
1	2018/05/20	shankhar	9*11
2	2018/05/23	Gumba	8*10
3	2018/05/27	Putali Dada	7*9
4	2018/06/02	Rakang	10*11

#### 6.5 Snow Leopard Fecal Samples

The scats observed were noted down along with transects. The scats samples were mostly from the Lekali ban and grassland.

##### Fecal Samples

sign	GPS Location		Elevation	Habit Type	Aspect	Slope
	X	Y				
scat	484785	3329375	2981	lekali ban	N	35
scat	486314	3332083	2929	lekali ban	W	35
scat	487677	3332468	3017	lekali ban	W	30
scat	494439	3332990	3348	grassland	S	35
scat	495413	3333099	3366	grassland	S	30
scat	495053	3333787	3706	grassland	S	20
scat	500536	3333136	3783	grassland	W	30
scat	501967	3332289	3797	grassland	W	30
scat	502519	3331821	3809	grassland	W	30
scat	502660	3331356	3820	shrub/grassland	W	30
scat	502911	3329854	3941	steepy rocks	N	35
scat	502925	3329776	3969	bushy land	N	45
scat	500906	3333693	3873	grassland	S	25
scat	501201	3334318	4004	grassland	W	30

## 6.6 Density of sign distribution

To know the status of the snow leopard, the density was calculated using the following formula.

Density = No of sign collection in the total sample plot/Total area of all sample plot

Here,

Sample Plot Area =  $500 \times 10 \text{ m}^2$

Number of Sample Plot = 25

Sample Plot Area =  $500 \times 10 \times 25 \text{ m}^2 /$

Density =  $23 / 500 \times 10 \times 25 \text{ m}^2$

= 0.000184

=  $0.000184 \times 1000 \times 1000$

= 184 no/km<sup>2</sup>

According to the data collection from the field, 184 signs were found in the periphery of 1 km<sup>2</sup>. It has shown that there are high density of species however it is difficult to find out how many signs strongly belongs to snow leopard. It is assumed that there must be the presence of snow leopard in Appi Nampa Conservation Area.

## 7. DISCUSSION

### 7.1 Habitat and Distribution

Snow Leopard, once plentiful in northern mountains has now heading towards crisis and vanishing from many parts of their former areas due to habitat encroachment and habitat fragmentation. Snow Leopard is nocturnal and very shy animal, so, the population status estimation and direct census is very difficult. Therefore, in the present study, Indirect Sign Transect method applied to estimate roughly Snow Leopard population status, habitat and distribution in Api Nampa Conservation Area.

In the present study five survey blocks were visited regularly and explored 25 transects with a total length of 12,500m (mean transect length = 500m). Inside transects, twenty total signs were identified in one visit.

The Snow Leopard population and distribution were estimated by radio- telemetry and camera trap methods. Shah (1983), Jackson (1996), Jackson and Ahlbom (1998) used radio-telemetry to explore home range, movements and habitat use of Snow Leopard in North Western Himalaya of Nepal. Snow Leopard has been radio tagged in other parts of Nepal (Oli 1994), India (Chundawat 1992) and Mongolia (Schaller et al. 1994). However, information has been severely limited by a small sample size (1-3 individuals) or short periods of monitoring (all less than 3 months).

Camera trap method also used for estimating the population of the animals, photo capture technique are being increasingly used to study solitary and secretive (Carbon et al. 2001), but little effort has been invested in seeing whether such techniques could be employed successfully to study Snow Leopard (Spearing 2002). In the present study, three camera traps were used to capture the photos of Snow Leopard habit. In our case, out of 6 film roll (216 print) camera captured 7 pictures of Red Fox, 2 of Marmots, 13 of domestic horses, 20 of Yaks, some with curious scenes and remaining pictures were of snowfall. Many biologists had used camera trap method for tiger census too.



Ruggedness of the topography was common feature in breaking the sing of Snow Leopard in present study and in Mongolia too. Present study showed that 52.5% of signs found in moderately broken followed by very broken ruggedness (36.6%), slightly broken (8.8%), rolling (2.2%) and flat (1.1%) which is approximately similar and near about to the study of McCarthy and Munkhtsog (1995) in Mongolia. They found 57.3% signs in moderately broken terrain, followed by very broken (24.5%) and slightly broken (13.8%). Transects were not randomly distributed within Snow Leopard range, rather these are placed in habitats where Snow Leopard signs were likely to find. The depredation hotspots were most likely to be located in moderately broken terrain within 100m of a cliff, near a vegetation edge (Jackson 1996). Present study also suggested that Snow Leopard properly used moderately broken and slightly broken ruggedness.

## 7.2 Threat to Snow Leopard

Majority of the research projects investigating the ecology of a number of endangered wildlife species have been focused largely to population studies. Quantification of the habitat types inhabited by them has not received in equal attention. This Snow Leopard study has been and effort in providing base line data describing complexities of the habitat and interaction between wildlife and human. With a better understanding of the relationships that exist between the habitat and wildlife, it would be a pragmatic approach in habitat management for the conservation of endangered fauna. Specially, when we discussed on carnivore species, then the prey species characterization needed. So the habitat of the Snow Leopard and its prey species need to protect because overgrazing and the consequent cattle trails have been found to have adverse effect on its habitat. It is then likely that prey species is being affected in their abundance and mobility.

Livestock farming has been found to be the main source of the economy of the local inhabitants. Dairy Development Co-operation has done a major investment for the production of cheese inside the park area. Every year, in summer, the locals take the cattle gradually higher up in search ample of grazing land. Thus, there is no place at any elevation that is untouched by the cattle and the people (plate....).

The teashops and hotels inside the Api Nampa CA facilitate the general tourists, trekkers, pilgrimage and mountaineers. It definitely enhances the economy of locals but this income seems not equivalent to the cost of the native vegetation that the teashops and hotels used as timbers and firewood. Such activities directly affect the habitat of many endangered and protected species ultimately loosing them permanently. Every year, local herder practices the shifting of the grazing ground for their cattle, which are located in distance from previous one. This practice compelled them to cut down trees for creating the cowshed (Goth) that is actually a highland shelter for the local herders. Therefore, the highland meadows and forested areas perceive double pressure, grazing and deforestation. The depletion of grazing land and its volume effects the survival of wild grazer species while deforestation causes the loss of hide out to many animals. Loss of grazing land means less food for grazers, it directly affect the number and health of herbivore of the area. Thus, their number will decline rapidly which is also the loss of prey food, e.g. Himalayan tahr, musk deer, Ghoral, Serrow, etc..

Large ungulates have been hunted out of many areas of the high Central Asian Mountain (Jackson 1992). Pika and marmot-poisoning program on and large scale of have been conducted on Tibetan plateau. Livestock population trends to be grater in areas of Tibetan Plateau where Wild Sheep and Goats population have been depleted (Millar and Jackson 1994).

## **8. CONCLUSION**

Api Nampa Conservation area has provided good habitats for Snow Leopards and its prey and other endangered wildlife species. Out of 23 total signs collected from the study area, 14 were the scat of the snow leopard, four were the pugmark, other are the scrap and scent marks. these all signs were collected during the field visit. Most of the signs were recorded between the elevation of 2900 m to 4000 m. More than five scat were recorded in Putalidada Tinker.

The future of Snow Leopard in Api Nampa Conservation area seems uncertain. Because of livestock depredation by Snow Leopard, local people have negative attitude and wanted to eliminate it. To rise the positive attitude about Snow Leopard, Conservation education was conducted in the local schools and even to herders to their herd sides (Plate ...). Illegal hunting of Snow Leopard and its prey species (i.e. Himalayan Thar and Musk deer), overgrazing, habitat destruction for fire wood and timbers, shifting grazing practices were the major threat to this endangered species the Snow Leopard and its prey species. Clear cut decision about the status of Snow Leopard and its prey species inside the ANCAP specific policies and plan for the management of this species are essential to reduce the conflicts and maintain harmony between Snow Leopard and local herders.

## **9. RECOMMENDATION**

The information presented in this report relates to Snow Leopard and its threats. From the present study one can suggest the following recommendation as a solution to the problems.

1. Strengthening national legislation and conservation policies

The government should address any gaps in legislation to ensure that Snow Leopards are fully protected by law. To provide full legal protection for Snow Leopard, government should ensure that legislation specifically out laws hunting. Possession, sale are trade of Snow Leopards including all their parts, derivatives and products made from these and that the legislation is applicable to all regions of the country, including those where Snow Leopards do not occur.

2. CITES parties, the CITES secretariat inter governmental organizations and NGOs should offer advice and assistance to relative authorities in revising or drafting legislation relevant to the protection of Snow Leopards.

3. Strengthen trade controls on known trade routes, at black markets and cross border points.

Field patrolling is difficult in many areas of Snow Leopard's range however known trade routes, wildlife black markets and important border cross Signs e.g. Nepalese Chinese border, Nepalese Indian border, should be regularly controlled by efficiently equipped and trained staff.

4. Illegal hunting from the park security person should be stopped.

5. Regular monitoring of major markets and known trade centers Governments in co-operation with NGOs, should regularly monitor markets and other locations where Snow Leopard skins and other products have been frequently offered, most notably markets and tourist stops in Nepal (Kathmandu) and china.

6. Herding practices : Government should co-operate with communities and NGOs at local level to encourage herding and guarding practices that reduce depredation Snow Leopards and other predators.

7. Assistance should be made to local communities in the construction of predator proof corrals night shelters and other means of livestock protection.

8. Governments resource managers, conservation NGOs and development agencies should undertake efforts that will help to promote livestock grazing practices that reduce impacts on native wildlife.

9. Scientific and other relevant institutions should compile information on the levels and impact of illegal hunting and or unregulated hunting of wild ungulates and other Snow Leopard prey species.

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