A Final Report on

"Human-Snow Leopard (*Panthera uncia*) Conflict in Northern Nepal-Dolpa"

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Executive Summary:

Snow leopards (*Panthera unica*) are receiving international attention as they are recognized as endangered by the IUCN through the red list process and are among the large carnivores which are vulnerable to human activities, as they require larger areas of habitat. This inevitably brings them in closer contact and therefore conflict with humans. This has been a major issue in the conservation and management of large carnivores such as snow leopard has always been a controversial subject and of great concern to conservationist all over the world. The problem is becoming severe with snow leopard predating on livestock and retaliatory killing of the predator by people. The research area lies in Trans-Himalayan range which is home to the endangered species snow leopard along with its primary prey and uniquely cultured nomadic communities practicing transhumance. Little recent scientific research has been undertaken on conflict between snow leopard and local communities in Dolpa district of Nepal. Livestock production is the major land-use in Dolpa region of the Trans-Himalaya, and is a crucial sector for the region's economy. Although conflict between human and snow leopard has been studied elsewhere in the Trans-Himalaya, knowledge on this aspect in the Shey Phoksundo National Park and its Buffer zone in Dolpa region is still rudimentary. As Dolpa is located in most remote and rural area of Nepal no adequate research has been conducted on ways and means to improve snow leopard conservation. The proposed research presented here is crucial to generate better, more detailed information on reasons for conflict between locals and snow leopard, which will lead to reduction in conflict and more effective conservation planning.

The project **Human-Snow Leopard (*Panthera uncia)* Conflict in Northern Nepal-Dolpa** was designed primarily to generate better, more detailed information on reasons for conflict between locals and snow leopard, which leads in reduction to conflict and more effective planning. Major three objectives this project aimed to overcome were to increase the understanding on human-snow leopard conflict hotspots, perception of local people towards conflict and conservation of snow leopard in the remote area of Dolpa district of Nepal. To investigate human-snow leopard conflicts in the Dolpa district, we conducted household interviews about livestock depredation, overall attitudes towards snow leopards. We found that within the seven years of time (2012 to 2017 BS), total 422 livestock (in average 60/year) were killed by snow leopard. The analysis revealed that the conflicts occurred highest in the Kaigaun VDC followed by Bhijer VDC where the livestock depredation was highest among all surveyed area. It shows that there exist a high conflict between snow leopard and local community which means retaliatory killing of snow leopard might increase. We recommend a multi-pronged conservation program that includes compensation, insurance programs, and training local veterinarians to reduce livestock losses.

Objectives:

Little recent scientific research has been undertaken on conflict between snow leopard and local communities in the Dolpa district of Nepal. A community discussion conducted by me in 2011, regarding snow leopard and conflicts with local community in the Rigmo village development committee has reflected a need for additional research and community awareness rising in other

areas of the Shey Phoksundo National Park and its bufferzone. This proposed project enhanced our understanding on:

- human-snow leopard conflict;
- perception of local people towards conflict; and
- conservation of snow leopard in the remote Dolpa district of Nepal.

These three objectives were achieved by engaging local communities through a questionnaire-based Delphic type survey, and by promoting awareness of the snow leopards an endangered species, but also as a key species in ensuring the ecosystem health of the whole mountain ecosystem in Nepal and other parts of the Himalayas. It also helped in developing future planning for the conservation of this endangered species in the Dolpa region. Because government agencies and non-governmental conservation organizations have focused their attention mainly on accessible regions, areas such as the Dolpa region, that are remote and rural and have considerable extent of critical snow leopard habitat, are often not even in the priority list of conservation action.

Methods:
Study Area:

Dolpa (29°10'N 83°4'E), biggest district of Nepal located in Trans Himalayan zone of Nepal with elevations ranging between 1525 m to 7754 m above sea level. Dolpa holds temperate, cool-temperate and alpine climatic zones and is spread across an area of 7889 sq. km with a population of 36,700 (NPR, 2011). In the Dolpa region we can find bio cultural diversity, and yet also bio-cultural conflict. Practice of various religions such as Hinduism, Buddhism, Bonposim etc. make Dolpa rich in culture while the presence of more than 33 mammals, 260 birds species, 529 useful plant species make Dolpa a biodiversity hotspot. Phoksundo Lake is designated as a high altitude Ramsar site, further underlining the international recognition of the importance of this region.
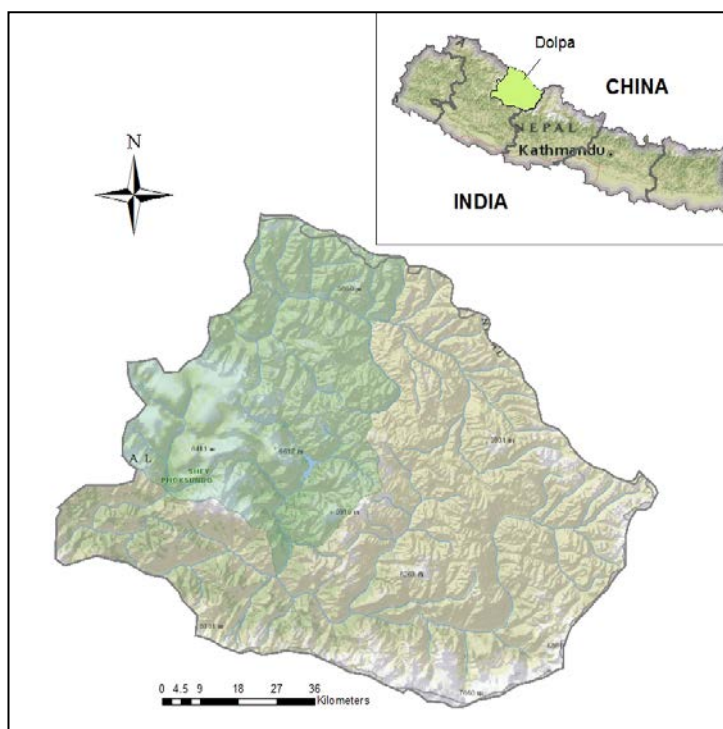

Figure 1: Map of study area.Dolpa district is located in northern region of Nepal.

3

Study Design and Questionnaire Survey:

Ethics Statement:

The household survey data used here were collected with the permission from the Shey Phoksundo National park. A verbal consent process from interviewees was used due to the low level of education of our interviewers. The verbal consent script was read to the selected respondents before conducting the survey. We continued to ask questions only when they agreed to participate in our survey.

The study was focused in the Dolpa district of Nepal (Figure 1), and built on my previous study (Upadhaya, 2011). The preliminary survey was conducted to identify the VDCs to conduct questionnaire survey. The interaction with local leaders, conservation officers, leaders of buffer zones helped us to identify the area for questionnaire survey. All activities i.e. interview surveys were carried out in these systematic grids for spatial coverage and for collecting robust socio-economic data.

A semi-structured, Delphic style household interview was conducted. The interviews were recorded for later analysis using statistical software R. The questions were focused on household economies; understanding of human- snow leopard interactions; perceptions of snow leopard conservation; understanding of conservation aims and ideas. The households were selected randomly. For each household the type of livestock kept; number and age of each livestock type thought to be lost to predation in the past year was the focus of the questionnaire. The aim was to minimize the chances of response bias.

Socio-economic variables were recorded through the interview. To assess human perception and understanding of human-snow leopard conflict, at least 10% of village households, with equal representation of all caste, sex and education levels, were interviewed.

Education and Outreach Program for Local Communities:

After assessing and quantifying the actual and likely conflict between snow leopard and people, and to produce a key conservation outcome, we designed a conservation awareness program focused for areas with highest likelihood of conflict. Where necessary, conservation awareness activities such as, displays, poems, art, essay competitions through schools were established at all the important sites of conflicts. Young people and schools were a key focus of these activities, since young people have been shown to have significant influences over parents and elder relatives, as well as themselves becoming sensitized to the issues.

Analysis:

Following Li et al.(2013), when range values (e.g. "4 or 5") for the number of livestock were given during interviews, we took an average of the numbers given (e.g."4.5"). The economic loss of livestock predation was calculated based on the average annual market prices in US dollars. Official information on market prices published by District Livestock Office was the primary source for this information. Perceptions in the community were ranked, and non-

parametric tests were performed. All statistical tests were conducted using the 'Stats Package' in version 3.1.2 of the R Statistical Computing Software (R Core Team 2014).

Results and Discussion:

We conducted survey in four village development committees (VDCs) namely, Kaigaun, Phoksundo, Saldang and Bhijer (Figure 2). The summary of socio-demographic of respondents is presented in table 1.
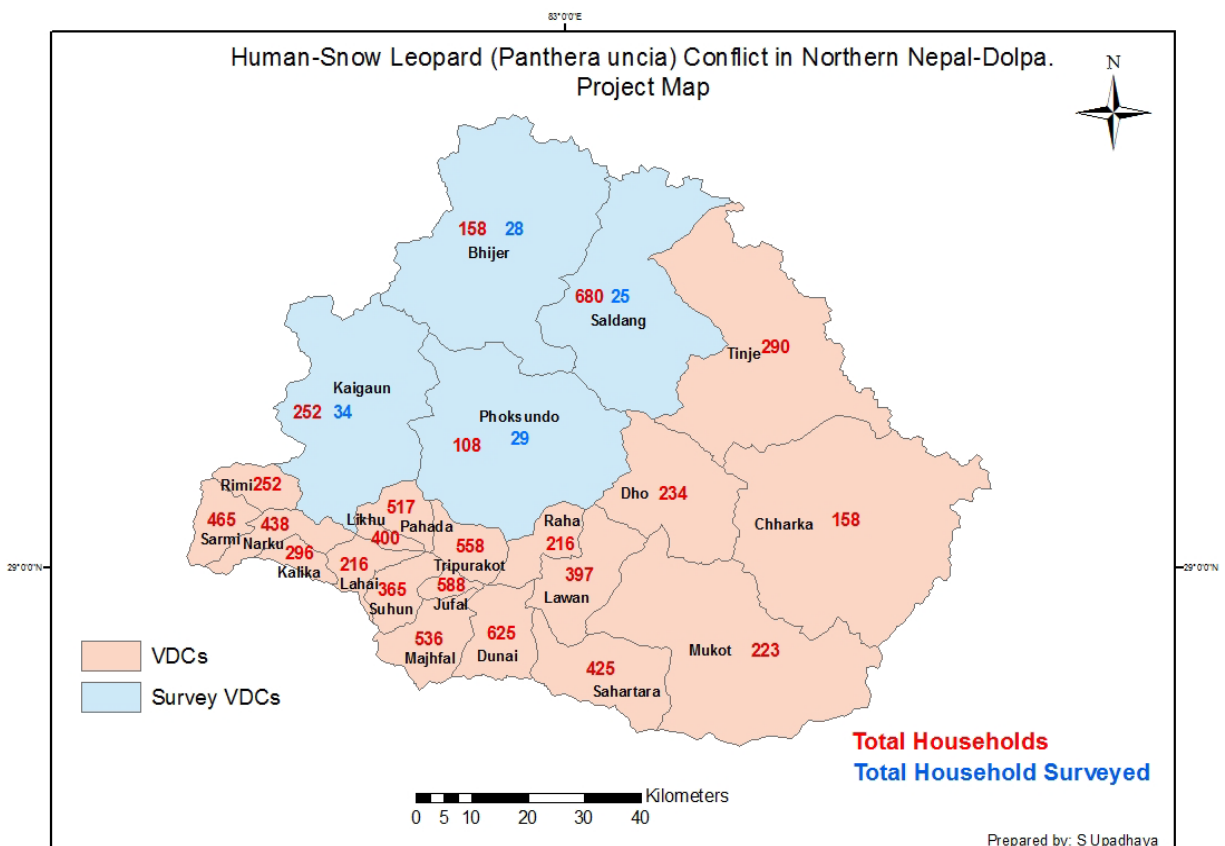

Figure 2: Village where surveys were conducted. Mainly surveys were conducted in four village development committees (VDCs): Kaigaun, Phoksundo, Saldang and Bhijer.

Table 1 Demographic information of respondents

Variables	Max	Min	Mean
Age	80	13	37.48
Family Size	15	2	5.91

The result revealed that majority of the population is practicing agriculture (livestock) followed by tourism and other business (Table 2). The average landholding size is 3.5 ropani while maximum is 41 ropani. Livestock husbandry and agriculture is the major source of income for people where more than half of the population is illiterate. The average income from livestock selling is $375/years and $444/year from agriculture. But people participating on hotel and yarchagumba (*Cordyceps sinensis*) earns more than $1000/year in average. The population involved on business is very low.

Table 2: Demographic information of respondents

Socio-economic characteristics	Total (%) N=116
Sex	
Male	65.52
Female	34.48
Occupation	
Agriculture	94.83
Business	0.86
Tourism	4.31
Major Income	
Agriculture	19.83
Business	0.86
Livestock	72.41
NTFP	2.59
Tourism	4.31
Education Level	
Educated	38.79
Illiterate	61.21

Livestock, a main source of income, is the major component of subsistence farming in the highland mountains of Nepal. More than 68% of the total households' main occupation is animal husbandry, which is more popular in the northern part of the district (Shrestha *et al*. 1998: Cited in Devkota 2010). Pastoralism and transhumance system of grazing livestock is one of the important traditional practices, which is under practice for centuries (DNPWC 2007). Trade (barter system) with Tibet used to be the dominant form of local economy. About 91% of the total households are involved directly or indirectly in agriculture and animal husbandry. But their agricultural production is not enough for more than three months. The Shey Phoksundo National Park has one of the highest altitude settlements with active agriculture and animal husbandry. As the animal husbandry is the major source of income, in average a household owns 6 yaks, two jhoppa, 2 horses and 20 goats (Table 3). Of total livestock holding, only 23% of respondents' livestock were insured.

Table 3 Size of livestock holdings

Livestock Types	Mean	Max	Min
Yak	6	45	0
Jhoppa	2	12	0
Cow	0	15	3
Horse	2	11	0
Goats	20	150	0

The survey revealed that the livestock holding is decreasing due to various factors. When asked to rank the reason for livestock decrease, majority of respondents ranked snow leopard as the major cause of their livestock depredation (Table 4).

Blue sheep and domestic stock are widely and sympatrically distributed throughout the Trans-Himalaya (Schaller 1977 & 1998). Blue sheep are considered as an important prey for snow leopard in Nepal and elsewhere in the Himalayan region (Oli *et al*. 1994). While domestic stocks are the integral parts of local subsistence livelihoods the controversy surrounding the issue of inter specific competition has been bottleneck for effective multi-species range management in Trans-Himalaya and elsewhere (Shrestha and Wegge 2008).The research revealed that there exist a high conflict between snow leopard and local community. Within the seven years of time (2069 to 2073 BS), total 422 livestock (in average 60/year) were killed by snow leopard. The analysis revealed that the conflicts occurred highest in the Kaigaun and Bhijer VDC (Figure 2) where the livestock depredation was highest among all surveyed area.

Table 4: Major causes of livestock depredation

Cause	Rank	% of respondents
Snow Leopard	1	44
Accident/Weather	2	25
Other Predators	3	17
Disease	4	14

Conservation Awareness:

School level conservation awareness and community conservation awareness programs were conducted during the project time period. As our preliminary analysis revealed that Kaigaun VDC posses high conflict, the conservation awareness was conducted there.
Also we conducted conservation awareness program in Dunai Boarding School located in district head quarters**.** During the time period of Cordyceps collection we felt it would be very effective to conduct awareness program focusing the students from Dolpa. We conducted different Snow leopard conservation awareness programs in Dunai Boarding School and Kaigaun VDC.

Essay competition:

Essay competition with a topic "Importance of forest" for students of grade three to seven was held. During the competition, the point of view of the students regarding the forests, its uses,

causes of destruction and importance of forest for important wild animals like snow leopards etc were clearly imprinted in their works. The names of the winners of essay competition are Anju Bhusal (grade three), Anjali Bhusal (grade four), Yuddha Budha (grade five), Prabek rokaya (grade six) and Prashant K.C. (grade seven).

Site visiting and live drawing competition:

A short visit to Jairigadh Hydroelectricity Head Point was organized to the students of grade six and seven along with three teachers with a motive of refreshment and developing visualization capacity of students. After the visit, a drawing competition based on the views they say was conducted with an aim of developing their visualization capacity and drawing skills. The winners of the competition were Yangyal Rokaya (grade six) and Rekha Sunar (grade seven).

Poem competition:

A topic "Tree" was given as a topic to write poem for the students of grade three to grade five and "wild animals" was the topic for the students of grade six and seven for the poem competition. Poetic side of the students was lightened during the program. Variations of views of the students expressed in the poems were proved to be of higher level than the expected. The winners of the competition were Anju Bhusal(grade three), Anju Bhusal (grade four), Yuddha Budha (grade five) and Mausami Malla(grade six).

Discussions:

Conservation and management of large carnivores has always been a controversial subject and of great concern to conservationist all over the world. Predators play a definite role in the dynamics of an ecosystem. The snow leopard (*Panthera uncia),* a flagship species of the mountain ecosystem is also considered as a "barometer" for assessing environmental health and biodiversity conservation in high mountainous areas. However, the number of snow leopard is declining because of habitat degradation and fragmentation, reduction in natural prey due to illegal hunting as well as competition with livestock, retributive killing of snow leopard, and lack of awareness and trans-boundary conservation efforts (McCarthy and Chapron 2003).Shey Phoksundo National Park constitutes a perfect habitat for the snow leopard's natural prey blue sheep but the interaction between livestock and blue sheep has never been assessed. Remoteness of Shey Phoksundo National park and busy schedule of local communities due to Cordyceps harvesting seasons were challenging to accomplish project activities which have demanded more time and efforts. The conflict exists in the area, Snow leopard is not only species causing damage to livestock but also other predators (wolf) are also causing damage to different types of livestock. Dolpa is the transition zone between Tibetan plateau and the Himalaya and represents the vast and unique grazing ecosystem, which harbors magnificent herbivores. Shey Phoksundo National Park lies in Dolpa in the Western Trans Himalayan region of Nepal and provides a good habitat for snow leopard, but illegal hunting, human-wildlife conflicts, and degradation of habitat still are potential threats. Livestock production is the major land-use in Dolpa region of the Trans Himalaya, and is a crucial sector that drives the region's economy (Bauer 2004). As the rangelands of Dolpa are characterized by low primary productivity (Bauer, 2004) there is

widespread transhumance, and wild herbivores compete with the burgeoning livestock on these impoverished rangelands (Mishra *et al*. 2002).

Mass awareness on the importance of preserving wildlife is critical for success and sustainability in conservation. Various conservation education, awareness campaigns and outreach programs have been conducted targeting a wide range of audiences from the grassroots level including local communities and schools, to policy and decision making level (DNPWC. 2017) The level of awareness is low in local people and they are not aware about insurance program because of which very low number of respondents is participating on insurance program. The livestock owners are requesting for insurance program in their area.

6. Photographs:

Photo 1: Snow leopard's main prey: Blue Sheep.

Photo 2: Community residing in Snow leopard's prime habitat.

Photo 3: Livestock grazing in pasture land.

Photo 4: Livestock grazing in high altitude grazing lands.

Photo 5: Interviewing livestock herders.

Photo 6: Temporary settlements for Cordyceps collection in high altitude, which is prime habitat of Snow leopard.

Photo 7: Student learning about importance of snow leopard and its habitat.

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