Conservation Science

Status and trends of human-wildlife conflict: A case study of Lelep and Yamphudin region, Kanchenjunga Conservation Area, Taplejung, Nepal

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Summary

Aim Human-wildlife conflict is one of the major challenges in Kanchenjunga Conservation Area. It may erode public support in wildlife conservation. Here, we review the extent to which wildlife damages livestock and crops.

Location Lelep and Yamphudin region, Kanchenjunga Conservation Area, Taplejung, Nepal

Materials and methods The study employed a combination of surveying methods such as focus group discussion, key informant interview and field observation from 21 July to 06 August 2013. Focus group discussion was done primarily with the representatives of snow leopard conservation committee in Lelep and Yamphudin.

Key Findings Livestock depredation in Ghunsa valley, Lelep village development committee was increasing with an annual average loss rate of 11% in ten years (2005-2014). Despite community-based insurance schemes, loss has increased to 28% from 17.2% in 2014. No retaliatory killings of snow leopards were reported since 2005, which may be attributable to the insurance scheme. In Yamphudin, the average annual livestock loss rate was 4.7% from 2005 to 2014, mostly by wild dogs. Similarly, crop damage was a severe problem in Yamphudin, mostly by the Himalayan black bear, palm civet, barking deer, rhesus monkey and porcupine.

Conservation implication Although strict guarding was effective to reduce conflict, alternative strategy is needed that requires minimum human involvement. Premium and relief amount is inadequte. It therefore needs a thorough revision. Predator proof corals in Lonak, Dhudhpokhari, Ramjer and Dasa pasture can be effective means to reduce the potential conflict.

Keywords Human wildlife conflict; Insurance scheme; Livestock depredation; Snow leopards; Wild dogs

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Introduction

Human-wildlife conflict is a phenomenon where wildlife negatively impacts on human wellbeing or when the actions of people are detrimental to the survival of wildlife (Madden 2004). Humans have directly impacted upon wildlife in many areas of Nepal by the destruction, degradation and fragmentation of wildlife habitats through activities such as logging, animal husbandry, agricultural expansion, and developmental projects (Fernando et al. 2005). The human wildlife conflict has even greater consequences for mega species such as wild elephants (*Elephas maximus*), rhinoceros (*Rhinoceros unicornis*) and big cats that require large quantities of food and extensive home ranges. However, human wildlife conflict is not only confined to lowland area but also can affect mountain communities in Nepal. Conflict with rural communities due to livestock depredation by large carnivores such as snow leopards (*Panthera uncia*), wild dogs (*Cuon alpinus*), common leopards (*Panthera pardus*) and wolves (*Canis lupus*) has risen sharply in recent years (Jackson et al. 1996). Likewise, crop damage is a common issue in Himalayan caused by barking deer (*Muntiacus muntjak*), Himalyan black bear (*Ursus thibetanus*), Himalayan palm civet (*Paguma larvata*), porcupine (*Hystrix indica*) and monkey (*Macaca mulatta*).

The snow leopard (*Panthera uncia*) is categorized as Vulnerable on the IUCN Red List (IUCN 2017). It is widely, but sporadically and sparsely distributed throughout the alpine ecosystems of the Himalayan mountain range (Nowell and Jackson 1996); approximately 4,000-5,500 meters above sea level (**Figure 1**). The snow leopards at times, kill livestock as in Himalayan, there is a transhumance herding practices where herders bring their livestock to a summer and winter

pastures, far from settlements, within the home range of snow leopard. Occasionally, conflict takes the extreme form. Instances of "surplus killing", in which as many as 100 sheep and goats are killed in a single night, has inevitably resulted in attempts at retaliatory killing of predators by herders suffering significant loss (Jackson et al. 1996). Nepal and India have taken steps to resolve human wildlife conflict by initiating state-sponsored compensation schemes. While several authors have acknowledged the importance of compensation schemes in achieving the double aim of alleviating farmers' economic hardships and conserving the snow leopard, they underline that, in most cases, the schemes have failed, seemingly due to the lack of an effective mechanism to prevent farmers from fraudulently claiming losses (Hussain 2000). Livestock depredation by the snow leopard is an increasingly contentious issue in Himalayan villages including Ghunsa, Phale, Gyabla, Bhotegaun of Kanchenjunga Conservation Area. Snow leopards are found in all four blocks in Kanchenjunga Conservation Area. Among four blocks, Khambachen block of Ghunsa is identified as a hotspot. Snow leopards have been reported to depredate yaks (*Bos grunniens*), yak hybrids and *urang*, hybrid of female yak and ox thus adversely impacting on the livestock assets of farmers.

Kanchenjunga Conservation Area is the first conservation area in Nepal that has been managed by local body. It entails that management responsibility of Kanchenjunga Conservation Area was handed over to local body by Nepal government as per the protected area legislation. Kanchenjunga Conservation Area Management Council, local body collects the tourist entry fee, conserves the natural environment and implements livelihood improvement programs for local communities.

Materials and Methods

Study area

Lelep and Yamphudin village development committees were identified as study areas in consultation with Kanchenjunga Conservation Office and Kanchenjunga Conservation Area Management Council (**Figure 2**). Kanchenjunga Conservation Area Management Council is the local body entrusted by law to manage the conservation area. Lelep is the largest village development committee and covers 825km^2. The Kanchenjunga Conservation Area is rich in natural resources and includes Mount Kanchenjunga, the third highest mountain in the world (8,586 masl). The total population of this village development committee is 2,205 (CBS 2011). In the upper belt of Lelep, the Snow Leopard Conservation Committees have been implementing community based livestock insurance scheme to reduce conflict between snow leopards and yak herders. Amjilesa, Gyabla, Phale and Ghunsa villages were covered by this scheme. Yamphudin is the third largest village development committee with the population of 730 (CBS 2011) and Bhotegaun village of this development committee was included in study. Yamphudin area is drained by the Kabeli river which meets with Tamor, the major tributary of Koshi.

The primary economic activities of Ghunsa valley are livestock herding. Hooker (1854) reported that livestock rearing dates back to 150 years because of the abundant pastures. Thus, livestock continues to be a major source of livelihood for herder communities in Ghunsa. However, in recent years, villagers have shifted towards tourism as an alternative source of income. Livestock farming in the Himalaya is the integral of farming system as it provides farmers with manure and drought power. In addition, herders derive income from butter/ghee and dry, hard curd cheese called chuurpi locally made out of milk. Yak/chauri/urang/sheep are the common domestic stocks.

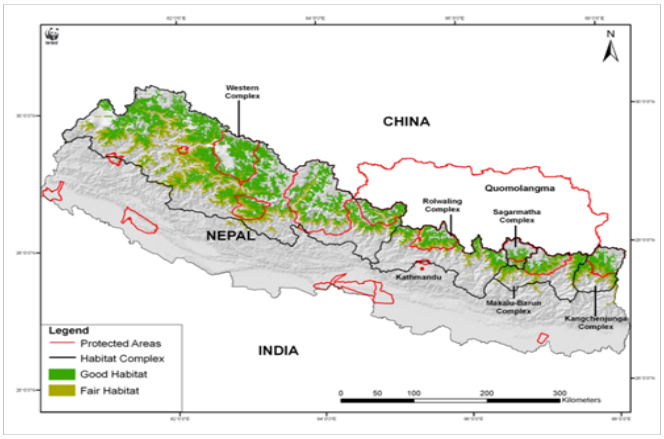

Figure 1 Snow leopard conservation complexes in Nepal (Adapted after WWF Nepal 2011)

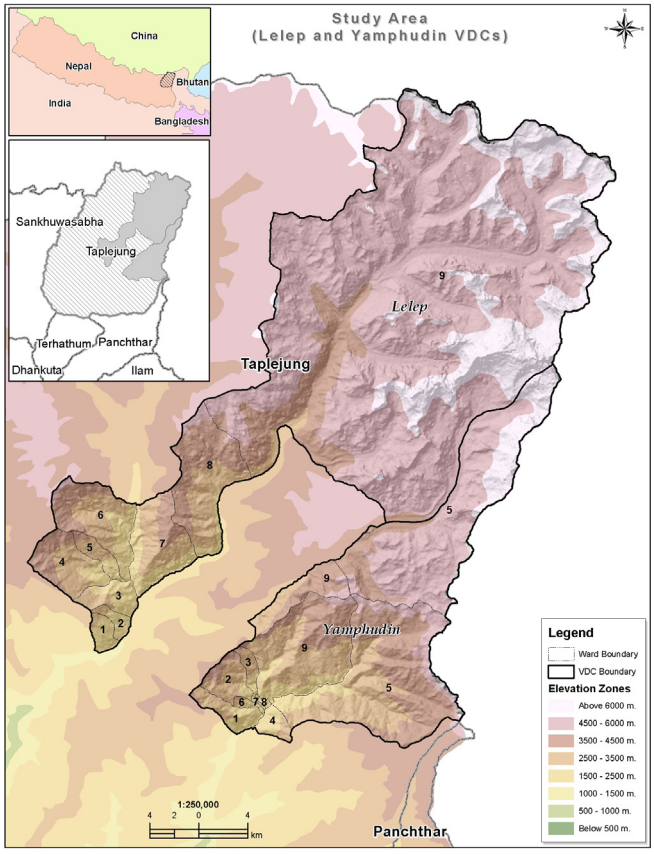

Figure 2 Location maps of study areas in Lelep and Yamphudin region, Kanchenjunga Conservation Area, Taplejung, Nepal

We conducted field surveys from 21 July to 06 August 2013. The survey methods were primarily focus group discussion, key informant interview and field observation. Focus group discussions were conducted with the Snow Leopard Conservation Committee in Lelep and Yamphudin to obtain the trend of livestock depredation, number of household participated in livestock insurance scheme and number of livestock killed by snow leopards. The Snow Leopard Conservation Committee administers a community based insurance scheme. This is a scheme to offset the certain loss caused by snow leopards. To be entitled for relief, herders need to pay

an annual premium of NPR. 100 (USD 0.98) and receives NPR 3,000 (USD 29.4) as a relief amount if registered livestock is killed by snow leopards. The exchange rate of one US dollar equivalent to Nepali currency 102 was used in the calculation.

Similarly, few herders and chairperson of Snow Leopard Conservation Committee were interviewed followed by the observation of winter pasture in Khambachen (4,020 masl), summer pasture in Ramtang (4,370 masl). All the livestock during field visits were in Ramtang. Eight temporary tents of herders were counted with hundreds of yak/chauri and their calves grazing in a vast alpine meadow. At the back of each tent, there was stone corral to fence the calves of 1-3 years while adult yak/chauri/urang were left in the meadow during night. Few watch dogs were also sighted which were used as an early warning system. Conflict hotspot map for human wild dogs was prepared jointly with Snow Leopard Conservation Committee, Yamphudin.

Figure 3 Summer pasture for yaks, Ramtang (4,370 masl)

Results

Livestock Depredation in Ghunsa valley, Lelep village development committee

Snow leopards negatively impact yak herders of Ghunsa valley (personal comm. with Himali Chungda Sherpa). Ghunsa valley comprises Ghunsa, Phale and Gyabla villages in Lelep village development committee. There are approximately 509 yak/yak hybrids from 39 households in Ghunsa valley (Field Survey 2013). All herders are Sherpa. We visited the summer pasture of Ramtang (4,370 masl), in the upper valley of Ghunsa to interview yak herders (**Figure 3**). There were eight livestock sheds in this pasture area.

As per the outcome of interview with yak herders, domestic stock kill is being increased in recent years. Despite herder's guarding, it was difficult to prevent attack in the vast meadow as informed. Snow Leopard Conservation Committee records confirm the herder's perception. It indicates the average loss of 11% of yak/chauri/calves in ten years (2005-2014). The average loss rate in the first five years (2005-2010) was only 4.7% indicating an increase in livestock loss in recent years (**Table 1**). Prior to 2005, Gurung et al. (2011) recorded yearly losses of 11 yak calves in Ghunsa. The increasing depredation trend exists despite numbers of snow leopard's natural pray; Himalayan blue sheep (*Pseudois nayaur)* is increasing. As per the record of Kanchenjunga field office, an estimated number of individual blue sheep is 1,372 in 2010.

The number of livestock covered by the insurance scheme increased up to 2009-10 but declined slightly in 2010-11 since herders from Phale sold livestock to Tibetans and the livestock insurance scheme could not be transferred as buyers were not local. This number again increased reaching a peak in 2013-14. However, there was a significant drop in numbers in year 2014-15 (**Table 1**).

The prey most vulnerable to snow leopard depredation was found to be two varieties of calves of 1-3 years of age. Firstly, the hybrid between female yaks and Tibetan bulls is known locally as *Ghokpe*. The hybrids born in spring are usually sold during the autumn of the same year for up to NPR 35,000 (USD 343) (Ikeda, 2004). The second variety is the offspring of female male yak and generally remains in the herd as 'movable property'. These calves are locally known as *Yakpe* and have a lower value than *Ghokpe*. The most expensive stock is a male yak. In 2013, the market price of male yak was NPR 52,500 (USD 515). During winter, due to lower availability of grasses, calves are weak and become easy prey to snow leopards. Strict guarding of these calves is necessary particularly during winter and calving seasons.

Livestock depredation mostly occurs around cliffs, broken rocks, ridges and depressions (personal comms with Himali Chungda Sherpa). Sites with moderately broken terrains are as the predominant kill sites suggesting that livestock are more vulnerable to depredation when grazing in or near such topographic features. Jackson et al (1996) reported a significant higher kill sites within 100 m of a cliff.

As a response to livestock depredation, the community based livestock insurance scheme was piloted in December 2005 by WWF Nepal in cooperation with management council (Gurung et al. 2011). Prior to 2005, there were occasional cases of retaliatory killing of snow leopards which was completely controlled since then. The success of controlling retaliatory killing is attributed primarily to insurance scheme and strict law enforcement. It is important to note that goats and sheep are not covered by insurance scheme.

Table 1 Livestock Insurance Records, Ghunsa (SLCC, Ghunsa)

	Fiscal year (15 July- 14 June)									
Descriptions	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Participating Household Number	18	23	36	40	43	33	33	33	41	44
Numbers of livestock insured	382	397	530	539	557	483*	515	509	542	360
Claim number	4	10	24	33	51	58	70	79	93	101
Annual loss rate (%)	1.0	2.5	4.5	6.1	9.2	12.0	13.6	15.5	17.2	28.1
Premium collected (NPR)	21010	21835	29150	29645	30635	26565	51500	50900	54200	36000
Premium Collected (US dollar)	206	214	286	291	300	260	505	499	531	353

*the reduction in the number of livestock covered by insurance scheme in 2010-11 was due to the sale of yak and chauri to Tibetan people from Phale village

Livestock Depredation in Yamphudin, Kanchenjunga Conservation Area

Wild dogs (*Cuon alpinus*) were found to be the most problematic predator in Yamphudin area. 11 wild dogs were sighted in Phedikhola in 1993 (personal comm. with Tchurim Sherpa). According to local perception, wild dogs might have existed in this locality for at least 25-30 years. Wild dog kills cow and urang easily as latter are the easy prey. April and May are comparatively riskier from wild dogs as these months are the calving period and livestock move far from settlements. Wild dogs are social hunters capable of feeding wide range of prey from small to very large and therefore the intensity of kill is great.

The record of the Snow Leopard Conservation Committee of Yamphudin indicates that 7-8 Urangs were killed by wild dogs from 2012 to 2013 in Barule pasture. Barule pasture is the conflict hotspot where herders bring their stocks for foraging. Similarly, one chauri calf was killed in 2012 in Samiya Deurali while two chauri calves were killed in Lase Danda in subsequent year. Likewise, the loss rate of stock due to wild dogs steadily increased from 2005/06 to 2010/11 and then sharply increased to 8.9% and 11.8% in next two years (**Figure 4**). It then drops slightly to 10.5% and 6% in 2013/14 and 2014/15 respectively. The second five year witnesses the increasing trend of conflict than the first five year.

Researchers did not have evidence if predators were wild dogs for a long time. This problem was solved in August 2010 when researcher Ambika Khatiwada confirmed the existence of wild dogs using the camera trap method in Samiya Deurali (3,759 masl). Local herders assume that wild dogs travel approximately 40-50 km per day. These animals reach as far as Tcheram from Yamphudin in one day and appear in Yalung next day. However, the reliability of this information should be checked whether it is the same individual or from another group. Khatiwada (2011) reports that wild dog signs were most commonly recorded at 3,000-4,000 m elevation and found along the human/grazing trails and edge of the mountain. The highest elevation where sign of wild dog found was Mathaba Bhanjyang (4,350masl).

Local people estimated that there are 4-5 groups of wild dogs. Each group might have 7-8 individual dogs. These dogs move frequently across Barule pasture, Lase danda, Samiya deurali, Harkati and Pathibhara. A conflict hotspot map for wild dogs was prepared with herders (**Figure 5**).

Crop damage in Ghunsa Valley, Kanchenjunga Conservation Area

Ghunsa Valley comprises of four main villages viz. Amjilesa (2,393 masl), Gyabla, Phale and Ghunsa. Out of which, Ghunsa village did not report crop damage incidence as crop fields are well surrounded by the settlements. Moreover, Ghunsa is the clustered village with 40 households of ca. 500 people. Amjilesa, a scattered small village situated at the eastern aspect overlooking Ghunsa river is impacted by Himalayan black bear and Himalayan palm civet. Mrs.

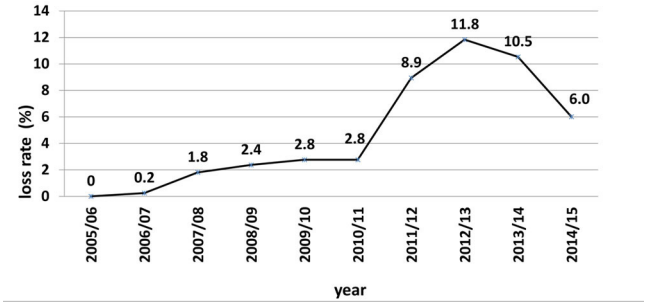

Figure 4 Loss rate of stock depredation in Yamphudin, Taplejung, Nepal

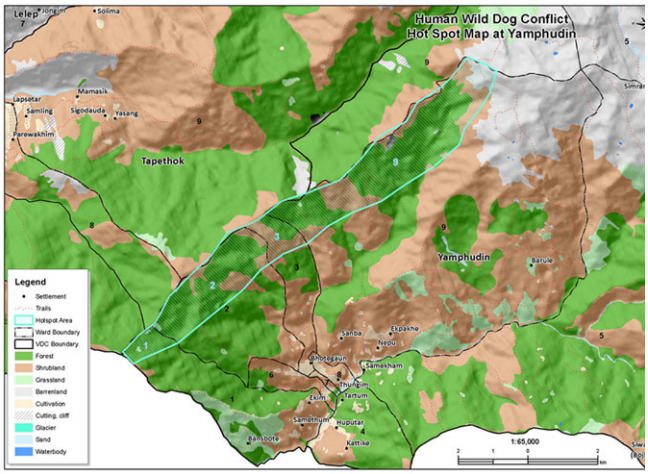

Figure 5 Human wild dogs conflict hotspot map in Yamphudin, Taplejung, Nepal

Manita Rai, treasurer of mother group informed that black bear has become a problem since 2010. Same year, she lost nearly 160 kg maize to bear and civet. Gyabla and Phale also report the crop raid. Maize, potato, wheat, barley and millet are major crops of Ghunsa valley.

Crop damage in Bhotegaun, Yamphudin, Kanchenjunga Conservation Area

Barking deer, Himalayan palm civets, porcupines and northern palm squirrels (*Funambulus pennantii*) are the main species that damage crops in Bhotegaun village, Yamphudin. We witnessed approximately 50,800 sq m of fallow land caused by crop raid which now having taken over by alder (*Alnus nepalensis*). The conversion into forest further increases the risk of crop damage as it creates an extended habitat for wild animals.

Maize, potato and wheat are the major crops cultivated in Bhotegaun. Among crops, the most substantial damage is reported in maize. Civet, barking deer, porcupine, squirrel and rhesus monkey were found to damage maize with high

Table 2 Intensity of damage on crop varieties

Wild animals	Maize	Potato	Wheat	Barley	Millet
Civet	High	No Damage	No Damage	No Damage	No Damage
Barking deer	High	High	High	High	Medium
Porcupine	High	High	No Damage	No Damage	No Damage
Squirrel	High	No Damage	No Damage	No Damage	No Damage
Monkey	High	No Damage	No Damage	No Damage	No Damage
Black bear	Medium	No Damage	No Damage	No Damage	No Damage

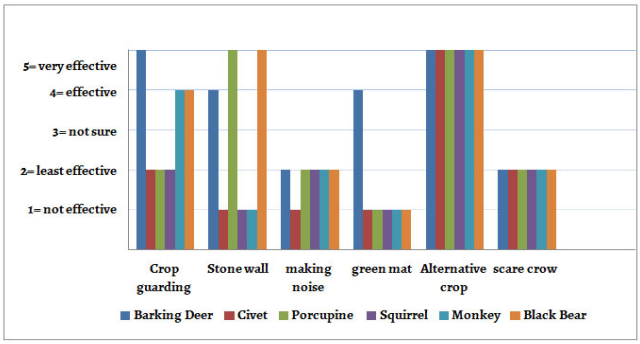

Figure 6 Perception on effectiveness of preventive measures

intensity while black bear damaged maize with medium intensity (**Table 2**). Potatoes are reportedly damaged by barking deer and porcupine. Barking deer damages all the crop varieties with varying intensity (**Table 2**).

Likewise, barley and millet are being damaged by barking deer. Porcupine damages maize and potato in night and therefore very difficult to protect. Monkey and squirrel enters to crop field through trees and therefore removal of tree around the crop field is important. Some villagers have erected a small shelter at an elevated point (yaksa) to obtain an observational vantage point for observing wild animals. If villages detect wild animals attempting to enter crop fields, they will make loud noises to deter the animals from entering.

Local perception on effectiveness of preventive measures, Bhotegaun, Yamphudin

Crop guarding, stone walls, ruptured bamboo (*phakphake* that makes a sound when pulled), green mat (*malingo*), scarecrows and alternative crop such as Chiraito (*Swertia chiraita*) are commonly used preventive measures to protect against crop damage. Crop guarding is the commonest of all. The effectiveness of crop guarding varies across wild animals. Local community perceives that it is very effective against barking deer but not so effective against monkey and black bear. Villagers were not sure if crop guarding is effective against small wild animals such as civet, porcupine and squirrel (**Figure 6**). Crop guarding is a labor intensive thus prevailing labor shortage due to out-migration adversely affects it. Villagers build an elevated hut to enhance view. The mere presence of farmers in and around crop field deters wild animals. Stone wall works best for porcupines and black bear; however, it does not work for tree climbing animals such as monkeys, civets and squirrels.

Phakpake is the simple device made from bamboo tied with rope. The partially ruptured bamboo produces a loud sound when pulled and scare away wild animals. This is the simple technology popular among villagers. Green mat (malingo) is mostly effective against barking deer. "Not effective" indicates that preventive measure was not found helpful to prevent crop damage against specific wild animals. For instance, porcupine digs hole underneath green mat and slips in to farm while squirrels and monkeys enter through trees/shrubs as farms in Bhoteguan, Yamphudin are close to forests. The problem with green mat is that this is not durable and has to replace in every two years. Scare crow is temporarily effective but only for birds. It tends to lose its efficacy in the long run. Chiraito as an alternative crop was found to be very effective which not only repels wild animals but helps generate income (**Figure 6**). Alternative crops are also considered a 'biological fence'. Some farmers were found to have used combination of measures to increase the effectiveness of measures. No one method is a 'stand alone' universal solution for conflict resolution/mitigation. Each technique has its advantages and disadvantages. Methods maybe used in differing permutations to increase their effectiveness (Fernando et al. 2008).

Discussions

Livestock Depredation in Ghunsa, Kanchenjunga Conservation Area

The stock depredation by snow leopards is on the rise in Ghunsa valley. This was found to be attributed to numbers of reason. First, lax guarding contributes to high depredation particularly near broken rocks, cliffs and depression where snow leopards find easy to hunt stocks. Generally, guarding system was not up the level of which it was required. Rapidly changing weather condition in the high altitude also makes the monitor challenging. Herders keep dogs but their impact is limited. The importance of watch dog was just to bring the attention of herders on the potential risk from snow leopards if dogs sense predator in close proximity. The limitation of guard dogs is they cannot chase away the snow leopards.

Second, the domestic stocks are the easy prey to snow leopards despite numbers of its natural prey, Himalayan Blue sheep has been increasing. The Himalayan Blue sheep are well adapted in the vertical terrain and therefore snow leopards preferred domestic stock over natural prey. Moreover, calves of yak/chauri are the easy prey as they follow the scent-spray of snow leopard without any hint of danger and fall prey to snow leopards (Thapa et al. 2013). Other plausible reason will be the limited relief payout NPR 3,000 (USD 29.4) of insurance scheme which no longer incentivize the herders for strict guarding. Herder registered the concern that pay out was small.

It is important to note that Chettri et al. (2017), in a study in a central Himalaya in Nepal found that domestic stock constitutes nearly 27% of diet of snow leopards. It may point to the situation that bringing livestock depredation below 27% diet level will be challenging

Domestic Stock Depredation in Yamphudin, Kanchenjunga Conservation Area

Wild dogs are social hunters and therefore vigilance is of utmost important in a hot spot especially during April and May–calving periods. Calves of yak/chauri, urang/sheep/goats were killed in a high alpine pastures or grazing trails where livestock herders do not have a physical fencing to protect stocks against wild dogs. Khatiwada (2011) reports that 87.5% livestock depredation in Yamphudin village was by wild dogs during the period of 2006 to 2011. The herders reported more livestock depredation by wild dogs but there is lack of data as all the herders did not list their livestock in livestock insurance scheme and there is no provision livestock insurance scheme for goats and sheep. Better understanding of distribution, ecology and behaviours of wild dogs are required in order to devise the preventive measures. Education to pastoral communities on the distribution, ecology and behaviours of predator might be helpful for adopting preventive measures. Inadequate number of herders, lax guarding, rapid changing weather in high altitude, poor monitoring gears and vertical topography are some factors responsible for continuing

negative interaction between human and wild dogs.

Crop damage in Ghunsa valley and Yamphudin, Kanchenjunga Conservation Area

One of the key reasons for increased crop damage is that poaching has been controlled by Kanchenjunga Conservation Area Management Council. Successful anti-poaching operations and wildlife trade curbing with the conservation of habitat contribute to increased number of wild animals which results in to increased crop damage incidence. Large tract of farming land abandoned due to the labor shortage is taken over by pioneer forest which functions as extended habitats. Himalayan black bear, civet, barking deer, porcupine, monkey and squirrels are the major wild animals raiding crops.

The best mitigation strategy is an alternative crop such as Chiraito which is unpalatable and avert wild animals. It also helps generate cash income for farmers. Well designed physical fencing would be appropriate measure against black bear, barking deer and civet though it would be costly. Crop guarding is the most common but in the context of ongoing labor shortage, it is facing a huge challenge. It is detrimental for the education of children due to inadequate sleep and fatigue. Combination of methods such as ruptured bamboo, scare crow; noise making will increase the efficacy of mitigation measures. In addition, farmers need to be oriented on the provision of wildlife relief directives so they will be able to lodge an application for relief as per the prevailing rules.

Conclusion and Implication for Conservation

Ghunsa valley has reported an increased livestock depredation from snow leopards despite number of their natural prey, Himalayan Blue Sheep is increasing. Calves of yak/chauri/urang of 1-3 years are the easy prey. Pastoral communities have received the community based insurance scheme well and it has contributed, to some extent, to offset the economic loss. No retaliatory killing of snow leopards was potentially the outcome of insurance scheme. However, it is recommended that premium and relief amount need to be revised to have a lasting conservation impact. Yamphudin has a conflict issue with wild dogs. Conflict with snow leopards also exists here but it is not as acute as Ghunsa. Behavioural changes of herders who have been using pastures above 3,000-4,000 masl appear to be critically important. Herds of yak/chauri/yakpe/ghokpe should not be taken close to cliff and broken terrains as these are the conflict hotspots. Conservation education and awareness are of utmost important for the pastoral communities. These communities would better cope with conflict if they will be trained on distribution, ecology and behavioural aspects of predators.

Amjilesa, Phale and Gyabla of Ghunsa Valley and Bhotegaun of Yamphudin were affected by crop raid from black bear, palm civet, barking deer, rhesus money and porcupine. Generally, crop raid was found to be on rise. The control of poaching and wildlife trade, development of extended habitat through land conversion and lax guarding contribute to the increased economic loss from crop damage. Preventive measures such as alternative crop, strict guarding, stone wall fencing were found largely effective with varying degree specific to wild animals. Scare crow is temporarily good for birds but loses its efficacy after some time. No single preventive measure stand outs as there are number of wild animals. Combinations of preventive measures were found to be the best strategy against human wildlife conflict.

Sharing of best practices and learning from other protected areas on the same issue would be helpful in a pursuit of tackling this conservation challenge.

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Biography

Roshan Sherchan is a PhD student at the Department of Environmental Science, Tribhuvan University, Nepal. He is also associated with Green Governance Nepal, a national NGO. Mr. Sherchan worked with WWF Nepal from 2009-2012, as a program manager for Sacred Himalayan Landscape. He has extensive experiences on community based conservation, local livelihoods and human wildlife conflict.

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