

Report on

Human Wildlife Conflict Management and Public Awareness in Manang District, Nepal

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Abstract

Human-wildlife conflict is major conservation threat in the world. Every year, numbers of livestock are being killed by wildlife in Nepal so human-wildlife conflict is becoming one of the major threats of biodiversity conservation in Nepal. This study was conducted in early 2021 in Manang District of Gandaki Province, Nepal to explore the current situation of human - wildlife conflict and to recommend to mitigate these conflicts. This study has identified the major conflict causing wildlife, their locations, and types of conflict in Manang District of Gandaki Province by analyzing the secondary and primary data. Secondary data were collected from published and unpublished literatures and primary data were collected from field. This study identify the snow leopard as major conflict causing animal in Manang. Beside snow leopard, Asiatic black bear and common leopard were also identified as conflict causing wild animals of this district. Snow leopard usually attack the livestock near to the livestock sheds. Both snow leopard and common leopard were threats to livestock whereas Asiatic black bear was notorious for human and livestock attack as well as crop depredation. This study recommends: snow leopard should be kept in first priority for human-wildlife conflict management; more attention should be paid in south-eastern part of the district; and intensive public awareness programs should be conducted and

effective community outreach materials should be distributed throughout the district to mitigate the human-wildlife conflict in Manang.

Keywords: Conflict, livestock depredation, modeling, wildlife management

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1. Background

1.1 Introduction

Biodiversity is the diversity among living beings. It can be divided into three levels: (1) Ecosystem diversity: diversity in an ecosystem (forest ecosystem, pond ecosystem and so on) (2) Species diversity: diversity in species (red panda snow leopard, black bear) and (3) Genetic diversity: diversity in gene level. The number of species of plants, animals, and microorganisms, the enormous diversity of genes in these species, the different ecosystems on the planet, such as deserts, rainforests and coral reefs are all part of biologically diverse earth. The variety of life on earth, its biological diversity is commonly referred to as biodiversity. For rich biodiversity, a variety of topographical and climatic situations, more variety of living beings and less or right about human intervention are necessary (Global Issues 2020).

Biodiversity boosts ecosystem productivity where each species, no matter how small, all have an important role to play. For example, a larger number of plant species means a greater variety of crops. Greater species diversity ensures natural sustainability for all life forms. Biodiversity plays a crucial role in human nutrition through its influence on world food production, as it ensures the sustainable productivity of soils and provides the genetic resources for all crops,

livestock, and marine species harvested for food (Global Issues 2020). The most obvious reason for conservation is to protect wildlife and promote biodiversity. Protecting wildlife and preserving it for future generations also means that the animals we love don't become a distant memory and we can maintain a healthy and functional ecosystem.

Biodiversity loss affects economic systems and human society. This lack of biodiversity among crops threatens food security, because varieties may be vulnerable to disease and pests, invasive species, and climate change (Lamsal et al. 2017). At least 40 percent of the world's economy and 80 percent of the needs of the poor are derived from biological resources. Besides, the richer the diversity of life, the greater the opportunity for medical discoveries, economic development, and adaptive responses to such new challenges as climate change (Global Issues 2020). Appropriate conservation and sustainable development strategies attempt to recognize this as being integral to any approach to preserving biodiversity. Almost all cultures have their roots in our biological diversity in some way or form. Declining biodiversity is therefore a concern for many reasons: such as the human-wildlife conflict, low economic condition of local people, low level of awareness, construction of physical superstructure and infrastructure and natural as well as human-induced calamities.

Human-wildlife conflict is identifying as major threat of biodiversity conservation everywhere. Conflicts between human and wildlife have been widely recognized as one of the most challenging issues for wildlife conservation globally. Although problems have been well known for many years, the increase in conflicts, particularly in regions with high biodiversity, suggests that improved strategies are urgently needed to promote the co-existence of wild animals and people (Dickman, Macdonald, and Macdonald 2011). The regular increase in the human population results in competition between people and wildlife for shared but limited resources, which manifest as various types of conflict, such as crop-raiding, livestock predation, property damage, human death and injury, and the retaliatory killing of wildlife (Peterson et al. 2010). Conflicts become largely controversial when people are attacked by species that are endangered and legally protected. Wildlife attacks are life-threatening and thus are not acceptable to society, so people often retaliate by killing the animals involved in the conflict. Large sized mammals such as elephant, rhino, tiger, leopard and bear are generally involved in the conflicts, and most of these species are threatened with extinction, so the retaliatory killings of threatened mammals further increases their extinction risk. The penalties for illegal killing endangered animals may further escalate hostile attitudes towards efforts of conservation.

Several measures, such as the distribution of compensation and the promotion of wildlife deterrents to support the livelihoods of people, have been implemented to foster the co-existence of humans and wildlife (Gore et al. 2008). However, the efficacy of these measures is largely uncertain due to the absence of information about the patterns of conflicts across various landscapes. Although human-wildlife conflicts have been extensively studied at local levels (Inskip and Zimmermann 2009) and to some extent in Nepal (Gurung et al. 2008), none of these studies report patterns of human fatalities and injuries caused by wild animals at the national level, with some exceptions in Africa (Dunham et al. 2010).

Nepal is situated in the central part of the Himalaya ($26^{\circ}22'$ - $30^{\circ}27'$ N, $80^{\circ}04'$ - $88^{\circ}12'$ E), covering an area of 147,181 km² and an elevation ranges from 67 m to 8848 m. Nepal has diverse climate due to the large variation in elevation. The climate varies from humid tropical type in the tropical lowlands in the south to alpine cold semi-desert type in the trans-Himalayan zone (Ohsawa, Shakya, and Numata 1986). Nepal's forest ecosystems can be categorized into 10 major groups on the basis of climatic conditions: (1) tropical, (2) subtropical broad-leaved, (3) subtropical conifer, (4) lower temperate broad-leaved, (5) lower temperate mixed broad-leaved, (6) upper temperate broadleaved, (7) upper temperate mixed broadleaved, (8) temperate coniferous, (9) subalpine, and (10) alpine scrub (Stainton, 1972). The average annual rainfall is around 1000 – 2000 mm, but

sometimes it exceeds to 3000 mm in some lower parts of the country (Ichiyanagi et al. 2007). Nepal has diverse geography that ranges from permanently snow and ice covered very rugged Himalayan Mountains in the north to the tropical alluvial plains in the south. Due to variation in climate and topography, Nepal is classified into five physiographic zones (i.e., Terai, Siwalik, middle Mountain, high Mountain and Himalaya) (Barnekow Lillesø et al. 2005; Shrestha et al. 2010).

In spite of the poor economic condition, the government of Nepal has established 20 protected areas: 12 national parks, six conservation areas, one wildlife reserve and one hunting reserve (**Figure 1**) (DNPWC 2017a). Around all national parks and wildlife reserves, buffer zones are declared for intensive management of the human-wildlife conflict. Out of total protected areas, six national parks, five conservation areas, and one hunting reserve are established in the Himalayan region, one national park is in middle Mountain region, and rest are in Terai and Siwalik region (DNPWC 2017a). These protected areas are providing the natural habitat for the elephant, musk deer, red panda, rhino, snow leopard, tiger, wild buffalo, wild dog and other threatened wildlife by covering 23.23 % of the total land of the country (Bhattarai et al. 2017).

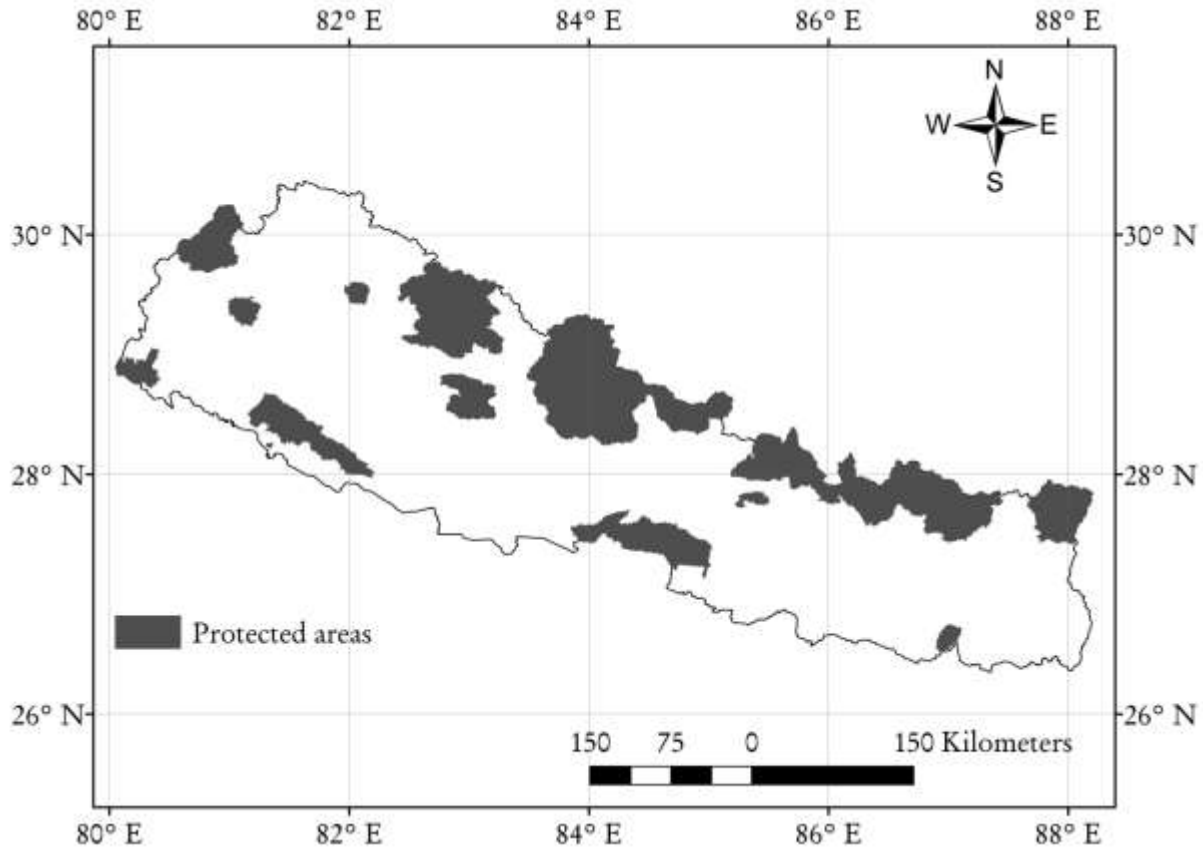


Figure 1: The geographical distribution of protected areas in Nepal

Protected areas in Nepal are disproportionately located at higher altitudes. Consequently, the fauna of the lowland regions, especially large mammals, are not adequately protected, and most of them live in human-dominated forest landscapes. The country has an unusually high proportion of globally threatened species of mammals in comparison to its area. Nepal is a predominately agricultural country, with forests providing many life-supporting ecological goods and services. For example, firewood and fodder make energy supply and livestock feed, respectively, used by the country, and these are mostly harvested from

forests. A close link between society and the natural environment and their close physical proximity are a major cause of human-wildlife conflicts. Various reports suggest that there is an increasing incidence of human casualties and injuries due to wildlife interactions, even in areas with no previously reported incidents (Inskip and Zimmermann 2009). Therefore, measures based on sound analyses of the spatial and temporal patterns of human casualties and injuries are needed to reduce the frequency of these conflicts.

In Nepal, people are attacked by large mammal species such as tigers, common leopards, rhinoceros, elephants and bears, but there is little discussion about the patterns of fatalities and injuries caused by wildlife or their underlying temporal dynamics. Such information could provide essential guidance for establishing future conservation and research priorities in Nepal. This study has identified the major conflict causing wildlife, their locations, and types of conflict in Manang District of Gandaki Province by analyzing the secondary and field collected data. In this study human conflict with Asiatic black bear, common leopard and snow leopard were identified and analyzed.

1.2 Objective of the study

The overall objective of this study was to identify and map human-wildlife conflict in Manang District of Gandaki Province, Nepal. Specific objectives of the study are as follows:

- To identify major conflict causing wildlife
- To explore the conflict spots
- To prepare maps by showing the conflict spots
- To identify the major types of conflicts

1.3 Scope and coverage of the study

- The study is confined to the Manang District of Gandaki Province.
- The study is limited to identifying and mapping the human wildlife conflict in Manang District.
- This study recommends the measures to mitigate the human-wildlife conflict on the basis of findings and conclusions.

1.4 Research hypotheses

This study has following hypothesis

- The large sized animals are more notorious in human-wildlife conflict.

- Human-wildlife conflict is concentrated in particular places of the district.

1.5 Limitation of the study

Due to the Covid-19 the field work was disturbed partially. Budget limitation was another problem. It is very hard to cover the field work of whole province within this limit of budget. It is not easy to visit whole area for data collection within this amount of money. Field was very difficult to visit.

2. Materials and methods

2.1 Study area

The study was conducted in the southeastern part of Manang District, Nepal. The study was conducted in the jurisdiction of the then District Forest Office in the rural municipality of Nasong, approximately 5 km inside the Annapurna Conservation Area (ACA) (**Figure 2**). During the study, we recorded *Pinus wallichiana*, *Abies spectabilis*, *Betula utilis*, *Taxus baccata*, *Picrorhiza scrophulariiflora*, *Dactylorhiza hatagirea*, *Ophiocordyceps sinensis*, *Swertia chirata*, *Paris polyphylla*, *Rhododendron anthopogon*, *Hippophae* spp., *Daphne bholua*, *Lilium nepalense*, *Juniperus indica* as the major plant species in the study area. *Panthera uncia*, *Moschus moschiferus*, *Panthera pardus*, *Lophophorus impejanus*, *Naemorhedus goral*, *Canis lupus*, *Ursus thibetanus*, *Muntiacus muntjac*, *Semnopithecus schistaceus* were recorded as the major animals during field data collection of the study.

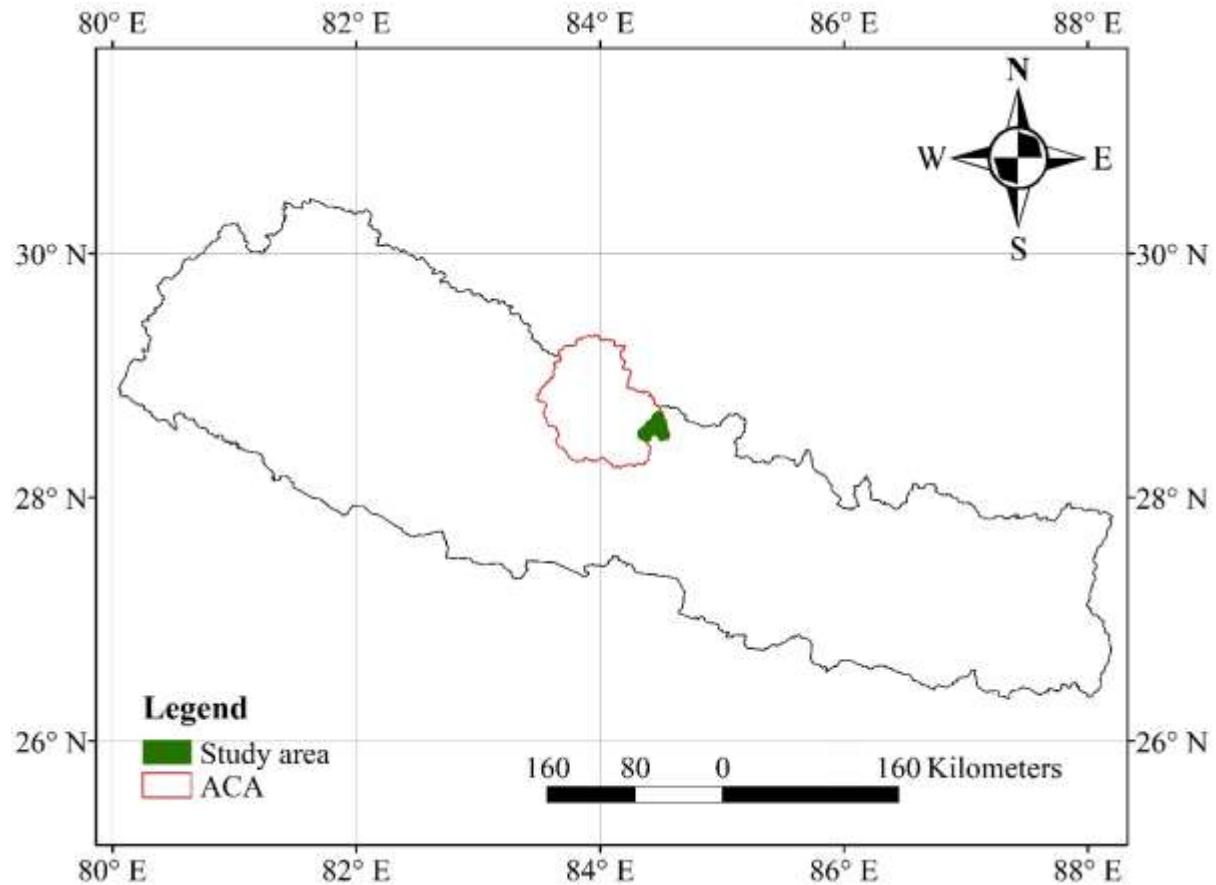


Figure 2: Study area

2.2 Data collection

2.2.1 Primary data collection

The study team visited all potential area of human-wildlife conflict of Manang District during late 2020. First of all study team collected the information of possible human-wildlife conflict area by the help of herders, staffs of Division Forest Office and villagers. Then team requested to them to help to visit these

sites. Finally study team visited these sites to record details of human-wildlife conflict.

2.2.2 Secondary data collection

The study team collected reports of previous studies, reports of governmental and non-governmental organizations and newspapers and other related documents. Then these documents were studied to extract required information of this study.

3. Result and discussion

This study identified Asiatic black bear, common leopard and snow leopard as major conflict causing wildlife in the study area.

3.1 Human- Asiatic black bear conflict

Asiatic black bear (*U. thibetanus*) is a bear having black hairs and lives in the High Mountain regions of the Nepal. This bear face several threats due to human activity. The species is listed as vulnerable" by the IUCN (Garshelis, D. & Steinmetz, 2016). Natural habitat loss, wide spread illegal killing and trade in bear parts are major threats of this bear (Ahmadzadeh et al. 2008; Awan et al. 2016; Escobar, Awan, and Qiao 2015). The species is also included in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2019). Better understanding the conflict status of Asiatic black bear in Nepal will serve to help identify important natural habitat and conserve this species and associated habitat.

Asiatic black bear is one of the conflict causing animal of the Manang District. This study identify the some conflict spots in south eastern part of the district (**Figure 3**). In these areas human and livestock are injured by this bear. Furthermore, crops are also damaged by the Asiatic black bear (**Appendix**).

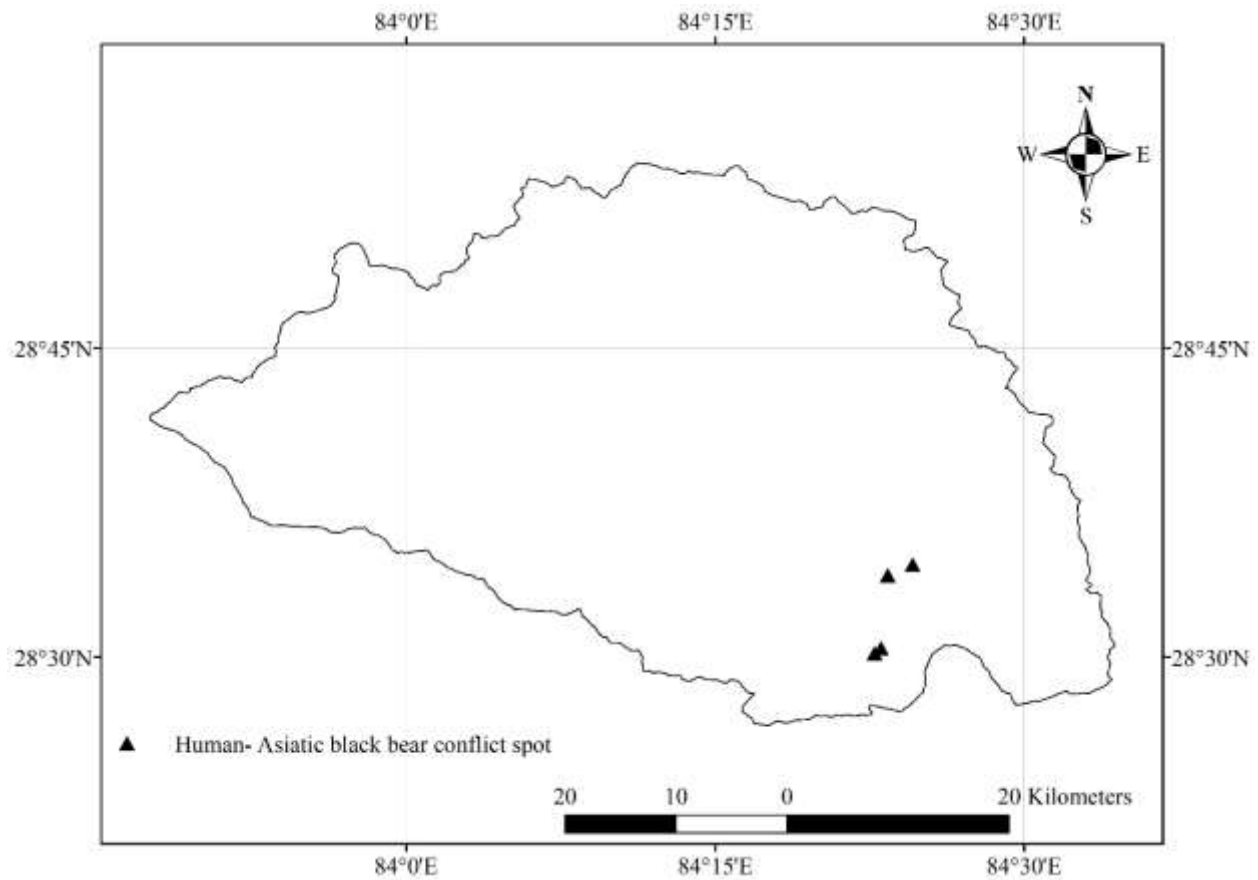


Figure 3: Human- Asiatic black bear conflict spots in Manang District

3.2 Human- common leopard conflict

The common leopard (*Panthera pardus*) is a subspecies of leopard widely distributed on the Indian subcontinent. Due to habitat loss and fragmentation, poaching for the illegal trade of skins and body parts, and persecution due to conflict situations, its population is decreasing so it is listed as vulnerable on the International Union for Conservation of Nature (IUCN) Red List (Stein et al. 2016). The *P. pardus* is a versatile, opportunistic hunter, and has

a very broad diet. It can take large prey due to its massive skull and powerful jaw muscles. The number of *P. pardus* in the country has significantly gone down in the last few years due to a shortage of food and a lack of safe habitat. A report published by IUCN in 2012 showed Nepal had a total of 1,000 *P. pardus*. The report had also stated that the number of *P. pardus* was decreasing every year (Stein et al. 2016).

Common leopard is one of the major conflict causing wildlife of Nepal (Acharya et al. 2016). It is notorious for livestock depredation (Adhikari et al. 2020). This study also identify this leopard as conflict causing wild animal in Manang District. South eastern part of the district is affected area of common leopard attack (**Figure 4**). Common leopard killed sheep and calf in Manang District (**Appendix**). This study did not record human casualties due to common leopard attack in Manang.

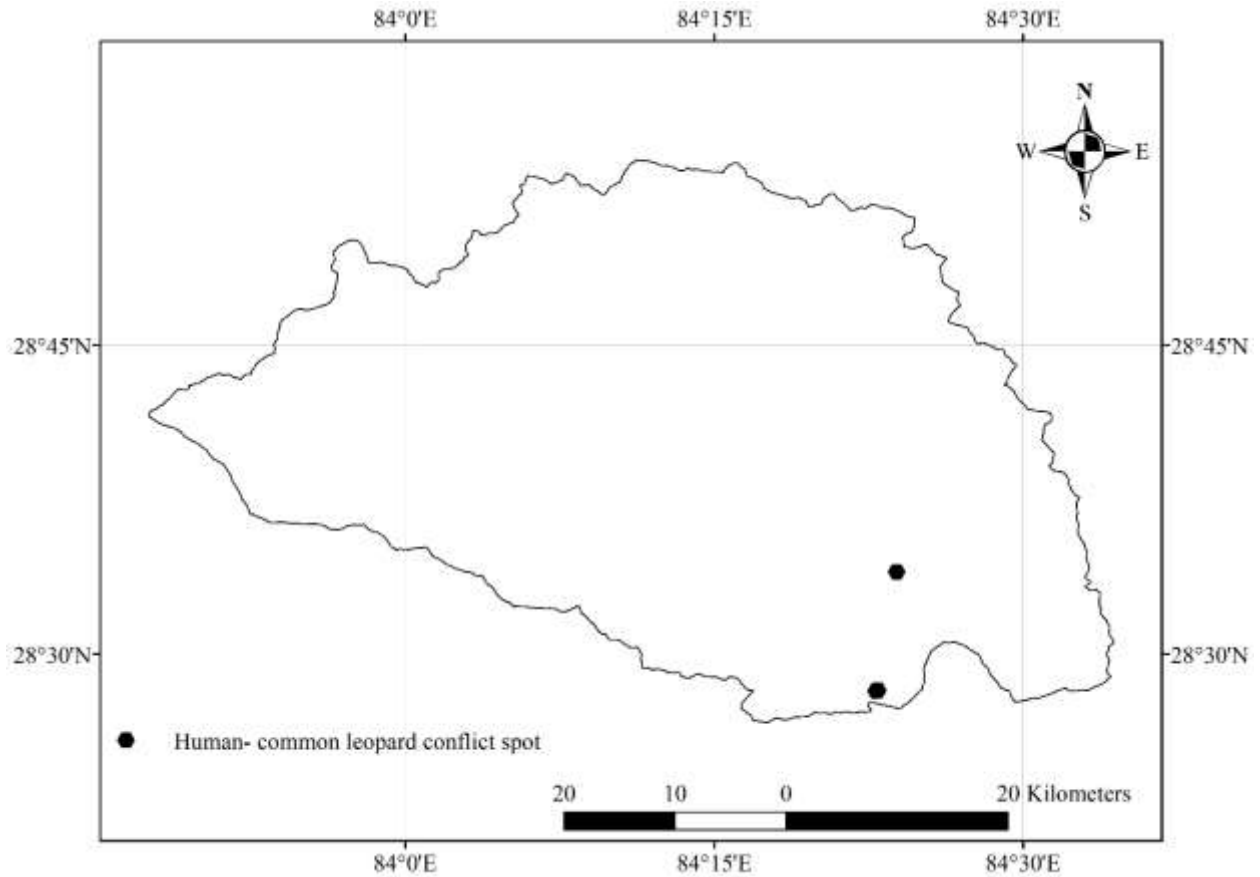


Figure 4: Human- common leopard conflict spots in Manang District

3.3 Human- snow leopard conflict

The snow leopard (*Panthera uncia*) is a wild carnivore native to 12 countries in central Asia (Afghanistan, Bhutan, China, India, Kazakhstan, Kyrgyzstan, Mongolia, Nepal, Pakistan, Russia, Tajikistan and Uzbekistan) (Mccarthy et al. 2017). The home range of this species is 124-207 km² (Johansson et al. 2016). In Qilianshan National Nature Reserve, China, the density of snow leopard is 3.31 individuals per 100 km² (Alexander et al. 2015). Nepal has extremely variable

population density; for example Langu valley has 10-12 animals per 100 km² and Manang has 5-7 animals per 100 km² (DNPWC, 2017) .The primary prey targeted by snow leopards include wild species such as blue sheep (*Pseudois nayaur*) and marmots (*Marmota caudate*) as well as domesticated livestock such as yak (*Bos grunniens*) and sheep (*Ovis* spp.) (Aryal et al. 2014; Weiskopf, Kachel, and McCarthy 2016).Snow leopards co-exist with other Himalayan carnivores, such as red fox (*Vulpes vulpes*), grey wolf (*Canis lupus*), Eurasian lynx (*Lynx lynx*) and dhole (*Cuon alpinus*) (Alexander et al., 2016a; Bocci et al., 2017). Male snow leopard represent a greater threat to livestock than females (Chetri, Odden, and Wegge 2017). While there are several studies characterizing snow leopards and their habits and habitats, there is a need for greater localized information to improve conservation management practices.

Human-snow leopard conflict, especially concerning livestock depredation, represents a major threat to snow leopards (Li et al. 2013; Mijiddorj, Alexander, and Samelius 2018; Suryawanshi et al. 2013; Ud Din et al. 2017; Wegge, Shrestha, and Flagstad 2012). Livestock grazing in snow leopard habitat has been shown to be a serious conservation threat to the species (Ghoshal et al. 2017; Khanal et al. 2018; Sharma, Bhatnagar, and Mishra 2015). One of the main stressors of snow leopard poaching was found to be retaliatory killing due to livestock depredation in a study that also showed the rate of snow leopard poaching increasing

(Maheshwari and Niraj 2018). Another important factor influencing snow leopard poaching is the illegal trade of body parts and pelts (Hussain, 2003), which is also on the rise (Li and Lu 2014). Furthermore, impacts of climate change have emerged as a primary threat to snow leopards; reductions to their habitats are expected throughout their range (Aryal et al. 2016; Li et al. 2016).

Snow leopards were recently removed from the IUCN's endangered species list and are now listed as vulnerable, although there may be insufficient field data to support this change (Ale and Mishra 2018). Mitigating human-snow leopard conflict through community engagement is one of the major objectives of the snow leopard conservation action plan for Nepal (2017-2021) (DNPWC 2017b). Research has shown that visitors are willing to pay for snow leopard conservation in the Annapurna Conservation Area in Nepal (Schutgens et al. 2018) but more research is needed on snow leopard interactions with human activities to better understand the influence of snow leopards on livestock herding practices and vice-versa (Alexander et al., 2016b).

Snow leopard is major conflict causing animal of the Manang District. This species attacks livestock near to their sheds (Karki and Panthi 2021). This study used the secondary information of the snow leopard attack of in the study area. Previous study recorded 109 snow leopard attack locations in this district (**Appendix**). Eastern part of the district is more vulnerable to snow leopard attack (**Figure 5**).

According to the previous study, the distance to goths (livestock shed), distance to paths, distance to motor roads and elevation are most important variable to model the snow leopard attack risk zone. The snow leopards prefer to attack the livestock near to the livestock shed and moderate distance from the human paths and motor roads. Probability of attacking livestock is high around 4000 m elevation.

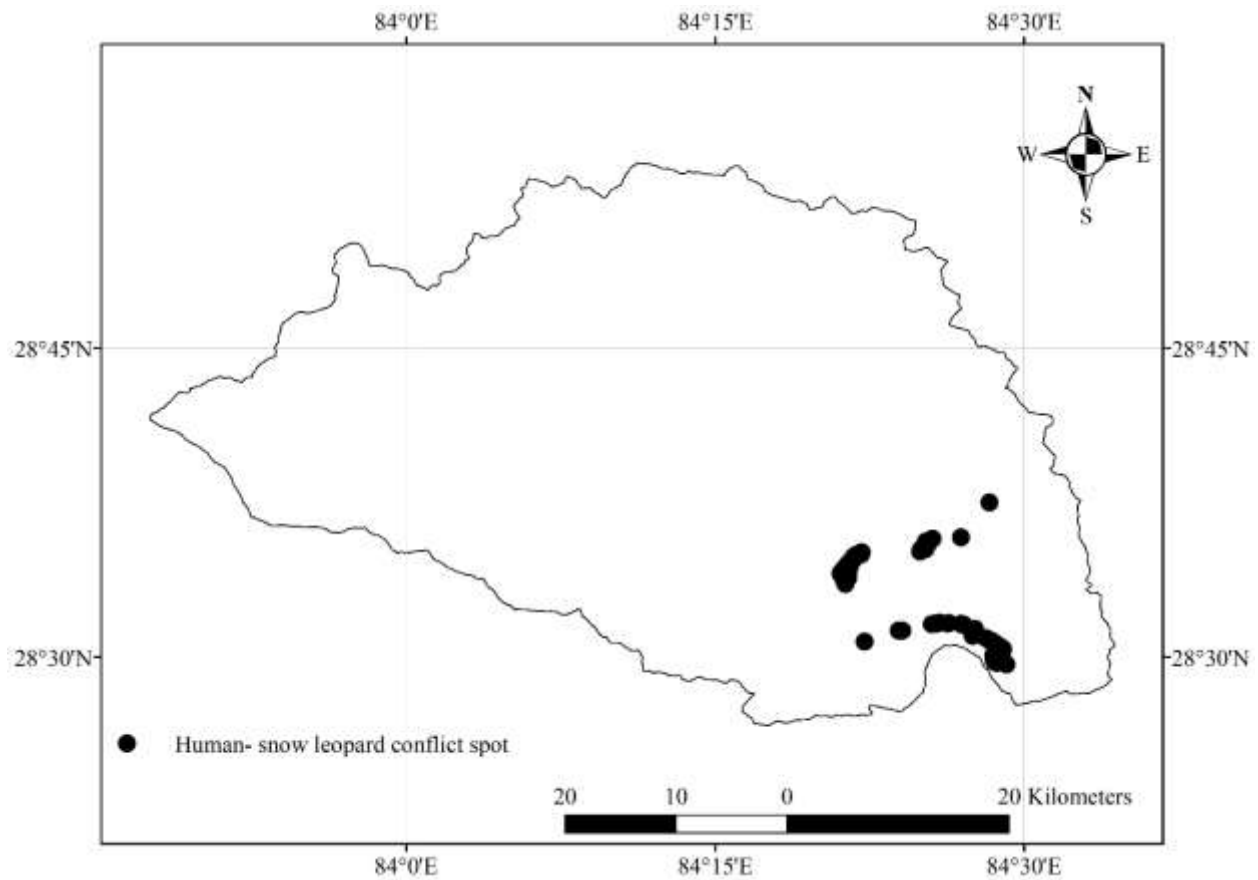


Figure 5: Human- snow leopard conflict spots in Manang District

3.4 Public awareness

Public awareness is major component is human-wildlife conflict management. Conservation of wildlife and overall biodiversity is crucial in one hand and sustaining local livelihood is also in another hand. In this scenario, Divisional Forest Office Manang, community based organizations, Annapurna Conservation Area and other local non-governmental organizations as well as all stakeholders should focus on public awareness programs to conservation the wildlife and to sustain the local livelihood in win – win basis.

4. Conclusions

This study identified the major conflict causing animals and major types conflict in Manang District. By analyzing the secondary and primary data, this study identify the snow leopard as major conflict causing animal in Manang. Beside snow leopard, Asiatic black bear and common leopard are also conflict causing wild animals of this district. Snow leopard usually attack the livestock near to the livestock sheds. Both snow leopard and common leopard were threats to livestock whereas Asiatic black bear was notorious for human and livestock attack as well as crop depredation. South-eastern part of the district is more vulnerable in terms of human-wildlife conflict.

5. Recommendations

Based on the findings and conclusions, this study has following recommendations:

- Snow leopard should be kept in first priority for human-wildlife conflict management.
- Human should be more careful with Asiatic black bear.
- More attention should be paid in south-eastern part of the district.
- Intensive public awareness programs should be conducted and effective community outreach materials should be distributed throughout the district to mitigate the human-wildlife conflict.

References

- Acharya, Krishna Prasad, Prakash Kumar Paudel, Prem Raj Neupane, and Michael Kohl. 2016. “Human-Wildlife Conflicts in Nepal: Patterns of Human Fatalities and Injuries Caused by Large Mammals.” *PLoS ONE* 11:e0161717.
- Adhikari, B., M. Odden, B. Adhikari, S. Panthi, J. V. López-Bao, and M. Low. 2020. “Livestock Husbandry Practices and Herd Composition Influence Leopard-Human Conflict in Pokhara Valley, Nepal.” *Human Dimensions of Wildlife* 25(1).
- Ahmadzadeh, Faraham, Homan Liaghati, Bahram Hassanzadeh Kiabi, Ahmad Reza Mehrabian, Asghar Abdoli, and Hossein Mostafavi. 2008. “The Status and Conservation of the Asiatic Black Bear in Nikshahr County, Baluchistan District of Iran.” *Journal of Natural History* 42(35–36):2379–87.
- Ale, S. B., and C. Mishra. 2018. “The Snow Leopard’s Questionable Comeback.” *Science* 359(6380):1110.
- Alexander, Justine S., Jeremy J. Cusack, Chen Pengju, Shi Kun, and Philip Riordan. 2016. “Conservation of Snow Leopards: Spill-over Benefits for Other Carnivores?” *Oryx* 50(2):239–43.
- Alexander, Justine S., Arjun M. Gopalaswamy, Kun Shi, Philip Riordan, and

- Antoni Margalida. 2015. “Face Value: Towards Robust Estimates of Snow Leopard Densities.” *PLoS ONE* 10(8):e0134815.
- Alexander, Justine S., Chengcheng Zhang, Kun Shi, and Philip Riordan. 2016. “A Spotlight on Snow Leopard Conservation in China.” *Integrative Zoology* 11:308–21.
- Aryal, Achyut, Dianne Brunton, Weihong Ji, Dibesh Karmacharya, Tom McCarthy, Roberta Bencini, and David Raubenheimer. 2014. “Multipronged Strategy Including Genetic Analysis for Assessing Conservation Options for the Snow Leopard in the Central Himalaya.” *Journal of Mammalogy* 95(4):871–81.
- Aryal, Achyut, Uttam Babu Shrestha, Weihong Ji, Som B. Ale, Sujata Shrestha, Tenzing Ingty, Tek Maraseni, Geoff Cockfield, and David Raubenheimer. 2016. “Predicting the Distributions of Predator (Snow Leopard) and Prey (Blue Sheep) under Climate Change in the Himalaya.” *Ecology and Evolution* 6(12):4065–75.
- Awan, Muhammad Naeem, Alexandros A. Karamanlidis, Muhammad Siddique Awan, Muhammad Ali Nawaz, and Muhammad Kabir. 2016. “Priliminary Survey on Asiatic Black Bear in Kasmir Himalaya, Pakisthan: Implication for Preservation.” *International Journal of Conservation Science* 7(3):719–24.

Barnekow Lillesø, J. P., T. B. Shrestha, L. P. Dhakal, R. P. Nayaju, and R.

Shrestha. 2005. *The Map of Potential Vegetation of Nepal: A Forestry/Agro-Ecological/Biodiversity Classification System*. Hørsholm: Center for Skov, Landskab og Planlægning/Københavns Universitet. (Development and Environment; No. 2/2005).

Bhattarai, Babu R., Wendy Wright, Buddi S. Poudel, Achyut Aryal, Bhupendra P.

Yadav, and Radha Wagle. 2017. “Shifting Paradigms for Nepal’s Protected Areas: History, Challenges and Relationships.” *Journal of Mountain Science* 14(5):964–79.

Bocci, Anna, Sandro Lovari, Muhammad Zafar Khan, and Emiliano Mori. 2017.

“Sympatric Snow Leopards and Tibetan Wolves: Coexistence of Large Carnivores with Human-Driven Potential Competition.” *European Journal of Wildlife Research* 63:92.

Chetri, Madhu, Morten Odden, and Per Wegge. 2017. “Snow Leopard and

Himalayan Wolf: Food Habits and Prey Selection in the Central Himalayas, Nepal.” *PLoS ONE* 12(2):e0170549.

CITES. 2019. *Appendices I, II and III, Convention on International Trade in Endangered Species of Wild Fauna and Flora*.

Dickman, Amy J., Ewan A. Macdonald, and David W. Macdonald. 2011. “A

- Review of Financial Instruments to Pay for Predator Conservation and Encourage Human-Carnivore Co-Existence.” *Proceedings of the National Academy of Sciences of the United States of America* 108(34):13937–44.
- DNPWC. 2017a. *Protected Areas of Nepal*. Department of national parks and wildlife conservation, Kathmandu, Nepal.
- DNPWC. 2017b. *Snow Leopard Conservation Action Plan for Nepal (2017-2021)*.
- Dunham, Kevin M., Andrea Ghiurghi, Rezia Cumbi, and Ferdinando Urbano. 2010. “Human-Wildlife Conflict in Mozambique: A National Perspective, with Emphasis on Wildlife Attacks on Humans.” *Oryx* 44(2):185–93.
- Escobar, Luis E., Muhammad Naeem Awan, and Huijie Qiao. 2015. “Anthropogenic Disturbance and Habitat Loss for the Red-Listed Asiatic Black Bear (*Ursus Thibetanus*): Using Ecological Niche Modeling and Nighttime Light Satellite Imagery.” *BIOC* 191:400–407.
- Garshelis, D. & Steinmetz, R. 20916. “*Ursus Thibetanus* (Asiatic Black Bear, Himalayan Black Bear).” Retrieved February 15, 2017 (<http://www.iucnredlist.org/details/22824/0>).
- Ghoshal, Abhishek, Yash Veer Bhatnagar, Bivash Pandav, Koustubh Sharma, Charudutt Mishra, R. Raghunath, and Kulbhushansingh R. Suryawanshi. 2017.

“Assessing Changes in Distribution of the Endangered Snow Leopard *Panthera Uncia* and Its Wild Prey over 2 Decades in the Indian Himalaya through Interview-Based Occupancy Surveys.” *Oryx* 1–13.

Global Issues. 2020. “Why Is Biodiversity Important? Who Cares? — Global Issues.” Retrieved June 16, 2020
(<https://www.globalissues.org/article/170/why-is-biodiversity-important-who-cares>).

Gore, Meredith L., Barbara A. Knuth, Clifford W. Scherer, and Paul D. Curtis. 2008. “Evaluating a Conservation Investment Designed to Reduce Human-Wildlife Conflict.” *Conservation Letters* 1(3):136–45.

Gurung, Bhim, James L. David Smith, Charles McDougal, Jhamak B. Karki, and Adam Barlow. 2008. “Factors Associated with Human-Killing Tigers in Chitwan National Park, Nepal.” *Biological Conservation* 141(12):3069–78.

Ichiyangi, Kimpei, Manabu D. Yamanaka, Yoshitaka Murajic, and Bijaya Kumar Vaidyad. 2007. “Precipitation in Nepal between 1987 and 1996.” *International Journal of Climatology* 27:1753–62.

Inskip, Chloe, and Alexandra Zimmermann. 2009. “Human-Felid Conflict: A Review of Patterns and Priorities Worldwide.” *Oryx* 43(1):18–34.

- Johansson, Orjan, Geir Rune Rauset, Gustaf Samelius, Tom McCarthy, Henrik Andren, Lkhagvasumberel Tumursukh, and Charudutt Mishra. 2016. “Land Sharing Is Essential for Snow Leopard Conservation.” *Biological Conservation* 203:1–7.
- Karki, Ajay, and Saroj Panthi. 2021. “Factors Affecting Livestock Depredation by Snow Leopards (*Panthera Uncia*) in the Himalayan Region of Nepal.” *PeerJ* 9:e11575.
- Khanal, Gopal, Laxman Prasad Poudyal, Bishnu Prasad Devkota, Rishi Ranabhat, and Per Wegge. 2018. “Status and Conservation of the Snow Leopard *Panthera Uncia* in Api Nampa Conservation Area, Nepal.” *Oryx* 1–8.
- Lamsal, Pramod, Lalit Kumar, Kishor Atreya, and Krishna Prasad Pant. 2017. “Vulnerability and Impacts of Climate Change on Forest and Freshwater Wetland Ecosystems in Nepal: A Review.” *Ambio* 46:915–30.
- Li, Juan, and Zhi Lu. 2014. “Snow Leopard Poaching and Trade in China 2000–2013.” *Biological Conservation* 176:207–11.
- Li, Juan, Thomas M. McCarthy, Hao Wang, Byron V. Weckworth, George B. Schaller, Charudutt Mishra, Zhi Lu, and Steven R. Beissinger. 2016. “Climate Refugia of Snow Leopards in High Asia.” *Biological Conservation* 203:188–96.

- Li, Juan, Hang Yin, Dajun Wang, Zhala Jiagong, and Zhi Lu. 2013. “Human-Snow Leopard Conflicts in the Sanjiangyuan Region of the Tibetan Plateau.” *Biological Conservation* 166:118–23.
- Maheshwari, Aishwarya, and Shekhar Kumar Niraj. 2018. “Monitoring Illegal Trade in Snow Leopards: 2003–2014.” *Global Ecology and Conservation* 14:e00387.
- Mccarthy, Tom, David Mallon, Rodney Jackson, Peter Zahler, and Kyle P. McCarthy. 2017. “Panthera Uncia.” *The IUCN Red List of Threatened Species* e.T22732A50664030.
- Mijiddorj, Tserennadmid Nadia, Justine Shanti Alexander, and Gustaf Samelius. 2018. “Livestock Depredation by Large Carnivores in the South Gobi, Mongolia.” *Wildlife Research* 45(3):237–46.
- Ohsawa, Masahiko, Puspa Ratna Shakya, and Makoto Numata. 1986. “Distribution and Succession of West Himalayan Forest Types on the Eastern Part of the Nepal Himalaya.” *Mountain Research & Development* 6(2):143–57.
- Peterson, M. Nils, Jessie L. Birckhead, Kirsten Leong, Markus J. Peterson, and Tarla Rai Peterson. 2010. “Rearticulating the Myth of Human-Wildlife Conflict.” *Conservation Letters* 3(2):74–82.

- Schutgens, Maurice G., Jonathan H. Hanson, Nabin Baral, and Som B. Ale. 2018. “Visitors’ Willingness to Pay for Snow Leopard *Panthera Uncia* Conservation in the Annapurna Conservation Area, Nepal.” *Oryx* 1–10.
- Sharma, Rishi Kumar, Yash Veer Bhatnagar, and Charudutt Mishra. 2015. “Does Livestock Benefit Snow Leopards.” *Biological Conservation* 190:8–13.
- Shrestha, Uttam Babu, Sujata Shrestha, Pashupati Chaudhary, and Ram Prasad Chaudhary. 2010. “How Representative Is the Protected Areas System of Nepal?” *Mountain Research and Development* 30(3):282–94.
- Stein, A. B., V. Athreya, P. Gerngross, G. Balme, P. Henschel, U. Karanth, D. Miquelle, S. Rostro-Garcia, J. F. Kamler, A. Laguardia, I. Khorozyan, and A. Ghoddousi. 2016. “*Panthera Pardus*.” *The IUCN Red List of Threatened Species* 8235:e.T15954A102421779.
- Suryawanshi, Kulbhushansingh R., Yash Veer Bhatnagar, Stephen Redpath, and Charudutt Mishra. 2013. “People, Predators and Perceptions: Patterns of Livestock Depredation by Snow Leopards and Wolves.” *Journal of Applied Ecology* 50(3):550–60.
- Ud Din, Jaffar, Hussain Ali, Aziz Ali, Muhammad Younus, Tahir Mehmood, Yusoff Norma-Rashid, and Muhammad Ali Nawaz. 2017. “Pastoralist-Predator Interaction at the Roof of the World: Conflict Dynamics and

Implications for Conservation.” *Ecology and Society* 22(2):32.

Wegge, Per, Rinjan Shrestha, and Øystein Flagstad. 2012. “Snow Leopard *Panthera Uncia* Predation on Livestock and Wild Prey in a Mountain Valley in Northern Nepal: Implications for Conservation Management.” *Wildlife Biology* 18(2):131–41.

Weiskopf, Sarah R., Shannon M. Kachel, and Kyle P. McCarthy. 2016. “What Are Snow Leopards Really Eating? Identifying Bias in Food-Habit Studies.” *Wildlife Society Bulletin* 40(2):233–40.

Appendices

Data collected from the field

S. N.	Conflict causing animal	Date of conflict	Description of conflict	Place of conflict	GPS Points		Remarks
					x	y	
1	Asiatic black bear	Shrawan 2075	Human injured by bear	Yak Kharka	246 608	3163 642	Tilche C F
2	Asiatic black bear	Bhadra 2077	Crop depredation	Surki	244 631	3162 740	Tilche C F
3	Common leopard	Jestha 2077	Sheep killed by leopard	Near to Tilche village	245 410	3162 740	Tilche C F
4	Asiatic black bear	Baishak, 2076	Yak injured by bear	Aalubaari	243 434	3155 754	Nache C F
5	Asiatic black bear	Bhadra, 2077	Sheep killed by bear	Inside the Nache	243 958	3156 197	Nache C F
6	Common leopard	Asar, 2077	4 Sheep killed by leopard	Pasture land of C F	243 683	3152 161	Taal C F
7	Common	Bhadau,	1 calf was	Inside C F	243	3152	Taal

	leopard	2077	killed by		537	103	C F
			leopard				

Data collected from existing literatures

SN	Place	x	y	Attack	Dead	Injured	Remark
1	Kyuchi Kharka	241280	3163265	Sheep	0	2	
2	Kyuchi Kharka	241355	3163103	Yak	1		
3	Kyuchi Kharka	241437	3163445	Animal's Part	1		
4	Dadakharka	241212	3163428				Leopard Sight
5	Khobro	241223	3162980	Sheep	2		
6	Khobro	241266	3162887	Goat	1	2	
7	Khobro kharka	241299	3162749	Horse	1		
8	khobro	241336	3162561	Sheep	1		
9	Yoba kharka	241190	3162282	Horse	2		
10	Yoba	241250	3162024	Sheep	1	1	
11	Yoba Dada	241313	3162076	Horse	5		
12	Khobro Pakha	241350	3162438	Yak		1	
13	Khobro Tumka	241429	3162484	Horse	1		
14	Khobro pahiro	241494	3162577	Goat	1		
15	Khobro khakhar	241507	3162696	Sheep	1	1	
16	Khobro cho	241447	3162911	Yak	1		

17	Dadakharka	241749	3164087	Horse	1	2	
18	Chauri goth	241836	3164175	Yak	2	1	
19	Chauri goth	242000	3164286	Sheep	2	1	
20	Syaule kharka	241953	3164376	Yak	1	1	
21	Syaule kharka	241956	3164438	Yak	1	1	
22	chhangle Khark	241995	3164495	Yak	1	1	
23	chhangle Khark	242138	3164598	Horse	1		
24	chhangle Khark	242607	3164862	Yak	2	1	
25	Kharka	242503	3164786	Yak	1		
26	Surki Dudhkhola	247766	3165456				Charibagh
27	Surki khola	247705	3165711	Horse	1		
28	Yak kharka	248246	3165956	Sheep	1		
29	Surki	247238	3164829	Horse	1		
30	Surki	247245	3164900	Cow	2		Animal parts
31	Surki	247271	3164958	Horse	1		
32	Surki Kharka	247290	3164994	Cow	6		Animals Parts
33	Surki khola	247522	3165153	Cow	2		
34	Surki Kharka	247654	3165037	Horse	1		
35	Surki Kharka	247813	3165348	Horse	1		
36	Chauri kharka	250502	3166029	Horse	4		
37	Pul bhim tang	252827	3169103	Horse	1		
38	Kyuchi Kharka	241188	3163179	Horse	1		
39	kyuchi Phedi	241117	3163162	Yak		1	
40	kyuchi Phedi	241069	3163158	Yak		2	
41	kyuchi Phedi	241042	3163150	Goat	2		
42	Kyuchi Kharka	240988	3163114	Horse		1	
43	Dadakharka	240940	3163076	Goat	1		
44	Dadakharka	240921	3163071	Horse	1		
45	Dadakharka	240868	3162997	Yak	6		Animals Parts
46	Khopro	241220	3163072	Sheep	5		

47	Khopro	241251	3163038	Sheep	2		
48	khopro kharka	241243	3163105	Jharal	1		
49	Kyuchi Kharka	241377	3163215	Yak	1	2	Animals Parts
50	Kyuchi Kharka	241482	3163210		2		Animals Parts
51	Kyuchi Kharka	241548	3163265	Yak	2		Animals Parts
52	Kyuchi Kharka	241609	3163414	Sheep	2		
53	Kyuchi Kharka	241692	3163845	Yak	1		
54	Kyuchi Kharka	241686	3164002	Yak	1		
55	Kyuchi Kharka	241531	3163863	Horse	3		
56	Syonle kharka	241881	3164136	Thar	1		
57	Syonle kharka	241965	3164231	Sheep	1		
58	Syonle kharka	242027	3164373	Yak	5		Animals parts
59	Chanle kharka	242084	3164541	Yak		1	
60	Chanle kharka	242381	3164632	Gharl	1		
61	Chanle kharka	242541	3164670	Thar	2		Animals parts
62	Kyujiged	240980	3162805	Horse	1		
63	Tiuri Nache	242667	3156846	Cow		1	
64	Nache	245684	3157748	Goat	1		
65	Dona khola	248016	3158284	Goat	1		
66	Nache bakhara	248328	3158356	Goat		2	
67	Nache bakhara	248638	3158382	Horse	1		
68	Kyuwa kharka	249385	3158364	Goat	2		
69	Kyuwa kharka	249343	3158343	Cow	2		
70	Dona kharka	251365	3157608	Yak	2		
71	Dona odor	251471	3157744	Yak	1		
72	Dona yak	251430	3157793	Horse	1		

	kharka						
73	Yak kharka	252870	3155046	Yak	1		
74	Dona yak kharka	253360	3156143	Yak	2		
75	Yak kharka	253080	3156400	Yak		1	
76	Dona lak	253479	3155822	Yak	2		
77	Dona yak kharka	253106	3154683	Yak	1		
78	Dharamsala Dona	252882	3154814	Goat	2		
79	Dona lak yak	253616	3155969	Yak	1		
80	Dharamsal odar	253173	3155512	Goat	1		
81	Dona yak kharka	252832	3155408	Yak		2	
82	Dona yak kharka	252846	3156585	Yak	1		
83	Yak kharka charen	252682	3156728	Yak	1		
84	Kharka ordar	250409	3158188	Goat		3	
85	Kharka ordar	250527	3158183	Goat	3		
86	Nache	245387	3157757	Goat	2		
87	Nache kharka	248272	3158327	Goat		4	
88	Nache kharka	248092	3158337	Sheep	1		
89	Nache kharka	249289	3158313	Cow		2	
90	Nache kharka	248458	3158330	Buffalo		2	
91	Yak kharka	251301	3157610	Yak		3	
92	Yak kharka	251271	3157510	Yak	1		
93	Yak kharka	251191	3157448	Cow	1		
94	Yak kharka	251212	3157238	Horse		2	
95	Yak kharka	251249	3157146	Yak	2		
96	Yak kharka	251342	3157297	Cow	1	2	
97	Yak kharka	252569	3156747	Yak	1		
98	Yak kharka	252882	3156467	Yak	2		
14	Dona Lek	253248	3155783	Yak	2	1	
15	Dona Lek	253611	3155827	Yak		2	
16	Dona Lek	253334	3155855	Yak	1		
17	Dona Lek	253367	3155051	Yak	1		
18	Dona Lek	253483	3154991	Yak	1		

19	Dona Lek	253568	3154890	Yak	1		
20	Dona Lek	253634	3154815	Yak	1		
21	Dona Lek	253696	3154651	Yak	2		
22	Dona Lek	253869	3154549	Yak	1		
108	Yak kharka	252290	3156934	Goat	1		
109	Omu Odar	250349	3158272	Goat	2		