An Assessment of Human Wildlife Conflict

in

Gandaki Province

(Case Study of Gorkha and Tanahun)

Provincial Government

Ministry of Forest, Environment and Soil Conservation

Forest Research and Training Centre

Pokhara, Kaski, Gandaki Province

April, 2022

Citation:

FRTC. 2022. An Assessment of Human Wildlife Conflict in Gandaki Provice, Forest Research and Training Center (FRTC), Ministry of Forest, Environment and Soil Conservation, Pokhara, Gandaki Province.

Contact Address:
Forest Research and Training Centre
Tel: 977 061456974
Email: frtc.gandaki@gmail.com
Website: frtc.gandaki.gov.np

Acknowledgement

The objectives of this study were to assess the nature, extent and patterns of existing situation of human wildlife conflict in Gandaki Province. Forest Research and Training Centre, Pokhara firstly would like to thank Nepal Foresters Association, Kathmandu, for their crucial role in completing this research project. The FRTC also express sincere gratitude to all the distinguished personalities and representatives of Ministry of Forest, Environment and Soil Conservation, Gandaki Province, Forest Directorate, Division Forest Office Kaski, Annapurna Conservation Area Project Pokhara, Institute of Forestry, Pokhara, Forest Seed laboratory and Storage Centre, Kaski for their valuable guidance, feedback, comments during the Inception and Provincial level workshop which were crucial to shape this report. Moreover, FRTC also like to thank Mrs. Manju KC, Assistant Research Officer, for her contribution and support to complete this study. Further, FRTC also thanks Mr. Rajesh Poudel (Assistant Training Officer), Mrs. Anshu Dhakal (Officer), Chungla Sherpa (Ranger) for their support. In addition, special thanks goes to Division Forest Office Gorkha, Division Forest Office Tanahun, Manaslu Conservation Area Project Gorkha, Manaslu Conservation Area Liason Office Gorkha, FECOFUN Gorkha, NGO Network Tanahun, community forest user groups of both Gorkha and Tanahun, residents of Gorkha and Tanahun for sharing their valuable information during discussion and meetings to the study team.

Thank You.

Rajesh Malla
Director
Forest Research and Training Centre
Pokhara, Gandaki Province

Acronyms

ACA	Annapurna Conservation Area
ACAP	Annapurna Conservation Area Project
CBS	Central Bureau of Statistics
CF	Community Forests
CFOP	Community Forest Operational Plan
CFUGs	Community Forest Users Groups
DCC	District Coordination Committee
DFO	Division Forest Office
DFRS	Department of Forest Research and Survey
DNPWC	Department of National Parks and Wildlife Conservation
FECOFUN	Federation of Community Forest Users Nepal
FGD	Focus Group Discussion
FRTC	Forest Research and Training Center
GIS	Geographic Information System
GoN	Government of Nepal
GPS	Global Positioning System
HHs	Households
HWC	Human-Wildlife Conflict
ICIMOD	International Center for Integrated Mountain Development
I/NGO	International/Non Governmental Organization
KII	Key Informant Interview
MCA	Manaslu Conservation Area
MoFSC	Ministry of Forest and Soil Conservation
NEFIN	Nepal Federation of Indigenous Communities
SWMO	Soil and Watershed Management Office
USDS	United States Department of States
WWF	World Wide Fund for Nature

Table of Contents

Contents

List of Tables

List of Maps

List of Figure

Executive Summary

This assessment entitled "An Assessment of Human-Wildlife Conflict in Gandaki Province" documented the nature of wildlife damages, their status, distribution, current practices to address issues, economic loss due to wildlife damages and future strategic actions to reduce human-wildlife conflict. The main objective of the assessment is to understand the human-wildlife conflict in Gandaki province, especially Tanahun and Gorkha districts and assessed in six rural/municipalities of of both districts. Social surveys, including structured questionnaire household survey, consultation meetings and focus group discussion were performed in the settlements that experienced highest human-wildlife conflict in Suklagandaki, Vyas and Bhanu municipalities of Tanahun district and Gorkha, Palungtar Municipalities and Barpak Sulikot Rural Municipality of Gorkha district. Twenty-four Community Forests were (four each from six municipalities) selected randomly in coordination with Division Forest Offices in district level consultation meetings. Secondary information were collected from Division Forest Offices, Annapurna Conservation Area and Manaslu Conservation Area Liaison offices of Pokhara and Gorkha, NGOs, media and other stakeholders. Key Informant Interviews are conducted with professional and knowledgeable authorities and personalities of Tanahun and Gorkha. Focus group discussions were conducted in 17 CFUGs and household survey was conducted in 240 households of 24 CFUGs. Microsoft Excel was used for all data analysis and statistical tools. Arc GIS is used to prepare maps.

There are 44% female respondents in the household survey. The mean age of respondents is 46.79 years, and the average family size is 5.75. Education of respondents varies from illiterate to master degree and occupation of 93% respondents is agriculture. Major sources of income are agriculture, service, business, remittance and pension. Average landholding size is 10.4 ropani, including upland non irrigated fields. Paddy (*Oryza sativa*), followed by maize (*Zea mays*), millet (*Panicum miliaceum*) and potatoes (*Solanum tuberosum*) are major crops produced, and 1,456 kg is average annual crop production per household, which is sufficient to feed 54% families for 12 months and 37,380 kg grain have been purchased to meet the food requirement of deficit 3-9 months by 46% households. Size of average livestock ownership is eight, and Goats (*Capra spp*.), Cows (*Bos spp*), Pigs (*Sus spp*.) and buffalo (*Bubalus spp*.) are common livestock owned. 73% of households adopted both stall feeding and grazing system for livestock farming. Eighty per cent of fodder for livestock is managed from private lands

and community forests. Two third households are located within 500 m of the forest. Sources of cooking are fire wood, LP Gas and electricity. Fifty-seven per cent of households are using all three means of these energy sources.

Common Leopard (*Panthera pardus*), Rhesus Monkey (*Macaca mulatta*), Jungle Cat (*Felis chaus*), Wild Rabbit, Jackal (*Canis aureus*), Porcupine (*Erethizon dorsatus*), Deer (*Muntiacus muntjak)*, Yellow-throated martens (*Martes flavigula*), Himalayan Black Bear (*Ursus thibetanus*) are major wildlife species inhabiting in neighboring forests. Common Leopard, Monkey, Jackal, Porcupine, Wild Rabbit are common visitors to settlements and found responsible for conflicts with humans. Crop damage, livestock depredation, human casualty and injury are major wildlife damages, and a small proportion of property damage exists. Fifty-eight per cent of respondents have experienced and realization of crop damage and fourty foty two percent have on livestock depredation by wildlife. In an average, a household from the study area loses 1.71 Muri (137 kg) crops per year. Monkey is common to crop raider (68.5%), which is followed by Porcupine (20.1%). Crops lost by wildlife includes Maize (70%), Rice (14%), Millet (14%) and Potato (2%). Crop damaging months are Jestha, Mangsir and Magh. Similarly, 11 incidences of livestock depredation occur per year due to wildlife. Common Leopard (92%) and Jungle Cat (5%) are two major wildlife species responsible for livestock depredation. More than half of the evidence occurs in farmlands, about one-third at home/shed and one-third in forests. Relief fund of livestock depredation distributed to victim households from 2075, which showed that a victim household received Nrs 16,269 in an average. Property damage is relatively less in the study area. Only four households experienced damage of livestock shed due to wildlife amounting NRs 20,000/- in total in the last ten years, which is very nominal. The financial loss of livestock during 2015-19 in five districts of Gandaki province was USD 115,656.00, equivalent to USD 142.61 per household (Baral et al., 2021). It is found that total economic loss due to wildlife damage in the study area is NRs 10,043 per household.

Since 2074 (2017), 11 people have lost their lives and 34 people injured due to wildlife attacks in Tanahun and Gorkha. More than 50% of wildlife attacks are in 2078, and incidences documented round the year. All eleven cases of human casualty occur in Tanahun, and victims are children of below 11 years. Out of that, about fifty per cent of children are 5-8 years. Common Leopard is responsible for all casualties, and 92% of attacks, including injuries, are

by Common Leopard. Himalayan Black Bear is responsible for injuries only and eight per cent of attacks in totality. Sixty-seven per cent of attacks were in the evening.

Evidence of wildlife poaching and retaliatory killing have not been revealed from the random survey. Secondary information collected from DFO Gorkha and Tanahun shows that 121 wildlife of 13 species are trapped, rescued and managed in 117 evidences from 2064 to Poush 2078. 79% cases were from Tanahun, and the remaining 21% were from Gorkha. Those animals have been rescued and managed from eighteen rural/municipalities of both districts, and the majority are from Bhanu (27%) and Vyas Municipalities (23%) of Tanahun. Cases of management of those many individuals are due to problematic nature (trapped in cages), natural death, rescue from the settlement (19 individuals), dead body found (54%), road accident, found in sick and injured condition, seizure by enforcement agencies etc. Of 121 individuals, 21% were released in their natural habitat, 17% sent to national parks and zoological gardens, and 45% buried in the pit. Death of those many wildlife and the unavailability of reasons for death is suspicious.

Numerous general and damage-specific preventive measures to minimize wildlife damages have been adopted at the household and community level. Ninety percent households adopted noise-making and shouting practices, followed by the use of catapult by 51% households to minimize crop damage by wildlife. 37% households placed scarecrows on the farm, and some of the households guard their croplands with or without dogs. It is found that 70% of households have adopted multiple measures, 22% adopted single measures and 8 percent do not practice any preventive measures. In minimizing livestock depredation by wildlife, 31% households improved their existing sheds, and very few of them have made noise to chase away wildlife. There were no specific measures adopted before human casualties in Bhanu municipality of Tanahun in 2076/077. After then, awareness-raising activities have been organized at household and community level, focusing on disseminating messages on the ecology and behavior of Common Leopard and other carnivores with some dos and don’ts. It includes the use of light around home in evening and night, avoiding leaving children unattended, walk in group in the forest, discourage to enter forest at night, improving livestock shed and promoting stall feeding livestock husbandry practices. Improvement of livestock shed has found effective, and none of the other works well. Some of them work for certain time and not effective for long run.

Based on the HWC Relief Fund Guideline and program of government, ACA and MCA liaison offices of Pokhara and Gorkha distributed relief funds to the livestock depredation victim households with the recommendation of DFOs and through them, which I time consuming in practice. Total of 436 families of 17 rural/municipalities of both districts received that fund from 075/076 to 078/079. 59 % of respondents know about the HWC relief fund process of GoN. Almost all of them shared that process is very complex and time-consuming. Facilitation in process documentation is of utmost importance, and there was no claim from Dharche Rural Municipality of Gorkha and very nominal from remote municipalities, settlements of Tanahun.

Reasons provided by respondents on wildlife movement outside forest area includes (a) increase in the number of wildlife, (b) no food available inside the forest, (c) habitat degradation, (d) proximity of settlements to the forest, and (e) problematic nature of wildlife, which resulted into conflicts with human. It is responded that wild animals come out of the forest at any time of the day and varies on wildlife species. Temporal distribution of wildlife damages depends on wildlife species and crop ripening time. Monkey, Jackal and Leopard Cat visit farms and homes from morning to evening. Common Leopard visit to settlements in the evening and night and Porcupine in the night. Wildlife movement to settlements and farmlands was found round the year but more in the months of Jestha, Shrawan, Kartik and Magh for crop-raiding and depredation and injuries. Eighteen rural/municipalities of Gorkha and Tanahun are impacted by wildlife damages, but the scale varies. Tsumnubri Rural Municipality of Gorkha falls in the Conservation area and is not included in this assessment. None of the wildlife damage evidences from Dharche Rural Municipality of Gorkha was reported. It is found that there are very high incidences in Gorkha and Palungtar municipalities of Gorkha and Bhanu and Vyas municipalities of Tanahun. Frequency of damages differs by nature of conflict, wildlife species, wards and settlements. Ward number 1, 2, 3 and 4 of Bhanu municipality of Tanahun was heavily impacted by human casualty and injury by Common Leopard. In addition, Gorkha municipality has more cases of livestock depredation by Common Leopard.

Future strategic actions for HWC reduction, in general, includes knowledge dissemination, awareness-raising, guarding farmlands, use of light around home in evening and night, bush clearance at the homestead, use of abandoned agricultural land. Specific actions to minimize crop damage include noise/shouting, fruit farming in the forest, catapult use, fence croplands, and waterhole construction in the forest. Similarly, specific actions suggested to minimize

livestock depredation include habitat management, improvement of livestock shed, promote stall feeding livestock husbandry practices, and increase prey base in the forest. In addition, actions recommended for controlling human injury/casualty include lighting in and around home in evening and night, removing unwanted bushes around house, not leaving children unattended, walk in group in the forest, and making noise while walking through/along forest areas.

Recommendation of the study includes revision in CFOP guideline to address issues of wildlife damages together with provision of relief fund distribution at community level, management of abandoned agricultural lands, wildlife habitat management, create common forum of stakeholders for better coordination in processing HWC relief fund and address HWC, formation and strengthening Rapid Response Team at municipal level, HWC management strategy and action plans development at provincial and municipal level and to manage and process releif fund distribution from local governments, capacitate and equip forest offices together with local governments in handling problem animals and wildlife damages, incorporate progress regarding wildlife damages in annual progress report of respective Division Forest Offices, establish insurance scheme at local level, promotion of alternative and wildlife-friendly crops, construction of wildlife friendly infrastructure, knowledge dissemination and awareness on ecology and behavior of predator wild species, develop and strengthen existing capacity of human resources in HWC documentation and strengthen overall system of HWC relief fund, mainstream HWC in all environmental concerns and green sectors development plans and priotize research on prey-predator status.

1. Introduction

1.1 Context of the Study

Nepal is endowed with rich biological diversity and its' unique geography with changes in elevation along relatively short (150- 250 km) north-south transect and associated high variability in the physiographic and climatic conditions resulted in a uniquely rich diversity of flora and fauna in the country (GoN/MoFSC 2014). The country occupies about 0.1 per cent of the global area but harbors 3.2 per cent and 1.1 per cent of the world's known flora and fauna, respectively. This includes 5.2 per cent of the world's known mammals, 9.5 per cent of birds, 5.1 per cent of gymnosperms and 8.2 per cent of bryophytes (GoN/MoFSC 2014). The forest cover of the country is increased to 44.74%, and more than one-third of the total forest area (37.80%) falls in the middle mountain region (DFRS 2015). However, the increased forest landscape does not guarantee the larger forest patches. Disconnected forest patches reduce habitat suitability and hinder the migration and communication processes of the animals (Ma et al., 2021).

Human-wildlife conflict is one of the biggest conservation challenges throughout the world (Sapkota et al. 2014), and understanding patterns of Human-Wildlife Conflict (HWC) and identifying the underlying causes are important components of conservation biology (Acharya et al. 2016). Habitat loss, its' degradation and fragmentation, pressure on natural resources through logging, animal husbandry, agricultural expansion, and unscientific and unmanaged developmental projects causes the HWC around the world (Fernando et al. 2005). However, human-wildlife conflicts are site-specific and vary from place to place (Distefano, 2005), which is directly associated with home and land use practices (Neupane et al. 2017a). It has been reported that human casualties, livestock depredation and crop damages are common in Seti Sub-River Basin (Adhikari et al., 2019). The infrastructure development process has accelerated the encroachment and conversion of forests to arable lands that caused the reduction in the ability of wildlife to disperse in their home ranges, thereby bringing them into proximity with humans and human settlements (P. Sharma et al., 2015). With the increasing human population and pressure due to unplanned and haphazard infrastructure construction, forest resource collection, livestock grazing, there would be an obvious change in land use and land cover, which will significantly influence the movement of wildlife (Shrestha 2016). Modifying the forest areas on human interest and human dominance on the natural resources eventually caused wildlife habitat fragmentation and intensified the conflict between humans

and wildlife (Michalski et al. 2006, Sharma et al. 2020), which resulted negatively in co-existence. In many cases, wildlife enters villages to fulfil the nutritional needs (Sukumar 1991) that can be easily accessed in agricultural fields or settlements. While wildlife enters into human settlements in search of food or prey species, it causes human and economic loss; and reduces food security and livelihood opportunities (Neupane et al. 2017b).

Human-wildlife conflict (HWC) is a well-known phenomenon in Nepal. According to DNPWC (2017), 69 districts have specific incidences of wildlife conflicts caused by 26 identified species. Still, the studies on the extent, nature, intensity of HWC, their underlying causes, patterns of casualties are often too general, vague and have less scientific merit. People's perception and attitude at an individual level are affected by socio-demographic factors such as gender, age, education level, source of income, exposure to the wildlife and previous experiences (Kansky and Knight 2014). Spatial trends of conflicts will help analyze the influencing factors (Anand and Radhakrishna 2017) of HWC. HWC has consequences on both the wildlife (Kretser et al. 2009) and human livelihood (Dar et al., 2009). Major forms of conflicts posed by wildlife in Nepal are crop damage, livestock depredation, property damage, and human injury and casualty (DNPWC 2017). The damage caused by animals may vary based on the species, season, and availability of the natural resources (Adhikari et al., 2018). Occasionally, big wild animals kill humans (GoN/MoFSC 2014). The increased loss and fragmentation of the habitats due to growing human population, change in land-use patterns and urbanization have intensified competition for shared and limited resources, which manifest various types of conflict such as crop-raiding, livestock predation, property damage, human death and injury and considering the economic loss, human causality and injuries, victim individuals and communities killed wildlife in retaliation.

Despite Nepal's remarkable achievement in wildlife conservation, multiple factors threaten their survival. Among many, the conflict between people and wildlife is an undeniable threat to their management and conservation. GoN formulated policies for preventive and curative measures to minimize human-wildlife conflict. Among them, the HWC relief fund mechanism is in operation at the local and federal levels. Community practices to minimize HWC include guarding crops and livestock, constructing fences and improved corral, managing scare crow and use of noise, etc. Those practices differ by locality, knowledge and capacity of households, groups and communities. The substantial knowledge on human-wildlife interactions and livestock predator dynamics, which is central in the management of HWC, is lacking. Hence,

improved strategies are urgently needed to promote the co-existence of wild animals and people. Reducing human-wildlife conflict is an urgent conservation priority and key to co-existence between humans and animals. In such circumstances, this study investigated the nature, extent, distribution, economic loss, existing mitigation measures, including their effectiveness and spatial and temporal patterns of human-wildlife conflict in Tanahun and Gorkha districts of Gandaki Province.

1.2 Research Objectives

The main objective of this study was to assess the nature, extent and patterns of the existing situation of human-wildlife conflict in Gandaki Province. The specific objectives of the assignment were as follows:

1. To assess the nature, intensity and quantity of the loss caused by human-wildlife conflict
2. To evaluate methods and techniques adopted to reduce human-wildlife conflict
3. To explore the spatial and temporal patterns of wild animals' attacks on people and identify conflict hotspots in the study area.

2 Methodology

2.1 Study Area

This study was carried out in Tanahun and Gorkha districts (Map: 1) extending from 27°36' - 28°15' N and 83°57' - 85°58' E. Gorkha district extends from 27°15' to 28°15' N and 84°27' to 85°58' E, and elevation ranges from 330 m to 8,156 m. The total geographic coverage of the district is 3,645.86 sq. km. Tanahun district extends from 27°36' to 28°05'N and 83°57' to 84°34' E, with an elevation range from 187m to 2,134 m. The total area of the district is 1,56 9.02 sq. km. There are 93,173 households in Tanahun and 72,968 households in Gorkha districts (CBS 2078). The total population of Gorkha and Tanahun districts are 2,52,201 and 3,27,620, respectively. Average family size of Nepal is 4.32, and family size in Gandaki Province is 3.66. The range of family size of Gorkha and Tanahun falls from 3.4 to 3.85 (CBS 2078). Brahmin, Kshetri, Gurung, Magar, Newar, Bishwokarma, Sunar and Nepali are major ethnic communities having agriculture, livestock husbandry, remittance, service and business as primary sources of income for livelihood. Major wild animals found in study area are Snow Leopard, Common Leopard, Barking Deer, Himalayan Black Bear, Ghoral, Musk Deer, Blue Sheep, Jackal, Porcupine, Jungle Cat, Wild Rabbit, Pangolin and avifauna including Danfe, Munal, Kaliz, Jungle Fowl, Bhyakur (DFO: Gorkha and Tanahun 077/078).

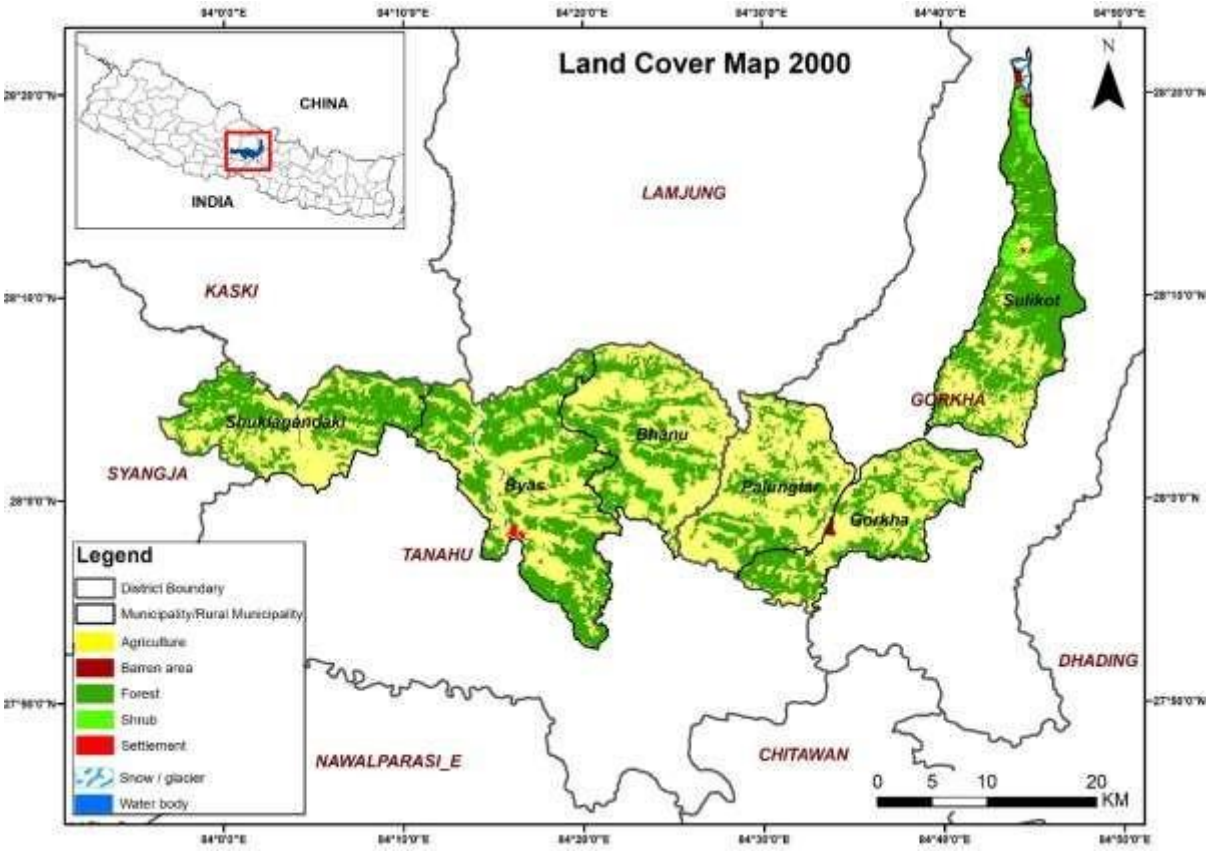
Vyas Municipality, Bhanu Municipality and Suklagandaki Municipality of Tanahun district and Gorkha Municipality, Palungtar Municipality and Barpak Sulikot Rural Municipality of Gorkha district purposively selected (Fig 1) based on the presence of serious human-wildlife conflicts. Land use land cover change of six selected rural/municipalities from 2000 to 2020 shows that there is an increase in forest cover and decrease in agriculture land, barren land and shrub land in the study area (Table:1). Higher per cent age of changes in agricultural land from 2010 to 2020 is due to abandoned agricultural land, which ultimately increased greenery and increased forest cover (Map 1, 2, 3 below). Shrub land is also decreased, and settlement area is increased.

Table 1: Land Use Land Cover Change

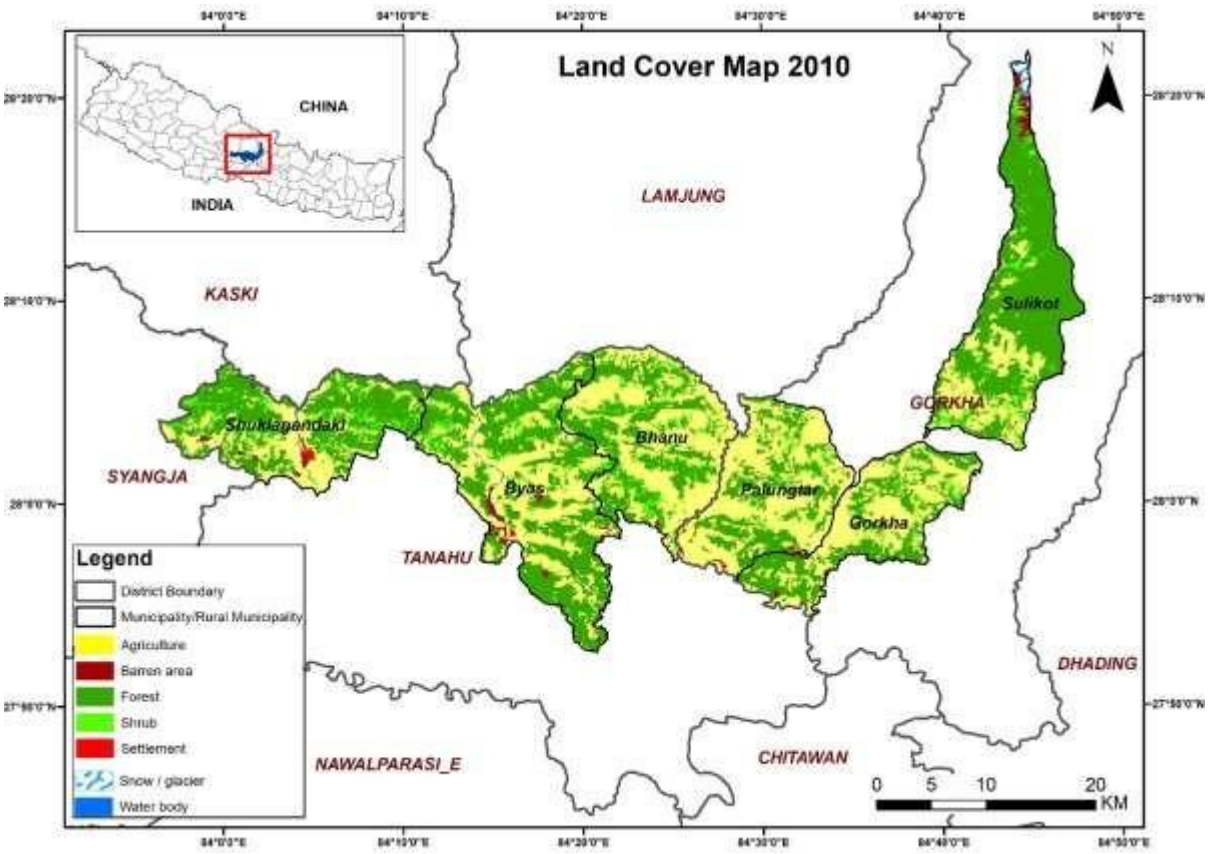
Sn	Class	2000	2010	Change	2020	Change
		Area_Sqkm	Area_Sqkm	Area_Sqkm	Area_Sqkm	Area_Sqkm
1	Agriculture	546.93	467.26	-79.67	325.10	-142.16
2	Barren Land	3.30	11.55	8.25	2.82	-8.73
3	Forest	492.12	521.46	29.34	732.91	211.45
4	Shrub	37.91	79.11	41.20	14.66	-64.45
5	Settlement	1.39	1.70	0.31	3.91	2.21

6	Snow/Glacier	3.32	3.45	0.13	3.27	-0.50
7	Water body	3.89	4.32	0.43	6.29	1.97
Total		**1089**	**1089**		**1089**	

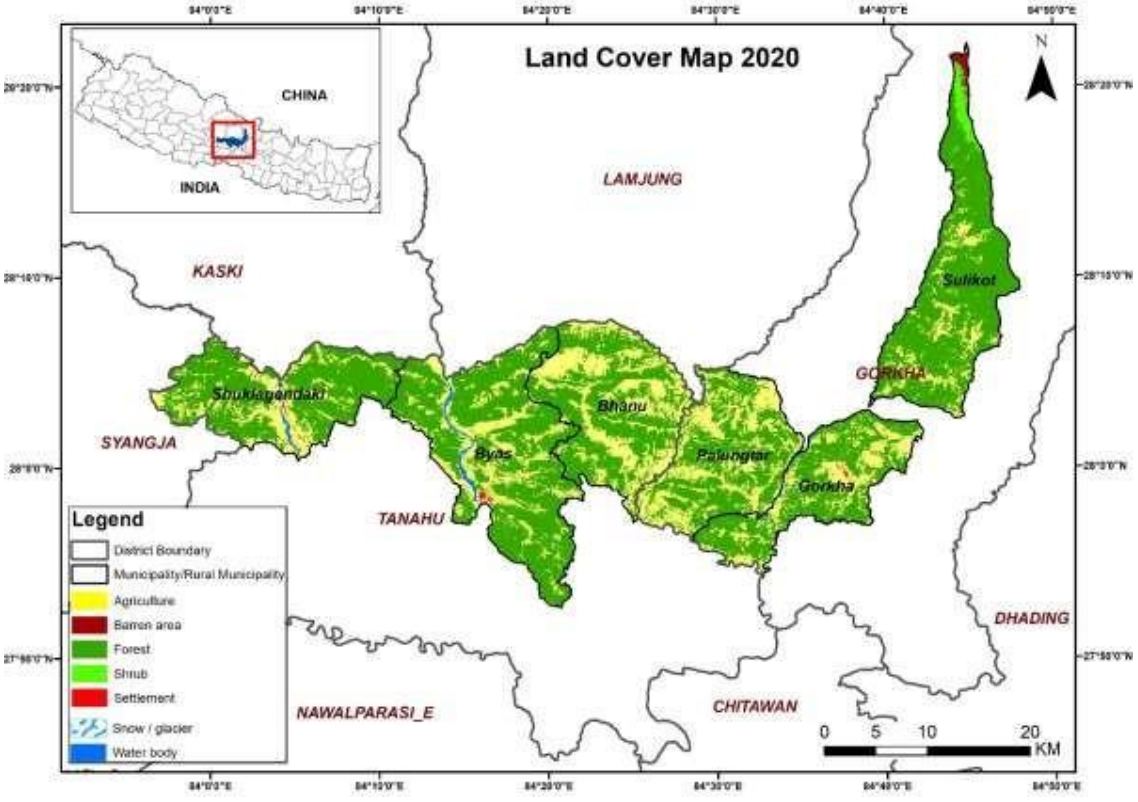
Source: ICIMOD 2000, 2010, USGS/Land ETM 2020



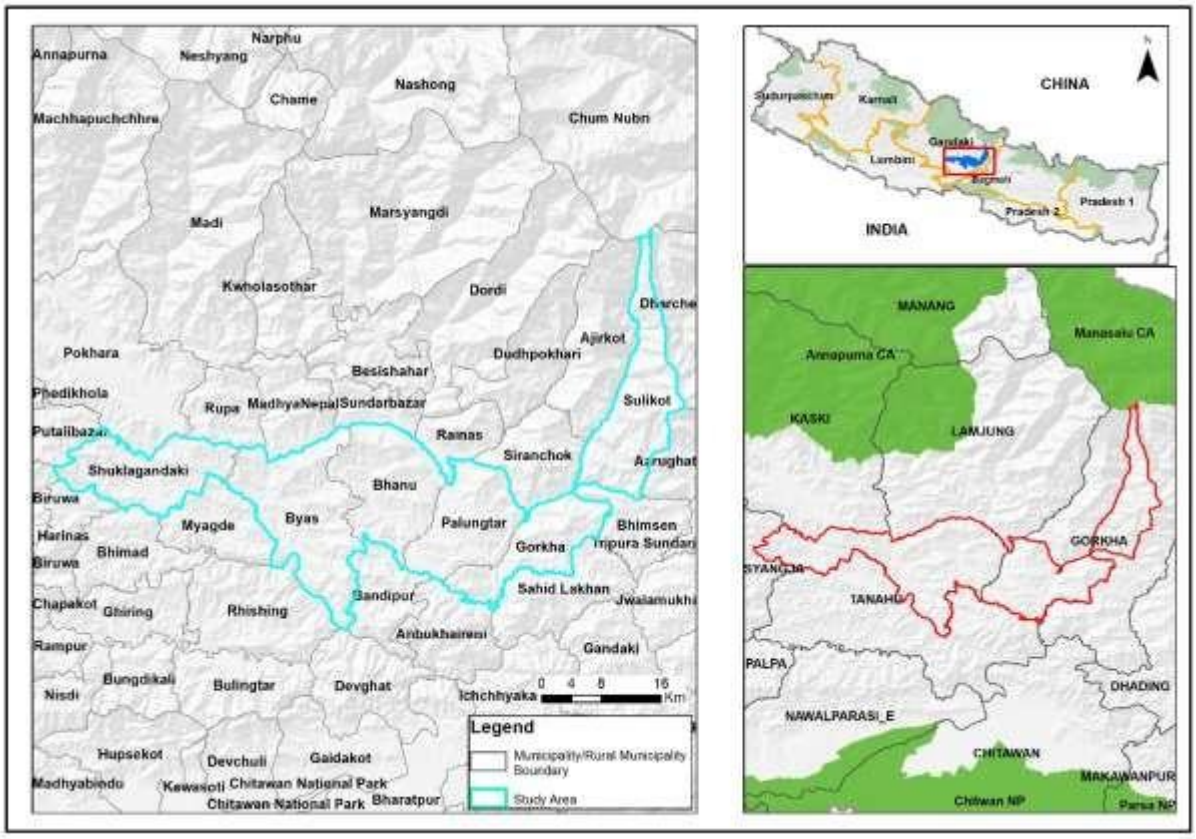
Map 1: Land Use Land Cover 2000



Map 2: Land Use Land Cover 2010



Map 3: Land Use Land Cover 2020



Map 4: Location Map of Study Area

2 Methodology

Extensive literature surveys and discussions at group level and key persons undertaken to select sites with the highest incidences of human-wildlife conflicts in Tanahun and Gorkha districts. Out of 21 local governments, six rural/municipalities, three each from both districts, were selected among the higher frequency of human-wildlife conflict in recent pasts. Twenty-four Community Forest User Groups (CFUGs), four CFUGs from each rural/municipalities, were selected randomly during district level consultations (Annex I). Name lists of organizations and authorities consulted for site selection is in annex II. Focus Group Discussions (FGD), Key Informant Interview (KII) and household surveys have been conducted for primary data collection. Groups for discussion are selected in district level consultations and households selected during focus group discussions. Two hundred forty households of 24 CFUGs (10 households from each CFUG) were selected on 1 in 5 bases as respondents. Female respondents were selected in alternate order during household selection from the CF constitution for inclusion and balance sex ratio of males and females. Structured questionnaire included

information on socioeconomic aspects, distance of house from forest, wildlife species found in the area, nature and intensity of conflicts in last ten years, location and time (year and month) of incidence, responsible species, economic loss, existing preventive measures and their effectiveness, HWC relief fund, reason of wildlife movement outside forests, GPS points, the spatial distribution of damages and future strategic actions to minimize HWC. Published literature and unpublished reports were reviewed and information have been collected from various stakeholders.

2.2.1 Data Collection

Focus Group Discussion (FGDs) have been organized in seventeen CFUGs (Annex III). One hundred eighty-seven community members, including 90 females and seven representatives of local governments, participated in discussions and provided their inputs on major livelihood options of villagers, wildlife species found in their forests, common species visited to settlements, crop field and village, incidences of wildlife damages in last ten years in village and major wildlife damages including responsible wildlife species. In addition, they have provided information on frequency and time of wildlife damages, impacted households in village, quantity of crop loss and number of lvestock depredated, average annual economic loss, preventive measures adopted and their effectiveness, evidence of retaliatory killing and wildlife poaching, reasons of wildlife movement outside their habitat, human-wildlife conflict relief fund and beneficiaries and future strategic actions.

During district level consultation in Tanahun in 9 January 2022, a participant shared that more human casualty had been recorded in Bhanu Municipality especially along Marsyangdi River.

Figure 1: Focus Group Discussion; Siddhabaraha CFUG, Vyas -11, Bhimsenthumki CFUG, Bhanu -1Tanahun and Dhaki Danda CFUG, Barpak Sulikot-7, Gorkha

Key Informant Interviews were conducted with four authorities and knowledgeable stakeholders from Division Forest Offices, Conservation Area and NGO sector (Annex IV).

Interviews were focused on their professional engagement in the field of biodiversity conservation, major conservation threats in their respective areas, conservation activities in practice, incidences of wildlife damages in last ten years, frequency of damages and geographic distribution, reasons for wildlife movement outside forest, status and effectiveness of HWC relief fund, major issues in managing HWC and strategic actions taken to minimize HWC and their effectiveness.

Two hundred forty households of 24 community forests of Gorkha and Tanahun are surveyed, survey questionnaire is in annex V and respondents were from various educational backgrounds, ethnic groups, sex and age. Information collected cover wildlife damage incidences of last ten years at group, experts and household level respectively. Data collected from the household survey have been verified with the information collected from Division Forest Offices. Supporting data were collected from published and unpublished reports and literatures.

Figure 2: Household Survey; Sano Deurali CFUG, Bhanu -2, and Bhimsenthumki CFUG, Bhanu -1, Tanahun

2.2.2 Data Analysis

Numerous variables were considered for data collection. Socioeconomic variables include the age of respondents, occupation, family size, sources of income and land & livestock ownership together with husbandry system and sources of fodder. In addition, devices used for cooking sources of firewood were the variables considered in data collection. Similarly, spatial variables include district, rural/municipalities, ward number, CFUGs, distance of home from forest, wildlife species responsible for damages. Livestock depredation site is classified as forest, home/livestock shed, and farms are other variables of data collection. Data have been organized by objectives of assessment (Shrestha et al. 2007) and analyzed adopting both qualitative and quantitative methods with the use of statistical tools through MS-Excel. For uniformity, all collected data through various methodologies are entered in a format, which helps in reviewing and deletion of duplicated information. The interpretation was made by descriptive frequencies, such as percentage, average, mean and range. Results were organized and presented in tables, charts and boxes. Crop damage and economic loss are calculated by using following formula (Bhatta M & Joshi R 2020).

Average damage per HHs per year (kg) = Total damage of crops of sampled HHs/ Number of sampled HHs Total damage of crops of sampled HHs (Kg) = Sum of the total damage of crops of each sampled HHs Monetary economic value of crops per year per HHs (NRs.) = Average damage per year per HHs (Kg) × Local market value (local currencies) of each crop per kg.

Number of wildlife attacks per year was summarized in terms of mean (M), and the number of events with regard to different spatial, temporal and socio-economic variables were analyzed by using percentage (Baral K 2021). Nature and intensity of conflicts by year, wildlife species, crops and livestock type analyzed in percentages. Livestock depredation sites have been classified in home/corral, farms and grazing lands and also analyzed in percentages. Ranges and averages are adopted to analyze remaining variables. Existing preventive measures for the minimization of human-wildlife conflicts, which were classified in 4 point Likert Scale (very high, high, moderate and not effective). Data on spatial and temporal distributions collected from numerous sources are analyzed in percentages. Some of them are presented in numbers as well. Land use land cover change data are used from ICIMOD 2000, 2020 and USDS/Landsat ETM 2020. Arc GIS was used to generate data in required format and preparation of maps. Hotspot map is generated by compiling locations of all nature of wildlife damages and categorized as very high, high, medium and low on the basis of number of incidences.

3 Results and Discussion

Results of socioeconomic, spatial and temporal variables and variables specific to wildlife damage, which include wildlife species, nature of damages, crop and livestock type, economic loss, preventive measures and their effectiveness, human wildlife conflict relief fund beneficiaries, problem wild animal management efforts of law enforcement agencies and future strategic actions are presented separately as follows.

3.1 Demographic Information

Findings of demographic information especially on ethnic group, sex, age, occupation, education (Table 2 Demographic profile of respondents), income sources, livestock and land ownership, livestock husbandry practices, sources of fodder, means of energy for cooking and sources of energy, food sufficiency of respondents are briefed separately as follows.

Table 2: Demographic Profile of Respondents

Respondents feature	Categories	No
Ethnic Group (Number - 240)	Brahmin	53
	Kshetri	50
	Indigenous communities	90
	Dalit	46
	Other	1
Sex (Number- 240)	Male	135
	Female	105
Age (Number - 240)	20-30	25
	30-40	49
	40-50	69
	50-60	57
	60-70	35
	70-80	5
Occupation (Number - 240)	Agriculture	222
	Business	10
	Service	5
	Third Country Employment	1
	Student	2
Education (Number -240)	Illiterate	32
	Literate (below SLC)	154
	SLC	32
	10+2	19
	Bachelor	2
	Master	1

3.1.1 Ethnic Composition of Respondents

All ethnic groups have been included in the survey. Out of 240 respondents, 38% are from indigenous communities, followed by Brahmin (22%) and Kshetri (21%). Nineteen per cent of respondents are from Dalit community, and 1 household is from Muslim community (Fig 3).

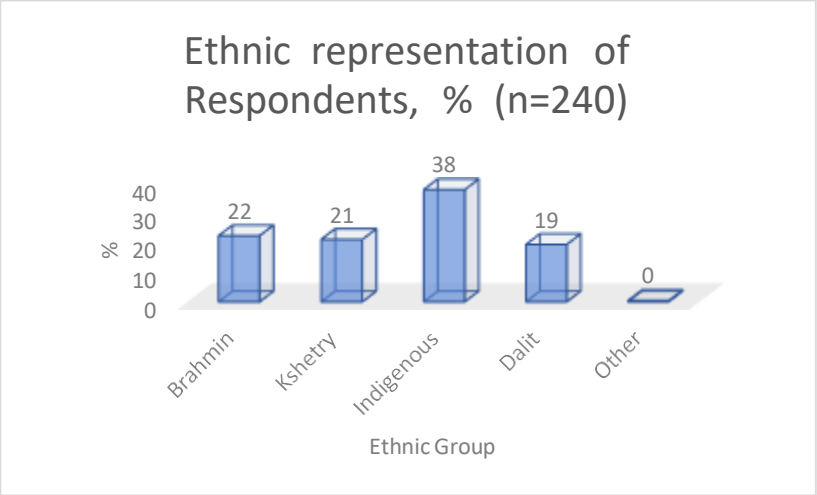


Figure 3: Ethnic Representation of Respondents

3.1.2 Respondents by Sex

Both male and female-headed households were selected alternatively from a list of users of respective CFs for the household survey. Among the respondents, 56 % are male, and 44% are female (Fig 4). The availability of female respondents during the survey is relatively less than males.

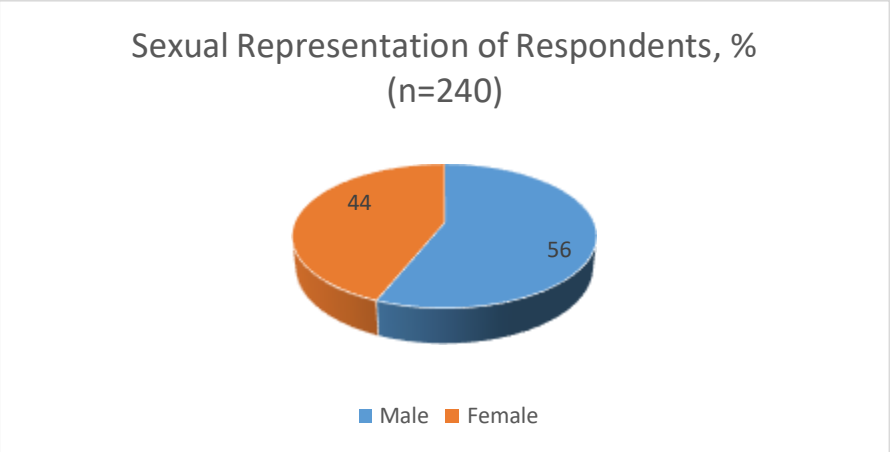


Figure 4: Sexual representation of respondents

3.1.3 Respondents by Age

The age of respondents has been categorized into seven categories from 20 years to more than 70 years. The highest categorical representation of age of respondents showed that 29% of respondents are from age group of 41-50, followed by 24% of respondents from age group of 51-60 (Fig 5). The mean age of respondents is 46.79 years. About half of respondents are from 40-60 years, which indicates that most of respondents are mature and knowledgeable on the targeted subject matter.

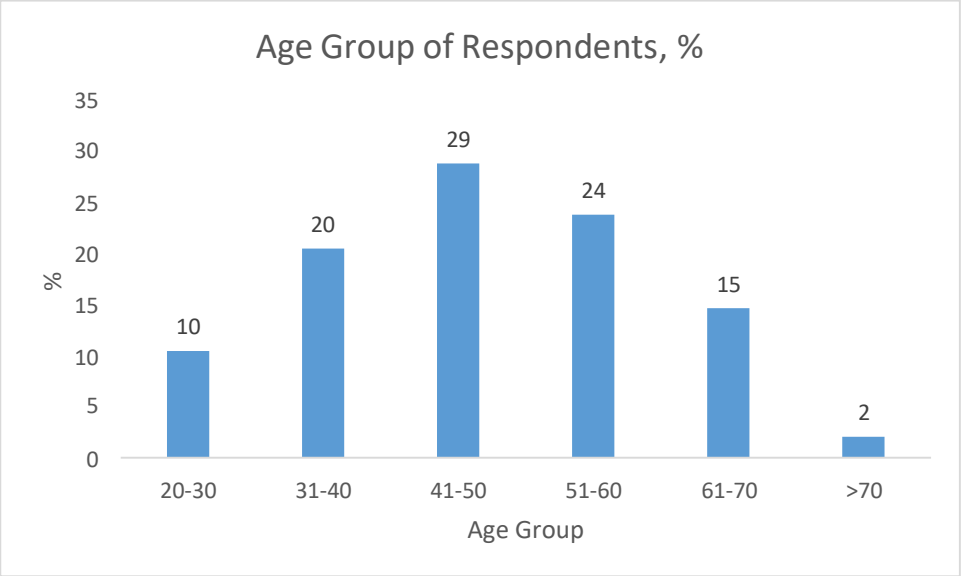


Figure 5: Age Group of Respondents

3.1.4 Occupation of Respondents

Respondents from various occupational groups are surveyed. Agriculture, Business, Service, Remittance and Pension are major income sources and occupation of respondents. Among them, Ninety three percent are farmers and engaged in agriculture together with livestock husbandry. Four per cent age of respondents are engaged in business and two percent in service. One per cent of respondents are students, and less than a per cent are from third country employment (Fig 6). Fifty one per cent households have multiple sources of income (Fig 7). Households with more than two income sources are very limited. Diversification in livelihood options increases livelihood support systems to make them secure for subsistence.

> One respondent shared that his major source of income is traditional occupation of Blacksmith complemented by agriculture.

Respondents from diverse occupations shared their thoughts and knowledge accordingly.

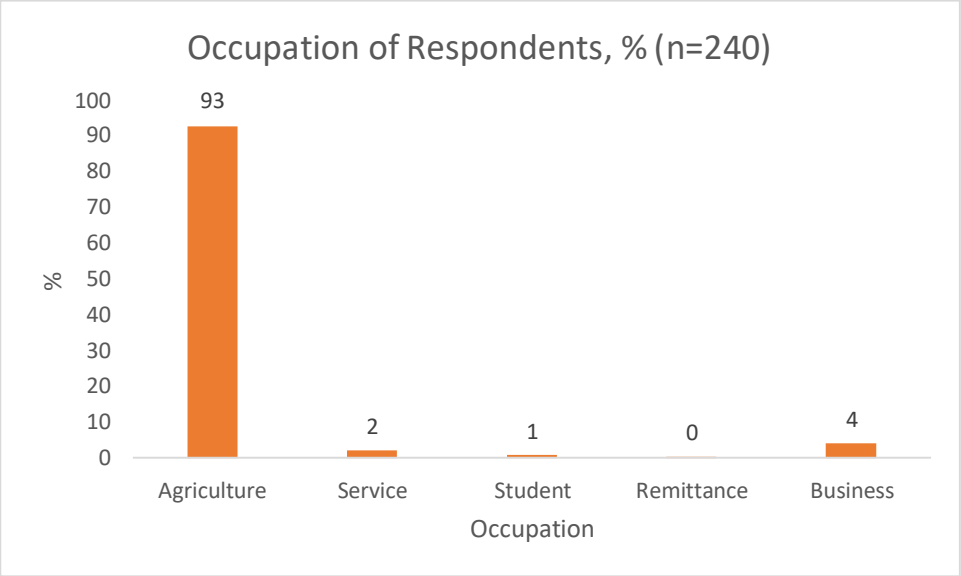


Figure 6: Occupation of Respondents

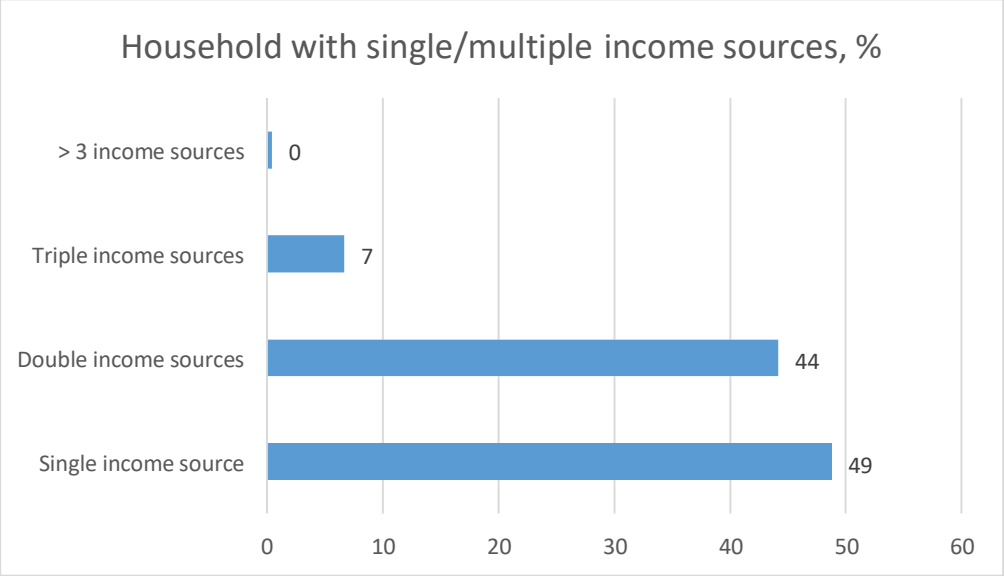


Figure 7: Households with Multiple income sources

3.1.5 Education of Respondents

Respondents are from different education level ranging from illiterate to master degree. Sixty-four percent respondents are literate/below SLC. Less than a percent of respondent having education of master degree (Fig 8). Such a wide range in education level and understanding of wildlife damages provided detailed knowledge and experiences on the issue.

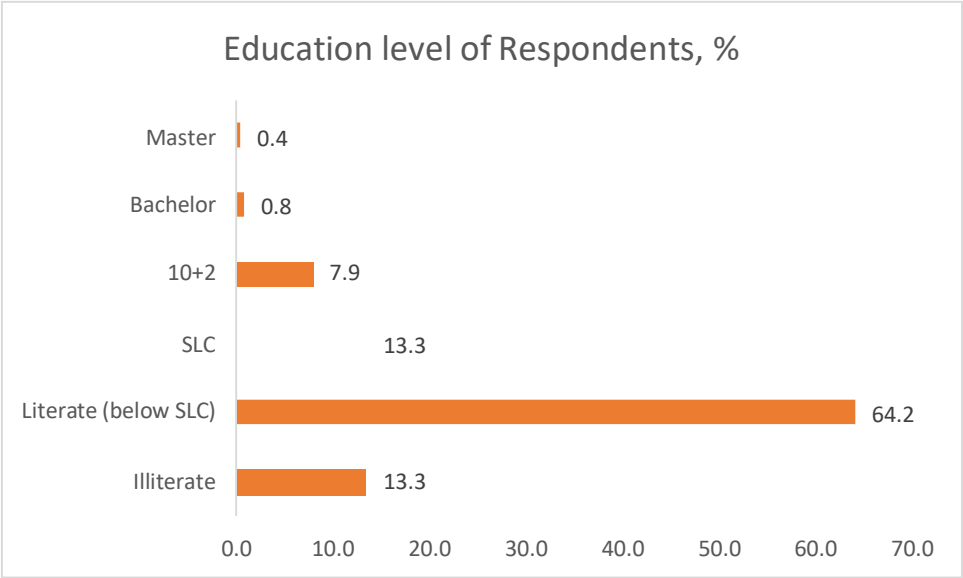


Figure 8: Education level of Respondents

3.1.6 Family Size

As per the preliminary report of CBS 2078, the national average family size is 4.32. Both study districts fall in Gandaki Province, whose average family size is 3.66. It is assessed from the study that 22% of households have five family members, which is followed by 18% households of four family members. There are fifteen per cent family members with nine and more than nine members (Fig 9). The average family size is 5.75, which is more than the national and provincial averages.

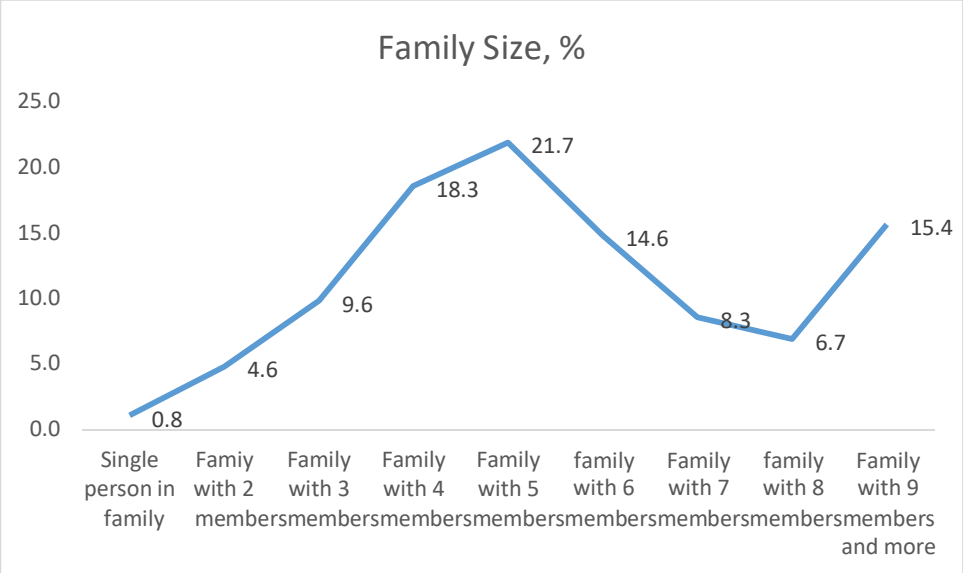


Figure 9: Family Size of respondents

3.1.7 Land Ownership and Food Sufficiency

Majority of the households in Tanahun district are engaged in in agriculture (72% HHs). There are 449 landless households and family having less than 2 ropani land is 3,693 HHs. Households with 4-10 ropani land are 20,467, households with 10-20 ropani are 16,152, households having 20-40 ropani land are 6,765 and households with 60-80 ropani land are 104 (DFO Tanahun 2076/78).

The study finds out that there are respondents from landless (17% HHs) to 100 ropani land ownership. 31% households owned 6-10 ropani, which is followed by 1-5 ropani by 25% of households (Fig 10). Average landholding size is 10.4 ropani, which is 0.52 ha. Nepal Living Standard Survey, CBS 2011 mentioned that landholding size in rural areas is 0.7 ha (14 ropani) and 0.5 ha in urban areas (10 ropani). 5% households are landless. Calculation shows that more than half of respondents have less than ten ropani lands included non irrigated fields, which is insufficient for subsistence livelihood.

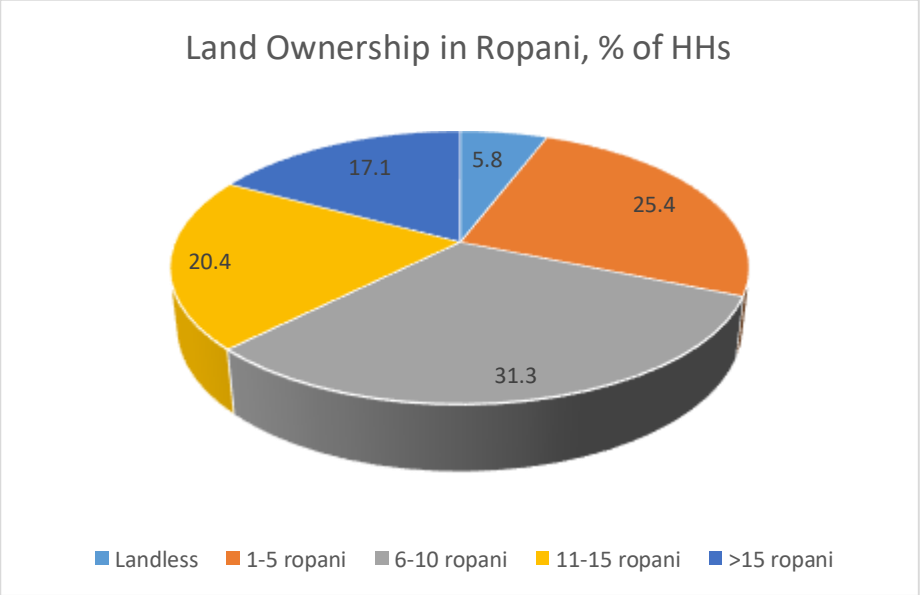


Figure 10: Land ownership of respondents

Respondents produce paddy, maize, millet, potato and vegetables. Produced crops are sufficient to 54 % of families to feed round the year, and 15% of families have food deficiency for whole year. Production is sufficient for three months only to 6% households and six months to 19% households (Fig 11). Food deficient and low economy families depend more on forest resources and are vulnerable from wildlife damage point of view.

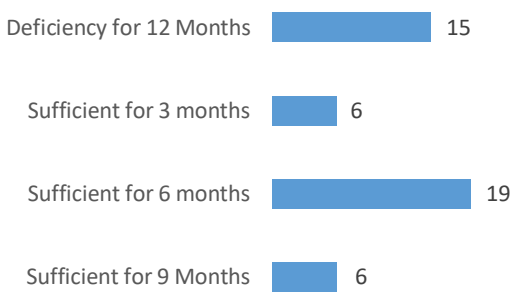


Figure 11: Food sufficiency of respondents

3.1.8 Livestock Ownership and Husbandry System

Common livestock species owned in the study area are goat, buffalo, cow, pig and chicken. Out of 240 surveyed households, 22 households do not own any livestock. One hundred nineteen households own buffalo, 89 households own goats, and 64 households have cows. Thirty-nine households own Pig and 43 own Chicken (Fig 12). The average livestock number per household is 8, excluding Chicken. Goat is largely owned livestock (average 6/HHs) in the study area.

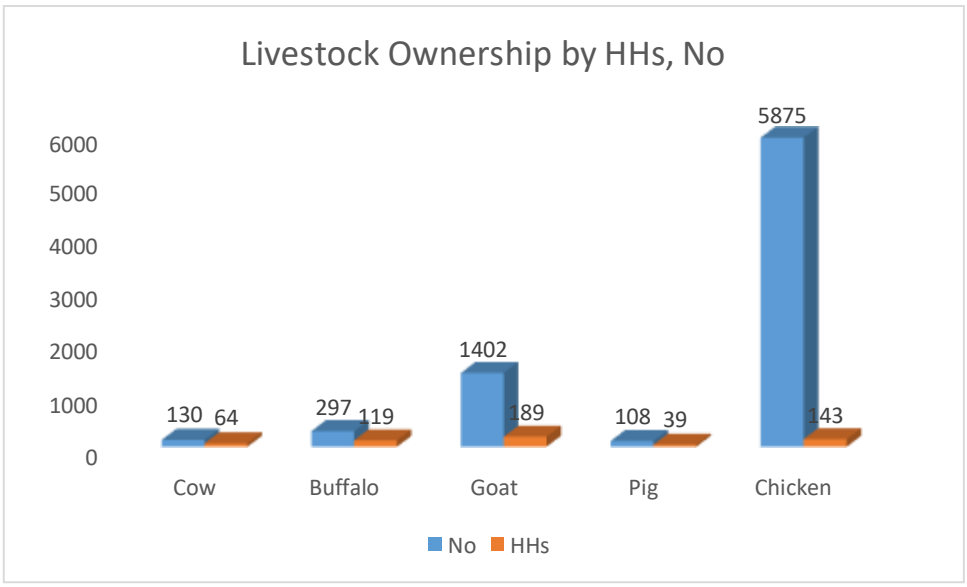


Figure 12: Livestock Ownership of Respondents

Stall feeding and grazing are two major livestock husbandry practices. None of the families is fully dependent on grazing system, but they practice grazing cum stall feeding. Twenty-seven percent households adopt stall feeding livestock practices, and 73% households practice both

of them (Fig 13). Result shows there is maximum practice of grazing cum stall feeding livestock husbandry practices, which indicates more chances of livestock depredation.

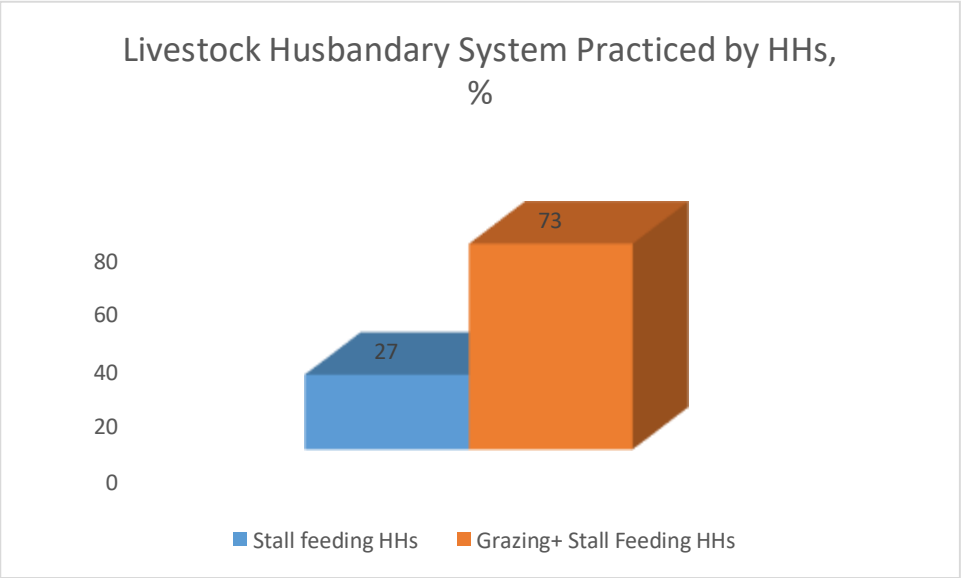


Figure 13: Livestock Husbandry System

Sources of fodder for stall feeding livestock are private lands and community forests. Six per cent households used crop residue and fodder from private lands. Fourteen percent households collect fodder from community forests, and eighty percent households use fodder from private land and community forests (Fig 14). When there is more movement to forest areas for fodder collection, there are more chances of wildlife attack.

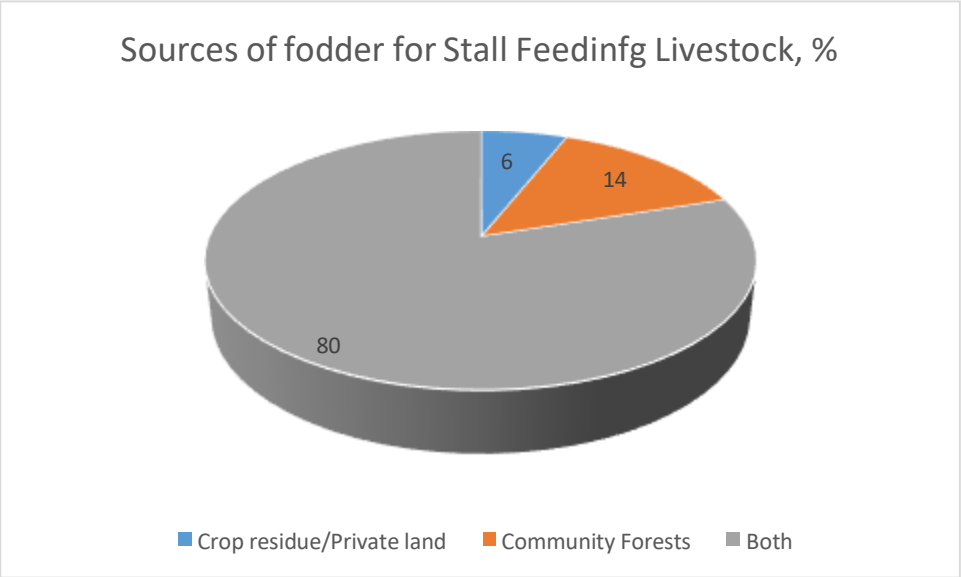


Figure 14: Sources of Fodder for stall feeding livestock

3.1.9 Annual Income Status

DFO Gorkha reported per capita income of NRs 46,488/- in the annual report of 2077/078. About two-thirds of the study area, households have estimated yearly income of Nrs 1,00,000 to 5,00,000. The annual income of the household ranges from NRs 36,000 to 20,00,000. The mean annual income of a household is NRs 4,98,575 (Fig 15).

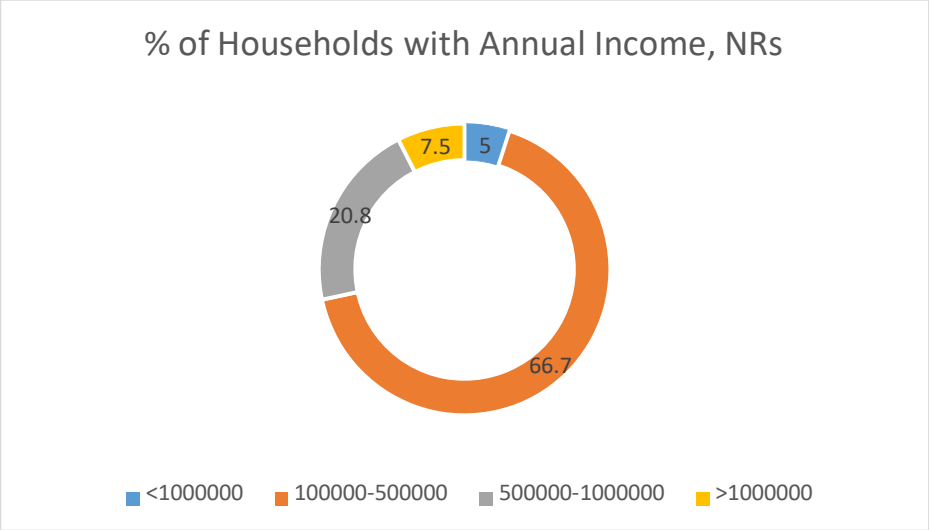


Figure 15: Annual Income status

3.1.10 Source of Energy for Cooking

Fuel wood, LP Gas and Electricity are three major energy sources for cooking. These sources are being used as a single source or combination of two of Fuelwood and LP Gas or three of Fuelwood, Electricity and LP Gas. Three percent households are using fuel wood only, and two percent households are using LP Gas only as source of energy. Thirty-seven percent households are using LP Gas and electricity, and fifty-seven percent households are using all three; fire wood, electricity and LP Gas for cooking (Fig 16).

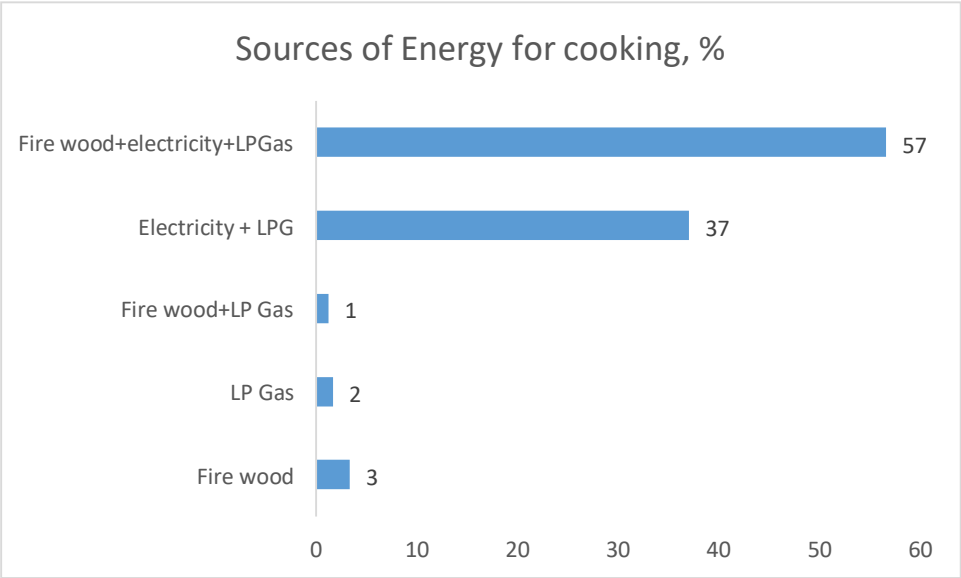


Figure 16: Sources of Energy for cooking

Firewood required for cooking is collected from crop residue/private land, community forests and national forests. Six percent households use fire wood from their farms and fields, twenty-one percent households collect fire wood from community forests, two percent households collect fire wood both from national forests and private lands, and sixty eighty percent households use fire wood from their farm and community forests. Assumption is that when there is increased mobility of human for fire wood collection in forests, it may have more chances of wildlife attack.

Table 3: Sources of Fire Wood for Cooking

Sn	Source of Fire Wood	% of Total
1	Private land/crop residue	6
2	Community Forests	21
3	Community Forests +National Forests	2
4	Community Forest+Private Land	68
5	No Use of fire wood	3
Total		**100**

3.1.11 Distance of Home from Forest

The proximity of home and settlement to forests may increase wildlife damages. Distance of home from forest have been categorized as <100m, 100-500m, 500-1,000 m and > 1,000 m (1 km). Seventeen percent households are within 100 m distance from forest. Forty-seven percent households are within the range of 100-500 m. Twenty-two percent households are located within 500-1,000 m distance from forest, and fifteen percent households are more than 1 km far from forest (Fig 17). The nearer the distance of home from forest, higher the chances of

conflict with wildlife. In this scenario, about two-thirds households are within 500 m far from forest and have more chances of conflict with wildlife.

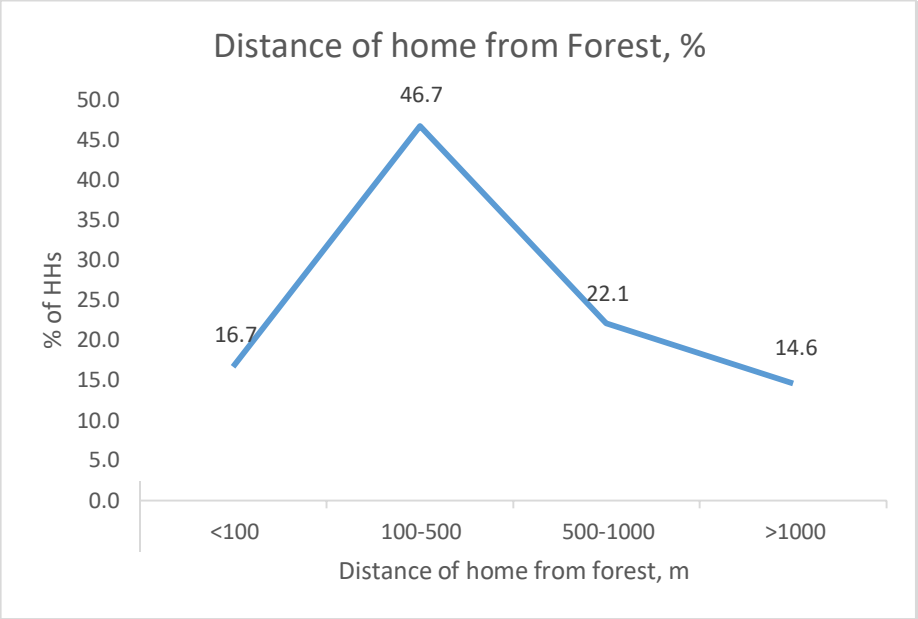


Figure 17: Distance of Home from Forest

3.2 WildlifeDamages

3.2.1 Wildlife species visiting to settlement

Though numerous wildlife species are present in forests and surroundings in study area, respondents shared that very few species are common to visit in settlements. Among them, ninety-nine per cent respondents shared that Common Leopard and ninety six percent shared that Monkey are two common visitors to settlements and farms, which is followed by Porcupine (52%) (Table 4). Same respondents shared multiple wildlife species visiting their areas. Least visiting wildlife species includes Mongoose, Fox, Deer, Black Bear.

Table 4:Wildlife Species visiting to settlements

Wildlife Spps	Perception of respondents, %
Leopard	99
Deer	1
Monkey	96
Jackal	13
Jungle Cat	17
Rabbit	14
Black Bear	4
Parrot	6
Fox	0
Mongoose	0
Porcupine	52

3.2.2 Nature of Wildlife Damages

Crop damage, livestock depredation, human injury and casualties and property damage are common wildlife damages. Respondents were requested to share common wildlife damages. fifty-eight percent responses are on crop damage and fourty two percent on livestock depredation. None of the respondents shared their views on property damage, human injury and casualties (Fig 18).

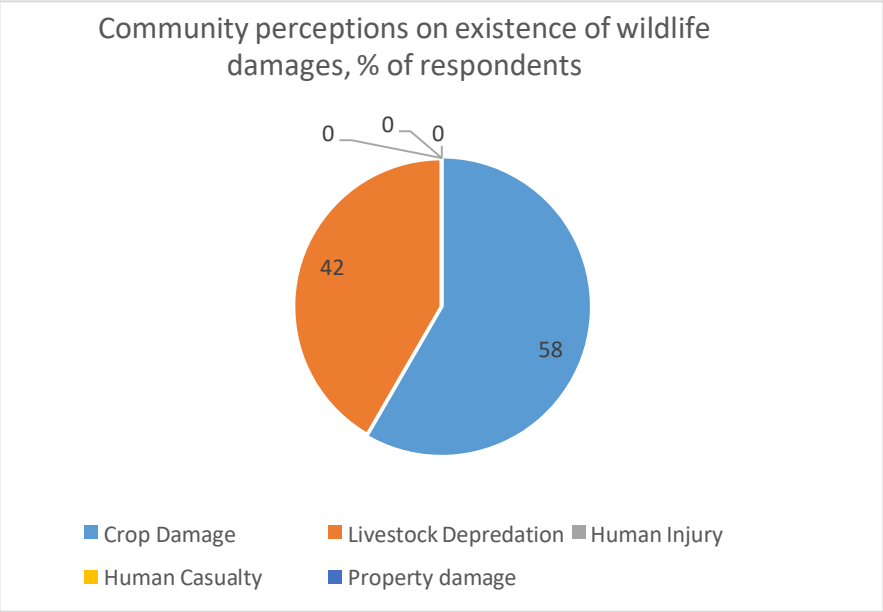


Figure 18: Community perceptions on existence of wildlife damages

Respondents were requested to share their views of all crop raiding species and they shared names of multiple species as well. Monkey, Rabbit, Himalayan Black Bear, Parrot and Porcupine are wildlife species responsible for crop damage. Among them, 64% respondents shared their perception that Monkey is the most common crop raider, which is followed by Porcupine (Fig 19).

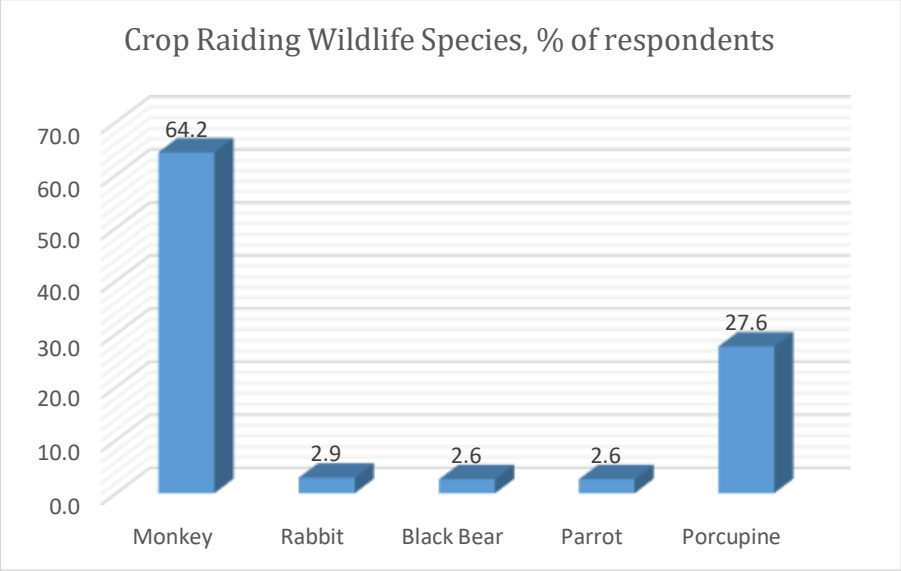


Figure 19: Perceptions on Crop raiding wildlife species

Similarly, respondents shared that Common Leopard, Leopard Cat, Jackal, Jungle Cat and Fox are common wildlife species responsible for livestock depredation. Eighty seven percent respondents perceived that Common Leopard is the most responsible wildlife species for livestock depredation, which is followed by Leopard Cat (Fig 20).

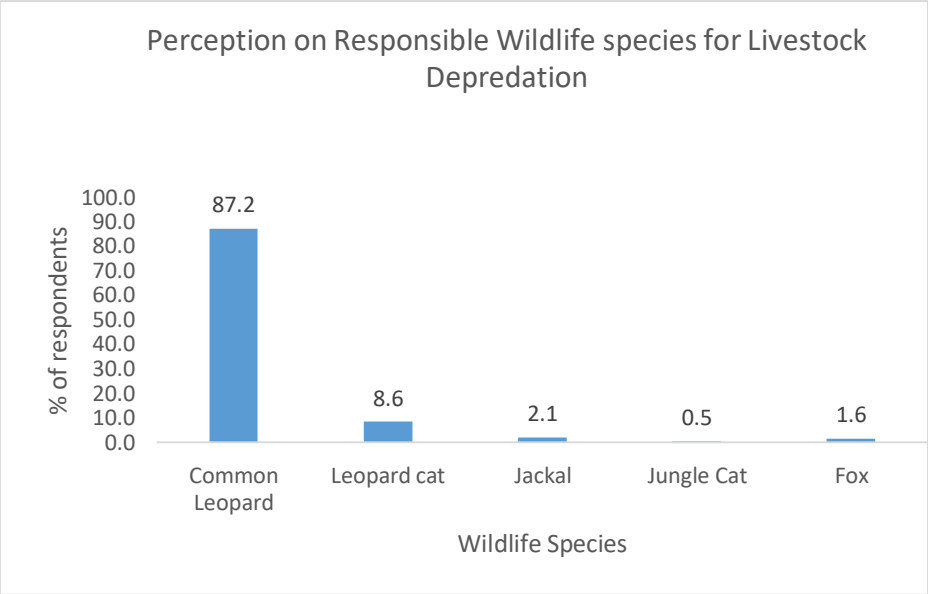


Figure 20: Perceptions on responsible wildlife species for livestock depredation

3.2.2.1 Crop Damage

Assessment revealed that paddy is the highest damaged crop by wild animals, followed by wheat and maize (Joshi et al. 2020) in the Kailali district. Maize, Paddy, Millet and Potato are common crop varieties damaged by wildlife in study area together with mustard and vegetables. Damage depends on cultivated varieties. Same household cultivate multiple crops and may lose

multiple varieties, which were under production. Seventy percent households lose maize, followed by fourteen percent each of paddy and millet. Potato is another crop damaged by wildlife, but the quantity is negligible (Fig 21). Distribution of crop damage showed that almost all of the settlements are impacted by wildlife (Map 5).

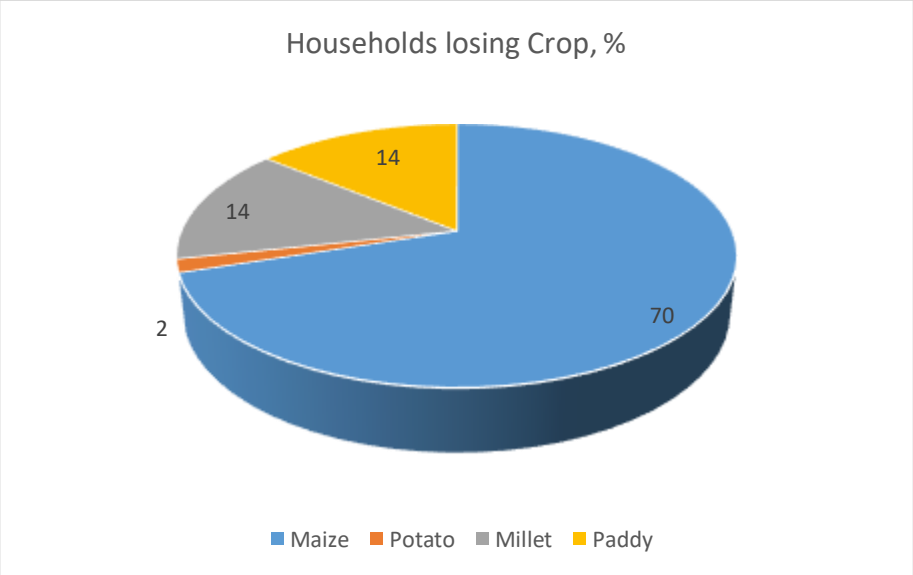
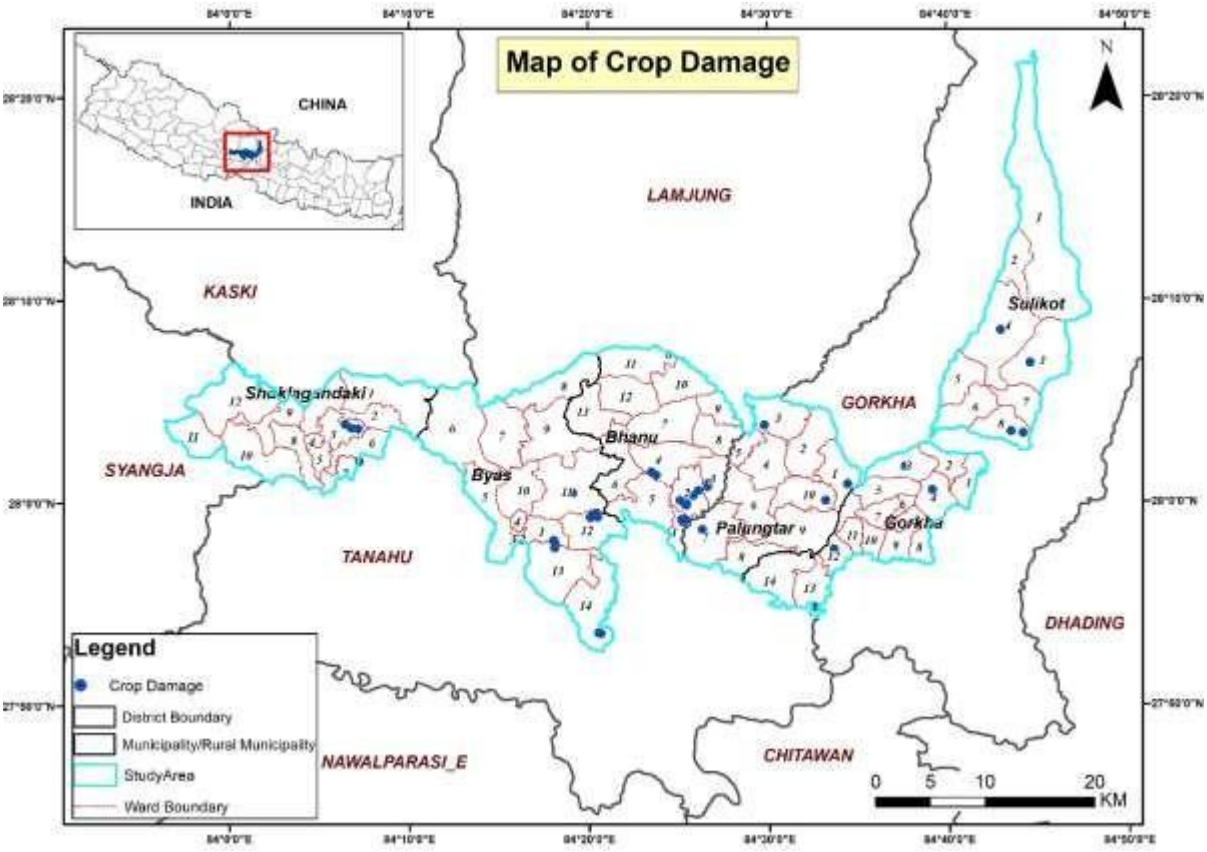


Figure 21: Households losing crops



Map 5: Crop Damage in Study Area

Out of 240 sampled households, 49% of households shared estimated crop loss by wildlife in last ten years. Monkey, Porcupine, Parrot, Deer and Wild Rabbit have been found as the responsible wildlife species for crop-raiding. Monkey is responsible for 68% crop damage (n=1,62,031 kg) together with by Porcupine (20%), Parrot (7%), Deer (1%) and Wild Rabbit (3%) (Fig 22). There are numerous comments regarding crop damage by monkeys, but there is no specific solution found at the local level and ignored the cases.

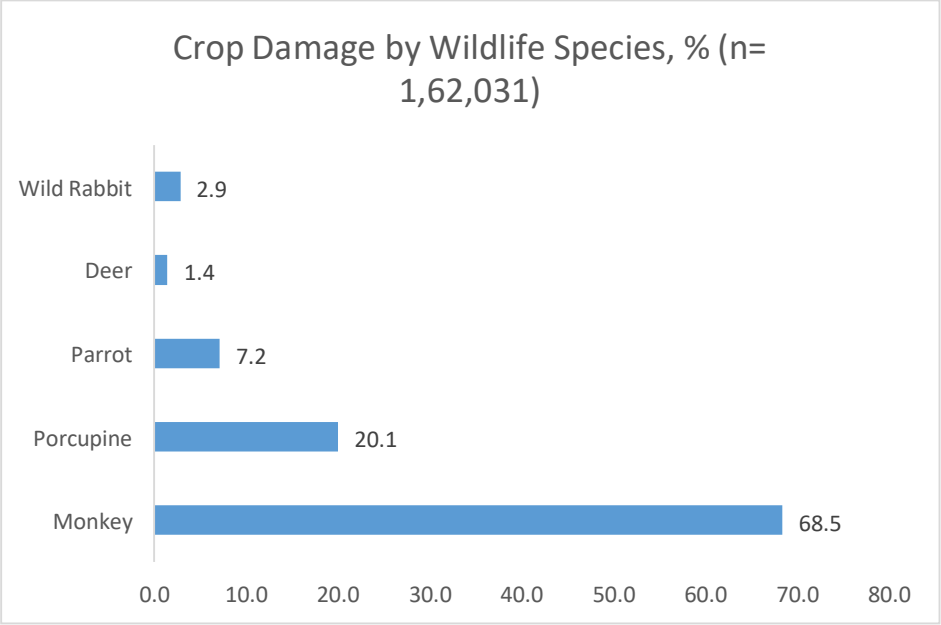


Figure 22: Weightage of crop damage by wildlife

The average loss of 1.72±0.72 muri of crops per household was incurred in the Seti sub-River basin annually from monkey. Conflict with the monkey in Seti Sub-River Basin caused loss of 1.62±0.61 muri of Maize and 0.38±0.32 muri of Paddy per household annually (WWF 2020). Economically, a household from the study area loses 1.71 muri (137 kg) crop annually by wildlife, equivalent to NRs 5,217. Average impacted crop damage area is 4 ropani per household (Table: 5).

Table 5: Crop Damage by Year

Year	Crop losing HHs	Area, Ropani	Quantity, kg	Price, NRs
2069	115	469	16,360	6,02,100
2070	115	469	15,647	5,95,900
2071	115	469	15,887	6,05,100
2072	115	458	15,447	5,89,100
2073	114	457	15,407	5,87,100

2074	114	457	15,407	5,87,100
2075	114	457	15,407	5,87,100
2076	114	457	15,407	5,87,100
2077	116	463	15,767	6,03,100
2078	144	556	21,295	8,12,020
Annual Average	**118**	**471**	**16,203**	**6,15,572**
Av Annual loss/HH		**4**	**137**	**5,217**

Responses showed that crop damage by Monkey is experienced round the year. Crop damage by months depends highly on crop ripening time. Jestha (31%) and Mangsir (33%) are two peak months of crop damage, followed by Ashad and Kartik. Jestha. Ashad and Shrawan are maize damaging months and Kartik, and Mangsir are paddy damaging months depending on altitudinal locality. Similarly, Potato damaging months are Magh and Phalgun (Fig 23).

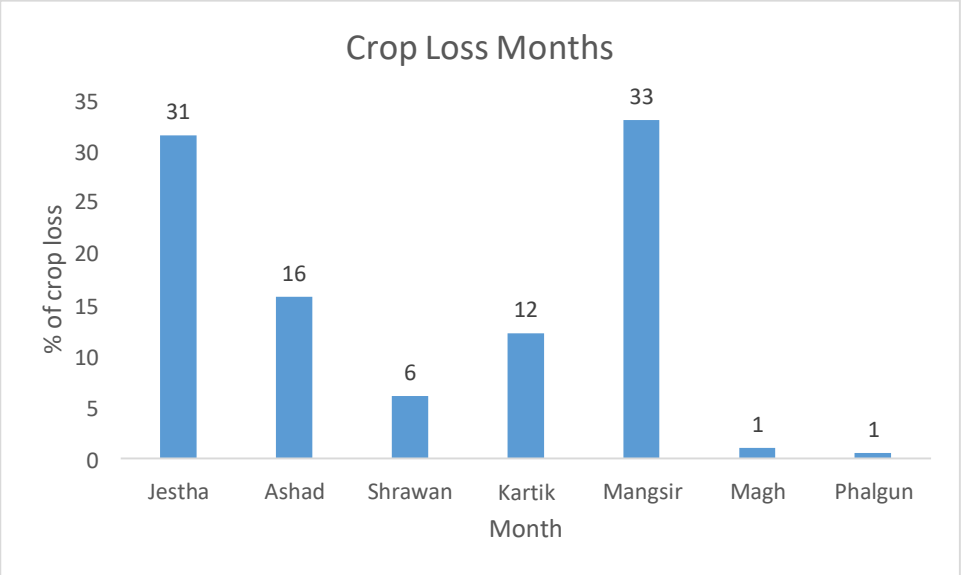
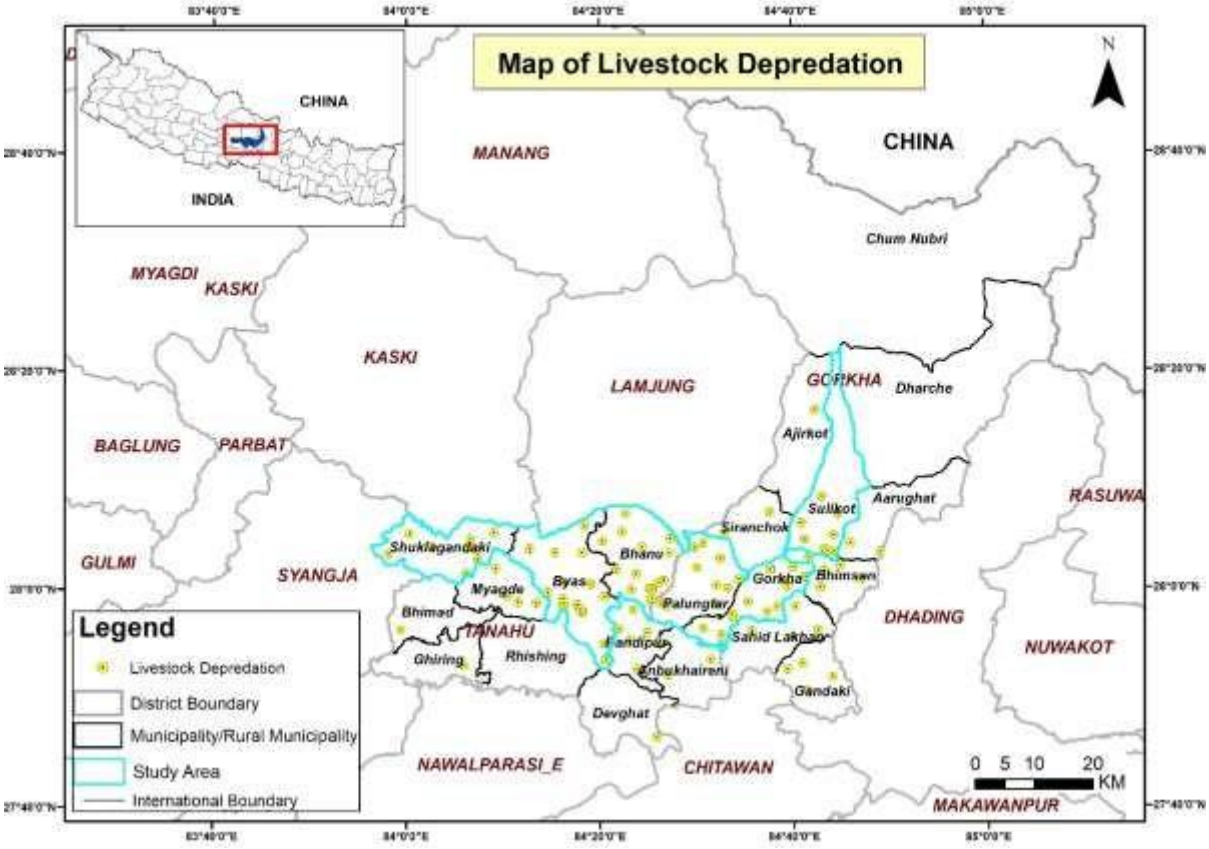


Figure 23: Crop Loss Months

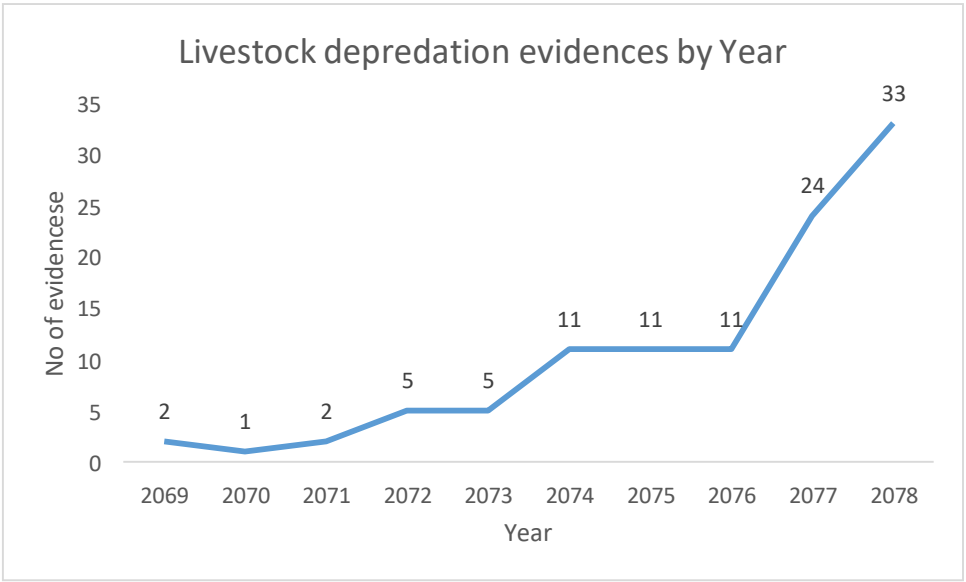
3.2.2.2 Livestock Depredation

Information on livestock depredation of both victim and non-victim households have been collected from household survey. Secondary information on relief funds provided to victim households was collected from Division Forest Offices of Gorkha and Tanahun. Trend of livestock depredation over the period is found in increasing order. One hundred five evidence of livestock depredation has been recorded in last ten years (Fig 24). The average annual evidence of livestock depredation is 11, excluding chicken. It is observed from the study that when there was no provision of providing relief funds to wildlife victims, none of them and organizations documented evidences in the past. So that information on livestock depredation during those days is almost lacking. Distribution of livestock depredation is exists in all

rural/municipalities of Tanahun and Gorkha (Map 6). None of the evidences reported from Dharche rural Municipality of Gorkha.



Map 6: Livestock Depredation sites



Data Source: HH Survey 2078

Figure 24: Livestock Depredation evidences by Year

Goat is the most killed livestock by wildlife other than Chicken. In the last ten years, one hundred six goats of 50 households were killed by wildlife (Table 6). Livestock depredation of cows and buffalo seems low because of the large body size and stall feeding husbandry practices.

Figure 25: Goat Killed by Common Leopard, Photo Credit- MCA Lias

Table 6: Details of Livestock under depredation

Sn	Livestock	HHs	No
1	Goat	50	106
2	Cow	2	2
3	Buffalo	3	3
4	Pig	1	1
5	Chicken	12	178
Total		**68**	**290**

Common Leopard, Jackal, Fox and Jungle Cat seem responsible for livestock depredation among the predators. Ninety-two per cent kill was due to Common Leopard, followed by Jungle Cat (5%). Jackal and Fox are responsible for 2 and 1 percent of livestock depredation, respectively (Fig 26).

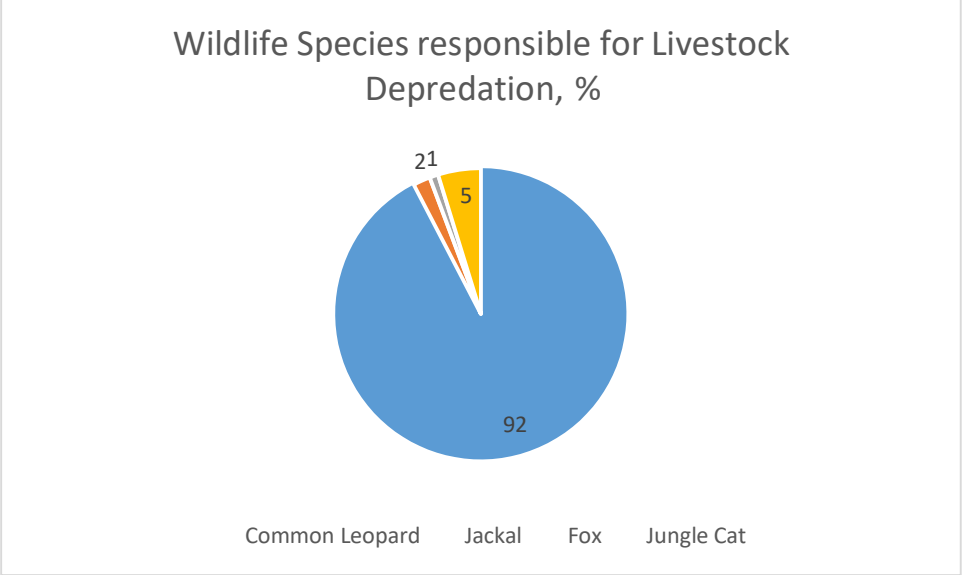


Figure 26: Wildlife Species responsible for livestock depredation

More than half of livestock killed at farm land, and more than one-third kills are at home, livestock corral and poultry farm. Thirteen percent of livestock were killed in forest areas

during grazing (Fig 27) and there is no provision to provide relief fund for such killings in forest areas in HWC guideline.

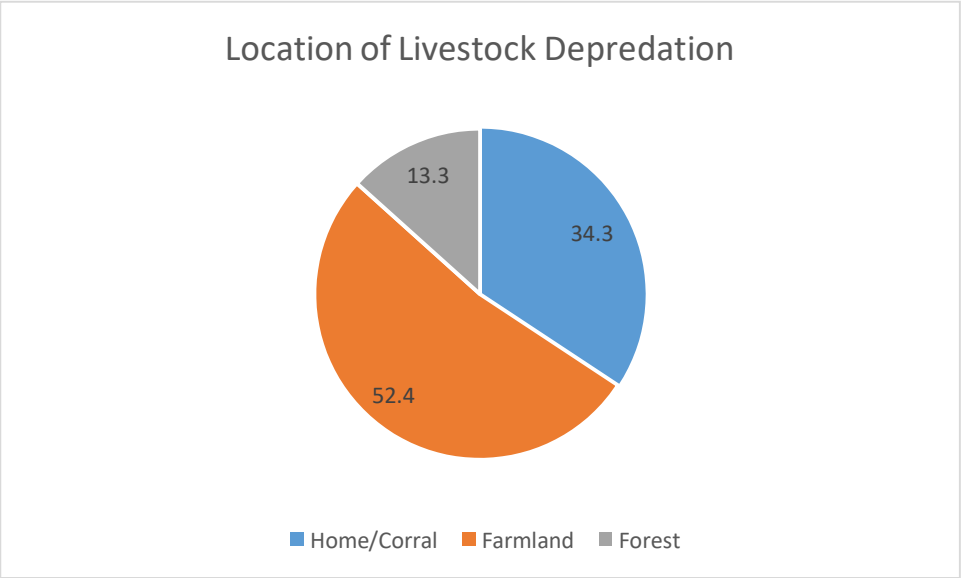
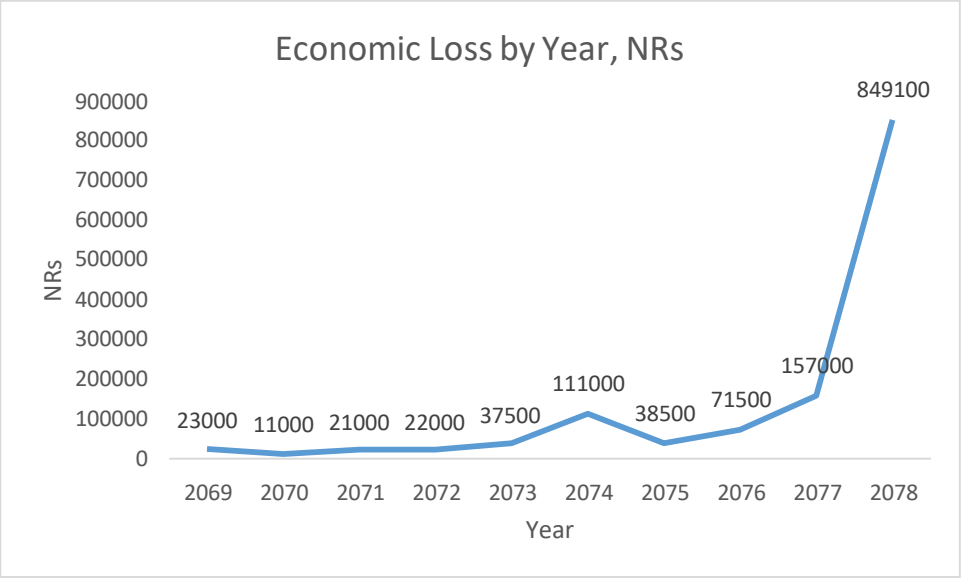


Figure 27: Location of Livestock Depredation

Economic loss due to livestock depredation seems to increase over the period (Fig 28). After fiscal year 2074/75, when the practice of providing relief fund by government increases, documentation of those kills started to process for relief fund.



Data Source: DFO; Gorkha and Tanahun

Figure 28: Economic Loss by Year

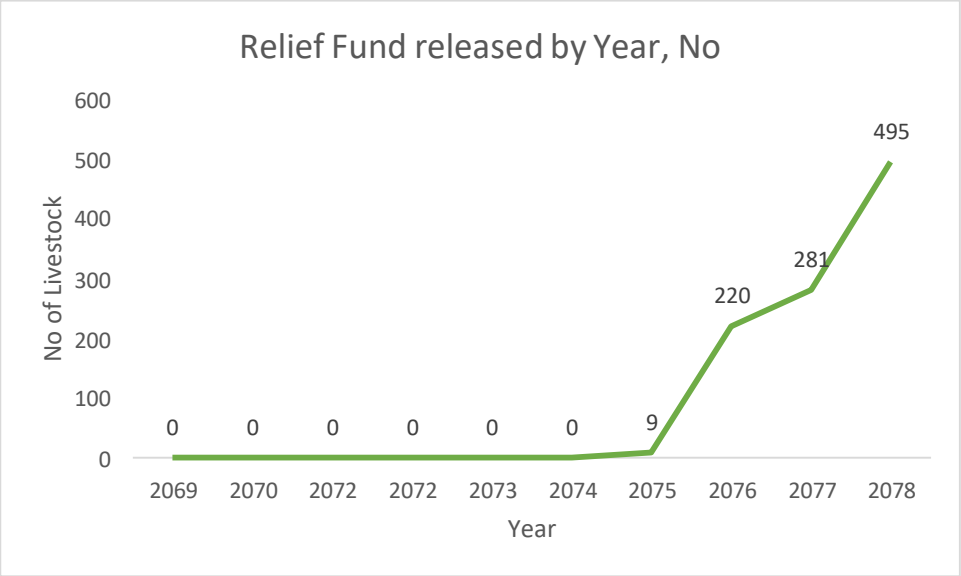
When there was no documentation of livestock depredation, there was no record of loss. In such circumstances, economic loss was found nominal till 2074/75. Economic loss due to livestock depredation per household per year assessed through random survey is NRs 1,973/- (Table 7).

Table 7: Details of economic loss by livestock depredation

Sn	Year	Evidences	No	Price, NRs
1	2069	2	4	23,000
2	2070	1	2	11,000
3	2071	2	2	21,000
4	2072	5	4	22,000
5	2073	5	8	37,500
6	2074	11	14	1,11,000
7	2075	11	7	38,500
8	2076	11	8	71,500
9	2077	24	15	1,57,000
10	2078	33	226	8,49,100
Total		**105**	**290**	**13,41,600**
Annual Average		**10.5**	**29**	**1,34,160**
Annual Average/HH, NRs				**1,973**

Data Source: HH Survey 2078

There was no practice to maintain information on livestock depredation before endorsing relief fund guidelines for Human-Wildlife Conflict. It seems excellent documentation by Division Forest Offices after fiscal year 2074/75. Fig 29 below shows that number of relief funds released against year increases over the period.



(Data Source: DFO Gorkha, Tanahun, ACA and MCA Liaison Office Pokharaand Gorkha)

Figure 29: Relief fund released by year

While calculating average annual amount of relief fund received against livestock depredation by wildlife in both districts, it is found that a victim household received NRs 16,269/- from 2075 to Magh 2078 (Table: 8), which is higher than the figure of random household survey and it should be.

Table 8: Relief fund received against livestock depredation

Year	Livestock No	Beneficiary HHs	Relief Fund Received, NRs
2074/075	9	3	
2075/076	220	42	9,38,300
2076/077	281	44	4,49,000
2077/078	495	347	57,05,850
Total	**1,005**	**436**	**70,93,150**
Average/HH, NRs			**16,269**

3.2.2.3 Property Damage

Four evidences of property damage/livestock shed damage by wildlife has been revealed in the last ten years in the study area. Three evidences of livestock corral/shed damaged by Common Leopard and one incident by Jungle Cat was found from the survey. Those incidences happened one each in 2069 and 2077 and two cases in 2078. Two evidences were recorded in the month of Ashad and 2 in Kartik. Total estimated loss of shed damage is NRs 20,000.00 and NRs 5,000.00 in an average of victim household.

3.2.2.4 Economic Loss due to Wildlife Damages

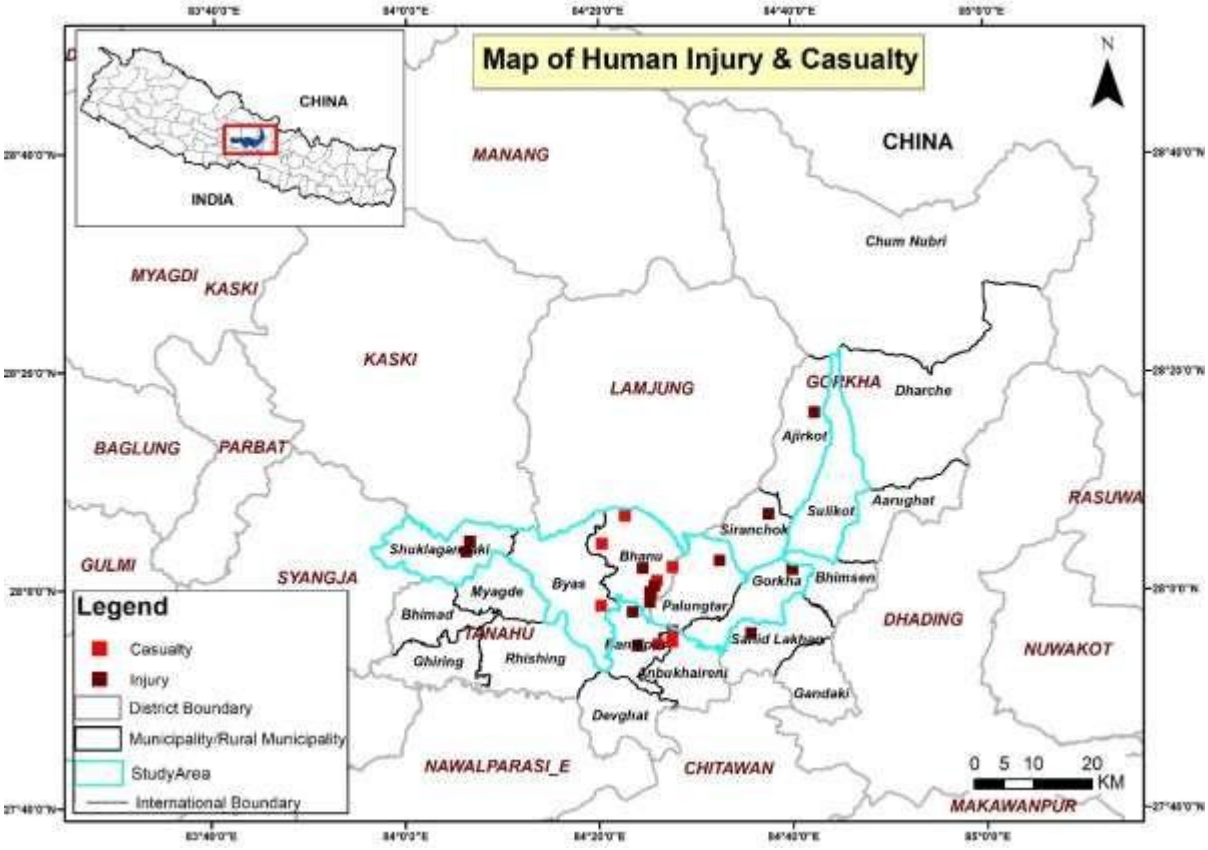
Due to lack of mechanism, neither communities nor government agencies document economic loss by wildlife damages previously. Documentation of livestock depredation has been in practice for the last two, three couple of years. Still, there is lack of mechanism and practice of record-keeping of crop damage by wildlife. Assessment showed that, annual economic loss due to crop damage, livestock depredation and property damage by wildlife in the study area is NRs 10,063/- per household (Table: 9).

Table 9: Total estimated economic Loss

Sn	Year	Crop Damage	Livestock Depredation	Property Damage	Total, NRs
1	2069	6,02,100	23,000	5,000	6,30,100
2	2070	5,95,900	11,000		6,06,900
3	2071	6,05,100	21,000		6,26,100
4	2072	5,89,100	22,000		6,11,100
5	2073	5,87,100	37,500		6,24,600
6	2074	5,87,100	1,11,000		6,98,100
7	2075	5,87,100	38,500		6,25,600
8	2076	5,,87,100	71,500		6,58,600
9	2077	6,03,100	1,57,000	5,000	7,65,100
10	2078	8,12,020	8,49,100	10,000	16,71,120
	Total	**61,55,720**	**13,41,600**	**20,000**	**75,17,320**
Per anum per HH		**2,565**	**559**	**8**	**3,132**
Victim HHs		**95**	**70**	**4**	
Per anum per victim HH		**6,480**	**1,917**	**1,667**	**10,063**

3.2.2.5 Human Injury and Casualty

Based on the information received from DFO Gorkha and Tanahun, there were 45 cases of wildlife attacks on humans in Gorkha and Tanahun from 2074 to 2078. The mean number of human attacks per year was 8.55±1.15 *(***Baral K et al. 2021**). Average annual case of injury and casualty is nine. Ratio of wildlife attacks (both inury and casualty) on human in Gorkha and Tanahun is almost equal. But in the case of human casualty, all cases are from Tanahun, and sixty-five per cent cases of human injury are from Gorkha (Table: 10). Distribution of wildlife attack on human is shown in Map 7.



Map 7: Human Injury and Casualty sites

Table 10: Details of human injury and casualty

Sn	District	% Injury	% Casualty	No injury	No Casualty	Total
1	Gorkha	65		22	0	**22**
2	Tanahun	35	100	12	11	**23**
Total		**100**	**100**	**34**	**11**	**45**

Data Source: DFO Gorkha and Tanahun

More than half of the cases were reported in 2078, which is followed by 12 cases in 2076 in both districts (Fig 30). Six cases of human casualty were documented in Bhanu Municipality of Tanahun only.

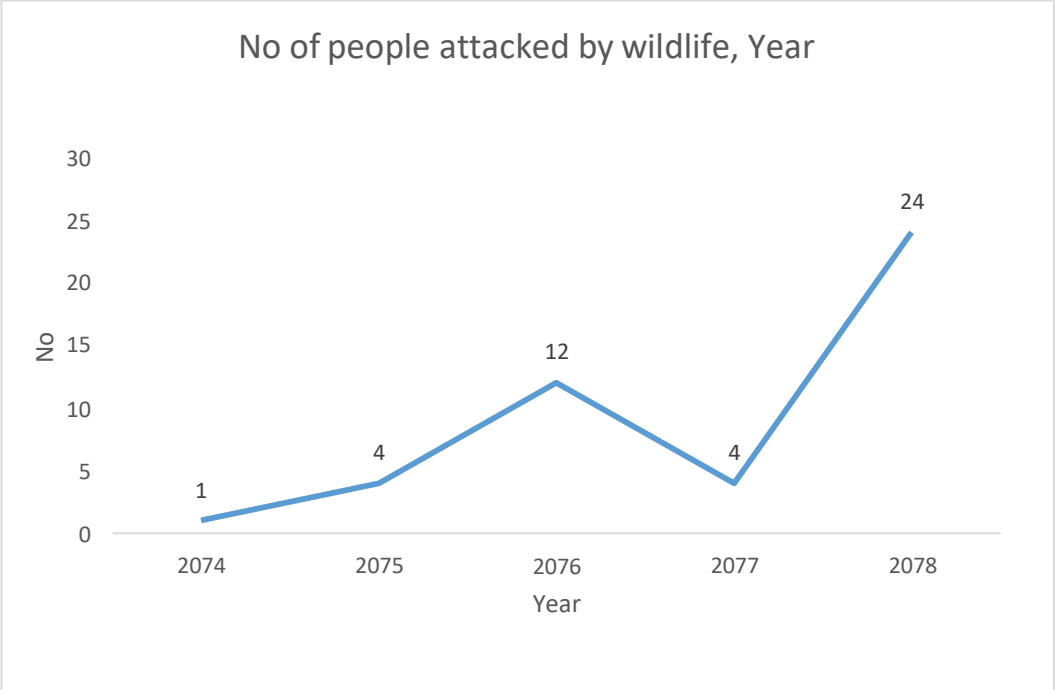
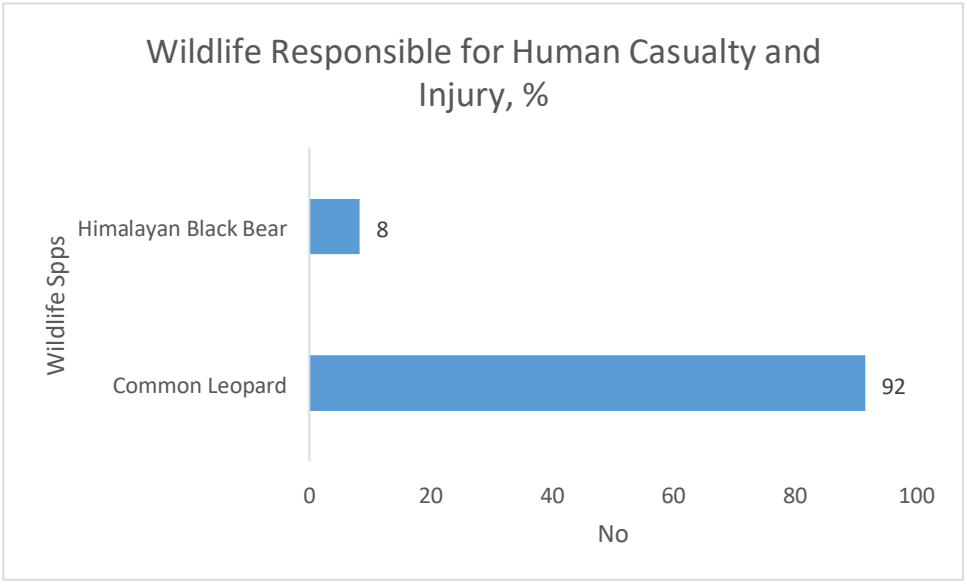


Figure 30: No of people attacked by Year

Common Leopard and Himalayan Black Bear are two wildlife species responsible for human injury and casualty. Ninety-two percent attacks are from Common Leopard and eight per cent by Himalayan Black Beer (Fig 31). Common Leopard is responsible for all cases of human casualty.



Data Source: DFO Gorkha and Tanahun

Figure 31: Wildlife responsible for Human Injury and Casualty

Considering the ethnic group of wildlife attacks of Gorkha and Tanahun from 2074 to 2078, 40% of victims are from the indigenous community, followed by 22% from the Kshetri community (Fig 32). Twenty per cent of the Dalit community and 18 % of Brahmin are attacked by wildlife.

During a group discssion in Gorkha, people shared that a children sleeping betwen mother and sister taken away by Leoard in the night in Masel in 2076. It indicates that smaller the size, higher the risk of leopard attack, particularly children.

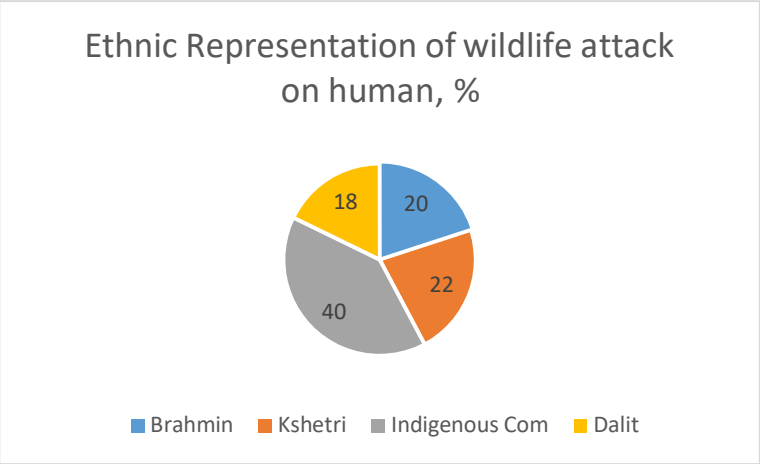


Figure 32: Ethnic representation of Wildlife attack on Human

Evidence showed that people killed by wildlife are below 11 years (Fig 33). While grouping ages in three categories, 2-4 years, 6-8 years and 10-11 years, about 50% of children aged 6-9 lost their lives due to wildlife attacks. In our general practice, very young children, i.e. age of 2-4 years, are attended almost full time by families. Children of age group, 6-8 years, normally start their schooling, come out of home for playing, and engage in some household affairs in the surroundings to go for shopping, cow shed, etc. Children of age group 9-11 years are little grown up and they are relatively knowledgeable on probable attacks. In such contexts, children of age group 6-8 years, who are unattended by parents and just started to move out from home, are more vulnerable to wildlife attacks.

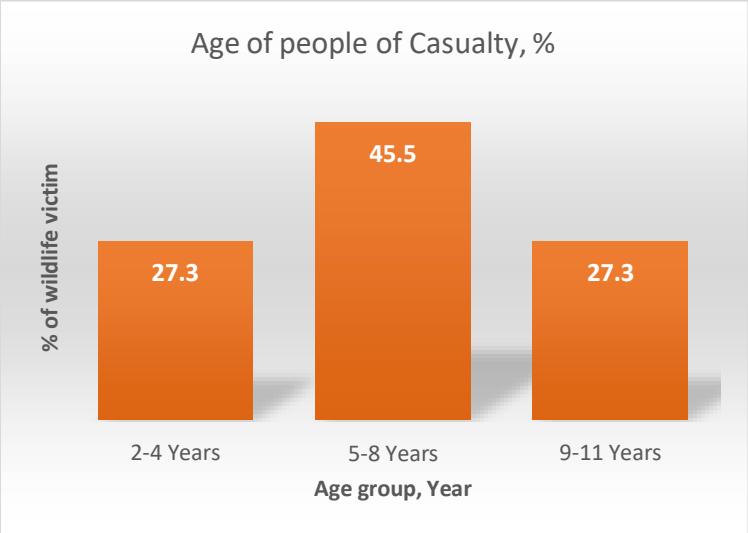


Figure 33: Age group of Human casualty

Among the cases of wildlife attacks, people of both sexes are injured and killed (Fig 34). Sixty-nine percent male and 31 per cent female are victims of wildlife attacks from 2074 to 2078.

CHILDREN ARE MORE VULNERABLE

A children of age 8 years of Bhanu Municipality 2, when playing in the courtyard of home was attacked by leopard and found dead in the forest nearby at 7:00 pm in the evening.
Similarly a children when playong in the courtyard in the evening (6:00) was attacked by Leopard and injured, Another children killed by leopard in the evening (5:00 pm) while he was playing in the courtyard,
Achildren when passing away in the trail near to home was killed by Leopard in evening (6:15 pm), siimilarly another children injured along the trail near to home in the evening (8:00 pm), his parents were also injured.

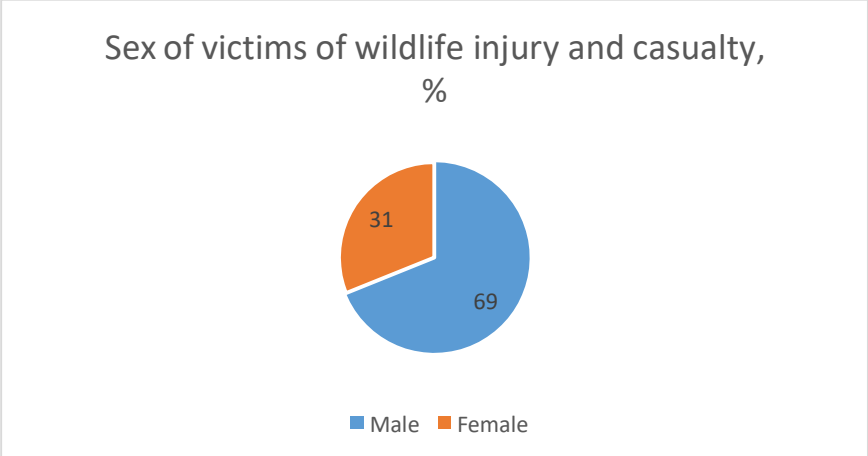


Figure 34: Sex of victims of wildlife attack

Frequency of human attacks varied with month and season. High proportion of attacks (42%) occurred between September and December and lowest in summer (July-August) **(Baral K et**

al. 2021). In the context of this study, thirty-five per cent of attack was in spring, which is followed by Autumn (30%).

Wildlife attacks has been recorded and noticed round the year except in the month of Ashad in study sites. More than one third (34%) of cases are documented in the months of Kartik and Phalgun (17% each). Shrawan is the next peak month (13%) of wildlife attacks, followed by Baisakh, Jestha, Aswin and Poush (9% each). Wildlife damages relies on their movement time in settlements. There are about 50% responses about the movement of Monkeys during day and about one-third of responses showed Common Leopard movement during night (Fig 35). Twenty-five responses are on the movement of Porcupine at night. In addition, responses showed that Wild Rabbit and Leopard Cat move to settlements in morning.

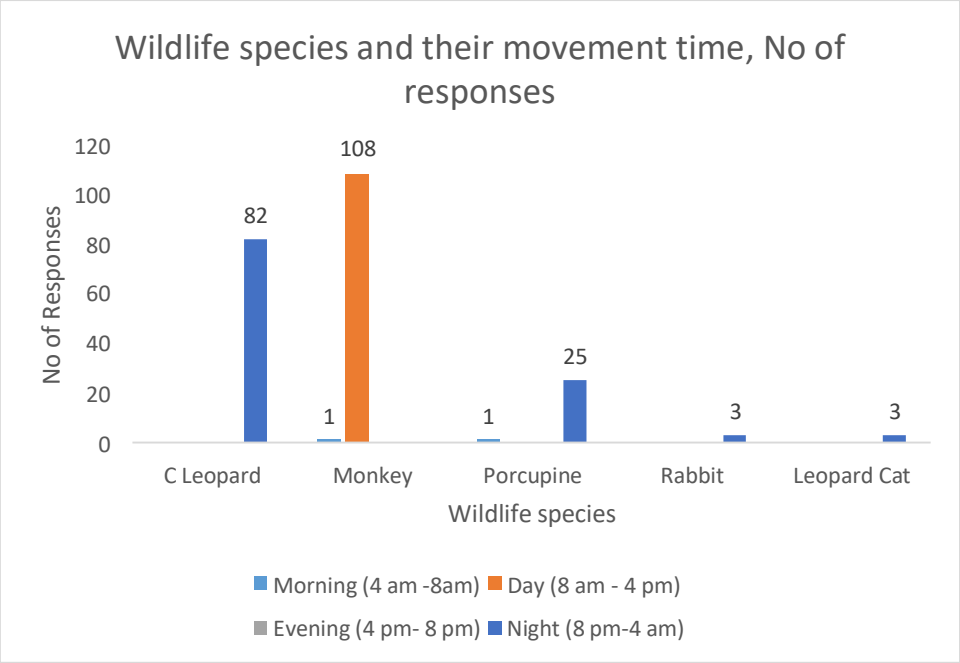


Figure 35: Wildlife Species and their movement time

The story is the same in recording the cases of human injury and casualty like crop damage and livestock depredation. Before endorsement and implementation of HWC relief fund guideline, cases of human injury and casualty were not recorded. In such circumstances, incidences of the early 2070s are not available.

Most of the children, who lost their life were unattended by guardians during the time of casualties. A case shown that there was only aged grandmother with a children in family and she sent her grand children to shop kitchen items in the evening. At that time, girl killed by Common Leopard on her way to shop. It can be assumed that if there is alternate adult person to go for shopping, she did not send children outside home in the evening and it certainly save life of children.

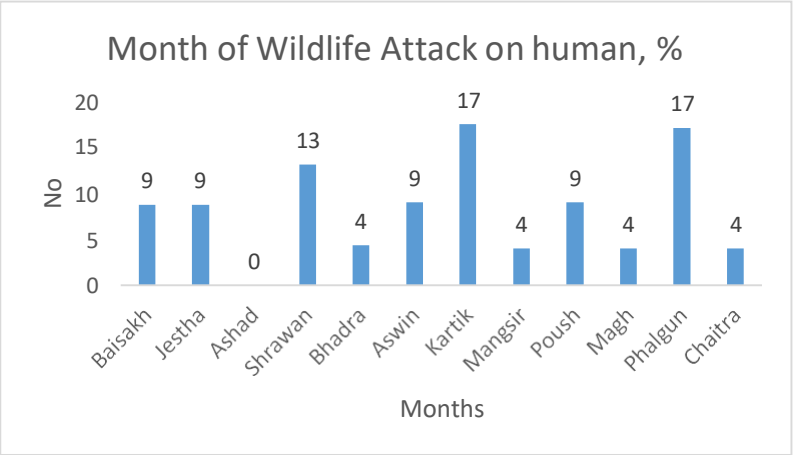


Figure 36: Month of Wildlife attack on human

Frequency of attacks varies with time of the day. Highest percent age of attacks was recorded between 15.00 pm and 19.59 pm **(Baral K et al. 2021**). It is found that sixty-seven per cent of cases happened in the evening time (4 – 8 pm), followed by 19% in the morning (5-10 am) (Fig 37) in the study area.

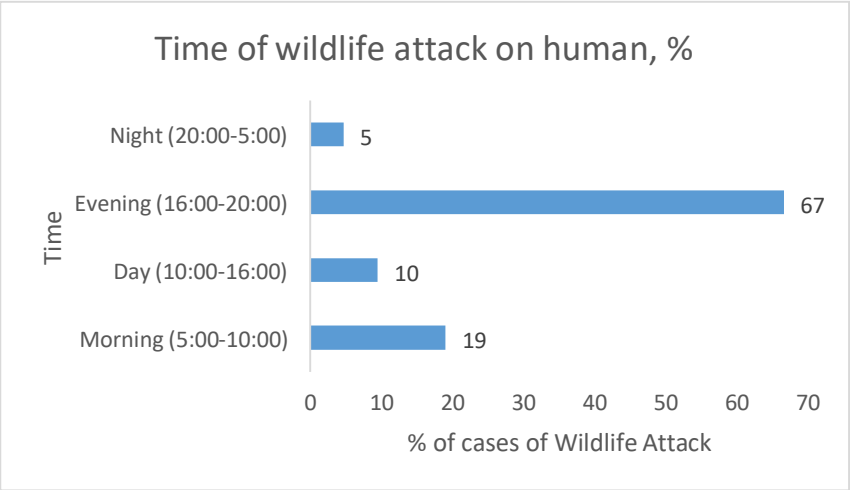


Figure 37: Time of wildlife attack on human

3.3 Wildlife Poaching and Retaliatory Killing

Respondents are well aware about importance of wildlife conservation. They do not hear and informed about wildlife poaching and retaliatory killing in their surroundings. Focus group discussion in Bhanu Municipality and Vyas Municipality of Tanahun shared that two dead Leopards were found in Bhanu -1 in 2077 and Musekhola of Vyas Municipality. Similarly, a case of retaliatory killing of porcupine was there in Vyas 13 in 2078 in the crop field. In the context of poaching, one respondent shared that outsiders visit community forests and kill pheasants, and one respondent shared they used to hear gunshots (Bhanu-4, Tanahun). Information collected from DFO Gorkha and Tanahun showed that there are numerous cases

of locating dead bodies of wildlife. DFO trapped and rescued problem animals from sensitive areas in Tanahun. Reasons for death of wild animals are unknown; those may be due to retaliation or natural death. Those incidences are categorized as problem animals and detailed as follows.

3.4 Problem Animal Management

Division Forest Offices of Tanahun and Gorkha managed 121 animals of 13 wildlife species (Fig 38) in 117 incidences from 2064 to Poush 2078 (Fig 39). Those animals include trapped problematic animals, especially man-eater Leopards, species rescued from settlement/home, dead bodies found in and around settlements, ill and injured animals, wildlife seized by enforcement agencies, natural death body, death due to road accident and died during treatment after capture (Fig 40). Out of these numbers, 79% cases managed by DFO Tanahun and 21% by DFO Gorkha. Seventy-one Common Leopard (live and dead body) managed by DFOs, and twenty-five Barking Deer. Other rescued wildlife are Pangolin, Himalayan Black Bear and Otter.

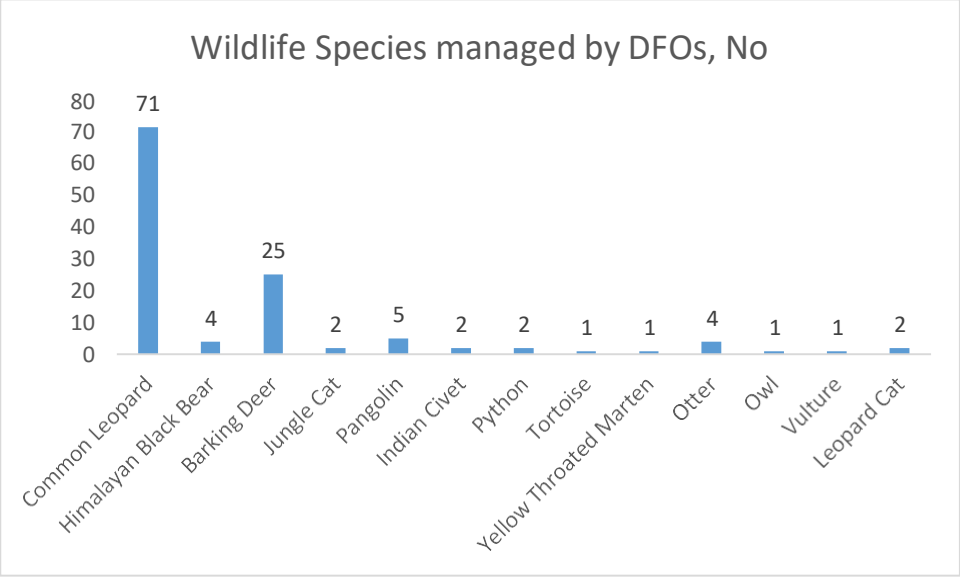


Figure 38: Species and number of problematic animals managed by DFOs

Wildlife species that have been managed from farms, trapped, seized, injured and found in dead condition in settlement areas show a higher level of conflicts with humans. Based on the data of DFO Tanahun and Gorkha, Common Leopard was in top of (59% of 121) list of problematic animals managed by them. Out of those individuals, 54% was found in dead condition.

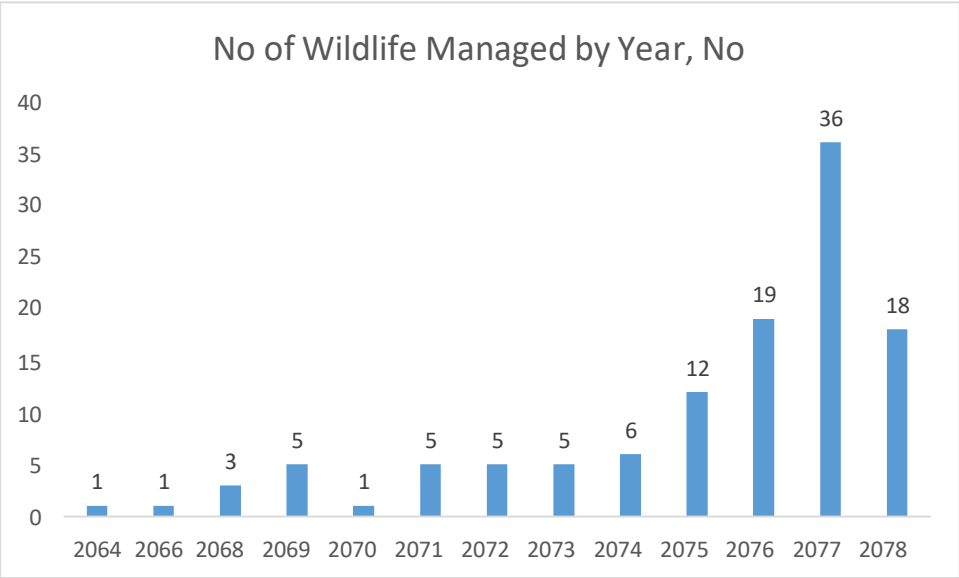


Figure 39: Number of animals managed by year

Recently, there has been an increasing trend of spotting more wildlife movement outside forest areas (Fig 41). In the cases of locating dead bodies, reasons for death are unknown, so these cases are suspicious and may be retaliatory killing or killed for trade.

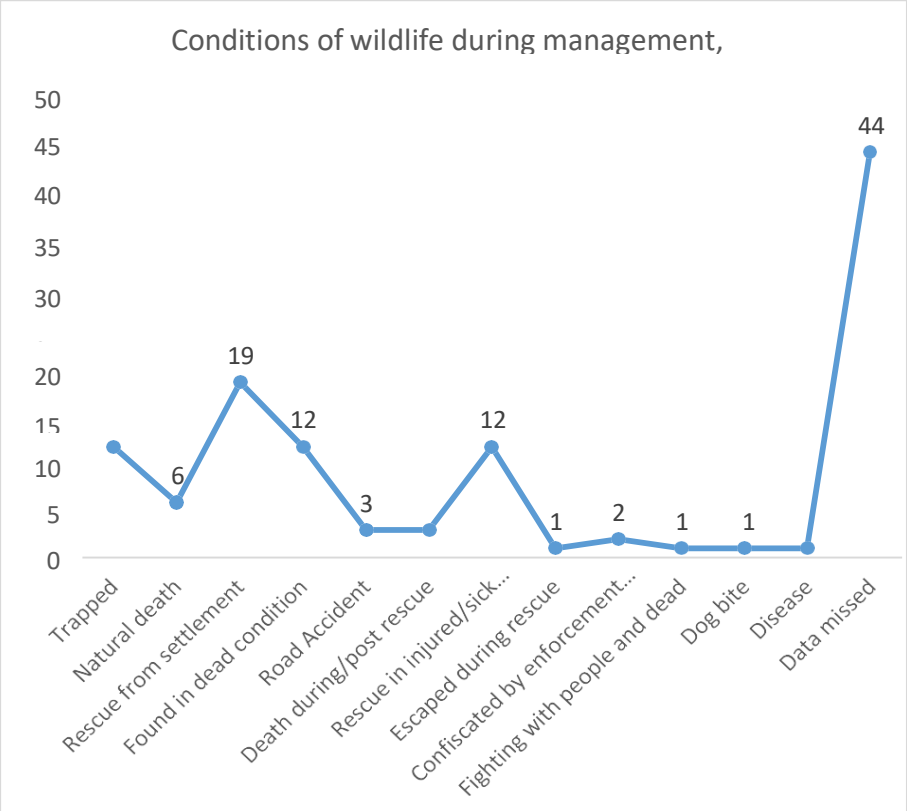


Figure 40: Reason and condition of wildlife during management

Reasons of death of 46% (n=121, found in dead condition, data missed) wildlife are not available. While cumulating numbers of individuals either trapped or rescued in live, injured, sick and dead condition from settlements, number seems high, which is 45%, and are related to conflicts with human. Numbers seized by enforcement agencies indicates those species are in trade, and death during/post-rescue shows problem animal management capacity of human resources together with the availability of tools and drugs.

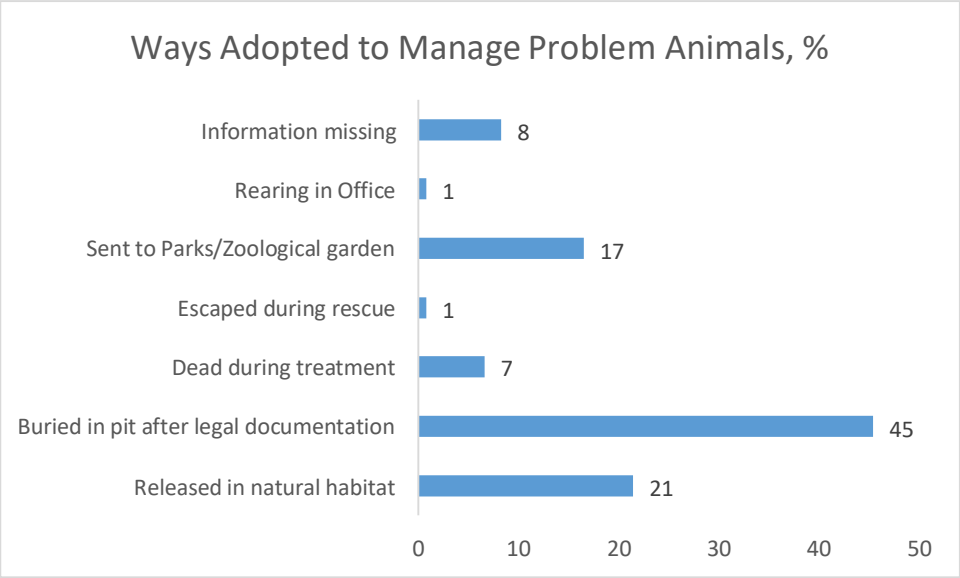


Figure 41: Ways adopted to manage problem animals

Out of 121 individuals, 45% of them have been buried in pit after completing legal procedures, 21% were released in natural habitat followed by 17% individuals sent to parks and zoological gardens (Fig 41).

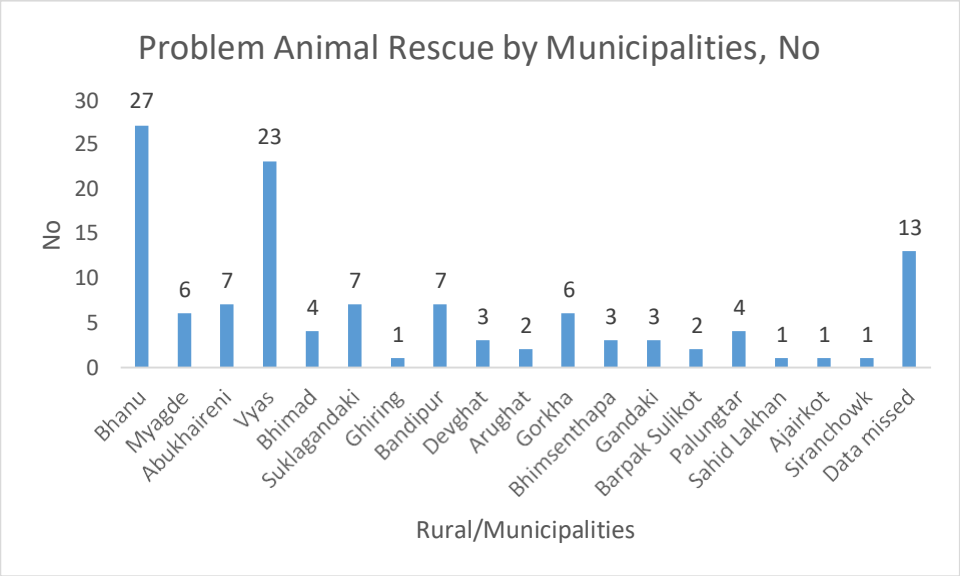


Figure 42: Problem animal rescued by municipalities

Problem animals have been rescued from almost all rural/municipalities of Tanahun and Gorkha. Forty one percent individuals rescued from Bhanu and Vyas municipalities, which is followed by Abukhaireni, Suklagandaki, Bandipur (7% each) of Tanahun, which is again followed by Myagde of Tanahun and Gorkha Municipality of Gorkha district (6% each) (Fig: 42). Eight Common Leopard trapped in ward no 1, 2 and 3 of Bhanu Municipality of Tanahun.

3.5 Preventive Measures and their Effectiveness


रोकिएन चितुवा आतंक

Various preventive measures have been adopted by communities and individuals to minimize wildlife damages. A single measure may be effective for multiple wildlife damages, or multiple measures may not work effectively. Some of the adopted measures are damage specific. As such, following are measures adopted in general and specific to minimize crop damage, livestock depredation, human injury and casualty.

Preventive measures adopted for crop damage includes guarding from traditional watchtower with or without dog, use of catapult, shouting/making noise, placement of scare crow and use of fire. Among these measures, shouting/making noise is the common practice adopted by 32% of households. It is followed by using a catapult (18%) and placement of a scare crow (13%), followed by guarding crop lands with/out dogs. The use

of traditional watch-towers and use of fire is not common; few exceptional cases are there (Fig 43). Survey showed that 70% of households adopted multiple measures, and 22% adopted single measures. Eight per cent of households use none of the preventive measures (Fig 44).

A success story on minimizing crop loss in Kilimanzaro, Tanzania

A complete HWC toolkit is composed by a strong LED flashlight (2000 Lumens), air horn, chili bombs and roman candles. The four tools can be used sequentially (torch-airhorn-chili bomb-roman candle), with the use of explosives as a very last choice against very stubborn/aggressive individuals. Although fences are in general more effective for crop protection, due to their severe impact on connectivity we decided against promoting this form of HWC mitigation (Osipova et al., 2018). Torches were reported to be the most effective tool, protecting about 64% of crops when used as a standalone tool, and 84% when used in combination with horns. In 56% of the cases the toolkits saved 100% of the cropped area, in 88% of the cases at least 75% (Valli, D 2019).

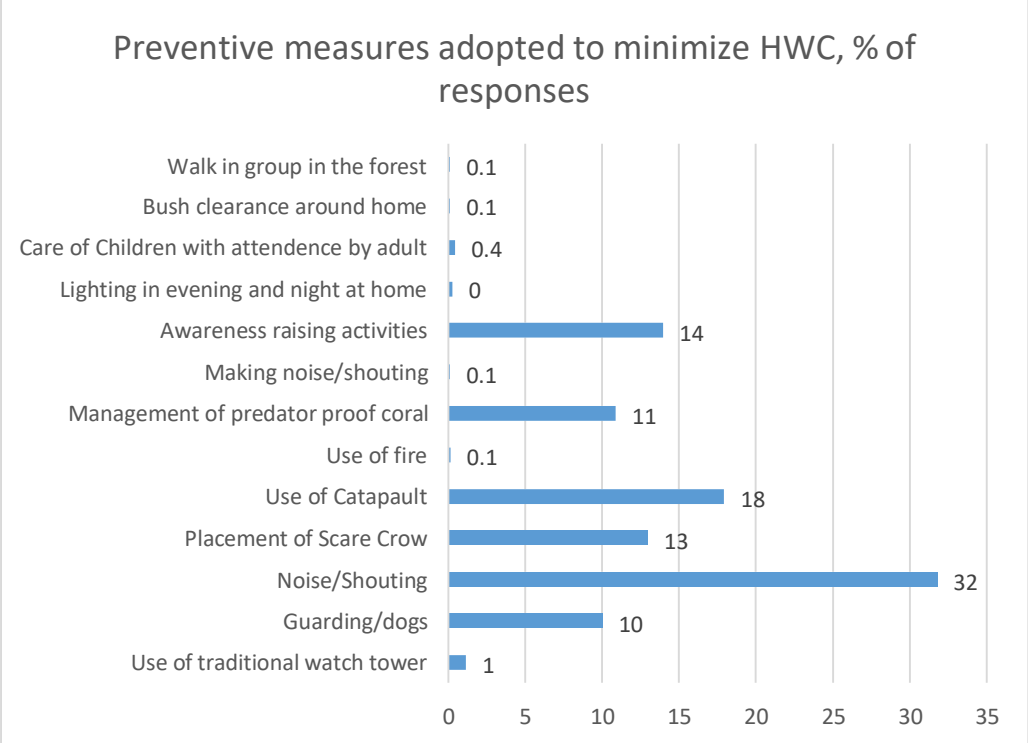


Figure 43: Preventive measures adopted to minimize HWC

Livestock depredation is another serious wildlife damage in the study area. To minimize economic loss due to livestock depredation, improvement of cow shed/corral and making noise/shouting are only two preventive measures found in practice. Improvement of shed/corral is specific to minimize livestock depredation and shouting/making noise is general and works for other damages too.

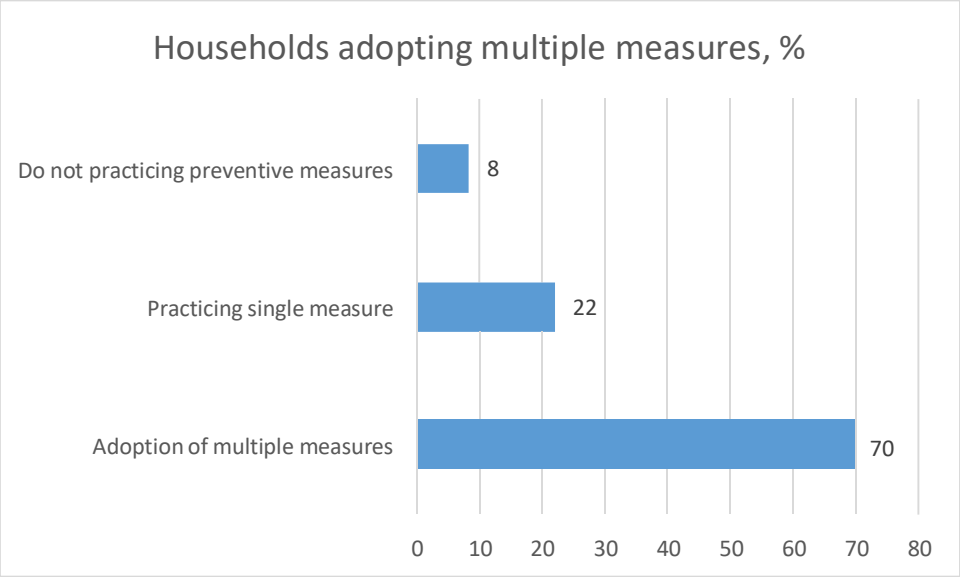


Figure 44: Households adopting multiple measures

It is not found any specific measures adopted to control human injury and casualty. Awareness-raising activities have been organized at community level during peak time of attack by Common Leopard in Tanahun. Other adopted measures include a. communities did not leave children unattended, b. lighting at home in evening and night, c. bush clearance around home and d. discouraging to walk alone in the forest (Fig 45).

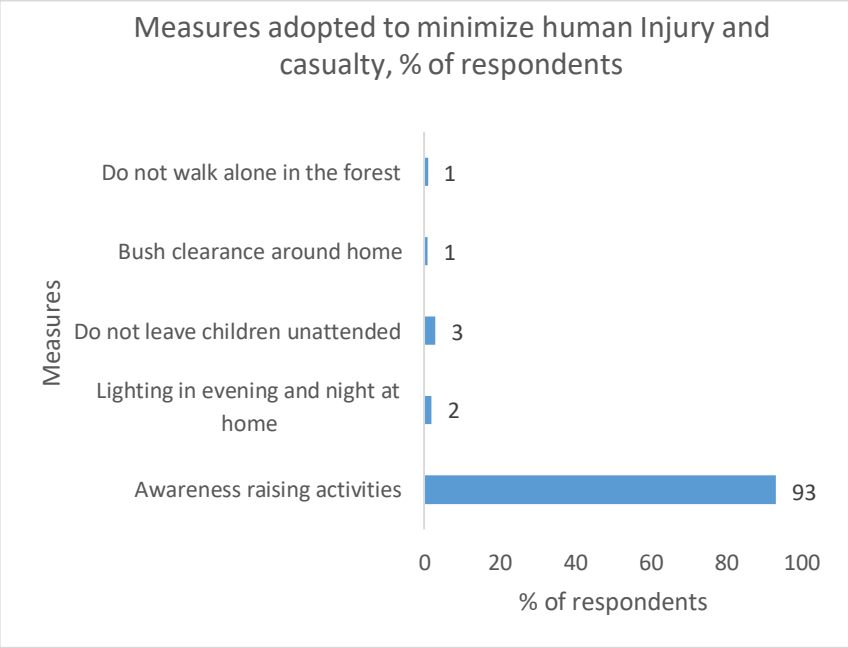


Figure 45: Measures adopted to minimize human injury and casualty

Case study of Bale Mountain National Park, Southeast Ethiopia

Local community used different controlling techniques to defend livestock predator animals, such as fencing (38%), chasing (30%), scarecrow (24%), guarding (8%), and smoking (0%) based on respondents rank. These traditional controlling techniques of the most effective methods are fencing and chasing, the second most effective methods are scarecrow and guarding (especially common jackal) and the least effective traditional controlling techniques are smoking (Mekonen, S 2020).

Analysis showed that non of the adopted preventive measures are effective enough to control human injury/casualty, crop loss and livestock depredation. Among the measures, about half respondents shared that predator-proof corral is effective to control livestock depredation at home. Making noise/shouting, fencing and placement of scarecrows are moderately effective to minimize crop loss (Table:11).

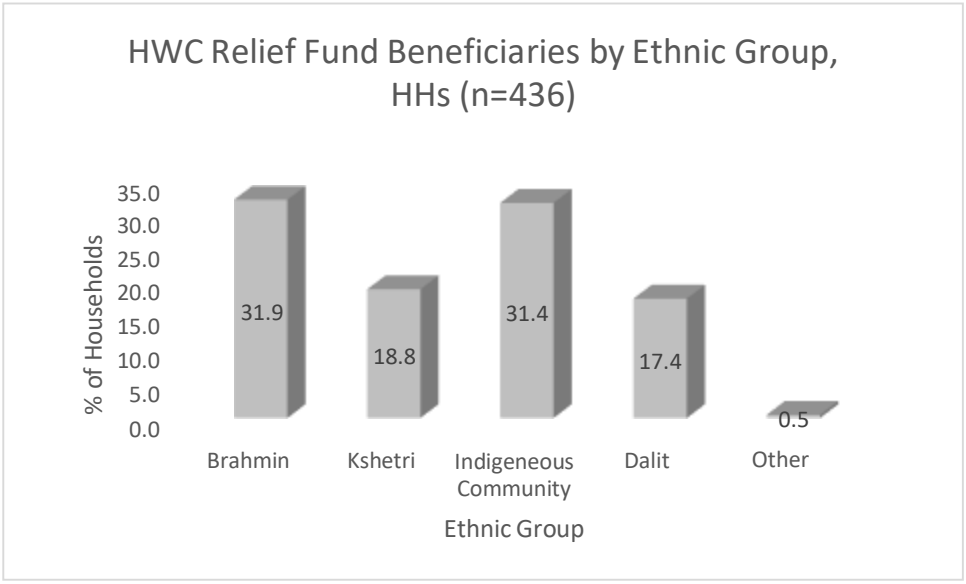
Table 11: Effectiveness of Preventive measures

Sn	Preventive Measures	Effectiveness, no of respondents				
		Very High	High	Moderate	Do not work	Total Respondents
1	Fence		1	31	38	70
2	Trench				4	4
3	Watchtower/Guarding				47	47
4	Noise/shouting		2	52	173	227
5	Use of fire			1	1	2

6	Placement of Scare crow		1	12	139	152
7	Predator proof coral	1	102	8		111

3.6 Human Wildlife Conflict Relief Fund

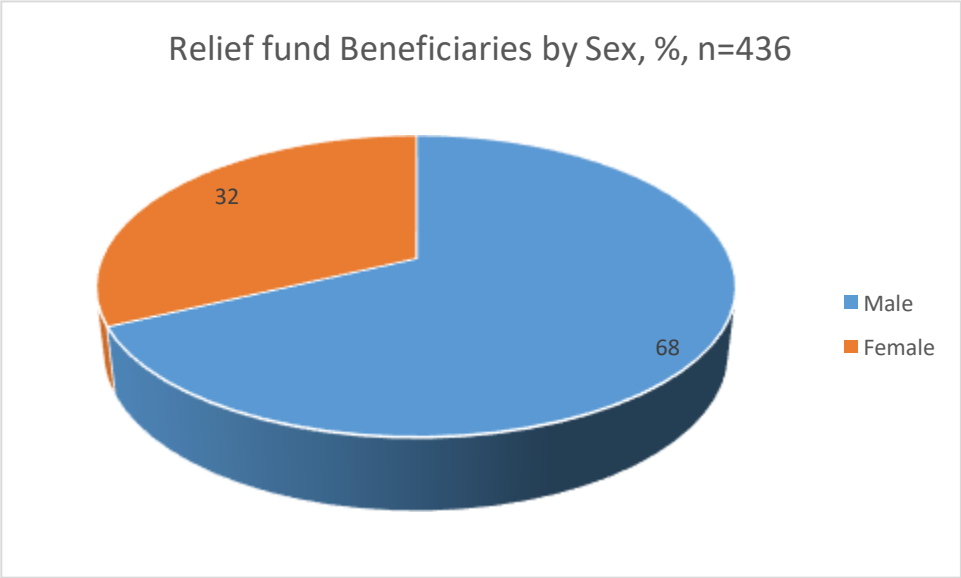
With the objective of complementing in finding out the distribution and extent of wildlife damages, information on human-wildlife conflict relief fund beneficiaries was collected from DFOs of Gorkha and Tanahun, ACA and MCA Liaison Office at Pokhara and Gorkha, respectively. After the endorsement of HWC relief fund guideline in 2069, wildlife victim households initiated to receive relief funds on livestock depredation, human injury, human casualty and property damage. Limits of fund are being amended over the period and there are improvements in distribution mechanism. Still, there is an area of improvement to cover the loss of crops damaged by wildlife especially Monkey in mid-hills. Details of relief fund recipients have been analyzed by ethnic group, sex (household head), municipalities, trend of relief fund distribution over the period and time span to process and presented as follows. Most respondents shared that mechanism is very complex and time-consuming, which is not much victim-friendly to process. In such consequences, information managed by DFO Gorkha and Tanahun and Liaison Offices has been analyzed. All ethnic groups are victims of wildlife damages in the last ten years and received relief funds. The weightage of Brahmin and Indigenous communities in receiving relief funds of wildlife damages is almost one third each, 31.9% and 31.4%, respectively. About 19 % of Kshetri communities and 17.4% of Dalit communities received relief funds for livestock depredation and is as per the number killed by wildlife (Fig 46).



(Data Source: DFO Gorkha and Tanahun)

Figure 46: HWC Relief fund beneficiaries by ethnic group

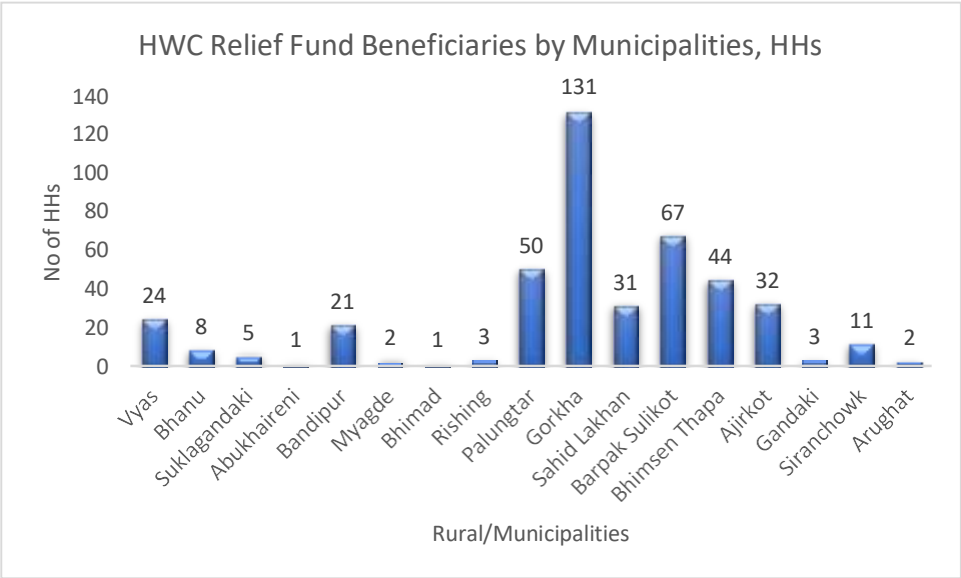
When considering the household head, relief fund beneficiary includes 32% female and 68% male (Fig 47).



(Data Source: DFO Gorkha and Tanahun)

Figure 47: Relief fund beneficiaries by sex

As per the information collected on relief fund beneficiaries, it seems that almost all rural/municipalities of Gorkha and Tanahun are impacted by livestock depredation. Maximum households receiving relief funds are in Gorkha Municipality, Barpak Sulikot rural municipality, Palungtar municipality of Gorkha district, Vyas, Bhanu and Suklagandaki municipalities and Bandipur rural municipality of Tanahun district (Fig 48). More households receiving relief funds indicates higher frequency of livestock depredation.



(Data source DFO Gorkha and Tanahun and ACA, MCA Liaison Offices)

Figure 48: Relief fund beneficiaries by municipalities

Relief fund was distributed for the kill of 1,005 livestock by wildlife and there are 93% are goats, 4.9% cow and 1.7% buffalo killed by wildlife (Fig 49). It proves that goat is the most vulnerable livestock by wildlife attack.

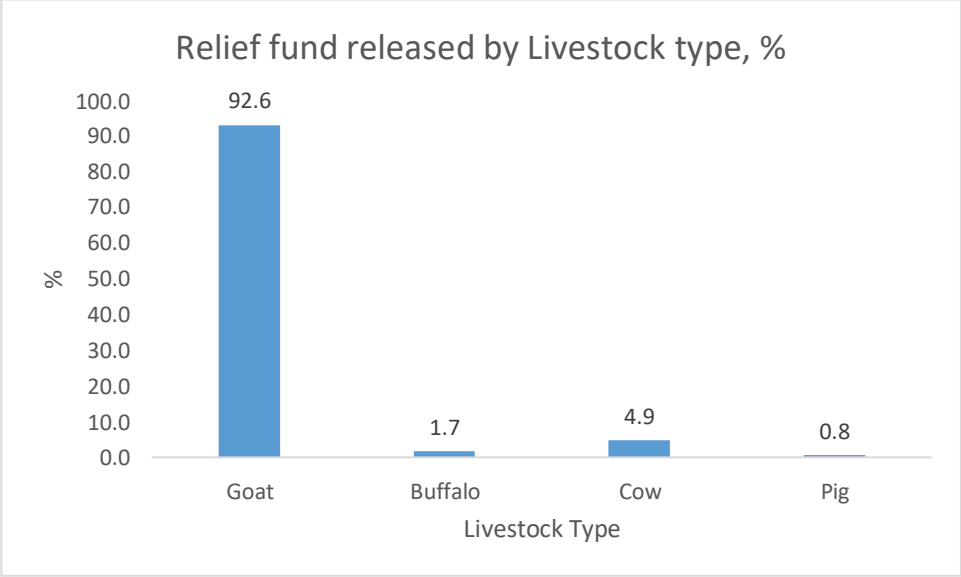
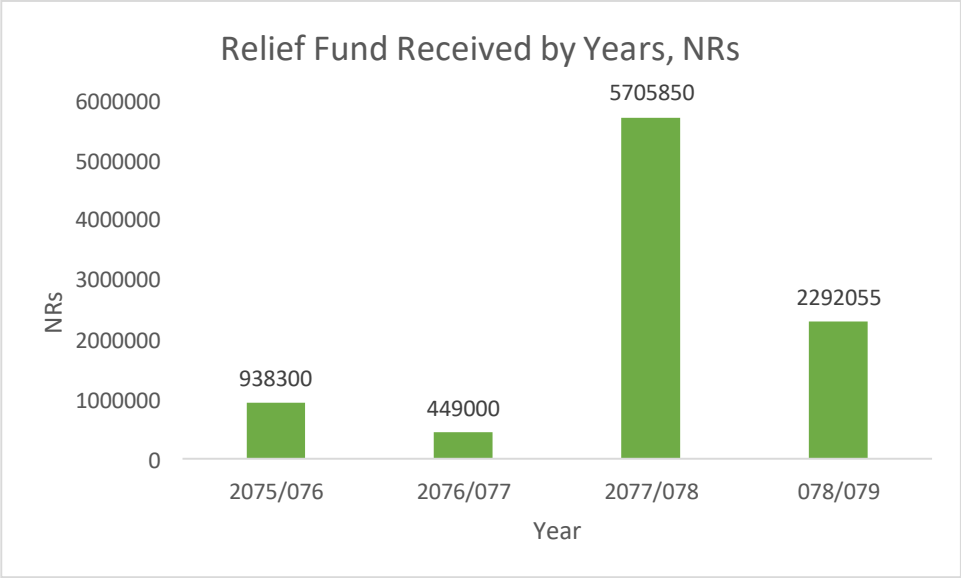


Figure 49: Relief fund released by livestock type

Though the HWC relief fund guideline was endorsed in 2069, the process works well after fiscal year 2075/076. The household survey showed that 58% respondents know the HWC relief fund, and 14 livestock depredation cases have been found. All of them are from the fiscal year 2076/77 to 2077/78 (Fig 50) and received total amount of NRs 2,52,000/- (Nrs 18,000 per kill).



(Data Source: DFO Gorkha and Tanahun, ACA and MCA Liaison Offices)

Figure 50: Relief fund received by years

Unless there is a relief fund for crop damage, actual crop loss cannot be estimated. Households responded, yes, there is crop damage by monkeys, porcupines, rabbits etc., but they could not provide actual quantity and economic loss. So that policy revision is of utmost importance to provide relief fund for crop damage by Monkey and it would be good to revise guideline to provide relief fund by local governments.

HWC Relief Fund process

Almost all respondents shared that relief fund providing mechanism is very complex and time consuming. As such, it has been calculated the average time taken for this process. Based on the data of 62 cases, average time taken from the date of livestock depredation to submission of documents for relief fund is 51days. Range of days to process and submission is from 3 to 259 days (Data source DFO Gorkha and Tanahun), which does not include time taken to approve submitted documents and release fund to wildlife victims. Longer the time taken to process and releasing the fund, higher will be the chances of increasing negative attitude of victims towards wildlife and may resulted to retaliatory killing.

3.7 Distribution of Wildlife Damages

A study in the Kailali district showed that wildlife comes out to settlements because of degradation of corridor and connectivity, animals' behavior, unavailability of food resources in the habitat, increase in the population of wild animals, habitat fragmentation and isolation, the proximity of settlement to wildlife habitat (Joishi et al 2020). This study found that 64% of people responded that there is no sufficient food in the forest for wildlife, 25 percent responded that increase in wildlife number and eight per cent shared that proximity of settlement to wildlife habitat are major reasons of wildlife movement in settlements, which may result in conflicts with human (Fig 51).

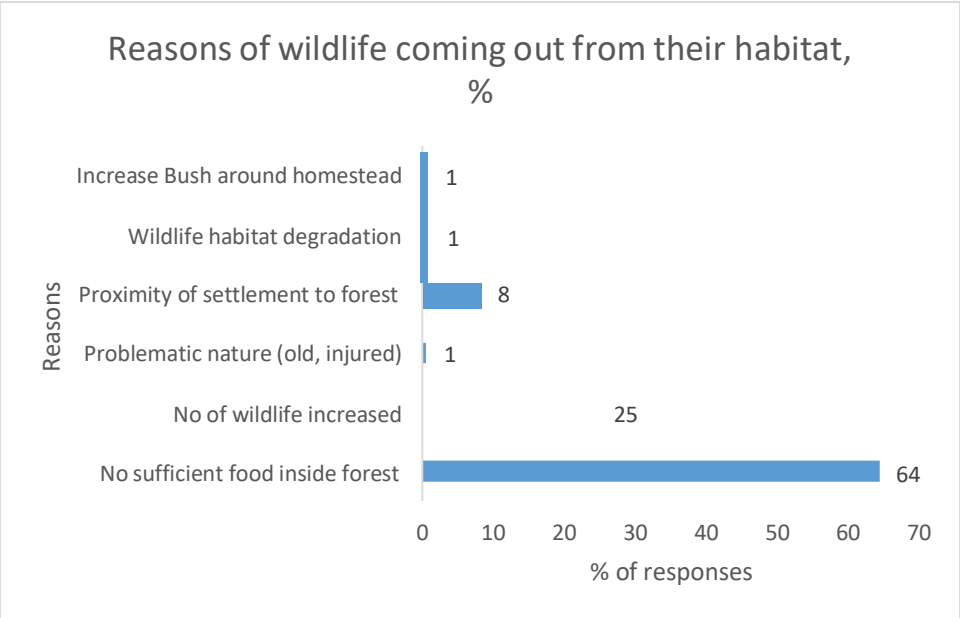


Figure 51: Reasons of wildlife movement out of their habitat

3.7.1 Temporal Distribution of Wildlife Damages

Crop damage, livestock depredation, human injury & casualty and property damage are the wildlife damages found in the study area. Crop damage is month specific, while livestock depredation occurs round the year. Evidence of human injuries and casualties were also recorded round the year except for Ashad in the last ten year. Property damage is not remarkable issue. None of the months occur all four damages, and none of the months has single wildlife damage. Jestha, Ashad, Shrawan, Aswin, Kartik, Magh and Phalgun are the months occurring three types of wildlife damages (Fig 52). If the case of property damage is not considered major ones, then Jestha, Shrawan, Kartik and Mangsir are the critical months of wildlife damages.

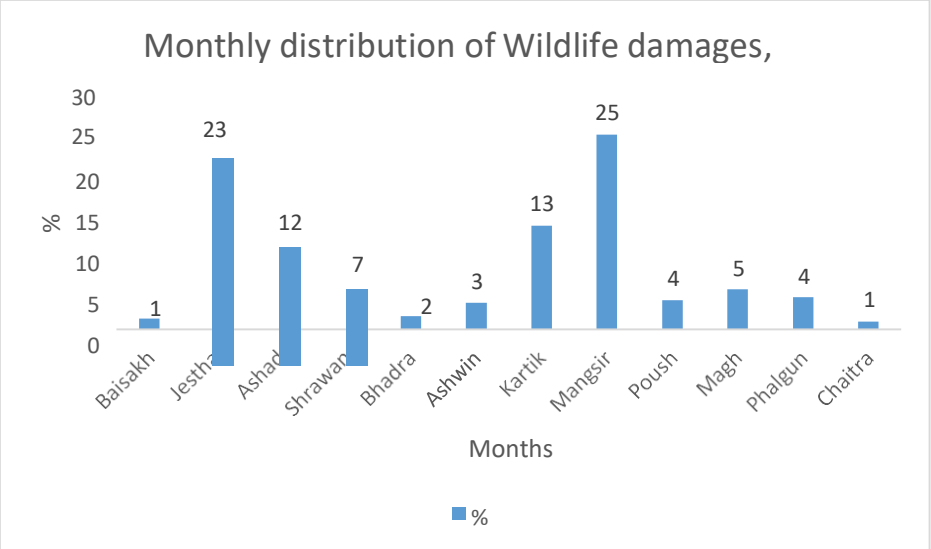
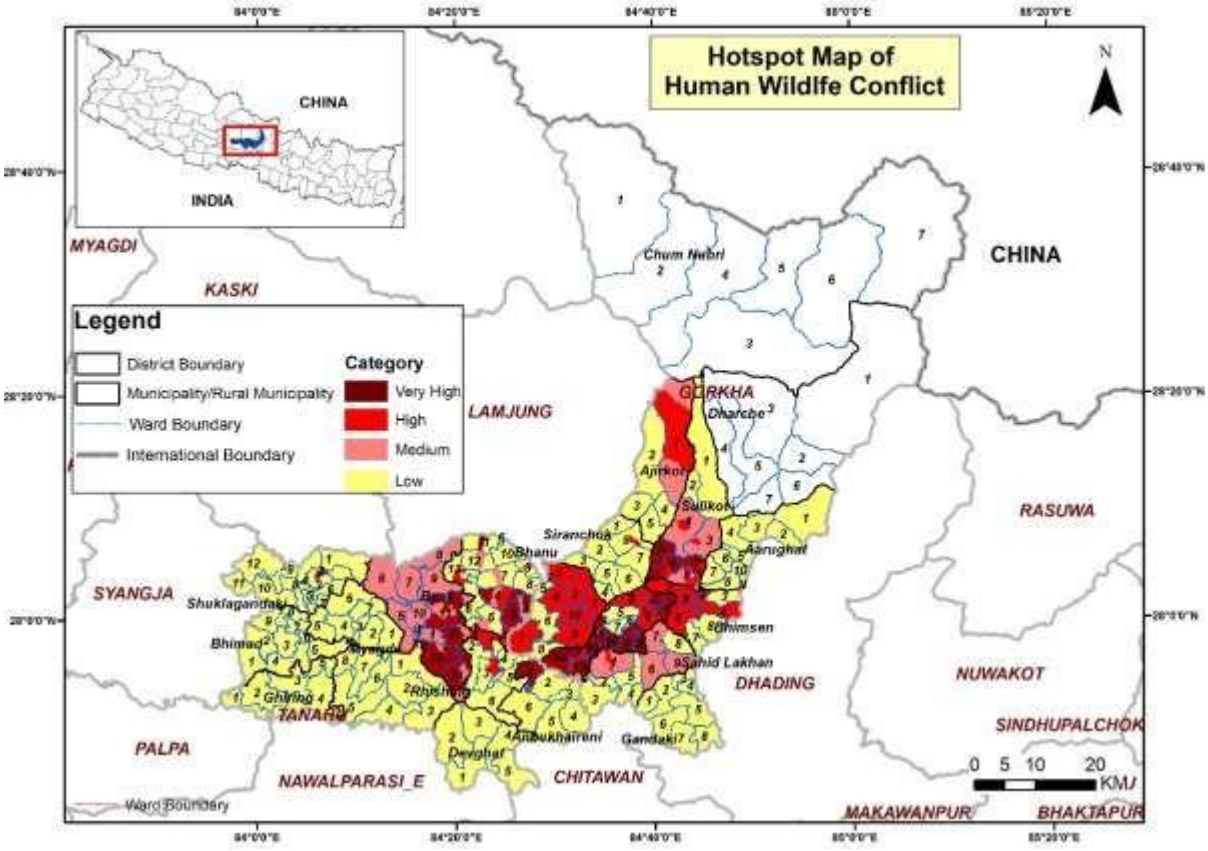


Figure 52: Monthly distribution of Wildlife damages

3.7.2 Spatial Distribution of Wildlife Damages

Wildlife damages are found in all rural/municipalities. But the scale and nature of conflict differ by municipalities. Palungtar Municipalities, and Barpak Sulikot Rural Municipalities of Gorkha and Vyas and Bhanu municipalities of Tanahun district are highly impacted by wildlife damages (Map 8).



Map 8: HWC Hotspots

4 Future Strategic Actions

Study has been found out future strategic actions in general and damage specific. Actions shared by responses are more on a local level and may not require large sum of financial support for implementation. There are some activities those will require more financial as well as technical inputs. General actions include;

a. Knowledge dissemination and awareness-raising activities are common to minimize all types of damages. In the context of this study, an increased level of awareness will minimize human injury and casualty and livestock depredation.

b. Guarding farmlands, corrals with or without dog is another action. Respondents shared that it works to minimize crop damage and work for livestock depredation as well.
c. Translocation of wild animals is another action responded as a general measure. It will minimize crop damage, livestock depredation and human injury/casualty. But this particular action is space specific.
d. The use of light around the home at night is useful to minimize livestock depredation and human injury/casualty. When there is light around the home and cowshed, predators can be seen from distance and help to adopt safety measures.
e. Bush clearance at the homestead is another general action to reduce human injury/casualty and livestock depredation. It will destroy hiding cover for predator nearby.
f. The use of abandoned agricultural land will minimize habitat for monkeys and shelter for predators around, and it will certainly minimise all types of wildlife damages.

Stakeholders during consultation shared that none of the activities on HWC minimization had been practiced before the incidences of human casualty and mortality in Bhanu Municipality of Tanahun. Immediate measures to control human injury and casualty by common leopard, traps were set in sensitive areas in forest and in fringe areas.

Specific actions responded to minimize crop damage on priority basis are as follows (Fig 53).

a. Noise/shouting help wild animals keep away from home and farmlands to minimise crop damages.
b. Translocate wild species
c. Guarding croplands with/out dogs
d. Use of catapult
e. Fruit farming in the forest
f. Fence croplands
g. Waterhole construction in forest.
h. Use abandoned agricultural land.

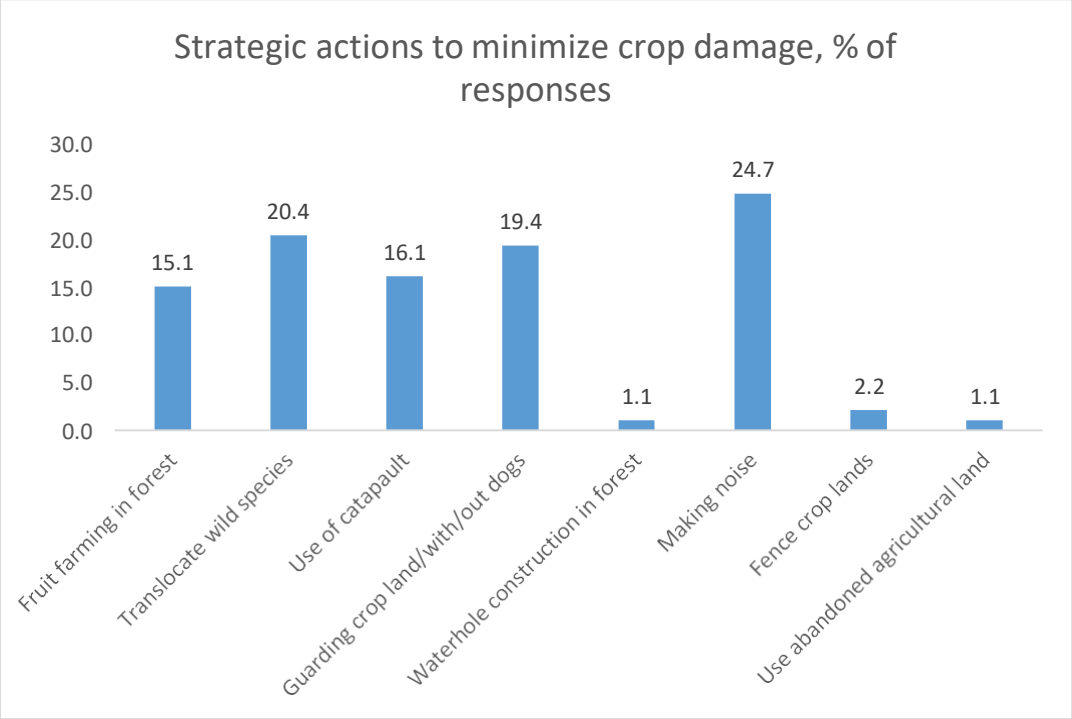


Figure 53: Community responses on future strategic actions

Figure 54: Information on precautionary measures to minimize conflict with Monkey placed in DFO Tanahun

Specific actions responded to minimize livestock depredation on priority basis are as follows (Fig 55).

a. Livestock shed/Corral improvement
b. Promote stall feeding livestock husbandry practices
c. Translocate wild species
d. Habitat management in forest that limits wildlife movement inside the forest and ultimately minimises damages such as construction of water harvesting ponds in forest
e. Increase prey base in forest
f. Clearance of unwanted bush
g. Use of light around home/livestock shed in night

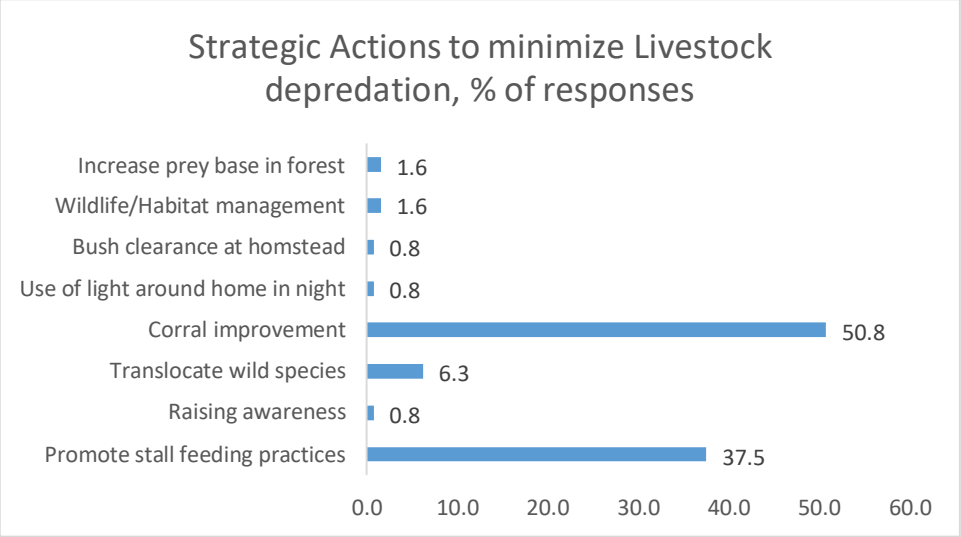


Figure 55: Strategic actions to minimoze livestock depredation

Specific actions recommended to minimize human injury/casualty on priority basis are as follows (Fig 56).

a. Knowledge dissemination, raising awareness
b. Do not leave children unattended
c. Lighting in and around home in the evening and night.
d. Remove unwanted bushes, prescribed burning
e. Walk-in group in the forest and make noise while walking through and along the forest.
f. Do not go to forest in night.

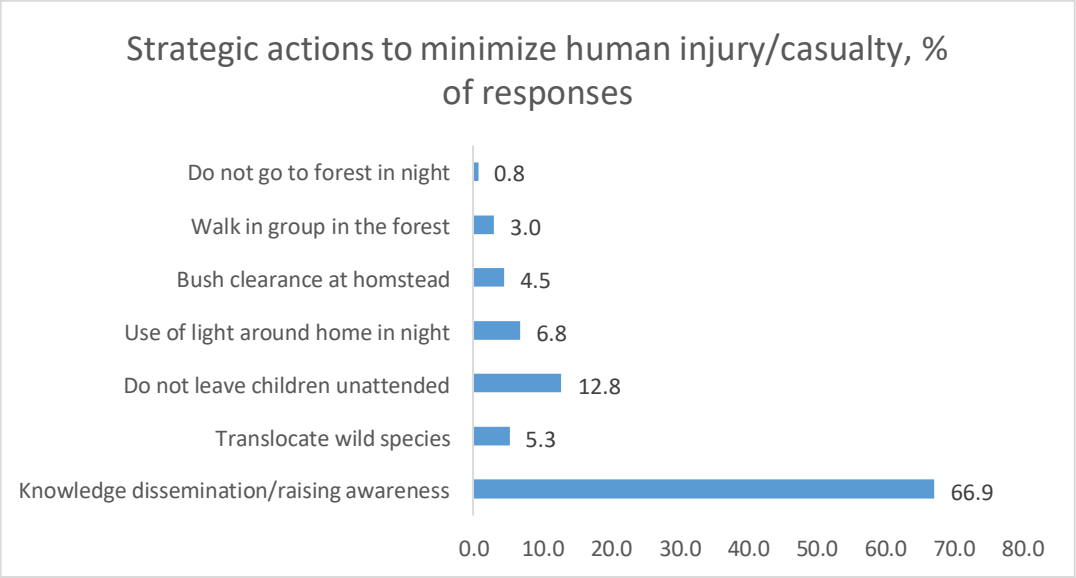


Figure 56: Strategic actions to minimize human injury/casualty

5 Conclusions

Socioeconomic information showed that 93% of households rely on agriculture and livestock husbandry for livelihood. Crops they produce includes paddy, maize, millet, potato, mustard and vegetables. Land ownership shows that more than half of households owned less than ten ropani lands, including upland non irrigated fields. In such circumstances, about 50% of households do not have food sufficiency for whole year. Goat is the common livestock and owned six goats in an average per household. Stall feeding and grazing are two husbandry practices, and about 80% households collect fodder from community forests. Majority households use firewood, LP Gas and electricity as source of cooking energy and firewood collection is from community forests. Fifty per cent households are within 500 m distance from forests. All above-mentioned socio-economic variables showed high dependency of communities on forest resources, which ultimately compel them to visit the forest, which increases conflicts with wildlife.

Low population density of wild prey, water resources and livestock grazing in and around forest would attract leopards into the village (Acharya et al. 2016). Communities experienced that Common Leopard, Monkey, Deer, Jackal, Jungle Cat, Wild Rabbit, Himalayan Black Bear, Porcupine are common visitors to settlements searching for food and water. It increased crop damage, livestock depredation, human injury/casualties, property damage.

Maize, millet, paddy and potato are common crops raided by Monkey, Porcupine, Parrot in the months of Jestha and Mangsir. Trend of crop damage by wildlife has been in increasing order in last ten year, and average annual crop loss per household is 1.71 Muri (137 kg). In an average, 11 livestock were killed by wildlife, excluding chicken per year, especially from farms followed by livestock shed. Goat is most killed livestock, and major responsible wildlife species are Common Leopard, Jackal, Fox and Jungle Cat. Information analyzed from HWC relief fund status showed that victim households received NRs 16,269 in an average. HWC relief fund distribution mechanism is still complex, and wildlife victims are not receiving fund in time. It needs to be revisited for simplicity. Wildlife damage relief for Tanahun district is channelled from ACAP Pokhara after the recommendation of DFO, Tanahun, which is not practical and not according to the concept of providing immediate relief to wildlife victims. The evaluation team at the district level constitutes representatives from various offices, which is the positive aspect, but all stakeholders are not found accountable. Crop damage by monkeys in mid-hill is a common problem and is in increasing trend. Revision in Human-Wildlife

Conflict Relief Fund Guideline is of utmost importance to support wildlife victims of crop damage by Monkey.

Very few cases of livestock shed damaged, with nominal economic loss, by Common Leopard and Jackal documented. The average economic loss from wildlife damages is NRs 10,063/hh/year in last ten year. There has been an increasing trend of human casualties and injuries over the period. In an average, 9 cases of wildlife attacks on human, including one-third of mortality, exists there since 2074. Children of below 11 years are more vulnerable and time of attack is evening. Common Leopard is the most responsible wildlife for both casualty and injuries and Himalayan Black Bear for human injuries.

To overcome wildlife damages, communities adopted various general and damage-specific preventive measures, including guarding croplands, use of catapult for Monkey, placement of scarecrow, shouting, livestock shed improvement, awareness-raising, etc. Effectiveness of those measures is not effective enough except the shed improvement to minimize livestock depredation from home. In conclusion, there is room for effective measures to reduce crop damage and livestock depredation. In the context of human injury and casualty, knowledge dissemination, awareness-raising activities are found effective to some extent and continuity to organize such activities at the household and community level is needed. It is found that households of conflicting areas adopt some preventive measures, including light in the homestead during evening and night, do not leave children unattended, walk-in group in the forest, and make noise while passing through forest. Bush clearance around home and periphery and farmlands is another practice they adopted.

Though the household survey does not reveal any wildlife poaching and retaliatory killing evidences, increasing trend of locating problem animals, dead or alive, over the period from 2064 to Magh 2078 showed that cases are suspicious. DFOs managed 121 individuals, including 54% dead bodies of wild animals from 117 incidences. Evidence of wildlife seized by enforcement agencies indicates the prevalence of wildlife poaching and trade. Communities and stakeholders are experiencing an increasing trend of wildlife damages over the period. Efforts made by government through providing relief funds to wildlife victims, except crop damage by Monkey, is the milestone intervention and effective to change the negative attitude of communities towards wildlife conservation to some extent. Wildlife victims and stakeholders suggested delegating HWC management authority and budget to the local

government. Their suggestions were due to the complexity of HWC relief fund process, time-consuming and not wildlife victim-friendly. Provision to provide relief funds for crop damage by Monkey is their suggestion. Realizing increased number of wildlife and habitat deterioration are important aspects to consider in planning for HWC minimization. Their input is to translocate Monkey and Common Leopard from their areas, but it is space specific measure and not the way out for long run.

Due to infrastructure development activities, total water from streams and rivers are diverting for hydropower generation, drinking water and irrigation facilities without considering the provision of 10% water flow in streams, rivers. These may compel wildlife to come out from their habitat. Communities suggested to incorporate activities like habitat and forest management activities, including water harvesting ponds construction in forest, plantation of fruit trees in forest, awareness-raising activities in upcoming plans. Management of abandoned agricultural lands minimizes the chances of movement of wildlife in and around farmlands. Evidence of handling problem animals showed high scope of capacity building and equipping forest offices on problem animal management. The highest level of attempts made through this study in finding out the nature and extent of wildlife damages, adoption of preventive measures and their effectiveness, economic loss due to wildlife damages, distribution of damages and future strategic actions together with management recommendations shows impacts and way-outs to address issues of wildlife damage in study area. There are several limitations in conducting this assessment, including unavailability of information of wildlife damages of previous years due to lack of mechanism of documenting wildlife damages, especially before the start of practice to provide relief funds to wildlife victims. Impact of COVID was there to consider during field mobility. The financial limitation is obviously there.

6 Management Recommendations

Based on results and conclusions of the study, the following management recommendations have been made.

a. CFOP guideline, which is user friendly but lacks provision of HWC management, would be better to revise to address issues of wildlife damages at community level.
b. Promotion of alternative and wildlife-friendly crops will help in utilizing abandoned agricultural land as well as minimize crop damage by wildlife, so that livelihood options for marginalized households will be diversified.
c. Wildlife habitat management including construction of water harvesting ponds, will provide access to drinking water to wildlife and plantation of wild fruits is recommended.

d. Good to create a coordination forum of stakeholders to facilitate and simplify process of HWC relief fund at local level.
e. Rapid response is urgent, so that effectiveness of funds will increase to save the life of both humans and animals and provide relief in time. Formation of Rapid Response Team (RRT) at municipal level is recommended.
f. HWC management strategy and action is necessary at the provincial and municipal level. Budget management for HWC relief fund at local government level is recommended.
g. Capacitate and equip forest offices to handle problem animals, minimise wildlife damages and to facilitate processes.
h. It would be better to incorporate progress regarding wildlife damages in the annual progress report of respective Division Forest Office.
i. Establishment of insurance scheme at local level would complement relief fund mechanism in-process and fund management on the one hand and be helpful in incorporating the provision of crop loss by Monkey on the other hand. It also addresses the issue of valuation of crop damage by wildlife.
j. HWC relief fund distribution status showed that wildlife victims of accessible municipalities accessed the fund. Beneficiaries of relief funds from remote municipalities are very limited. It would be better to simplify the process, manage facilitation support, and provide relief funds from the local authorities, so that the effectiveness will be increased.
k. Knowledge dissemination and awareness on ecology and behavior of wild predator species, safety measures, ways of human-wildlife coexistence, and relief fund mechanism need to be increased at household and community level.
l. Existing capacity of human resources in HWC documentation and system needs to be developed/strengthened.
m. HWC Relief Fund Guideline needs to be revised to incorporate learnings of implementation so far.
n. Human-Wildlife Conflict is found undermined and treated with less priority. It would be good to mainstream HWC in all environmental concerns and green sectors' development plans, e.g. agriculture, livestock, water, and energy.
o. Considering cases of wildlfe injuries and death, efforts need to be in priority to maintain migration routes and corridors/connectivity, wildlife friendly infrasturucture development is of utmost importance.

p. Concern on the increase in wildlife and their damages is found everywhere. It would be better to coordinate concerned authorities and stakeholders for research on prey-predator status in such consequences. Based on the result of such researches, policies can be revised in managing the exceeding population of wildlfe, if there is, based on the carrying capacity of respective areas.

References

Acharya, K.P., Paudel, P.K., Jnawali, S.R., Neupane, P.R. and Koehl, M. 2017. Can forest fragmentation and configuration work as indicators of human-wildlife conflict? Evidence from human death and injury by wildlife attacks in Nepal. Ecological indicators 80:74-83.

Adhikari, J.N., Bhattarai, B.P. and Thapa, T.B. 2018. Human-wild mammal conflict in a human-dominated mid-hill landscape: a case study from Panchase area in Chitwan Annapurna Landscape, Nepal. Journal of Institute of Science and Technology 23(1):30-38.

Anand, S. and Radhakrishna, S. 2017. Investigating trends in human-wildlife conflict: is conflict escalation real or imagined? Journal of Asia-Pacific Biodiversity 10(2):154-161.

Baral K et al 2021. Human Wildlife Conflict and Impacts on Livelihood: A Study in Community Forestry System in Mid-Hills of Nepal

Baral K, Sharma HP, Rimal B, Thapa-Magar K, Bhattarai R, Kunwar RM, et al. (2021) Characterization and management of human-wildlife conflicts in mid-hills outside protected areas of Gandaki province, Nepal. PLoS ONE 16(11): e0260307. https://doi.org/10.1371/journal.pone.0260307

Bhatta, M. and Joshi, R. (2020) Analysis of HumanWildlife Conflict in Buffer Zone: A Case Study of Shuklaphanta National Park, Nepal. Grassroots Journal of Natural Resources, 3(3): 28-45. Doi: https://doi.org/10.33002/nr2581.6853.03033

Dar, N.I., Minhas, R.A., Zaman, Q. and Linkie, M. 2009. Predicting the patterns, perceptions and causes of human-carnivore conflict in and around Machiara National Park, Pakistan. Biological Conservation 142(10):2076-2082.

DFRS. 2015. State of Nepal's forests. Forest Resource Assessment (FRA). Department of Forest Research and Survey, Kathmandu, Nepal.

Dickman, A. and Marker, L. 2005. Factors affecting leopard *(Panthera pardus)* spatial ecology, with particular reference to Namibian farmlands. South African Journal of Wildlife Research-24-month delayed open access 35(2):105-115.

Distefano, E., 2005. Human-Wildlife Conflict worldwide: collection of case studies, analysis of management strategies and good practices. Food and Agricultural Organization of the United Nations (FAO), Sustainable Agriculture and Rural Development Initiative (SARDI), Rome, Italy. Available from: FAO Corporate Document repository http://www. fao.org/documents.

DNPWC. 2017. Profiling of Protected and Human-Wildlife Conflicts Associated Wild Animals in Nepal. A report submitted to Kathmandu, Nepal.

DFO Gorkha. Annual Monitoring and Evaluation Report 2077/078

DFO Gorkha. Annual Progress Report, 2077/078

DFO Gorkha. Annual Monitoring and Evaluation Report, 2075/076

DFO Gorkha. Annual Progress Report 2075/076

DFO Tanahun. Monitoring and Evaluation Report of Community Forests 2076/077

geoportal.icimod.org 2019

Fernando, P., Wikramanayake, E., Weerakoon, D., Jayasinghe, L.K.A., Gunawardene, M. and Janaka, H.K., 2005. Perceptions and patterns of human–elephant conflict in old and new settlements in Sri Lanka: insights for mitigation and management. Biodiversity & Conservation, 14(10), pp.2465-2481.

GoN/MoFSC, 2014. Nepal Biodiversity Strategy and Action Plan 2014-2020. Government of Nepal, Ministry of Forests and Soil Conservation, Kathmandu, Nepal

GON/MoFSC/DNPWC/MCA, Laision Office 075/076; Annual Progress Report

GON/MoFSC/DNPWC/MCA, Laision Office 076/077; Annual Progress Report

https://ekantipur.com/pradesh-4/2021/12/31/164094868536434729.html m

https//:www.sthania.gov.np/gis/

Human Wildlife Conflcit Relief Fund Guideline 2069, (IInd amendment 2074)

Joshi et al 2020; Assessment of human-wildlife conflict in Kailali district of Nepal

Kansky, R. and Knight, A.T. 2014. Key factors driving attitudes towards large mammals in conflict with humans. Biological Conservation 179:93-105.

Kretser, H.E., Curtis, P.D., Francis, J.D., Pendall, R.J. and Knuth, B.A. 2009. Factors affecting perceptions of human–wildlife interactions in residential areas of northern New York and implications for conservation. Human Dimensions of Wildlife 14(2):102-118.

Ma, B., Xie, Y., Zhang, T., Zeng, W. and Xue, Y. 2021. Construction of a human-wildlife spatial interaction index in the Three-River Source Region, China. Ecological Indicators 129:107986.

Maheshwari, A. and Sathyakumar, S. 2020. Patterns of Livestock Depredation and Large Carnivore Conservation Implications in the Indian Trans-Himalaya. Journal of Arid Environments 182:104241.

Marker, L. and Sivamani, S. 2009. Policy for human-leopard conflict management in India. CAT news 50(1):23-26.

Mekonen, S. Coexistence between human and wildlife: the nature, causes and mitigations of human wildlife conflict around Bale Mountains National Park, Southeast Ethiopia. *BMC Ecol* **20,** 51 (2020). https://doi.org/10.1186/s12898-020-00319-1

Michalski, F., Boulhosa, R., Faria, A. and Peres, C. 2006. Human-wildlife conflicts in a fragmented Amazonian forest landscape: determinants of large felid depredation on livestock. Animal Conservation 9(2):179-188.

Neupane, D., Johnson, R.L. and Risch, T.S., 2017. How do land-use practices affect human—elephant conflict in Nepal?. Wildlife Biology, 2017(4).

Pokharel, B., Stadtmüller, T. and Pfund, J.L. 2005. From degradation to restoration: An assessment of the enabling conditions for community forestry in Nepal.

Pokharel, M. and Aryal, C. 2020. Human-Wildlife Conflict and its Implication for Conservation at Sundarpur, Udayapur, Eastern Nepal. International Journal of Environment 9(2):217-233.

Saraswoti Sapkota, Achyut Aryal, Shanta Ram Baral, Matt W. Hayward, and David Raubenheimer "Economic Analysis of Electric Fencing for Mitigating Human-wildlife Conflict in Nepal," Journal of Resources and Ecology 5(3), 237-243, (1 September 2014). https://doi.org/10.5814/j.issn.1674-764x.2014.03.006

Sharma, P., Chettri, N., Uddin, K., Wangchuk, K., Joshi, R., Tandin, T. et al. 2020. Mapping human-wildlife conflict hotspots in a transboundary landscape, Eastern Himalaya. Global Ecology and Conservation 24:e01284.

Sharma, P., Chettri, N. and Wangchuk, K. 2021. Human-wildlife conflict in the roof of the world: Understanding multidimensional perspectives through a systematic review. Ecology and Evolution.

Sherchan R, Bhandari A (2017) Status and trends of human-wildlife conflict: A case study of Lelep and Yamphudin region, Kanchenjunga Conservation Area, Taplejung, Nepal. Conservation Science, 5: 19-25 Shrestha, B.P. 2016. Faunal (mammal) diversity and human-wildlife conflict in community forests. In: Mainstreaming Biodiversity and Ecosystem Services into Community Forestry in Nepal, 51.

Shrestah R, Bajracharya S.B, Pradhan NMB, A Case Study onHuman-Wildlife Conflict in Nepal (With particular reference to Human-Elephant Conflict in Eastern and Western Terai regions) 2007

Sukumar, R., 1991. The management of large mammals in relation to male strategies and conflict with people. Biological Conservation, 55(1), pp.93-102.

Suryawanshi, K.R., Bhatia, S., Bhatnagar, Y.V., Redpath, S. and Mishra, C. 2014. Multiscale factors affecting human attitudes toward snow leopards and wolves. Conservation biology 28(6):1657-1666.

USGS Earth Explorer 2020

Valli Davide, Ceppi Silvia, Button Samantha, Laizer Richard, Testing low-cost solutions to mitigate human - wildlife conflict: A success story from Kilimanzaro, Tanzania 2019.

Woodroffe, R., Thirgood, S. and Rabinowitz, A. 2005. The impact of human-wildlife conflict on natural systems. Conservation Biology Series-Cambridge 9:1.

WWF Nepal; Hariyo Ban Program 2020, Status of Human-Wildlife Conflict in Seti sub River Basin of Chitwan Annapurna Landscape, Nepal

www.censusnepal.cbs.gov.np

Annexes

Annex I: Selected Rural/Municipalities and Community Forests for field study

Sn	District	Rural/Municipalities	Ward No	CFUG
1	Gorkha	Barpak Sulikot Rural Municipality	7	Dhaki Danda
2			4	Dandrepatal
3			6	Chankhi
4			8	Dhadeni Pakha
5		Palungtar Municipality	10	Deurali
6			3	Siudeni Dumre
7			7	Balthum Pakha
8			1	Annapurna Devisthan
9		Gorkha Municipality	13	Rajdevi
10			4	Bhagawati Simle
11			3	Thuli
12			11	Shikhar Danda Ludhipkha
13	Tanahun	Bhanu Municipality	1	Bhimsenthumki
14			2	Majhuwa Okhle
15			3	Deurali
16			2	Sanodeurali
17			4	Bhanubhakta
18		Suklagandaki Municipality	3	Thulopakha Tinpokhari
19			3	Thulopakha
20			3	Kalika
21		Vyas Municipality	11	Siddhabaraha
22			12	Paling
23			13	Begane Bhalukuna
24			14	Kocho

Annex II Authorities consulted at District level

Sn	Name	Position	Organization	Consulted Date
1	Mr Komal Raj Kafle	Divisional Forest Officer	Division Forest Office, Tanahun	2078/9/24
2	Mr Kashi Raj Pandit	Assistant Forest Officer	Division Forest Office, Tanahun	2078/9/25
3	Mr Daya Nidhi Aryal	Assistant Forest Officer	Division Forest Office, Tanahun	2078/9/25
4	Mr Raj Kumar Shrestha	Assistant Forest Officer	Division Forest Office, Tanahun	2078/9/25
5	Mr Krishna Raj Bhatta	Assistant Forest Officer	Division Forest Office, Tanahun	2078/9/25
6	Mr Rajeshwor Hadkhale	General Secretary/Media Person	NGO Network, Tanahun	2078/9/25
7	Mr Karan Gurung	B. Sc. Forestry Graduate	Resident of Damouli, Tanahun	2078/9/25
7	Mr Ashok Shrestha	Divisional Forest Officer	Division Forest Office, Gorkha	2078/9/24
8	Mr Sita Ram Shrestha	Executive Director	Shree Swanrasaghan Integrtaed Community Development Center, Gorkha	2078/9/26
9	Mr Narendra Lama	Former Project Chief	Manaslu Conservation Area Project, Gorkha	2078/9/23
10	Dr Madhu Chhetri	Former Project Chief	Manaslu Conservation Area Project, Gorkha	2078/9/23
11	Mr Mahesh Poudel	Assistant Forest Officer	Division Forest Office, Gorkha	2078/9/26
12	Mr Hom Bahadur Balchudi	Assistant Forest Officer	Division Forest Office, Gorkga	2078/9/26
12	Mr Kamal Lamichhane	Chaiperson	FECOFUN, Gorkha	2078/9/26

13	Mr Satya Narayan Shah	Project Chief	MCAP, Gorkha	2078/9/26
14	Mr Subhash Pokharel	Ranger	MCA, Liason Office, Gorkha	2078/9/26

Annex III: Participants of Focus Group Discussion by Community Forests

Sn	CF	Rural/ Municipalities	Ward No	Date	No of Participants	M	F	Local Gov Rep
1	Rajdevi	Gorkha	13	10/5/2060	23	12	11	1
2	Dhodeni Pakha	Barpak Sulikot	8	10/11/2078	18	10	8	1
3	Dhaki Danda	Barpak Sulikot	7	10/12/2078	14	12	2	1
4	Dandrepatal	Barpak Sulikot	4	10/13/2078	5	3	2	1
5	Balthum pakha	Palungtar	7	10/17/2078	29	11	18	
6	Annapurna Devisthan	Palungtar	1	10/10/2078	11	6	5	1
7	Siudeni Dumre	Palungtar	3	10/7/2078	6	5	1	
8	Chankhi	Barpak Sulikot	6	10/14/2078	8	3	5	
9	Shikhar Danda Ludhipakha	Gorkha	11	10/4/2078	7	3	4	1
10	Deurali	Palungtar	10	10/6/2078	14	6	8	
11	Siddha Baraha	Vyas	11	2078/10/3	13	2	11	
12	Paling	Vyas	12		5	2	3	
13	Kocho	Vyas	14	2078/10/4	6	3	3	
14	Bhimsenthumki	Bhanu	1		8	4	4	
15	Deurali	Bhanu	3		4	3	1	1
16	Dangdunge	Suklagandaki	3	2078/10/8	6	6		
17	Kalika	Suklagandaki	3		10	6	4	
Sub Total					**187**	**97**	**90**	**7**

Annex IV Key Informant Interviewee

1. Mr. Ajeet Tumbahangphe, Conservation Officer, MCAP, Gorkha
2. Mr. Mahesh Poudel, AFO, Division Forest Office, Gorkha
3. Mr. Sita Ram Shrestha, Executive Director, SSICDC, Gorkha
4. Mr. Komal Raj Kafle, Divisional Forest Officer, DFO, Tanahun

Annex V Questionnaire for Household Survey

Name of data collector: *Date:*

A. Background Information

Respondent name: Sex: Age:

Address: District Municipality: Ward no:

Occupation: Education:

Family size: Male: Female:

Adult: Young: Children:

Name of Community Forest:

GPS location: Latitude Longitude

Major income sources of family: a. b. c.

Landholding: ……. ropani ,

Irrigated land…… ropani,

Non irrigated land….. ropani,

Kharbari……. ropani

1. Crop Production:

Sn	Crop	Annual production, Muri	Sufficiency, in month	Quantity purchase, kg	Cost per kg	Remarks
1	Paddy					
2	Maize					
3	Millet					
4	Wheat					
5	Other					

2. How far is your land from forest? ..... km. or..... meter

3. Do you have any livestock? Yes: No: if yes:

No of Goat ( ), Cow ( ), Buffalo ( ), Chicken ( ), Pig ( )

4. How do you feed your livestock? **a.** Stall feeding b. free grazing c. both

5. What is the major source of fodder for your livestock?

a. Crop residue/private land ( ) b. Community forest ( ) c. National forest ( ) d. Other …….

6. What is the source of energy for cooking in your house?

a. Firewood () b. Biogas () c. Kerosene stove () d. Electricity () e. LP Gas ( )

7. What is the major source of firewood for cooking?

a. Crop residue/private land ( ) b. Community forest ( ) c. National forest ( ) d. Other ( )

8. If you do not mind, would you please provide your household's estimated annual income?.....

B. Wildlife Damages

9. What are the wildlife species found in your neighboring forests?

a. c. d. e.

10. Does any wildlife visit to your house, fields and surroundings? Yes ( ), No ( )

b. c. d. e.

11. What are the problems created by wildlife in your village and surroundings?

Animal					
Damages					

12. What are the major damages from wild animal in your house and farms in last 10 years?

Year	**Crop Damage**	**Livestock Depredation**	**Property Damage**	**Human Injury**	**Human Casualty**	**Other**
2069						
2070						
2071						
2072						

2073						
2074						
2075						
2076						
2077						
2078						

13. Is there any crop damage evidence from wild animals in your family is last 10 years?

Yes ( ), No ( ), if yes

Year	**Crop**	**Month**	**Wildlife species**	**Area of damage, Ropani**	**Quantity of damage, kg**	**Price per kg**
2069						
2070						
2071						
2072						
2073						
2074						
2075						
2076						
2077						
2078						

14. Is there any incidence of livestock depredation in your family in last 10 years:

Yes ( ), No ( ), if yes

Year	**Livestock**	**No**	**Time**	**Month**	**Wildlife species**	**Price of livestock**	**Location (forest, crop field, home)**
2069							

2070							
2071							
2072							
2073							
2074							
2075							
2076							
2077							
2078							

15. Is there any incidence of human injury by wildlife in your family in last 10 years:?

Yes ( ), No ( ), if yes

Year	**Type of injury**	**Wildlife Species**	**Month**	**Time**	**Location (forest, crop field, home)**	**Condition of person at that time (sitting=1, walking=2, working=3)**
2069						
2070						
2071						
2072						
2073						
2074						
2075						
2076						
2077						
2078						

16. Is there any case of human casualty by wildlife in last 10 years?

Yes ( ), No ( ), if yes

Year	No of casualty	Wildlife Species	Month	Time	Location (forest, crop field, home)	What is doing by that person at that time
2069						
2070						
2071						
2072						
2073						
2074						
2075						
2076						
2077						
2078						

17. Are there any incidences of property damage by wildlife in your family?

Yes ( ), No ( ), if yes

Year	Type of damage	Wildlife Species	Month	Time	Estimated cost of damage, NRs	Remarks
2069						
2070						
2071						
2072						
2073						
2074						
2075						
2076						
2077						
2078						

18. Do you practice any preventive measures for the minimization of above mentioned conflicts?

Sn	Conflict	Preventive measures adopted
1	Crop damage	
2	Livestock depredation	
3	Property damage	
4	Human injury/casualty	

Note: a. Power fence b. Trench c. Watch Tower / Machan d. Shouting e. Fire

f. Predator proof coral g. Scare crow

19. What is the effectiveness of these measures?

Sn	Preventive measures	Effectiveness	Sn	Preventive measures	Effectiveness
1	Power fence		5	Predator proof corral	
2	Trench		6	Shouting	
3	Fire		7	Scare crow	
4	Machan				

Note: 1. Very high 2. high 3. moderate 4. not effective

20 Do you know about the relief fund mechanism? a. Yes ( ) b. No ( )
If yes, did you get any relief fund for the wildlife damage in last 10 years?

Type of damage	Total estimated damage (NRs)	Amount received, NRs)	Year	Name of organization provided relief fund
Crop damage				
Property loss				
Livestock injury				
Livestock depredation				
Human injury				
Human loss				

21. In your opinion, why do animals come out of forest?

a. No sufficient food inside forest

b. No of wildlife increased

c. Problematic nature (old, injured)

d. Proximity of settlement to forest

e. Loss of habitat inside the forest

f. Don't know

22. At what time normally wild animal come out of forest to human settlements, farms?

a. Morning (4am-8am) ( )
b. Day (8am-4pm) ( )
c. Evening (4pm-8pm) ( )
d. Night (8pm-4am) ( )

23. Do you know any retaliatory killing of wildlife in last 10 years? If yes

Year	Wildlife species	No	Location	Month	Time	Specific Reason
2069						
2070						
2071						
2072						
2073						
2074						
2075						
2076						
2077						
2078						

24. Are there any cases of wildlife poaching in your area in last 10 years? Yes ( ), No ( )

If yes:

Year	Wildlife species	No	Location	Month	Time	Remarks
2069						

2070						
2071						
2072						
2073						
2074						
2075						
2076						
2077						
2078						

25. In your opinion, what strategic actions need to be taken to minimize human wildlife conflict?

Sn	**Conflict**	**Strategic actions to be taken**
1	Crop damage	
2	Livestock depredation	
3	Property damage	
4	Human injury/casualty	

Thank you for your time and information. Do you have any suggestions or messages to us?

Annex VI: Study Team

Sn	Name	Qualification/Expertise	Role in Assessment
1	Mr Purna Bahadur Kunwar	M. Sc. Forestry, Biodiversity Conservation	Team Leader
2	Mr Saroj Koirala	M. Sc in Geospatial Technologies	GIS Expert
3	Mr Karan Gurung	B. Sc. Forestry	Field Associate, Tanahun
4	Mr Ek Bahadur Budhathoki Magar	SLC	Field Associate, Gorkha

Annex VII: Photographs

Siddhabaraha CFUG, Vyas -11 and Paling CFUG Vyas 12 Tanahun


Bhagane Bhalukuna CFUG, Vyas -13, Tanahun



Khochyo CFUG, Vyas -14, Tanahun


Bhimsenthumki CFUG, Bhanu -1, Tanahun



Majuwa okhle CFUG, Bhanu -2, Tanahun



Sano deurali CFUG, Bhanu -2 and Deurali CFUG, Bhanu -3, Tanahun


Bhanubhakta CFUG, Bhanu -4, Tanahun

Dandunge tinpokhari CFUG and Thulopakha thinpokhari CFUG Suklagandaki -3, Tanahun


Kalika CFUG, Suklagandaki -3, Tanahun

Bhanu 3 ward member Tanahun

Chankhi CFUG, Barpak Sulikot Rural Mujicipality -6, Gorkha

Dandre Patal CFUG, Barpak Sulikot 4, Gorkha

Dhaki Danada CFUG, Barpak Sulikot Rural Municipality-7, Gorkha

Dhadeni Pakha CFUG, Barpak Sulikot Rural Municipality-8, Gorkha

Siudeni Dumre CFUG, Palungtar Municipality-3, Gorkha

Deurali CFUG, Palungtar Municipality-10, Gorkha

Rajdevi CFUG, Gorkha Municipality 13, Gorkha


Shikhar Danda Ludipakha CFUG, Gorkha Municipality-11, Gorkha


Bhagawati Simle CFUG, Gorkha Municipality 4 and Thuli CFUG, Gorkha Municipality-3, Gorkha