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RESEARCH ARTICLE

Assessment of human-carnivore conflict in Chitral, Pakistan

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The study was conducted to assessed human carnivores' conflict, its causes, severity and recommending conflict mitigation suggestions. Conflict in the study area was assessed through interview questionnaire, focus group discussions, pasture's visits and observations. Results showed that 19% respondents had experienced conflict with carnivores. Carnivores depredation on livestock and poultry was the main cause of conflict. Wolves and Foxes are among most blamed carnivores in the study area. Last seven years depredation cases indicated that wolfs are the most destructive and lethal predator of livestock among all. In the pastures wolfs contributed 90% of the total damage. While In the adjacent village's foxes contributed 73% of the total poultry depredation cases. No records of snow leopard depredation cases were found in the last 7 years. Depredation cases of lynx and jackal were very few. Most of the livestock depredation reported during the summer months from May to September while most of poultry depredation w0ere reported during the winter months from September to March. Respondents revealed that no compensation had given to the affected households, not from the responsible authorities nor from NGOs, that is why their perception towards carnivore is not good. Of the total 28% recommended killing of carnivores, 22% were in favor of paying compensation for losses to affect. Our results indicates that human carnivore conflict is intense in the area. However, it could be reduced by multi-prolonged conservation programs includes compensation, insurance programs, awareness creation and Improving the livestock and poultry Corals/Sheds. Introducing trophy hunting in the area can also play a vital role in mitigating conflict. The money generated from hunting can be utilized for losses compensation and developmental purposes in the area.
Keywords: human-carnivore conflict; depredation; snow leopard; wolf; fox; lynx; jackal

Introduction

Since ages, the human populations are dependent on the natural resources for their livelihood. The foremost dependence of human communities is upon forest and rangeland resources, while these forests and rangelands are the natural habitats of carnivores. Thus, large home ranges of carnivores draw them into recurrent competition with humans thus bringing up a clear and vivid conflict with humans in these areas. Human-carnivore conflict is defined as the interaction between carnivores and people and the resultant negative impact on people or their livestock/poultry, or carnivores or their habitat. A huge number of carnivores are likely to have a conflict with humans. The carnivore's habitat ranges are large areas due to overpopulation and urbanization some time human settlements overlap with carnivore's habitat, results in destruction and fragmentation of carnivore's habitat (Treves and Karanth, 2003). Conflict starts, when growing human populations overlap with carnivore's natural territories, creating disturbances which results in the reduction of prey, carnivore's habitat loss and habitat fragmentation.

Carnivores also injure or kill domestic animals and poultry and threaten or kill people. Human-carnivore conflict nowadays is considered to be a major conservation and rural livelihood issue because too many carnivore species have been killed due to an increased conflict level with the local communities (Dar et al., 2009). Conflict causes a substantial financial effect on rural people. Because those who live near to forest or pastures, which is the natural habitat of carnivores tend to or likely to be with lower income source, they are mostly dependent on these natural resources for their livelihood. This issue therefore lessens the tolerance of these people towards carnivores, as a result some time people wrongly identify the culprit and kill other species. Therefore, conservation of conflict species as well as non-conflict species is becoming challenging (Naughton-Treves, 1998; Linkie et al., 2007). Mostly these conflict starts due to depredation on livestock or poultry by carnivores. Depredation attacks typically manifest in one of two ways. Either a single domestic animal will be taken from the edge of a herd grazing at pasture or large carnivore like the snow leopard or wolf will enter the cattle pen of a household through some opening and attack the cornered livestock inside. Attacks of the second variety often result in "surplus killing," or the killing of 20-50 animals at once, usually goats or sheep. This results from the poor livestock corals in pastures and husbandry practices in villages. As a result, livestock or poultry losses can harm local people's livelihood (Satterfield, 2009).

These depredations on livestock and poultry cases are the cause of human-carnivore conflict and results in threat to large carnivores all over the world (Treves and Karanth, 2003). In Pakistan 142 livestock losses attributed to common leopards were reported from the Ayubia National Park (Lodhi, 2007), and 363 livestock losses were reported from the Machiara National Park, Azad Jammu and Kashmir (Dar et al., 2009). In Chitral wolves and Lynx were identified as the most destructive due to their high rate of depredation on livestock (Ahmad, 2017). Wolves are considered to be most lethal predator in Chitral and community wanted to reduce them (Din et al., 2013). HCC occurs because of the natural prey of carnivore's shrinkage, habitat loss, habitat fragmentation; human intervention in carnivore's habitat or disturbances created by people is increased. As a result, carnivores injure or kill domestic animals and poultry, threaten or kill people, and conflict starts. The objectives of the study were to estimate livestock and poultry losses based on carnivore conflict during (2011-2017), to investigate the human perception towards carnivores in the study area, and propose mitigation measures to minimize conflict.

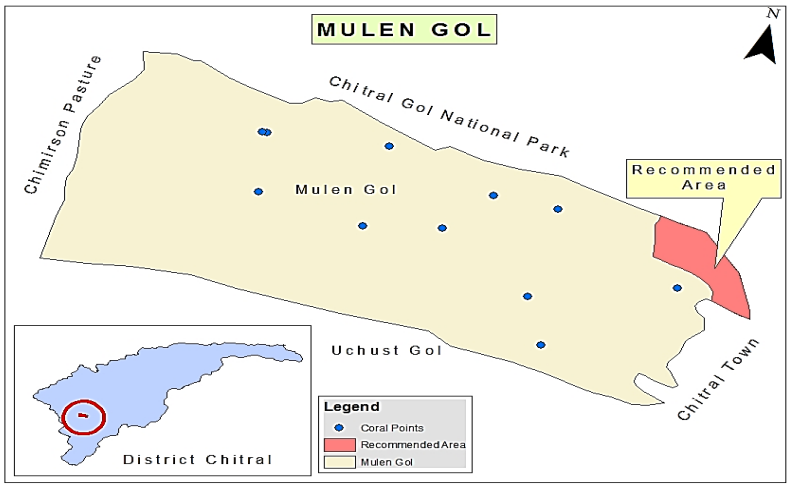


Fig. 1. Uchust Gol in the south and Chimerson in the west.

Materials and Methods

Study area

The study was conducted in Mulen Gol (MG). MG is one of the buffer zones of Chitral Gol National Park (CGNP), which is situated in the Khyber-Pakhtunkhwa province of Pakistan. It is adjacent to CGNP that lies to its northeast. MG is located at a distance of 6 km west of Chitral town and the approximate geographical position of the Park is 35°50′ and 35°51′ N and 71°40′ and 71°45′ E. with an average elevation of 3,048 mt. MG is stretched over an area of about 2,782 ha or 27.8 km^2. MG shares boundaries with CGNP in the northeast, adjacent villages including Khorkashandeh, Dangerakandeh, and Pachil in the southeast, Uchust Gol in the south and Chimerson in the west (Figure 1). Its name composes of two words "Mulen" Down and the term "Gol" stands for stream in local language i.e., Khowar, Chitrali-dialect. The MG stream originates from the northwestern pasture known as Chatran and pours into River Chitral (Kunar River) in the east of Chitral town only in flooding season because rest of the year, this water is used in adjacent villages for drinking and agriculture purposes. The custodian/Adjacent villages of MG are Khorkashandeh, Dangarakandeh and Pachil. There in total 640 Households (HHs) accommodating about 4800 individuals. Only these village inhabitants have the user right over collection of fuelwoods, timber, Non-timber forest products (NTFPs), pasture grazing etc. No outsider can graze their livestock in MG, nor collect NTFPs and fuelwood. MG is rich in biological resources of diverse typologies. As MG is adjacent to CGNP that is why all the species which are existing in CGNP also exist in MG. There are numerous existing species of mammals, birds, amphibians, and reptiles, and they are migrating from CGNP and other adjacent places towards MG. According to Chitral Wildlife Department, a large number of Markhor (*Capra falconeri*) is living in the area that was declared as Endangered until 2015 by IUCN. Carnivores i.e., Grey wolf (*Canis lupus*), Asiatic jackal (*Canis aureus*), Red fox (*Vulpes vulpes*), Eurasian lynx (*Lynx lynx*) and snow leopard (*Panthera uncia*). Different species of Trees, shrubs, and herbs increase the beauty of this area. In MG most of the area is steep slopes. There are two types of pastures, summer pastures and Foothill pasture. Summer pasture grazing mostly starts from the start of May until the end of September. Some of the summer pastures where herders graze their goats in summer are Pushinal, Allugher, Talishal, Koach, Tushani, Sikander, Shal, and Chatran. While Foothill pastures are nearer to villages, foothill grazing in these pastures continues throughout the year by the domestic livestock and by the herders' goats in winter.

Interview questionnaire

An interview questionnaire was developed in the initial phases of the research. The questionnaire included questions about the history of human-carnivore conflict, community recommended solutions to carnivore's conflict issues and suggestions to tackle any damage. Questions to know the attitudes and perceptions of local people towards carnivores specially the main conflict species. The questionnaire was thus used as the main medium of data collection in this research that was filled by the local community including herders, hunters, students and elders of the community randomly. The data collected was then entered into the computer software i-e excel for interpretation and analysis.

Focus Group Discussion (FGD)

One focus group discussion was conducted at summer pasture, where herders were the respondents. Discussions with herders were conducted to know the severity of human-carnivore conflict. Different Questions were asked to know the attitudes and perceptions of local people towards the main conflict species including Snow leopard, wolf, lynx, jackal and fox. The second group discussion was conducted in Khorkashandeh (MG adjacent/custodian village) where some elders of the community were invited, who were good informants. They Enlighted us about the historical events of human-carnivore conflicts and told us the conflicts they had experienced, or they had heard from their elders.

Pastures visits and observation

Different pastures inside Mulen Gol includes Pushinal, Allughar, Talishal, Koach, Tushani, and Sikandershal and the most famous and enrich forage pasture in MG (Chatran) were visited. Some of the phenomenon that was observed included the presence of skulls and bones of livestock, which were left after depredation by carnivores, conditions of corals/pen, grazing pattern of livestock, state or condition of existing fences, incidences of conflict and carnivore's presence in the study areas.

Results

Respondents' demography and economic status

A total 130 respondents, comprising 8 from the summer pastures and 122 from the villages were interviewed. Majority of the respondents belonged to age cohort of 20-30. Some 31% respondents belonged to this age group. Respondents belonging to age

group of 30-40 years represented 22% of the total. Respondents belonging to age group of 40-50 years represented 19% of the total. 50-60 years aged respondents constituted 12% of the total. The citizens representing age group 60 and 60+ were 15%.

Most of the community members lie in poor category their dependency on natural resources is so high. The middle-class community constitutes 38%. They are also dependent on forest for fuelwood and use pastures for grazing their livestock. The rich class community constitutes 4% of the total; their dependency on the forest is low. They mostly rely on the market for the basic needs. Nearly 99% respondents had their own houses. No respondents were living in tents neither in the villages nor in the pastures. Only one family from a Gujjar tribe lives in a tent at summer pasture. In winter, they shift near the village along with their livestock. The remaining herders are locals. In summer, they live in pastures individually and come to home once in a month, while in winters they shift corals near the village; 12 corals are present in the summer pastures.

Grazing pattern of livestock

In Mulen Gol, seasonal grazing in the high altitude (summer pastures) and foothill grazing is practiced. Summer pasture grazing mostly starts from the start of May till the end of September. Some of the pastures where local community leave their cattle's in summer for free gazing and herders graze their goats are Pushinal, Allughar, Talishal, Koach, Tushani, Sikander shal and Chtran. Nearly 920 goats and 37 cattle's graze around the year.

Occurrence of human carnivore conflict

To know the general perception about HCC, different questions were asked including the type of conflict, losses suffered, the timing of conflict, the response of community after the incident, reasons of the conflicts, community perceptions about carnivores and any compensation from wildlife department or any NGOs. About of 19% of the total respondents had experienced conflict with carnivores.

Type of conflict and losses

Wolf and Fox are the most blamed carnivores in MG and its adjacent villages. Majority of the respondents pointed Wolves and Foxes for depredation for livestock and poultry. The perception of respondents towards snow leopard is good, but they are confident that snow leopard attack will be more destructive. However, lynx and jackal are not considered that much destructive as compared to wolf and fox.

Description of the conflict

In pastures, large-scale conflicts certainly exist in depredation hotspots. Almost 89% of the total cases of the attack were either nighttime or dawn. Only 11% depredation of livestock was during daytime by large carnivores (Wolves). Majority of the corals are without roofs and walls to resist the predators. When the respondents were asked about reasons of depredation, 28% of the respondents attributed livestock depredation to lack of prey in pastures, 25% were of the view that poor quality of livestock and poultry sheds, 6% respondents were of the view that negligent herding practices is the main reasons, 16% were of the view that increasing population of the carnivores is the main reason, and 9% were of the view that over grazing is the reason. Of the total, 8% believed that moving into sensitive ecological zones or wild animal habitat is the reason for HCC.

Seasonal patterns of livestock and poultry depredation

Of the total 59% of livestock depredation reported during the summer months from May to September and 25% reported during winter's months from September to March. Only 16% cases were reported from March to May. Of the total 57% of poultry depredation was reported during the winter months from September to March, 25% reported from March to May while only 18% from May to Sep. Most of the livestock depredation cases reported during summer months from May to September while poultry depredation cases were occurred during winters from September to March (Figure 2).

Respondent's response after incident

Of the total 32% of the respondents stated that they had searched the predators after the incident to kill but fortunately, they did not catch them yet if they caught those predators after the destruction the result will be worse. 68 % of the total respondents stated that they act patiently and tolerate such losses. Because they know, they cannot do anything with wild animals.

Depredation cases in the last 7 years

The last 7 years depredation cases indicate that wolf is the most destructive and lethal predator among all. After assessing, it is evaluated that total 80 livestock depredation cases occurred. Out of 80, the wolves contribution is 72, which constitutes 90% of the total. The majority of the respondents reported the population of snow leopard has decreased significantly, in the past one decade having no records of any depredation cases in the last 7 years. In the villages, fox is the most blamed carnivore because of depredation on poultry. Of the total 86 poultry depredation cases, foxes contribute in 63 cases. This constitutes 73% of the total. Lynx and foxes are the moderate predators. So far, five Billy goats and 15 poultry depredation cases of lynx were reported while jackals 3 Billy goats and 8 poultry depredation cases were reported (Fig. 3). Almost 89% of the total cases of the attack were either nighttime or dawn. Only 11% depredation of livestock was during daytime by large carnivores (Wolves).

Preference ranking of community for carnivores

A separate one-pager questionnaire was developed to assess the preference ranking of community for Snow leopard, wolf, lynx, jackal, and fox. The question included options like would you like to increase, maintain, reduce or eliminate the mentioned species in MG. Of the total respondents, 71% wished to increase the population of snow leopard in MG. Only 16% of the respondents wished to eliminate SL population, 8% wished to maintain and 5% suggested reducing SL in MG. The response from the respondents about the preference ranking of wolf was somewhat mixed. A total of 44% of the respondents suggested that the population of the wolves in the MG should be maintained; 22% think that the population of the wolf in MG should be increased; 22% suggested elimination of wolves in MG; 12% respondent suggest they should reduce from MG. The same trend has been observed from the respondents as it was observed for wolves in the MG about the preference ranking of lynx. 44% consider that the population of the lynx should be maintained and 22% stated that there should be increase in the population of the lynx in MG, whereas 12% are against the presence of the lynx in MG and consider that it should be eliminated; 12% suggest reduction of the species; 53% of the total respondents wanted complete elimination of the jackals from the MG. Only 3% wanted to increase the population of the jackals in the MG. About 35% suggest maintenance of the population at present level and 9% chose that there should be reduction in the population of jackals in MG. Foxes are the species that are mostly hated by villagers due to their depredation on poultry. Most of the respondents (56%) wanted the population of the foxes to be completely eliminated. However, very few of the respondents (3%) wanted to increase the

population. The respondents who suggested maintaining this species in MG is 28%, while 13% respondents wished to reduce the population of the fox from MG.

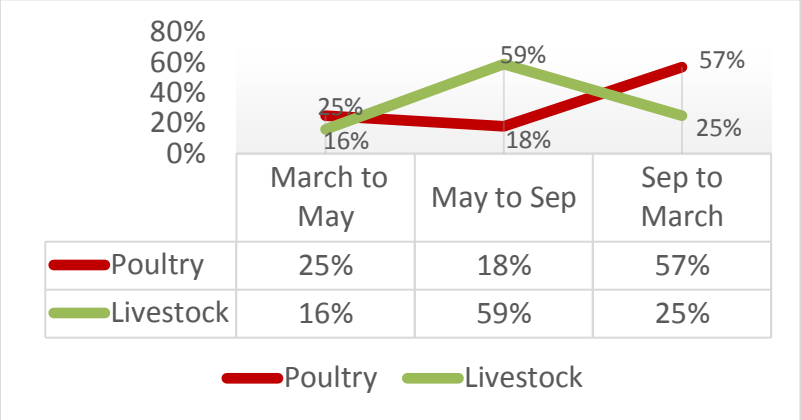
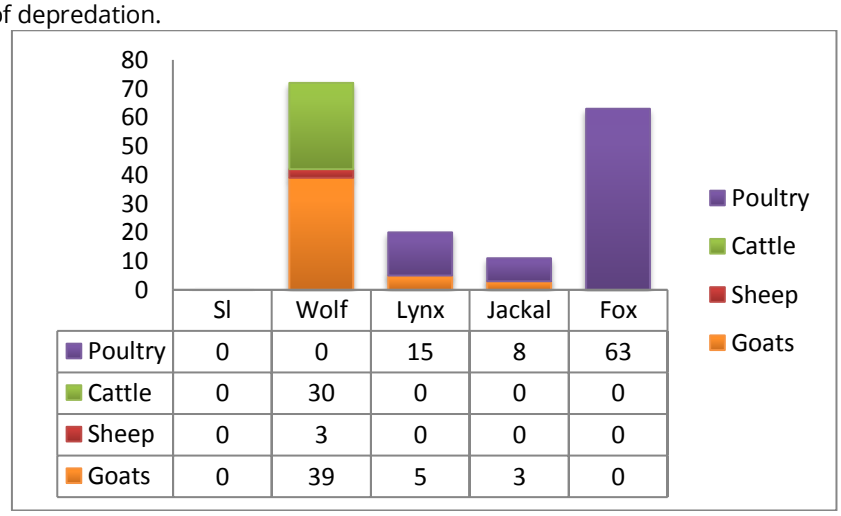


Fig. 2. Seasonal pattern of depredation.



	Sl	Wolf	Lynx	Jackal	Fox
Poultry	0	0	15	8	63
Cattle	0	30	0	0	0
Sheep	0	3	0	0	0
Goats	0	39	5	3	0

Fig. 3. Depredation cases in past 7 years.

Discussion

Description of the conflict

After detailed assessment, we found that a considerable human-carnivore conflict exist in the area. These conflicts started by carnivore's side because MG custodian communities are financially not so strong to tolerate losses because of carnivore's attacks. Even a single livestock or a few poultry hen loss is quite considerable for them as they get any compensation neither from the Government authorities nor from the NGOs. Hence, such losses force humans to start hating these carnivores and kill such carnivores if they anticipate a danger, and thus leads to human-carnivore conflicts. Because of the forage shortage, the local community leave their cattle's in summer pastures free gazing. Thus, cattle become much vulnerable to predators in summer pastures. Almost all of the conflict-experienced respondents had a conflict because of the depredation by carnivores. Wolf was found to be the most destructive and lethal predator among all in the pastures and fox in the villages while the perception of people about Snow leopard was good. After surveys and discussions, we also came to know that the corals and sheds are not so protective in the area. Majority of the corals are without roofs and walls to resist the predators. When large carnivores as if snow leopard and wolf enter the cattle pen, this often result in surplus killing (Satterfield, 2009. Depredation attacks occur typically in three ways. Depredation on goats/cattle that miss their herds, the depredation on free grazing cattle, which left to high pastures for open and free grazing thus they become much vulnerable, and the predators enter into the coral of livestock as well. Lack of prey in pastures drawn carnivores to attack on livestock and poultry for getting their food, if this problem is not resolving this conflict can be much worse. These carnivores can also attack humans to fulfill their dietary needs. Carnivores like wolves mostly killed livestock in the summer pastures where livestock were left for free grazing while carnivores like Fox killed poultry in winters when the area received heavy snowfall as food availability and accessibility in the forest became difficult. Most of the carnivores are nocturnal in behavior therefore most of the attack were either nighttime or dawn. Carnivores attacked livestock more during the night when livestock were in corals (Mponzi et al., 2014). In adjacent rural people searched the predators after the incident to kill but fortunately, they did not catch them yet if they caught those predators after the destruction the will definitely kill them.

Solutions recommended by community to reduce HCC

Majority of the respondents recommended killing of carnivores for reduction of conflict. They were mostly those people who had suffered any type of losses, so they wanted revenge. Others recommended compensation because they said if government gives them compensation for any damage, they do not need to worry about losses. Compensation programs are used globally to increase tolerance for and help offset economic loss caused by large carnivores (Morehouse et al., 2018).

Preference ranking of community for carnivores

Majority of the respondents wished to increase the population of snow leopard in MG. they think that presence of Snow Leopard expels other carnivores like wolves and lynx from the area. Of the total most of the respondents wished to reduce wolf because they are lethal for livestock. Increase in the population of wolves cause very severe issues for their livestock as well as for them. Predation

on domestic ungulates leads to extensive killing of wolves all over the world (Meriggi & Lovari 1996). Foxes are the species that are mostly hated by villagers due to their depredation on poultry. Most of the respondents wanted the population of the foxes to be eliminated. The preference about the population of jackal by the respondents was not encouraging as most of the total respondents wanted complete elimination of the jackals from the MG. They complained that they how whole night, eat their fruits and sometimes eat poultry and Billy goats if sheds are not closed. The response from the respondents about the preference ranking of lynx was somewhat mixed. Because lynx depredation records are not so high.

Suggestions to mitigate conflict

Mitigating conflict between large carnivore's humans is one of the most pressing and uncontrollable concerns in conservation (Todd and Stewart, 2012). For mitigating the conflict, we suggest giving education and awareness to the local communities and employing herders and locals in conservation department. For losses, a payment of direct compensation should be given to affected people. By giving direct compensation of these loses are an effective way to remediate and minimize the conflicts. Livestock insurance schemes can also play an important role in reducing the conflicts, as they are also a mean of compensation. In the present scenario, no proper protective measures are being considered. The animals in the high pastures face even worse scenario. In MG pastures majority of the corals are without roofs and walls. In order to protect the animals from the carnivores a proper structure of corals and sheds in the pastures as well as in the villages should be made.

Conclusion

According to Chitral wildlife department large number of Markhor (*Capra falconeri*) population are residing in the study area. As Markhor is a very demanding animal for trophy hunting. The most accessible and nearest location in MG is Shadrish as mentioned in Fig. 1 where hunting can be easily conducted. It takes approximately 1.5 hour from town Chitral to reach this location on foot. The local can utilize the money generated from hunting in order to strengthen their corals/sheds, giving them compensation for their losses as well as for other developmental purposes in the area. Our detail information of influencing factors and mitigating suggestions of human carnivore conflict laid a foundation for the future carnivore's conservation programs in the northern Pakistan.

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