Original Article

The human-wildlife conflict in Musk Deer National Park, Neelum Gureze Valley, Azad Jammu & Kashmir, Pakistan.

O conflito entre humanos e animais selvagens no Parque Nacional Musk Deer, Vale Neelum Gureze, Azad Jammu e Caxemira, Paquistão

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Abstract

Growing human population is a solemn risk to biodiversity at a global level. Massive anthropogenic pressure and invasion in the natural habitats initiated the human-wildlife conflict in rural areas. Present study aimed to assess human-wildlife conflict in Musk Deer National Park (MDNP) from 2013 to 2018. Results revealed an estimated 241784 nomadic and 5589 residential livestock heads grazed in different areas of MDNP during the summer season. A total of 126 heads were depredated by carnivores during the study period. Majority (n=39) of livestock heads were killed in May (n=29). Livestock depredation resulted in economic losses worth 3.115 million PKRs (25744 US$) to the herder community while farmers received 1.629 million PKRs (13466 US$) losses due to crop raiding. Most (64%) of the respondents believed human-wildlife conflict heightened due to scarcity of food or prey in the natural habitats of carnivores. Majority (92%) of the respondents did not like the presence of predators in MDNP. Loss compensation schemes could turn this negative attitude into the positive one and increase tolerance about the presence of carnivores in their vicinity. This study provides an insight into the human-wildlife conflict in MDNP and paves a way for understanding the conflict and conservation of carnivore species in the study area.

Keywords: human-wildlife conflict, livestock depredation, conservation, National Park, Pakistan.

Resumo

O crescimento da população humana é um risco solene para a biodiversidade em nível global. A pressão antrópica maciça e a invasão nos habitats naturais iniciaram o conflito homem-vida selvagem nas áreas rurais. O presente estudo teve como objetivo avaliar o conflito entre humanos e animais selvagens no Parque Nacional Musk Deer (MDNP) de 2013 a 2018. Os resultados revelaram uma estimativa de 241.784 cabeças de gado nômades e 5.589 residenciais pastando em diferentes áreas do MDNP durante a temporada de verão. Um total de 126 cabeças foi depredado por carnívoros durante o período de estudo. A maioria (n = 39) das cabeças de gado foi morta em maio (n = 29). A depredação do gado resultou em perdas econômicas no valor de 3.115 milhões de PKRs (US$ 25.744) para a comunidade de pastores, enquanto os agricultores receberam 1.629 milhões de PKRs (US$ 13.466) perdas devido à invasão de plantações. A maioria (64%) dos entrevistados acredita que o conflito entre humanos e animais selvagens aumentou devido à escassez de alimentos ou presas nos habitats naturais dos carnívoros. A maioria (92%) dos entrevistados não gostou da presença de predadores no MDNP. Esquemas de compensação de perdas podem transformar essa atitude negativa em positiva e aumentar a tolerância com a presença de carnívoros em suas proximidades. Este estudo fornece uma visão sobre o conflito homem-vida selvagem no MDNP e abre caminho para a compreensão do conflito e conservação de espécies carnívoras na área de estudo.

Palavras-chave: conflito homem-vida selvagem, predação de gado, conservação, Parque Nacional, Paquistão

1. Introduction

Humans-wildlife conflict is one of the most common and obstinate matters for conservation biologists. There is a huge diversity of conditions and species, from grain-eating rodents to man-eating tigers (Barlow et al., 2009). The human-wildlife conflict poses a global threat to important wild animals involved in such conflict.

Human settlements extended into the biodiversity-rich areas and pose a serious threat to the existence of important threatened flora and fauna. The space, growth rate, and nursing patterns of wild animals are affected worldwide as a consequence of this anthropogenic pressure (Wackernagel et al., 2002). Human settlements have a direct (habitat alteration) or indirect impact on the biodiversity by operating land values and other charges of accomplishing conservation (Balmford et al., 2003). The most obvious phenomenon of anthropogenic pressure is deforestation, which is observed at a large scale in tropical forests (Laurance et al., 2002). Besides deforestation, habitat degradation, habitat simplification and invasion of invasive species are major anthropogenic causes of the destruction of biodiversity and threatened species (Brashares et al., 2001; Balmford et al., 2003).

The obvious form of human-wildlife conflict includes crop-raiding and livestock depredations. Crop raiding carried out by herbivore or omnivore species causes economic losses rather a personal safety to humans. Important crop raider species included wild boar, porcupine, black bear, rhesus monkey and grey langur in Pakistan (Kazmi et al., 2019; Zahoor et al., 2021; Khan et al., 2022). Livestock depredation is carried out by large carnivores that become perceived or real threats to the livestock or personal safety of humans (Miller et al., 2016; Naha et al., 2018). This conflict increased at a global scale (Anthony, Scott, and Antypas 2010), caused not only economic losses but also emotional trauma for livestock owners and can lead to the retaliatory and preventive killing of carnivores (Treves & Karanth, 2003; Samelius et al., 2021). Active subdual by humans built on predator threats to livestock has been recognized as an important factor in carnivore declines (Packer et al., 2005; Perez and Pacheco, 2006; Dai et al., 2020). A significant correlation is noted in economic losses and tolerability of predators in developed countries (Røskaft et al., 2007) the phenomenon strengthens in developing or low economic profile communities. Conflicts that occur at any scale, globally or locally, threatened species and raise conservation concerns (Can et al., 2014; Furqan et al., 2021).

Most common carnivore species involved in livestock depredation in Pakistan are common leopard, brown bear, black bear, grey wolf and snow leopard. Human-wildlife conflict is considered a key factor for the decline of carnivore populations in this region (Ali et al., 2016, 2018; Ahmad et al., 2016; Waseem et al., 2020). This conflict is one of the most challenging tasks for conservation biologists to comprehend and subsequently implement effective mechanisms that promote coexistence between humans and black bears (Dai et al., 2020; Naha et al., 2020).

Human-wildlife conflict can be reduced by imposing a management plan that compensates economic losses as well as by minimizing anthropogenic pressure in the natural habitat of wild animals (Kumar et al., 2020). Literature revealed that the concept and understanding of the human-wildlife conflict heavily influenced by social and cultural perceptions, values, history and ideology (Oltedal et al., 2004; Dickman, 2010).

Human-wildlife conflict received little attention in MDNP. Being remote and situated at the Line of Control,

MDNP has a hostile environment, particularly for field visits. A large number of livestock heads and invasion of human settlements in the natural habitats of wild animals during summer is evident in this park. Present study aimed to assess the extent of human-wildlife conflict, economic losses and perception of herder community toward the conservation of wildlife.

2. Materials and Methods

2.1. Study area

Azad Jammu and Kashmir falls in the western Himalayas and a mountainous region that has rich biodiversity (Qamar et al., 2012; Ali et al., 2016). Being a hilly region, most of the population (77%) lives in rural areas that relay rely on surrounding natural resources. focusing on the conservation of biodiversity, the government of AJ&K established various protected areas including bio-reserve, national parks, sanctuaries and game reserves. Present study was conducted in Musk Deer National Park (MDNP), District Neelum, Azad Jammu & Kashmir (AJ&K). Study area situated in the extreme Northern AJ&K (Upper Neelum Valley) on both sides of the River Neelum, at about 155 km from Muzaffarabad, the capital city of AJ&K. MDNP extended over 495 km², comprised on two forest blocks i.e. Janwai (compartment 16-42) and Sawnar Forest Block (compartment 1-31) of Sharda Forest Division. Study area was bounded to East and North-East by Indian held Kashmir through Line of Control (LoC), while West and North West by Gilgit Baltistan (GB). Deosai National park is connected to the northern boundary of the MDNP (Nawaz, 2007). Most of the study area falls under the temperate zone while upper fringes have alpine grasses, its altitude ranged from 1990 to 4935 m above sea level. Apart from the nomad population, there are 18 villages in and out of MDNP having an estimated population of some 30000 individuals (GoAJ&K, 2018). Thick deciduous, coniferous and mixed forests provide habitat to various threatened species such as *Ursus thibetanus*, *Ursus arctos*, *Panthera pardus* and *Moschus cupreus*. *Canis lupus*, *Capra ibex*, *Lophophorus impejanus*, *Pucrasia macrolopha*, *Martes foina*, *Martes flavigula* are some prominent species of the park. *Cedrus deodara*, *Pinus wallichiana*, *Pinus roxburgi*, *Juglans regia* and *Quercus spp*. are important flora of the study area (Ali et al., 2007).

2.2. Methodology

Seasonal-based field surveys were conducted from 2013 to 2018 to assess human-wildlife conflict in MDNP. Data were gathered through direct observation and by using prescribed questionnaires (n=576) asked randomly to the farmers and herders in the park (Ali et al., 2016; Fraser-Celin et al., 2018). Formal and informal interviews were conducted with wildlife watchers, forest guards, local elders and knowledgeable persons, seasoned herders and farmers to ensure the validity of the information. The questionnaire consisted of demographic information, livestock assets, conflict with wild animals, economic losses and the perception of the local people about the

conservation of the predators. Respondents were grouped into 6 age classes ranging from <27 years to >59 years. Their education was categorized into 4 classes ranging from illiterate to graduate. Data gathered were analyzed statistically using SPSS (ver. 24) and MS Excel (ver. 2010). ANOVA and Chi-square tests were used to analyze data collected from field visits.

3. Results

3.1. Respondents information

Respondents' information plays a vital role in any study, especially human-carnivore conflict can be well evaluated from community observation and knowledge. Data on human-wildlife conflict were gathered through questionnaires (n=576). Respondents belonged to different classes of ages, education and professional economy. Most of the respondents (29.86%) belonged to the age class of 44-51 years with a high illiteracy rate (67.18%) (Table 1). MDNP was established in remote and comparatively, underdeveloped areas of AJ&K, therefore most of the respondents belong to a low economic profile community. Data revealed that minimum (n=19, 3.29%) respondents had a monthly income of PKRs 25001 and above while the majority (n=93, 16.15%) had an average monthly income between PKRs 3001-5000 (Table 2).

3.2. Livestock heads

A total of 28545 livestock heads were estimated in the study area. Respondents who resided permanently in MDNP reared a total of 5589 livestock heads (20% of the total stock), among them goats (n=17940) and sheep (n=6912) while equine (n=1788) were reared in the least number (Figure 1). During the summer season, nomads from the lower plains of AJ&K, the Pothohar region of Punjab and KP (Pakistan) moved along with their massive

herds of livestock. Many of these nomads used MDNP as a migratory route and spent their summer in Deosai National Park adjacent to the MDNP. However, 50 to 70 nomad families stayed in MDNP territory and spent 3-4 months of their summer seasons. The nomad stock comprised 22956 livestock heads, majority of them were goats (n=15534) followed by sheep (n=5732) and equines (n=1690) (Figure 2).

3.3. Livestock depredation

A total of four carnivore species were involved in livestock depredation, among them Asiatic black bear depredated most (n=79) of the livestock in MDNP while brown bear killed minimum (n=15) livestock during
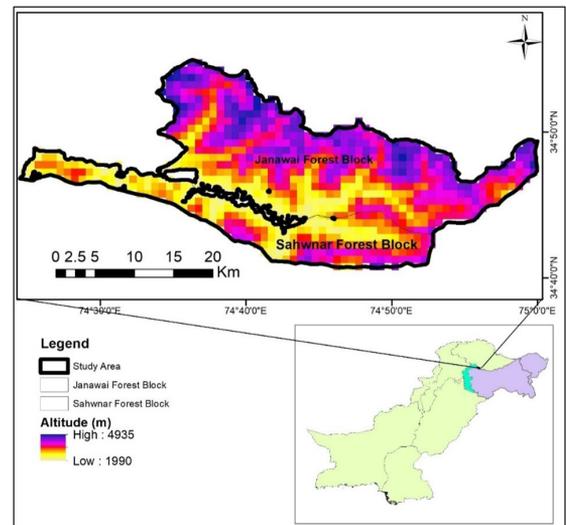

Figure 1. Map of the Musk Deer National Park showing altitude and main forest blocks.

Table 1. Demographic Information of respondents recorded in the study area during study period.

Variable	Classes	Numbers	Percentages (%)
Age (years)	27 and below	29	5
	28-35	119	20.65
	36-43	133	23.09
	44-51	172	29.86
	52-58	89	15.45
	59 and above	34	5.9
Education	Illiterate	387	67.18
	Primary	104	18.05
	Secondary	53	9.2
	Graduate	32	5.55

Table 2. Comparison of average monthly income of respondents in the study area during study period.

Income Classes	Income (PKRs)	Respondents	Percent
1	below 3000	84	14.58
2	3001-5000	93	16.15
4	5001-7000	65	11.28
5	7001-9000	59	10.25
6	9001-11000	56	9.74
7	11001-13000	42	7.29
8	13001-15000	39	6.77
9	15001-17000	36	6.25
10	17001-19000	32	5.56
11	19001-23000	27	4.68
12	23001-25000	24	4.16
13	25001 and above	19	3.29
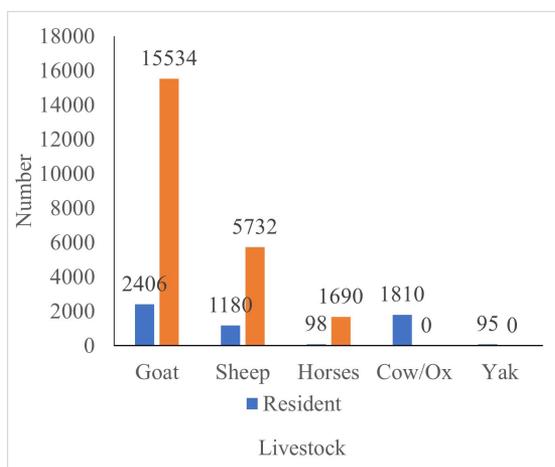
Figure 2. Number and types of livestock reared by respondents in the study area.

2013-2018 (Table 3). During the study period, 126 livestock heads were reported to be killed by different carnivores, most of the depredations (24.60%) were recorded during 2017 followed by 2016 (20.63%) and 2018 (19.84%), while minimum (7.4%) depredations were recorded in 2014. Maximum goats (n=13) were killed in 2017 followed by 2014 (n=12) and 2016 (n=11). A similar trend was recorded in sheep depredation, most (n=10) of killings were reported in 2017 followed by 2016 (n=8) and 2018 (n=7). (Table 4). ANOVA revealed that livestock depredation by types and carnivore species varied significantly (F=3.414, p= 0.01) in MDNP. Most of the livestock (n=39±4.13) were killed in May, followed by June (n=30±3.57) and August (18±1.41) in MDNP during study period (Table 5).

3.4. Factor affecting livestock depredation

Livestock depredation was influenced by season, place, watch and ward, herd size and types of livestock.

Table 3. Livestock depredation by predators during 2013-2018.

No	Livestock	Total killing	Predators			
			Snow leopard	Black bear	Brown bear	Wolf
1	Sheep	38	6	29	2	1
2	Goat	60	10	41	6	3
3	Cow	15	2	9	4	0
4	Horses	7	5	0	2	0
5	Mule	6	5	0	1	0
Total		126	28	79	15	4

Table 4. Annual depredation of livestock killing by different carnivores during 2013-2018.

Years	Sheep	Goat	Cow	Horse	Mule	Total	Percentages
2013	4	12	2	0	0	18	14.28
2014	5	6	0	0	0	9	7.14
2015	6	9	2	0	0	17	13.49
2016	8	11	4	2	1	26	20.63
2017	10	13	4	3	4	31	24.6
2018	7	9	3	2	4	25	19.84
Total	38	60	15	7	6	126	

Table 5. Monthly trend in livestock depredation in MDNP from 2013 to 2018.

Months	2013	2014	2015	2016	2017	2018	Mean±SD
April	1	0		2	3	1	7±1.14
May	7	2	2	7	8	13	39±4.13
June	3	1	3	11	7	5	30±3.57
July	2	1	4	1	6	2	16±1.96
August	4	1	2	3	5	3	18±1.41
September	1	3	5	1	1	1	12±1.67
October	0	1	1	1	1	0	4±0.51

Table 6. Association of factors in terms of depredation rate.

Factors	Categories	Depredation rate		Chi-Square test
		High	Low	
Depredation seasons	Early summer (April-July)	96	4	X²=2237.8, df=2, p=0.01
	Late summer (Aug-Oct)	64	36	
	Winter (Nov-March)	0	100	
Depredation place	Forest	87	13	X²=489.59, df=1, p<0.01
	Non-forest	11	89	
Livestock safety	Guarding	9	91	X²=152.26, df=1, p<0.01
	non-guarding	73	27	
Herd size	Large (> 50)	82	18	X²=258.69, df=1, p<0.01
	Small (< 50)	82	74	
Types of livestock	Smaller (sheep and goats)	91	9	X²=802.17, df=1, p<0.01
	Larger (bovines and equines)	19	89	

Maximum depredation occurred during early summer (April-July) as compared to late summer (64%). Results revealed that maximum depredation was recorded in the forest (87%) as compared to non-forest (11%), while most (73%) of the killing of livestock were recorded in the absence of watch and ward or the protective measures to the herds. Most (91%) of the depredations were recorded on goats and sheep as compared to bovines or equines (19%). The Chi-square test revealed a significant (p<0.05) difference between types of livestock (Table 6).

3.5. Crop raiding

Crop damages were estimated during the study period from 2013-2018 in MDNP. Maize was the chief crop cultivated in the whole Neelum valley including study area. A total of 54.5 metric tons of maize was raided by wild animals, mainly by rhesus monkey (*Macaca mulatta*) and Asiatic black bear (*Ursus thibetanus*). Maximum (9 metric tons) damages of maize were recorded in an area of 3.4 acres in Taobut, followed by 1 metric ton in Doga and Nikron at an area of 0.4 and 0.5 acres respectively (Table 7). A large quantity (6.3 metric tons) of maize was raided by black bears in Taobut, followed by Saonarr (6.02 metric tons) while monkeys damaged a maximum (4 metric tons) of maize crop in Machal area (Table 7).

3.6. Financial loss

A total of 4.744 million PKRs (39210 US$) was caused by the wild animals to the local community of the study area. Livestock depredation by carnivore species resulted in the loss of 3.11 million PKRs to the respondents in MDNP during the study period. Maximum (0.84 million PKRs) loss was reported in 2018 followed by 2017 (0.78m) while minimum (0.14 m PKRs) loss was recorded in 2014 (Figure 3). Depredation loss was highest (1.02 million PKRs) for goats followed by cows (0.6 million) during the study period (Table 8).

Table 7. Average crop raiding and economic losses to communities during the study period.

Localities	Quantity (metric ton)	Area (acre)	Loss (PKRs)
Taobut	9	3.4	132353
Karimabad	4	1.3	153846
Sundas	2	0.9	111111
Nikron	1	0.5	100000
Halmat	6	2.8	107143
Hanthi	5	2	125000
Sardari	4	1.8	111111
Saonarr	7	2.8	125000
Marnatt	3	1.2	125000
Phulwai	2	1	100000
Doga	1	0.4	125000
Janderseri	1.5	1	75000
BoriNala	5	1.8	138889
Machal	4	2	100000
Total	**54.5**	**22.9**	**1629453**

3.7. Respondents opinions

Human-wildlife conflict affects the conservation opinion of the affected people in the study area. Majority (91.84%, n=529) of the respondents have disliked the presence of any predator species in their vicinity in MDNP as compared to a small fraction (8.16%, n=47) who accepted predators in MDNP (Table 9). Nevertheless, this acceptance was based on the medicinal uses (n=21) and trophy hunting (n=26) of predators. Maximum (n=469) respondents believed to restrict predators in zoos or other sanctuaries where they could not harm the human properties and

livestock. According to the respondents (n=369), there was insufficient prey for predators in the forest, resultantly they are heading toward livestock depredation, crop and fruit raiding to feed themselves. All the respondents agreed that the predators were a pest to the human settlements and
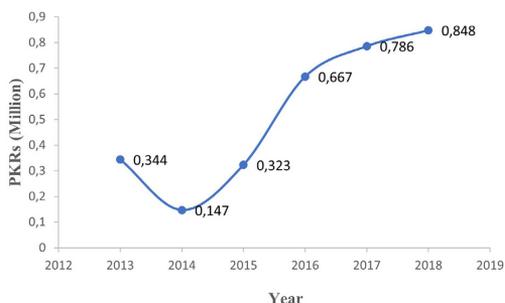

Figure 3. Annual trend in economic losses caused by livestock depredations in MDNP during study period.

Table 8. Economic losses to the respondents due to livestock depredation in MDNP during study period.

No	Livestock	Total killing	Average price (PKRs)	Total loss (PKRs)
1	Sheep	38	15000	570000
2	Goats	60	17000	1020000
3	Cows	15	40000	600000
4	Horses	7	55000	385000
5	Mules	6	90000	540000
Total		126		3115000

they damaged their properties. This situation heightens the level of human-wildlife conflict in the study area (Table 9).

3.8. Conservation management

Majority (68.5%, n=395) of respondents believed that human-wildlife conflict could be reduced by compensating for their losses (Table 10). At present no compensation scheme is going on in the study area, however, a small fraction (1.9%) of respondents get some of the compensation from administrative departments of the state (Table 9). All the respondents urge to start compensation or insurance schemes in MDNP. Maximum (87%, n=504) respondents demanded compensation prices equal to the current market values of their crops and livestock (Table 10).

4. Discussion

The human-wildlife conflict was obvious in Musk Deer National Park though it has scattered and low-density human settlements compared to large towns of AJ&K. Average age of respondents was recorded as 43.7 years. Most (67%) of the people were illiterate which was far less than the station literacy rate i.e. 77% (GoAJ&K, 2018). Low literacy rate would be attributed to lifestyle, economic profile and priorities of the community and the state. Most of the people do not prioritize the education of their children, particularly girls. Sometime unavailability of opportunities becomes a hurdle to getting an education. There is no college established to facilitate education beyond 12th grade in the study area. Limited sources of income hamper families to send their children to towns or cities where higher education facilities are available. Literature supported these results and the low literacy rate is evident in the herder and farming community in South Asia (Bagchi & Mishra, 2006; Shoukat et al., 2020).

Table 9. Conservation attitude of respondents toward conservation place, livestock depredation and predator killing.

Queries	Response	Respondents	Percent
Like conflicting wild animals or not?	Like	47	8.16
	Dislike	529	91.84
Where should carnivores Conserve?	National Park/Reserve	39	6.77
	Buffer zone	21	3.65
	Natural forest	47	8.16
	Zoo	469	81.42
Causes of Livestock depredation	Prey deficiency in the natural habitats of carnivores.	369	64.1
	Carnivore prefer livestock on natural prey.	207	35.9
Causes of predator' killing	Use/Trade of their body parts	37	6.43
	Retaliatory killing (in response to livestock depredation, crop raiding)	539	93.57
Did you receive any compensation for your losses?	Yes	11	1.9
	No	565	98.1

Table 10. Conservation management perspectives of human-wildlife conflict in the study area during study period.

Management Strategy	Responses	Resonpendts	Frequency
Conflict can be managed through	Conservation education	122	21.25
	Monitoring and alarming	59	10.24
	Compensation of loss	395	68.51
Compensation rate for economic losses	Market value	504	87.5
	75% of market value	54	9.375
	50% of market value	14	2.431
	25% of market value	4	0.694

Improving education could provide better management of human-wildlife conflict in the study area.

The rural community of the MDNP has a high dependence on the livestock for their subsistence. They rear selective livestock breed for milk, meat or trade. A large number of livestock heads (n=28545) regarded by respondents indicated that each respondent has, on average, 50 livestock individuals. Among these, goats (n=17940) were the prominent breed reared in MDNP. Agrawal (1999) and Kaul (1998) also recorded the highest number of goats possessed by nomads of Utter Pradesh and Ladakh in India. A similar trend was recorded in China (Miller, 2000) and Tibetan steppes (Sheehy et al., 2006). Goats and sheep are agile, move swiftly upon sloppy mountains of Himalaya and could graze effectively as compared to heavy-bodied cattle or buffalos. These large number of livestock herds pose a grazing pressure in every habitat of the MDNP. Resultantly, a food competition emerged between wild and domestic grazers, which usually compel wild grazers from their natural or preferred habitats to unwanted or distressed corners (Bhatnagar and Wangchuk, 2001). This invasion of domestic stock proved to be an easy target for starving predators in MDNP. Kabir et al. (2014) recorded that sharing a common habitat of livestock and wild carnivores was a major cause of conflict between humans and carnivores in Machiara National Park. Awan et al. (2020) reported the massive conflict of common leopards in Ayubia National Park with highly negative human perception about predator's conservation. Inskip and Zimmermann (2009) supported the opinion that an increase in wild prey can reduce livestock depredation by carnivores. Destocking of livestock and establishing of veterinary checks could offer a potential solution to avoid overgrazing in the study area. A prescribed grazing system could be introduced that may lead to the reduction in conflict between humans and wildlife.

Present study revealed a total of 126 animals were depredated by carnivores during the study period, majority of these were goats. Goats and sheep are medium-size mammals, having a resemblance to the wild grazers such as ibex or grey goral. Their large number attracts carnivores and escalate the human-wildlife conflict. Results were supported by studies conducted in AJK that recorded the highest percentage of goats and sheep killed during carnivores in Machiara National Park (Dar et al., 2009; Kabir et al., 2014), Shounther Valley (Ali et al., 2016), Musk Deer National Park (Ahmad et al., 2016) and Pir Chinasi (Awan et al., 2016). Goats are ideal leopard prey and the most affected among the depredated animal followed by sheep (Ogutu et al., 2016).

Most of the depredation events were recorded in the early summer in MDNP. This could be due to the following speculations; i) seasonal migration of local inhabitants and nomads to their temporary summer residence started in early April and completed in May. Domestic livestock entered in the natural habitat of wild carnivores during this period. ii) In early summer, it is assumed that limited forage or food would be available to the predators. Seeds, fruits and wild barriers are not available during this season. Furthermore, most of the carnivores breed in spring and thus need plenty of food for their growing cubs. These predators do not dither to attack livestock to nourish their young ones in MDNP. Shortage of food would be one of the main reasons that enhance human-wildlife conflict. Besides depredation, crop-raiding by black bears and rhesus monkeys was another major cause of human-wildlife conflict. Historically, crop-raiding has existed since humans started farming and are the most prevalent form of Human-wildlife conflict worldwide (Minhas et al., 2010; Nyirenda et al., 2011; Long et al., 2020). This conflict occurred in late summer or early autumn when crops are ripened. Both wild species take plentiful crops adjacent to their habitat as an opportunity to increase their body fat for the upcoming harsh winter. This viewpoint is supported by Kazmi et al. (2019) and Zahoor et al. (2021) who conducted their studies in Machiara national park and Qazinag game reserves of AJ&K respectively. Frequent attacks on the ripen crop annoyed farmers that may adapt retaliatory killing of problematic animals as a management strategy.

Human conflict with wild carnivores is a universal fact, however, people living in the Himalayas and relying on livestock to fulfill their basic needs of life people become easy victims of this conflict. Findings of this study revealed that the majority (91.84%) of respondents disliked the presence of predators in MDNP, mainly due to their economic losses. Qamar et al. (2010) reported a similar result based on the human-leopard conflict in Machiara National Park. Ali et al. (2016) recorded human-grey wolf conflict in Shounther Valley, adjacent to MDNP and revealed that economic losses to low profile communities were the main elements that drive people's attitude toward disliking of the carnivores. Retaliatory killings of black

bears (n=3), *Panthra pardus* (n=1) and *Panthra uncia* (n=2) were recorded during the present study. Study revealed that *Capra ibex sibirica* (n=5) and *Moschus chrysogaster* (n=4) were illegally hunted for trophy and musk in MDNP during the study period.

Factors that determine human-wildlife conflict in the study area included depredation sites, season, watch and ward, herd size and type of depredated animal (Table 6). the Chi-square test revealed that these parameters affected depredation or raiding rate significantly (p<0.05). forests were preferred depredation sites, while a high level of depredation was recorded on large herds of goats and sheep in the summer season. Results could be explained by several reasons. Forests provide predators a chosen habitat for the attack on livestock. Goats and sheep are medium-sized animals hence could be an easy target for predators ranging from common leopard to brown bear. the density of domestic grazers in the park is determined by season. Similar patterns on human-wildlife conflict were recorded by Ali et al. (2018) in Mansehra, Pakistan and Bibi et al. (2013) in Pir Lasora national park, AJ&K.

There is no proper management or plan to compensate economic losses of the affected community. The absence of insurance schemes or government compensation schemes let the herders and farmers helpless when their animals are killed or crops are raided. This study revealed that local people adapted a series of management strategies including watch and war, guarding herds or farms, making noise and fencing their barn or fields. These conflict mitigation measures seem ineffective due to a lack of proper training and sufficient budget. A compensation scheme could dramatically turn a negative attitude into a positive one. Local people were agreed to tolerate conflicting animals in their vicinity if their economic losses are fulfilled. This loophole in the biodiversity conservation strategy of national parks has been identified by many of the previous studies conducted in AJ&K (Ali et al, 2016; Kabir et al., 2014; Dar et al., 2009; Bibi et al., 2013).

5. Conclusion

Human-wildlife conflict could determine the fate of many carnivore species in the study area. Human invasion in natural habitats was the main reason that risen the conflict between humans and wildlife. Their shrinking habitat could not support them to provide shelter, food or breeding grounds. Disturbed and simplified habitats split into various patches that hinder home range and the free movement of wild animals. This conflict is governed by factors such as depredation spot, season and herd size. Mitigation strategies to reduce this conflict are formal and a lot of improvements are needed. Compensation of the losses would be the best conservation and management option to improve tolerance and the existence of conflicting wild species in the study area. this study provides a baseline for future conflict insight in the Musk Deer National Park.

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