



Human-Black Bear (*Ursus thibetanus*) Conflict and its Mitigation Strategies at Siran and Kaghan Valleys of District Mansehra Pakistan

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ABSTRACT

Asiatic black bear (*Ursus thibetanus*) is facing various threats because of the human conflict in the northern mountainous areas of Pakistan. The present study was initiated to provide baseline information regarding human-black bear conflicts and their possible mitigation at Siran and Kaghan valleys of District Mansehra, from April-2018 to April 2019. A total of 100 inhabitants of various occupations were interviewed and questionnaires were filled from 32 villages of both valleys. Agriculture crops destruction was documented as a common conflict issue (92%), followed by livestock predation (90%), and human casualties (85%). Maiz was frequently raided crop (50%) followed by fruits and vegetables (27.1%, 22.6%). Goats were the most (47.61%) preyed animals, followed by sheep and cattle (37.14%, 12.38%). Human casualties were rare and mostly accidental, while victims often experienced deep injuries. Local communities faced annually Rs.167,922 (US\$ 1085.47) agriculture loss and Rs. 1,620,000 (US\$ 10,731.19) livestock loss during 2015-19. Generally, local inhabitants expressed negative attitudes (48%), and they were in favor of eliminating bears due to frequent conflict incidents. Although good husbandry is the most effective measure of preventing black bear damage, compensation of loss and community involvement in conservation programs were documented as the most effective mitigation strategies. Human dependence on forest resources, habitat destruction, anthropogenic food waste, and retaliatory killing were the main conservation threats to black bear survival in the study area.

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IU and ZU conducted field survey, data collection and wrote the manuscript. SM and ZI supervised the research. JK and NA reviewed the manuscript.

Key words

Black bear, Crop destruction, Livestock predation, Human casualties, Conflict mitigation

INTRODUCTION

Among large carnivores, bears are primarily subjected to conflicts with humans across the globe (Dar *et al.*, 2009; Aryal *et al.*, 2014) and face survival threats due to human intervention in their naturally associated environment (Dar *et al.*, 2009). The common types of conflict include livestock predation, crop destruction, and human casualties (Thirgood *et al.*, 2005; Aryal *et al.*, 2012; Ali *et al.*, 2018; Penjor and Dorji, 2020). Such events generate negative perceptions in local communities

regarding conservation initiatives (Browne and Jonker, 2008; Can *et al.*, 2014; Piedallu *et al.*, 2016). People experiencing property damages mostly had negative attitudes and they were in favor of killing harmful carnivores in their surrounding areas (Browne and Jonker, 2008; Don *et al.*, 2009). Human-black bear conflicts are now becoming an emergent force for species extinction in the future (Woodroffe, 2000; Ogada *et al.*, 2003; Dar *et al.*, 2009). The success of bear protection largely depends on the local community close to the forestland, however regular conflicts diminish the community support to conserve the species (Treves and Karanth, 2003; Can *et al.*, 2014). Protection of bear population without addressing the needs of the local community is unproductive and leads to escalation of conflicts rather than conservation (Browne and Jonker, 2008; Liu *et al.*, 2011; Piedallu *et al.*, 2016).

Human-bear conflict is now becoming a global issue and has been reported in many countries (Madden, 2004; Ambarli and Bilgin, 2008; Liu *et al.*, 2011; Penjor and Dorji, 2020). In Asia, particularly in Pakistan, the black bear gets more public concern (Ali *et al.*, 2018; Ullah *et al.*,

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2020) than any other carnivore due to regular interaction with rural communities (Abbas *et al.*, 2015; Naeem *et al.*, 2016). This may be due to changes in forested land use patterns, such as agricultural land expansion, human dependence on forest resources, infrastructure development, and rising human population around bear habitats, as well as disturbance of bear habitats (Woodroffe, 2000; Sathyakumar, 2001; Can *et al.*, 2014). Black bear usually competes with humans for cover, security, food, and space. Anthropogenic food is the major attractant to compel the bears toward a human settlement. This gives rise to human black-bear conflict throughout their range (Bargali *et al.*, 2005; Escobar *et al.*, 2015). Additionally, black bears also cause huge damage to agriculture crops, beehives, livestock, fish farms, and humans located around their habitat (Chauhan, 2003; Bargali *et al.*, 2005; Penjor and Dorji, 2020; Khan *et al.*, 2021; Ullah *et al.*, 2021c).

Researchers have reported various indigenous methods useful to reduce black bear damage to crops and livestock, such as the use of barbed wire fencing around valuable crops, keeping guard dogs (Ogada *et al.*, 2003), and drumming empty metal containers (Charoo *et al.*, 2011; Can *et al.*, 2014). Numerous studies have been conducted regarding human-black bear interaction in the northern region of Pakistan and highlighted an increase in incidents of human-bear conflicts through the last decade (Awais *et al.*, 2016; Naeem *et al.*, 2016; Ali *et al.*, 2018; Ullah *et al.*, 2020). We present baseline information regarding patterns of human-black bear conflict and mitigation based on field observations and conducting interviews or questionnaire-based surveys at Siran and Kaghan valleys of District Mansehra, Khyber Pakhtunkhwa, Pakistan.

MATERIALS AND METHODS

Study area

The study was conducted at Siran and Kaghan valleys of District Mansehra (34° to 35°N and 72° to 74°E), Khyber Pakhtunkhwa, Pakistan (Waseem and Ali, 2011). The study area lies under the Himalayan moist temperate forest zone, has diverse ecosystems, and supports an extensive variety of wildlife species (Qasim *et al.*, 2013). Both valleys are situated to North-West and North-East sides of the district covering 35,744 hectares of the area including Reserved and Guzara forests. The land use of both valleys comprises agricultural land (2.6%), forestry (24.6%), highland pasture (55%), and 17.8% unproductive used for infrastructure (Ali *et al.*, 2018; Ullah *et al.*, 2021a, b).

Methods

We conducted interviews and a questionnaire-based

survey from the residents of 32 villages including seasonal settlements of both valleys. These methods are mostly used and acceptable in conservation science that provide opportunities for researchers to closely assess the explicit and tacit aspects of the community regarding human-wildlife interaction (Ali *et al.*, 2018; Ullah *et al.*, 2020).

First, we randomly interviewed local inhabitants of both valleys based on their interests. This method is different from structured questionnaires as this provides chances of a two-way conversation and follows the discussion regarding the concerned issue. During field visits, informants were interviewed at public places, hotels, or hiking tracks to assess human wildlife conflict and factors affecting the local peoples (White *et al.*, 2005).

The second source of data collection was a questionnaire survey. The questions of the questionnaire had open-ended answers. Key informants and affected villagers were selected for questionnaire filling by adopting participatory rural appraisal (PRA) techniques (White *et al.*, 2005). Teachers, forest and wildlife staff, hunters, and labor were also questioned during the field survey. The respondents were questioned in their native languages (Urdu and Hindko). A total of 100 questionnaires were filled in with the help of local wildlife staff members and local villagers from selected villages of both the valleys (Appendix 1). Finally, the collected information was logically verified by the researcher through proxy questions by following (Waseem and Ali, 2011; Abbas *et al.*, 2015; Ali *et al.*, 2015).

RESULTS

Demographic assessment of respondents

Livestock keeping and agriculture farming were the main sources of livelihood in both valleys. Goat and sheep were the most kept animals preferred to cattle. Most of the villagers were farmers (37%) and had a high interaction rate with bears (51%). People interviewed were mostly illiterate (53%, n=53), whereas 47% (n=47) had various educational levels (Table VI).

Human black bear conflicts

Agriculture crop destruction

Villagers reported 66 cases of crop damages, of which 50% (n=33) damages occurred to maize crop during Summer followed by Autumn (48%, n=32). Although most cases of crop damages (72%, n=48) occurred close to the forest edge within a distance <250m (51%, n=34) from seasonal huts or villages. The mean value of bear damage in single attacks was 197.8 ± 78.4 kg, of which maize was 192.5 ± 75.7 , fruits 2.9 ± 1.4 and vegetables 2.37 ± 1.2 kg, respectively. Whereas the mean area raided was 15.1 ± 4.1

m² of total area (453 m²). Overall minimum damage to the local community was counted as 5863 kg, which is equal to Rs. 167,922 (US\$ 1085.47) annually (Table I).

Livestock predation

A total of 105 cases of killed livestock during 2015-19 were recorded, of which 47% (n=50) preyed animals were goats and sheep (37%, n=39) and cattle (12%, n=13) (Table II). Mostly predation occurred in Autumn (57%, n=60), at night time (74%, n=78) within dense forest (70%, n=74). Although 63% (n=67) attacks occurred <500m distance from seasonal huts. The mean value of livestock predation was (27 ± 8.25) animals per year; goats (12.5 ± 3.7), sheep (9.7 ± 2.5), cattle (3.2 ± 1.2) respectively. Based on local market value, black bear inflicted an annual economic loss of Rs. 1,620,000 (US\$ 10,731.19) to local villagers at both valleys (Tables II, III).

Human casualties

We recorded 30 incidents of human casualties, of which 6 incidents resulted in human death, while 24 attacks led to serious injuries. Most (46%, n=14) incidents occurred accidentally within dense forest (50%, n=15) when victims were searching cattle (33%, n=10). In addition, five incidents occurred inside the village,

of which in one attacked victim was busy in defecation during night time. Further detail of the victim's profile is shown in Table IV.

Mitigation strategies

Table V shows that self guarding is the most (35%) effective method for protecting livestock herd from black bear attacks, whereas 30% of respondents suggested barbed wire fencing to check agriculture crop destruction. The majority of respondents (70%) suggested that compensation of loss was the best solution for reducing the retaliatory killing of black bear while 25% were in favor of the involvement of local people in a conservation program to resolve human-black bear conflicts.

Community attitude

Most of the local inhabitants (n=48) expressed a negative attitude regarding black bears' presence in their surroundings. A relationship in attitude was found among the respondents' age, occupation, and interaction with a black bear. Respondents living close to forestland generally showed negative attitudes, whereas shepherds disliked bears more often than farmers. Similarly, elder villagers mostly disliked bears more than younger people (Table VI).

Table I. Reported cases of black bear damage to agriculture crops, fruit, and vegetable from respondents at Siran and Kaghan valleys of District Mansehra during April 2018-April 2019.

Site name	Attacks frequency (%)			Total (%)	Minimum estimated damage (kgs)			Total (%) (kgs)	Area raided (m ²)%	Elevation ranges (m)
	Maiz	Fruit	Veg*		Maize	Fruits	Veg*			
Kaghan valley	18 (27)	12 (18)	09 (13)	39 (58)	2,725	30	23	2778 (47.3)	232 (51.5)	1820-2250
Siran valley	15 (22)	06 (9)	06 (9)	27 (40)	3,050	20	15	3085 (52.6)	221 (48.5)	1900-2350
Total	33 (50)	18 (27)	15 (22)	66 (99)	5,775	50	38	5863	453	
Mean±SEM					192.5±75.7	2.9±1.4	2.3±1.2	197.8±78.4	15.1±4.1	

Veg*, Vegetable.

Table II. Reported cases of livestock predation by a black bear and its local market value in Pak rupees, from respondents of Siran and Kaghan valleys of District Mansehra during 2015- 2019.

Years	Attacks frequency (%)					Local market value				
	Goat	Sheep	Cattle	Other*	Total	Goat	Sheep	Cattle	Others	Total
2015	12	10	02	00	24	180,000	100,000	60,000	--	340,000
2016	10	07	03	00	20	150,000	70,000	90,000	--	310,000
2017	10	13	03	02	27	150,000	130,000	90,000	60,000	430,000
2018	18	09	05	01	33	270,000	90,000	150,000	30,000	540,000
Total	50 (47)	39 (37)	13 (12)	03 (2)	105	750,000	390,000	390,000	90,000	1,620,000
Mean±SEM	12.5±3.7	9.7±2.5	3.2±1.2	1.5±0.7	27±8.25					

Other, Horse; Donkey, Mule.

Table III. Black bear damage to agriculture crops and livestock predation at Siran and Kaghan Valleys of District Mansehra Pakistan during April 2018- April 2019.

Description	Crop damage		Livestock killed	
	#	(%)	#	(%)
Total	66	100	105	(100)
Season of attack				
Spring	01	01	09	08
Summer	33	50	25	23
Autumn	32	48	60	57
Winter	0	0	11	10
Time of attack				
Morning	10	15	03	02
Day time	05	22	05	04
Evening	06	09	19	18
Night	45	68	78	74
Place of attack				
Dense forest			74	70
Pasture	05	07	13	12
Inside Village	13	19	05	04
Edge of forest	48	72	13	12
Distance from forest/ Seasonal huts				
<250m	34	51	13	12
>350m	20	30	25	23
<500 m	12	18	67	63
Elevation range (m)				
1800-2000	25	37	20	19
2000-2400	41	62	85	80
Nature of damage				
High	30	45		
Moderate	20	30		
Low	16	24		

DISCUSSION

We assessed three major conflict types including; crop destruction, livestock predation, and human casualties, as has been reported by [Awais *et al.* \(2016\)](#) and [Ali *et al.* \(2018\)](#) at Kaghan valley. However, the researchers claim that such conflicts often occurred for shared and limited resources between a human and black bear ([Graham *et al.*, 2005](#); [Don *et al.*, 2009](#); [Ali *et al.*, 2018](#)). Human population has a direct effect on forest landscapes, as agriculture

Table IV. Reported cases of human casualties by a black bear, and description of victim profile at Siran and Kaghan Valleys of District Mansehra Pakistan, during April 2018-April 2019.

Sites	Number	(%)
Siran valley	19	63
Kaghan valley	11	36
Total	30	100
Variables of a bear attack		
Sex		
Men	22	73
Women	03	10
Children	04	13
Season of attack		
Winter	0	0
Spring	13	43
Summer	12	40
Autumn	05	16
Time of attack		
Morning	10	30
Day time	06	20
Evening	08	26
Night	06	20
Place of attack		
Dense forest	15	50
Edge of forest	09	30
Inside Village	06	20
Type of attack		
Accidentally	14	46
Provoked	06	20
Predatory or defending cubs	10	33
Behavior of bear		
Running with four legs	26	86
Standing on hind limbs	04	13
Group of bear		
One	16	53
Two	04	13
Three	8	30
Victim response		
Runaway	15	50
Loud noise	09	30
Fight	07	23

Table continue on next page.....

Sites	Number	(%)
Victim activity		
Livestock grazing	08	30
Busy in field	06	20
Searching cattle	10	33
Mushroom or timber collection	05	16
Defecation	01	3
Target part of the victim		
Face	15	50
Back	10	33
Legs or other body parts	05	16
Consequence of attack		
Victim killed	6	20
Victim Injured	24	80

Table V. Respondents' suggestion on mitigation strategies of Human-black bear conflict.

Strategies	Variables	Frequency	%
Preventive measures	Stonewall shelter	20	20.0
	Barbed wire fencing	30	30.0
	Self guarding	35	35.0
	Dog guarding	15	15.0
Mitigative measure	Compensation of loss	70	70.0
	Employment	25	25.0
	Elimination of damaging animal	05	05.0

Table VI. Respondents' attitudes according to their age, education, occupation, and interaction with a black bear.

Categories	n=100	Attitude frequency			Total
		Positive	Negative	Neutral	
Age	< 25	10	4	6	20
	26-45	8	15	10	33
	> 45	12	25	10	47
Education	Illiterate	15	30	8	53
	Primary/Middle	5	15	5	25
	Secondary/H. secondary	4	10	2	16
	University	6	0	0	6
Occupation	Farmer	10	20	7	37
	Shepherd	2	25	5	32
	Govt. employee	13	0	3	16
	Other	8	3	4	15
Interaction with bear	High	4	37	10	51
	Medium	10	9	15	34
	Low	11	1	3	15

land expansion towards forested land, increased human dependence on forest resources, leading to disturbing wildlife, particularly bears, and hasten risk of encounters (Charoo *et al.*, 2011; Escobar *et al.*, 2015).

In the present study, maize was the most invaded crop by a black bear, as compared to fruits and vegetables during the summer months of August and September, which showed consistency with the finding of Ali *et al.* (2018), although wheat crop damage has also been reported from District Diamer, Gilgit-Baltistan by Ali *et al.* (2018). The villagers had the experience of recognizing black bear damage, as most of the respondents claimed that black bears pulled over standing plants with their paws, removed the cob corn, ate them, and destroyed the crop by crawling and rolling over the rest of the field. Such behavior insight that black bears preferred to feed on anthropogenic food sources found proximate to forest land, which might be due to depletion of wild food consumed by livestock within bear habitat (Liu *et al.*, 2011). Livestock pressure on forest resource and human dependence leads to depletion of natural food due to which black bear is forced to visit human settlements and cause damage to crops.

Livestock predation was the next common conflict issue reported, of which goat and sheep were the most preyed animals (Charoo *et al.*, 2011). Similar findings were reported by Huygens *et al.* (2003) and revealed that domestic animals might be easier for black bear or other wild predators to prey due to lack of escaping experiences.

Studies revealed that wild predators easily encountered domestic livestock as compared to natural prey (Woodroffe, 2000; Liu *et al.*, 2011). However increasing density of carnivores leads to a decreased population of natural prey, which may be correlated with increased incidence of livestock depredation (Huygens *et al.*, 2003; Madden, 2004; Graham *et al.*, 2005). During the summer season, livestock was mostly disposed to black bear attacks, because local inhabitants routinely migrated towards highland pastures (temporary residences) for livestock grazing, providing an opportunity for a black bear to attack. However, in autumn, bears generally faced scarcity of food, as a result, changed their abode towards lower elevation to avail chances of livestock predation (Huygens *et al.*, 2003; Ali *et al.*, 2018). In addition, human casualties mostly occurred accidentally, leading to severe injuries or even death. The main contributing factor of human casualties was human interference in bear habitat during dusk or dawn time which shows consistency with the finding of Liu *et al.* (2011), Awais *et al.* (2016), and Penjor and Dorji (2020).

Statement of conflict of interest

The authors have declared no conflict of interest.

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