

CROP RAIDING BY HIMALAYAN BLACK BEAR: A MAJOR CAUSE OF HUMAN-BEAR CONFLICT IN MACHIARA NATIONAL PARK, PAKISTAN

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ABSTRACT

Human-black bear (*Ursus thibetanus*) conflict is one of the major conservation and rural livelihood issue in Azad Jammu and Kashmir (AJK). Mitigation strategies of such conflicts require a firm understanding of their underlying patterns. To understand these human-black bear conflict patterns with special reference to crop raiding, present study was conducted from April to December 2011 in Machiara National Park (MNP), Azad Jammu and Kashmir, Pakistan. Field (n=30) and questionnaires (n=108) surveys were conducted in three union councils of MNP to collect information on patterns of crop raiding by black bear, local tolerance and perception about black bear during 2007-2011. About 945 acres area with 53.88 metric tons estimated maize crop yield was damaged by black bears during five years. The maximum (33.94%) of crop raiding was reported between elevation range of 2164 and 2285 m above sea level (asl.) along the boundary of the national park (61%) during 1801-0200 hours (69%). Maximum crop raiding was recorded during year 2011 (18.2 metric tons), while the maximum incidences of crop raiding were reported in the month of October (68.51%). The financial value of the damaged crop, according to the local market, was estimated as 1.370 million PKR (US\$=14732.258) as per the currency values during the study period. In response, 11 black bears were killed by the community during 1998-2011, while five incidents of bear attacks on human were also recorded. Accordingly, 82% of respondents disliked black bear and suggested its ex-situ conservation (95%). These conflicts are among the main issues, which not only affect the livelihood of poor local villagers but also create serious threats to the conservation of these threatened bears in the area. To improve the local livelihood prospects and black bear protection around the study area, a proper research-based conflict mitigation strategy is seriously required.

Keywords: Crop raiding, black bear (*Ursus thibetanus*), human-bear conflict, Machiara National Park.

INTRODUCTION

Asiatic black bear (*Ursus thibetanus*) is distributed through many parts of Southern Asia (Afghanistan, Pakistan, India, Nepal and Bhutan), Northeastern China, Korea, Taiwan, far eastern Russia and Japan (Charoo *et al.*, 2009; Jamtsho and Wangchuk, 2016). In Pakistan, black bear is found in the northern mountain regions, including Azad Jammu and Kashmir (Abbas *et al.*, 2015; Escobar *et al.*, 2015).

Black bear is listed as vulnerable by the IUCN, due to risk of extinction in the wild (Garshelis and Steinmetz, 2016). While, the CITES included this species under Appendix-I which includes species with threat of extinction (Yadav *et al.*, 2009). In Pakistan, however, due to more severe threats, this bear is listed as critically endangered (Sheikh, 2006).

Bears are opportunistic feeders; consume a wide variety of foods, reflecting omnivorous and generalist nature (Malcolm *et al.*, 2014; Awan *et al.*, 2016) its diet generally comprises of more than 90% plant material, however, being a carnivore, it also exhibits certain

characteristics of large carnivores (Yadav *et al.*, 2009). Home range and movement of black bear is largely dependent on the quality, quantity and distribution of food (Ahmad *et al.*, 2016). Bears have excellent memory standard that allows them to locate seasonally available foods in their natural habitats (Malcolm *et al.*, 2014). However, humans can involuntarily provide high quality food for bears in terms of orchards, beehives, fruits and crops. Bears that have once tasted good quality and high energy food come out regularly to raid the crops and orchards, variety of fruits near their natural habitats (Craighead, 2000; Davis *et al.*, 2002).

Black bear damages agricultural and horticulture crops and thus directly affect the local people that leads to black bear-human conflict in the area (Charoo *et al.*, 2009; Bashir *et al.*, 2018). In Kashmir and related areas, during the period of fruit shortage, they become bold and solitary hunter and travel more widely in search of food towards crop lands resulting more frequent encounters with human especially during cropping season (Charoo *et al.*, 2009; Awan *et al.*, 2016). As a result, a human-bear conflict is created in a broader community (Sillero-Zubiri and Laurenson, 2001). The major crops grown and

damaged by black bear in Asian countries are millet, maize, wheat, paddy, buckwheat, black lentils, potato, and soybean leading to considerable loss of total yield in these areas (Yadav, 2011).

Due to thick vegetation cover (Haleem *et al.*, 2014) and good food availability, population of black bear has increased in the Kashmir valley, resulting in a big problem during the last few years (Akhtar and Chauhan, 2010). This increase in human-bear conflict is due to various reasons including competition for resources at different levels, fear as a threat to local people, and hunting for trade of its body parts (Sillero-Zubiri and Laurenson, 2001; Shepherd, 2006; Ahmad *et al.*, 2016). Besides, increasing human population in and around protected areas or forests, and interruption or disturbance to the natural habitat have led to increased frequency of bear-human encounters (Charoo *et al.*, 2009).

Black bears found in Azad Jammu and Kashmir have been heavily victimized partially because of the increasing levels of conflict with rural population near the forest or protected areas. These conflicts are not only affecting the socioeconomics of the local people but also result in population decline of black bear which has vital role in ecology of the area. Mitigation of such conflicts requires a proper understanding of their underlying factors and patterns. The present study explored such conflict patterns of human-black bear with reference to the crop raiding in and around Machiara National Park.

MATERIALS AND METHODS

Study Area: The study was conducted in the Machiara National Park (MNP) Azad Jammu and Kashmir, lying between 34° to 31° N and 73° to 37° E at 2,000 to 4,700m elevation above sea level (asl.), covering an area of 13,532 ha. The park falls in the moist temperate zone with cold winters and deep snow at its higher altitudes. The mean annual rainfall is 1526.7 mm, with 84.5 rainy days per year. The heavy rain month is July, with rainfall of 327.6 mm, while the driest month is November receiving a mean rainfall of only 35.4 mm (Qamar *et al.*, 2008; Qamar *et al.*, 2010; GoAJK, 2018).

In the southern periphery of the Machiara National Park, there are 30 main villages, comprising about 7635 households with more than 52000 human populations (Minhas *et al.*, 2010). Agriculture and livestock are the integral part of economy of village community (Anwar *et al.*, 2006). Regarding agriculture, subsistence farming prevails and about 3-5% of the total land is suitable for cultivation mostly with single cropping season. The valley bottoms and gentle slopes are used to raise agricultural crops mainly maize, potatoes and vegetables (GoAJK, 2009; 2018). Most of the families also earn a good part of their living from

sources like public service, business and services in the cities.

Methods: The field surveys (n=30) were carried out from June-December, 2011 in 30 villages of the study area. Information about human-black bear conflict pattern was collected from affected community people (n=108) by using semi-structured questionnaire. Respondents were asked a series of questions (on prescribed data sheets) about cropping pattern, seasonality, crop loss and attack or killing of their family members along with bear behavior and circumstances during 2007-2011. In addition to affected persons' interviews, field staff of the Wildlife and Forest departments and other community-based organizations (CBOs) were also contacted directly or indirectly. Field surveys were carried out in affected areas, group discussions/meetings (n=14) were held with general community and knowledgeable persons for acquiring the information regarding frequency of livestock depredation, crop raiding, injury or causality. For more accuracy and viability of results, direct observations of affected localities were taken to assess the loss in cropping season (September -November). Evidences of crop damage, such as damaged remains and fecal materials were also observed directly to confirm the crop raiding.

Similarly, the area and quantity of crop damage was estimated based on the questionnaire survey (as reported by the affected respondents), however, during field surveys, damaged area and crops were also measured to confirm and concise with the community reports. Financial valuation of the damage was assessed according to the local market values of the crops during the study period.

RESULTS

Spatial pattern of crop raiding: Crop raiding by black bear was reported from various localities of the study area. The major crop cultivated in the area was maize, and about 945 acres (7625.88 kanals, 378.82 hectares) area of maize crops was damaged by black bear during the last five years (2007-2011). In these affected areas, a total of about 53.88 metric tons (53,880 kg) of maize was consumed/damaged or destroyed by the black bear. The highest level of crop raiding incidences was observed at Village Gali Khaitar with 20 metric tons crop losses, followed by Gahatian (12 metric tons) while, lowest level of crop raiding (2.88 metric tons) was recorded at Dhairi village (Table 1; Fig. 1).

Crop raiding was assessed at various elevation levels, divided into six elevation classes, starting from <1828 m to >2434 m asl. The maximum level (33.94%, 18.12 metric tons) of crop raiding was recorded at an elevation range between 2164 and 2285 m asl. in the areas located along the boundaries of the national park

(61%), while, minimum level (2.48 metric tons) of crop raiding was recorded at 2438 m asl. (Fig. 2; Fig. 3).

Temporal patterns of crop raiding: Crop damage assessment during the study period indicated that most (376 acres area with 18.12 metric tons crop yield) of the crop damage took place during 2011 followed by 2007 (216 acres, 17.32 metric tons), and 2008 (127 acres with 7.12 metric tons). However, only 83 acres area with 4.48 metric tons crop yield damaged by black bear was recorded in 2009 (Fig. 4). Maximum crop raiding activities of bear were reported between 1800-0200 hours (69%) while minimum during 0601-1000 hours (Fig. 5). Bear raided maize crop during months of September, October and early November. However, the maximum raiding incidences were reported during the last weeks of October (Fig. 6).

Financial valuation of crop damage: The financial valuation of the crop damage by black bear in different villages was estimated according to the local market rates. The price of maize fluctuates annually and varies from locality to locality. The total cost of damaged crop (53.88 metric tons) in 945 acres area was estimated as PKR 1.370 million (US\$=14732.258) from 2007 to 2011. The highest financial loss (461500 PKR) was experienced by the locals residing between 2164 and 2285 meters (asl.) followed by the people living between 2010 and 2133 m (388,800 PKR), while, lowest financial loss was recorded above 2438 m asl (Fig. 7).

Factors involved in human-black bear conflict: It was recorded that the main cause of Human-black bear conflicts experienced by the local community of the area was damage of crops and livestock by the black bear. Most of the respondents (74%) believed that bears were facing the deficiency of their natural prey species in the forests while others (26%) believed they preferred human crops and livestock more than the natural prey. Whatever

the cause, the damage of crops is resulting in killing of black bear is due to the following reasons.

Compensation of loss: Local communities of the area were very disappointed with government and National Park authorities, who have devised no mechanism of compensation against the material and life losses. Most of the respondents (95%) reported that human loss can never be compensated, while only 5 % were in favor that human life loss should be compensated by at least an amount of Rs.1.5-2.0 million. A total of 70% of the respondents suggested that community loss in term of crop raiding by bears should be compensated at the market value, while 30% agreed that compensation should be at least 75% of the total loss.

Local tolerance and perception towards Black Bear: Majority of villagers (82%) dislike black bear while 18% were in favor of its existence. About 95% of the respondents supported that black bear should be conserved in wildlife parks and zoos while only 5% supported that black bear should be conserved in natural habitat i.e. National Park. All the respondents disagreed to support black bear conservation if it threatens human life or kills livestock. All the people were unsatisfied with human-black bear conflict management by the Wildlife Department.

Retaliatory killings of black bear: During the last 14 years (1998-2011) eleven (11) registered black bear killings were reported from different localities of AJK, out of which 4 killings were reported from different localities of MNP (Table 2). These killings were retaliatory, in response to crop raiding (n=9), livestock depredation (n=01), and attacks and human injuries (n=01) by the black bear. All these cases were registered for action against the culprits. Out of these, 4 were resolved by fining the culprits by Wildlife Department while remaining 7 were still pending (Table 2).

Table 1. Spatial pattern of crop raiding by black bear in MNP.

Name of villages	Localities	GPS coordinates	Amount of damaged crop (Metric tons)	Percentage damage	Financial Value US\$
Gahatian	Gahatian Dubriyal	N34,32.323 E73,35.288	10	18.55%	2734.2721
	Gahatian	N34,32.232 E73,35.288			
	Gahatian Lar	N34,32.656 E73,35.446			
	Magri	N34,31.919 E73,31.416			
Chreel Dubriyal	Jangrhi	N34,32.179 E73,35.054	10	18.55%	2734.2721
	Chathyan	N34,32.232 E73,35.288			
	Dubriyal	N34,32.323 E73,35.288			
	Magrah	N34,32.323 E73,35.288			
	Chreel	N34,33.430 E73,35.430			
	Gagan	N34,33.168 E73,35.076			
Galli Khaitar	Galli Khitar	N34,37.656 E73,35.430	20	37.16%	5468.5442
	Magri	N34,33.431 E73,35.430			
	Magri Galli	N34,32.656 E73,35.430			
Machiara	Trappa	N34,31.088 E73,37.701	8	14.84%	2187.4177
	Bankhoran	N34,30.919 E73,37.413			
	Thora	N34,17,271 E73,48.451			
Sarli Sacha	Phutan	N34,29.253 E73,39.255	3	5.56%	820.28163
	Takia	N34,32.656 E73,35.446			
Dhairi	Klawan	N34,33.964 E73,37.346	2.88	5.34%	787.47036
	Kunda, Doda	N34,32.323 E73,35.288			
Total Crop damage			53.88		14732.258

Table 2. Registered cases of retaliatory killings of Black bears in AJK during 1998-2011.

Place	No. of Killings	Year	Status of case against culprit
Ghugyan Behak	1	1998	500 Fined
Copra Galli	2	1998	Pending
Kail	1	2000	Pending
Machiara	1	2001	3000 Fined
Ghamot	1	2002	3000 Fined
Doga	3	2003	Pending

Hawelli	1	2008	Pending
Ashkot	1	2011	3000 Fined

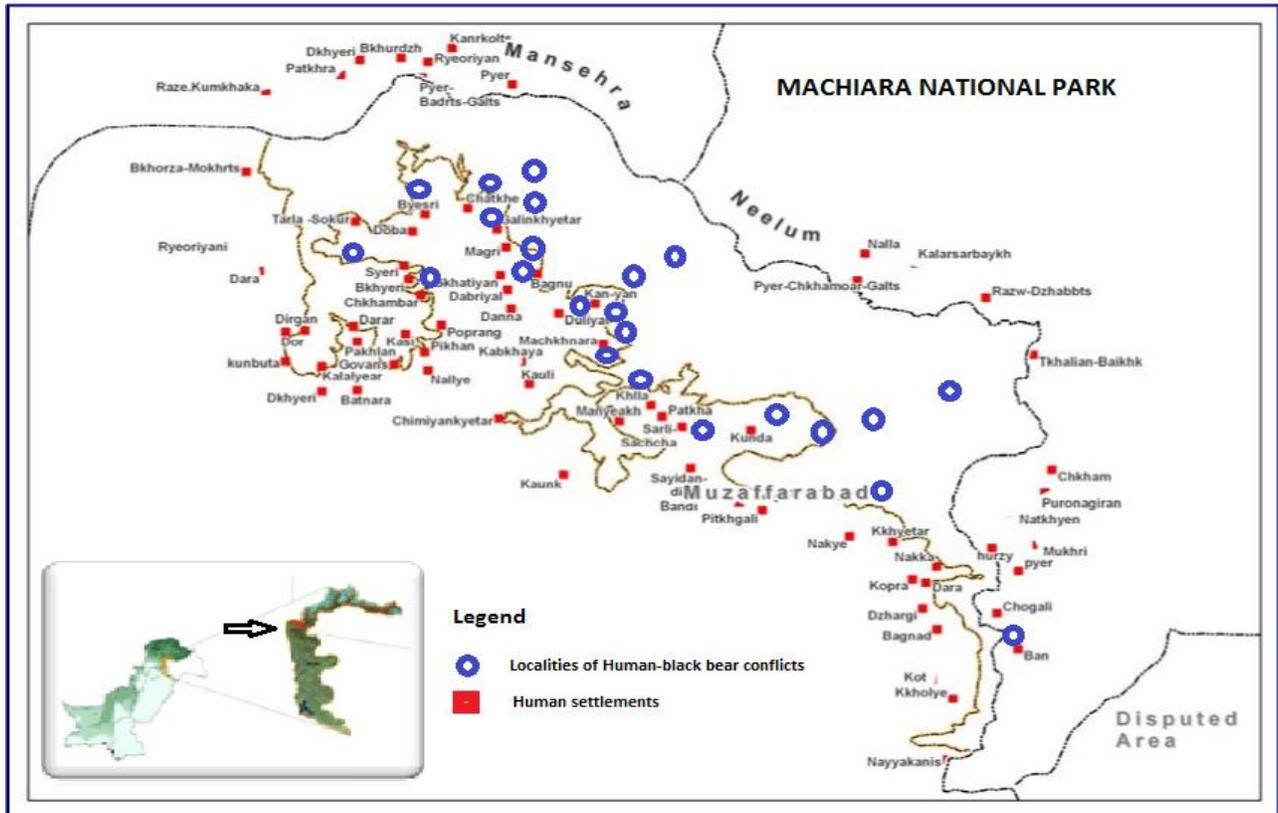


Figure 1. Localities with extensive human-black bear conflicts in MNP

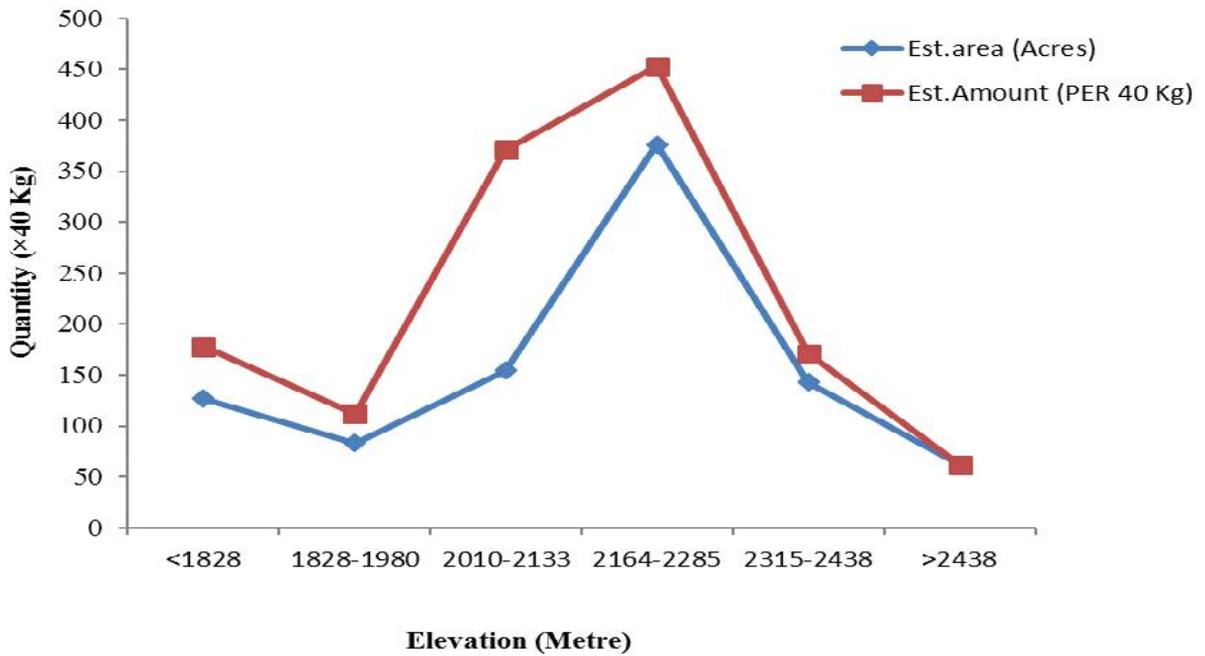


Figure 2. Crop raiding by black bear at different elevation levels

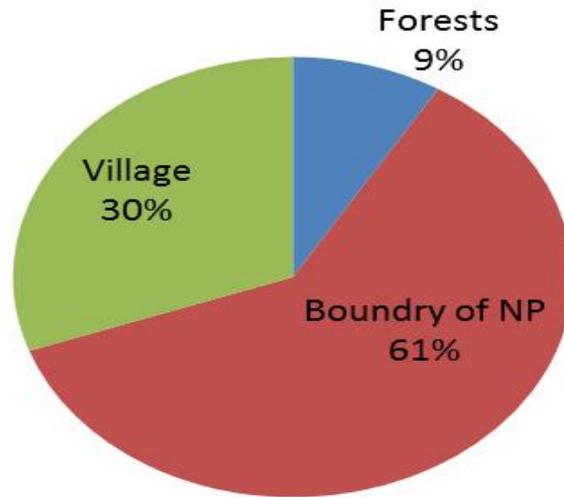


Figure 3. Location of crop damage by black bear in MNP

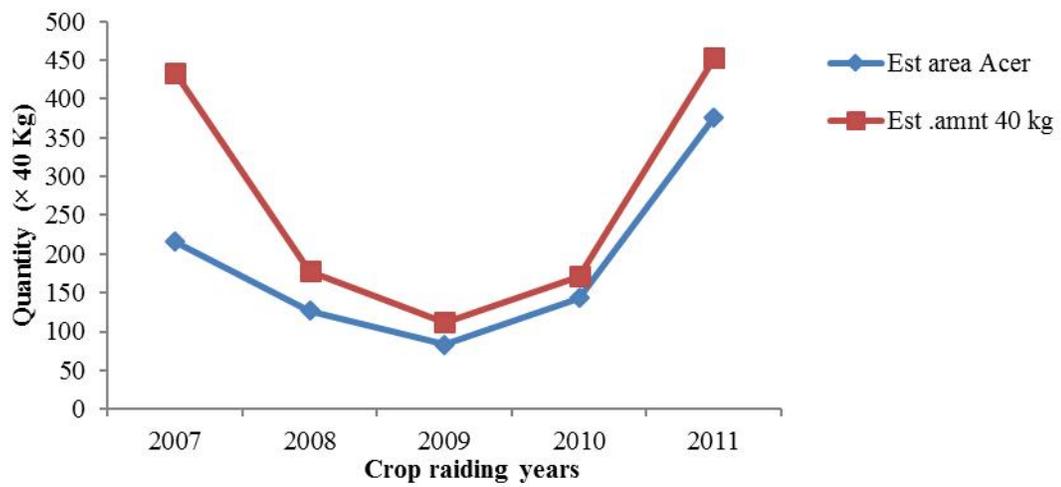


Figure 4. Annual trend of crop raiding by black bear in MNP

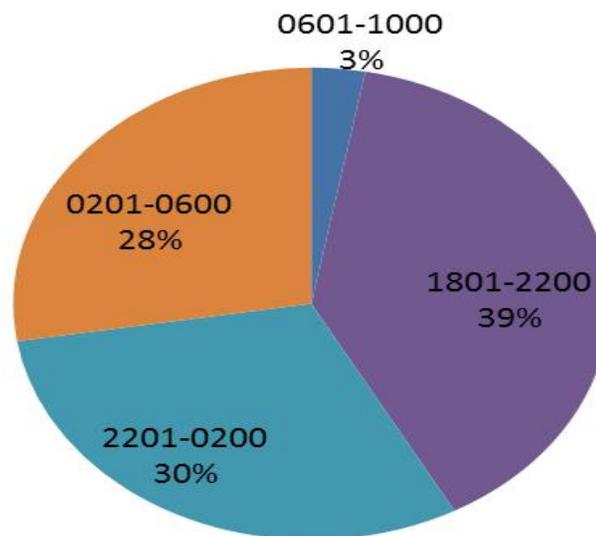


Figure 5. Temporal patterns of crop raiding by black bear in MNP

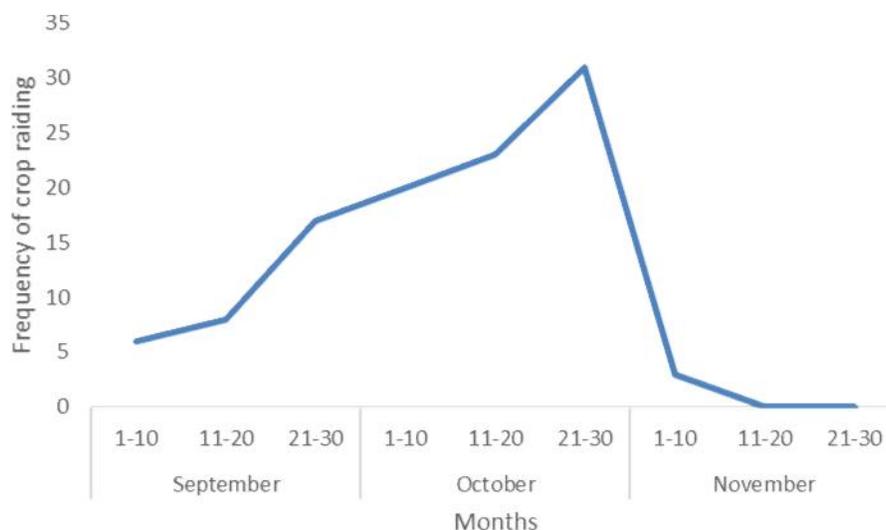


Figure 6. Monthly distribution of crop raiding by Black bear in MNP

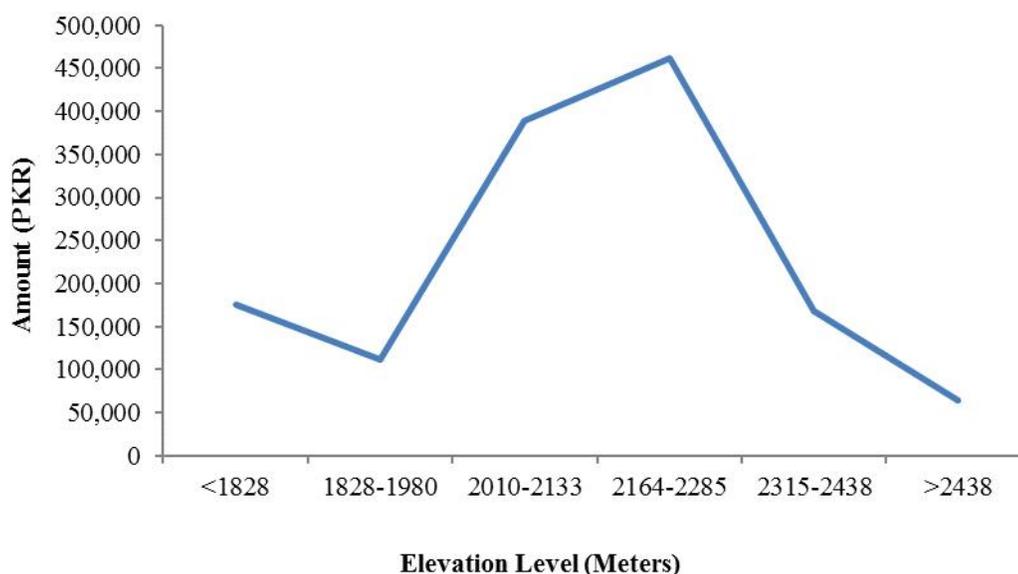


Figure 7. Cost of damaged crop with respect to different elevation level in MNP

DISCUSSION

This study highlights black bear as the main agent responsible for crop raiding in the study area. The major crop raided by the black bear was maize, which is widely cultivated the different localities at different elevation levels of the study area (GoAJK, 2009). Ali *et al.* (2017) reported that crops comprised one third of the volume in black bear scats in Western Himalaya, Pakistan. Yadav (2011) also reported that the major crops grown and damaged by black bear in Asian countries was millet, maize, potato etc., leading to about 34.65% loss of total yield in these areas. Black bear's dependency on protein rich high digestible food prior to hibernation would be a significant factor that attracts its attention in

the study area at the ripening stage of the maize crop coincides with bear's preparation for denning.

Spatial pattern of crop raiding: During last five years (2007-2011), the highest crop raiding was recorded from Gali Khaiteer, Gahatian and Charil Dabriyal villages. These villages are located directly along the southern boundary of the national park at close or some distance away from forests. Awan *et al.* (2016) reported that crop damage occurred significantly more often at locations very close to the forest edge (i.e., < 250m) in AJK. Such conflicting behavior of black bear was recorded at the periphery of many other protected areas, where the bear was involved in crop raiding such as maize, apple, cherry, pear, and walnut etc. (Charoo *et al.*, 2009; Bashir *et al.*, 2018).

The present study highlights that the highest crop raiding by black bear was recorded at localities between 2164–2285 meters asl. These moderate elevations were suitable for crops cultivation in the study area and also lie at the peripheries of forests. Low damage was recorded at the higher elevation areas as these elevations are not much suitable for cultivation of the maize crop. Escobar *et al.* (2015) reported that black bear preferred low elevation in AJK, Pakistan. However, Bista and Aryal (2013) recorded most signs of Asiatic black bear at 2301–2700 m (> 40%) and 2701–3100 asl (> 25%) from Nepal. In India, crop raiding by black bears was also reported as the main problem in the localities that were located near the periphery of forests or protected areas (Charoo *et al.*, 2009).

Temporal pattern of crop raiding: The study indicated that about 376 acres area with 18.12 metric tons of maize crop yield was damaged by black bear in 2011. The increasing trend of crop raiding during the present study is an indication that the population of black bear in the study area might be increasing. Minhas (2008) also reported that the population of black bears is gradually increasing in MNP. This increase in population is a good sign for bear conservation because previous studies have indicated a low estimated population (n=1000) of black bear in Pakistan (Sheikh, 2006).

In the present study, the crop raiding season was from early September to first week of November. This was the stage when maize was soft, sweet and milky and it became victim of black bear most frequently. Charoo *et al.* (2009) reported that in Dachigam National Park, the crop raiding by black bear was usually recorded from July to August. The difference in crop raiding time might be due to climatic conditions, as around Machiara National Park maize crops become mature and reach to the harvesting stage late during the September and October. In addition to the climatic conditions the difference between varieties of crops might also be among the factors that affect maturing and harvesting period.

There was a substantial financial loss of the local community, due to crop raiding activities of black bear in the study area. The total financial loss of villagers arising from crop raiding by black bear, during 2007–2011, was estimated as 1.370 million PKR (14732.258 US\$). These estimates cover only the value of damaged crop, as there are so many other losses in terms of taking protective measures by local villagers to safeguard their crops from these bears. Such financial losses have been experienced by the communities living along the habitats of wildlife in other areas as well. An economic loss of PKR 1,633,000 (US\$ 16,330) was reported in Musk Deer National Park, AJK (Ahmad *et al.*, 2016) In the United States, agricultural producers spent US\$2.5 billion to manage wildlife problems during 1990s, while

metropolitan households spent US\$5.5 billion over the same duration (Bruggers *et al.*, 2002; Conover, 1998; Rao *et al.*, 2002). In another study, Ambarli (2006) estimated an amount of approximately US\$ 25,000 as the annual cost of damages by bears in Artvin Province Turkey.

Bears causing great economic loss to the communities annually around MNP, is not acceptable to them. All respondents interviewed from 30 villages were located on the southern periphery of Machiara National Park. Local residents were less educated with low monthly incomes and largely depending upon crops, livestock, and forest resources. Crop loss by the bears causes great loss to the economy of these communities.

Due to this damage majority (82%) of the respondents throughout the study area, dislike the black bear. About 95% of respondents responded that black bear conservation should be in zoos and wildlife parks. Accordingly, during the last 14 years, 11 retaliatory black bear killings were recorded in different areas of Azad Jammu and Kashmir. Schaul (2006) also reported that bears are considered as threats to humans and livestock which has caused the killing of many bears in areas where local villagers cultivate their crops and rear large number of livestock. Similarly, Ahmad *et al.* (2016) reported a higher (4.5 %) negative perception of black bear among local peoples in some areas of Musk Deer National Park, AJK. Asian bears are facing very high levels of threats due to habitat loss, fast growing human activities as well as lack of knowledge about their status, conservation, distribution and survival (Severheen *et al.*, 1999).

Conclusion: Black bear cause great annual damage to the livestock and crops of the local communities residing around MNP. These damages have created human-black bear conflicts in the area which is harmful to the both parties. As black bear is a threatened species thus to mitigate these conflicts in terms of bear retaliatory killings in response to the community loss, must be properly managed. The conflicts between black bear and human have increased during the last five years and maximum crop damage was recorded in 2011. There is no any compensation program, to compensate the loss of the affected villagers run by Park authorities or any other Government or non-government organization. Majority of the locals dislike black bear existence in the in-situ condition in MNP. The main reason for increased crop raiding and livestock depredation by black bear as reported by the respondents was unavailability of natural food for black bear. To improve black bear protection and local livelihood prospects around study area, various conflict mitigation strategies including community loss compensation schemes, livestock and crop insurance schemes, community awareness and improvement in protection strategies should be initiated.

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