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Status of crop raiding caused by wild animals in Lansdowne forest division, Uttarakhand

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ABSTRACT

The human-wildlife conflict is one of the serious problems faced by people living in forest fringe villages. This has been a major problem since ages especially for the people residing near the wildlife protected areas but the problem has aggravated over the period of time. After the mid 19th century, it is being considered as a major problem, affecting the social, economic and cultural life of the people especially in the Himalayan region of our country. The aim of our study was to access crop damage by the wild animals in the agricultural areas of Lansdowne forest division of Pauri district of Uttarakhand. Crop damage by the wild animals was found in almost all the study sites (ranges) during the study period.

Key words: Agriculture, *Boselaphus tragocamelus, Elephas maximus*, Human wildlife conflict

Crop damage by the wild animals in and around protected areas in India is a very serious issue among the farmers and conservationists. It needs serious concern particularly in the Terai region of Himalayas. Crop raiding, livestock loss and the loss of human lives by the wild animals play a major role in developing negative attitude of humans toward the wildlife (Theves and Karanth 2003; Sillero-Zuberi *et al.* 2007). High population settlements close to the boundaries of forests and protected areas in Asia is responsible for man-wildlife conflict adversely affecting farmers and the wildlife (Nyhus and Tilson 2004; Johnson *et al*. 2006). Economic loss due to crop damage by wild animals is also responsible for negative human-wildlife interaction. The farmers spend much money, time and energy to keep wild animals away from their agriculture field for the protection of crops. A wild animal not only harms the edible crops, but also the non-palatable crops. Asian elephant (*Elephas maximus*) damages the crop, infrastructure and inflicts injuries to a large extant as compared to other wild animals (Madhusudan 2003).

Human settlements near the protected areas are at major risk of casualties and crop damage by wild animals (Gubbi 2012; Karanth *et al*. 2012). Compensation provided for the crop damage to the affected peoples by the forest department has played a significant role to mitigate the conflict and reduce the negative attitude of human towards wild animals (Gubbi 2012; Karanth *et al*. 2013).

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MATERIALS AND METHODS

Study area

Lansdowne forest division (LFD) is situated between 29° 37' to 30° 2' N and 78° 19' to 78°43' E in the Uttarakhand state of India. Climatically, three weather seasons (winter, summer and monsoon) with a warm and temperate climate is found in LFD. The forest division lies in the southwest Pauri Garhwal district and it includes Jehrikhal, Dwarikhal, Yamkeshwar and Duggada development blocks. The forest division is situated between Rajaji National Park on its western side and Corbett Tiger Reserve at the east. The division includes a protected forest area of about 460 km^2. The area of forest division is composed of terai region.

The assessment of crop damage was surveyed physically in the study area by identifying the affected crop fields from July 2015 to March 2018. Each affected village was visited time to time for the damage assessment, if any, during the study period.We covered all the available agricultural types affected by the wild animals such as wheat (*Triticum aestivum* L.), sugarcane (*Saccharum officinarum* L.) and rice (*Oryza sativa* L.). The secondary data of agricultural damage was collected from the LFD and the information was cross checked with the help of survey and interviews of affected farmers.

Agricultural practice in the hilly areas of Uttarakhand is a challenging task due to the presence of forest areas near to the villages and crop fields. Farmers in the hilly areas face challenges including natural disasters, landslides and soil erosion etc. Besides this, another major problem

for the agriculture in this area is crop damage by the wild animals. All these factors are badly affecting the life of farmers in the study area.

Crops

In this region, people cultivate the variety of crops such as potato *(Solanum tuberosum* L.), legumes, maizes (*Zea mays* L.), blackgram (*Vigna mungo*). Wheat and rice are the major crops cultivated by the farmers in the study area.

RESULTS AND DISCUSSION

Crop damage

Season of *rabi* crop starts in December-January and include crops like wheat, mustard and blackgram. Wheat is cultivated by the most of the farmers in the study area producing it as a major crop. In this season, a total of 65.2 acres area was found damaged, out of which, wheat damage area was 52.68 acres, while 6.95 acres, 2.98 acres, 1.98 acres and 0.63 acres was onion (*Allium cepa*), potato (*Solanum nigrum*), mustard (*Brassica campestris*) and garlic (*Allium sativum*) respectively (Table 1).

The cultivation of *kharif* crop starts in the monsoon season during June to August. During this period, various kinds of crops are cultivated. However, rice and maize are the major grown crops in the study area. During the study period a total 23.85 acres rice field and 10.9 acres maize field was damaged by the wild animals in the study area (Table 1).

Damage of crops in different ranges

Kotdwar: This range also has the plain area (Terai) of the agriculture fields. It also has the most affected agricultural fields than the other ranges. This range covers the highest number (178) of villages and also owns largest agricultural area among all the ranges on the LFD. The southern part of this range is connected with the Kalagarh Tiger Reserve and the northern part is connected with Dugadda and the Laldhang ranges of LFD. As this range has the predominant area of agricultural land among all the ranges, so the possibility of the crop raiding was found high in comparison to other ranges. In this range, the farmers prefer to grow wheat, rice, maize and some variety of vegetables. The 58.75 acres of agricultural area was damage out of the total 99.41 acres area and the elephant was found the most problematic animals in the agricultural fields of this range. Elephant damaged 56.94 acres (96.9%) and wild boar damaged 1.79 acres (3%). No other animal was found problematic in this area during the study period (Table 2).

Laldhang: This range comes under the Terai region of Shivalik hills connected with the Pathri range of Haridwar forest division and Kotdwar range of LFD. This range has flat terrain with agriculture fields and includes 67 villages. The farmers of this area mostly cultivate the wheat and rice. During the study period, total 9.94 acres was damaged out of 99.41 acres. It was damaged by elephants. Elephant is considered as main problematic animal in the range.

Dugadda: This range includes 105 villages and the farmers of this area prefer to grow wheat and some vegetables such as potato, onion and garlic. In this range, the lower regions were affected by the elephants and the upper regions were affected by the wild boars mostly. The wild boar is found as the most problematic animal especially in potato crops. In Dugadda range, 29.4 acres of the area was damaged by the wild animals out of 99.41 acres (total damages of agricultural fields) from all ranges during the study period. In this range, total damage to crop fields was recorded as 20.8 acres by elephants (71%) and 8.52 acres by wild boars (29%) (Table 2).

Lansdowne: Lansdowne range of LFD is known for its natural beauty and lovely weather conditions. This range covers 152 villages. In this range, nominal damage (0.16 acre) out of total (99.41 acres) damage in agricultural fields was recorded. Total 0.16 acre area was found damaged and all damage is caused by the wild boar (Table 3).

Kotri: This range is purely forest range and has very few human settlements found under this range. 1.16 acres area damage out of 99.41 acres area has been recorded. Elephant was found as the most problematic animal in this area. In this range, elephant causes the maximum damage of 1.04 acres with a percentage of 90% and the wild boar cause the 0.11 acre area damage accounting 10% respectively (Table 3).

In all the above ranges, elephant was found as the most problematic animal with the area damage of 87.42 acre (87.9%) followed by wild boar that damaged the area of 10.64 acres (10.7%) and nilgai damaged the area of 1.19 acres (1.9%) out of total area damage of 99.41 acres during the study period (2016-2018) in the study area (Table 4).

For comparison of the damage caused by elephant, nilgai and wild boar in different ranges/study sites, one way ANOVA test was used considering the number of incidences of damage in each range.

Damage caused by elephant

Results revealed that significant damage was caused by elephant in Kotdwar, Laldhang and Dugadda range ($P< 0.01$ Kotdwar vs. Kotri as controlled site, $P<0.04$ Laldhang vs. Kotri, $P<0.03$ Dugadda vs. Kotri).

Table 1 Damage of *rabi* and *kharif* crops (acre) in the study area

Rabi				*Kharif*		
Wheat	Onion	Potato	Mustard	Garlic	Rice	Maize
52.68	6.95	2.98	1.98	0.63	23.85	10.93

Table 2 Range-wise agricultural damage

Ranges	Area in acres
Kotdwar	58.75 (59.0 %)
Dugadda	29.4 (29.7%)
Laldhang	9.94 (9.9%)
Kotri	1.16 (1.16%)
Lansdowne	0.16 (0.06%)

Table 3 Involvement of different wild animals in the agricultural damage (area in acres)

Forest ranges														
Kotdwar			Laldhang			Dugadda			Kotri			Lansdowne		
Elephant	Wild boar	Nilgai	Elephant	Wild boar	Nilgai	Elephant	Wild boar	Nilgai	Elephant	Wild boar	Nilgai	Elephant	Wild boar	Nilgai
56.94	1.79	0	8.57	0.17	1.19	20.87	8.52	0	1.04	0.11	0	0	0.16	0

Table 4 Involvement of wild animals in crop damage individually

Wild animal	Damage (acres)
Elephant	87.42 (87.93%)
Wild boar	10.64 (10.70%)
Nilgai	1.19 (1.19%)

Damage caused by wild boar

Results indicated that significant damage was caused by wild boar in Dugadda range (P< 0.002 Lansdowne as controlled site).

Crop wise damage

As per the data of crop damage, the highest damage was found in the wheat because wheat is the major cultivating crop with the 52.68 acres out of total 99.41 acres with the percentage of 52.9% damage of crop. Rice was found as the second major affected crop with 23.85 acres out of a total of 99.41 acres with a percentage of 23.9%. Maize was the third major affected crop after the wheat and rice with 10.93 acres of area damage out of total damage 99.41 acres with a percentage of 10.9 %. Some vegetable crops were also affected such as onion (6.95 acres) with percentage of 6.9%, potato 2.98 acres with percentage of 2.98 and mustard (1.98 acres) with percentage of 1.9% out of total 99.41 acres damage of agriculture land. Garlic was also damaged in small scale 0.63 acres with percentage of 0.63% (Table 5).

Year-wise crop damage

During the study period, it is revealed that the rate of crop damage is increasing yearly. A total of 99.41 acres crop was damaged by wild animals. 24.5 acres, 20.1 acres 23.2 acres, 32.1 acres and 39.1 acres crops were damaged during 2013-14, 2014-15, 2015-16, 2016-17 and 2017-18 respectively. The data for 2013-14 and 2014-15 were obtained from the LFD (Table 6).

Table 5 Percentage of affected crops individually during the study period in the study area

Crop	Damage (acres)
Wheat	52.68 (52.9%)
Rice	23.85 (23.99%)
Maize	10.93 (10.99%)
Onion	6.95 (6.99%)
Potato	2.98 (1.99%)
Mustard	1.98 (1.98%)
Garlic	0.63 (0.63%)

Compensation policy

The damage of crops is increasing year by year. State Government has taken necessary steps to provide compensation against damage to the farmers and also increased the rate of compensation for developing a better relationship of farmers with wildlife.The compensation provided by the government for sugarcane from 2004-2008 was ₹ 2500/acre. It was increased in 2009 as ₹ 3000/acre and in 2012, it was increased from ₹ 3000 – 25000/acre till this date. For wheat, rice and oilseeds (tilhan) crops, the compensation was ₹ 1500 till 2008 and it was increased up to ₹ 2500/acre in 2010. It was also increased in 2012 from ₹ 2500 to 15000/acre. The compensation for all the other (rest of the above) crops was also increased in the same way from ₹ 800 – 1250/acre in 2009 and in 2012, it was increased to ₹ 1250 – 8000/acre.

There are various problems in the mountain areas and one of the major problems is agricultural damage caused by wild animals which are increasing rapidly and giving rise to various other troubles. The wild animal population is increasing in a great way due to the efforts made by the government and conservationists. Its direct impact can be viewed on the farming and the more loss is found in those areas that are nearby to the forest area (Kumar *et al.* 2017).

The wild herbivores animals such as elephants, wild boar, Nilgai etc. are also damaging crops because they have easy access to crop fields, so they found crop as better food options. Gubbi (2012) discussed in their study done at Nagarhole National Park that the damage was found excessive in crops by wild animals which came under the range of 1-5 km from the forest edge. In our study, we have also found that the distance of forest from farm areas also has a major impact on crop damage. The farm areas near the forest have more damage and the farms that are far away from the forest face less damage.

The findings reveal that in our study area elephants

Table 6 Year-wise crop damage

Year	Crop damage (acres)
2013-14	24.5
2014-15	20.1
2015-16	23.2
2016-17	32.1
2018-19	39.1

(87.9%) have emerged as the most harmful animal that causes more loss in farm areas in comparison to other wild animal species because the population of this animal is very high as compared to the other animals in this region (Madhusudan 2003; Gubbi 2012; Karanth *et al.* 2013). The wild boar (10.7%) and nilgai (1.9%) also damage the crops but found less harmful than elephants.

According to National Crime Reports Bureau (NCRB, 2012), one farmer is leaving the farming every minute and every third minute, one attempts suicide. The people will not be ready for farming in such circumstances that may lead to serious threats in the future. The Palayan Aayog report (2018) by Government of Uttarakhand briefed that the migration is increasing due to the damage caused by wild animals and the farmers of the study area are leaving the mountains and their agricultural occupation and moving to plain area for the employment and fulfilling necessities. This phenomenon is contributing to establish the negative attitudes towards wildlife and it is not suitable for the betterment of the life of wild animals in the future. (Heinen 1993; Studsrod and Wegge 1995; Basnet 2004; Kumar *et al*. 2017).

Conclusion

Crop raiding can be controlled by practising diversification of crops by shifting to pulses and some major efforts might be done for the marketing of those pulses and local agricultural products. Solar electric fencing can be a better option to mitigate the problem and it can be designed according to the need of farmers and site conditions (Meena 2017, Kumar *et al*. 2017) and govt must have taken some serious steps to resettle the people who left their villages, traditional agriculture and livelihood and make sure that the compensation would reach to the every affected farmer with in the time.

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