

## LEOPARD PRESENCE IN HUMAN USE LANDSCAPES OF PUNJAB, INDIA

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### ABSTRACT

There is increasing evidence of the presence of numerous wildlife species in human use landscapes in India, however, systematic studies of their distributions are scant. We surveyed the state of Punjab in order to assess the presence of leopards, and the damages caused to livestock and humans. The survey carried out in 2014 based on compensation information provided by the Punjab Forest Department for livestock damages caused by leopards. Seventy four reports relating to loss of 82 livestock were recorded between February, 2013 to April, 2014. Most of the losses were reported from human use landscapes in hilly areas in the districts of Hoshiarpur, Pathankot and Ropar which adjoin Himachal Pradesh. No human deaths were recorded in the same time period and one person was injured by a leopard during a rescue operation. Our interview data of the affected people indicated that the livestock losses were largely incurred by economically weak farmers with small land holdings and lower educational qualifications. Based on our results we recommend the use of effective livestock protection measures, wide scale public awareness programmes and building the capacity of the wildlife wing of the Forest Department.

**KEYWORDS:** Survey, Punjab, Leopard, Livestock Depredation, Conflict assessment

Wildlife interactions are inevitable where wildlife species share space with humans, especially in a densely populated country like India. Large cats use large landscapes and because of their exclusively carnivorous diet cause livestock losses to farmers and sometimes attack humans (Redpath et.al. 2013). However, managing the resultant interaction between humans and wildlife requires an in- depth understanding of the species ecology in the conflict setting as well as understanding the nature of losses people face due to the presence of these predators (Madden, 2004; Treves and Karanth, 2003; Dickman, 2010). Conflicts between wildlife and people affect the conservation of large carnivores as they are particularly prone to retaliatory killing when people face substantial economic losses that lead to low acceptance levels.

Species like leopards with their wide distribution and high degree of adaptability often share spaces with humans leading to livestock loss (Athreya et. al., 2014) and in rare instances attacks on people (Athreya et. al., 2010). Despite high poaching and other anthropogenic pressures (Treves and Karanth, 2003) they persist near human settlements by feeding on livestock and domestic dogs (Athreya et. al., 2014; Edgaonkar and Chellam, 1998). India has one of the highest livestock densities in the world which may be

attributed to dependency of people on milk as a major source of animal protein as well as use in agriculture (Tisdell and Gali, 2000). This implies that abundant food resource in the form of domestic animals is present in human use landscapes. (Athreya et. al., 2014)

In this survey we aimed to assess the distribution of leopards in Punjab, and investigate the nature of interaction with people. We also documented the reasons for livestock losses and overall economic losses incurred by people. We hope this survey will provide initial inputs to the forest department so that they can focus their management efforts in areas where people face higher economic losses due to the presence of leopards.

### METHODS

#### Study Area

We studied the livestock depredation in Punjab, located at 30.79° N to 76.78° E coordinates (Figure 1). The state has an area of 50,362 sq.km. Its population comprises 2.28% (2,77,04,236) of the total population of India (1,21,01,93,422) in 2011 (Census, 2011). The population density of Punjab is 551 persons per sq.km. There are three main seasons in Punjab: summer (April to June with temperatures as high as 49 °C), monsoon (July to September- average

annual rainfall of 649 mm occurs) and winter (December to February temperatures fall as low as 0 °C). The plains are mainly covered with grass, shrubs and bushes. Floral diversity is richest in the Shivalik region with 355 species of herbs, 70 species of trees and shrubs, 31 species of pteridophytes, 27 of bryophytes and one of gymnosperms (*Pinus roxburghii*) other trees such as eucalyptus (*Eucalyptus globulus*), shisham (*Dalbergiasisoo*), kikar (*Prosopis juliflora*), mulberry (*Morinda citrifolia*), khair (*Acacia chundra*), poplar (*Populus spp.*) and varieties of bamboo (*Bambuseae spp.*) are planted by the forest department. Faunal species such as: Sambar deer (*Rusa unicolor*), Wild pig (*Sus scrofa*), Monkeys (*Macaca mulatta*), Porcupine (*Hystrix indica*), Jackals (*Canis aureus indicus*), Peacocks (*Pavo cristatus*), Jungle fowl and hens (*Gallus gallus*), Nilgai (*Boselaphus tragocamelus*), Black bucks (*Antilope cervicapra*), wild dogs (*Cuon alpinus*) and Langur (*Semnopithecus schistaceus*) are also present in Punjab. There has been an exponential rise in conversion of all types of land into agricultural land in Punjab after the initiation of the Green Revolution in India (Sidhu, 2005). The average livestock density in Punjab is 14.7 livestock per sq.km. There are 12 Wildlife Sanctuaries (323.7 sq.km.) in Punjab which cover 0.64% of the total state area. There are no National Parks in Punjab.

### Survey Protocol

We obtained compensation records from the Punjab Forest Department on livestock losses reported between 2012 and 2014. The compensation data had a total of 74 incidences of livestock depredation; 49 in Hoshiarpur, 23 in Pathankot, eight in Ropar and two in Mohali district (Figure 1). Information on leopard deaths (N= 7), sightings (N= 9) and rescues (N= 6) were also obtained from all 22 districts in Punjab. We also interviewed 35 officials from the Punjab Forest Department to understand their perspective about this issue.

The survey was conducted from July to September, 2014 and interviews were conducted in Punjabi which is the regional language and information was collected on individual demography: age, occupation and educational qualification; the incident of depredation- time of attack, number of animals killed, livestock protection measures used before and after the

attack along with individual views about reasons for increased depredation, leopard population and methods to better protect livestock. Not all respondents answered all questions and hence the number of individuals responding to each question is mentioned in the results.

### RESULTS

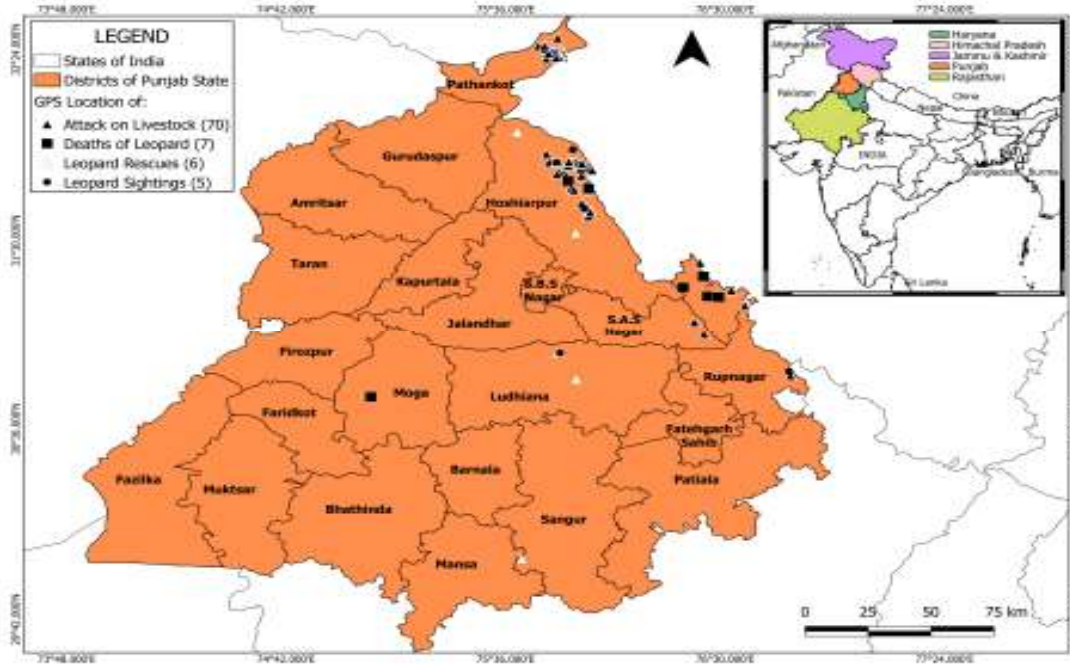
Livestock losses to leopard are reported in seven of the twenty two districts in Punjab, but most of the incidences occur in the three eastern districts of Hoshiarpur (N= 49), Pathankot (N= 23) and Roopnagar (N= 10) which border Himachal Pradesh. In the one year and two months between February 2013 and April 2014, a total of 82 livestock owned by 74 farmers were attacked by leopards.

In the same period, one attack on a person was reported in Sangowal, Ludhiana on 3rd May, 2013 during a rescue operation after the leopard was tranquilized (GPS coordinates: 30 50'08.47"N, 75 53'25.21"E). Also, a total of seven leopard deaths were reported in the districts of Hoshiarpur (N= 2), Ropar (N= 4) and Moga (N= 1). Three leopards were rescued one each from Hoshiarpur (N= 1), Ludhiana (N= 1) and Sangrur (N=1). Three rescue attempts (2 in Ludhiana and 1 in Hoshiarpur) failed where the leopard escaped during the rescue operation. (Figure 1). All the captured leopards are housed in Chhatbir Zoo, Punjab.

More recently three attacks on people were reported but all appear to have occurred because of inappropriate behavior on the part of the individuals. On June 5th 2014, one human attack incident was reported in which two women were injured by a leopard while collecting wood in the forest of Deriyan village in Hoshiarpur district (GPS coordinates: 31 48'24.427"N, 75 54'41.676"E) (Figure 1, Table 2). On January 13th 2015, two people were attacked in Papprali village, Roopnagar when they chased the leopard after it was discovered in a farmer's field. The animal tried to escape from the area but fell in a well and was saved by two villagers and a forest guard. On August 7th 2014, three people including a media person were injured at RattaKhera, Sangrur during a rescue operation when they insisted on taking images of the animal even after being prevented

from doing so by the forest guards. (GPS coordinates: 29 59'11.60"N, 75 40'00.21"E).

**Figure 1: Map indicating the spatial spread of leopard human interactions that occurred in Punjab between 2008 to 2014**



**Livestock Ownership and Depredation**

The total number of livestock owned by the 74 farmers in the period February 2013 to April 2014 who had filed for compensation was 688. Goats constituted half that of the total livestock owned.

Goats were also most commonly lost to predation (38% of losses) by leopards. Dogs were lost in large numbers to leopard depredation even though they were only 1/4th as numerous as goats (Table 1).

**Table 1: The ownership of livestock and losses due to leopard predation over the period February 2013 to April 2014 as reported by 74 farmers in Punjab**

Livestock Type owned	Total number of animals owned in last year	Average number of Livestock owned in last one year	Total number of animals lost in last year
Goats	306	4.08	38
Cows	106	1.41	20
Buffalos	77	1.03	0
Calves	70	0.93	18
Dogs	75	1.00	24
Bulls	31	0.41	2
Sheep	21	0.28	2
Ox	2	0.02	2

TOTAL	688	9.16	106
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**Patterns Of Livestock Depredation**

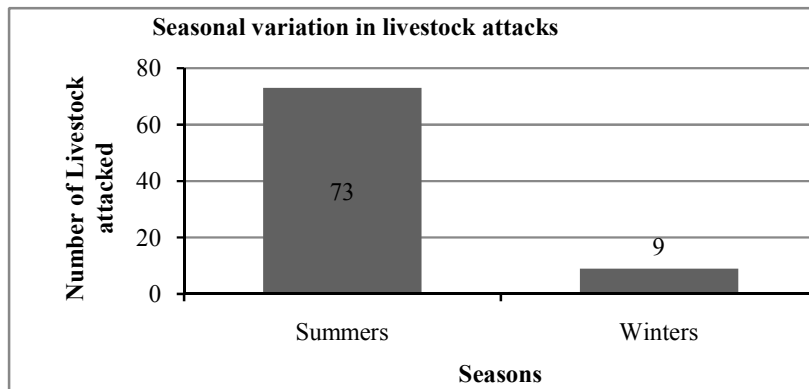
Most of the leopard attacks on livestock took place in the summer season (between the months of June to September), (Figure 2 (a)) and mainly occurred at night when livestock was tied in

the open (Figure 2(b), Table 2). The livestock attack resulted in death of at least one individual animal and two cases of livestock stampede were also recorded.

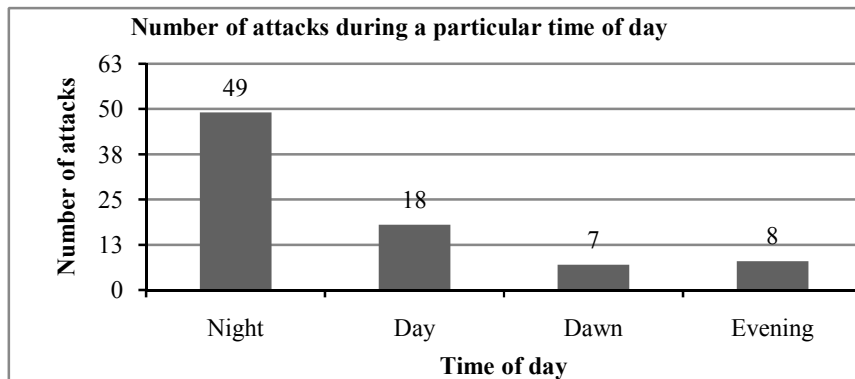
**Table 2: Sites of livestock depredation by leopards in Punjab obtained from 82 livestock depredation incidents collected from 74 respondents that filed for compensation between February 2013 and April 2014.**

Site of attacks	Number of incidents
Tied in the open near home	37
Tied or grazing in the field/ forest	26
Kept in an easily penetrable shed	16
Roaming around free at home/ in field	3

**Figure 2(a): Season wise livestock losses to leopard attacks.**



**Figure 2(b): Number of attacks during particular time of the day.**



Fifty one of the 74 farmers faced livestock depredation for the first time. In 45% of the cases (N= 82), livestock were attacked when they were tied outside the house in the open. In all the depredation cases, the livestock was not well protected (Table 2).

**Protection Measures Implemented**

Following the livestock loss, most of the affected farmers did not engaging in any protective measures to avoid future leopard attacks on livestock. Only 5.4 % of the affected farmers (N=74) kept the livestock indoors in the night following a livestock loss due to leopards. (Table 3)



Images showing the type of sheds used to keep livestock in summers by the respondents in Punjab, India.



Images showing the type of enclosures used to keep the livestock in winters by respondents in Punjab, India.

Table 3: Livestock protection measures used by 74 farmers in Punjab even following a livestock loss to leopard attack

Protection measures used	Percentage of people using them
Tie in the open under vigil, shed used for winters	40.54%
Installed lights	24.32%
No change	21.62%
Keep livestock indoors	5.41%
Put up fencing	4.14%

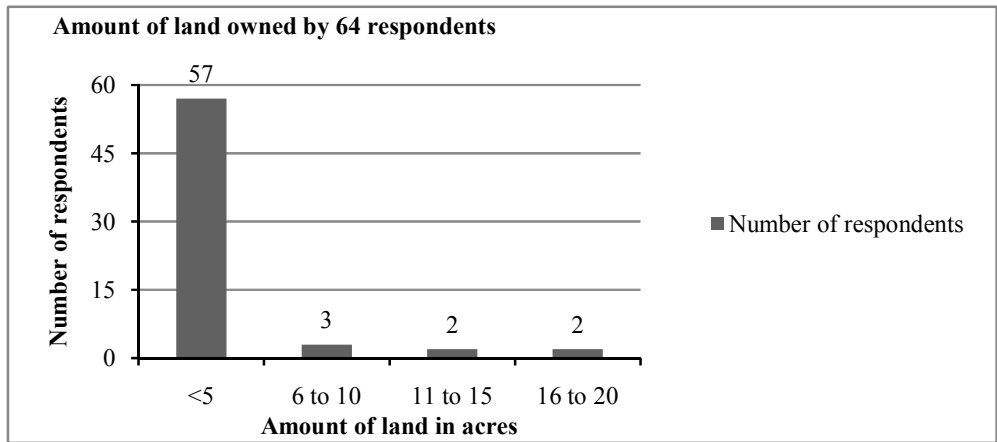
Sold all animals	4.14%
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**Information about Respondents**

Sixty two of the 74 respondents answered questions about their income and land. Of these, 45% (N=28) were farmers, 32% (N= 20) were laborers and 37% (N=23) respondents in addition to being either farmers or laborers did other work such as animal rearing, owned shops, etc. Majority of the 64 respondents; that is 48% had studied less

than the tenth grade, 33% had completed twelfth grade, only one respondent was a graduate and 17% respondents were illiterate. Only 9% of the respondents earned 10,000 and above per month. Fifty seven of the 64 people who provided information about their land ownership owned five acres or less, only two people owned land between 16 to 20 acres. (Figure 3)

**Figure 3: Chart depicting the ownership of land by 64 respondents in last one year in Punjab.**



**Compensation Measures**

Of the 74 people who filed for compensation only seven people received the compensation till September 2014 when we completed the interviews. Average compensation for loss of goat was ₹5085.71 (\$ 81.37), for calf ₹ 1900 (\$ 30.4), for sheep ₹ 1600 (\$ 25.6) and for jersey breed of cow ₹ 18,000 (\$ 288). All the seven people felt that the compensation was not adequate due to loss of a milch cow, jersey breed or pregnant animals. Compensation is not given in case of loss of pet dogs (N= 7) and death of livestock due to succumbing to injuries (N=1). Forty eight people have applied for compensation but have not received it so far. Eleven people did not apply as they either did not know about the procedure or found it very lengthy.

**Perception Of Locals**

Twenty two respondents (N= 72) who replied to the question on presence of leopards in

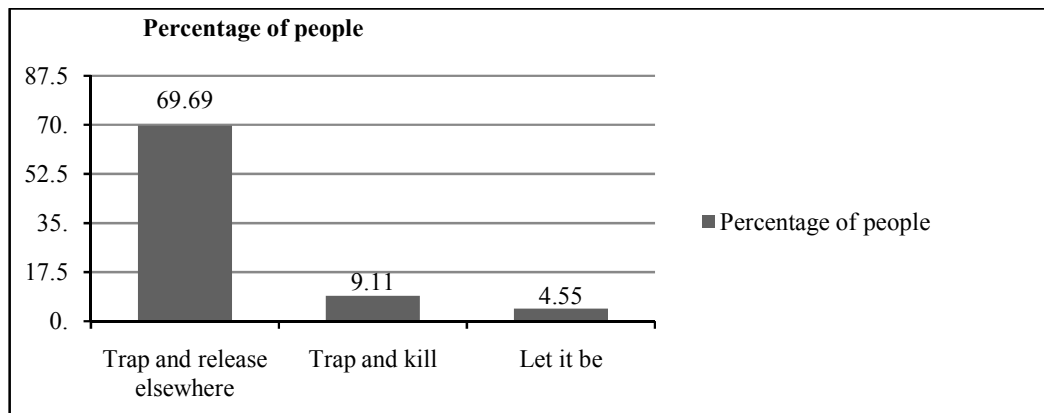
their area, confirmed the presence of leopards since the past 10 to 15 years, but they state that livestock attacks escalated only in the past 2 to 3 years (N= 29 of 72). Most of the farmers believe that the main prey of leopard in the landscape is Sambar deer (*Rusa unicolor*) but it also predate on stray dogs and calves and cubs of wild as well as domesticated animals. Other wild animals present in the seven districts include: Wild pig (*Susscrofa*), Monkeys (*Macaca mullata*), Porcupine (*Hystrix indica*), Jackals (*Canis aureus indicus*), Peacocks (*Pavo cristatus*), Jungle fowl and hens (*Gallus gallus*), Nilgai (*Boselaphustragocamelus*), Black bucks (*Antilope cervicapra*), wild dogs (*Cuonalpinus*) and Langur (*Semnopithecusschistaceus*). When enquired about the perceived increase in leopard numbers 70 of the 74 respondents in Punjab stated reasons such as: preying on easy food such as livestock (34.29%), presence of houses near the jungle (20 %), lack of sufficient water, prey and increased deforestation in the jungle (11.43%), leopards

released by the Forest Department (8.57%), ban on hunting and increased protection (4.28%). When asked about incidents of dog bites only 10 out of the 74 respondents said that the young of animals are attacked by feral dogs.

Majority of the 74 respondents (70%, N= 46 of 66 who replied) wanted the leopard to be trapped and

shifted to a zoo or sanctuary and only 5 % chose to let the leopard be if it doesn't cause any loss (Figure 4). As the forest guards accompanied us in all interviews the responses may not have been entirely candid in terms of how they viewed the leopard which is a Schedule I species in the Wildlife Protection Act (1972).

**Figure 4: Chart indicating choice of 66 out of 74 individuals interviewed in Punjab to the multiple choice question: What should be done with the leopard**



The most common method proposed to reduce human-leopard interactions by 56 of the 74 respondents was to keep the leopards in a zoo or sanctuary (30%), followed by keeping proper vigil, installing lights and making better enclosures (29%) and fencing of jungles (7%). Twenty five percent of the respondents could not provide a solution and wanted the government to decide on a concrete plan for the same.

**Forest Official's Opinions**

We interviewed the Chief Wildlife Warden, the Chief Conservator of Forest (Wildlife), six Divisional Forest Officers, seven Range Forest Officers, five Block Forest officers and thirteen Forest Guards. According to the officials the leopard attacks have increased in the past two to three years. The only method employed by the department if a leopard is present in human use areas is to install a trap cage to capture the animal. If trapped, it is sent to Chhatbir zoo. The Police Department is also involved for crowd control during rescue operations. None of the leopards rescued so far have been released back into the wild. In addition to trapping, in some areas awareness related to living with leopards is also

provided by the Forest Guards in their particular Beats.

Compensation provision has not been efficient due to a lack of funds; this delay in compensation might ultimately decrease people's tolerance towards the leopard. A few challenges within the Department were also noticed such as: delay in payment of salaries, low rate of recruitment which results in problems during rescue operations, lack of availability of proper rescue and tranquilization equipment at all district offices along with presence of relatively inadequately trained staff. Provision of proper infrastructure and an efficient functioning of the compensation scheme can reduce the aggression of people in relation to the instances of livestock depredation and crop loss and help the employees in performing their duties more effectively and efficiently.

**DISCUSSION**

Leopards are known to be the most adaptable of all the big cats. They can survive in a wide variety of habitats and live in close proximity of humans (Athreya et. al., 2010; Odden et. al, 2014). Our survey indicates that leopards are present in human use landscapes, outside the Protected Area Network in seven districts of

Punjab. The maximum number of livestock depredation incidents were noted in Hoshiarpur's villages in the forested areas adjoining Himachal Pradesh. No predatory attacks on humans are reported in this area. Rare livestock depredation events were reported although we are not certain if it is due to non reporting of depredation incidents. There have been a few leopard "rescues" in central and southern Punjab where livestock depredation events are not reported. These could be dispersing animals but we have no data to ascertain the same. All the "rescued" animals are presently in captivity in the zoo.

Among the livestock lost to leopard depredation, goats were the most common; goats were also more commonly owned by the farmers. As seen in other areas in India (Odden et. al, 2013), in Punjab too, dogs were killed disproportionately more than goats. What is striking from the information we obtained from the interviewed farmers was that there were much higher livestock losses in the summer compared to the winter. The farmers when asked for the reason stated that the return of the migratory herders to higher altitudes in the summer reduced prey for leopards in their areas leading to increased depredation of the resident livestock. However, our information on the livestock husbandry practices indicates that in winter the livestock are kept secure due to the colder temperatures whereas in the summer the livestock are tied in the open due to the hot temperatures. This would lead to greater availability of the livestock for predators like the leopard.

From our interview data it was noted that despite a loss, the farmers did not actively employ better livestock protection measures. This could be related to the lower economic status of the people. When we questioned them about what needs to be done with the presence of leopards, the most common responses were to remove and only a very small fraction of them stated that the animal needs to be killed. This could also be biased by the fact that we had a forest guard accompanying us during our surveys. A few people even said they accepted the presence of leopards in their area.

From the management perspective, there is lot to be done for and from the Forest Department. Our interviews with them indicate that

they need more funds, more training and more support in terms of handing out faster and adequate compensation to the affected people. The Wildlife Wing needs to be empowered to better handle human wildlife emergencies in the state. Overall, the results of this survey indicate that leopards are present in the human use areas of Punjab, outside Protected Areas. This adds to the increasing knowledge of the presence of many different wildlife species outside Protected Areas. We recommend that proactive measures such as livestock shed subsidy, fast and just dispensation of compensation and increasing the capacity of the Forest Department to handle the presence of wildlife outside protected areas is required urgently.

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