

# **Human attacks by leopards in Uttarakhand, India: an assessment based on perceptions of affected people and stakeholders**

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Leopard image © Manoj Nair



# Human attacks by leopards in Uttarakhand, India: an assessment based on perceptions of affected people and stakeholders

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## Key words

human wildlife conflict, Himalayas, *Panthera pardus*, social survey

## Abstract

Attacks on humans by leopards have been a serious issue for many decades in Uttarakhand, India. This study uses forest department compensation data between 1998 and 2012 to ascertain conflict intensity in Uttarakhand and examines the social aspects of the conflict using on-the-ground assessment with affected victims, their families and associates of victims as well as other stakeholders such as forest department personnel, local community members, hunters and non-governmental organizations. A total of 80 interviews were conducted in 69 villages in five Forest Divisions of Pauri Garhwal, Tehri Garhwal, Almora, Lansdowne and Mussoorie. In addition 35 stakeholders were interviewed. Based on these interviews, the nature of leopard attacks on people, the landscape in which these attacks occurred, the seasons and times during which these attacks occurred were analyzed. The perceptions of the local community and the stakeholders to the conflicts, its causes and potential solutions were assessed. The data showed that despite perceptions to the contrary, leopard attacks on humans have not increased over time, and do not show any clear trends of an increase. The efficacy of existing mitigation measures, namely compensation payment and translocation or killing of the leopard, are examined. Key questions that remain to be answered, as well as a set of recommendations for action are listed in the paper. This report was submitted to the Uttarakhand Forest Department in April 2016.

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## **Introduction**

Incidences of large cats attacking and killing people is a serious issue, evoking strong reactions from the public and media. Knowledge on the aspect of large cats attacking people is very scant, due to the rarity of these events as well as the secretive nature of the large cats. “Man-eating” has been made infamous by hunter turned naturalists like Jim Corbett (1944) and Kenneth Anderson (1957; 1961). Incidences of large cats killing people although uncommon are reported to occur by leopards, lions and tigers in different parts of India (Saberwal et al. 1994; Athreya et al. 2010; Chauhan & Goyal 2000). This phenomenon is also reported from less populated countries (Packer et al. 2005), as well as in areas like the Russian Far East with extremely low densities of humans (Goodrich et al. 2010). Theories for this behaviour are many but scientific studies are few and are at best correlations between attacks and other events that occurred at the same time such as droughts (Saberwal et al. 1994), translocation (Athreya et al. 2010) and low prey base (Packer et al. 2005) except for Goodrich et al. (2010) which tracked the tigers using collars and found that most of the tiger attacks were due to provocation by humans.

India is home to four large wild cats that also share space with dense human populations (Banerjee et al. 2013; Athreya et al. 2013; Kshetry et al. In Review; Athreya et al. In review; Andheria et al., Unpublished report). Attacks on humans by Asiatic lions, leopards and tigers are reported although not in numbers we would expect given the high degree of spatial overlap of large cats, especially Asiatic lions and leopards with humans (Athreya et al. 2013, Banerjee et al. 2013). It appears that attacks on humans in India are not random in time or space. They are clustered either by region or by period. High intensity attacks on humans by lions, tigers and leopards occur in some sites and peak at some times (Athreya et al. 2006, 2010; Chauhan & Goyal 2000; Saberwal 1994) although Uttarakhand has reported leopard attacks on humans since early 20th century.

Leopard attacks on humans and livestock have been studied in Uttarakhand by Goyal et al. (2000), Goyal et al. (2007), Agarwal et al. (2011), Mathur (2014), Nicholson et al. (2013); in Kashmir by Habib et al. (2014); in north Paschimbanga by Bhattacharjee & Parthasarathy (2013); in Maharashtra by Dhanwatey et al. (2013), Edgaonkar & Chellam 2002, Athreya et al. (2010) Athreya et al. (2013), in Himachal Pradesh by Kumar (2011) and in Gujarat by Vijayan & Pati (2002).

There are many ecological studies on large carnivores but most of these studies are conducted within Protected Areas with few studies in human-dominated landscapes (Ghosal et al. 2013). These studies are not useful in addressing complex conflict issues, which occur in shared spaces where it is important to understand the dynamics of the conflict not just from a conservation perspective but also from the underlying social aspects (Jhamvar-Shingote & Schuett 2013; Kansky & Knight 2014; Madden & McQuinn 2014; Mathur 2014; Redpath et al. 2014;).

The human-leopard conflict in human-dominated landscapes in Uttarakhand has both dimensions; of human safety and livelihoods that are affected due to attacks on humans and livestock by leopards on one hand, as well as leopard welfare and conservation on the other hand. This study uses compensation data from the Forest Department to identify the problem areas that have large number of human attacks by leopards and examines the social aspects of the conflict using an on-the-ground assessment with affected victims and families and associates of victims. Using the information obtained in this study we also discuss the results and recommendation previous studies have published.

## **Materials and methods**

### **Study Area**

The hill state of Uttarakhand was formed in the year 2000 (then called Uttaranchal), being carved out of the state of Uttar Pradesh and was the twenty-seventh state of the Republic of India. Located in north India, the Himalayan state of Uttarakhand has an area of 53, 483 sq. km of which 86% is mountainous and 65% is forested (FSI, 2014). The state is divided into 13 Districts (Figure 1) and has six National Parks, seven Wildlife Sanctuaries and four Conservation Reserves covering an area of 7897.61 sq. km. The population of the state is 10.08 million with 69.7% of the population living in rural areas (Census of India, 2011).

**Figure 1: District Map of Uttarakhand, India**



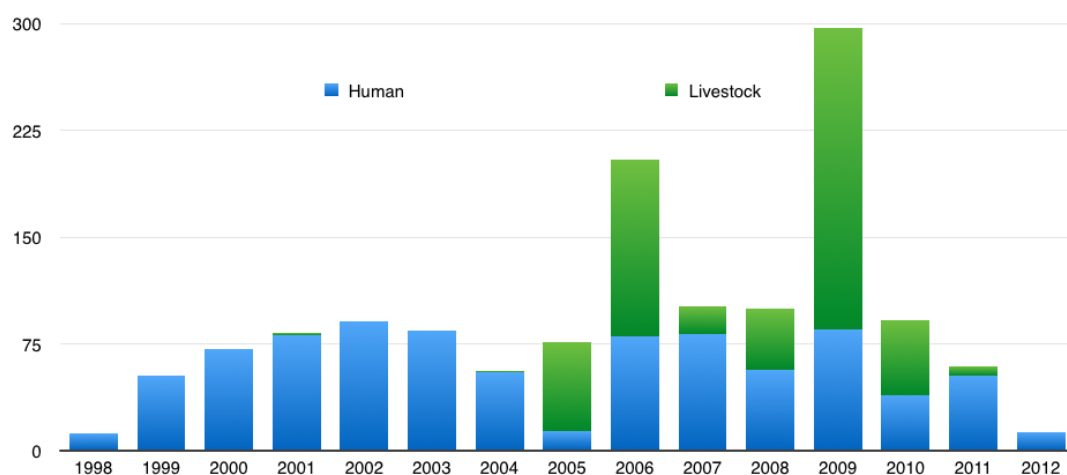


### Selecting the study sites

The study sites that reported high levels of attacks on humans and livestock were selected based on the forest department compensation records. Till November 2012, information of leopard attacks on people and livestock across the state were sent to a central location in the Uttarakhand Forest Department Finance office in Dehradun for processing the monetary compensation. From December 2012, the individual Forest Divisions were authorized to process the compensation requests. We accessed compensation records of livestock and human attacks by leopards that occurred between 1998 till the end of 2012 from all the 40 Forest Divisions (Figure 2).

From this data, the attacks on humans by leopards by Forest Divisions were compiled between 1998 and 2012 (Figure 3). Four Forest Divisions with significant number of human attacks by leopards were selected for more detailed surveys that were Garhwal (henceforth called Pauri Garhwal), Tehri (henceforth called Tehri Garhwal), Almora and Lansdowne Forest Divisions. These Forest Divisions were easier to access than Pithorgarh and Kedarnath Forest Divisions, which, too, had high number of attacks. At the same time, one Forest Division with very few attacks on humans by leopards (Mussoorie Wildlife Division), was chosen for obtaining detailed information on damage incidences to livestock and people due to leopards. We wanted to sample a low conflict intensity area in order to assess whether or not leopards were present there.

**Figure 2: Number of reported incidences of leopard attacks on humans and livestock between 1998 and 2012**

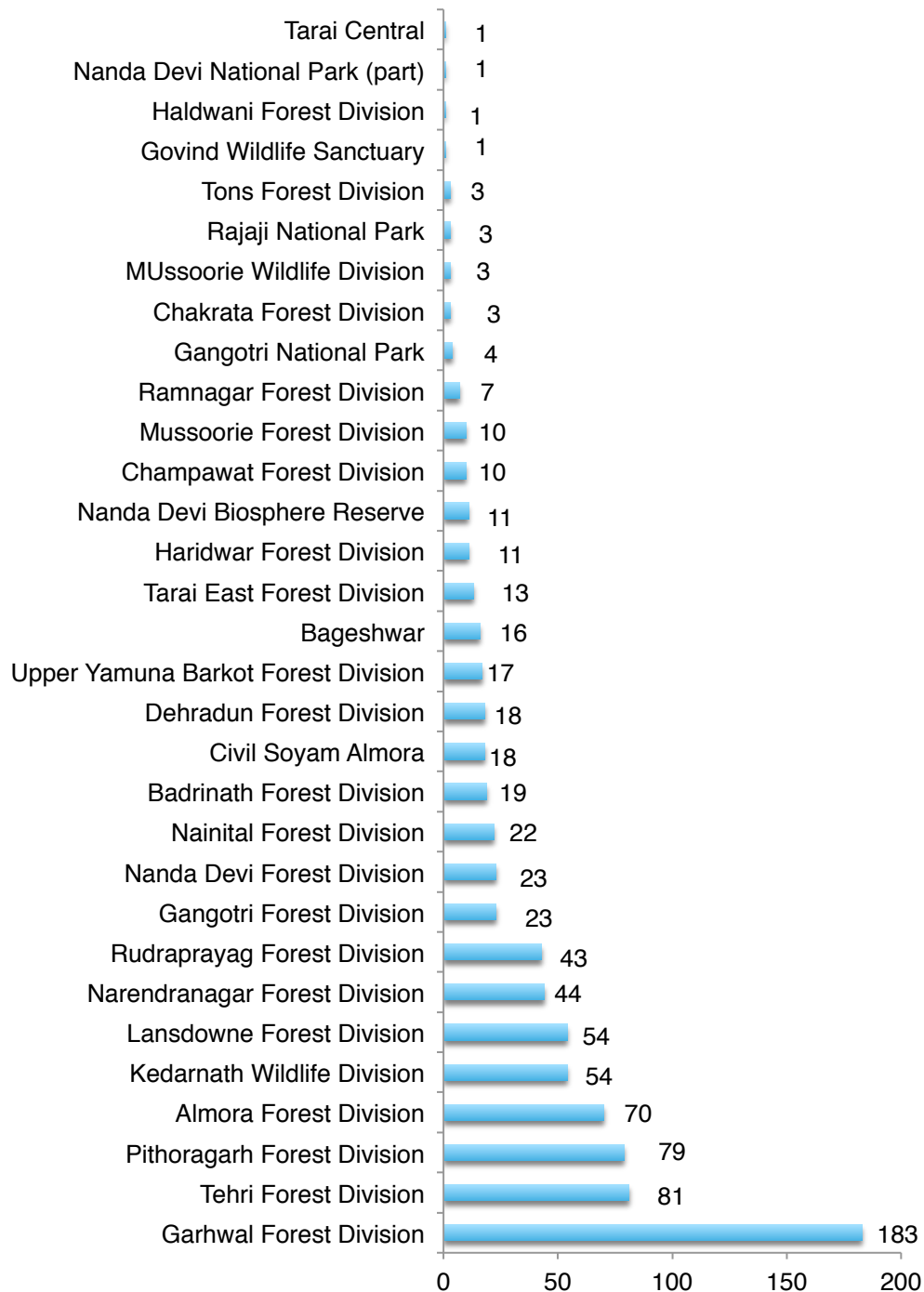


### Methodology used to assess people's perception to the conflict

Within the four Forest Divisions with high number of human attacks by leopards, we compiled the list of villages where leopard attacks that had taken place in the five-year period 2007-2012, so as to ensure that the attacks were of recent origin. These villages

were selected after consultation with local Divisional Forest Officers. Many of the villages were at remote locations and we used the assistance of the local Forest Department personnel to locate the victims and their associates.

**Figure 3: Leopard attacks on humans by Forest Division between 1998 and 2012**



A semi-structured questionnaire (Annexure 1) was used to assess people's perception to the conflict as well as to understand perceived causes and solutions. We compiled social and personal data of the victims, queried victims or their associates about the human-

leopard conflict addressing both leopard attacks on humans and livestock depredation. GPS readings were taken during the course of the interviews: most of these readings were at or within 100 m of the location of the leopard attack.

A semi-structured questionnaire (Annexure 1) was used to assess people's perception to the conflict as well as to understand perceived causes and solutions. We compiled social and personal data of the victims, queried victims or their associates about the human-leopard conflict addressing both leopard attacks on humans and livestock depredation.

A similar questionnaire was used to ascertain the views of other stakeholders such as members of the local community, forest department staff, hunters and non-government organisations about the nature of the leopard conflict, potential causes and solutions of the conflict.

Although, the Forest Department personnel did not participate in conducting any of the interviews, we cannot rule out that people were not affected by the presence of the forest department personnel who were accompanying us.

## Results

We conducted a total of 80 interviews in 69 villages in five Forest Divisions (Table 1) between March and September 2014. These 80 interviews included 69 interviews of people/people's associates affected by leopard attacks, 2 interviews of people attacked by bears and the 9 interviews of people who lost livestock to leopards.

**Table 1: Summary of interviews of affected people**

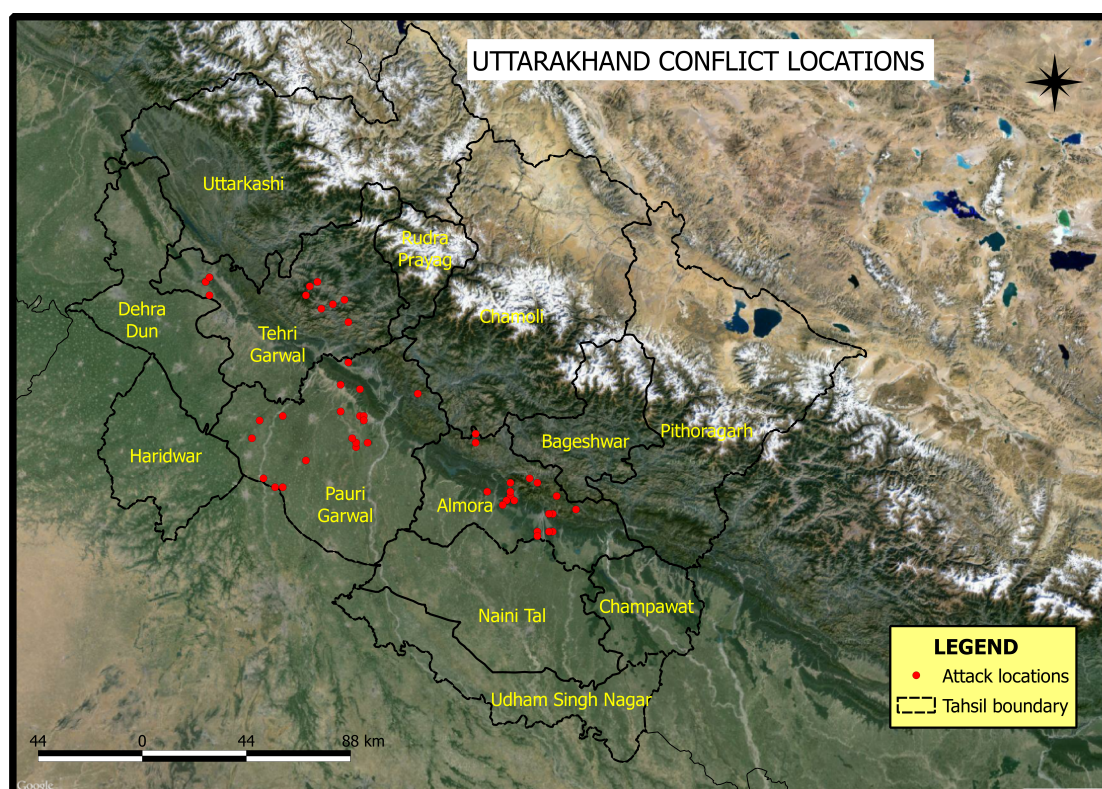
<b>Forest Division</b>	<b>No. of villages visited</b>	<b>No. of interviews</b>
<b>Pauri Garhwal</b>	17	19
<b>Tehri Garhwal</b>	14	20
<b>Almora</b>	22	25
<b>Lansdowne</b>	8	8
<b>Mussoorie</b>	6	8
<b>Total</b>	67	80*

**\*The 80 interviews included 69 interviews of people affected by leopard attack on humans, 2 interviews with people affected by bear, wild pig attack and the remaining nine were those who lost livestock to leopards.**

A total of 133 attacks on people by leopards occurred between 2007 and 2012 in the four highly affected Forest Divisions of Pauri Garhwal, Tehri Garhwal, Almora and

Lansdowne. Of these 133 attacks, we could interview 69 human attack victims/victim associates in 67 villages. The other 64 victims were from villages that we could not easily access. 97% of the 69 incidents had occurred between 2007 and 2012 and the remaining 3% (two interviews) of the incidents had occurred before 2007. This was because we interviewed all the affected people we met in the villages we visited. The locations of these interviews are shown in Figure 4, and largely correspond to the attack locations.

**Figure 4: Map of the conflict locations where interviews were conducted (N=69)\***



**\*The GPS coordinates on this map correspond to the interview locations of attacks between 2007 and 2012 (N=69). The interview location is at or within 100 m of the location of the leopard attack.**

In addition to the above 80 interviews, a total of 35 key stakeholders were interviewed between March 2014 and January 2015 to obtain their views on the leopard issue (Table 2). The interviews included prominent members of the local community (eight interviews), NGO's (five interviews), Forest Department authorized hunters of leopards declared as man-eaters (five interviews) and forest department personnel which included senior forest officials as well as ground level field staff (17 interviews).

### **Analyzing livestock depredation by leopards**

The Forest Department compensation data between 1998 and 2012 for leopard attacks on livestock was found to be incomplete and we were unable to capture records prior to 2004 (Figure 2), rendering any analysis meaningless. The summary of livestock compensation data was maintained by the forest department only after 2004. Since it was not possible in this study to summarize the records prior to this from the detailed records of the

department, hence analysis of livestock data was carried out for records only after 2004. In addition, in the early years, many village people did not know about the procedure for compensation and hence did not file claims. This issue continues to be so for claims for livestock losses, especially in remote areas, where access to the Forest Division office is difficult.

**Table 2: Summary of interviews of stakeholders**

<b>Stakeholder</b>	<b>No of interviews</b>
<b>Local community</b>	8
<b>NGO's</b>	5
<b>Forest Department personnel</b>	17
<b>Hunters</b>	5
<b>Total</b>	35

#### **Analyzing the nature of human attacks by leopards**

In the case of leopard attacks causing human injury or death, forest department compensation data listed 874 human incidents over a period of 14 years (Figure 2) with an average of 60 attacks per year on people.

69 interviews of leopard attack victims and victim's associates were conducted in four Forest Divisions (Table 1). These incidents represented 52 % of a total of 133 leopard attacks on people in these Forest Divisions. Of the 69 victims, 21 people died and of these 21, in seven incidents, the leopard had fed on the bodies. The remaining 48 people suffered injuries in the leopard attacks. 60% of the victims (N=69) were female, and the remaining were male. 27% of the victims (N=69) were less than 18 years old and 73% were older than 18 years (total of 48 affected people).

73 % (N=69) of the leopard attacks on people were away from the forest; 21 % of the incidents occurred in fields, 29% in or near homes and 20 % on the road while the rest of the attacks occurred in forest habitat (27%). Half the 69 incidents occurred during the day, the rest between sundown and sunrise. The seasonal spread of the leopard attacks (Table 3) showed attacks on people had occurred throughout the year. However, it has to be noted here that this information represents 52% of the total number of people attacked in the Forest Divisions.



**Table 3: Month wise break up of leopard attacks on people in our study area based on our interview set (N=69)**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
No of incidents (N=69)	5	7	12	5	5	1	10	4	5	2	7	2

### **Analyzing the landscape where leopard attacks occurred and description of human activities during the attacks**

Uttarakhand has 65% forest cover (FSI, 2014) and during the interviews we enquired the nature of the habitat in the environs of the attack site; 65 % (45 incidents, N=69) of the incidents took place in areas where the forest near the village consisted mainly of Chir pine (*Pinus roxburghii*), 29% (20 incidents, N=69) of the incidents took place inside or near the home, more than 50% of the incidents took place outside homes when activities such as cattle grazing, fodder collection or firewood collection were being carried out. Less than 6% of the incidents took place when people were visiting the outdoors for defecation.

The interview data revealed that in the period 2007 to 2012, in 65% (44 villages, N=69) of the villages, only a single leopard incident had occurred during this period. In another 17% (11 villages) of the villages, two incidents had taken place in the same time frame.

### **Livestock depredation (local community perceptions)**

Local community perceptions on livestock depredation were collected during the 80 interviews that were conducted in the areas of high (72 interviews) and low conflict (8 interviews) intensity. The data generated was not robust enough to decipher any specific patterns for livestock depredation in areas of high and low conflict. 82% (56 respondents) believed that livestock depredation by leopards had increased in the last five years. 79% (54 respondents) of the interviewees felt that the tended livestock population in the village had decreased and mentioned that people are rearing less livestock. 36% (25 respondents) of the interviewees stated that population of feral cattle in the village had increased. 33 % of the interviewees (23 respondents) stated that there were some feral cattle in the village. Not everyone was aware of the compensation offered and the procedures involved. People mentioned that residents living in remote areas did not generally apply for compensation because the effort required to do so was very high.

### **Leopard attacks on humans (local community perceptions)**

94% (65 respondents) of the interviewees believed that the leopard population had increased. 42% (39 respondents) of the interviewees believed that the incidents of leopard attacks on humans and livestock had increased in the last 5 years, while 43% believed that

conflict intensity had remained unchanged. Most people were not satisfied with the speed of response and the conflict resolution mechanism of the Forest Department.

It is perceived that the lack of toilets is responsible for leopard attacks (especially on women who tend to go outdoors to defecate early in the morning or late in the evening) but 42 % (29 respondents) stated that more than 75% of the people in the village had toilets at home. On the other hand, 28% (19 respondents) stated that less than 25% of the village had toilets at home. When we consider the information from Pauri Garhwal, which is the Forest Division with the highest number of leopard attacks on people separately, more than 56% of the respondents stated that more than 75% of the homes in the village had toilets.

### **Causes and solutions to conflict (local community perceptions)**

During the course of local community engagement, we had asked people to provide their perceptions of the causes for the conflict and potential solutions (Table 4, Table 5). The top five causes as viewed by people are increase in weeds such as *Lantana* and *Eupatorium*, reduction of wild prey base, increase in leopard population, lack of and decrease of suitable forest habitat for leopards and increase in forest fires resulting in decreased prey base. We had also asked the local community to provide their perceptions of potential solutions to the leopard conflict. The top five solutions proposed by the local community is increased education and awareness about reducing the chances of leopard attacks, increase in leopard prey base, better quality forest for the leopard, decrease in *Lantana* and *Eupatorium* and more responsible media reporting.

Twenty-two respondents believed that increased education and awareness on how the leopard attacks could be minimized, on the need to ensure that a mob-like behaviour does not result in inappropriate action such as an incorrect leopard being hunted down, as well as the need for a measured, scientific response to manage leopard attacks was needed. Eight respondents suggested that the media needed to play a more responsible role in portraying the conflict in a balanced manner rather than sensationalizing the leopard conflict and stirring up local emotions preventing a rationale and measured response to the conflict. It is important to note that the causes and solutions mentioned here are only perceptions of the local people.

### **Stakeholder engagement**

A second part of the interviews constituted engagement with 35 stakeholders including prominent members of local community, hunters authorized by the forest department to kill declared man-eaters with due Forest Department approval, NGO's and Forest Department personnel. A summary of insight from these engagements is mentioned below. As many of the viewpoints of stakeholders matched those of the local community, we are capturing only key similarities or differing points of view below.

### Stakeholder perceptions about the leopard issue in relation to attacks on humans in Uttarakhand

- 70 % of the stakeholders felt that leopard attacks on people has increased in the last 5 years.
- Leopard population: Varied responses by stakeholders with views varying from stable to increased population. One of the hunters believed that the leopard population in Uttarakhand is between 5,000 to 13,000 leopards.
- Mitigation measures by the forest department have improved in the last five years with speedier compensation payment, especially for attacks on humans (FD view).

**Table 4: Causes of leopard incidents as perceived by the affected people**

1	Increase in Lantana and Eupatorium	39
2	Lack of wild prey for the leopard	27
3	Leopard population is increasing	24
4	Lack of suitable leopard habitat/Decreasing forest	20
5	Increase in forest fires	17
6	Decrease in water availability in forest	11
7	Increase in stray dog population	7
8	Increase in feral cattle	7
9	Increase in livestock population	5
10	Decrease in livestock population	5
11	Decreased agriculture	4
12	Decrease of people activity due to people migration from villages	3
13	Shifting of leopard population from plains to hills	3
14	Decrease visitation by people to forest	2
15	Decrease in human population	1
16	Increase visitation to forest by people	1
17	Hunting of wild animals	1
18	Availability of food within village like stray dogs and cattle	1
19	Increasing forest near village	1
20	Creation of roads in village leading to easier access to wild animals	1
21	Increase in <i>chir</i> pine	1

22	Leopard released by forest department	0
23	Tiger population decrease	0

**Table 5: Potential solutions to the conflict as perceived by affected people**

1	Increased education and awareness	22
2	Increase prey availability for leopards	21
3	Better quality forest habitat for leopards	14
4	Decrease lantana and other bushes	9
5	Better media reporting	8
6	Make water available in forest	8
7	Better designed animal shelters	7
8	Catch leopards in cages and relocate	6
9	Control and reduce forest fires	6
10	Allow to kill leopard or FD should kill	6
11	Decrease human dependence on forest	3
12	Reduce leopard population	3
13	Make special parks for leopard	2
14	Speedier appropriate compensation measures	1
15	Census of leopards	1
16	Create forest department office near village	1
17	Reduce stray dogs	1
18	Reduce forest entry at night	0

**Stakeholder perceptions about the leopard issue in relation to attacks on humans in Uttarakhand (cont'd from page 10)**

- The issue has gained in prominence with increased media coverage, quicker information dissemination (mobiles, television) resulting in more vocal local communities and hardening of attitudes. (All stakeholders view).
- Situations related to leopards are often viewed as “entertainment” by members of the local community making scientific response difficult (FD view).
- People want instant solutions; show greater impatience and more forceful in stating demands (FD view).

- Permission process to get approval to kill “man-eating” leopards is cumbersome and time consuming. (Local community, hunters and NGO view).
- Hunters are not or poorly compensated by the Forest Department. (Hunter view).
- FD responses to conflict in PA’s and outside PA’s is different (FD view).

### **Stakeholder perceptions about the causes of leopard attacks on people**

- Increased population of leopards (Most stakeholders, though some FD personnel believed that the population could not have increased on account of increased poaching and retaliatory killing).
- Prey base and water decline in forest, increased population of feral cattle as residents leave villages and move to the plains, shift in leopard diet from wild animals to livestock (All stakeholders).
- Increased proximity of humans to leopards on account of spread of human habitation to forest edges, especially in urban areas (FD view).
- Decreased forest cover not a reason for the conflict, as leopards have always visited human habitation (Hunter & FD view).
- Issues related to leopard attacks on people and livestock not sufficiently highlighted as an electoral issue (NGO view).
- Change in leopard behaviour-no longer afraid of people (All stakeholders).
- Decline of tiger population in higher altitudes in the last decade leading to increased occupation of leopards in this habitat (Local community view).
- Increased *Lantana* & *Eupatorium* providing cover for leopard (All stakeholders).
- “*Palaayen*” which is the phenomenon by which the hill people migrate to the plains appears to play a role according to the people interviewed. *Palaayen* (or migration) decreases agriculture, villages have fewer young people on account of migration to cities, and are largely inhabited by older people. Younger people are also no longer interested in agriculture therefore leading to greater abandoning of fields and reduced acreage under cultivation (All stakeholders).
- Increased reproduction of leopards and higher survival rate of cubs due to abundant feral cattle as prey base (Hunter view).
- More aggressive during breeding and cub rearing? (Hunter view)
- Better sanitation and use of indoor toilets...still low, despite having toilets at home...running water, traditional habits (NGO view).
- When questioned if poaching of leopards has increased or decreased in recent times, we obtained differing views depending on the stakeholder, with varying views even amongst FD personnel. The FD feels that there is better reporting today, and hence more incidents of leopard poaching get highlighted (FD view, local community view).
- Increased forest cover near habitation makes leopards come near semi urban areas leading to attacks on people e.g. Forest Research Institute, Dehradun (FD view).
- Shift of leopard populations to sub-optimal habitats brings them closer to humans leading to attacks on humans (FD view).



- Better quality cattle, raised inside or near homes leading to reduced forest visitation by villagers (Most stakeholders).
- Lack of vigil by humans leads to attacks on people by leopards who are vigilant only for a few days after a leopard attack (All stakeholders).
- Leopard's behaviour change has lead it to attack livestock more than wild prey (All stakeholders).

### **Potential solutions for decreasing attacks on people and livestock (stakeholder perceptions)**

- Increased awareness and education for people sharing habitat with leopard populations, media, forest department and other stakeholders (All stakeholders).
- Lack of data on leopard population and prey base density (All stakeholders).
- The need was felt for an effective rural sanitation program that would increase the number of toilets inside homes to reduce forest visitation for defecation, especially by women during early mornings and late evenings (All stakeholders).
- All the stakeholders, including Forest Department officials stated that the current FD response was a reaction to leopard attacks on people with no attempts made to understand this issue, and to mitigate it on a pro-active manner, both inside Protected Areas and outside Protected Areas where a large leopard population still exists (All stakeholders).
- All the stakeholders mentioned that FD approval process to obtain permit for killing a leopard in response to a human attack requires improvement and has limited scientific basis. (All stakeholders).
- There was a need expressed for improved and more mature media reporting (All stakeholders).
- Reduce feral cattle in the villages by making cattle shelters (NGO view).
- Rapid response teams manned by competent professionals of forest department to deal with leopard attacks on people in a scientific manner, in the shortest possible time in high conflict areas are required (Local community view).
- Program to reduce *Eupatorium* and *Lantana* growth in villages because it is often stated that their presence leads to leopard attacks on people (All stakeholders).

### **Discussion**

#### **Insights into the leopard human conflict based on engagement with the local community and stakeholders.**

The analysis of the Forest Department compensation data from 1998 to 2012 of attacks on humans by leopards indicates that there is no clear trend that of increasing attacks by leopards (Figure 2), despite perceptions of all stakeholders to the contrary. A previous study by Goyal et al. (2000; 2007) related to human attacks by leopards carried out in Pauri Garhwal between the period 1988 and 2005, too, revealed no consistent pattern on the number of leopard attacks on humans over the study period, though Goyal (2007) did report a correlation between leopard deaths (poaching, retaliatory killing and official killing) and human deaths. Goyal (2007) reported that in

two blocks, Pabua and Dugdda, human deaths declined in the years following increased leopard deaths through retaliatory killing, implying a reduction in the leopard population in the area. However, this trend was not replicated when examined at the State level as shown in Figures 2 and 6 of Goyal (2007). Yet, discussions with members of the local community and stakeholders (prominent members of the local community, Forest Department personnel including field staff and managerial staff, Forest Department appointed hunters of leopards and NGO's) revealed that both groups believed that the leopard attacks on humans had increased, even though this is not borne out by Forest Department data.

However the Forest Department data also indicates that an average of 60 attacks per year on people by leopards occurred between 1998 and 2012. This is extremely high and Uttarakhand has been a state uniquely affected by chronic leopard attacks on people since a very long time. Despite the conflict's existence for many decades, there has not been any resolution with respect to this issue. The only mitigation measures used are payment of compensation and killing or translocation of a leopard (which might not necessarily be the one involved in the humans attack). Furthermore, some districts have been chronically reporting attacks on people while others that report presence of leopards and similar landscapes and human densities do not report the same extent of human attacks by leopards.

The perceptions of many stakeholders were that the leopard population in the State had increased leading to increased leopard attacks. 94% (65 respondents, N=69) of the people affected by leopard attacks believed that the leopard population had increased. However, people were not able to differentiate between increased sightings of leopards and increased population of leopard.

The Uttarakhand Forest Department census for the leopard population inside and outside Protected Areas is mentioned below (<http://forest.uk.gov.in/files/wildlife.pdf>) with 2,335 leopards listed in the State in 2008 (Table 6):

**Table 6: Uttarakhand Forest Department leopard population data**

	2003 in PA	2003 Outsid e PAs	2003 total no of leopar ds	2005 in PA	2005 Outsid e PAs	2005 total no of leopar ds	2008 in PA	2008 Outsi de PAs	2008 total no of leopar ds
No of leop ards	537	1555	2092	567	1538	2105	593	1742	2335

However, this data is not likely to be reliable as it uses pugmarks, which are known to be unreliable in enumerating wild cat numbers.

Furthermore, it is commonly, though mistakenly, believed that leopard population and density are linked to leopard-human conflict. Research in Maharashtra revealed that it was the human intervention in the form of large scale capture and release that was related to the increased attacks on humans rather than density of leopards or people (Athreya et al, 2007; 2011, 2013). In the winter of 2014, a leopard census in SGNP found a density of 22 individuals in 100 sq. km and not a single incident of human attack although the minimum density of people around the Park is 20,000 people per sq. km (Surve et al., 2015).

A key issue discussed with the local community was the veracity and completeness of the FD compensation data related to human attacks. Unlike that suggested by Mathur (2014) who stated that “dubious statistics” exist for deaths and injuries caused by leopard attacks, responses by most members of the local community lead us to believe that all leopard attacks on humans, whether causing injury or death, are reported, unlike livestock depredation, which may go unreported.

Based on the interviews conducted, 60% (41 respondents, N=69) of the victims were female, while 40% were male. However, the pattern might be different if the entire sample size of 133 attacks between 2007 and 2012 is examined. The higher proportion of female attacks is probably on account of the larger share of outdoor activities that women in the hills are involved in and this could possibly lead to them bearing a disproportionate part of the costs associated with the HWC (Ogra, 2008).

27% of the victims (19 affected people, N=69) were less than 18 years old and 73% were older than 18 years (48 affected people). However, the pattern might be different if the entire sample size of 133 attacks between 2007 and 2012 is examined. When Goyal's data was compared with our data only for Pauri Garhwal, the same trend was seen (21% of the victims were children <18 years; Goyal, 2007). This is different from Maharashtra (Athreya et al, 2011) where 25% of the attacked people were children less than 14 years of age before the translocation program of leopards which went up to 51% during the period when leopard translocations were taking place.

Of the victims (N=69), leopard attacks led to the death of victims in 31% (21 people) of the cases of which, 31% (7 people) of the bodies were eaten. However, in many cases the leopard was often scared off by people. The victims were eaten only in those cases where the human death had gone unnoticed and the leopard had an opportunity to return to the victim's body to feed. In no case was the body of a victim left unattended for the leopard to feed on, though this happened quite often if the leopard kill was that of a cow or a buffalo. If a leopard preyed upon a goat, the villagers often recovered the goat's remains

to eat, if the kill was fresh. Local religious beliefs do not permit Hindus to feed on beef, but mutton from goat or sheep is readily consumed.

Of the 52% of the human attack cases we sampled from the four highly affected districts (Pauri Garhwal, Tehri Garhwal, Lansdowne, Almora), majority (63%) of the leopard attacks on people occurred in fields, in or near homes and on the road, away from forested habitat. Goyal (2007) reported that habitat degradation was one of the main reasons for the leopard-human conflict. However, the data from the study (Goyal, 2007; Figure 11) itself showed that there was no difference in area under forest, scrub and human habitation between areas of low, medium and high rates of leopard attacks on humans. No clear seasonal pattern of leopard attacks on humans emerged from the Forest Department records, which was also seen in Goyal et al. (2000; 2007).

The lack of indoor sanitation facilities has often been attributed as a cause for leopard attacks, especially on women at dawn and dusk (Goyal et al., 2000). This was not substantiated in our surveys with less than 6% of the incidents have occurred when people were outdoors for defecation. Our interviews revealed that toilets were increasingly being built in homes; however, this does not necessarily imply increased usage. Toilet usage depends on other factors such as indoor toilet hygiene reflected by the lack of running water in the toilet as well as the fact that for women, stepping out together provides them with an opportunity of socializing without the presence of the men-folk. In the area of highest conflict intensity i.e. Pauri Garhwal, 56% (N=25) of the respondents stated that >75% of the homes in the village had toilets versus an average of 42% for all the other villages we visited.

One of the beliefs of the local community, especially in areas of with high numbers of leopard attacks on people was that the leopard enters homes and attacks people (pers. comm., interviews). From the information obtained during our interviews, 29% of the attacks occurred near houses and a few of the attacks occurred even when other people were around. We regard this as aberrant behaviour because the first response of a leopard or any other wild animal is to move away from human presence. Also, in three other cases of large felid attacks on humans, lions in Tanzania (Packer et al., 2005) and in Gir (Saberwal et al., 1994) and leopard attacks in Pune district (Athreya et al. 2004/5 report) the behaviour of the large cats was noted as strange with them entering houses and killing people, as well as killing people when they were in the presence of other people and livestock as well.

The perception that the leopard repeatedly strikes in certain villages in high conflict Forest Divisions was not borne out from the interviews but the attacks appear to be clustered in the region. Although 82% of the villages (N=69) we visited reported only one or two attacks in the five-year period 2007-2012, the GPS locations of the 69 attacks appeared to be closely spaced (Map 1). Our interviews represented 52% of the attacks in the four Forest Divisions with high conflict intensity; however, GPS data to spatially map

100% of the conflicts is currently unavailable. It also should be noted that due to the hilly terrain, villages can be very far off from the perspective of the villagers but locations can be close by with respect to how a leopard uses the landscape.

In areas of high conflict intensity, the fear of leopard was seen consistently across all respondents. Many of the interviewees stated that they lived in constant fear of the leopard, and their day-to-day lives were impacted by this fear. As an example, in areas of high conflict, children are no longer sent to school alone, but are mostly accompanied by an adult. In addition, children and adults are discouraged to travel long distances within the village after sunset. If at all people travel outdoors at night, they attempt to do so in groups. However, this attitude did not necessarily result in a strong call for killing or translocation of leopards. Only six people (N=69) responded to killing of leopards or translocation of leopards as the preferred solution to this conflict. This also could have been because Forest Department personnel accompanied us to most of these remote villages and even though they were not necessarily present during the interviews, their presence itself might have elicited a less-than-frank response on retaliatory killing or translocation of leopards. Hence these contradictory feelings of fear of the leopard on the one hand, and the love of nature and a deep-rooted tolerance resulting in an acceptance of co-existence with the leopard on the other hand is consistent with other attitudinal studies of the leopard-human conflict (Jhamvar-Shingote & Schuett, 2013). Though there was no call for mass killing of the leopard from affected people, the responses and mindsets of people immediately after a leopard attack are different, and there are often stringent calls to kill the leopard responsible for the attack.

Interviews with the local community in the Mussoorie Forest Division showed that despite the presence of leopards, attacks on humans had not occurred at all. While the local community experienced livestock depredation, there was no fear of the leopard, as shared by respondents living in areas of high leopard attacks on humans. Although subjective, the quality of forest in the areas of low leopard attacks on humans was not significantly different from areas where attacks were high. Also, respondents in areas of low number of attacks also stated that wild prey in their forests had also decreased with time.

While the Forest Department compensation data for livestock was not considered robust enough to be analysed meaningfully, livestock depredation is an important facet to understand the leopard human conflict. Goyal (2007) reported that Forest Department data for Pauri Garhwal showed livestock losses of 130 individuals per year for the period 1996-2000, compared with 86 livestock losses per year over a 10-year period (1990-2000) thereby showing an increase in livestock depredation. However, it remains to be seen whether this was actually an increase in depredation or just an increase in reporting of livestock depredation. In addition, Goyal's survey revealed livestock loss estimates of 260 individuals per year (Goyal, 2007), which is higher than that shown through Forest Department compensation records. A significant number of the respondents (82%)



believed that livestock depredation has increased, similar to the findings of Goyal (2007). Interviews with the local community revealed that not all people reported livestock depredation. This was because a) the low amount of compensation being offered b) the high effort required to claim the compensation. We also determined that many people were not familiar with the procedures for compensation, unwilling to undergo the pains of garnering compensation on account of bureaucratic lethargy and hence shied away from filing for compensation.

Mathur (2014) captures some of the problems the local people face while obtaining compensation. People in remote villages could not justify time and effort, and hence would not report livestock losses. It is pertinent to note that the compensation amount for livestock has increased in 2012 and this might increase the livestock depredation claims in the years to come. Interviews with the forest department officials indicated that increase in compensation for livestock depredation may also lead to an increase of false claims being filed.

Though Goyal (2007) reported a negative correlation between human deaths and livestock mortality; i.e. higher livestock depredation in areas of lower human attacks, no such trend emerged during our interviews. The decrease in livestock population was also seen in areas of low conflict intensity, and the reasons for this are largely driven by the phenomenon of “*palaayen*” (migration) and the lack of people willing to take care of livestock. In addition, many respondents stated that the lack of people to tend to cattle, the decrease in livestock, and increased availability of cattle fodder close to the village meant that fewer people were taking cattle out to the forests to graze, thereby resulting in fewer opportunities for the leopard to predate on cattle in the forest. The decrease in cattle being tended to by villagers and the trend of people leaving the hills for the plains has resulted in an increase livestock being released in and around the village, largely unattended, resulting in an increasing population of feral cattle in and near villages which in turn could increase the prey base for leopards. It is likely that the cattle that has been let loose might form an important part of the leopard’s diet in this landscape and is something that needs to be studied.

In the villages that we visited, a significant social issue was people migrating to the plains (a phenomenon described by local people as “*palaayen*”). The average estimate of the abandoned homes was 28% in the villages we visited. However, it is unlikely that the leopard conflict has any bearing on this issue, which is a complex social issue with numerous factors contributing to the phenomenon, which is not unique to Uttarakhand.

Some of the other issues that were raised during the consultations with local communities and stakeholders were whether leopards are reacting to retaliatory killing and poaching by compensating through increased reproduction. Weilgus & Peebles (2014) showed evidence that wolves compensate for retaliatory killing by increased reproduction but there is no evidence to show that this is true for felids, it might be a factor to investigate.

Another unanswered question was whether the availability of abundant livestock as prey and abundance of plant cover is leading to better survival rate of leopard cubs but that is unlikely to have any bearing on their attacks on people.

### **Insights into perceived causes and solutions through the engagement with the local community and stakeholders**

Discussions with members of the local community and stakeholders (prominent members of the local community, Forest Department personnel including field staff and managerial staff, Forest Department appointed hunters of leopards and NGO's) on perceived causes and solutions were listed in Table 4 and Table 5.

Notwithstanding these suggestions, there remains little scientific evidence to prove or disprove these perceptions as very limited scientific work has been done in Uttarakhand to address the leopard conflict since Goyal's studies.

Another factor that was stated as the cause for increased leopard sightings in villages is the extensive village road network that has been created under the Pradhan Mantri Gram Sadak Yojana (PMGSY) ([www. http://pmgsy.nic.in](http://pmgsy.nic.in)), which started in 2000. Under the PMGSY scheme, lakhs of kilometers of new village and upgraded roads are being constructed. Many of the villagers we spoke to mentioned that the leopards are using these very roads, and hence are seen far more frequently than previously.

### **Conclusions and recommendations**

The data that this study has relied upon to designate hotspots of conflict is in variance with other data sources (Table 7a & b). Data compiled by us from Forest Department compensation records are inconsistent with the data in the Uttarakhand State Paper, 2001 and with the data in Goyal (2007).

**Table 7a. Inconsistency in leopard-human incident data (Uttarakhand State Paper 2011 versus Forest Department Compensation data).**

Data source	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
<sup>1</sup> Uttarakhand State Paper 2011	92	81	73	54	57	72	59	29	23	10	92
<sup>2</sup> FD compensation data (Uttarakhand)	81	91	84	55	14	80	82	57	85	39	53

<sup>1</sup>Leopard-human incidents based on Uttarakhand State Paper, 2011

<sup>2</sup>Leopard-human incidents based on Forest Department compensation compiled from Forest Divisions

**Table 7b. Inconsistency in leopard-human incident data (Goyal, 2007 vs. Forest Department Compensation data)**

Data Source	1998	1999	2000	2001	2002	2003
<sup>1</sup> Goyal, 2007 paper	17	48	21	22	41	8
<sup>2</sup> FD compensation data (Pauri Garhwal)	3	15	27	20	37	25

<sup>1</sup>Leopard-human incidents based on Goyal (2007) from Pauri Garhwal

<sup>2</sup>Leopard-human incidents based on Forest Department compensation compiled from Forest Divisions for Pauri Garhwal

Perceptions of the local community on issues such as leopard populations, increased attacks on human in recent years, repeated attacks by leopards in the same village as well as some of the causes and solutions for the leopard attacks on humans are at odds with the analysis based on the limited data that we have. There is clearly a need to dispel misinformation amongst the local community, media and other stakeholders on the attacks on humans by leopards.

In addition, the conclusions by Goyal (2007) on the factors leading to leopard attacks on humans, namely habitat degradation, depletion of prey species and an increase in leopard population at a few sites are not corroborated by evidence presented in their paper.

In addition, Goyal's study of the conflict does not answer the key questions-why is the conflict in Uttarakhand so high in certain regions, and not so high in other, apparently similar habitats, with both areas having leopard populations.

The previous studies on the attacks by leopards on humans in Uttarakhand, as well as our social survey raise many unanswered questions that need to be addressed through social, ecological and behavioral studies in areas with leopard populations where the attacks on humans are high, as well as areas where the attacks do not occur.

#### **Further study: key unanswered questions**

*Differences between high and low conflict areas:* What are the significant differences in leopard-wild prey populations, habitat quality, feral cattle populations, land use patterns and people's attitudes the conflict in areas of low and high conflict intensity based on scientific evidence?

*Leopard habitat and wild prey dynamics: does it really matter?*

The lack or reduction in the wild prey base for the leopard has often been said to be an important cause for the conflict (Goyal, 2000; 2007). However, Goyal's study revealed that >95% of the leopard's prey base constituted domestic livestock based on scat

analysis. In addition, his study also showed areas of low, medium and high intensity of conflict has no difference in the relative abundance of livestock (Goyal, 2007; Table 3). Table 8 shows that the average livestock density across high conflict areas in the State varies from 72 to 171 animals/sq. km buttressing the theory that livestock density has no or low correlation with conflict intensity. During a study in Mandi District, Himachal Pradesh (Kumar, 2011), 66% of the leopard's prey base was domestic livestock based on scat analysis. Athreya (2014) reported that 87% of the leopard prey-base based on scat analysis consisted of domestic animals in a human-dominated landscape in western Maharashtra. Shehzad *et al.* (2014) reported that 95% of leopard prey consisted on domestic species in a study in Ayubia National Park in Pakistan. Given the ease of predating on livestock versus wild prey, the key question is whether wild prey densities, given sufficient prey biomass of domestic animals, do at all matter for leopards in human-dominated landscapes.

In Ahmednagar district, the average livestock density is 176 livestock head per sq. km (Athreya, 2014), which is higher than that in the high conflict areas in Uttarakhand (Table 8) and there is no comparable conflict in relation to human attacks in that region. The Uttarakhand State average of livestock head is 93 head per sq. km (Livestock Census, 2003).

**Table 8 (Livestock Census, 2003)**

District	Livestock density, animal/ sq. km.
Pauri Garhwal	114
Bageshwar	116
Almora	171
Tehri Garhwal	89
Pithoragarh	72

*What is the link, if any, between leopard-human conflict and retaliatory killings and poaching of leopards?*

There is an increasing trend of leopard deaths in Uttarakhand (Table 9). Though leopard deaths by natural causes is the highest, many deaths attributed to natural causes may actually be retaliatory killings as it may not always be possible to decipher the cause of death by the postmortem of the carcass. In two blocks in Pauri Garhwal, Goyal (2007) reported a trend of decreasing human deaths with increasing leopard deaths. However, the impact of poaching and retaliatory killings and the role it plays, if any, in the human-leopard conflict is yet to be understood.

**Table 9: Leopard deaths in Uttarakhand**

	<b>Man-eaters killed</b>	<b>Leopard deaths by natural causes</b>	<b>Accidental</b>	<b>Illegal hunting</b>	<b>Total/year</b>
<b>2001</b>	<b>3</b>	<b>14</b>	<b>16</b>	<b>8</b>	<b>41</b>
<b>2002</b>	<b>3</b>	<b>14</b>	<b>3</b>	<b>13</b>	<b>33</b>
<b>2003</b>	<b>9</b>	<b>19</b>	<b>7</b>	<b>5</b>	<b>40</b>
<b>2004</b>	<b>2</b>	<b>28</b>	<b>18</b>	<b>5</b>	<b>53</b>
<b>2005</b>	<b>2</b>	<b>25</b>	<b>11</b>	<b>2</b>	<b>40</b>
<b>2006</b>	<b>8</b>	<b>23</b>	<b>23</b>	<b>1</b>	<b>55</b>
<b>2007</b>	<b>5</b>	<b>41</b>	<b>14</b>	<b>6</b>	<b>66</b>
<b>2008</b>	<b>0</b>	<b>47</b>	<b>27</b>	<b>0</b>	<b>74</b>
<b>2009</b>	<b>11</b>	<b>54</b>	<b>19</b>	<b>5</b>	<b>89</b>
<b>2010</b>	<b>2</b>	<b>25</b>	<b>26</b>	<b>7</b>	<b>60</b>
	<b>45</b>	<b>290</b>	<b>164</b>	<b>52</b>	<b>551</b>

It is important to note that despite continued retaliatory killing of leopards in areas of high conflict intensity, the conflict has really not reduced over time in Uttarakhand. As no scientific basis for identifying and killing of leopards responsible for human attacks exists, the efficacy of removal of leopards from a landscape of high conflict remains suspect. Small-scale removal of large cats from landscapes does not reduce their populations as other individuals occupy the vacuum created by the animals that have been killed (Gross 2008; Loveridge et al. 2010). Therefore, the current practice of removal through translocation or killing of leopards is unlikely to be a solution and can even increase the conflict.

*Forest Department response mechanism:* Mapping of the Forest Department response to the leopard-human conflict in PA/non-PA's and suggesting improvements thereof based on scientific inputs from other studies (Athreya, 2006). Based on discussions with local community and Forest Department staff, the existing Forest Department response mechanism to leopard attacks on humans is either one of using cages or chemical capture to trap the leopard for translocation or to authorize local hunters to shoot the leopard after the Chief Wildlife Warden of the State has given written permission. Translocation as a conflict mitigation strategy continues to be used despite the fact that numerous studies have questioned effectiveness of translocation as an effective mitigation strategy to human-wildlife conflict (Athreya, 2006; Massei et al., 2010; MOEF, 2011) and only a few



scientific studies of leopard behaviour after translocation are available in India (Athreya, 2010; Mondal et al. 2013). Most of the operating level staff of the Forest Department was unaware of the guidelines issued by the Ministry of Environment and Forests for managing leopard conflict (MOEF, 2011). However, senior level forest staff and PA managers had knowledge of the guidelines but admitted in private that implementing the guidelines on the ground were difficult.

### **Recommendations**

- Putting in place a Management Information System (MIS) system by the Uttarakhand Forest Department to collect human-wildlife conflict data that is authentic, meaningful and easily retrievable.
- Need to initiate an ecological and social study to understand why some Forest Divisions have greater conflict than other Divisions, despite similarity in leopard populations, prey base and habitat in order to understand the causes of the leopard attacks better. The traditional explanation of prey base depletion, habitat degradation and high leopard populations do not sufficiently explain why the attacks on humans are taking place in some areas, and not in others. Hence, there is a need to conduct appropriate studies in high and low conflict areas.
- Sensitizing local communities, media and other stakeholders to the leopard attacks on humans to ensure that responses to leopard attacks are measured and with a scientific basis. This should also include local capacity building for forest staff in public relations as well managing conflict including familiarity with and implementation of MOEF guidelines to the leopard-human conflict.
- Revisit and deliberate the strategy of removal of problem leopards from areas where leopard attacks on humans is high, as a mitigation measure, as the efficacy of this action is in doubt.
- Given the feedback of stakeholders about the need for an improvement in the Forest Department response mechanism, well equipped and trained Rapid Response Teams in high conflict areas: Garhwal, Bageshwar, Tehri, Pithoragarh, Almora should be immediately initiated.

Scientific answers to the above questions are crucial to find innovative ways of protecting the significant biodiversity that resides outside of Protected Areas (Mathur & Sinha, 2008) to minimize conflict between leopards (as well as other biodiversity) and humans.

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ANNEXURE 1

**PROJECT: LARGE FELID CONFLICT IN UTTARAKHAND:  
ASSESSING PEOPLE'S PERCEPTIONS TO THE CONFLICT**

Questionnaire for local community:

Date of interview:

Location/district of interview:

GPS reading:

Interviewed by:

Name of interviewee:

Mobile no:

Occupation of interviewee: Agriculture/livestock/hotel industry/shop owner/laborer/diary

Level of education:

Age:

Sex:

Caste:

Category of interviewee: Local community

Victim of

a) human loss/injury: death or injury.

Name of victim/relative:

Injury type:

Date of incident:

Name of village:

Time of incident:

Location of incident:

b) livestock depredation

Type of livestock:

buffalo/cow/goat/dog/other

Date of incident:

Name of village:

Time of incident:

Location of incident:

GPS reading, if possible:

c) not victim

A. Social and personal data

Family size	Adult Male	Adult Female	Young Male >16-21 years	Young Female >16-21 years	Children<16 yr
Today					
10 years					

ago					
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No of members involved in agriculture:

Land holding size:

Do you have a toilet in your home?: Yes/No

Do you have lighting outside your home?

Livestock holdings

Livestock holdings	Buffalos & Cows	Goats & Sheep	Dogs & Cats	Chickens, others
Today				
5 years ago				
Mortality rate over last 5 years				
Reasons for mortality				

B. Leopard conflict

Are there significant incidents of human injury and livestock depredation by in your area?  
Yes or No

Have these incidents increased in the last five years?

Increased or decreased

**Causes for increase/decrease of leopard incidents (human conflict)**

What do you think are the number of incidents/year wrt to human deaths or injuries in your locality?

	Leopard incidents/year Human deaths/injuries	Remarks
Five years ago		
Today		

What do you think are the reasons for increase/decrease in leopard incidents for human deaths/human injuries? List as many reasons as possible.

Open-ended response:

Where did these incidents mainly occur? Forest/village/Tok/fields/elsewhere

Which month/s or season/s is the leopard conflict at its peak?

What activity was being conducted when this incident occurred? Grazing cattle, collecting firewood, hunting, others.

What are the top 3 three causes for increase/decrease of leopard incidents in your area? Feel free to add your own reasons. Rank 1-3.

Causes	Human deaths/injuries	Remarks
Availability of suitable leopard habitat		
Availability of wild prey for the leopard		
Leopard population		
Increase in human population		
Increased visitation to forest habitat by people		
Increase in livestock population		
Increase in stray dogs population		
Increase in lantana growth		

**Causes for increase/decrease of leopard incidents (livestock depredation)**

What do you think are the number of incidents/year w.r.t to livestock depredation in your locality?

	Livestock depredation-type of livestock: cows, buffalos, goats	Number of livestock
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Five years ago		
Today		

What do you think are the reasons for increase/decrease in livestock depredation by leopard incidents in your area? List as many reasons as possible.

Open-ended response:

Where did these incidents mainly occur? Forest/village/Tok/fields/elsewhere

Which month/s or season/s is the leopard conflict at its peak?

What do you do with the livestock that is killed?

What are the top 3 three causes for increase/decrease of leopard incidents causing livestock depredation in your area? Feel free to add your own reasons. Rank 1 to 3.

Causes	Livestock depredation	Remarks
Availability of suitable leopard habitat		
Availability of wild prey for the leopard		
Leopard population		
Increase in human population		
Increased visitation to forest habitat by people		
Increase in livestock population		
increase in stray dogs population		
Increase in lantana growth		

Do you think that the behaviour of leopards has changed over the last 3-5 years?

Do you think the behaviour/tolerance of man has changed over the last 3-5 years?

Did your elders worship leopards? Are they still worshipped today?

How did you elders deal with the leopard problem in the past?

Were any other animals also a problem? How was this dealt with by your elders?

Do you think the population of wild pigs in your area has increased over the years?

Is crop damage by wild pig a big problem in your area?

Is crop damage by rhesus macaque a big problem in your area?

How many troops of macaques do you think are there in your village?

What percentage of your crops are damaged by a) wild boar b) macaque c) other animals?

### **Possible solutions**

What do you think are the solutions to reduce leopard incidents in your area?

Open-ended response:

What could be the top 3 solutions to reduce leopard incident in your area?

Solutions	Leopard incident Human death/human injury	Leopard incident Livestock depredation	Remarks
Increased education and awareness			
Better designed animal shelters			
Decrease human dependence on forests			
Reduce forest entry at night			

Speedier and appropriate compensation measures			
Better media reporting			
Better quality forest habitat for leopards			
Increased prey availability for leopards			

Which solution have you tried? Did it work and feedback.

Are there any concerns of implementing these solutions?

### **Compensation**

Is there any compensation given by any department for A. livestock depredation? B. Human injury/death? Which department? What is the compensation?

Are you satisfied with the procedures for compensation? If not, how can it be improved?

Are all case for human injury/death and livestock reported to the forest department? If not, what percentage do you think go unreported?

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