Research Article

ASSESSMENT OF HUMAN-LEOPARD INTERACTION IN VANSDA TALUKA, SOUTH GUJARAT

*[1]M.I. Dahya, [2]A.A. Kazi, [3]A.I. Shah and [4]D. Nayak

[1] BKM Science College, Valsad - 396001 Gujarat, India
[2,4]College of Forestry, Navsari Agricultural University, Navsari - 396450, Gujarat, India
[3]B.P. Baria Science Institute, Navsari - 396445, Gujarat, India

ABSTRACT

The leopard has been a menace in the Vansda Taluka since the occurrence of negative interaction with this cat has increased many folds in the last decade. In 42 villages of Vansda Taluka, 29 human casualties were reported in five zones of the study area in the last ten years and out of them, maximum incidents were reported in North zone (n=8), whereas the least were from West zone (n=2). Farmers working in the sugarcane fields have been found the most vulnerable in this study. Out of total casualties on humans, the highest (n=10, 32.14%) were reported in the age group of 31 to 40 years, followed by 21 to 30 years (21.4%). The highest casualties (n=21, 75%) were in the evening time between 4 to10 pm, whereas 26.5% casualties were in the morning 4to10am. 66 % incidents have been experienced during the crop operation work followed by livestock rearing (22%) and household work (12 %). The study shows a significant variation in the activities of the victim while the attack of leopard coincides with time, location and type of activity. A base map has been prepared by using 0.79 cm scale to understand the activity of leopards and chances of human interaction in the study area.

Keywords: Leopard, Interaction, Human causality, Vansda.

INTRODUCTION

Leopard is one of the most common animals in human-animal conflict (Karanth *et al*., 2012; Khorozyan *et al*., 2015). Reasons for high human-leopard conflict are due to the greater adaptability of leopard's diet- from mammals, arthropods, rodents, amphibians to rotting carcasses (Daniel *et al*., 1999; Karanth *et al*., 2012). In most part of India, government grant ex-gratia for livestock damage, crop raid or human injury by any wild species including leopard; however, a large sum of rural population is unaware about these compensatory schemes. Sometimes villagers indulge in retaliatory killings because of high panic or aggravated anger (Athreya *et al*., 2015; Malviya & Ramesh, 2015). In one of the studies by Terborgh *et al*., (2002), 11 people were killed by Leopard in 1995; and as a reaction villagers killed 17 Leopards in a small village of Karnataka. Attacks on livestock are tolerated to a large extent due to the inherent non-violent attitude of the people and also due to the ex-gratia paid by the government, but human-leopard conflict turns uncontrollable once human injury or deaths are experienced. One of the most important factors that allow leopards to survive close to human habitation is large number of stray animals. India is agriculture-based country and livestock is a subsidiary vocation. Most of the cattle are grazed around village lands, kept near homes and similarly large numbers of stray dogs can be seen in the cities (Dahya *et al*., 2021; Dhurandhar *et al*., 2013). Moreover, population control of stray animals is not routinely carried out and cows are not killed because of religious sentiments (Athreya & Belsare, 2007; Athreya *et al*., 2016).This has lured leopards from forests to villages and towns. Sugarcane field, tea plantation and other tall crop like jowar and bajra have provided ideal habitat, and thereby imposing leopards to live close to humans and consequently cause the conflict. In Gujarat too, the same reasons are guessed as possible causes for the increasing in human-leopard conflict (Mishra, 1997; Mukherjee & Mishra, 2001).

MATERIALS AND METHODS

The Vansda Taluka of Navsari district is selected for the present study as frequent human-leopard conflict has been reported in the area for the last 10 years i.e. 2010 to 2020. The Vansda Taluka lies between 20.450 N to 73.220 E. With an area of 557 sq km, the Taluka is situated in Sahyadri region of Western Ghats and is entirely hilly except some part of fertile valley. As per land utilization survey carried out in 2014-15, the land pattern comprises of Vansda Taluka Forest (20,270 ha), barren and uncultivated land (20,270 ha.), permanent pastures and other grazing land (2,216 ha.), land under miscellaneous tree crops and grooves (41,280 ha.), fallow land (105 ha.) and agricultural area (59,972 ha.) (Evans & Gasparini, 2013; Miller *et al.*, 2016).

A base map of this study area was prepared by removing all the divisional boundaries, settlement area, drainages, roads and survey which was carried out by using 0.79 cm scale. The vegetation and other landscape features survey was carried out in 2019-20. After the survey, a grid of 2×2 km was generated for the study area to get accurate information about human leopard conflicts (Mohan, 1997). Vegetation and other habitat types were classified using GPS system and number of human leopard conflicts for each grid was observed during the study period. The survey of conflicts was estimated on the basis of numbers of leopard attack on human. Primary data was collected on presence of leopard's pugmarks and scat, and information of attack on livestock and/or human was collected. Secondary data was collected from the forest department, local survey through interview and questionnaire and the literature of last ten years was also considered to get related information. Primary and secondary data of human leopard conflicts was collected and graphical representation was done in the form of map (Kshettry *et al.*, 2017).
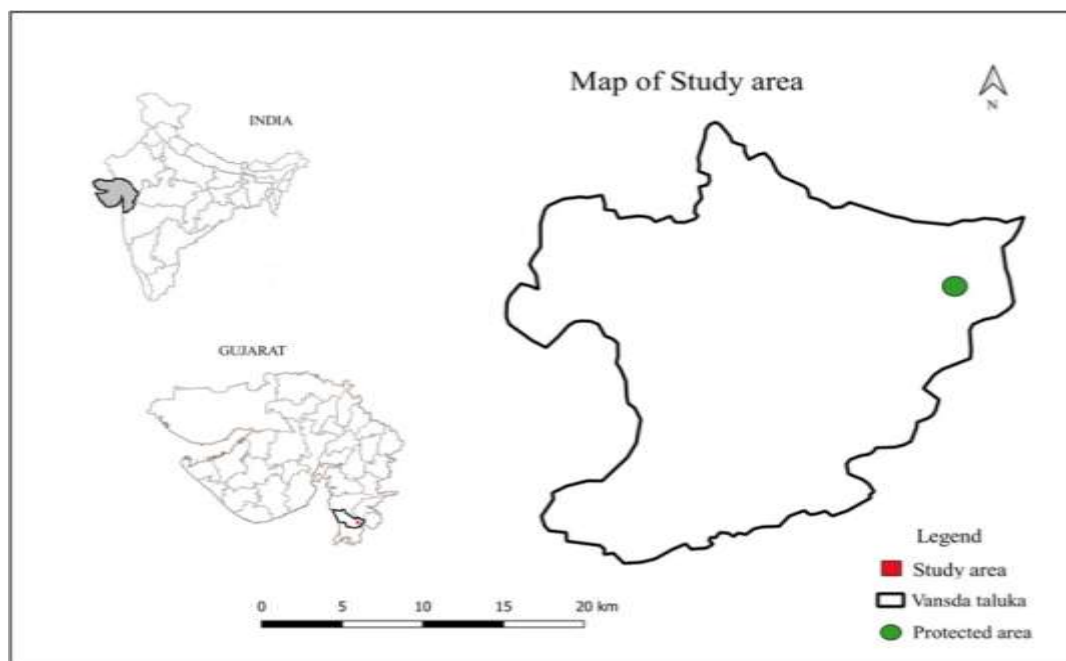

Figure 1. Study area of Human-leopard conflict in Vansda taluka, Gujarat, India.

Table 1. List of Zone wise Villages of Vansda taluka undertaken for the study.

Zone	Name of Villages
Central Zone	Vansda Town, Ranifaliya, Patafaliya, Manpur, Sitapur, Vasiatalav.
North Zone	Chadhav, Kukda, Unai, Sindhai, Bhinar, Sara, Kevdi, Kureliya, Bartad, Khambhaliya, Kureliya, Kharjai.
South Zone	Dholumber, Anklach, Vanderwela, Mindhabari, Limzar, Jamaliya, Boriyach, Pipalkhed, Vanderwela, Vanarasi, Rangpur. Rumla, Sukmad, Ravaniya.
East Zone	Nani Waghai, Navtad, Sadardevi, Ambabari, Charanwada, Zuj, Zari, Mavhas, Khambhla, Dhakmal, Choravni.
West Zone	Motivalzar, Nanivalzar, Pratapnagar, Kandolpada, Vaskuie, Doldha, Lakhawadi.

Data Collection

This study aimed to investigate the nature and extent of human injuries and also leopard deaths by humans along with spatial and temporal patterns of conflict between humans and leopards. To study the human-leopard conflict, a reconnaissance survey was carried out in the study area. We examined attack frequency of leopards on humans for the period 2010 to 2020. Field data were collected using a combination of qualitative methods (unstructured interviews, participatory observation and focus group discussions) and quantitative methods (structured interviews). Information on human casualty was collected in questionnaire formats and by interviewing the affected villages. Information on number of injured and killed persons; time of incidence, age and sex of the victims, place of attack, activity of the victims, mode of attack and nature of injuries etc. was collected from all the affected villages and survey sites in pre-designed questionnaire formats. The study area was divided into five zones: (1) Central Zone, (2) North Zone, (3) South Zone, (4) East Zone and (5) West Zone (Table 1)

RESULTS AND DISCUSSION

Based on the data of human-leopard conflict collected from the forest department and interviews from 42 villages, 29 human casualties were reported in five zones of Vansda taluka in ten years i.e. from March 2010 to March 2020 (Figure 2). Out of them, maximum incidents occurred in North Zone (n=8), whereas the least human casualties were from West Zone (n=2). During these ten years, there has been no human death recorded. Polynomial regression

showed a significant variation with increasing pattern in the year 2014 with 12 cases and then decreasing and varying between 1 to 2 cases in years 2010 to 2020 with leaving no case in 2012 (Figure 3). In Vansda taluka, people of different age group were found to be victimized by leopard (Figure 4). Among the victims, people of 31 to 40 years of age suffered the most. Farmers those who were working in the fields are the most of the victims. Out of total 29 human casualties, the highest number of human casualties (n=10, 32.14%) occurred in the age group of 31 to 40 years followed by 21 to 30 years (21.4%). The time of occurrence of human casualties by leopard i.e., morning, daytime, evening and night were recorded. There was significant variation in the diurnal pattern of occurrence of human mauling. The highest number of casualties (n=21, 75.0 %) occurred in the evening time during 4 PM to10 PM. 6 cases (26.5%) recorded in the morning time i.e 4 AM to10 AM, and a single case was found during the late night time frame (3.5%) between 10 PM to 4 AM (Figure 5). The victims were found engaged in different kinds of activities as farming, livestock rearing and house hold activities when leopards attacked the them (Figure 6). The incidents of human casualties were very high when the victims were engaged in walking or cycling during the cattle rearing; however, the highest number of incidents were noticed during the victim were working in the farm. Amongst 29 cases, the highest incidents were observed during the crop operation work i.e. 66 % (n=18) followed by livestock rearing- 22 % (n=6) and when the victim was engaged in house hold work- 12 % (n=4). This shows a notable variation in the activities of victim while the leopards choose to attack on them.
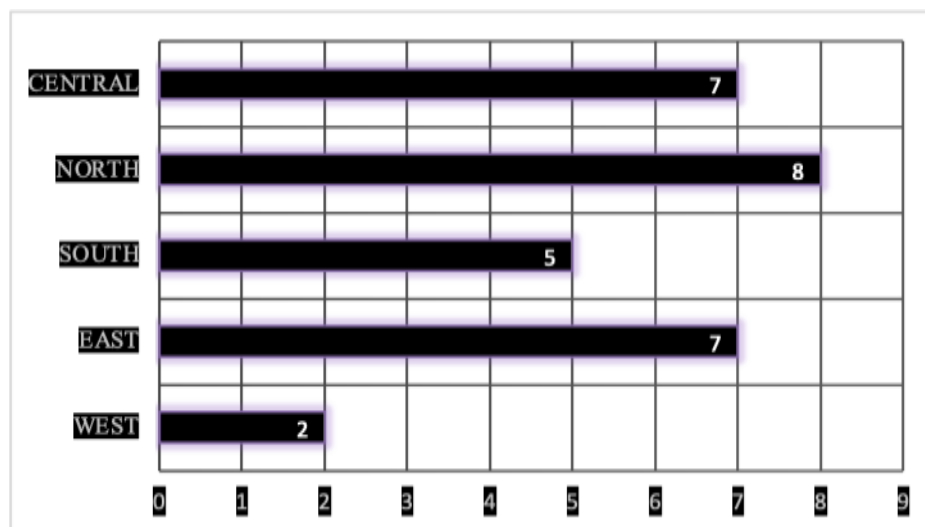

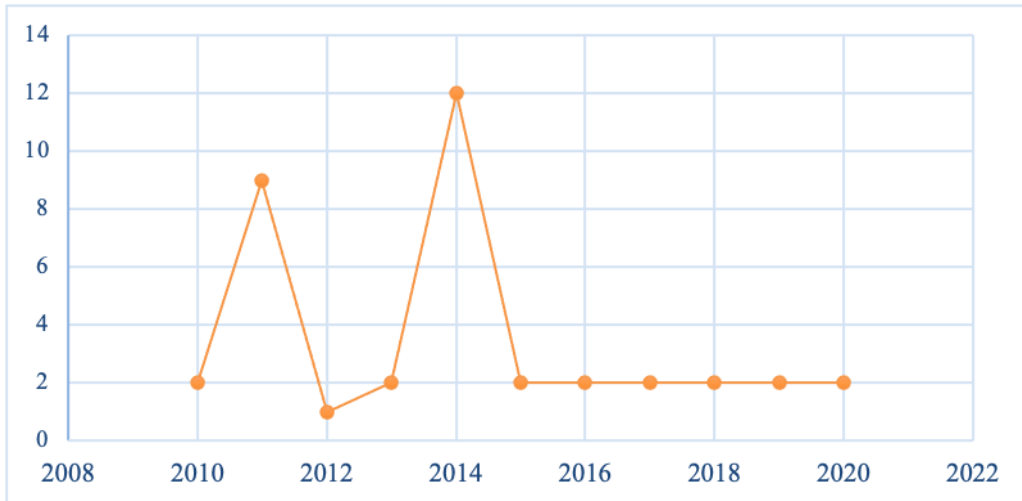**Figure 2**. Recorded human attack from March 2010 to March 2020 in Vansda Taluka.

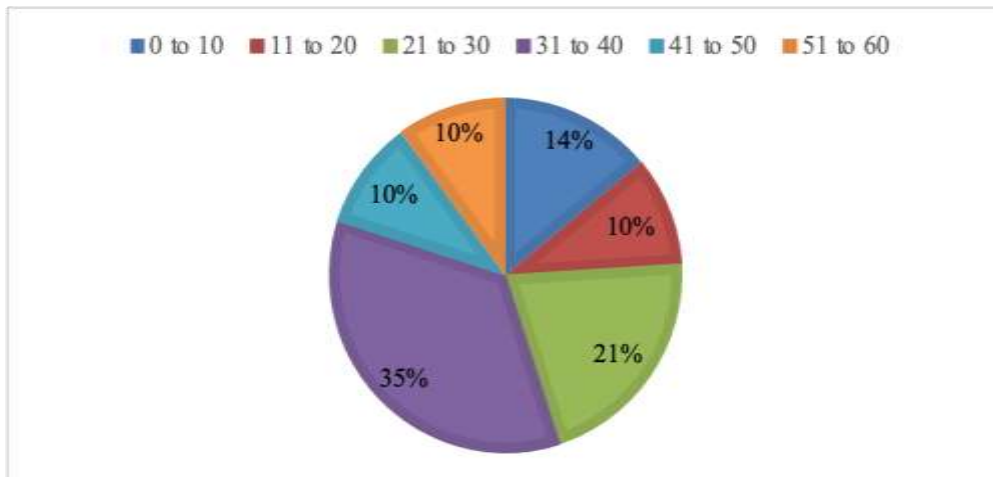**Figure 3**. Year wise recorded human attack in Vansda Taluka, Gujarat, India**.**

Figure 4. Age of victims affected by leopard in Vansda taluka, Gujarat, India.
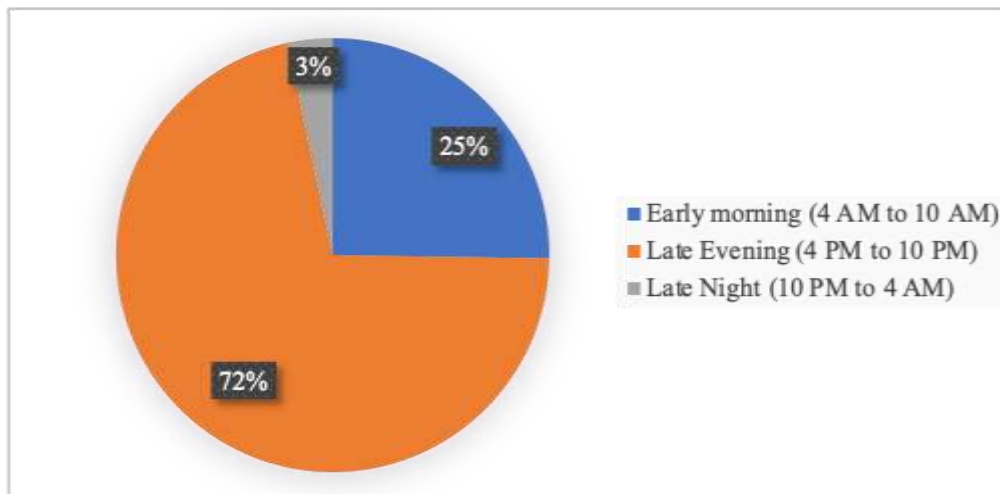
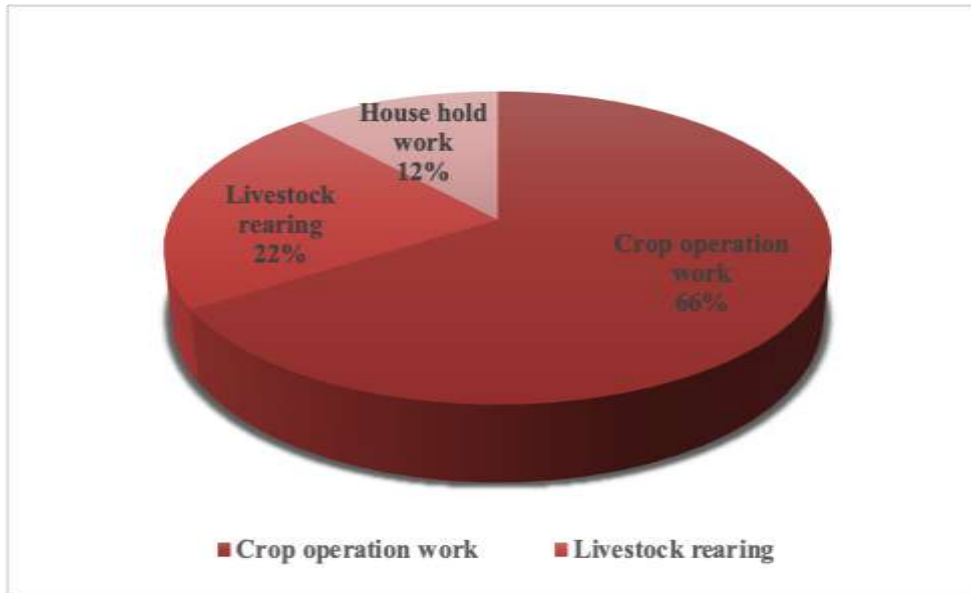**Figure 5.** Time of human casualties by leopard in Vansda taluka, Gujarat, India.

Figure 6. Activity of human during Attack by leopard in Vansda taluka, Gujarat, India.
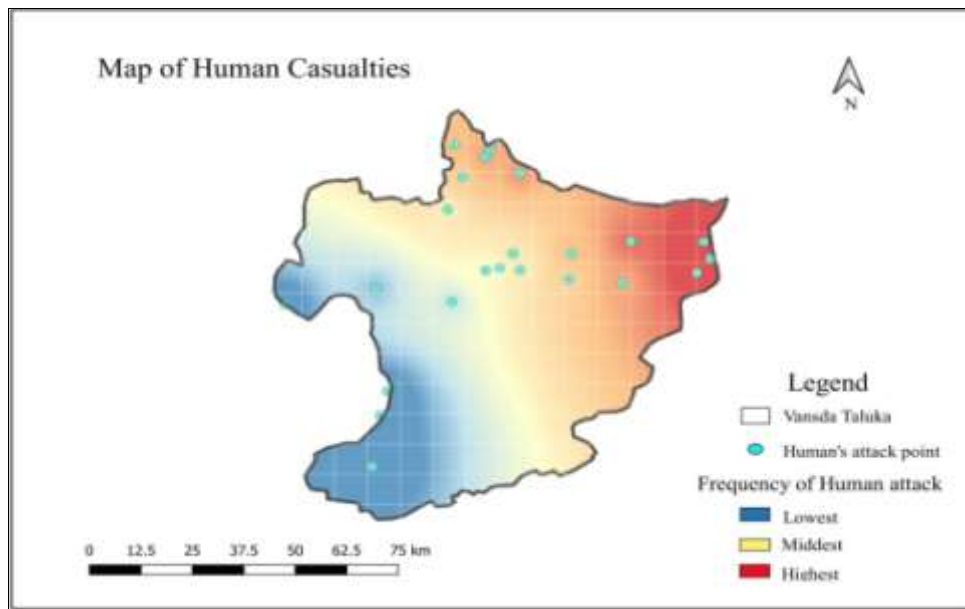

Figure 7. Gradient of human casualties in Vansda taluka.

According to the data collected from primary and secondary sources, all grids were classified and coded into different conflicts categories i.e., low, medium and high. Finally categorized grids were overlaid on the map with the help of QGIS (3.12) & (2.8) and IDW plug-in. By using this software different areas of landscape or land cover associated were extracted with the different levels of conflicts zones. The Figure 7 presents an overview of the quantitative data analysis procedures that have been collected from 42 villages through survey. An important step in a multiple regression analysis is to assure that the assumption of correlation has been meet. Correlation is a statistical phenomenon in which two or more predictor variable in a multi relation module is highly correlated as displayed in Table 2 and 3. Prospectively correlations were also calculated for predictive variables. Table 2 and 3 depict that the correlation reached upto 0.80 threshold limits. From the analysis, it can be revealed that, both the variables are closely related to each other.

Table 2. Correlation coefficient for Human-Leopard Conflicts in Vansda, Gujarat, India.

Model	Coefficients	Standard Error	t-test	P-value
Intercept	0.361	0.285	1.263	0.515
(x1)	0.268	0.210	1.276	0.520
(x2)	0.056	0.197	0.285	0.556
(x3)	0.241	0.174	1.388	0.524
(x4)	0.113	0.142	0.796	0.431
(x5)	0.550	0.330	1.663	0.505

Table 3. Regression Statistics for Human-Leopard Conflicts in Vansda, Gujarat, India.

Multiple R	R Square	Adjusted R Square	Standard Error	Observations
0.814	0.802	0.792	0.349027	5

Figure 8. Negative interaction of leopard with human in Vansda taluka, Gujarat, India.

Figure 9. Leopard in human dominated landscape of Vansda taluka, Gujarat, India

Towards multiple correlation, regression analysis is 0.792 percent of the variance is explained in the predictor of the variable (R square .792 x 100 = 79.2; 79.2+20.8 = 100%). The predictive variables of the Human leopard conflicts are crop, sex of victim, age, position and time are displayed in this model. The R square in a multiple regression represents the explained variation that can be contributed in the predictor in a correlation analysis. The R square gives explanatory power as in Table 3, the model summary shows that the R squared of .802 (.802 x 100 = 80.2%) or 80.2 reveals the variance in the dependable variable (Human-Leopard Conflict). (x1) Surrounding crop were attack happen, (x2) sex of victim, (x3) Age of victim, (x4) position of victim at the time of attack, (x5) shows time of attack. The correlation between collected data with that of method of correlation regression for analyzing the data is used here. By this analysis summary models were produced. Four predictive variables to the significant at the 0.5 level [(x1) 0.52, (x2) 0.55, (x3) 0.52, (x5) 0.50], all the models show significance level of p = 0.5, except the value of (x4).

CONCLUSION

In Vansda Taluka, the forests are patchy and fragmented. Sugarcane, paddy and vegetables are being grown in abundance around the villages, and the leopard is increasingly using these sugarcane farms for hiding, ambush and coming in contact with human and livestock. Villages are scattered but most of them are located in the close vicinity of forests. People often go in open areas for defecation in the late evening or morning and the timings coincide with the peak activity of leopards; hence, such people turns more vulnerable to attack. The villagers should regularly remove all bushes or shrubs from the surroundings so as to increase visibility. Villagers should try to avoid work in sugarcane fields in late evening and night time, or if highly required due precautions must be taken. The villagers should be vigilant and alert in early mornings and late evenings when leopards are active. Villagers are advised to accomplish activities such as social visit, fetching water from streams or river, grazing cattle, collection of household items etc. during day time and can avoid negative interaction with leopards.

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