

Managing Success

Asiatic lion conservation, interface issues and attitudes of local communities in Greater Gir Landscape



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Abstract

Globally, human-carnivore interface issues are among the biggest conservation challenges of today. In this context, coexistence with local people and survival of the only free-ranging population of Asiatic lion in the agro-pastoral landscape outside Gir PA was studied based on assessment of magnitude of human-lion conflict and people's perception of these issues. Records of human injury and livestock losses obtained from the Gujarat Forest Department for 11 year period from 2001-2011 was analysed to understand temporal and spatial patterns of conflict. Livestock losses were examined in greater detail to spatially demarcate conflict intensive zones. In addition, 3314 individuals in 84 villages in Visavadar, Talala, Mendarda, Malia, Una, Dhari and Khamba were interviewed to assess knowledge and perception of the cost and benefit of residing in close proximity (<5km) to Gir PA. Local people's attitude towards conservation practitioners was also assessed. One-time rapid survey was conducted in Kodinar, Sutrapada and Palitana to understand lion movement and conflict. The entire field survey was undertaken in 2010.

Incidence of human attacks and livestock raiding by lions and leopards has increased in the entire landscape from 2001-2005 to 2006-2010. Lion and leopard populations have grown in this time and there is increased movement outside entire Gir PA boundary and also in other meta-population and sub-optimal habitats. High and medium conflict villages were not concentrated in the entire periphery of the Gir PA but rather distributed in specific pockets. They seemed to be more distributed in areas that have connecting natural habitats like Mitiyala, Paniya Sanctuary and Palitana. Based on spatial distribution of livestock kills it could be concluded that lion and leopard movement between Gir-Girnar was minimal. Based on this observation, Girnar WLS can be considered a meta-population considering the fact that carnivore movement is restricted to periphery of the WLS. Livestock raiding incidents indicated that there is spilling out of lion and leopard population further north of the WLS and not restricted to Gir-Girnar corridor alone. Overall, Khamba, Dhari and Talala Talukas had greater proportion of high and medium conflict villages. Among surveyed villages, Khamba and Talala ranked higher in terms of loss to livestock predation while farmers in Dhari and Khamba reported greater % crop loss due to wild ungulates.

Overall, people had a positive attitude towards forest, lions and forest management. The survival of Asiatic lions in the Greater Gir (*Brihat Gir*) landscape so far can be attributed to cultural acceptance and tolerant attitude of people. It was also noted that there was greater fear, uneasiness and less acceptance in areas newly colonized by lions. Although people were dissatisfied with livestock compensation scheme, they had a positive relation with the Forest Department. There was greater negative attitude towards crop raiding wild animals and comparatively greater acceptance of livestock raiding by lions and leopards. Attitude towards lion translocation was more Humanistic and Ecologicistic as compared to Scientistic, Utilitarian, Negativistic and Moralistic categories. Knowledge and awareness of endangered status of lions and conservation issues was low in the landscape. As a step towards increasing awareness among village children, awareness posters designed in regional Gujarati language was distributed in Government schools in the villages surveyed through this project.

Based on the study, it is suggested that conflict mitigation and maintaining positive public perception, with focus on villages demarcated as High and Medium conflict areas is important for lion conservation.

Introduction

Stochastic processes acting on demography and genetics are not the only predictors of survival of large carnivores that typically occur in low densities, have extensive ranges and occur as isolated or fragmented populations (Woodroffe and Ginsberg 1998, Macdonald and Sillero-Zubiri 2002). Their survival is threatened when their ecological requirements bring them in close contact with human activities in the areas bordering Protected Areas (Woodroffe & Ginsberg 1998). Concerns for human safety and losses through livestock raiding render them vulnerable to retaliatory human-induced mortality (Sillero-Zubiri and Laurenson 2001, Woodroffe and Frank 2005, Ogada et al. 2003). The magnitude of this threat depends on the availability of wild prey, land-use, people's tolerant attitude and the extent of damage to human resource and safety (Chardonnet et al. 2010, Macdonald and Sillero-Zubiri). Issues causing conflicting situations between forest and local people act as a negative influence on conservation and management of forest and wildlife (Woodroffe and Ginsberg 1998). The resolution of human-carnivore conflict is a world-wide concern and is particularly relevant for endangered and isolated carnivore species (Macdonald and Sillero-Zubiri 2002, Shivik 2006, Treves et al. 2006, Sillero-Zubiri et al. 2007, Treves et al. 2009).

The only free-ranging population of the Asiatic lion (*Panthera leo persica*) exists in the Gir Protected Area (PA), Gujarat, India. Constituted in 1965 with the Asiatic lion as focus of conservation, the protection of the Gir Sanctuary has been further strengthened by implementation of the Gir Lion Sanctuary Project (1972), constitution of inviolate Gir National Park (1975), partial relocation of forest dwelling indigenous communities (1972-87), reinforcement and expansion of Protected Area in subsequent years (Pathak et al. 2002).

Sustained conservation efforts of this nature spanning nearly five decades has resulted in revival of the Asiatic lion population (Singh 1997, Meena 2010) shifting its conservation status from Critically Endangered (CR) to Endangered (CE) in the IUCN red list of threatened species (Breitenmoser et al. 2008). This conservation success has resulted in increased dispersal and movement of lions through the agro-pastoral landscape around the PA using small patches of natural vegetation and plantations as day-time refuge (Singh 1997, Meena 2010). The newly established lion habitats are interspersed by densely populated human habitations (Meena 2010). People living in the vicinity of these habitats regularly encounter lions - a situation endangering human life as well as causing economic loss due to livestock-raiding. These issues influence local perceptions towards lions and thereby lion survival. A study was conducted in 2010 to document the magnitude of human-lion conflict in the Gir landscape and assess people's perception, attitude and acceptance of lions in habitations within 5km of Gir PA boundary.

Project Objectives

1. Evaluation of magnitude of human-lion conflict in Greater Gir landscape
2. Assessment of local residents perception towards conservation

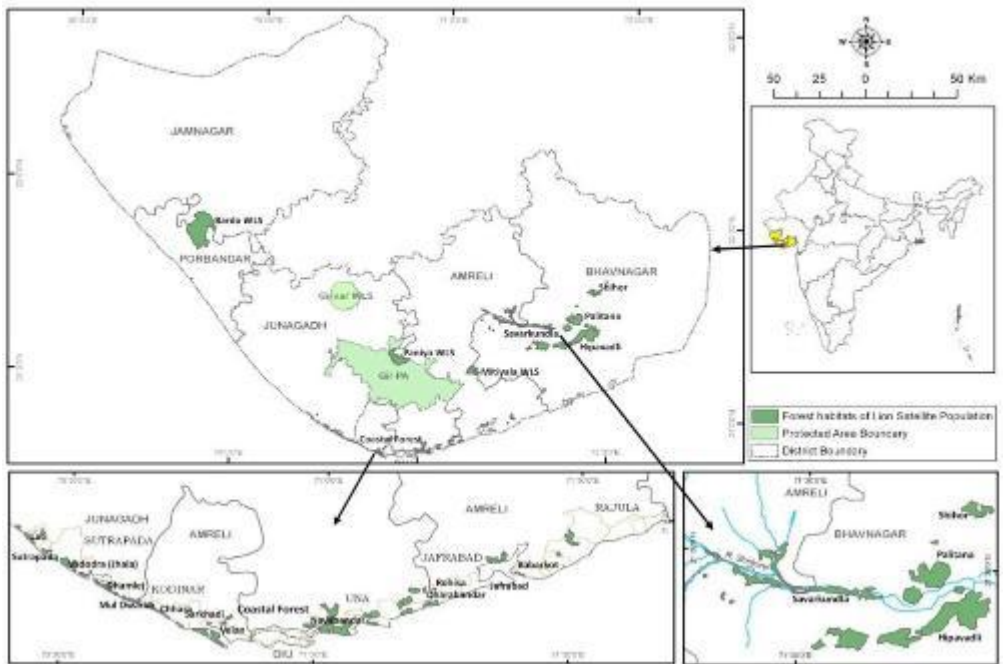
Study Area

The Greater Gir landscape (Fig. 1) extending now into Amreli, Junagadh and Bhavanagar districts managed by four territorial forest divisions – Gir (West), Gir (East), Junagadh Forest Division (JFD) and Bhavanagar Forest Divisions present encompasses the present lion territory. The Gir Conservation Unit (GCU) comprises Chachai-Pania wildlife sanctuary (39.64 km²), Reserved forest (245.90 km²), Protected forest (107.51 km²) and Unclassed forest (77.19 km²) of valuable grassland and forests forming a buffer area around Gir Wildlife Sanctuary (1154 km²) and National park (258 km²). The Gir WLS and NP (Gir PA here after) is located in the southern part of the Kathiawar peninsula, in the state of Gujarat in western India, extending across districts of Amreli and Junagadh, at 20° 57' and 21° 20' N latitude and 70° 27' to 71° 13' E longitude (Fig. 1). The two districts are highly populated with agriculture as the backbone of the economy. Mineral based cement industry, fish processing, agriculture based industries such as sugar, edible oils, solvent extraction processing are some of the chief industrial activities of the region. Bhavanagar district has significant reserves of limestone and lignite. The key industries in the district include: soda ash, ship breaking, ship-building, plastic manufacturing, diamond polishing and cutting, chemicals, engineering products, foundry, salt, tobacco products, rubber, textile machinery and agro-product based units.

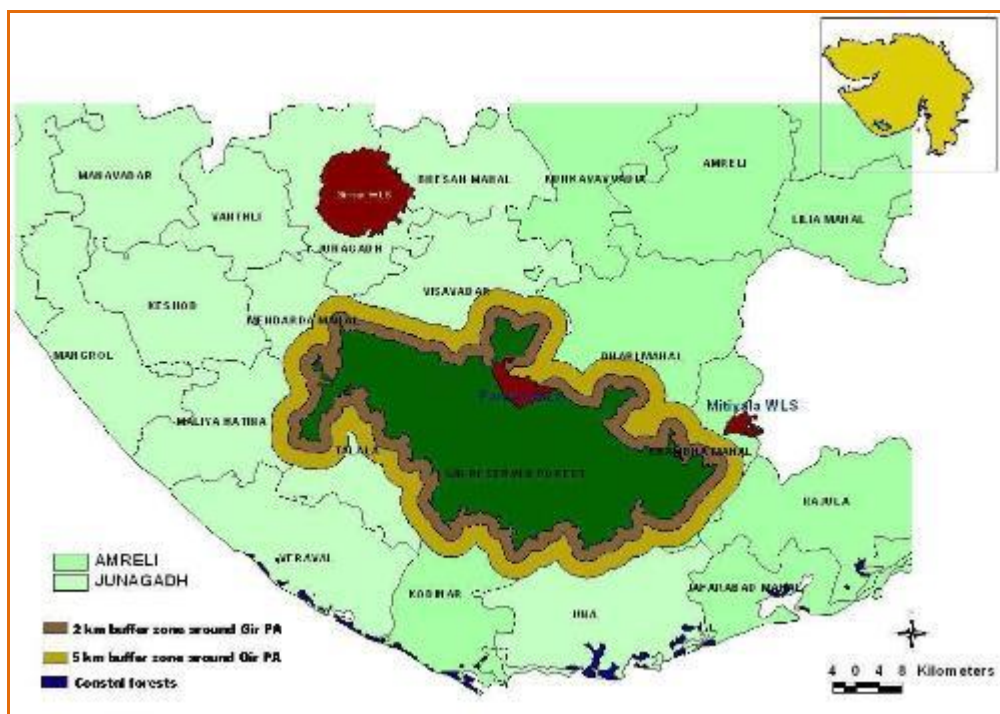
There are 97 peripheral villages with over a lakh human population and over 90,000 livestock within 5km of the PA. The economy in this landscape is largely driven by farm based agriculture, horticulture and animal husbandry.

The Girnar Wildlife Sanctuary (205 km²) is located to North of Gir PA at a distance of 22km and is located in Junagadh district (Fig. 1). Palitana, Savarkundla and adjoining lion habitats (250 km²) are largely part of Bhavanagar Forest Division at 21° 17' and 22° 18' N latitude and 71° 15' to 72° 18' E longitude (Fig. 1). In this paper, lions in these habitats will be referred as Girnar and Shetrunji populations respectively.

Figure 1. Project Areas



- a. Greater Gir lion habitats in Junagadh, Amreli and Bhavnagar District. Inset shows location of Greater Gir in the State of Gujarat, India.



- b. Location of Gir PA across Junagadh and Amreli districts including 7 Talukas surveyed. Map also shows other Talukas in Greater Gir lion habitat in Junagadh, Amreli and Bhavanagar districts.

Methods

1 Magnitude of conflict

1.1 Summary

Records of monetary compensation claims for human injury as well as livestock losses caused by lion and leopards were obtained from four forest divisions of Gujarat Forest Departments – Junagadh Forest Division, Gir (E), Gir (W) and Bhavanagar Forest Division. Lion population census occurs every five years and was conducted in 2005 and 2010. Correspondingly, village level claims for two five year periods from 2001-2005 and 2006-2010 were collated with respect to different - (a) seven Talukas (sub-district) (b) four Forest Divisions were compared.

Average number of kills per year was not comparable as the sizes of the Talukas were variable. Instead, the average number of kills per village in each Taluka better indicated the magnitude of conflict.

1.2 Spatial Analysis

Average number of kills per year for each village within a Taluka was calculated from 2005-2011. These values were classified into 3 categories 1-6 (low conflict), 7-12 (medium conflict) and >13 (high conflict). This classification was based on whether any given village would have 1 kill every six months, one kill/month, or 2 or more kills/month. This data was then spatially represented to indicate high, medium and low conflict villages. Una, though the largest Taluka with important areas of lion movement, was not plotted on map as there were some problems with the map layer.

2 Assessment of local residents' perception towards conservation

Human population data was obtained from the office of Registrar General, India for the year 2001 for districts of Amreli, Junagadh, and Bhavnagar at the Taluka* and village level. A 2-km and 5km buffer was built around Gir PA (ArcMap 9.2 ESRI, Redlands, CA). Data on population of villages within this zone and those separating Gir PA and Mitiyala WLS were also extracted. Within each village 20% sampling protocol was followed making sure all communities, age class and strata of the village people were interviewed (Appendix 2). Interviews in each village were usually started and continued only with the knowledge and consent of the village-heads (*Sarpanch*). For other habitats in Greater Gir landscape, systematic sampling was not logistically feasible. Therefore, meetings with *Sarpanch* and informal group interactions with local people was done in Palitana and coastal habitats.

The interview schedule had five parts:

2.1 Respondent Characteristics

Details on respondent name, age, gender, community, occupation and related information.

2.2 Relation with the forest

2.2.1 Benefit

Benefit from living in close proximity to forest was assessed based on respondent's use of forest for fuel wood, livestock grazing and other resources.

2.2.2 Loss

- Annual crop loss: Respondents were asked to name the crop raiding species and also specify mitigation measures. The perceived crop damage by herbivores was recorded as % loss against annual income from agriculture for 2009. The % loss varied within a village depending on the proximity to PA, crop-type and related factors. Therefore, the Median value of % loss in each village was averaged for that particular Taluka. The 6 Talukas were then ranked on a relative scale based on this average. The Taluka with a ranking of 1 had the highest crop loss.
- Livestock depredation: The relative Taluka ranking for livestock loss was based on total livestock compensation claims for 2009 divided by the number of villages surveyed in that Taluka. This was to obtain an index for each Taluka since the Taluka sizes were variable. Villages of greater % of livestock loss are ranked higher.

2.3 People-PA Staff Relation

Assessment of Interaction, satisfaction with an attitude towards the Gujarat Forest Department

- a. Willingness to report or exchange information with the department about injured or dead wild animals in farm/village vicinity
- b. Satisfaction and opinion about monetary compensation for livestock loss offered by Forest department
- c. Nature of interaction with Forest department –Bad and Good/None

2.4 Opinions and attitude

- a. Did farmers perceive carnivore presence as a deterrent for crop raiding animals?
- b. Do you perceive the forest as useful or as causing loss?
- c. In a hypothetical situation, if lions were removed (translocated) from your village-area, what would be your reaction? The response to this question was in an unstructured format to capture the actual attitude of the respondent. The responses were later categorized based on (Kellert 1985, Table 1).

2.5 Awareness and Knowledge

Assessment of knowledge of local communities regarding lions, forest related news and incidences. Interactive sessions with school children (11-13 years) were conducted in randomly selected villages for the same purpose. Respondents were asked questions that were related to the most eventful lion-related incidents in the past five years (Table 7). The proportion of knowledgeable respondents was expressed as overall %. The Talukas were ranked on a relative scale from 1 to 6 for each question. The average rank for all 6 questions for each Taluka was compared again to get an overall relative rating. High rating indicated greater knowledge. Majority of articles pertaining to the Asiatic lion and Gir PA published in dailies, magazines, reports and electronic media from 2007 (<http://asiatic-lion.blogspot.in>) were summarized to determine exposure to information on the topic.

Table 1. Opinion categories based on a range of responses for retaining lions in the village vicinity and surrounding habitats.

Humanistic	<ul style="list-style-type: none"> • Our Pride and status symbol • We feel lions as part of our family • Lion is the jewel of the forest and should remain here • We feel reassured and happy when we hear lions roar in our vicinity • National and International tourists come to see lions. Our treasure and gives us our identity
Ecologistic	<ul style="list-style-type: none"> • Should live where they survive best • Forests exists because lions exist • Lions do not cause harm why should they be disturbed? • Why lions? take away leopards/ problem causing crop raiding animals like Nilgai and Wild pig
Scientistic	<ul style="list-style-type: none"> • Will not survive in other areas • People elsewhere will not have the tolerance and love for lions that we have here
Utilitarian	<ul style="list-style-type: none"> • Useful animal • Trees will be cut down if fear for lions is not there • Poachers and thieves will become bolder and we will no longer be safe • Check crop raiding (100 lions are better than a few Nilgai!!!) • Protect the forest
Negativistic	<ul style="list-style-type: none"> • Take lions away they kill our livestock • We fear to go to fields in the night
Moralistic	<ul style="list-style-type: none"> • Would you like it if you are displaced from your birthplace? • If you take the kings away how will the subjects be happy? • Gir and lion is like mother-child relationship should not be broken

Results

a. Magnitude of conflict in Gir landscape: Human injury and livestock depredation

1.1 Summary

Division-wise average annual livestock kills for lion and leopard through two periods, namely, 2001-2005 and 2006-2010 showed 45-240% increase and between 184-469% increase for lions and leopards respectively (Table 2). Human attacks by carnivores have not shown such drastic increase (Table 2). Lion and leopard population increase in this time period are also indicated (Table 2). Livestock predation or kill number showed a significant negative relationship with distance to Gir PA (linear regression: $R^2 = 0.62$, $T = 12.06$, $P < 0.001$). Maximum kills (30) occurred within 5 km and occurred up to a distance of 30-35 km of PA (Fig. 3). In the two five-year periods not only the number of kills but also the number of villages with kill incidences has increased (Table 3, Fig. 5, Fig. 4a & b). This means lions are more widespread than before and the extent of movement outside PA is greater than before. At the same time, the numbers of kills in some villages have gone down (Fig. 5, Table 4) particularly villages closer to Sasan Gir from where majority of wildlife relocation and rescue operations are coordinated. Also, Maldharis (traditional pastoralist community) residing in Nesses within Gir PA (Katithar, Alavani, Barvania) have started to leave the PA during certain months in the year, hence the observed decline.

1.2 Spatial analysis

Periphery of Gir PA

When average kill per village per Taluka was calculated it was evident that High Conflict villages as defined in this study (villages which would approximately have at least one kill every month of the year) were few. The high and medium conflict villages were not concentrated in the entire periphery of the Gir PA but rather distributed in specific pockets (Fig. 6a). They seemed to be more distributed in areas that have connecting natural habitats like Mitiyala, Paniya Sanctuary and Palitana (Fig. 1 & 6). Livestock predation by leopards was much less in the entire landscape and villages largely fell in the low conflict category (Fig. 6b). This information and spatial depiction of livestock raiding could be very useful to prioritize High and Medium conflict villages for greater conservation and mitigation focus. A list of these villages is given in Table 6.

Gir-Girnar & Girnar WLS

Kill incidents were restricted to Girnar WLS and did not extend more towards Gir PA indicating that lions here are now an established meta-population (Fig. 7a). Predation events, of both lion and leopard, occurred in villages in periphery of Girnar WLS in Junagadh and Bhesan Taluka (Fig. 8 & 9). Of greater concern is the spill over towards north of Girnar WLS indicating further dispersal of lions where cultural acceptance and tolerance for lions and leopards may be much less (Fig. 7a).

Gir PA-Mitiyala WLS

The most conflict intensive region as compared to other Talukas was Khamba Taluka and particularly the villages linking Gir PA and the 18 km² Mitiyala WLS (Fig. 7b). This area calls for greater focus and conservation planning.

Coastal Habitats

Dispersing southwards from Gir and reaching a dead end at the Arabian Sea Coast, lions have proven their remarkable resilience by adapting to this habitat. The remarkable presence of lions along the sea coast has been recorded from 1995 and lions have since taken permanent residence in available natural habitats and *Prosopis* plantations. Although historical distribution of lions could have extended up to Sutrapada, Kodinar, Una, Jafrabad and Rajula, these areas are now densely populated, urbanized and bustling with industrial activity. The Saurashtra coast is punctuated with several creeks and tidal rivers that provide naturally sheltered harbours and ports favouring much maritime activity and industry. Archaeological remains in these areas also indicate that these areas had been centres of civilization and trade since ancient times. In the past 50 years, the abundant availability of salt and limestone has promoted industrial growth, particularly soda ash. Leading manufacturers and exporters of cement and soda ash are located in these coastal areas. Of the 5 coastal Talukas, Jafrabad is less industrialized relying more on salt manufacturing and fisheries.

About 12 & 15 adult lions have been recorded in the 2005 and 2010 census respectively in the entire coastal stretch (Table 5). The entire coastal habitat covers approximately 110 km² and these areas are not necessarily linked to each other (Fig. 11a & b). The movement of these lions needs to be investigated in greater detail.

A good expanse of natural habitat occurs along Kodinar coast. Suitable wildlife habitats are found connecting Kotda, Santheswar, Malawar, Janasar, Jogikara and includes *Gauchar* land (village grazing land) along with 471 ha of forest area extending into Velan and Sarkhadi (Fig. 10). There is a wetland called Jogi Talav in this area where numerous water birds including greater flamingos (*Phoenicopterus roseus*) visit seasonally. Lion movement is observed around this area. Muldwaraka has no record of lion or leopard in recent years. Lions have been sighted in Chara, Velan and Sarkhadi since 1995 and there are also records of leopards in these areas (Fig.10). In adjoining sugarcane cultivated areas there are many cases of leopard attacks on humans and on many occasions forest department have had to relocate or remove problem causing animals from the area. In the past two years, the number of lions has come down and only 1 individual was recorded in the recently concluded census. Local people report a group of 7 lions prior to that. An average of 40 livestock claims occurs each year and spurt in livestock predation was observed between 2007 and 2010 that later declined with dip in the lion population. Chital and Nilgai are seen here since past 20 years and are responsible for 50-60% crop loss.

Since 1995 lions have been recorded in Sutrapada area and were observed till 2006 (Fig.11a). Prior to that there were 2 adult males and 2-3 female lions in the area. The male lions were relocated owing to some

reported incidents of human attack. In the past census only 1-2 lions have been reported. Leopards are also reported from here and account for many human injuries.

Presently lion movement has increased in Rajula area in Bhabarkot, Bhankodar, Kovaya and about 5-6 lions are reported (11.b).

Conservation Perception

A rapid survey was conducted along the coastline habitats and the *Sarpanches* of Velan-Kotda-Madwad, Sarkhadi, Chara, Kanjothar, Damlej, Lodva-Damlej, Vadodara Jhala and Lati-Kadvar were interviewed. The collective opinion of people interviewed was that if not for the forest, agriculture would be impossible in the coastal areas. People had a great tolerance for lions and leopards in spite of much economic loss due to livestock raiding. All the people interviewed were satisfied with the lion and leopard capture-and-translocation programme of the Forest Department and spoke in their favour and appreciated the conservation efforts. The Taluka-Sabhya of Vadodara-Jhala admitted that when lions first came into the area 15 years back, there was much fear but that was not the case anymore. "There are still about 2-3 lions moving through this area but not as frequent. The forest habitat is excellent with good water availability so lions are doing well. There are also 2-3 leopards in the area and they are more troublesome. They haven't actually injured people but there have been few encounters and attacks. These incidences are more in the sugarcane cultivated areas towards Kodinar. Unsupervised *Ramdan* cows and sheep are predated more and therefore the economic loss is not huge. Sheep-keeping is more and sheep predation is common around here. We have good relation with the Forest Department and we are also quite satisfied with the livestock compensation scheme. They have on several occasions come here to rescue animals from open wells but I feel they have done little to rid of the problem itself. Forest is good for us as it reduces the heat and makes the land suitable for cultivation. We suffer 30-35% crop loss -sometimes even more especially for crops like groundnut. Since we don't have electric fencing we are forced to stay up and guard the crops. Lions do help to reduce this menace and we don't mind having them around here."

Table 2. Comparison and % increase in number of livestock claims and Human attack cases involving Lions and Leopards in 4 Forest Divisions between 2001-2005 and 2006-2010 and corresponding Lion and Leopard census figures for the two time periods

	YEARLY AVERAGE LIVESTOCK KILLS BY LIONS (N ±SE)		% INCREASE	YEARLY AVERAGE LIVESTOCK KILLS BY LEOPARD (N±SE)		% INCREASE	YEARLY AVERAGE LION ATTACKS ON HUMANS (N)		YEARLY AVERAGE LEOPARD ATTACKS ON HUMANS (N)		LION POPULATION ESTIMATE		LEOPARD POPULATION ESTIMATE	
	2001-2005	2006-2010		2001-2005	2006-2010		2001-2005	2006-2010	2001-2005	2006-2010	2001-2005	2006-2010	2001-2005	2006-2010
Gir (West)	501.4 (2507, 35.5)	729.8 (3649, 4.16)	45	34.8 (174, 15.8)	170.2 (851, 77.7)	389	11.4 (57)	13 (65)	3.2 (16)	5.6 (28)	170	170	176	209
Gir (East)	618.8 (3094, 114.2)	1300 (6500, 99.8)	110	28.4 (142, 6.7)	161.6 (808, 27.3)	469	10 (50)	13.6 (68)	10 (50)	12 (60)	150	156	183	155
Bhavanagar	51.8 (259, 22.4)	176 (880, 13.2)	239.8	NO CLAIMS	1.6 (172, 0.24)	NO CLAIMS	2.4 (17)	NO CLAIMS	14	33	16	22		
Junagadh	29.8 (149, 6.3)	78.4 (392, 24.3)	163.1	10.2 (145, 3.7)	29 (145, 3.7)	184	0.4 (2)	1.25 (8)	0.8 (4)	2.4 (13)	17	38	87	10

Figure 2. Average (\pm SE) number of Livestock kills per village from 2006 to 2010 in 9 Talukas in Greater Gir Landscape. Average kills (\pm SE) per year are indicated in parenthesis.

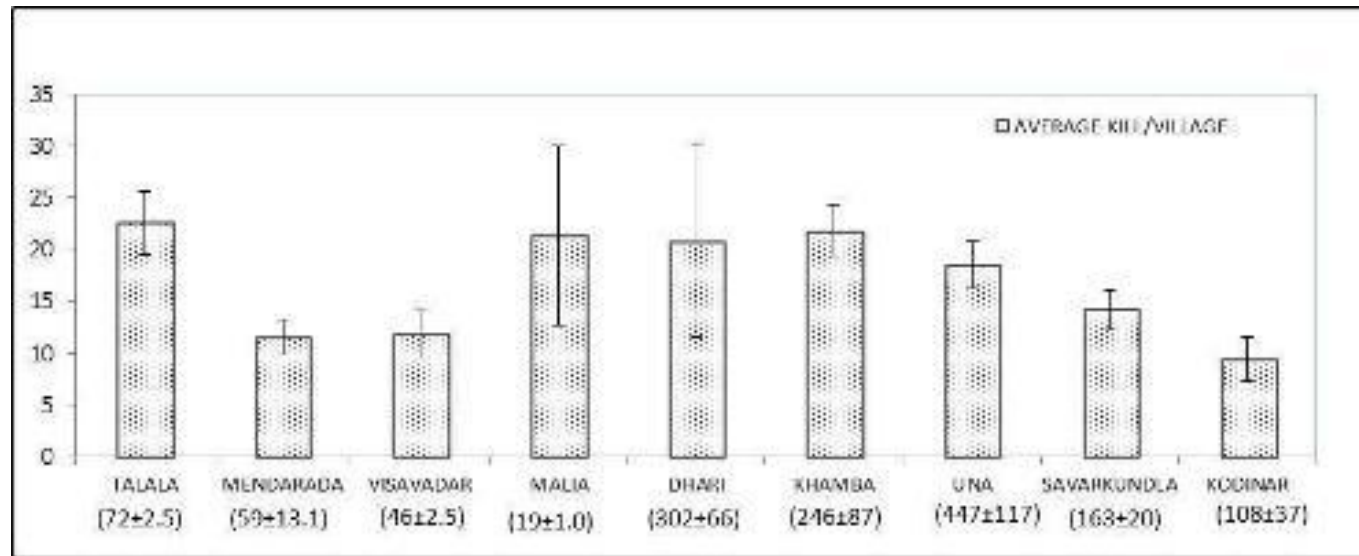


Figure 3. Maximum livestock kills by lions in villages located at different distances (km) from Gir PA

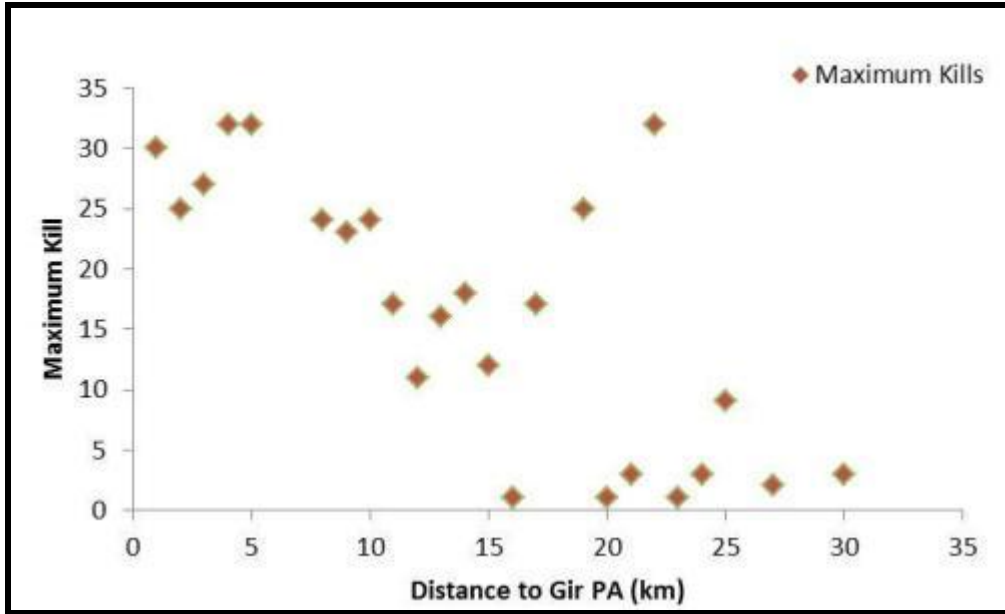
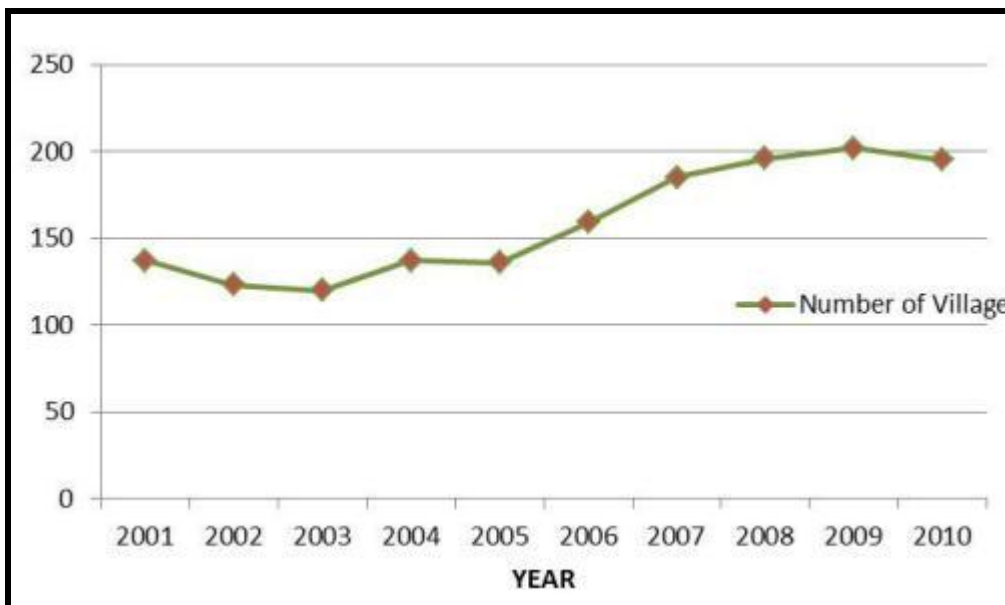


Figure 4. Temporal variation in livestock predation by lions

- a. Number of villages recording livestock predation events by lions from the year 2001 to 2010



- b. Comparison of relationship between kill number and frequency expressed as % cumulative loss between 2002-2005 and 2006-2010

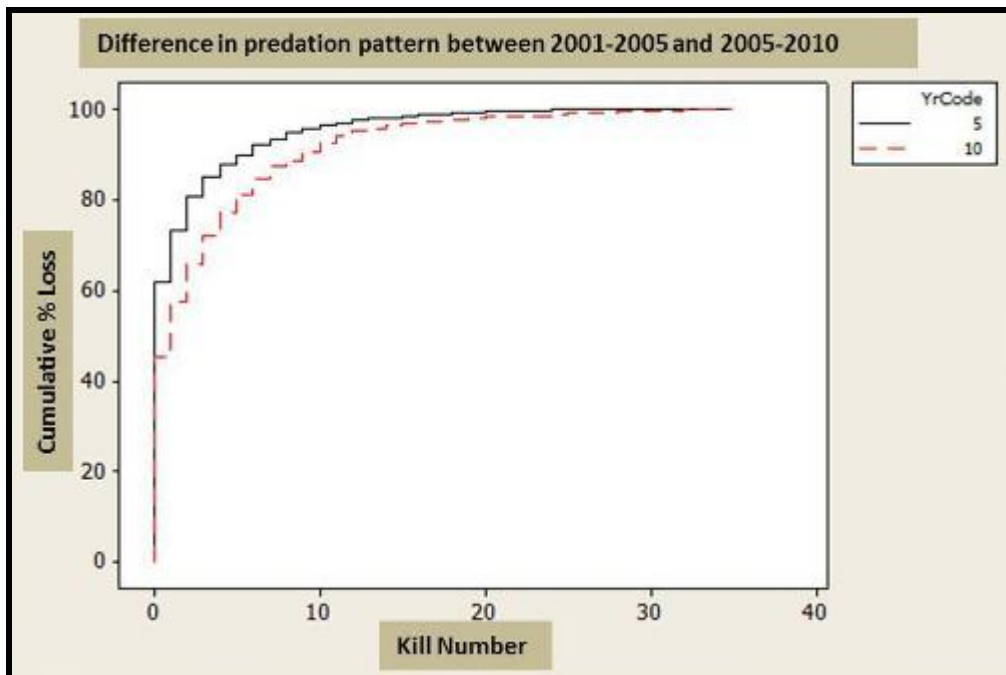


Figure 5. Number of villages showing difference in the number of livestock kills by lions between 2001-2005 and 2006-2010. Villages with positive Difference values had more kill incidents and villages with negative Difference recorded lesser kills in the latter period

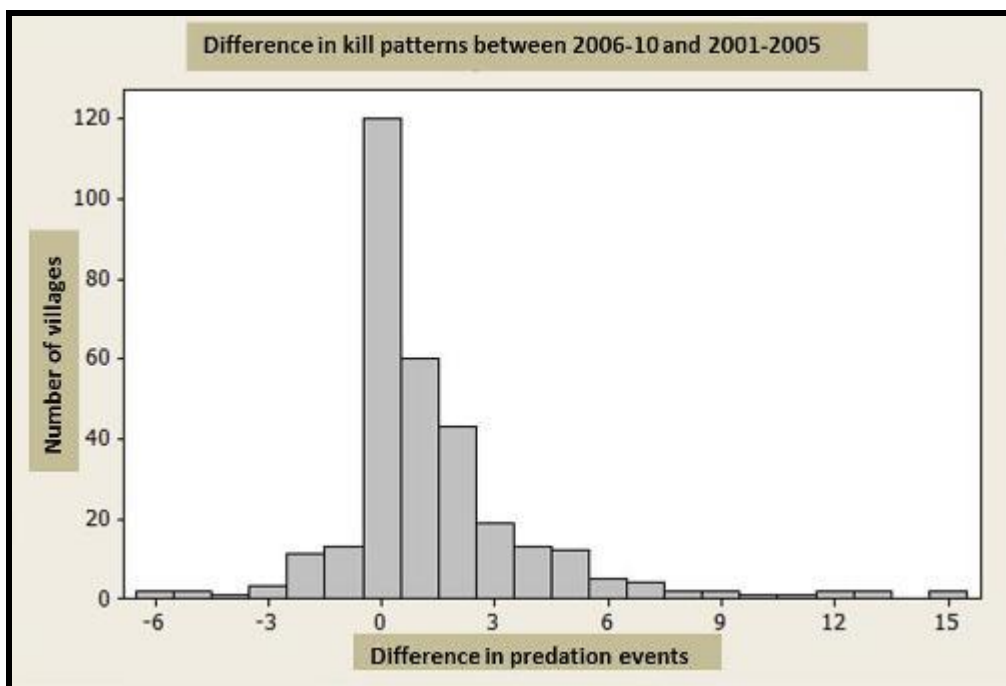


Table 3. Villages showing increase in average/year livestock predation by lion in 2006-10 than 2001-05

Village Name	Distance to PA (km)	Overall Average / Year	Average per Year (2001-05)	Average per Year (2006-10)	Difference
Jetalvad	3.07	3.6	1	6.2	5.20
Bhavardi	2.92	9.7	7	12.4	5.40
Barman	17.36	3.2	0.4	6	5.60
Hirava	3.75	6	3.2	8.8	5.60
Padargadh	19.04	2.9	0	5.8	5.80
Hudli	16.52	3.9	0.8	7	6.20
Monvel	4.27	4.1	1	7.2	6.20
Borala	0	4.7	1.4	8	6.60
Lalpur	1.6	8	4.6	11.4	6.80
Dhargani	18.91	3.6	0	7.2	7.20
Gopalgram	22.47	4.8	1.2	8.4	7.20
Devla	9.09	5.7	1.8	9.6	7.80
Vekaria	3.63	5.4	1.4	9.4	8.00
Dedan	8.45	5.6	1.2	10	8.80
Ingorala	9.48	5.3	0.8	9.8	9.00
Shemardi	0	13	8	18	10.00
Jamka	6.51	8.7	3	14.4	11
Borvav	4.9	14.3	8.4	20.2	11.80
Bhaniya	0	11.8	5.80	17.8	12.00
Dadli	2.64	10.6	4.2	17	12.80
Ambardi	17.52	6.111	0.40	13.25	12.85
Dhari	4.31	13.6	6.2	21	14.80
Hadmatiya	13.23	19.667	12.8	28.25	15.45

Table 4. Villages showing decline in average/year livestock predation by lions in 2006-2010 than 2001-2005

Village Name	Distance to PA (km)	Overall Average per Year	Average per Year (2001-05)	Average per Year (2006-10)	Difference
Surajgadh	0	7.3	10.4	4.2	-6.20
Bamanasa	1.3	8	11.00	5	-6.00
Vankiya	12.97	4.7	7.4	2	-5.40
Vadla	1	10.4	13	7.8	-5.20
Lushala	2.3	13.6	15.8	11.4	-4.40
Samadhiyala	13.81	4.5	6.2	2.8	-3.40
Kathitar ness	0	5.1	6.4	3.8	-2.60
Lasa	1.41	3.5	4.8	2.2	-2.60
Jambuthala	0	1.2	2.4	0	-2.40
Piyava	2	2.7	3.8	1.6	-2.20
Bhojde	1.8	9.5	10.6	8.4	-2.20
Talda	4.86	3.8	4.8	2.8	-2.00
Bhalchhel	1.2	2.9	3.80	2	-1.80
Ranidhar	0.6	1.5	2.4	0.6	-1.80
Karmdadi	0	1.8	2.6	1	-1.60
Munjiasar	11.8	1.4	2.2	0.6	-1.60
Alavani ness	0	2	2.8	1.2	-1.60
Barvania ness	0	1.6	2.40	0.8	-1.60
Sarasiya	2.63	8.2	9	7.4	-1.60
Dadhiya ness	0	1.4	2	0.8	-1.20
Gangajalia ness	0	0.8	1.4	0.2	-1.2
Mithapur(Dungri)	22.22	3.9	4.4	3.4	-1.00
Jambuthala	0	6.3	6.8	5.8	-1.00

Figure 6. Map showing extent of conflict with respect to livestock losses due to a) Lions and b) Leopards across the landscape. The conflict events also trace the movement of lions and leopards in the landscape.

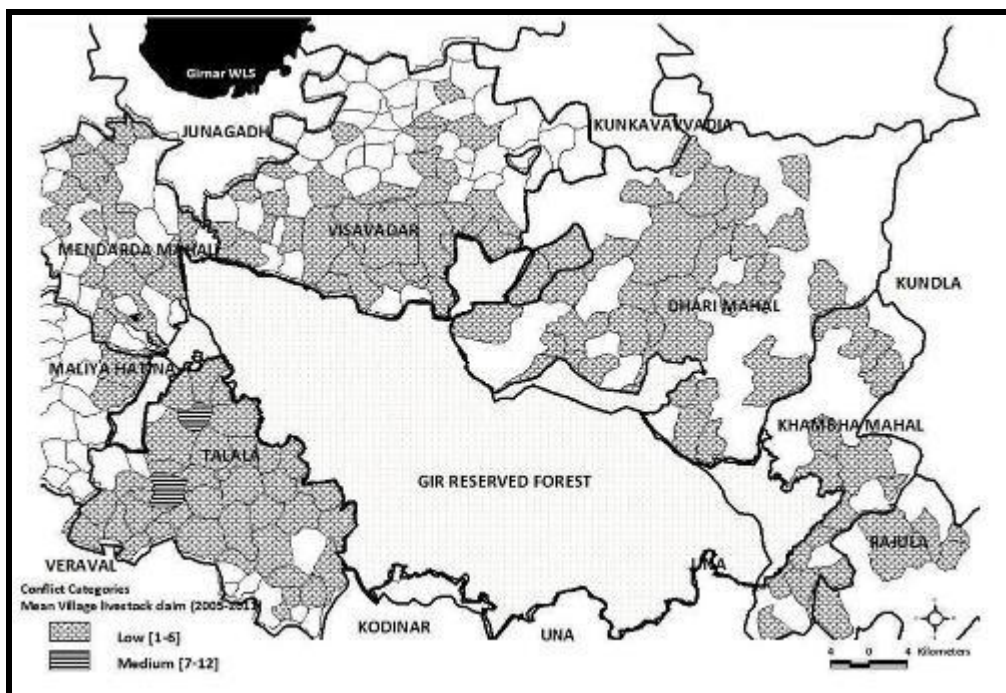
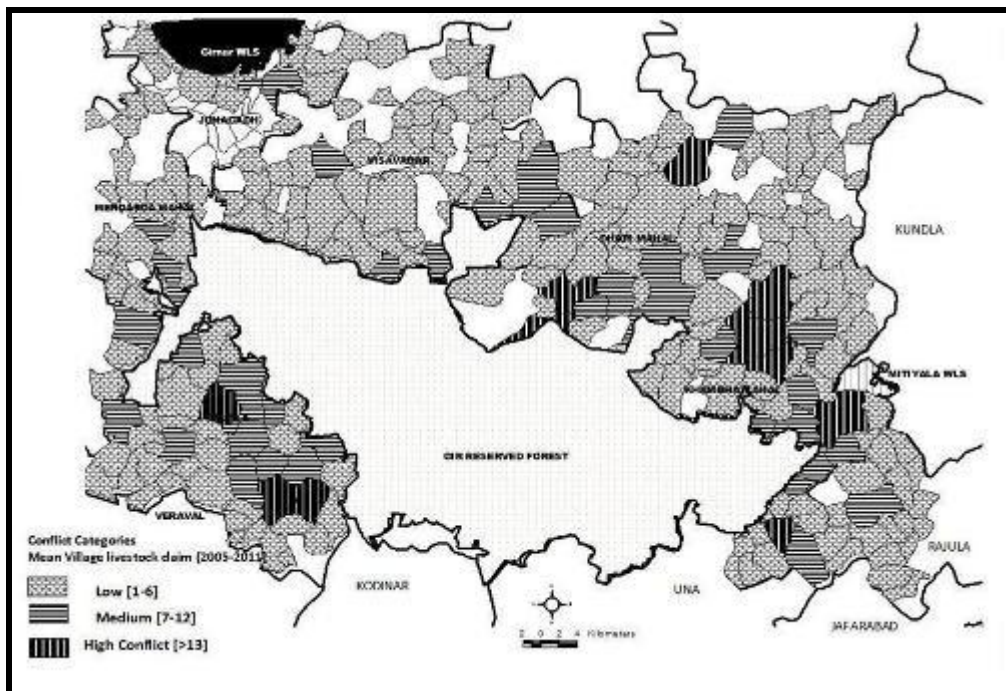


Figure 7. Tracing livestock kills & conflict areas between a) Gir PA- Girnar WLS b) Gir PA- Mitiyala WLS

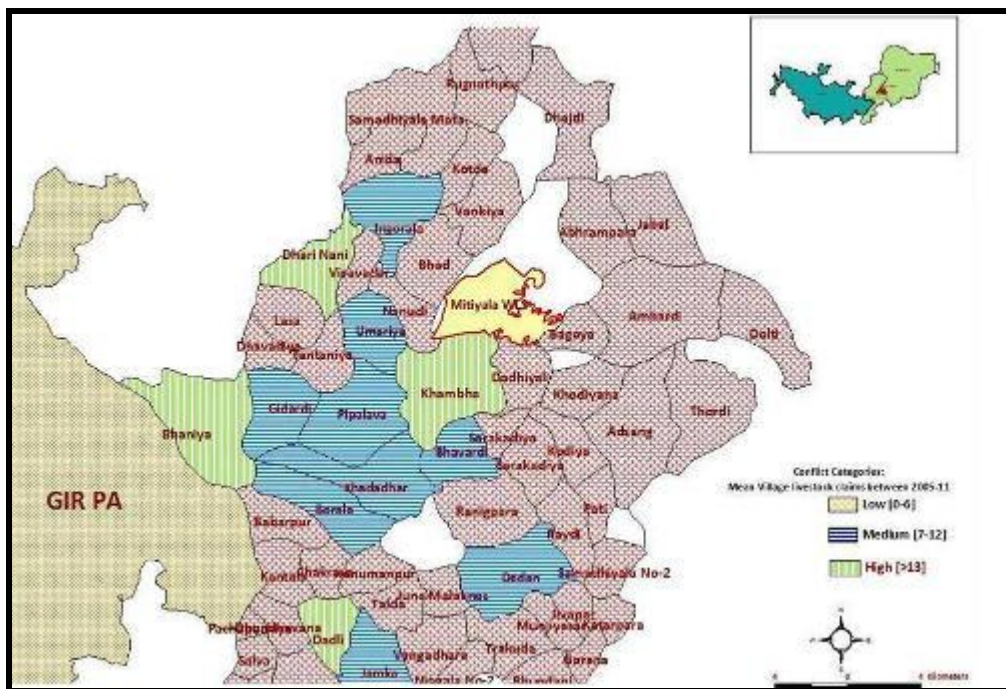
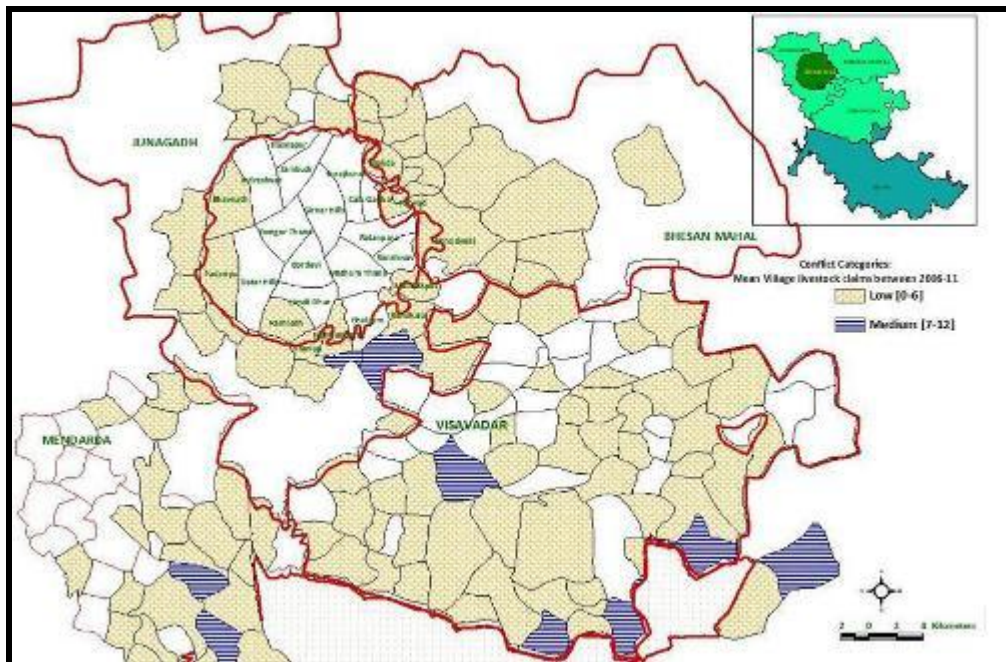


Figure 8. Tracing livestock kills by lions around Girnar WLS

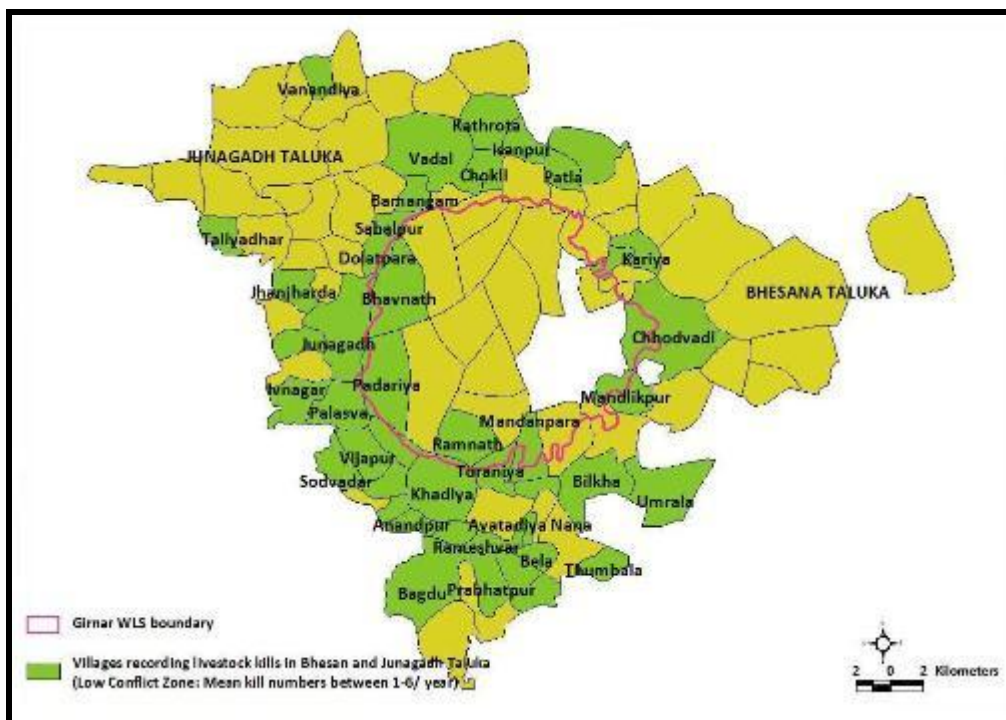
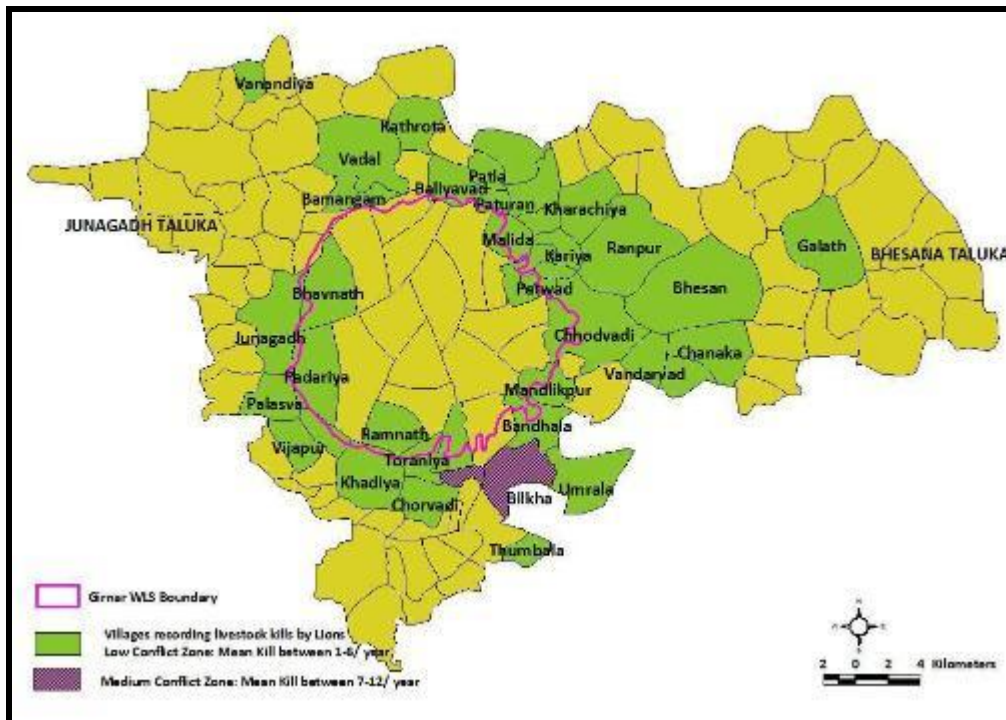


Figure 10. High, Low and Medium conflict villages based on livestock kills by lions in Kodinar Taluka.

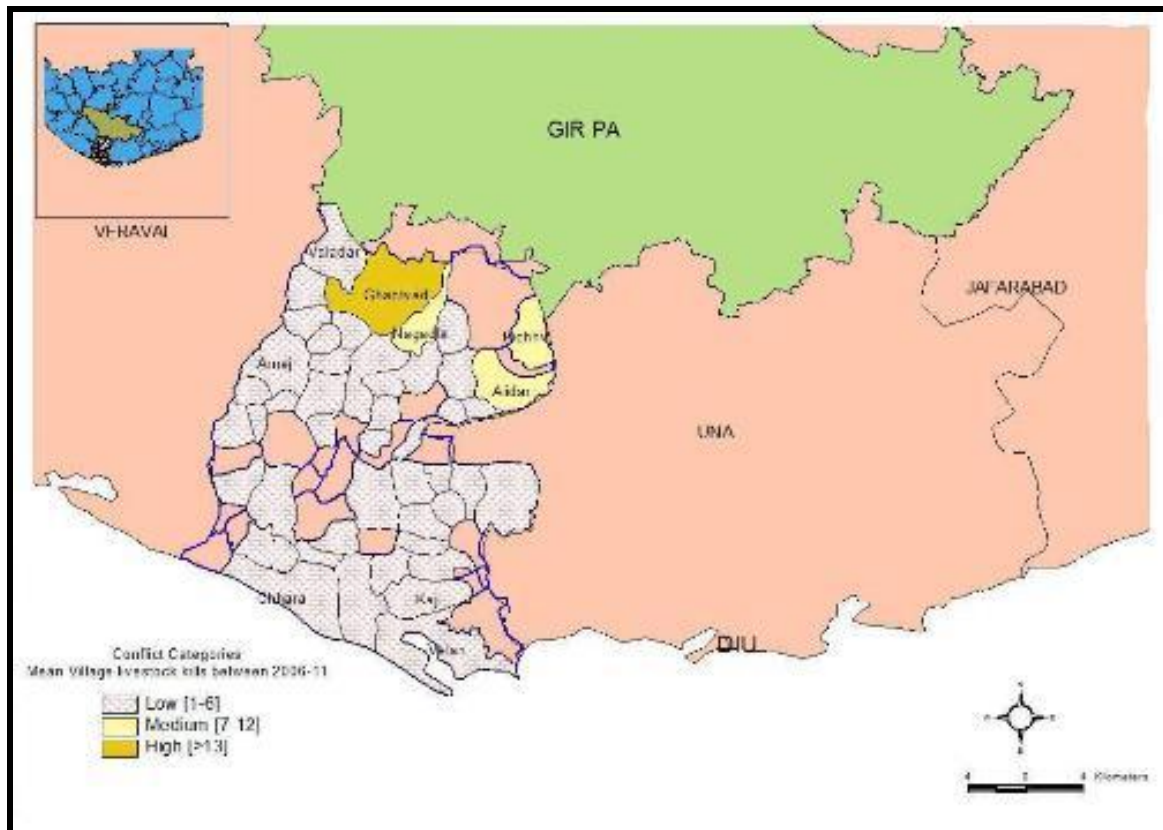


Figure 11. Coastal Habitat: a) Veraval and Kodinar Taluka b) Una, Jaffarabad and Rajula Talukas.

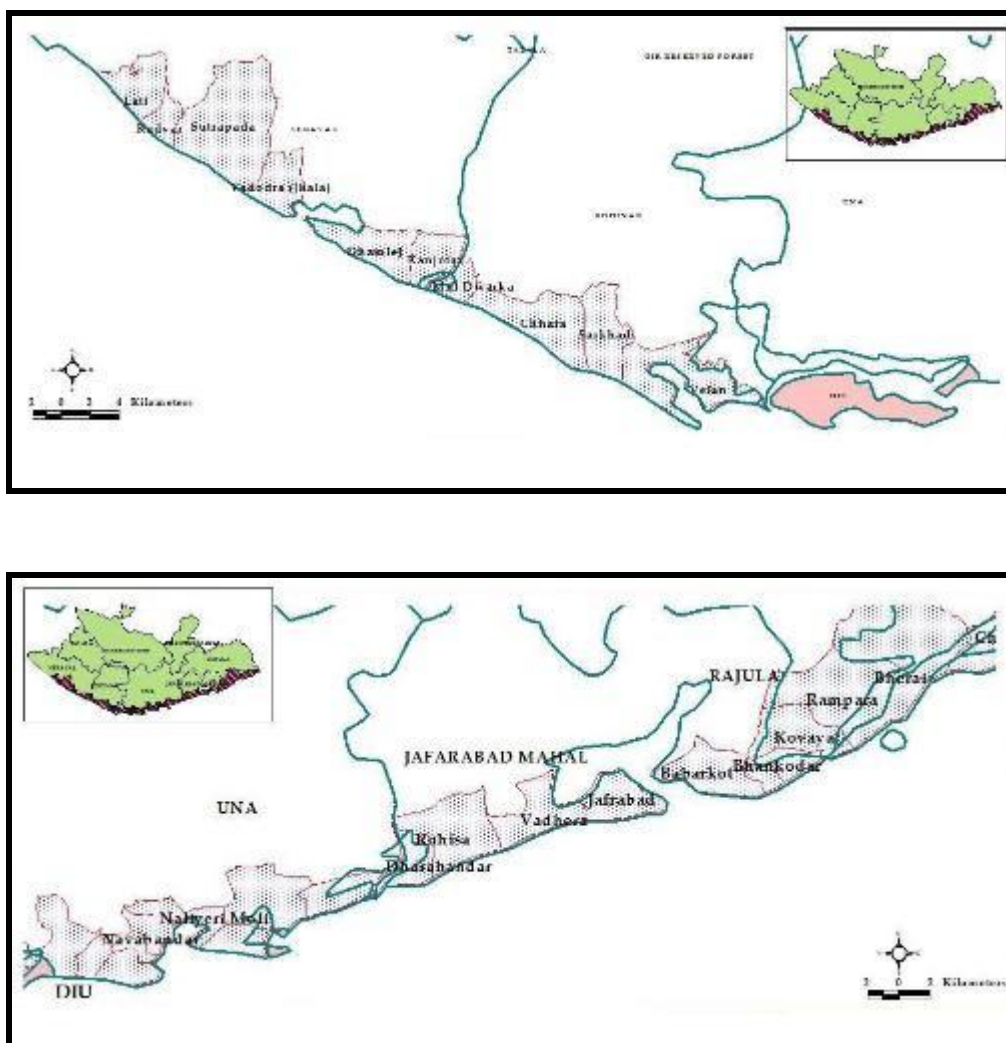
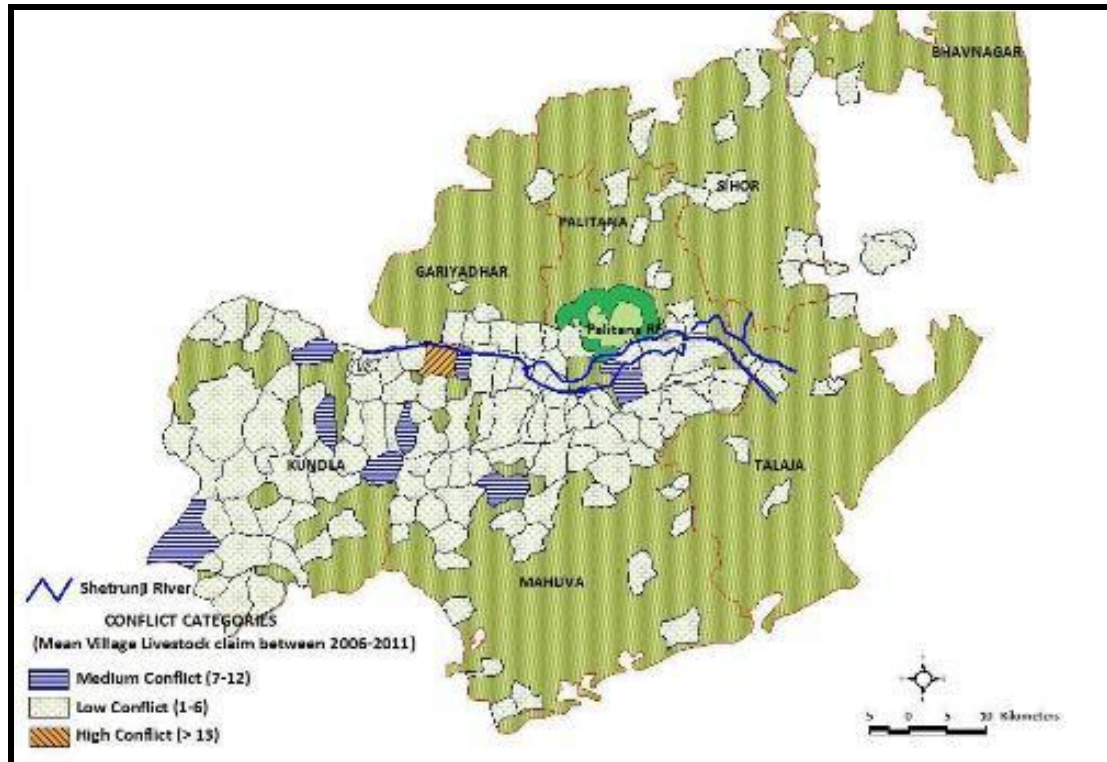


Table 5. Lion Population trend in the past five years in Coastal Habitats

District	Taluka	Coastal Villages	Lion population trend in last 5 years
Junagadh	Sutrapada	Sutrapada, Lati, Kadvar, Kanjotar, Vadodra (Jhala), Dhamlej	Decline
	Kodinar	Chara, Sarkhadi, Velan	Decline
Amreli	Una	Navabhandar	No data
	Jafrabad	Dharabhandar, Rohisa, Jafrabad, Babarkot, Varahasarp, Bhankodar	Increase
	Rajula	Kovaya, Chanch, Khera, Patva	Increase

Figure 12. High, Medium and low conflict areas based on livestock kills by Shetrunji Lion Population



Shetrunji Population

Forest patches and conflict mitigation responsibilities of Savarkundla Taluka rest with Gir (E) Division (Fig.12). Lion movement is widespread in the forests and grassland patches (locally called *Veedis*) in the area. The remaining habitats in Mahuva, Talaja, Palitana and Gariadhar are managed by Bhavangar Forest Division. Mahuva and Palitana Taluka have more habitat patches, such as the Palitana RF and also have greater lion and leopard movement. Leopard conflict is relatively less in this Division so far (Table). Lion population has shown a dramatic increase from 14 to 33 individuals inclusive of cubs, sub adults and adults. From the map it is evident that lion conflict (livestock raiding) is concentrated around Palitana. Based on the rapid survey it appeared that lion movement is around the fringe of the Shethrunji Dam namely, Gandhor, Jaliya (Mota)-Amraji & Hasthagiri, Haathasan & Sarvajiya. When dam water recedes lions cross over to villages such as Garajiya and Kanjara. Rohisala, Gandhor, Jaliya-Amraji, Haathasan, Jaliya-Manji, Dedara, Rajasthali, Sajanasar, Panderiya, Vadan villages are frequented by lions. Palitana and Jesar consist of forest patches and privately owned hills and wastelands. Reinforcing and strengthening a viable habitat for dispersing lions in this Division is one of the top priorities for the Gujarat Forest Department. Ensuring adequate resources, viable habitat for lions, conflict mitigation and also creating awareness and acceptance among the local people is among the major challenges. As mentioned, surveys conducted in this area were one-time and involved interviews of Sarpanch in unstructured format.

Table 6. Villages falling in Medium and High conflict categories with respect to livestock predation by lions and leopards

Categories	Taluka	Village
Lion High Conflict	Dhari	Ambardi, Virpur, Dalkhaniya, Gadiya, Shemardi
	Junagadh	Bhilka
	Khamba	Dhari Nani, Khamba, Bhaniya, Dadli
	Kodinar	Ghantvad
	Una	Asundarali, Timbarva, Jasadar Itvaya, Kodiya, Khilavad
	Savarkundla	Gobha
Lion Medium Conflict	Dhari	Hirava, Govindpur, Devla, Sarasiya, Sakhpur, Gopalgram, Monvel
	Khamba	Jamka, Bhavardi, Khadadhar, Dedan, Pipalava, Umariya, Ingorala, Borala, Gidardi
	Mendarda	Kenedipur, Malanka
	Talala	Madhupur Jambur, Lushala, Haripur, Ankolvadi, Bhojde, Jasapur, Dhava, Vadla, Surva, Talala, Bakula Dhanej
	Malia	Jalondar
	Visavadar	Rajpara, Javaladi, Vekariya, Chaparada, Khambhda, Hasnapur
	Savarkundla	Thavi, Pipardi Bhonkarva, Mitiyala, Kerala, Senjal
	Kodinar	Nagadla, Pichvi, Alidar
Leopard Medium Conflict	Talala	Talala Sangodara
	Una	Una
	Junagadh	Navagam

2 Assessment of local residents' perception towards lion conservation

2.1 Respondent Characteristics

Questionnaires were administered to a total of 3314 individuals in 84 villages in Visavadar, Talala, Mendarda, Malia, Una, Dhari and Khamba. While the former three Talukas fall in Gir (W) Division the latter two occur in Gir (E). Women were not particularly targeted for interviews unless they came forward and indicated an understanding of forest related issues. Otherwise, women were not in situations related to encounter with carnivores or involved in following up on livestock compensation claims. There were two women *Sarpanch* and questionnaire was administered to them as in other villages.

Occupations were related to agriculture (Table 7), animal husbandry, local business enterprises and wage-labour (mostly in crop fields). Few youngsters were employed in diamond polishing either in nearby towns or cities like Surat, Baroda and Mumbai. Three respondents were employed by the Forest Department. Groundnut, wheat, cotton, mango, *bajra* (pearl millet), *jowar* (sorghum), sugarcane, *tuvar* (pigeon pea), oilseeds and other fruits and vegetables were the major crops cultivated. Cattle, buffalo, goat, sheep were commonly reared. Livestock was largely reared for milk and milk products. In a predominantly vegetarian State, there was market only for goat meat. Camel, donkey and horse were used as pack animals and oxen were used as farm animals.

Most common communities were Maldhari (Charan/Gadvi, Rabari, Ahir and Bharvad), Patel, Coli, Kumbhar, Harijan, Muslim, Darbar (Kati & Karadia), and few other communities including Bavaji, Lohana, Maher, Mamna, Mochi, Sagar, Siddhi Muslims, Vaghiri, Vanan, Vanja, Vankar

Table 7. Respondent characteristics across 3314 households in seven Talukas surveyed

Taluka	Dhari	Khamba	Maliya	Mendarda	Talala	Visavadar	Una*
Number of Villages	16	16	6	15	12	15	4
Number of Households	479	672	261	560	696	599	47
Age (%)							
18-30	13	13	26	14	23	15	25
31-50	55	50	52	63	58	70	47
>50	32	37	22	23	19	15	28
Taluka literacy (%)							
Agriculture (%)	79	79	83	75	67	86	51
Resident for generations (%)							
Land-holding (acres)	98	99	98	97	93	94	100
1-10 (%)							
11-20 (%)	23	14	30	23	32	41	52
21-40 (%)	29	25	22	37	32	40	24
>40 (%)	28	31	25	21	21	13	9
	20	30	23	19	15	6	15

* Data deficient

2.2 Relation with the forest

2.2.1 Benefit

Villager's dependency on forest for grazing and fodder was only during certain months of the year (post monsoon). Landowners were less dependent on fuel-wood and were more a requirement of wage labourers and graziers who couldn't afford other energy sources. Forest resource (NTFP) collection occurs but is not a major source of livelihood. The benefit from Gir, according to majority of the respondents was through indirect benefits like a clean environment, water availability and seasonal rains.

2.2.2 Loss

- Crop Loss: Nilgai (*Boselaphus tragocamelus*) and wild pig (*Sus scrofa*) were named as the greatest menace feeding and trampling crops. Porcupine (*Hystrix brachiyura*), chinkara (*Gazella benetti*), Indian peafowl (*Pavo cristatus*), sambar (*Cervus unicolor*) and chital (*Axis axis*) in that order were also considered as nuisance. Khamba and Dhari Talukas rated highest in terms of crop loss (Table 8).
- Livestock Loss: Talala and Khamba recorded more livestock predation events than other Talukas (Table 8)

Table 8. Relative ranking of cost incurred due to proximity to forest in the 7 survey-Talukas based on i) Crop loss intensity ii) Livestock loss based on compensation claims from forest department

Taluka (no. of villages surveyed)	Division	Mean Crop- loss (%) (2009-10)	Relative Rank Crop-raiding by wild ungulates	Total Livestock loss (2009-10)	Livestock loss per village	Relative Rank Livestock loss due to carnivores
Khamba (18)	Gir(E)	51	1	122	6.8	1
Dhari (16)	Gir(E)	41	2	55	3.4	5
Malia (4)	Gir(W)	30	3	14	3.5	4
Mendarda (16)	Gir(W)	28	4	31	1.9	6
Talala (16)	Gir(W)	26	5	61	3.8	2
Visavadar (15)	Gir(W)	17	6	54	3.6	3
Taluka Average		34				

2.3 People-PA Staff Relation

- a. 98% of the respondents (N=2533) would pass on information on injured/dead/distressed wild animals with the Forest Department.
- b. 66% of respondents (N=205) who had claimed monetary compensation for livestock loss due to predation had negative opinion with respect to compensation amount, delays in processing and also discouraged by cumbersome procedures and having to deal with dishonest/uncooperative staff. Even respondents satisfied with the scheme desired for more compensation amount (Figure 13)
- c. 95% respondents (N=2366) claimed to have good/neutral relation with the Forest Department and 5% claimed to have bad relation.

2.4 Opinion and Attitude

- a. 60% of respondents (N = 1005) felt that presence of predators like lion and leopard did not reduce crop-raiding menace. The remaining felt that the carnivores checked both crop-raiding wild ungulates as well as free-ranging unproductive livestock.
- b. 98% respondents (N= 2533) perceived forest as being useful to them and only 2% said proximity to forest causes loss.
- c. Response to question regarding attitude towards lion translocation could be distinguished in following categories - 31% Humanistic (relating to anthropomorphic associations such as affection for lions and regional pride), 23% Ecologicistic (maintaining existing balance and harmony), 20% Negativistic (fear and mistrust towards lions), Utilitarian (usefulness or relevance to peoples' lives), Scientific (concerning safety and wisdom of disturbing lions from their current habitat) and Moralistic 2% (reasoning from a moral standpoint (Figure 14)

2.5 Awareness and Knowledge

There were 16 and 7 articles per month in English and regional dailies respectively in the past 5 years. There was at least 1 media feature on lions each month apart from promotional tourism advertisements. In the past 5 years there have been 10 reports, 11 press releases, 33 web-posting and 6 scientific publications.

Totally 2367 interviews were conducted to test awareness levels of respondents (Table 9).

Table 9. Taluka-wise relative ranking based on proportion of positive response for 6 questions: Rank 1 denotes greater proportion of knowledgeable respondents relative to other Talukas; Rank 6 is the least

Taluka	Mendarda	Malia	Visavadar	Khamba	Dhari	Talala
1. Aware of endangered status of Asiatic lion? Are you aware that worldwide this the only population?	3	4	6	1	2	5
2. Aware of 2006 poaching incident?	2	3	1	5	4	6
3. Aware of 2010 lion census and population estimate?	2	5	1	6	3	4
4. Do you take keen interest in lion related articles in print media?	3	1	2	4	5	6
5. Watch lion related news on TV?	1	2	4	5	6	3
6. Aware of lion Translocation project?	4	2	6	1	3	5
Mean Rank	2.5	2.8	3.3	3.7	3.8	4.8
Overall Taluka Rank	1	2	3	4	5	6

Figure 13. Respondent opinion of monetary compensation for livestock losses given by Gujarat Forest Department (N =196)

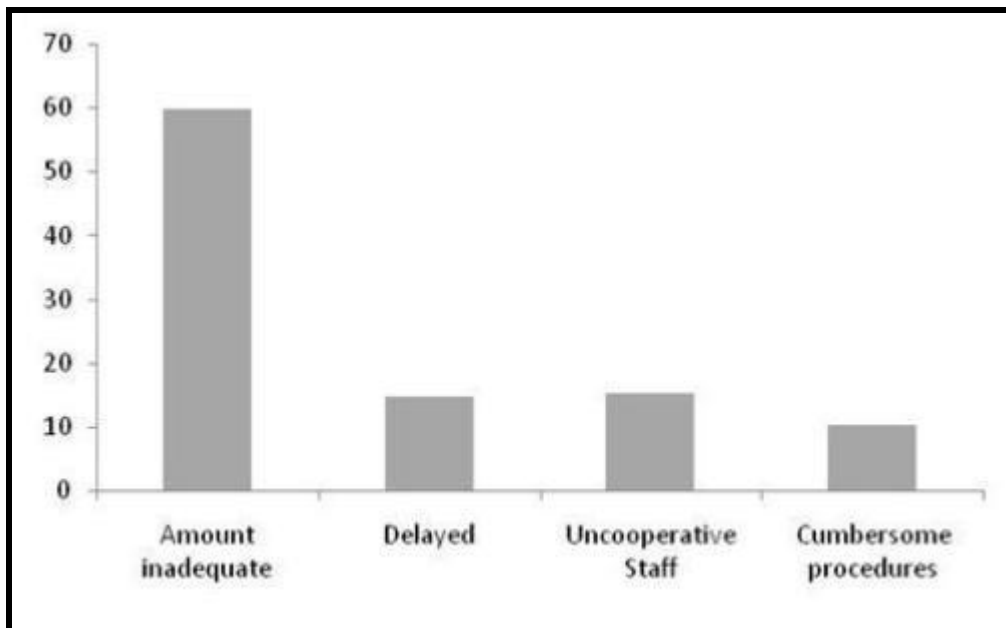
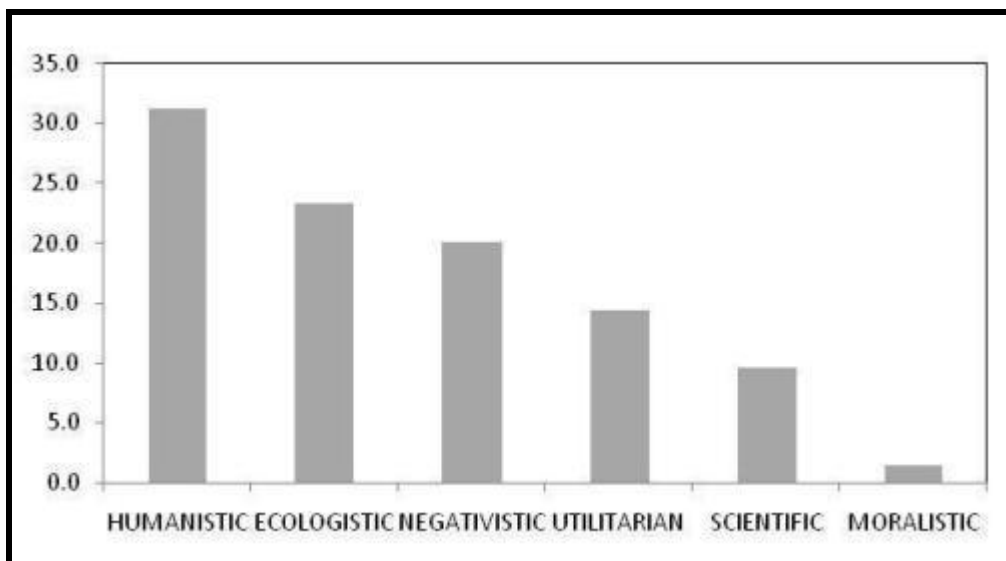


Figure 14. Respondent opinion of Lion Translocation



Discussion

Proximity to PA: Boon or Bane?

Gujarat, particularly Saurashtra, has recorded phenomenal growth in agriculture due to various developmental schemes and increase in ground water availability in recent years (Shah et al. 2009). Villages within 15km radius of Gir PA have relatively higher irrigated land, more cultivated area of farm-based crops and horticulture crops generating nearly 3 times greater crop productivity (Pandya et al. 2001). Gir PA also plays a role in providing fodder and grazing land for livestock within and outside PA. The direct grazing benefits to livestock owners are valued at approximately Rs. 967.3 crores (17 million USD) of which 85% benefit is derived by livestock owners in the bordering villages chiefly during monsoon and winter season (Pandya et al. 2001). About 15000 mt fuel wood is utilized by people living within and in border areas of Gir PA (Pandya et al. 2001). Wildlife tourism is another income generating activity thriving in the western part of Gir PA chiefly benefitting Sasan Gir and few other villages in Talala Taluka. From about 100000 tourists in 2003-04, promotional tourism campaigns riding on a country-wide tourism boom has doubled the tourist inflow in the past 3 years going over 200000 in 2009-10 generating a revenue of 25000000 (455000 USD) (Kumar and Meena 2011). Close to 2.5 lakh religious tourists visit Kankai, Banej and Tulsishyam temples within Gir PA promoting local employment and business opportunities. The contribution of Gir PA through indirect environmental benefits is also substantial in terms of improvement in water quality and reduction in salinity ingress, carbon sequestration and water availability (Pandya et al. 2001). Gir PA is the store-house of several water sources – 7 perennial and other seasonal rivers and streams, reservoirs and check-dams that supply water throughout the year. Significantly higher rainfall is received within 15km of Gir PA (Pandya et al. 2001).

In spite of the stated benefits, people were only partially dependent on the PA resources. While traditional pastoralist Maldharis had grazing rights all through the year, the fodder requirements of other communities in the bordering villages were largely met in village fallow land and crop fields. The use of the forest for grazing was only in monsoon and winter season. On the other hand, the numbers of livestock kills in villages outside PA have increased in all Forest Divisions proving that natural dispersal or movement of lions has not been unidirectional but rather radiated in all directions outside the PA (Table 2, Fig.2). The average annual livestock predation has shown more than 100% increase except in Gir (W) Division in the past five years. This observation is further corroborated by the increase in lion and leopard populations (Table 2). Yet, the evaluation of lions and leopards particularly outside the Forest Divisions in the village vicinity maybe ambiguous and under estimated. There has also been an increase in the number of villages recording kill incidences indicating that predation is occurring in more villages than before (Fig. 4). An average of 30 kills per year could be expected to occur within 1-5 km of PA with the incidence reducing beyond 30 km. This strong negative relationship (-0.8) between distance to PA and livestock raiding (Fig. 3) indicates that kills are being made by resident lions with a part of their range outside Gir PA. Thus, there is less movement between Gir PA and Girnar, coastal and Shetrunji sink populations. Visavadar had lower kill incidences close to Gir PA boundary with high conflict zones closer to northern boundaries of the Taluka indicating that the kills were made more by the Girnar population rather than from the source population (Fig.3).

The kills were concentrated around the periphery of the Girnar WLS indicating that this population has a weak link with the source population. Interestingly, lion kills have increased or spread in the northern part of Girnar WLS indicating again that the dispersal of this population is independent of the source population. There were High conflict areas between Gir PA and Mitiyala sanctuary, the intervening corridor areas of which are heavily populated (Meena 2010). It would be useful to focus mitigation measures in this area. Although the average number of leopard kills each year is low the % increase from 2001-2005 to 2006-10 is much higher than that of lions. Among the villages surveyed, Talala and Khamba district rated higher in terms of livestock losses (Fig. 2, Table 8).

There was a greater negative feeling and less tolerance towards crop raiding ungulates. 60% of respondents were of the opinion that presence of carnivores did not reduce crop raiding menace. Correspondingly, the presence of wild ungulates does not also reduce the predator pressure on livestock. Overall, villages in Khamba and Dhari in the eastern part of the Gir PA had higher crop loss incidence compared to other 4 Talukas (Table 8). Although Maliya Taluka had only few villages close to the Gir PA border, it rated high in both conflict types (Table 8).

Respondents were asked about the measures taken to reduce human-wildlife conflict and commercial loss. Mitigation measures to reduce livestock included active supervision during day while grazing, construction of corrals and rising boundary walls of houses to prevent lions or leopards from breaking in. To keep off crop-raiding wild animals, farmers stayed up all night and chased them away by creating noise and commotion. Fencing off crop-fields was not an affordable option for all farmers to protect from crop raiding animals. The use of illegal electric fences is prevalent but comes to fore only when lions are accidentally electrocuted. Farmers requested for funding for putting up fences, removing problem causing animals, crop insurance and any other schemes to reduce crop raiding.

Attitude and Awareness

Majority of respondents (98%) recognized the benefit derived from close proximity to the forest in terms of healthy environment, seasonal rains and direct benefits to agriculture and crop yield. Only 2% of respondents felt proximity to forest spelt loss and suffering in terms of danger to life from carnivores and crop loss caused by crop raiding ungulates. Since the main focus of the study was the Asiatic lion, the one question relating to lion translocation defined the people's attitude towards the endangered species. Only 20% of the respondents had negative feeling towards lions and said would be happy to have lions removed from their habitation and surroundings. The majority of response was related to the Humanistic and Ecologicistic categories (Fig. 14). Regional pride and cultural attachment to lions was one of the common responses. A number of respondents felt that it was unnecessary to translocate as it was an animal that was peacefully coexisting with them and that it would be of greater significance to relocate leopards and crop raiding animals. Some respondents also stated that they never claimed livestock compensation as it was lion's natural food and culturally unacceptable to claim money for the death of sacred animals that provide great value and service when alive.

Questions relating to people's knowledge and awareness of PA related information was framed so as to test people's connection with the PA. Mendarda ranked higher because of location of tourist and concentration of resorts and hotels. Tourists from all over the world visit to see the last population of the endangered Asiatic lion. Yet, in the survey villages around the Gir PA only 27% knew that the Asiatic lion was endangered and found nowhere else in the world. 33% claimed to follow natural history programmes on television and some confused African lions with the Asiatic subspecies and had the misconception that lions had a very wide distribution. The direct benefit from the enormous tourist inflow is so lopsided that it is profitable to only a few villages around the tourism zone. This is probably the reason why there was no great curiosity to know more about the animal or the forest. The poaching incident claiming lives of 7 lions was a sudden one-time event (Times of India, Dasgupta, 7th April, 2007) following which several stringent conservation measures were enforced including better information networking of forest management with local villages and appointment of *Van mitras* (friends of the forest) in each village. The *Van Mitras* are village youths who are paid a small monthly income to monitor and report illegal conservation activities, health and movement of wild animals in the village vicinity. Yet, only 15% of respondents were aware of the incident. The once in five-year lion census is a very high profile event, keenly followed and reported by the media, attracting volunteers and experts from all over the country. Trackers are hired from local villages and lion locations are reported from the entire Gir landscape. In 2010, the year of lion census apart from press release on the final population assessment, news features in English and regional dailies and electronic media were very high (<http://asiatic-lion.blogspot.in>). The lion translocation is the most widely debated and long pending project in lion conservation history (Meena 2010) but respondents had no connect with the issue. Only 21% and 14% respectively were aware of these two events. Apart from these key events, only 23% of respondents indicated interest in articles or news features published each day in spite of the huge amount of media attention that the Gir PA and lions generate. Although, they were not expected to follow articles in English newspapers, reports, web-postings or scientific publications they were expected to know what was published in regional dailies or aired in electronic media. In a largely agrarian society, news relating to Gir PA, conservation status of lions and management policies were considered irrelevant and of no importance to the local people. They did not have a world view of the wild animals seen frequently in the village vicinity. Almost all villages surveyed have Government run Primary and Middle schools. Yet, the knowledge and awareness about lions and Gir PA was found to be inadequate in spite of nature camps and sporadic awareness programmes conducted by Forest Department (Kumar and Meena 2011, Pathak et al. 2002). This can be considered a shortcoming when compared to awareness and sensitivity created about endangered wildlife among Middle-school children of the same age in urban schools. These students have been motivated to take up conservation campaigns (http://saveourtigers.com/sancturyasia_campaignlaunch.php) for charismatic species like tigers (*Panthera tigris*). Environment education and awareness campaigns in villages and village schools adjoining PAs could improve local knowledge, allay fears and also decrease risk of predator attacks by promoting anticipatory and proactive precautionary measures as suggested by Lagendijk and Gusset (2008). Through this project, posters with information and facts about Asiatic lion and Gir PA was distributed in all villages surveyed to be displayed in VI & VII classrooms, school notice board and *Sarpanch* office (see back-cover).

Overall, the PA-people relationship is very positive but it is important to maintain and win over the people with negative feelings. In contrast, Saberwal (1994) reported hostile attitude of people towards the forest and the management. The reason for this disparity was the timing of the study following a drought when there was an escalation of human-lion conflict and also the low sample size (Saberwal et al. 1994). Some of the concerns reported such as the danger posed by carnivores when farmers are compelled to go to irrigate and guard crops at night were comparable with this study (Saberwal et al. 1994). Such constraints of choosing between safety for life and crop yields were voiced by many respondents. The vast divergence in opinion also indicates tolerance is precarious and may shift when there is an escalation in conflict such as a natural calamity which may not augur well for the endangered Asiatic lion.

People-PA staff relation

Conservation policies, rights/access to forest resources, extent of dependency on forest resources, threat to human life, magnitude of losses and the compensation offered by the forest management define the attitude of people living in close proximity to forests (Shibia 2010, Romanach et al. 2007, Treves et al. 2009, Bagchi and Mishra 2006). Relation with field staff and overall bureaucracy define local attitude and are crucial for successful PA conservation (Karanth and Nepal 2012). This was observed in the study whereby this kind of positive relation with the PA staff added to cultural tolerance plays an important role. Villagers within 5km boundary of Gir PA did not gain direct benefit in terms of employment and resource dependency so that dependency on the forest is manageable. The India Eco-development Project (IEP) funded by Global Environmental Facility (GEF) implemented through World Bank with a budget of US\$ 67 million was ineffective in changing ecologically detrimental livelihood practices especially within the park but successful in improving people-management relationship (Varma 2009). Thus, schemes introduced by local NGOs and the forest department such as the IEP are attempts to further reduce pressure and reduce demands for fuel wood and fodder but so far with only partial success.

Conflict mitigation schemes are extended to improve local people's attitude towards forest and conservation. The Gujarat Forest Department approaches this task in 3 ways :- i) Capture and relocation of problem causing or injured lion and leopards. These operations also include rescue of lions and leopards that accidentally fall into open wells in villages. ii) Monetary compensation for losses incurred due to wildlife. Human injury/mortality due to carnivore attacks varying from Rs.5000 (900 USD) to Rs.30000 (1800 USD) depending on the severity of the attack. Monetary compensation for livestock loss estimated based on the type, age and productivity of livestock. The amount is variable between Rs.1100-8000 (20-145 USD) for Buffalo, 1100-6000 (20-109 USD) for cow and between 425-7500 (8 -137 USD) for other domestic animals such as camel, goat, sheep and horse (Kumar and Meena 2011). iii) Protection of wildlife and resources. Vigilance against poaching and the need for constant monitoring of forest boundaries throughout the periphery of the Gir PA requires good communication and networking with local villages. This has been strengthened by the appointment of *Van Mitras* in each village.

The wildlife relocation and rescue programmes have a positive effect on people's attitude towards forest department. These operations have increased and currently average approximately 60 and 97 lion and leopard cases annually (Meena 2008, Pathak et al. 2002, Kumar and Meena 2011). 98% of respondents said they would pass on the information to the forest department directly or through *Van Mitras* or *Sarpanch* if they encounter injured or dead wild animals. Yet, a small proportion of people feared being dragged and booked in wildlife offence cases that are dictated by stringent laws. Majority of respondents (95%) stated that they had good or no relation with the forest department while 5% of the people were in conflict with the PA staff and mistrusted or feared them.

Though compensation schemes are seen as positive step to reach out to local people (Karanth and Nepal 2011, Athreya et al. 2010), there seemed to be a lot of dissatisfaction among respondents largely due to amount offered in lieu of value of livestock lost to predation (Fig. 13). It is evident that the livestock loss is gauged more against compensation and market value of the livestock lost rather than against the overall service provided by the forest.

Conclusion

In a predominantly agricultural land-tenure system, the villages around Gir PA have witnessed an increase in carnivore related conflict particularly livestock loss. Crop raiding ungulates were considered the most negative influence of forest by the local people. Present coexistence and survival of lions in the agro-pastoral landscape outside the PA has been rightly attributed to the continued tolerance of local communities. Of the villages surveyed, Khamba and Dhari were more susceptible to crop loss and Khamba and Talala Talukas had greater livestock loss in 2009. Overall, awareness of issues related to lions and forest was low.

Throughout their range, lions (*P.l.leo*) are vulnerable to retributive killing and trophy hunting (Bauer & Van Der Merwe 2004, Loveridge et al. 2007) and rarely tolerated in a cultural context (Lagendijk and Gusset 2008). The Asiatic lion survives in a landscape where people have high tolerance and despite losses consider lions as part of their natural heritage. In a situation where lion movement has increased throughout the periphery of the PA, conflict mitigation and maintaining positive public perception is important for lion conservation.

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Appendix 1

An assortment of respondent's thoughts that does not necessarily represent the collective opinion of the community. A collection of random statements, some funny quotes, some serious accusations and earnest opinions:

- The reason for movement of lions outside PA is that in earlier days, every 2-3 km there were lionesses and lions used to have adequate food. Since the time Maldharis have been evacuated from forest, lions are having to come to villages in search of food
- I have informed FD suspicious movements near Hadmathiya but no action has been taken. Before there were just one forester and 2 guards for the entire forest area but we were familiar with them and they used to know the villagers personally. Nowadays, in spite of all the facilities we have lost that connect. The new recruits patrol the roads on their bikes, just pass through our villages and also have no idea what is happening inside the forest. They never patrol on foot within the forest that is the reason why they are clueless about things.
- Good schemes never reach grassroots people
- We do not agree with the translocation. We need lions. Lions are for us and not for other people.
- We protect the forests, volunteer during emergencies like forest fires and also have no fear of lions. We feel FD should take us with them in their endeavour to protect the forest as we appreciate the fact that our lives are dependent on the forests, for the pure air and water we enjoy. They don't understand it is after all it is our treasure and we should be involved in the protection. There is a lot of corruption and they are the ones ruining the forest in the name of protection
- Because Nesses have been relocated animals are straying out. You will see lions by the road because Nesses are now located here in these places and less in the forests. I remember, when I was young (30years back) Hadala and Timbarva was covered by thick forests with only 2 patrolling guards and yet the forest was well taken care of whereas now even though the staff have increased the forest is vulnerable. There is more corruption, crores of rupees are spent for conservation with no visible difference
- Why can't our livestock go in for grazing? It will keep lions from moving out afar. We will kind of buffer and prevent their dispersal. We don't mind losing our Rs.40000 worth buffalo if we get grazing rights.
- We live in border villages and yet we are not provided with information about our environment.
- We would love to go back to forest if we are allowed. We will rush in even if we don't have a roof over our heads. Our livestock will also love to be back in forest in spite of threat to their lives. Maldharis came out and lions followed them. Lions still come to our doorstep for food. I left Sasan because of the restrictions to use the forest. The forest is now infested with *Cassia tora* weed because of these restrictions (**opinion of a Maldhari**).

- We feel so safe when lions come to our fields because the patrolling that we do is instead done by the lions and that too without taking any charge from us. Lions are very much needed by us and they are a boon for us.
- If lions are exclusive to Gir, the area will remain popular otherwise Sasan will lose its pride and popularity.
- People surviving in a carnivore habitat are in constant risk. We have to go to our crop fields in the night and if we lose our lives nobody will answer for that but if wild animals die in our fields we have to face a lot of problems.
- We want our children to get on and not depend on FD and want to ensure they are eligible for jobs elsewhere. We love the forest and lions but all this is inadequate for livelihood **(opinion of Maldhari)**
- We depend on livestock for livelihood we should be given more compensation for our losses **(opinion of Maldhari)**
- In spite of patrolling and staying up we lose large part of our yield to crop raiding herbivores.
- Lions cannot be without these jungles and we cannot be without them. They are the king of the jungle and our protectors. Outsiders (tourists) are attracted to this area because of lions and even you have come here because of the lions. We earlier used to live in the jungle and still desire to do so. Given an option we will abandon this comfortable life and gladly shift back into the forest. When Maldharis were residing in the forests, lions were well protected **(opinion of Maldhari)**
- We were vigilant of outsiders and poachers. Nowadays innocent poor people get caught in forest related cases and poachers are roaming outside scot free.
- We enjoy watching lions even though we lose our livestock to them. We enjoy watching them feed. We know that lions never attack people and that leopards are more dangerous.
- Livestock loss in forest is natural. We know that livestock is lion food we don't have any problem accepting the fact. Obviously lions can't eat grass!!!
- Lions raise so much revenue here. I personally do not have an opinion of lion translocation and as far as we are concerned we don't mind having lions around if it means losing few of our livestock to predation.
- The FD response is not prompt we have to guard the carcass till they come to inspect the kill against dogs and other scavengers
- Lions shouldn't be taken out of the forests it is their home just like our Nesses. We are born and belong to these forests and this is our identity **(opinion of Maldhari)**
- Lion, this forest and Maldharis are all Gir's identity. Our wellbeing and joy comes from living with lions.
- Jungle che saras to ame che swastha
- Because Maldharis have been relocated, forest has become dense. Lazy animal such as lions require open areas this is the reason why they now roam in search of open spaces
- We face enormous losses but yet love forest & wildlife and have no ill will towards it
- Lions are needed to protect the forest we will cooperate to ensure their safety
- We would like to build stone wall boundary around our farms. We would like the government to provide loans for construction & permission to remove stones from forest

- Lion is a very lazy animal and requires open spaces. The Gir forest has become very dense therefore the animals have come out.
- We need permission for construction of boundary wall and to be allowed to bring stones from the forest.
- We are not allowed to cut trees but wild animals cause enormous loss to our crop fields. We get no compensation for that and worse, when a Nilgai or wild animal dies in our field we face hell and are troubled a lot by the forest department.
- Man's identity is moustache; Gir's identity is from lions"
- Lion is protector of forest; crocodile of water and police of people
- New recruit officers don't have the knowledge we have and yet are the ones that take important decisions for forest conservation. For example, a certain type of grass is found here that grows immediately after monsoon. The newly recruited staff mistook it for a weed and obtained orders to clear the area. None of them knew that it is food for many small animals and that bird's build nest among these plants (grasses). All this was destroyed with one wrong decision. Tell me, who does more harm to the forests?
- 2 years back I lost a cow to lions but did not even claim compensation because predation is natural and livestock is lion food.
- Before lions used to be in big groups (15) regularly but now we see maximum group of 4.

Appendix 2

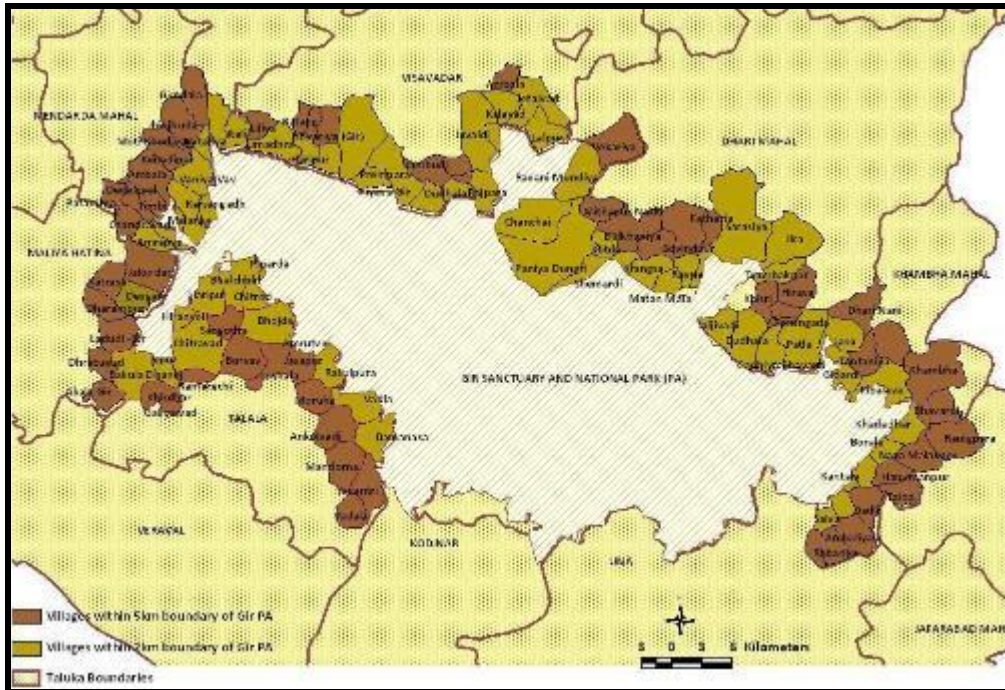
Table 10. Surveyed Villages

S.no	District	Taluka	Village Name	Population	No. of households	Distance to PA (km)
1	Amreli	Dhari	Chanchai	720	119	2
2	Amreli	Dhari	Kotda	332	35	2
3	Amreli	Dhari	Trambakpur	1304	228	2
4	Amreli	Dhari	Krangsa	261	65	2
5	Amreli	Dhari	Patla	280	32	2
6	Amreli	Dhari	Jaljivadi	1135	215	2
7	Amreli	Dhari	Gadhiya Chavand	591	89	2
8	Amreli	Dhari	Khisri	868	167	5
9	Amreli	Dhari	Rajsthali	511	97	5
10	Amreli	Dhari	Paniya Dungri	338	61	5
11	Amreli	Dhari	Mithapur Nakki	920	160	5
12	Amreli	Dhari	Facharia	636	102	5
13	Amreli	Dhari	Sakhpur	780	151	5
14	Amreli	Dhari	Hirava	1135	216	5
15	Amreli	Dhari	Dudhala	1305	237	5
16	Amreli	Dhari	Tarsingada	385	75	5
17	Amreli	Khamba	Lasa	1518	200	2
18	Amreli	Khamba	Dhavadiya	455	90	2
19	Amreli	Khamba	Chakrava	1047	150	2
20	Amreli	Khamba	Dhundhavana	754	150	2
21	Amreli	Khamba	Salva	700	144	2
22	Amreli	Khamba	Dhari Nani	1446	216	5
23	Amreli	Khamba	Umariya	1769	291	5
24	Amreli	Khamba	Nava Malaknes	1578	299	5

S.no	District	Taluka	Village Name	Population	No. of households	Distance to PA (km)
25	Amreli	Khamba	Tantaniya	2167	336	5
26	Amreli	Khamba	Bhavardi	1656	298	5
27	Amreli	Khamba	Hanumanpur	1139	169	5
28	Amreli	Khamba	Talda	1733	303	5
29	Amreli	Khamba	Dadli	902	146	5
30	Amreli	Khamba	Ambaliyala	926	195	5
31	Amreli	Khamba	Pipariya	862	157	5
32	Amreli	Khamba	Rabarika	1126	216	5
33	Junagadh	Maliya	Devgam	798	183	2
34	Junagadh	Maliya	Jalondar	1632	279	5
35	Junagadh	Maliya	Katrasa	1438	289	5
36	Junagadh	Maliya	Dharampur	1124	208	5
37	Junagadh	Maliya	Dhrabavad	1058	194	5
38	Junagadh	Maliya	Akala Gir	818	153	5
39	Junagadh	Mendarda	Itali	1275	262	2
40	Junagadh	Mendarda	Nataliya	255	49	2
41	Junagadh	Mendarda	Vaniya Vav	65	14	2
42	Junagadh	Mendarda	Malanka	1070	243	2
43	Junagadh	Mendarda	Ranidhar	190	48	2
44	Junagadh	Mendarda	Amrapur	802	167	2
45	Junagadh	Mendarda	Gadakiya	151	19	2
46	Junagadh	Mendarda	Patarama	762	164	5
47	Junagadh	Mendarda	Dedakiyal	859	213	5
48	Junagadh	Mendarda	Nani Khodiyar	1505	350	5
49	Junagadh	Mendarda	Jhinhuda	1514	297	5
50	Junagadh	Mendarda	Moti Khodiyar	1327	277	5
51	Junagadh	Mendarda	Kenadipur	958	214	5
52	Junagadh	Mendarda	Ambala	1502	305	5
53	Junagadh	Mendarda	Chandravadi	910	176	5
54	Junagadh	Talala	Chitrod	1401	281	2

S.no	District	Taluka	Village Name	Population	No. of households	Distance to PA (km)
55	Junagadh	Talala	Bhojde	1622	331	2
56	Junagadh	Talala	Bhalchhel	1328	286	2
57	Junagadh	Talala	Hiranvel	859	156	2
58	Junagadh	Talala	Rasulpura	1093	192	2
59	Junagadh	Talala	Jepur	1326	259	2
60	Junagadh	Talala	Vadla	901	173	2
61	Junagadh	Talala	Khirdhar	1085	233	5
62	Junagadh	Talala	Sangodra	1313	299	5
63	Junagadh	Talala	Lushala	316	75	5
64	Junagadh	Talala	Galiyawad	912	160	5
65	Junagadh	Talala	Vadala	1557	267	5
66	Junagadh	Visavadar	Javaldi	1482	91	2
67	Junagadh	Visavadar	Govindpara	1482	37	2
68	Junagadh	Visavadar	Khambha Gir	1787	297	2
69	Junagadh	Visavadar	Rajpara	1026	180	2
70	Junagadh	Visavadar	Piyava Gir	1026	231	2
71	Junagadh	Visavadar	Dudhala	1026	169	2
72	Junagadh	Visavadar	Manandiya	1026	78	5
73	Junagadh	Visavadar	Jambudi	1026	226	5
74	Junagadh	Visavadar	Ishvariya (Gir)	1787	112	5
75	Junagadh	Visavadar	Miya Vadla	1787	101	5
76	Junagadh	Visavadar	Ambala	1459	168	5
77	Junagadh	Visavadar	Kalavad	1482	221	5
78	Junagadh	Visavadar	Ratang	1787	226	5
79	Junagadh	Visavadar	Liliya	1787	204	5
80	Junagadh	Visavadar	Haripur	1787	180	5
81	Junagadh	Una	Naliya Mandvi	1424	262	2
82	Junagadh	Una	Chanchakvad	1394	285	2
83	Junagadh	Una	Hadala	112	25	2
84	Junagadh	Una	Jamvali	35	8	2

Figure 15. Geographical location of the villages surveyed





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