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 Acknowledgements

"Evaluating habitat and human bear conflict in north Gujarat, India, to seek solution for human-bear coexistence" A research project is a 2nd Grants from the Rufford Small Gants Foundation, London, UK. We are highly grateful to RSGF for funding and help in continuing the bear study in the region. As no systematic study on sloth bear is carried out in Gujarat and the present study would be very helpful in providing baseline information and formalizing conservation and management strategies for bears and habitat in the region.

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Introduction

Bears are member of the family Ursidae. According to Prater (1948), the family Ursidae's home is distributed largely in the northern hemisphere, where every region has its characteristic species. The Arctic is the home of the polar bear (*Ursus maritimus*). The temperate zone, south of the Arctic, is the typical habitat for brown bear (*U. arctos*) and the black bear (*U. americanus* and *U. thibetanus*). South of the temperate zone, forests of India and south-eastern Asia are the home of two tropical bear species; the sloth bear (*Melursus ursinus*) and the sun bear (*Helarctos malayanus*). One species of bear found only in the southern hemisphere is the spectacled bear (*Tremarctos ornatus*), a native of the Andes (Prater 1948).

Sloth bears are the most widespread species of bear in India. They are one of the largest termite-eaters (up to 175 kg) of lowland India, Bangladesh, Nepal, and Sri Lanka. At least 50% of its diet consists of ants and termites, whereas much of the remainder is fruit (Eisenberg and Lockhart, 1972; Laurie and Seidensticker, 1977; Schaller, 1967). Movements and habitat use of a sloth bear include nocturnal activity, carrying young on the back, and extended parental care. In addition, other myrmecossphagous mammals tend to occupy relatively small home ranges, presumably due to their low metabolic rates and a general abundance of prey (Gittleman and Harvey. 1982). Ants, termites, and fruit are foods associated with low basal metabolic rates in mammals that weigh >100 g, and surely this is expected to be the case in the sloth bear. (McNab B. K. 1992)
Sloth bears are found widely in Indian subcontinent; it is reported in Srilanka, Nepal, India, Bangladesh and Bhutan. The bear lives in a variety of habitat such as Teak forest and Sal forest, low land evergreen forest, hill country and up to elevation of 1700 meter. They are also found in river side forest and tall grass areas on the floodplains of Nepal, and in Bhrahmaputra valley of Assam (Cowan 1972,

Krishnan 1972, Brander 1982). Presently sloth bear occurs commonly and is distributed widely across the tropical forest of the Indian subcontinent (Yoganand, *et al.* 2006). Whereas, in the past, until the early 1800s sloth bear may have occurred in most non-arid, low-altitude forests of India. They were reported to be abundant during mid-1800s but declined severely due to hunting and habitat loss from late 1800s until the 1950s (Gilbert 1897, Dunbar-Brander 1923, Prater 1948, Phythia-Adams 1950, Krishnan 1972). A similar or accelerated habitat loss continued even after 1950, until about the 1980s, primarily due to conversion of forest for agriculture (FSI 1997). As a result of the continued habitat destruction and degradation, sloth bear populations have declined or become fragmented all over and as a result, they have become locally extirpated in some areas. (Krishnan 1972, Garshelis *et al.* 1999, Singh 2001). Sloth bears are found occurring in the forest patches where there is sufficient availability of food, and favor places where outcropping of

rock and tumbled boulders offer them shelter during the hot weather and the rains.

In India, sloth bear occurs fairly in moist and dry deciduous forest (42% and 33% respectively) and less frequently in wet evergreen (13%) and dry scrub (6%) type of forest (Yoganand, *et al.* 2006). Sloth bears are reported to exist in 174 protected areas in India, which includes 46 National Parks and 128 Wildlife Sanctuaries (Chauhan, 2006). Whereas in Gujarat sloth bears found to occur mainly in north eastern and central part of the state (Nishith 2009). Except previous research study by our RSG team (Nishith 2009, Ratnayeke and Dharaiya, 2009) and a Ph.D. thesis on bear-human conflicts (Mewada, 2011), very few studies have been carried out on sloth bear in Gujarat.

Out of five protected areas where sloth bear occurs in Gujarat, (Shoolpaneshwar, Jambughoda, Ratanmahel, Jassore and Balaram Ambaji wildlife Sanctuaries) Balaram Ambaji and Jassore wildlife Sanctuaries of Banaskantha forest of the North Gujarat region have reported with the highest sloth bear population which is also reported to have highest densities of sloth bear anywhere in India by Garshelis, *et al.* 1999, whereas the state's highest bear population is reported in Vijaynaagr and Dholvanai ranges of

Sabarkantha forest having maximum dry deciduous forest patches with some evergreen patches, according to the latest bear population census (in 2011) by Gujarat forest Department.

Sloth bear population in Gujarat is facing the problem of habitat degradation, habitat fragmentation and high level of anthropogenic pressure due to increasing human population (Cowan 1072, Servheen 1990, Garshelis *et al.* 1999 and Kemf *et al.* 1999) and developmental activities (Nishith 2009). The human-animal interaction mostly manifest as conflict rather than being competition. Conflict resolution may influence the survival of a species and therefore has crucial conservation implications. Wildlife management itself, frequently, is about managing these conflicts that occurs at various levels. The study of an animal's behavior ecology cannot be complete without dealing with the question of how that animal interacts with humans, why it reacts the way it does, and what factors lead to such interactions.

We started the research study in one of the highest bear density districts of North Gujarat (Banaskantha) in 2007, with the financial support from the Rufford Small Grants Foundation, UK which met all the following objectives successfully. In the previous study we,

- Studied the status and distribution of bear in Banaskantha,
- assessed and documented the nature and frequency of human-bear conflicts
- Made the recommendations to minimize human-bear conflicts in study area.

We already completed the study with above objectives in Banaskantha district with significant findings through which we extended our research in the other

districts of north Gujarat (i.e. Sabarkantha and Mehsana) through 2nd Grants from Rufford and continued with the following objectives:

- To study the status and distribution of sloth bear in Mehsana and Sabarkantha District, where the high population of sloth bears in the state is reported,

- To assess the nature and frequency of human bear conflicts in the study area,

- To organize the awareness campaign in the forest villages of the area and
- To recommend the strategies to minimize conflicts in the study area, that will benefit both people and wildlife.

In the previous study we have found considerable answers which can helps in bear conservation with local participation, which enthused to expand our study in two other districts of north Gujarat, viz. Sabarkantha and Mehsana adjoining to Banaskantha and also possessing good bear population. However, the forests in these districts are neither declared as wildlife Sanctuary nor a National Park. According to current population estimation by the forest department Gujarat, the total bear population in the state is reached the figure of 293, out of which around 40% bear population is concentrated in Banaskantha, Sabarkantha and Mehsana districts (i.e. the North Gujarat), which indicates the systematic and scientific studies on bears and some concrete conservation actions for this bear population. We studied bear distribution in Banaskantha (2009) and the rest of the area is illustrated in the present study. We also aimed to continue the research on mapping bear population and documenting the human-bear conflicts in the state in other areas possessing bear population (Panchmahal and Vadodara) in future to congregate with the goals of IUCN Bear Specialist Group. Figure 1 below depicts the scope of our study in the north eastern parts of the state with high bear population.

2

The study area for the present study falls under the jurisdiction of two districts of the North Gujarat region, Sabarkantha and Mehsana. Geographically the district of Sabarkantha falls in sub biotic province 4B3-hilly area, while Mehsana belongs to zone 4B4- the arid/semi arid lands. The present study area is shown in figure 2.1
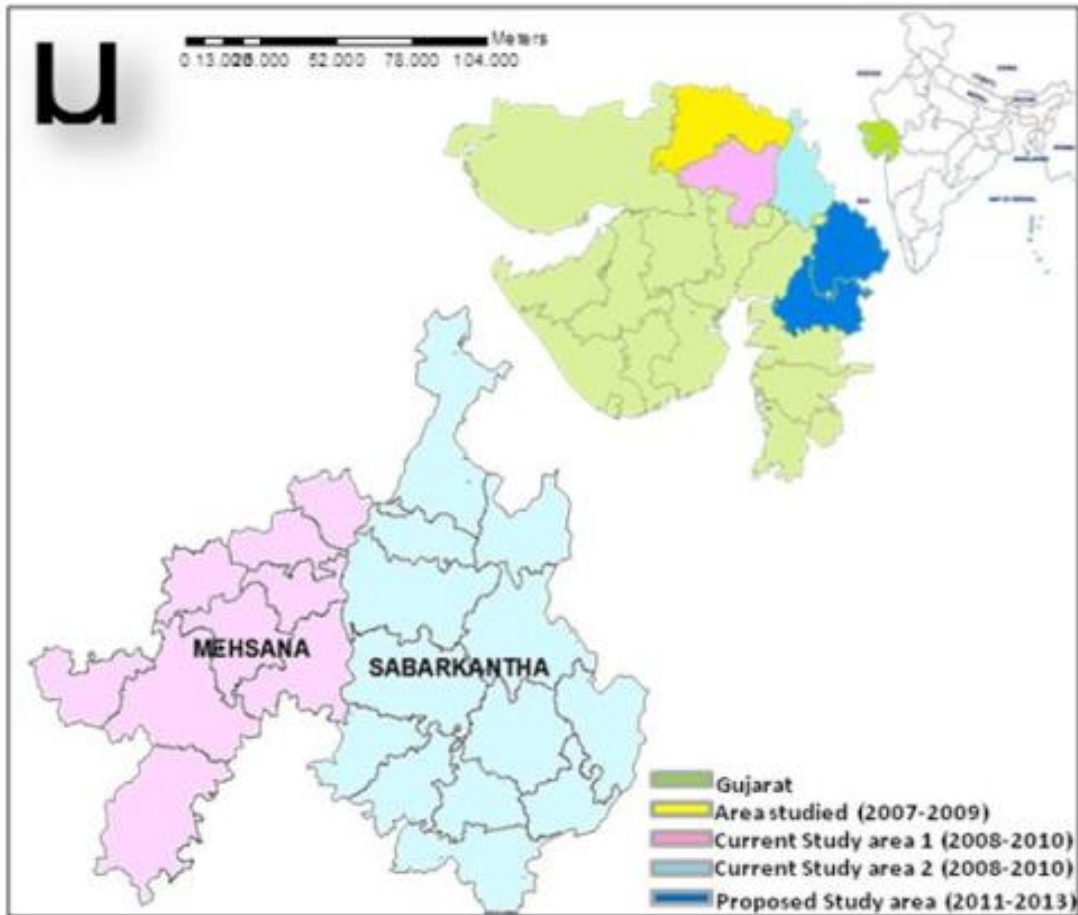
Figure 2.1: Map showing the study area, Sabarkantha and Mehsana districts of north Gujarat.

Climate
Both the districts have almost same climatic conditions with infinitesimal variations. The climate of the study area is sub-tropical with three main seasons. There is considerable variation between the different parts of the both the districts and between the summer and winter months.

Monsoon or Rainy Season start from the first week of June and lasts up to the month of September. Winter or cold seasons encounter from November to February while summer or hot season is externs from March to June. Winter is quite pleasant however extreme cold, and frost are experienced in Dholwani and Vijayngar areas of Sabarkantha district. Climate on an average is healthy, warm and dry.

The Forests
Out of two districts, Sabarkantha is having comparatively good (1270.2 sq. Km) forest cover (figure 2.2) at the terminating ends of Aravali mountain ranges.

Mehsana is mainly known as a land of pastoral and agricultural activities with very scar forest patches (3.8%) and hilly terrain around. Although the forest cover is fairly low in the region (3.8% of the total state forest cover, out of which 0.58% having open forest and 3.32% having scrub forest). There are some patches with good forest cover adjoining the Banaskantha district and harbouring significant variety of floral and faunal species where the bear found to occur.

In Sabarkantha according to revised classification of Champion and Sheth (1968) the dry deciduous forest (21.8% of the total state forest cover) The forest cover can be again classified as dense forest (5.83%), open forest (5.52%) and scrub forest (9.87%) spread through the west and south–west part of the district. These forests are scattered in Khedbrahma, parts of Bhiloda, Meghraj, Modasa and Bayad Taluka (sub districts). The crown density of these forests is less than 0.4. The forest of this category is degraded due to

unmanageable biotic pressure and high human activity. It is also reported that Polo forest of Vijayanagr range having good teak forest cover.
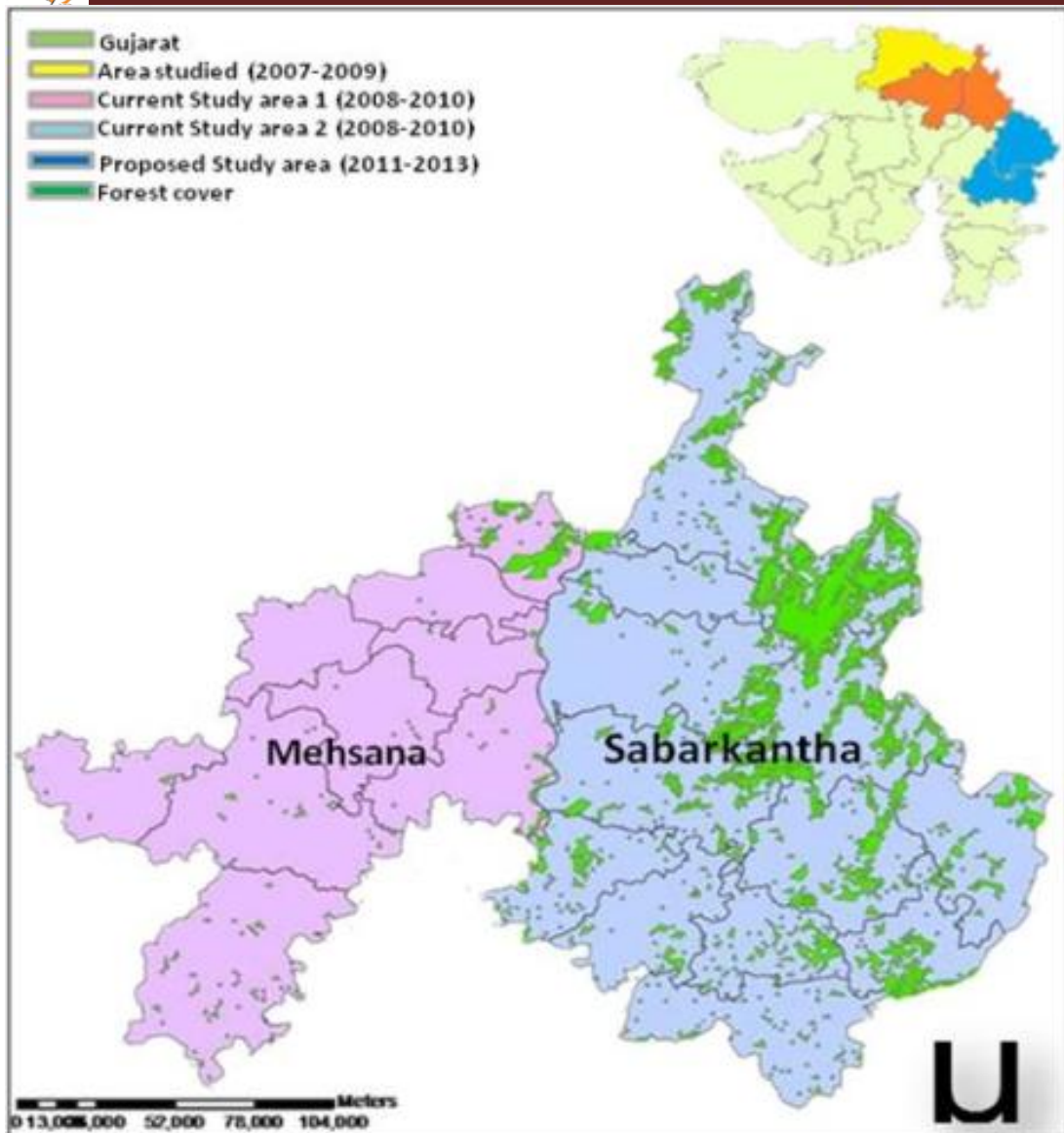
Figure 2.2: Forest cover in the Study area

There was a time when tiger roamed in the area. Polo forest, a rich biodiversity area, is northern limit of teak forest in the country. Forests of Vagheshwari, Zer, Bhankhra, Vandol, Golwada, Abhapur, Kaherwada, Saroli, Vanaj and neighboring villages are a compact block of dense forest. Sloth bear, leopard, and four horned antelope are frequently seen in forests of Vijaynagar, especially in forests of Polo and Vanaj. A forest guard at Vanaj claimed that he saw a group of eight bears in Vanaj forest in 1999 (Singh, 2001).

Flora and Fauna
The main flora of the study area are *Cassia fistula*, *Madhuca indica*, *Butea Monosperma*, *Aegle mamelos*, *Soymeda febrifiga*, *Oroxylum indicum*, *Sapindus emarginatus*, *Anogeissu latiflia*, *Diospyros melanoxylon*, *Lannea coromandelica*, *Miliusa tomentosa*, *Boswellia serrata*, *Sterculia urens*, *Emblica officinalis*, *Bridelia retusa*, *Mitragyna parviflora*, *Adina cordifolia*, *Pterocarpus marsupium*, *Acacia catechu*, *Acacia leucophloea*, *Terminalia crenulata*, *T. belerica*), *Albizia lebbeck*, *Dalbegia latifolia*, *Holoptilia*

integrefolia, Gmelina arborea, Zizyphus spp., Phonix spp., Ficus spp. etc. Out of which many plant species or their parts are commonly preferred by both human as well as Sloth bear results in conflicts.

The common wild animals in both the districts include Sloth bear, leopard *(Panthera pardus)*, blue bull (*Boselaphus tragocamelus*), striped hyena (*Hyaena hyaena*), wolf (*Canis lupus*), jackal (*Canis aurius*), porcupine (*Hystrix indica*), wild boar (*Sus scrofa*), small Indian civet (*Viverricula indica*), Jungle cat (*Felis chaus*) and Indian ratel (*Mellivora capensis*). These animals often found moving outside the forest area, invading the villages and farms mainly in search of food or water where there may be acute possibility of confrontation between wildlife and human.

Apart from these general characters following are some district specific peculiarities which can be best describe the variations in the study areas with respects to location, soil regimes, rivers etc.

Mehsana District
Mehsana district is located between the parallels of latitude 23.2' and 24.6' and the meridians of longitude 71.56' and 72.52'. The length from north to south of this territory is about 118.1 km and from east to west is about 94.0 km. The total area is around 4,400 km². The district is bounded by four districts mainly Banaskantha in north, Sabarkantha in east, Patan in west and Ahmadabad in Southern side. Banaskantha and Sabarkantha shared some good forest patches with the district.

Soil Regimes
Nearly 90% of the soil is light sandy. Black soil is met with but only in patches and chiefly towards the south and west. The sandy loam soil differs in richness and contents in some parts of the district.

Water Supply:
Water supply is mainly through the Banas River; irrigation dams like Dharoi Mokeshvar and other small natural water bodies which dries out during the summer season and results in water scarcity problem.

Sabarkantha District
The name Sabarkantha is derived as the district is located on the bank of the river Sabarmati. It is located between Latitudes 23º 13' 15" and 24º 35' 30" North and longitudes 72º 47' and 73º 37' 30" East. The forests are mostly confined in the northern and eastern hilly region of the district, but isolated patches are also distributed over the southern and western part of the district.
Ridges of the hills and the rivers normally constitute the boundary with the state of Rajasthan in the north and east. District is bounded in southern elevation with Ahmadabad district and western with Gandhinagar and Banaskantha district.

Soil Regimes
The soil, in general, is sandy with varying proportion of loam. Generally, plains, valleys and pockets have deep and fertile soil. Again, the Soil varies from red loam to yellow loam and it is deeper with good fertility.

Water Supply

Water supply is mainly through rivers, rivulets and streams, many of which run dry in summer causing water scarcity. The tract at present is traversed by seven main rivers, viz., Sabarmati, Khari, Hathmati, Meshwo, Mazum, Vatrak and Harnav.

Altogether diverse climatic condition support different types of forest cover in the region which serve as good habitat for different wild animals. The main

animal, Sloth bear occurs in good number as the forest supporting many plant species which serves as chief components in their diet.

3

Methodology

We more or less employed the same methodology as our previous study carried out in Banaskantha district (Nishith 2009). Similarly, we divided the area of Sabarkantha and Mehsana into the square grids of 5x5 km and all the grids systematically surveyed mainly for,

1. Bear presence-absence in the area and general habitat for bear
2. To record human-bear conflicts and
3. Interviews of local villagers to know their perception towards presence of bear in the area.

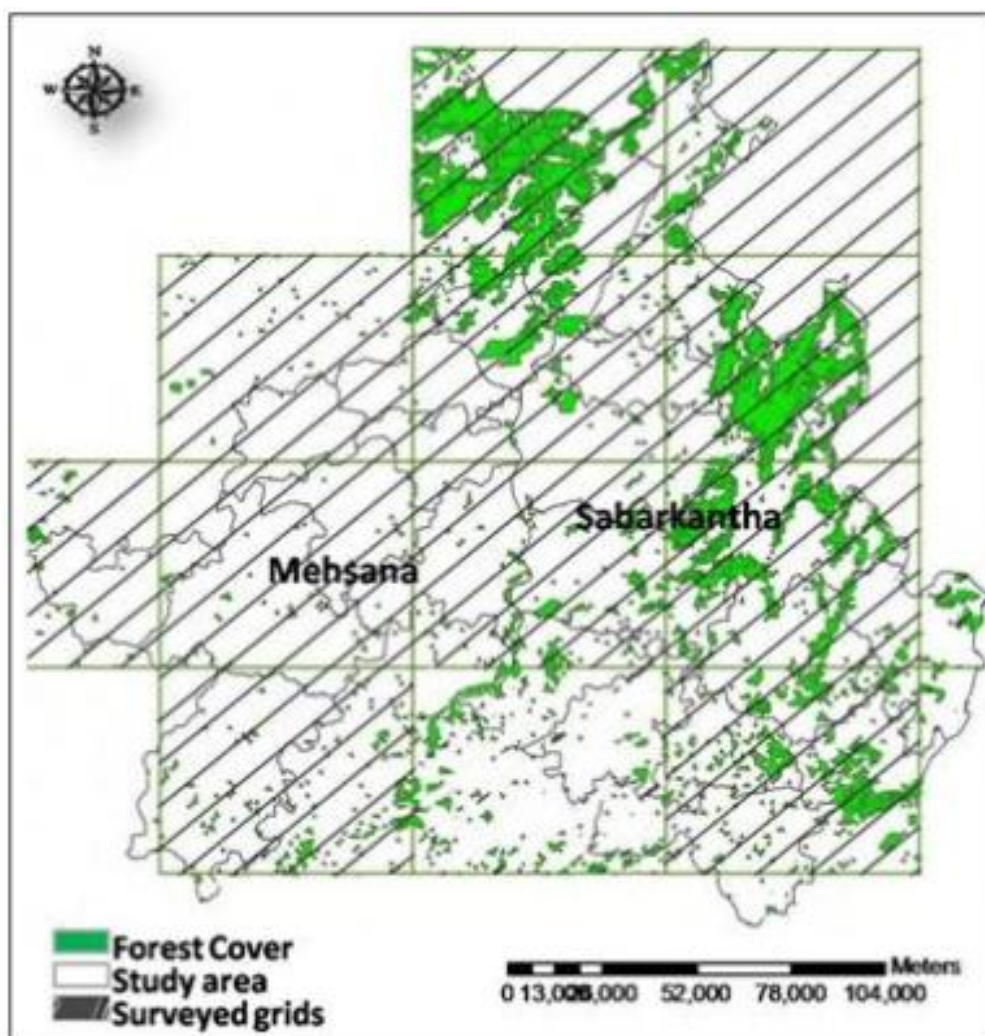Figure3.1 illustrates the area divided into grids of 5x5 km and the grids which are surveyed for the present study.

Figure 3.1: Surveyed grids in the study area

Bear Presence –Absence study

Each grid of the study area was surveyed to know the presence/absence of sloth bear in the area. The grids were surveyed through sign survey (Nishith 2009). We covered the maximum area of the grid to search the signs of the sloth bear, such as scats, tracks, trails, land scratch, tree scratch, information of local people, etc. GPS locations were also recorded as we detect the sign of sloth bear. The occurrence of sign is considered as bear presence in the area, while no sign or information from locals were considered as bear absence. Further the grids were marked on the 1:50000 map with bear presence and absence for the further analysis and studying the land use and occupancy of the sloth bear in the area. Bear presence –absence data were analysed through the software Presence® to study the bear occupancy.

Village survey

The respondents were interviewed using a structured questionnaire (Appendix 1). The questionnaire was divided into different sections on different aspects of the human-bear conflict: the demographic information, the economic impact, spatio-temporal patterns of human-sloth bear interaction and the attitudes of the local people towards Sloth bear. Village survey mainly includes the collection of following information:

A] Demographic: age, education level and occupation of respondents
B] For farmers: land holding, and crops cultivated by the respondents
C] Livestock holdings and animal husbandry practices
D] Direct experience and perceptions of victims,

It is very productive to have interview of villagers with first-hand knowledge of the forests in the area that would be most likely to report on the presence or absence of sloth bears.

In account to demographic data we have inquired about the name, age, family size, address and occupation of the respondent and livestock numbers if they have. Related to bear, we collected the information like time of bear seen/attack, season, approximate distance between bear and respondent, number of bears, activity during encounter was asked to the respondent. We had also set up the questions like awareness about compensation scheme, compensation claimed (if any), and weapon used to ward of attack and how long it took to recover etc.

During the survey the sites of both the districts of the reported attack were also mapped. We also documented incidents and costs incurred by villagers who reported crop damage by sloth bears if any.

Scat Analysis

We also collected and analyzed sloth bear scats from both the districts on the field itself for rapid identification of food remains in the bear scat and to know the principle food composition in bear diet in the area during different seasons.

Bear – Human encounter record

We gathered information on the date and time of encounters, the kind of habitat, the activity of humans and bears at the time of encounters, number of bears and people involved the kind of injuries, and the circumstances that led to the encounters.

Awareness campaign

As recommended in our earlier report (Nishith, 2009), we organized the awareness campaigns for local villagers and tribes in the identified bear conflict zones during the study period. We had visited about 20 such villages in the vicinity of the entire bear habitat where we called a meeting of the locals and explained them about the bear behaviour, food and feeding ecology of the bears, preventive measures for bear attack and about the first aid after bear attack. We prepared banners (fig. 3) in local language (Gujarati) with all such details about bears and posted them at some public places of villages where maximum people can look at it. We mainly selected the places like

Government Grocery Shops, public meeting places, Hospitals, forest offices and Schools to display such banners.

As per the findings of previous study carried out in 2009, the process of claiming compensation after the bear attack is very complex and tedious. Further, high level of illiteracy in local tribes, people generally refuse to claim for the compensation and failed to take benefit of this scheme as and when they got injured by sloth bear or any wild animals such as leopard. Along with the hoardings we also prepared and distributed the simpler preformatted form for application to claim the compensation (Annexure 2) for claiming compensation so that people can just sign and submit the application to the forest offices. We also informed and aware the local forest field staff about these forms and approved by the local forest authorities while distributing the forms. We also provided the forms to local forest offices, hospitals and other places.

4

Results & Discussion

The major aim of the present study is to map the bear distribution and to identify the habitats and landscapes occupied by the sloth bear. The study was carried out by direct bear encounters, sign surveys, scat collection and through information from local villagers and forest officials in all the 5x5 km grids laid on 1:50000 map. Table 4.1 summarizes the research and survey activities in a nutshell. It depicts the total grids laid on the map and the grids surveyed; the villages and surrounding surveyed for bear presence and bear victims interviewed during the study period.

Table 4.1: Summary of field activates in the study area during the study period.

No	Activity	Survey carried out		
		Total # in the Study area	**# Surveyed**	***Remarks***
1	Grid survey (5x5 km)	150	105	*Grids falling in the urban areas have not been surveyed.*
2	Village survey	~ 1000	594	*Villages only nearby forest area were surveyed.*
3	Interviews of bear victims	35	35	*All victims of bear attack during the study period were recorded and interviewed.*

Sloth Bear Presence in the Study Area

The study shows that the Sloth bears are patchily distributed in the forest areas of both the districts. The forest areas here are not declared as a protected forest. These forest patches are classified as the reserved forests according to the state forest department which can be used by the local villagers and other stakeholders unlike the Wildlife Sanctuaries and National Parks. The adjoining forests falls in neighbouring state of Rajasthan, also having good bear population; local people reported frequent visits of bears from Rajasthan forest in the study area as a result of natural dispersal or in search of food and water.
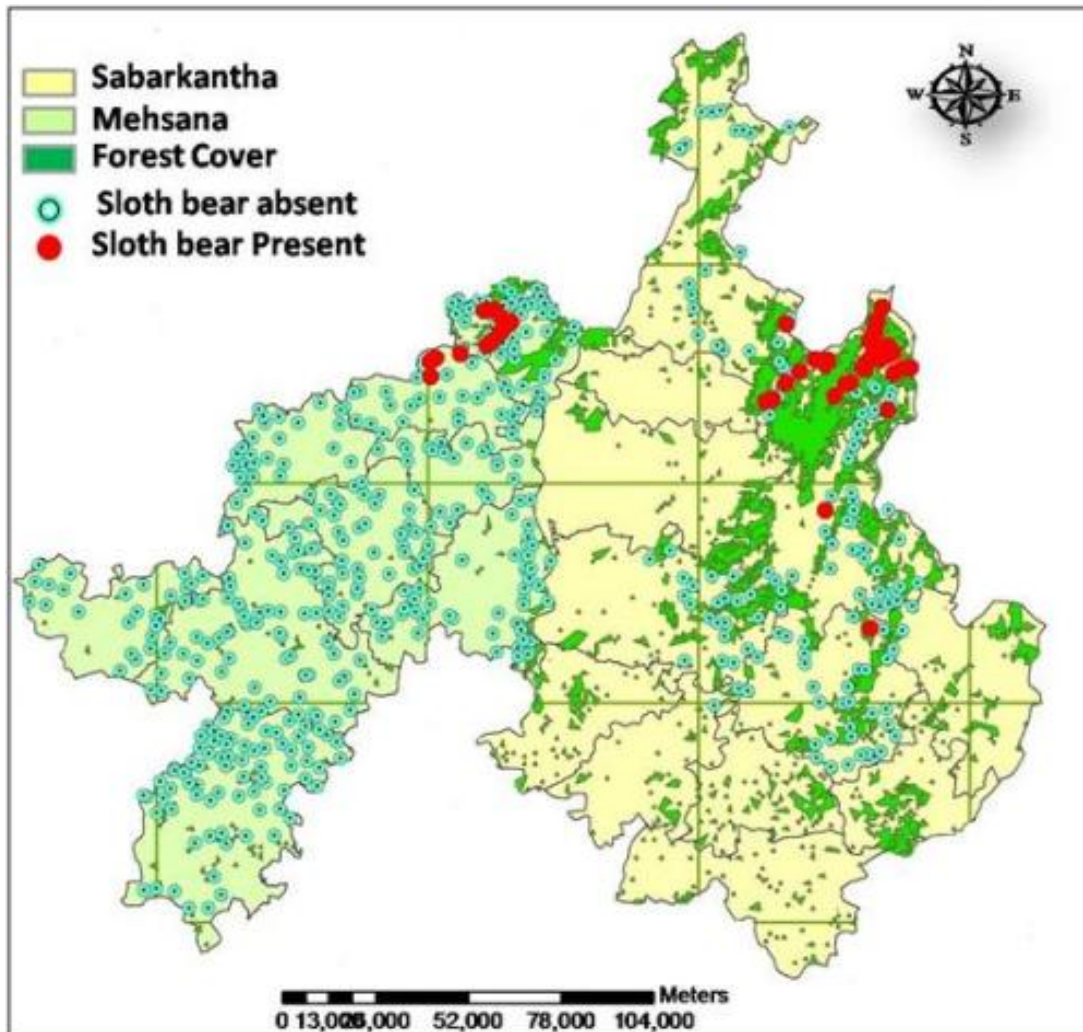
**Figure 4.1: Forest patches occupied by sloth bear in the study area**

Figure (4.1) shows the forest patches occupied by the bear in the study area. We recorded several signs of bear in this area or collected the information through the local herders as well as forest officials (Fig. 4.2). We also had few direct encounters of the bear which confirms the bear occupancy in the area.

As per the sign survey, forest areas in human proximity are more occupied by the bear which reflects the insufficient availability of food or water in the forest. The forest type of this area is dry deciduous and sub tropical forest, which turns very dry during the summer period with very few natural water

reservoirs. The villages and farms in the vicinity may attract bear for both food and water and cause the most of human-bear confrontation.

Around 32% of villagers in Mehsana and 53% in Sabarkantha reported that sloth bears are often seen in forest around their village. Very few respondents out of total (12% of Mehsana and 4% of Sabarkantha) were unsure about the presence or absence of bears in the nearby forest of their areas.
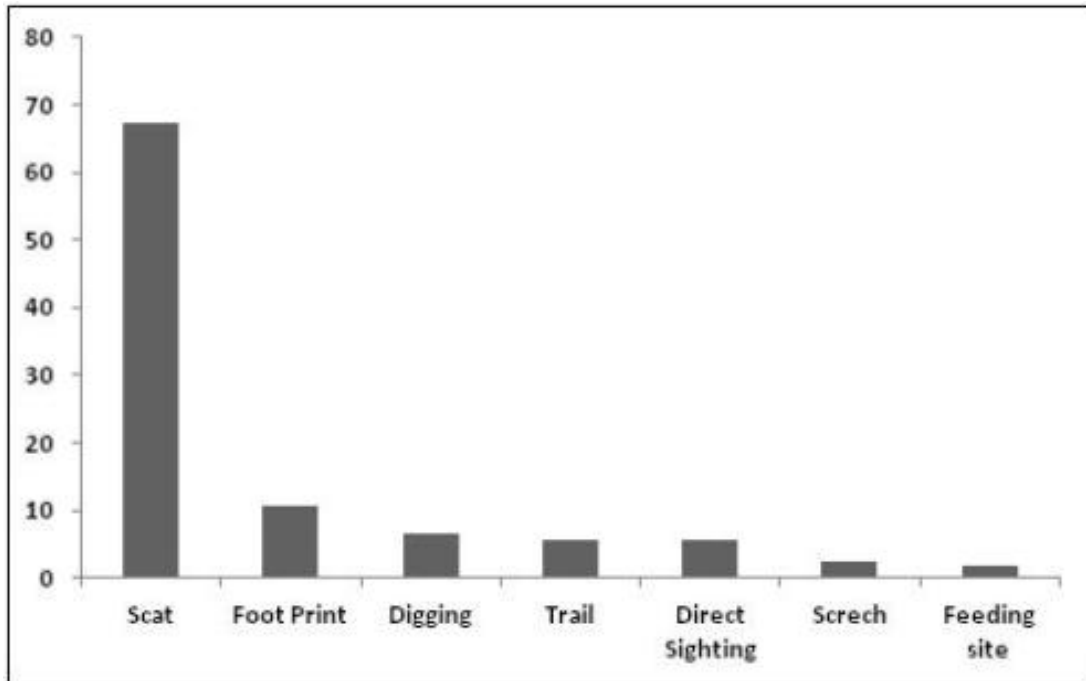

Figure: 4.2 shows indirect encounter of Sloth bear in the area

Food: One of the common resources of human and Bear
In central India, sloth bear has a formidable reputation and considered one of the most fearsome of all the wild animals (Pillarisett, 1993, and Rajpurohit and Chauhan, 1996). It is highly unpredictable in attacking human beings on bumping knowingly in forest or when mother is with cubs (Prater, 1980,

Pillarisett, 1993, Nishith, 2008). It generally attacks human beings if disturbed while feeding on natural forest resources which are commonly shared by locals for food and their livelihood.

During the study we found about 35 plant and animal species which were shared by sloth bear and locals. The major food of sloth bear in the area is the fruits of Cassia fistula and Zizyphus among plants and honey, termites, ants etc among animals (Fig. 4.3). Which are also used by locals for food and making local beverages as well as trading.
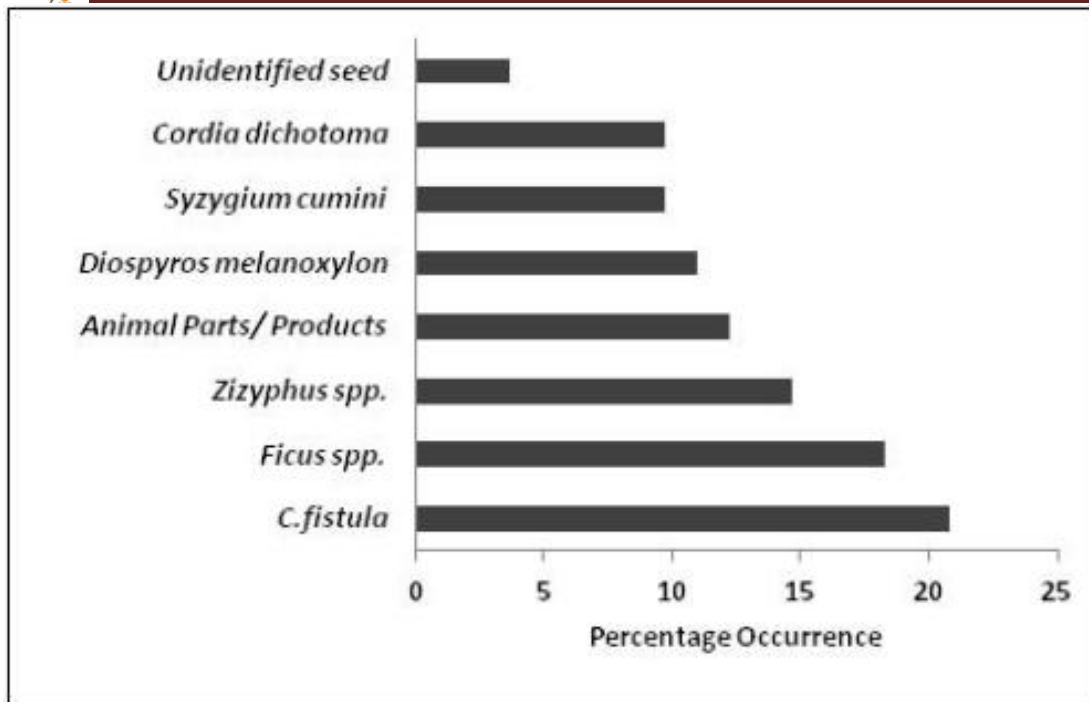
Figure: 4.3 Occurrence of food items found in Sloth bear scat analysis

Human-bear interaction
No livestock depredation/ killing were reported by sloth bear were reported in the study area; however, Rajpurohit *et al.*, (2000) has reported few livestock killing in some areas of India and Burma. Human causalities by sloth bear were reported more than that of by tiger in Madhya Pradesh, India; 48 people died, and 686 people was injured by sloth bear 1989 – 1994 (Rajpurohit *et al.*, 2000). One specimen, known as the sloth bear of Mysore (Kenneth 1954), was single–handedly responsible for the deaths of 12 people and the mutilation of 2 dozen others before being shot by Kenneth Anderson. Similarly, in Mehsana district, sloth bear had injured 7 people in a single day as it was come into one

village during its dispersal. About 5,000 people of surrounding villages were gathered and defended 2-3 for days which untimely resulted in killing of the bear by local people (Dharaiya and Ratnayeke, 2009).

This reflects that the bear and human interaction are very acute in the study area because of several reasons like (i) the area is not declared as a protected forest due to which human activity cannot be restrict in the forest, (ii) human settlements are very close to the forest areas and (iii) the habitats for the bear are highly degraded forces bears to move towards the nearby villages for primary living resources. Such situations are the indicators of the urgent needs of some conflict mitigation strategies or finding out the options of bear-human coexistence in the area. This is supported by figure 4.4 which shows that maximum bear attacks found in or around the villages in vicinity of the forest.
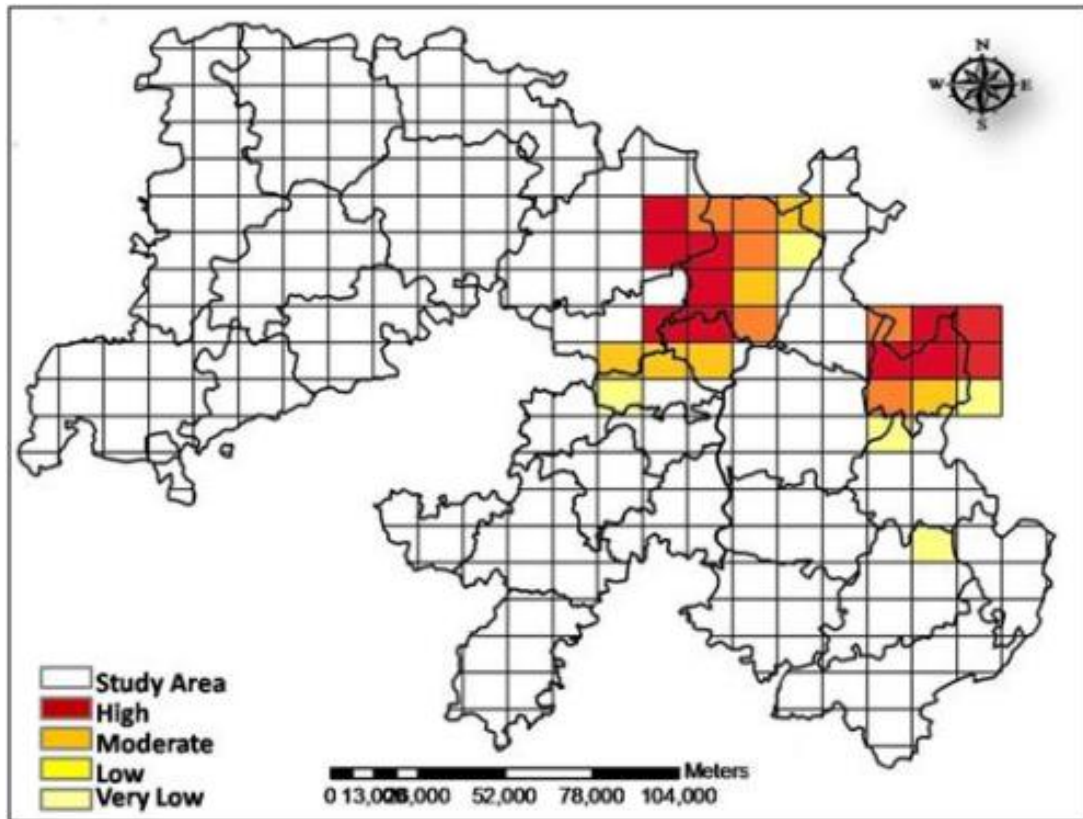
Figure 4.4 Conflict zones in the study area

Encounter location and time
Most resent encounter locations were visited and details such as coordinates, habitat and terrain type, vegetation cover, visibility, presence of bear dens, proximity to trails or roads were recorded. For some locations with known

landmarks, such information was gathered through interviews. The encounter time characteristics were put into seasonal and diurnal time classes that were used in the study. Figures (4.5 & 4.6.) below depict the human-bear interactions during different season and time of the day in the study area.
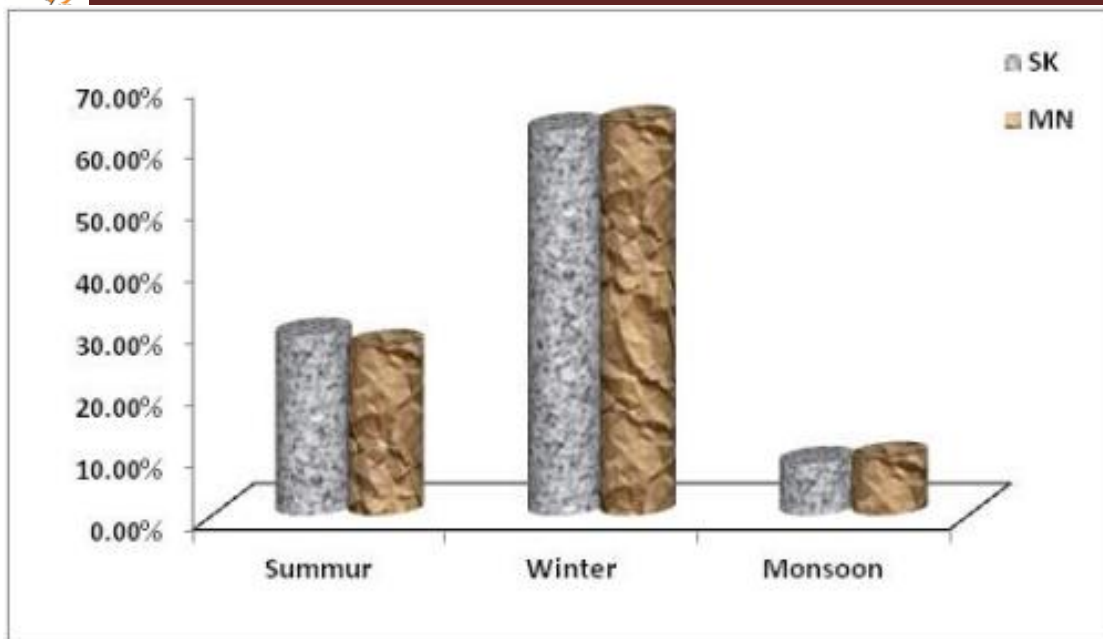
Figure 4.5: Relative frequencies of sloth bear attacks on human in different seasons *(SK- Sabarkantha, MN- Mehsana)*

Figure 4.5 shows that most attacks occur during winter (63% Sabarkantha and Mehsana), while in summer it was 29% in Sabarkantha and 27% in Mehsana which decrease in monsoon comparatively in both the districts. In Sabarkantha more than 38 % of the attacked happened in the Day period, and about half were in the crepuscular time (dusky light) as people use forest for collection of forest produces (Fig. 4.6).
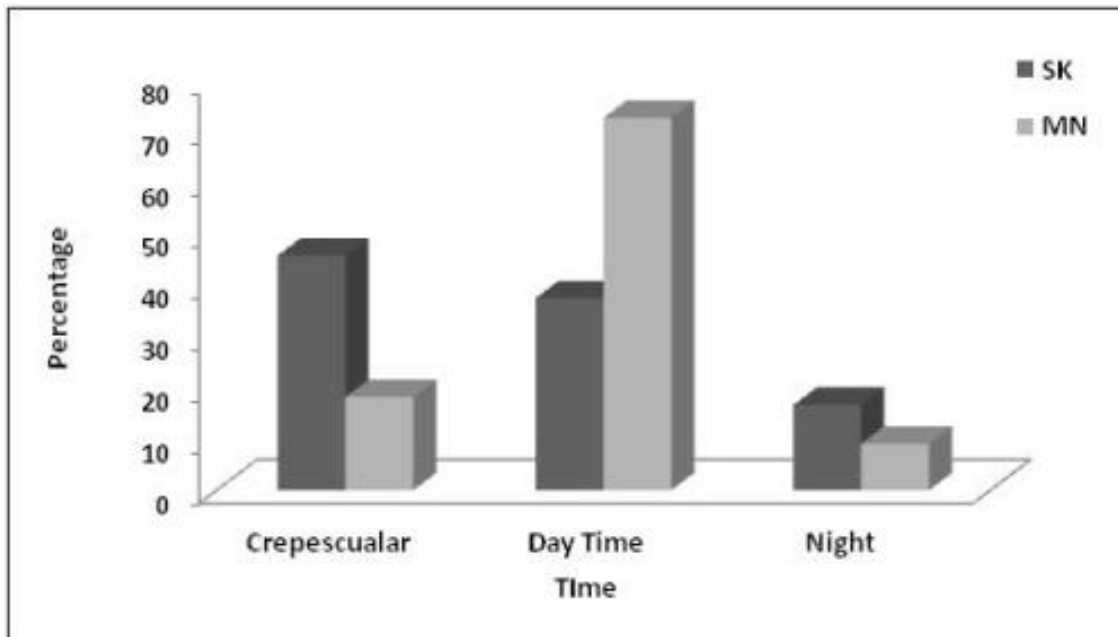
Fig: 4.6 Time of bear attack *(SK- Sabarkantha, MN- Mehsana)*
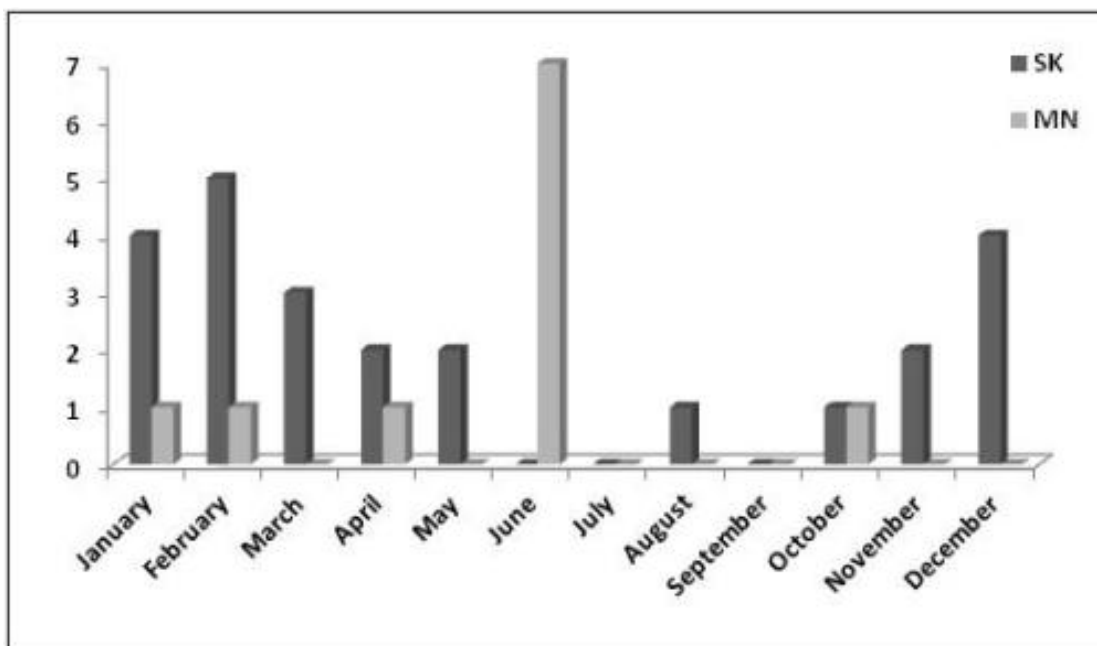
Figure 4.7: Bear attacks recorded in different months during the study period *(SK- Sabarkantha, MN- Mehsana)*

As shown in the figure 4.5 the maximum causalities have been occurred in Sabarkantha during winter and in Mehsana during summer which is supported by figure 4.7. Figure depicts that maximum attacks inside the forest occurred in winter when both human and sloth bear using the forest maximally. The forest products like Gum, Zyziphus fruits and Mhua (*Madhuca indica*) flowers and honey collection is maximum by the local tribes which makes the sloth bear tempting for the same natural resources in the forest for the food.

In case of Mehsana the situation is same as Sabarkantha but in year 2009, June was recorded as hottest month of the season where people also faced water problems in towns. This condition leads the bear to visit the nearby village may be for water or food. The bear faced accidental confrontation of local villagers while it was moving in the street of villages and injured 7 people.

Bear and human responses
In most encounters bears fled but sometimes they changed at humans and then either attacked or retreated without making physical contact. The humans also usually run away upon sensing a bear. If the bear escape in an encounter, then the humans also moved away or if the bear rushed towards or attacked, then they either panicked or passively gave in, or occasionally, held their ground and chased it away or attacked it in return.

Sloth bear is always reported dangerous and unpredictable for attack on human; especially when the female bear carrying litter (Pillarisett 1993, Rajpurohit & Chauhan 1996, Nishith, 2008). They are unpredictable, especially mother with cubs; they attack humans readily if they perceive their cubs to be threatened (Prater 1980 and Pillarisett 1993). Figure 4.8 shows the numbers of bear presence during attack in the study area. In most of the incidence of casualties in Vijaynagar and Dholwani range of Sabarkantha and Satlasana range of Mehsana had bear were in the group of two (SK- 45 %, MN- 27%), while single bear found in the case of 38 % in Sabarkantha and 72% in Mehsana, further three were observed less as 17% in Sabarkantha and 0% in Mehsana. This depicts that bear attacks were occurred when single bear roaming in the area and forced to attack as it felt unsafe itself or some time results into accidental confrontation.

Many human casualties occur when humans enter sloth bear habitat or when sloth bears invade agriculture fields. We recorded 35 cases of bear attack in the study area (24 in Sabarkantha district and 11 in Mehsana). Referring the secondary information from the forest office record, it is said that the bear attacks in these districts is moderately rising during last few years.
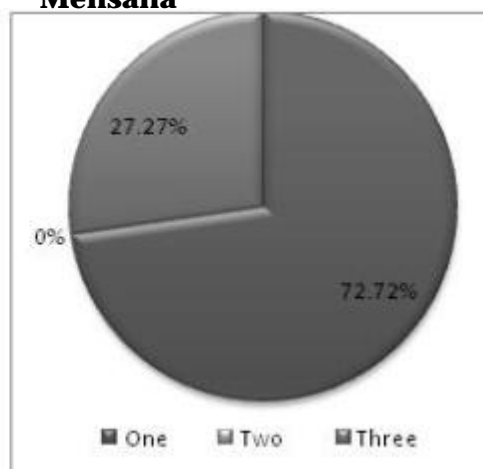
Sabarkantha
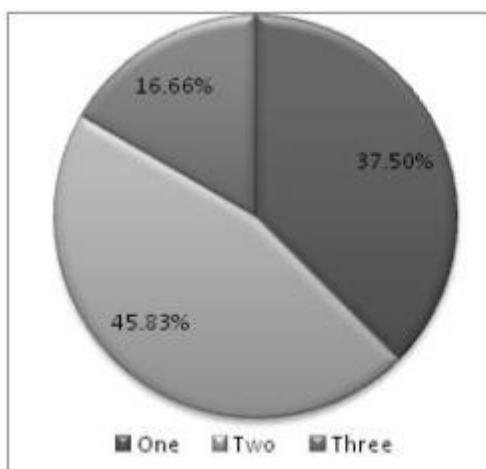
Mehsana

Figure: 4.8 # Bear individuals involved during human-bear interaction

Bear respondents in the study area

The average family size in the villages of the study area is 7±2 and the respondents belonged to more than 25 different castes, which mainly includes tribal casts. Out of the total respondents 80% were men, 20% women in Mehsana (n=324) and 85% were men and 15% women in Sabarkantha (n=292). The age group mainly selected for the interview was 20-70 years except 2 children of 7 years and 9 years were injured by bear. Out of all respondents interviewed, around 10% of respondents were those who actually confronted and injured by bear.

Figure 4.9 shows the age classification of victims according to their age group in both the districts. Maximum victims were in the age group of 35-60 years in the study area.
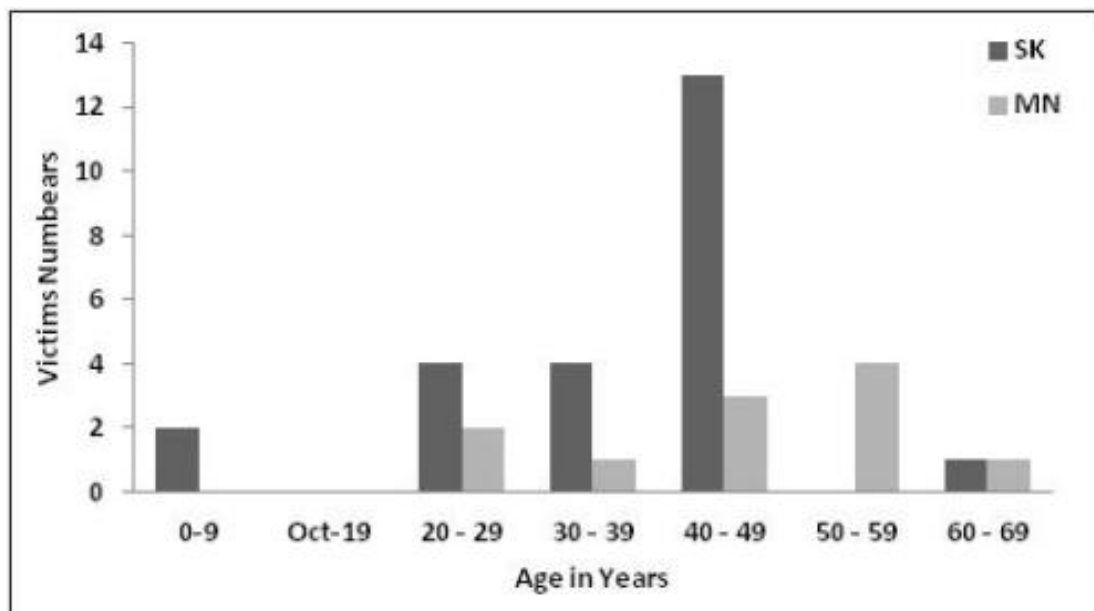

Fig: 4.9 Age classification of bear victims according to their age group

Type of encounter

Using the information collected through the interviews, regarding the circumstances leading to each encounter and on the activity of bear and people at the time of encounter, we classified the encounters into surprise or deliberate encounters. The former kind of encounter was when either humans or bear involved were not aware of each other prior to the incident and the encounter happened suddenly. The later was when either the human or the bear were aware of the other prior to the encounter. It may happen when a human approached a bear to provoke or harm it, or when a bear approached humans or a human habitation in search of food.

All attacks happened when human encountered bear abruptly in the forests, or in six cases, near the village or in the farm. Most victims reported that they realised the bear's presence only at a close range. Most other humans who were interviewed reported that they also often encountered bears in the forest suddenly. The bears also may have sensed the human mostly immediately

prior to encounter. Victim's activities at the time of bear attack are illustrated in figure 4.10.

Most victims reported that they realised the bear's presences only at a close range (when the distance between them often was less than 2.5 meters). Most other human who were interviewed reported that they also often encountered bears in the forests suddenly. This shows that bears also avoid coming in the villages except in case of searching for water and food during scarce condition.
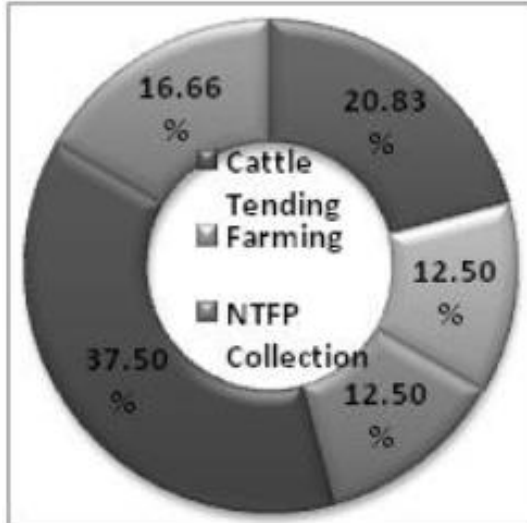
Sabarkantha
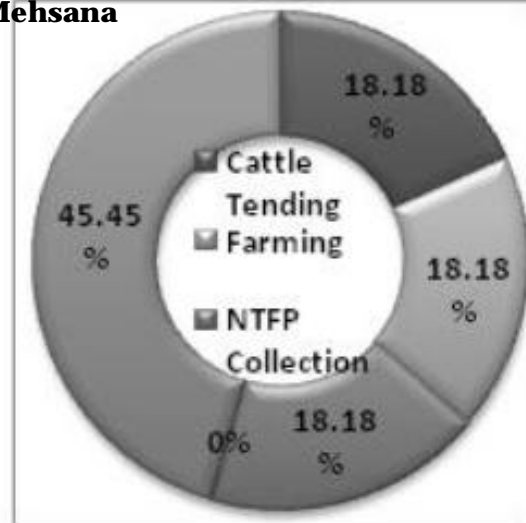
Figure: 4.10 Activity of victims at the time of bear attack

37% of attacks in Sabarkantha were happened when the victim was moving through the forest for several purposes. The forest trails in the study area provide the short rout to reach nearby towns or villages, even these villagers are moving on foot, so they prefer the shortest foot trails in the forest. 13% of bear attacks in Sabarkantha and 18% in Mehsana were occurred while the victims were collecting minor forest products (NTFP = Non Timber Forest Products; like, honey, fruits, firewood, etc.) and 20% in Sabarkantha and 18% of bear victims in Mehsana were tending their cattle in the forest for grazing. In crop fields, incidences occurred mainly when the victims were involved in farming activities. In forests, incidences of mauling were highest when the victims were engaged in cattle grazing as well as local movement other activities like early morning defecation due to no sanitation facilities in tribal villages.

Bears have been reported to cause extensive damage to agricultural damage (Peyton, 1980; Vaughan et al., 1989; Servheen, 1990; Conover and Decker, 1991; Reid et al., 1991, and Stowell and Willging, 1992). In the alpine pastures in India, brown bear causes extensive livestock depredation, and the migratory grazers often kill them to reduce the predation on their cattle (Sathyakumar, 1999a). Increased incidences of livestock depredation and attack on humans by black bears have also been reported by Sathyakumar (1999b).

In India and Nepal, sloth bear are reported to cause agricultural crop depredation and raiding variety of crops such as potatoes, sweet potatoes,

onions, groundnuts, sugarcane, peanuts, yams and maize (Laurie and Seidensticker, 1977; Iswariah, 1984; Murthy and Sanker, 1995; Rajpurohit and Chauhan, 1996, and Rajpurohit and Krausman, 2000). Local people in the study area were also reported the crop raiding by sloth bear especially in the Mehsana district of the study area.

Forest fire is one of the prime reasons as the area having major dry deciduous forest patches, which may make this individual more effected and scarier and it rushed towards the town near by forest for shelter or/and for food and water.

5

Strategies for Bear conservation

Many human activities, such as hunting, logging, animal husbandry, collection of non timber forest products (NTFP), agricultural expansion, Transport and Tourisms as well as development projects operating around the study area and in some reserve, forests are adversely impact the bear habitat and movement of sloth bear. Although our concern here is with the issue of adverse impacts of Sloth bear on human interests, we emphasize that such conflicts often follow because of adverse human impacts on Sloth bears.

Stakeholder involvement in various aspects of wildlife management can yield many benefits (Chase *et al.* 2000). The specific conservation recommendations for minimizing bear-human conflicts and bear habitat conservation are as follows:

Bear movement study
We found that sloth bears were absent in large expanses of the forest patches of the study area as the range in the lowlands is hugely fragmented, however the local people informed us, and we also recorded human injury cases in the low land degraded forests due to Sloth bear. This indicates that they still inhabit the Forest patches of Mehsana. Some hilly terrines of the study area are steep, dry, and much less conducive to growing crops, and thus have a lower human density than the other districts, which explains the continued presence of sloth bears there. However, it is uncertain whether the sloth bears that presently live in the Mehsana district represent a viable population that would persist. In this case, the status of sloth bears in Sabarkantha is much more as the area is very less developed due to majority hilly terrain.

The entire study area required a long-term scientific study by radio telemetry technique with special emphasis on bear movement and ranging patterns. This can be helpful to know the actual habitat type used by sloth bear, their home

ranges and the important corridors of their movement which can be further conserved managed through habitat improvement programme.

Regular Monitoring
Periodically resurvey the study area to monitor changes in bear population status, habitat types and resource utilization. Standardized transects to quantify sloth bear diggings for termites can be used to compare areas and to assess changes in abundance over time. These transects could be established in a few key places throughout the forest ranges, and study should be conducted at recurrent intervals. Additionally, involving local people in collecting information may be helpful in verifying the presence or absence (especially the recent disappearance) of bears in an area.

Habitat improvement

Community forestry development projects can be initiated at a large scale for restoration of degraded lowland forests in Mehsana and Sabarkantha areas. Remaining blocks of unprotected forest are heavily used by local people, and it seems probable that this continued use, combined with low-level poaching and illegal encroachments, is causing gradual declines in sloth bear numbers. Thus, it is necessary to focus on land-use and declaring the area as protected zones. Community forestry programs, wherein local people learn the value of planting and protecting trees, could expand habitat for sloth bears, and could also reduce the bear-human interactions. The strength of this approach is that it is instigated from the bottom up (i.e., people do it because it benefits them, rather than because it is mandated), but it also must be supported from the top down (Poffenberger 1990; Western *et al.* 1994).

Education and Awareness

The study reveals that majority of the local people are uneducated as they are primitive tribes of the region and still attached with their ancient culture. Education should be providing not only for the necessity of protecting forest habitats in order to ensure the survival of Sloth bear, but also for highlighting the benefits to people in protecting and managing valuable resources.

Moreover, the uniqueness of sloth bears, related to their feeding on ants and termites, make them a powerful example not only of how animals adapt to and exploit their environment, but also of how reliance on specific foods and habitat types makes them vulnerable to extirpation. It is important to emphasize that these bears do not kill livestock, and rarely damage crops, when provided adequate habitat with good supplies of natural food.

Conservation education should be developed around the theme of maintaining large forest ecosystems that protect many species and simultaneously provide benefits to local people (Grumbine 1994). Moreover, the literacy and the awareness of the government scheme of compensations is also lacking among the locals. During the present study we distributed preformatted applications for claiming compensations after the injury by wild animals (particularly Sloth bear in the study area) which showed great acceptance by both local community and forest officials as it has made the process easy, transparent and uniform. Many people reported us that these forms have accelerated the process of paying compensation as well as more people are coming forward for claiming their compensation.

The workshop on awareness about bear ecology and attacks has also provided significant results towards the perception of local community. As stated by one of the Range officers of the forest, that the entire workshop carried out by the RSG team also helped to the forest field staff.

It is hence recommended that the local forest divisions should regularly organize such workshops and awareness campaigns by involving the local community heads. In routine nature education camps, a special session on bear ecology and behavior may prove very effective.

Administration

Apart from the awareness and involvement of local people, the administrative reforms are also required for effective conservation of bears and habitat. Forest patches in both the districts of present study area are hugely suffers

from tremendous biotic pressure including grazing, encroachment, tourism, transportation, mining, etc. This can be reduced by the proper law enforcement, controlling transport during night and restricting human activities.

The forest patches of Taranga in Mehsana and Vijaynagar in Sabarkantha where the sizable bear population reported should be declared as protected area (Wildlife Sanctuary). This will automatically restrict the biotic pressure, increase field staff patrolling and enhance the conservation and protection of the habitat.

Our meetings with forest officials during the field staff training programme also reflected that the areas with high human-bear interaction are short of protection staff. It is recommended that the more field staff with vehicles should be recruited in such identified conflict areas with high bear population. The forest administration particularly the Training, Research and Orientation wing of the forest department should encourage some small-scale research programmes, regular monitoring and evaluation programme and stakeholder training and awareness programmes in these areas.

The tourism spots like Taranga in Mehsana and Polo forest camp site in Sabarkantha require a state of art Orientation cum interpretation Center, which can enhance the awareness and help in managing tourism activities. Although there is an orientation center in Polo forest, but it should be well equipped with some more information and proper staff who can guide and interact with tourists from different regions.

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Annexure

a. Village Survey

Date_____			Data entry by_____		
1. Respondent's data:		Name		Sex	
		Age		Occupation	
2. Village name		Map Name		Co-ordinates of interview	
3. Are sloth bears present in this area?		Yes	No		Unsure
4. If NO, were sloth bears present in this area before?		Yes years ago	No		Unsure
5. If YES to question 3, what type of sign indicated that bears were present?					
Sighting		Sound	Scats		Tracks
6. Where did you see sloth bear sign? Note grid cell numbers (see Supplement to Survey Questionnaire).					
7. If YES to 3, most recent date (year)	a)		b)		c)
8. Frequency of encounter:	Once a week		Once a month	Once a year	< Once a year
9. Respondent's activity during encounter:					
10. If bear was seen, outcome usually was (can circle more than one)					
a) Respondent:	Bear avoided		Bear attacked	People avoided	People attacked
b) People say:	Bear avoided		Bear attacked	People avoided	People attacked
11. Sloth bear numbers over the last 10 years have:					
Increased		Decreased	Remained stable		Unsure
12. Sloth bear is a threat to man		Agree	Disagree		Unsure
13. Absence of bear - blessing		Agree	Disagree		Unsure
14. Have bears been killed in this area?		Yes	No		Unsure
If YES, why killed?	Self-defense		Body parts	Accidental	Other (specify)
Details (note grid cell numbers if known)					
Body parts collected:	None		Fat	Bones	Teeth
	Gallbladder		Claws	Other (specify)	
Use of body part:					
15. Bear needs protection	Agree		Disagree		Unsure
16. Other economic loss due to bear:	**No**		**Yes: If Yes**		
17. Additional notes					

b. Bear attack respondents

Date		Data entry		
1. Respondent's data:	**Name**		**Sex**	
Age	**Occupation**		**Address**	
2. Date of attack:	Year		Month	
3. Geographic location of attack:		**3a) Frequency of Bear occurrence:**		
4. Respondent's activity during encounter:				
5. Time of the encounter:				
Night	Early morning	Mid day		Evening
6. Number of people with victim (within 5 m) during encounter				
7. Number of bears:				
8. Cubs present?	**No**	**Yes**		**How many?**
9. Describe size and location of major injuries				
** Specific Identity of Bear if any:				
10. No. of days in hospital				
11. How long did it take to recover?				
12. Have you recovered fully? If not give details				
13. Victim or companions were armed?	Yes	No		Type of Weapon
14. Was weapon used to ward off attack?	Yes	No		Details
15. Distance between victim and bear when charge occurred				
16. Bear approached	From behind	From front		From behind tree or rock
17. Bear's behavior during attack (underline all that apply)				
Charged on all fours	Rose up on hind legs	Vocalized		Used teeth
Used claws	Knocked victim to ground	Rapidly charged		Bear approached slowly
18. Duration of attack				
19. How did you react to the bear's attack?				
20. How did your companions react?	Ran away	Climbed tree	Yelled at bear	Attacked bear
	Details			
22. Outcome of attack (underline all that applies):	Bear ran away	Bear was killed		Bear was wounded
	Other details			