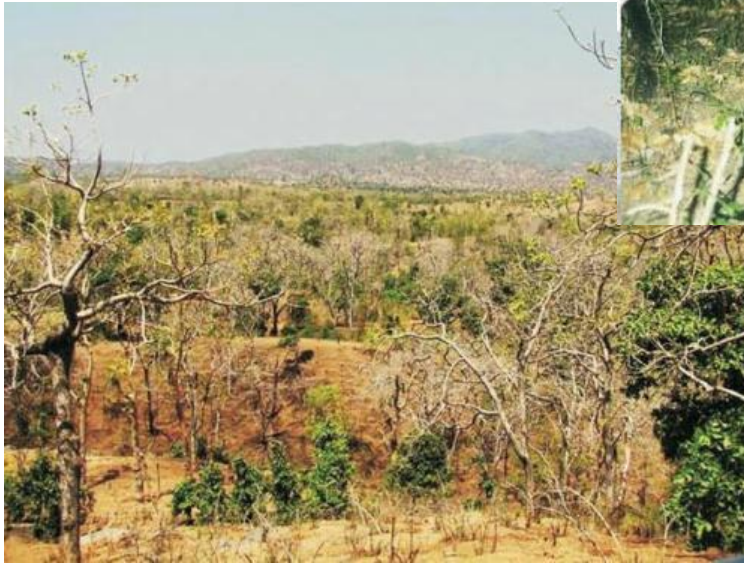


Evaluating Habitat & Human-Bear Conflicts in North Gujarat, India, to Seek Solutions for Human-Bear Coexistence



Research Project Report
Submitted to



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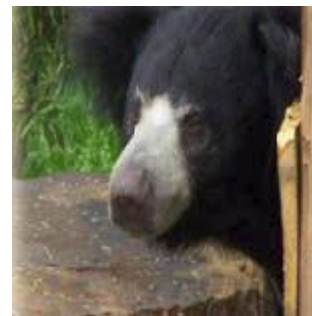
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Introduction

Bears are the members of 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*). The 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 found widely in lowland forests of the Indian subcontinent. They were reported to be abundant during the mid 1800s, but declined severely between the late 1800's and mid 1950s due to habitat loss and hunting (Prater 1948, Krishnan 1972). As a result of continued habitat destruction and degradation, sloth bears have been extirpated in some areas in India. (Krishnan 1972, Garshelis *et al.* 1999, Singh 2001). The bear lives in a variety of habitat such as Teak forest and Sal forest, lowland evergreen forest, and the hill country up to elevation of 1700 m. Sloth bears are also found in riparian forests and tall grass areas on the floodplains of Nepal (Joshi 1995) and in the Brahmaputra valley of Assam (Cowan 1972, Krishnan 1972, Brander 1982). Presently sloth bears occur commonly and is distributed widely across the tropical forest of the Indian sub continent (Yoganand, *et al.* 2006).

Sloth bears are one of the largest termite-eaters (up to 175 kg) occurring in lowland India, Bangladesh, Nepal, and Sri Lanka. A significant portion of their diet consists of ants and termites, whereas much of the remainder is fruit (Eisenberg and Lockhart, 1972; Laurie and Seidensticker, 1977; Schaller, 1967).

In India, sloth bear occur frequently in moist and dry deciduous forest (42% and 33% respectively) and less frequently in wet evergreen (13%) and dry scrub (6%) forests (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). However, baseline information on their distribution and present status in India is lacking. The current distribution of sloth bears in India (Figure 1) is better known within protected areas. North Gujarat, India represents the western edge of the range of this species, but information of sloth bear distribution in this region is limited to protected areas (Chauhan 2006) or lacking altogether (e.g. Yoganand *et al.* 2006).

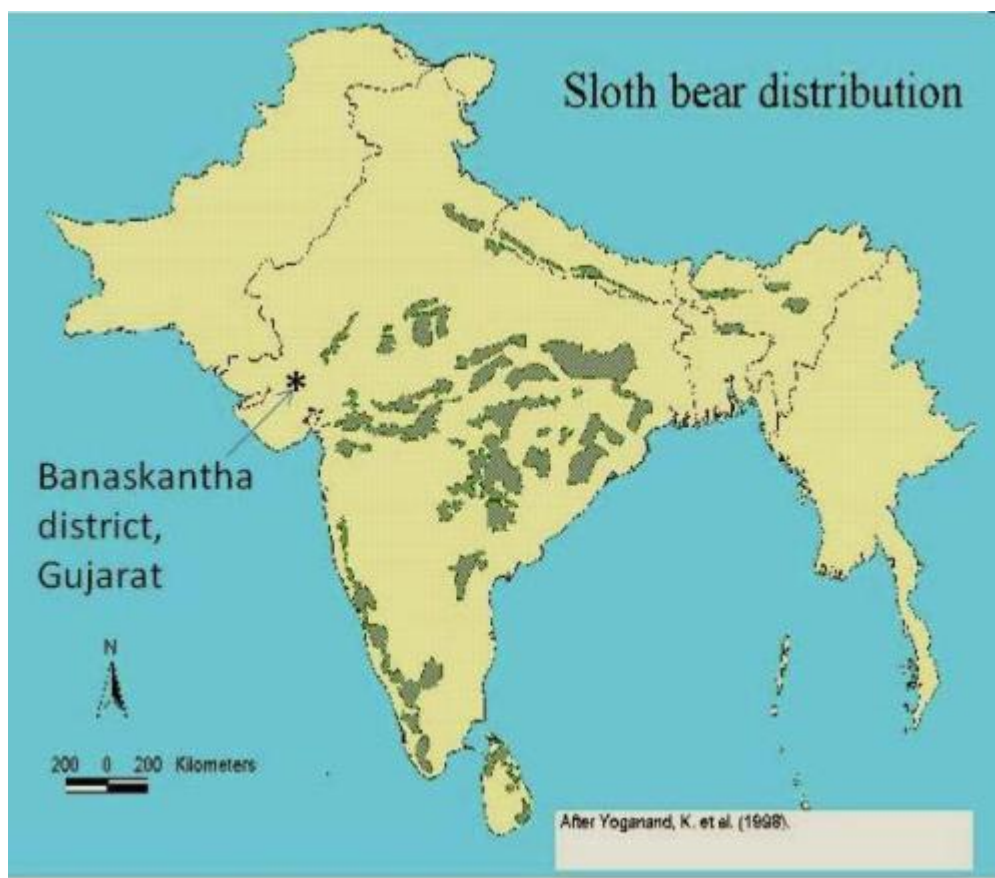


Figure 1. Distribution of Sloth bear in Indian subcontinent (Yoganand *et al.* 2006). The distribution of sloth bears in Gujarat state is not reported and was unexplored at the time.

In the state of Gujarat, India, bears are reported in five protected areas viz. Shoolpaneshwar, Jambughoda, Ratanmahel, Jassore and Balaram Ambaji Wildlife Sanctuaries. Balaram Ambaji and Jassore Wildlife Sanctuaries are located in Banaskantha district of North Gujarat (the study area of the present work) and reported some of the highest sloth bear densities in India (Garshelis, *et al.* 1999).

Our goal is to map the distribution of bear populations in North Gujarat and document and evaluate human-bear conflicts in the region. With support from Rufford Small Grants, London, we completed a survey of Banaskantha district, North Gujarat, in 2008. This report provides details of the work carried out during 2008.

Objectives

The followings are the main objectives set forth for the present research study:

- To study the status and distribution of sloth bear in Banaskantha District, where the highest population of sloth bears in the state is reported,
- To assess the nature and frequency of human bear conflicts in the study area and
- To make recommendations to minimize human-bear conflicts in the study area.

Duration of the Study to Date

Funds from Rufford Small Grants were awarded in February 2008 to initiate and complete a survey of Banaskantha district; we implemented fieldwork in February 2008 and have completed the survey of this district. Sloth bears also occur in Sabarkantha and Mehsana districts and in some isolated patches of forest to the south of the state. We plan to continue the study for the next two years to cover the entire range of sloth bears in the state of Gujarat (Figure 2).

Study Area

The present study was carried out in Banaskantha district of the North Gujarat Region; the north Gujarat region comprises 15.68% (2955.87 km²) of the total forest cover (18,868.28 km²), of Gujarat state. Within North Gujarat, 1500.25 km² of forest lies within the study area i.e. Banaskantha district, the rest falling within Mehsana (178.16 km²) and Sabarkantha (1277.46 km²) (Forest Survey of India 1997).

The entire region experiences much variation in temperature with a minimum of 5°C in winter and a maximum of 46° C in summer. The topography varies from plains to low hills, with elevation gradients of 10m to 600m above mean sea level.

The mean annual rainfall of 765 mm is received mostly during the monsoon season from July to mid September. Winters from October to February and summers from March to the end of June. The average rainfall of 765 mm provides ideal environmental condition for an abundance of diverse flora and fauna.

The District of Banaskantha

Banaskantha district lies between 23° 35' to 24° 43' North and 71° 0' to 73° 0' East on the Banas River. The area of the district is 12703 km² and constitutes 5.5 % percent of the total area of Gujarat state. Banaskantha is the third largest district in the state. Habitats within the district consist of saline to sandy desert areas in the west and undulating hilly terrain of the Aravalli Mountain Range in the north and northeast.

The forests support a diversity of the ground dwelling birds and the other migratory wetland birds. Apart from the sloth bear, few mammalian fauna are recorded in the region. Blue bull (*Boselaphus tragocamalus*) is one of the most common large mammals. Small to medium-sized carnivores such as the small Indian civet (*Viverricula indica*), jungle cat (*Felis chaus*), Indian ratel (*Mellivora capensis*), and leopard (*Panthera pardus*) are common. A recent

study by Nishith (2008) reports 28 species of mammals in the North Gujarat region.

Two wildlife sanctuaries lie within the district, viz. Balaram Ambaji and Jassore Wildlife Sanctuaries; both protected areas harbour sloth bears. Apart from these protected areas, Danta and Ambaji forest ranges constitute sizeable patches of sloth bear habitat and, fall under the categories of reserved forest and unclassed forests. These patches also harbour a variety of wildlife including sloth bear, leopard, hyena, blue bull etc.

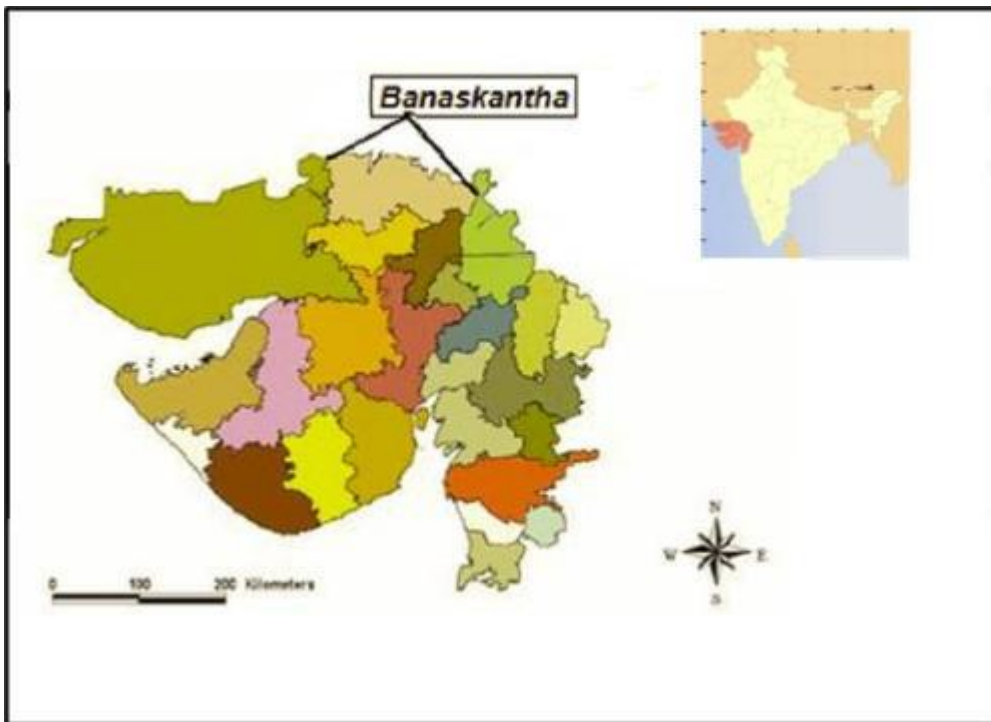


Figure 2. Map of Gujarat, showing four districts of North Gujarat including Banaskantha

The forest tracts of the area are highly undulating with broken ranges of hills of height ranging from 170 to 923 m. above mean sea level. Most of the hilly tract is steep with slopes ranging from 90 to 100 percent in some places. The important hills of the area are Koteswar, Gabbar, Surmata, Diwania, Kaleto, Trishulia, Virampur, Hathidra and Chamunda hills. The hills and hillocks form a network of catchments leading to a big valley, locally called *Nala*, entering the plains and draining into the rivers and small streams. (Singh. R, Chand K, G.A. Patel, 2002).

Flora

As per the forest classification by Champion and Seth (1968), this region supports southern dry mixed deciduous forests 4B 3, 4B 4, 5A/C3. The forest on hills supports *Boswellia* and *Lannea* forests at the top, the intermediate regions of the hills are covered by *Acacia*, and the foot hills are dominated by *Anogeissus* forests. Apart from these species, the Ambaji range supports an abundance good density of Teak (*Tectona grandis*), and bamboo species. This unique ecosystem harbours 483 species of plants including 107 tree, 58 shrub, 219 herb, 49 climber, 40 grass and 10 lower plant species. (Pandey, 2004).

Fauna

Among the fauna, the area supports a high diversity of ground dwelling birds and other migratory and resident wetland and terrestrial birds. Mammalian fauna are less diverse in the region. Bluebull (*Boselaphus tragocamalus*) is one of the most common large mammals in entire area, while other ungulate population is found too low in the region. There are more records of small to medium sized carnivores/omnivores like Small Indian Civet (*Viverricula indica*), Jungle Cat (*Felis chausa*), Indian Ratel (*Mellivora capensis*), Sloth Bear (*M. ursinus*) and Leopard (*Panthera pardus*).

Cover and Food for Wild Animals

The vegetation density and diversity is an important factor determining the habitat condition for particular wild animals. Different animals prefer different type of habitats for food and shelter.

The flagship species of the area i.e. sloth bears use wild fruits, honey, flowers and rhizomes of some species. The fruits of *Zizyphus*, *Diospyros*, *Phoenix*, *Ficus* and the flowers of *Madhuca indica* etc. form more preferred food. The second important species in the sanctuary is the leopard which needs wooded and shrubby groves for hiding and predation which are available in most part of the forested area.

The existence of a loose boundary structure and eroded rocks found in proper food chain and thin terrain forms an ideal cover for this big cat. In the absence of proper food chain Because herbivore populations are thin, the fairly good population of leopards quite often invade the domestic live stock to full fill their food requirements. Hyenas are also found in similar habitat conditions. The avifaunal population needs different stories of flora for nesting and different species have preference for different trees and shrubs. Several species depend upon seeds of grasses and fruits of various species while others predate on insects and a variety of smaller birds. The *Ficus* species provide nesting habitat and food for a variety of birds.

Distribution of sloth bear in Banaskantha District

We surveyed protected and unprotected land within Banaskantha using a 5 x 5 km grid overlaid on 1:50,000-scale land-use maps to determine sloth bear presence or absence. We conducted interviews with villagers with first-hand knowledge of the forests in the area who would be most likely to report on the presence or absence of sloth bears. With assistance from local tribesmen, we verified reports from villages by surveying grid cells for sloth bear sign such as tracks, scats, and diggings to identify areas used by sloth bears. All locations of scats, tracks or other bear sign were mapped using a Garmin GPS.

During the survey, we inquired about incidents of human-bear conflict. Victims of bear attacks were interviewed and the site of the reported attack was also mapped. We also documented incidents and costs incurred by villagers who reported crop damage by sloth bears.

We collected and analyzed sloth bear scats to identify the types of foods utilized by sloth bears and to determine whether agricultural crops composed a part of the diet of sloth bears.

Bear – Human encounter record

We surveyed 130 villages in the study area to study frequencies of sloth bear-human encounters, encounter locations and other associated parameters. Villages were visited and over 200 people who had close encounters with sloth bears and who used the forest areas intensively for various purposes such as grazing livestock were interviewed. 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 suffered, and the circumstances that led to the encounters.

Conflicts and Co-existence of Human–Sloth Bear

Conflict resolution may influence the survival of a species and therefore has crucial conservation implications. The study of an animal's behaviour and 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. With this view, we studied conflicts between sloth bears and humans in Banaskantha district to assess patterns and underlying factors.

We documented human-bear conflict in all the villages in the study area. Village representatives including knowledgeable parties were interviewed to record information about the occurrences of human casualties in different years, cropping pattern, agricultural crop damage, collection of non-timber forests products and compensation paid to victims.

We obtained some information from Forest Department records and the remainder from interviewing victims or their family members. Information on human casualties, age and sex of victims, activity of victims, place and date of the incident, number of bears involved, mode of attack, and nature of injuries etc. was collected in a predesigned questionnaire format.

Results and Discussion

Field work was conducted from February to December 2008 (Table 1) the data collected were analysed to prepare final findings which is discussed further in this chapter. Table 1 show that about 2000 km² area of protected and non protected forests in the district were sampled and surveyed to know the presence of bear. Further almost all the villages within that area is surveyed and villagers from each village were interviewed to know their perception towards the presence of bear in the area. During the sign survey, we collected 138 scats of bear and all those were analysed in the laboratory to know the food items of bear in the area.

Table: 1 Summary of field activities in Banaskantha district, 2008.

Activity	February 2008 to December 2008
Grids surveyed	75 grids (5x5 km)
Villages Survey	202
Villagers Interviewed	230
Victims Interviewed	47 from 31 villages
Scats Collected and analysed	138

Sloth Bears in the Area

We conducted interviews in 130 villages within the study area to inquire about sloth bear presence or absence. Approximately 65% of interviewees reported that sloth bears occurred in forest patches close to their village and many had regular sightings of sloth bears on their farms and nearby water sources. About 30% of the interviewees reported that there were no sloth bears in their vicinity. A small number of respondents (3%) were uncertain about the presence or absence of bears in the adjoining forest of their village.

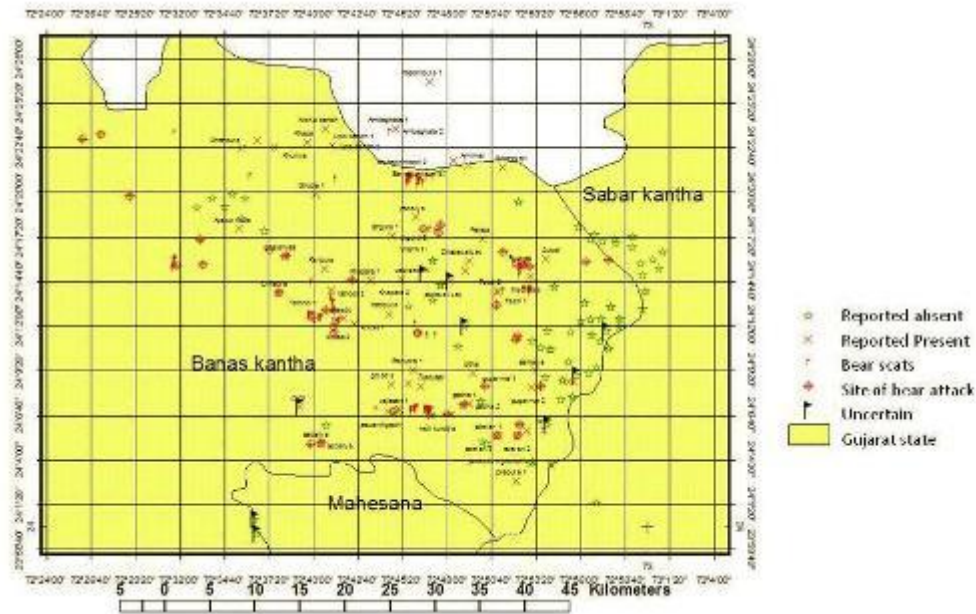


Figure 3: Reports of sloth bear presence and absence, and locations of bear scats documented during sign surveys in the region of Banaskantha district where sloth bear populations still remain.

Sloth bears are patchily distributed in both protected and unprotected forests in the study area (Figure 3). The adjoining forests falling in the Rajasthan district reportedly contain sloth bears and are contiguous with forests in Banaskantha District. The majority of sites where human-sloth bear conflicts occurred were around the unprotected forests of Danta and Ambaji range.

Apart from very few direct encounters with bears in the area ($N = 7$), we used sign surveys to study the presence of bear in the study area. Sign survey data further confirms the distribution range of bears in the study area. Very few direct sightings of sloth bears were recorded during the study period; bear sign was used to supplement and corroborate information obtained from interviews with local tribes (Figure 4).

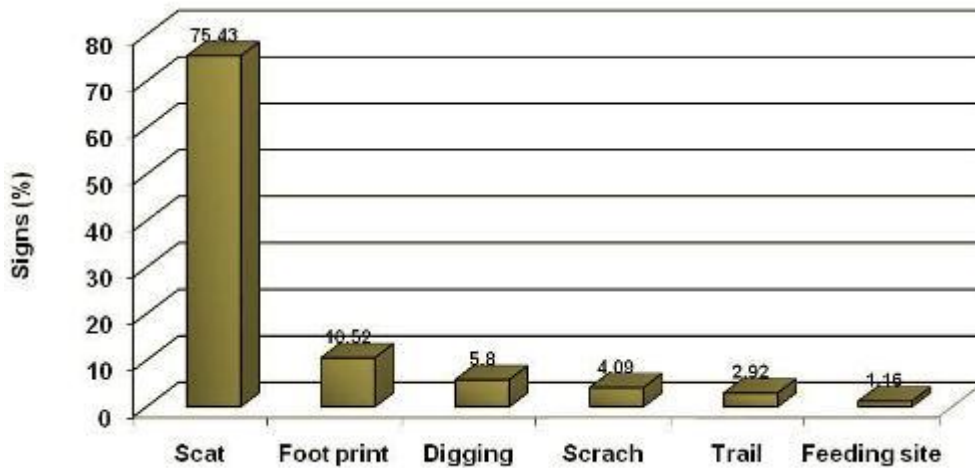


Figure 4. Types of sign recorded in the study area during sign surveys.

The sign survey study also revealed some patterns of habitat use of sloth bears in the study area. Bears occurred mainly in the hilly terrain adjoining the villages. Further, we located nine dens of sloth bear further confirmed by finding scats and tracks within or nearby the den. Occurrence of bear dens in the study area may reflect the favourable habitat for bear. The scat analysis revealed that bears in the area fed upon fleshy fruits, insects, honey hives (Figure 5, 5a and 5b).

In our study area sloth bears were apparently omnivorous, eating plants and animal (insects) food, with plant materials constituting a major part of their diet.. Prater (1965), Schaller (1969), Prue and Napier (1977) and Davidar (1893) have also reported a similar diet. Bear scat chiefly contained the remains of fleshy fruits (Figure 5). These were observed in much other forest of India (Baskaran *et al.* 1997). They reported at least 20 plants and grass species, nearly 3 groups of insect and birds remnant (Single occurrence) were recorded. *Zizyphus mauritiana* and *Cordia domestica* were the most frequently used. Baskaran (1977). While in our area shows the *Syzigium cumini* (22 %), *Diospros melanoxylon* (18 %), *Cordia dichotoma* (13 %) and *Phoenix sylvestris* (12 %), four species dominated the diet in study area.

Sloth bears possess special adaptation for feeding on termites (Pocock 1933, Erdbrink 1953; Sacco and van Valkenburgh 2004). Predictably, termites compose a large proportion of their diet in Sri Lanka but seasonally available food including fruit, honey and meat are also consumed (Ratnayeke *et.al.*, 2006). In present study, food composition of sloth bear shows 78% Plant material and 10 % of animal part which includes large red and black ant and honey bee along with the bee wax. Further, 12 % of the scats were found with both plant and animal parts, shown as mix food in figure 5.

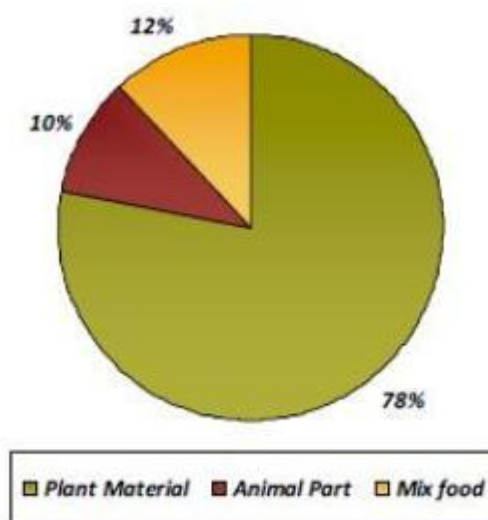


Figure 5. Food items occurred in the scats of sloth bear

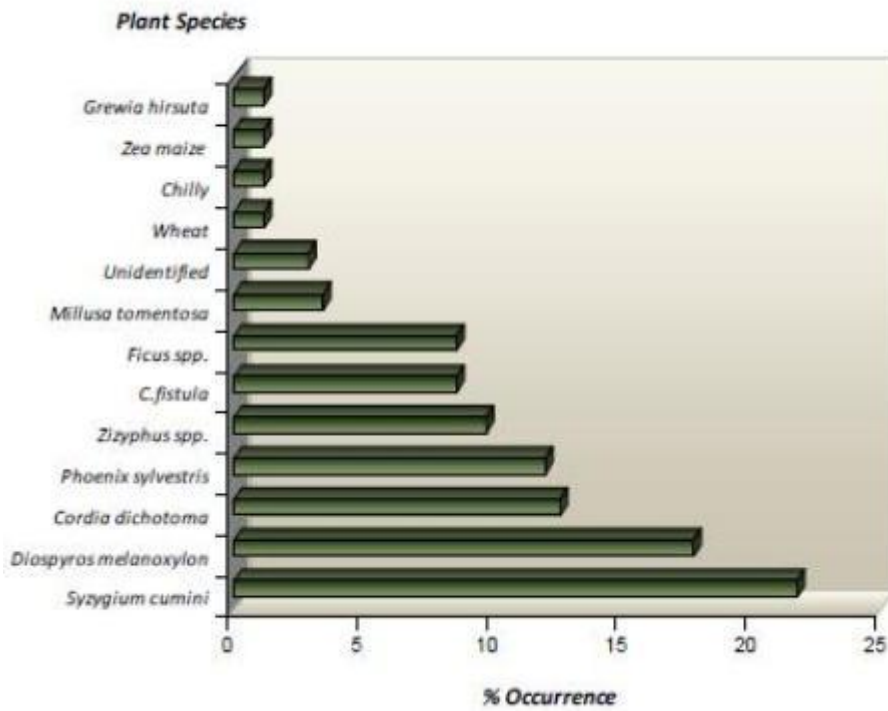


Figure 5a. Occurrence of fruits of different plant species in bear scat

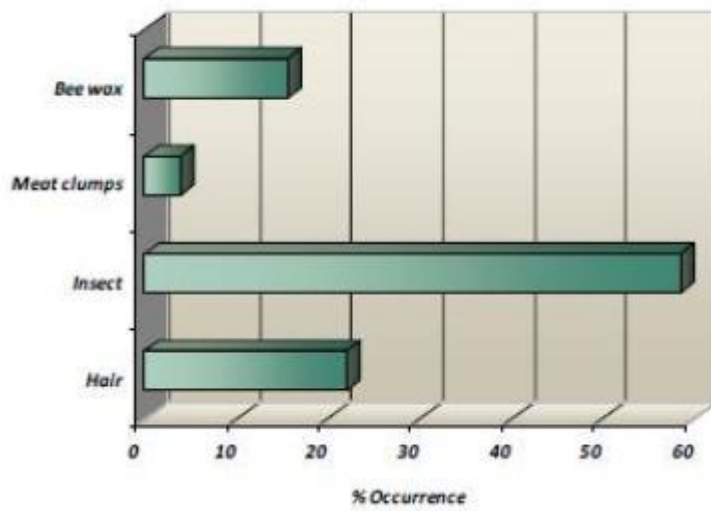


Figure 5b. Occurrence of various animal parts in bear scat

In Wilpattu National Park, Sri Lanka, Eisenberg and Lockhart (1972) found that Sloth bears fed heavily on termites and fruits, when in season. Schaller (1967) examined 92 Sloth bear dropping in Kanha National Park, central India, and found that termites were the year - round staple, with fruits important primarily from April to June (Laurie and Seidensticker, 1977) Animal material which contain hair 22% and Insect part 58% while meat and bee wax clumps is 20% found in the 136 scat.

Table 2 Plant species used as food by sloth bear and their availability in different season in the study area

No.	Plant Species	Part used as food	Availability through the year
1	<i>Aegle marmelos</i>	Fruit	May - June
2	<i>Cassia fistula</i>	Fruit	November - Jan
3	<i>Diospros melanoxylon</i>	Fruit	April - June
4	<i>Ficus Glomerata</i>	Fruit	May - June
5	<i>Ficus religiosa</i>	Fruit	December-March
6	<i>Ficus bengalensis</i>	Fruit	December- March
7	<i>Madhuca indica</i>	Fruit, Flowers	March - June
8	<i>Mangifera indica</i>	Fruit	May - June
9	<i>Syzigium cumini</i>	Fruit	June - July
10	<i>Zyzybus Jujuba</i>	Fruit	December - Feb
11	<i>Phoenix sylvestris</i>	Fruit	June - August
12	<i>Cordia dichotoma</i>	Fruit	May - July
13	<i>Grewia hirsute</i>	Fruit	October-Dec
14	<i>Millusa tomentosa</i>	Fruit	May-August

Table 2 above shows the availability of the food resources in the study area during different time period of the year. This shows that food for bear in the area remains available throughout the year.

The overall study depicts that due to good availability of food and other resources in the study area, bears are equally distributed in both protected and un protected areas in the Banaskantha district. Hilly terrine with the dense forest patches provides good sites for feeding as well as breeding.

Human-Bear Conflict

Sloth bear are known for their aggressiveness. In central India, sloth bears have a formidable reputation, and are considered one of the most fearsome of all the wild animals (Pillarisett 1993; Chauhan and Rajpurohit 1996). They are highly unpredictable in attacking people, especially when mother are accompanied by cubs (Prater 1980; Pillarisett 1993). Krishna Raju *et al.* (1987) has reported occurrence of 20 – 30 mauling cases/yr by sloth bears in Andhra Pradesh. Human – Sloth bear conflict has been reported from many parts of the Madhya Pradesh and Chhattisgarh (Chauhan and Rajpurohit, 1996; Chauhan *et al.*, 1999; 2003; Rajpurohit and Krausman 2000; Bargali *et al.*, 2005).

As bears found equally distributed in protected and unprotected forests in Banaskantha district, it raises the opportunities that bear may fall in confrontation with human residing in vicinity. Bears have reported visiting villages, farms and other human dominated areas which increase the chances of bear attack on humans, crop depredation and some time human attacks on bears. We collected the information of all such records through village survey, secondary data and other sources to evaluate human-bear conflicts. Figure below shows the number of cases recorded with forest department in last fifteen years.

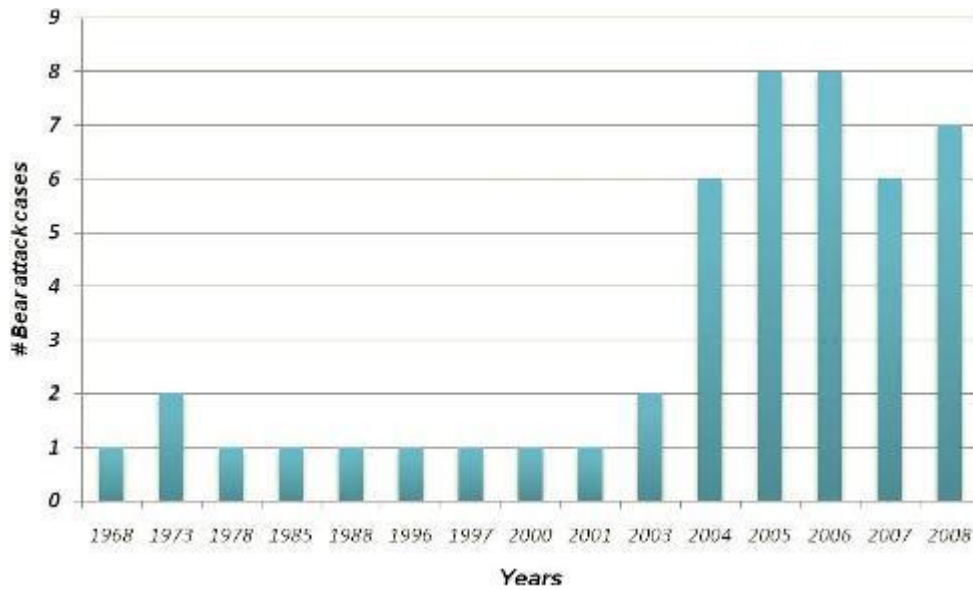


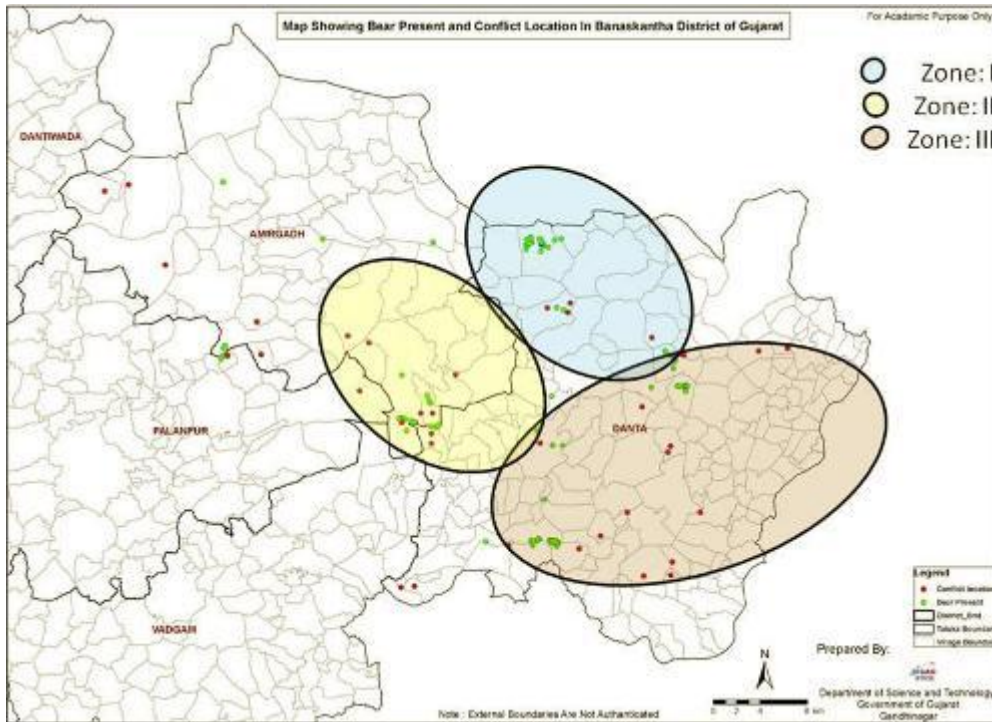
Figure 6. Number of sloth bear attacks during the past 15 years in Banaskantha gathered by interviews. Fewer attacks in the period 1968 to 2003 do not indicate that the frequency of attacks increased thereafter. Rather it indicates that information on recent incidents is more readily available.

Conflict Zones

Forested land in Banaskantrha district was assess as 1107.4 km² (FSI, 1999) and composed of 39.1 % dense forest, 28.35 % open forest, 23.11 % of Scrub forest and 9.42 % of Open forest land. The different habitat types were characterised by various dominant plant species (trees and shrubs) and common sloth bear food plant.

Most recent encounter locations were visited and location 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 from interviews. The encounter time characteristics were put into seasonal and diurnal time classes. Using these data we have identified, conflict prone zones in the district. We surveyed these zones intensively to study characteristics like time, age group, reason for conflicts, etc. Figure 7 shows three distinct conflict zones according to the intensity of bear attack in the area during study period. It can be seen from figure 7 that conflicts in Danta zone (*Zone III*) followed by Zone II and Zone I. Zone II is a protected area of Balaram Ambaji Wildlife Sanctuary, where as zone I and III are unprotected reserved forest. Moreover, the high occurrence of bear

attack in Danta zone is due to an incident of bear attacked on five people in one night. Thus the intensity of conflicts in all the zones is remains similar, whether it is a protected area or unprotected area. All these zones is mapped using GIS in figure 7.



Zone I: Ambaji (23%), Zone: II Balaram Sanctuary (32%), Zone: III Danta Forest range (45%)

Figure 7. Map showing identified conflict zones and percent of bear attack recorded during the study period

Most attacks occurred during cold (43%) or wet (30 %) seasons. About 58% of the attacks occurred in daylight hours, most of the remainder were during dawn or dusk (crepuscular), and a small proportion of attacks occurred at night.

The bear attack recorded were also analysed on the bases of time of attack, this shows that majority of bear attack occurred during the day time (58%) which is followed by crepuscular and night time (Figure 8). People from the surrounding village visit forests for minor forest produce collection during the day time or early morning, which make them more vulnerable for bear attack. Further it was also recorded that around 45% attacks recorded in winter season. Winter is the fruiting season of most of the plants occurring in the study area, these fruits are consumed by sloth bears as well as collected and sold by the local villagers. This might be the major cause of confrontation of bear and human in the area.

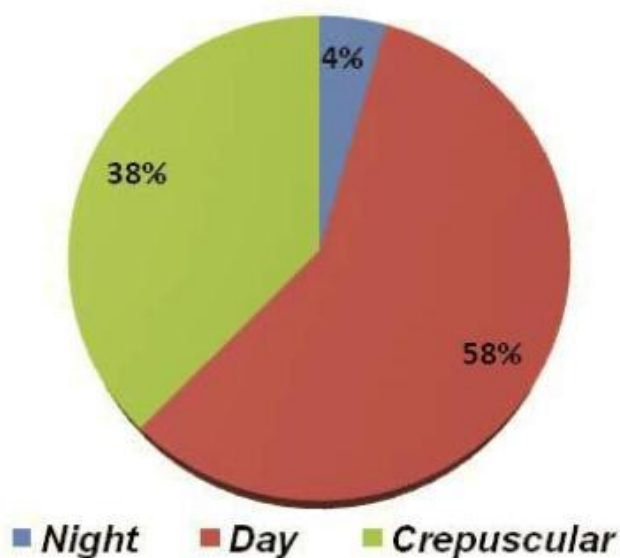


Figure 8. Occurrence of bear attack at different time of the day

Encounter type

Using the information from local people on the circumstances leading to each encounter, encounters were classified into “surprise” or “deliberate” encounters. The former kind of encounter was when either humans or bears involved were not aware of each other prior to the incident and the encounter happened suddenly. The latter 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. This is again supported by the activity of a respondent at the time of bear attack (Figure 9).

It is revealed that cattle tending and MFP collection are the main activity of a people in the forest areas during which majority of the conflict cases occurred. This also reflects that bear attacks are occurring in the forest areas, thus bears are not entering in the villages, but the human activities in the forest is high and might be a cause of escalating conflict issues.

About 35 % of the humans who encountered bears were herding cattle in the forest, 20% were collecting minor forest products (such as edible fruits, honey, firewood, etc.) and 10 % were travelling along local roads in the forest to reach nearby villages.

Bear attacked primarily when the encounter was sudden and the attacks were probably a defensive response. The frequency of attacks on humans engaged in various activities was related to their intensity of usage of different habitats. It was also found in the present study that human and bear activity overlapped in the crepuscular periods, often greatly in the evenings, and the period of overlap was longer in the wet and cold seasons.

During wet and cold seasons, more humans used the forests and particularly the same habitats that the bears used. New flush of grass and brose during wet seasons attracted livestock and the humans who tended them. Such associations that sloth bear attacks had with seasons, time of day or habitat type were also reported from other areas. Rajpurohit and Krausman (2000) reported that in Madhya Pradesh state in central India, the attacks that occurred in forest habitats were more frequency between April and October and the attacks in Village gardens and crop fields were more frequent in October. Chauhan *et al.*, (1999) reported that in north Bilaspur Forest Division (NBFD), an intense conflict area in eastern central area, attack were more frequent from August to October, January and May. However, both these studies have happened during morning activity of humans bear habitats (Bergali *et al.*, 1999)

All attacks occurred when humans encountered bears abruptly in the forests, or in two cases, in the vicinity of village in farm fields. In most cases respondents reported that they realized the bear's presence only at close range. Most villagers reported that sudden encounters with sloth bears were

the most common type of interaction. We think that bears also may have sensed human presence only immediately prior to the encounter.

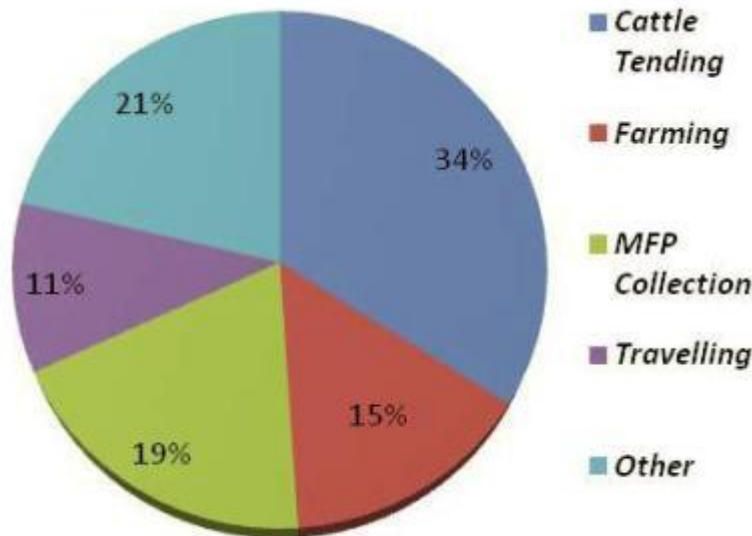


Figure 9. Activity of respondent at the time of attack by bear

Out of more than 200 Villages surveyed, 31 villages reported with frequent bear attacks. We documented 47 of such incidents. Of these, 12 occurred between 1968 and 2003. We acknowledge some potential error in the precise year reported by respondents and some incidents may have gone unrecorded or forgotten.

Bear and human responses

In most encounters bears fled, but sometimes they charged humans and then either attacked or retreated without making physical contact. Humans also usually ran away upon sensing a bear. If the bear retreated in an encounter, then the humans also moved away. If the bear charged or attacked, people either panicked or did not resist the attack. Occasionally, people held their ground and chased the bear away, or tried to defend themselves with an available tool or weapon. The age class distribution of victims shows that person of the age from 31-45 and up to 60 have more been the victims of bear attack due to their involvement in cattle herding, MFP collection and all other activities in the family.

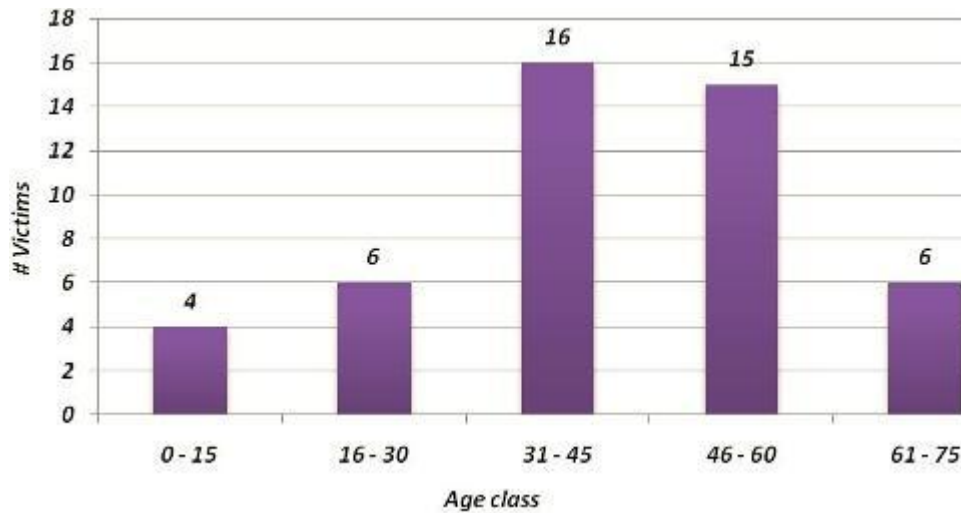


Figure 10. Classification of victims by their age classes

All the victims as well as the local villagers were interviewed to know their perception towards the presence of bear in the area. The people were asked three main questions; one is about the status of bear population in the area, second presence of bear is threat to man and third whether the bears need protection. The study shows that majority of the people are unsure and some of the people showed their hostility towards the bear (Figure 11 a and b). High number of unsure people shows the lack of awareness in the area. As the study area of Banaskantha district falls in the tribal zone of North-east Gujarat, these tribal people are very shy, illiterate and less interactive.

Out of all the villagers interviewed, 87 % has said that presence of sloth bear is threat to man while in answering majority of the questions the people were remain unsure. Figure 12b shows that about 8% of the respondents were admitted that the sloth bear population is increasing and almost half of the respondents were unsure to say about the status of bear in the area.

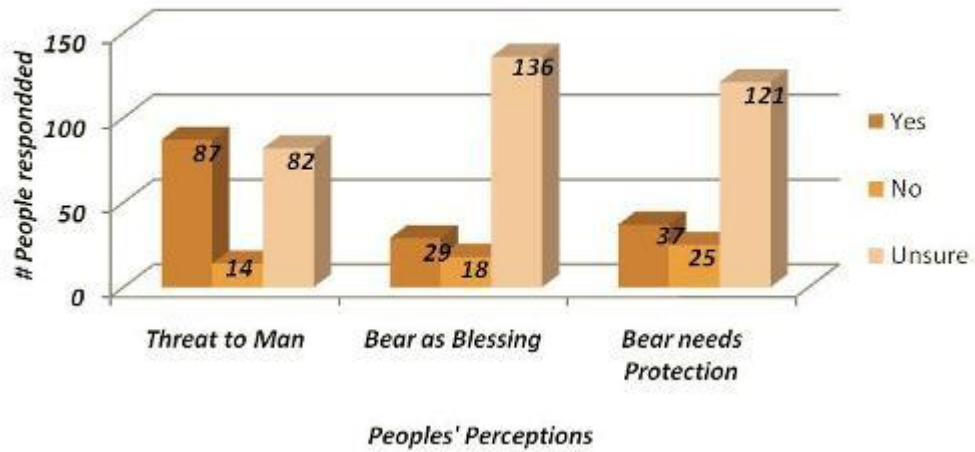


Figure 11a. Peoples' perception towards bears in the area

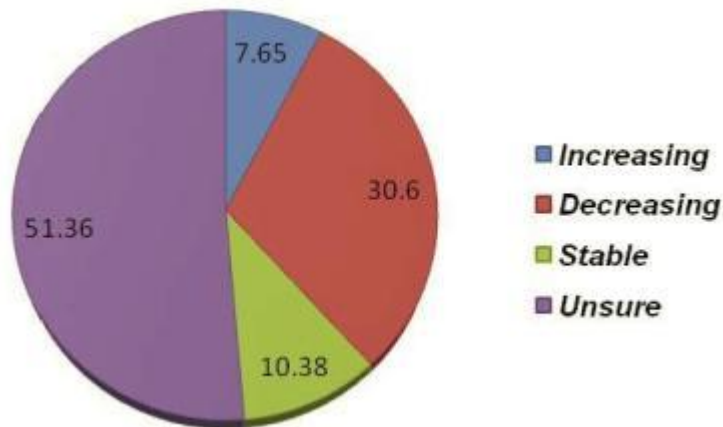


Figure 11b. Peoples' view about the bear population in the area

Recommendations to Reduce Conflicts and Strategies for Bear Conservation

Sloth bear population in Indian sub continent is declining over a past century, primarily due to loss of habitat due to fragmentation and human encroachment. Besides this, conflict with human was considered a threat in over 40% of all Sloth bear areas (Yoganand *et al.* 2006). The conflicts become very high and frequent when the bear population is abundant in a smaller forest patch. Conflicts are also found to be more acute with the degree of use of the same habitats by human. The present study has been carried out during the year 2007-2008, i.e. one year in one of the districts of Gujarat where sloth bear occurs. Hence it is not possible to make specific suggestions and recommendations with the limited information collected for a year. However on the bases of the present study, finding and analysis we are suggesting some general strategies to reduce the human-bear conflicts and conservation of bear population. This recommendation may serve as a primary steps towards long term conflict resolution and conservation management plan for sloth bear population in the region of North-east Gujarat.

It is found that dense forest habitat, particularly forests along escarpments is more used by sloth bears in the study area and thus it is more crucial for bear; on the other hand the same habitat is used by humans for various purposes like MFP collection, cattle herding, local transport, etc. This situation has been the major cause of bear-human conflict in the study area. It is hereby suggested that such habitats and forest patches should be identified and protected from humans use. Further various human use of this habitat, e.g. for grazing livestock, collecting fodder and other minor forest products, should be limited up to some specific season and time of the day to reduce the bear-human confrontation.

The bear distribution study shows that a considerable number of bears are residing in the unprotected areas, i.e. Danta and Ambaji range of the forest, the same area is also identified as a conflict zone in the present study. Establishment of protected area in these ranges for regulating human

infiltration and maintaining habitat may be a better step for the future of sloth bears (Japan bear network, 2006). Unlike Sri Lanka, the cases of bear hunting and poaching are very less in Gujarat but similarly a large population of tribal people and local villagers are depending on the collection of forest produces which can be regulated and managed if the range of Danta is declared as PA.

It is also found that majority of bear attack were surprise attack, in which bear and/or human is not aware about the presence of each other. Such circumstances can be reduced by restricting human use and entries in escarpments and hillocks where bears are littering and resting.

The interviews and meetings with the local villagers and bear attack respondents have revealed that the people in the area are less aware, less interactive and more ignorant about the compensation policies, conservation and other issues related to conflicts. It is therefore felt that, education and awareness programmes related to conservation, bear ecology and behaviour, causal factors for menacing behaviour by bears, and possible mitigation strategies need to be conducted for villagers in the affected areas. Such education and awareness programmes can also inculcates the conservation ethics among the locals.

People in the area are not reporting bear attack to the forest department for claiming the compensation due to their illiteracy and very complex application procedure. It is thus suggested that some prescribed compensation claiming application form can be made available to the people, so that they can easily fill the form and claim for compensation.

The bears are recorded moving on the fringes of the villages and forest during early morning and dusks, this is the general time when bears come out from their den for foraging purpose or returning to the den after feeding during night. Entry of local villagers, cattle graziers can be restricted during this time. If the local transport road is passing through such areas, the system can be developed through which, all people at a time can pass this areas to avoid sudden confrontation of bear. Their presence in the vicinity of bears will adversely impact bear activity and behaviour and may result in bear attacks on them.

Besides cattle grazing by local villagers, nomadic graziers from neighbouring state (Rajasthan) also congregate and stay in these degraded forest during late winter and summer. These activities not only disturbed bear population but also cause further degradation of the habitats. Some time high anthropogenic pressure and human activity may cause forest fire in the area. It is suggested that the entry of such nomadic graziers into forests should be restricted, checked and forest areas to be frequently monitored during this season to reduce the situations of forest fire.

Mining is the one of the major threat not only to bear population but to the overall ecosystem leading to habitat loss and human infiltration in the bear habitat. Mining activities in the vicinity of bouldary hillocks, with potential densities of bears, leopard, hyenas and other wild animals, should be immediately banned. Villagers collect and bring *Madhuca indica* (Mahuda) flowers into their homes to prepare traditional liquor. The strong scent of Mahuda residue may attract bears towards the villages. Likewise, bear may also be attracted to *Ziziphus mauritiana* (Ber) fruits stored in the house. To avoid this, some common disposal point of Mahuda residue should be decided outside the village or disposed off far from villages and preferred food items of bear such as *Ziziphus* fruits need to be properly stored or concealed.

Bear attacks recorded and studied during last 15 years and in the study period respectively suggests that they are not seasonal like black bear and Grizzly bears (Christopher, 2003). However two main reasons increase their intensity during dry and cold seasons. These are water scarcity during the dry season and fruiting season in the winter and post winter. Water sources in the localities of day-resting sites should be protected or if lacking, could be provided. Restoration measures could include reducing the causes of degradation, facilitating regeneration of plants, and planting trees species including key food plants to augment cover and food for bears in those habitats.

The study depicts that the sloth bears in the study area depend on two main foodgroups, fruits and insects – both are relatively abundant and easily accessible. The problem of habitat degradation is directly affects to both fruit and insect abundance and therefore sloth bear survival and reproduction.

It is also suggested to create a fair database on distribution of bears, their past and present range of distribution and record of bear attack as well as hunting, poaching or any adverse human activity in the area. Further the forests in the area are fragmented in to smaller patches, there were some records of bear movement from one patch to other, crossing the human settlements. Such forest patches shell be monitored and corridors of bear movement should be identified and protected to reduce conflicts and re-establish and improve the habitat.

The entire area of North-east Gujarat require a long term, systematic scientific research on distribution, movement pattern and resource utilization pattern of sloth bear that will not only contribute to conservation, but also create awareness and community involvement in bear conservation in the area.

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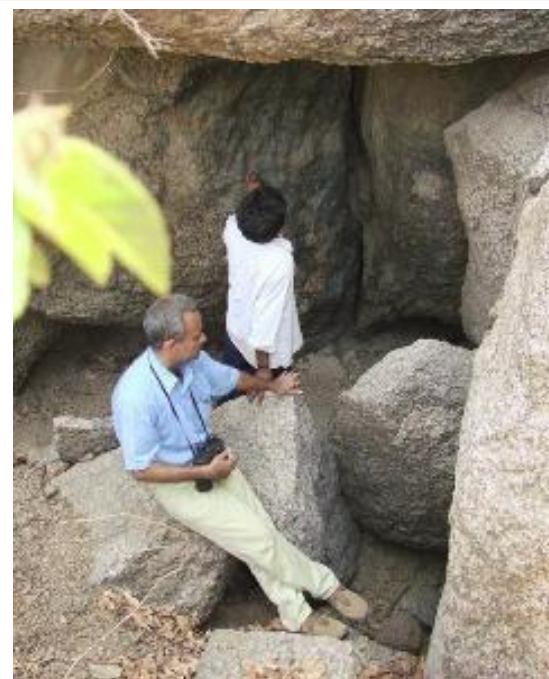
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Plate 1
View of the study area:



a. A Typical Sloth Bear Habitat



b. Identified Den of Sloth Bear

Plate 2
Sloth bear signs in the study area.



a. Scat of Sloth bear



b. Foot Print (Bear Trail)



c. Leftover food (Bee Hive)

Plate 3
Sloth bear food composition through scat analysis



Plate 4
Main food of Sloth bear in the study area



Plants

(i. *Millusa tomentosa*, ii. *Ficus religiosa*, iii. *Zyzyplus*, iv. *Syzygium cumini* & *Phoenix sylvestris*)



Insects

(i. Ant, ii. Red ant and iii. Honey bee)

Plate 5
Sloth bears victims



a. Person injured by Bear



b. Person injured by bear



c. Place of Bear attack inside village

Plate 6
Village surveys and Public meeting and Interviews with sloth bear victims



a. Public meeting



b. Nomadic cattle charmer



c. Interview with Bear Victim

Plate 7
Sloth bear cubs



Annexure I: List of food items found in scats study

<i>Plant Species</i>	<i>Local Name</i>	<i>Part Consumed as Food</i>
<i>Aegle marmelos</i>	Bily	Fruit
<i>Cassia fistula</i>	Garmalo, Amaltas	Fruit
<i>Diospros melanoxylon</i>	Timru, Tendu	Fruit
<i>Ficus recemosa</i>	Umaro	Fruit
<i>Madhuca indica</i>	Mahua, Mahuda	Fruit, Flowers
<i>Mangifera indica</i>	Ambo, Mnago	Fruit
<i>Syzigium cumini</i>	Jambu, Jamun	Fruit
<i>Zyzyplus Jujuba</i>	Bor, Ber	Fruit
<i>Phoenix sylvestris</i>	Kahjur, Date	Fruit
<i>Cordia dichotoma</i>	Gunda	Fruit
<i>Grewia hirsute</i>	Trambet	Fruit
<i>Millusa tomentosa</i>	Umb	Fruit

<i>Animal Species</i>	<i>Local Name</i>	<i>Part Consumed as Food</i>
Large black ant	<i>Kala Makoda</i>	Whole, entire
Large red ant	<i>Lal Makoda</i>	Whole, entire
Honey Bee	<i>Madhumakhi Or Madhumakkhi</i>	Whole, entire
Amphibians	<i>Frogs, toad, etc.</i>	Whole, entire
Small Birds (chicks)		Whole, entire

Annexure 2: Survey Questionnaires

II a. Village Survey

Date _____

Data entry by _____

Sloth Bear Survey (Gujarat)

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 Gallbladder Teeth 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 _____

II b. Bear attack respondents

 Date _____ **Sloth Bear Attacks Questionnaire** Data entry _____

1. Respondent's data: Name _____ Sex _____

Age _____ Occupation _____ Address _____

3. Date of attack: Year _____ Month _____

4. Geographic location of attack: _____ **4a) Frequency of Bear occurrence:**
5. Respondent's activity during encounter: _____

6. Time of the encounter: Night Early morning Mid day Evening

7. Number of people with victim (within 5 m) during encounter _____

8. Number of bears: _____ **9. Cubs present?** No ___ Yes ___ **How many?** _____

10. Describe size and location of major injuries _____

**** Specific Identity of Bear if any:** _____

11. No. of days in hospital _____ **12. How long did it take to recover?** _____

13. Have you recovered fully? If not give details _____

14. Victim or companions were armed? Yes No Type of Weapon _____

15. Was weapon used to ward off attack? Yes No Details _____

16. Distance between victim and bear when charge occurred _____

17. Bear approached From behind From front From behind tree or rock

18. 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

19. Duration of attack _____

20. How did you react to the bear's attack? _____

21. 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 _____

Annexure 3:
List of Villages Surveyed

1	Aderan	62	Machkoda
2	Aheado	63	Madhasudanpura
3	Ajapur mota	64	Magvas
4	Ambaghata	65	Mahuda
5	Ambaji Ranpur	66	Makad champa
6	Ambapani	67	Mandali
7	Amirpura	68	Mandaliya
8	Amlimal	69	Mandalyara
9	Bahodra	70	Mankadi
10	Bamnoj	71	Manpura
11	Barvas	72	Motipura
12	Beda	73	Moredungra
13	Bedapani	74	Mornasada
14	Begadiyavas	75	Mota bamodara
15	Bhachadiya	76	Moti kukdi
16	Chhapra	77	Tundiya
17	Chikanvas	78	Nagel
18	Chorasan	79	Navanupadar
19	Chota pipodra	80	Navavas
20	Devaliyavav	81	Navi Sendhani
21	Dhabavalivav	82	Nichlo bandh
22	Dhanpura	83	Padaliya
23	Dharangivas	84	Pansa
24	Dhareda	85	Panudra
25	Dholiya	86	Pasiya
26	Divadi	87	Piplavali vav
27	Engora	88	Pitha
28	Gadh	89	Puniyari godhani
29	Mahudi	90	Rabaran
30	Ganapipalia	91	Ranika
31	Ghantodi	92	Ranpur
32	Ghareda	93	Rapat
33	Ghoda	94	Rayania
34	Gorad	95	Rupvas
35	Goratekari	96	Samaliya
36	Guda	97	Sanali
37	Gugarmal	98	Sandhosi
38	Harivav	99	Sarakala
39	Hathi pagala	100	Sarhadchhapri
40	Jasvanthgadh	101	Sebaliya
41	Jasvantpura	102	Sebalpani

42	Javara	103	Shayavada
43	Jelana	104	Surela
44	Jetwas	105	Taleti
45	Jorapura	106	Tarangada
46	Jostar	107	Tathodi
47	Joyta	108	Thalvada
48	Juni sendhani	109	Udavas
49	Kanpura	110	Upalo Bandha
50	Karabiyavas	111	Vadnal
51	Kasampura	112	Vadusar
52	Khaivas	113	Vadvera
53	Khajuriya	114	Vagdakari
54	Khandor Umari	115	Vajasan
55	Khapa	116	Vasi
56	Khapara	117	Vekari
57	Khermal	118	Vijlasan
58	Khuniya	119	Viramviri
59	Kousa	120	Virpur
60	Lotol	121	Zamro
61	Machhala	122	Zufali

List of village where bear attack recorded

01	Aderan	16	Jasavanthghad
02	Ahedo	17	Kansara
03	Beda	18	Karza
04	Bhadramal	19	Madhusudanpura
05	Bhokhari	20	Manpuria
06	Chhapara	21	Motipura
07	Chikanvas	22	Nani Tundiya
08	Chowkibor	23	Revaun
09	Danta	24	Rupwas
10	Dhamanva	25	Sebaliya
11	Gajipur	26	Ukarda
12	Gavra	27	Vaghadasa
13	Ghad	28	Viramviri
14	Gothada	29	Viramviri (Undhapipaliya)
15	Gugarmal	30	