OCCASIONAL REPORT NO. 29

BEAR NECESSITIES

A scientific approach to understand and mitigate Human Sloth Bear conflict in Madhya Pradesh

Debobroto Sircar, Anil Kumar Singh, Rahul Kaul and Vivek Menon

2012

Wildlife Trust of India

Wildlife Trust of India (WTI), Wildlife Trust of India (WTI), is a non-profit organisation, committed to conserve wildlife and its habitat and to work for the welfare of individual wild animals, in partnership with communities and governments. Its vision is a secure natural heritage of India.

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CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

Bears in India, unfortunately, are known more for conflict than as ubiquitous carnivores of the Indian forests. Though, Madhya Pradesh, the heart of India, has declared itself as a tiger state, it is also home to beautiful sloth bears. There is a village named Jamthun in the Ratlam district, which may have been taken from Jambawan or Jamvanta, the bear king. The myth of the ancient bear king of the central India has been forgotten and only the human-animal conflict is remembered now. This conflict may escalate in the summer months, and reach epic proportions, with the forest trees, M*adhuca indica*, flowers being looked at as a food source by both humans and bears.

This detailed project work by the Wildlife Trust of India seeks to understand the range of conflict, its causes and recommend solutions at very specific district level. If followed up on the ground, both this plan and the one produced four years ago for the state of Jammu & Kashmir will ensure reduction in bear conflict even if not complete mitigation.

Vivek Menon
Executive Director
Wildlife Trust of India

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Special thanks are due for all the Range officers for providing us with valuable information and details regarding the conflict scenario that made my work more comprehensive. Also, we are grateful to all the forest field staff i.e. Deputy Rangers, Foresters, Beat Guards and Forest Chowkidars who accompanied us to the locations /areas and endured the hardships to reach the victims and helped me in the survey.

We are highly thankful to all the interviewee and victims of conflict who cooperated with us during the study tenure in revealing the conflict circumstances which helped me prepare the report.

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EXECUTIVE SUMMARY

The wildlife conflict with humans has become a priority issue in the much needed conservation efforts for large carnivores including bears. In Madhya Pradesh, an alarming increase in the number of sloth bear conflict has been witnessed which has translated into a public outcry. The State forest department of Madhya Pradesh on its part is highly concerned and initiated a study which is carried out by Wildlife Trust of India. The purpose of this study was to identify highly prone conflict areas and put forward implementable action to reduce the conflict.

The study was carried out in 10 forest circles of Madhya Pradesh spanning 37 forest divisions & 24 districts. Over 500 victims were interviewed by visiting conflict prone villages in the state. The purpose of this exercise was an attempt to combine what is known locally in the context of bear conflict and combine them with statistically significantly facts, mainly to determine and identify the precursors of the conflict and then suggest prescription for its mitigation.

In our extensive survey, we ascertained that human encounters with bears have increased almost exponentially since the last couple of decades i.e. from 1990 till 2009. Seasonality of attack showed a bimodal pattern which coincides with local communities' movement inside the forest in Pre and Post Monsoon months whereas Diurnal patterns indicate that humans are most prone to be attacked by bears in dusk and dawn in comparison to daylight hours. Sloth bear conflict cases in all the affected circles bring forth the result that most bear encounters have occurred inside the forest boundaries than inside villages. Although,

exception in certain forest circles were found as in parts of Jabalpur, Seoni and Shahdol Forest Circles have recorded considerable cases inside the village boundaries hinting to the fact that sloth bear are venturing out of their habitat in search for food (fruits, home garden vegetables and crops) thus, increasing the chances of fatal encounter with humans. Activities like Herding livestock, NTFP collection inside the forest have been witnessed to have higher chances of encountering a sloth bear. However, it is when locals, due to lack of sanitation facilities inside the village goes to the fringes of the agricultural fields or forest to defecate, the chances of encountering and attacked by sloth bears becomes very high. Due to these threats, a perception analysis was carried out which indicated towards an undercurrent of apathy towards the sloth bear resulting into many unrecorded retaliatory killing of this Scheduled-1 species.

Based on the data collected firsthand from the field and also from GIS tools a kernel map of bear conflict was prepared depicting the intensity levels (peaks and colour coded) in the state of Madhya Pradesh over a temporal span. This helped us prepare and put forward steps of implementable actions in the high conflict prone sites that can lower the levels of conflict. Steps include both people as well as bear specific, each differing in short and long term approaches.

1. INTRODUCTION

1.1 Human Wildlife Conflict

All over the world a wide array of wildlife species threaten or mostly perceived to be threatening the human lives and their livelihoods, are subsequently killed by people for this reason. Unfortunately, large numbers of such species are threatened with extinction.

As a group, carnivores exert a profound influence on their immediate biological communities through predation and interspecific competition. Carnivoran species, both as top predators and as highly diverse, charismatic, and 'popular' animals also play an important role in conservation (M. Cardillo et al, 2004). As is true for every mammalian species worldwide, many carnivores are experiencing population decline, some are currently at the brink of extinction. Researchers have found that Under heavy pressure from humans, from hunting or livelihood related habitat loss & fragmentation, species with long gestation periods can't repopulate fast enough and thus, become critically endangered (M. Cardillo et al, 2004) forcing negative repercussions on both. Thus the term Human carnivore conflict came into being and later became popularly known as Human Wildlife Conflict (HWC).

Human Wildlife Conflict can be defined as:

"*Any event in which animals injure, destroy or damage human life or property (including destruction of crops), and are killed, injured, captured or otherwise harmed as a result – i.e.*

both humans and animals suffer from the interaction with each other."

Brian.T.B. Jones 2006
(Human Wildlife Conflict Study)

As per IUCN, World Park Congress (2004), "Human-wildlife conflict occurs when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife". Often, HWC is seen from the standpoint of the human, where it is believed that human is incurring all the losses when wildlife causes loss in agricultural productivity, destruction of property, human injuries and fatalities when encountered in the wild or reduction in a person's quality of life. Very few even consider the loss, which might cause to the wildlife existence in the long run because of such conflicts. In recent years, it has been witnessed that apart from the normal view of wildlife conflict (Human & economic loss), the state of HWC escalates and gets further exaggerated when local communities developed the feeling that the needs or values of wildlife are given more priority instead than their own needs, or when local institutions are inadequately empowered to deal with the conflict. In both the cases, the conflict intensifies to a point, where it is viewed as conflict not only between humans and wildlife but also between the human's perception about the need & importance of wildlife.

In India especially, the Human Wildlife Conflict (HWC), related threats to human life and their economic security, poses an immediate and urgent challenge, because it brings the human's in direct

confrontation with wildlife and more often than not, it is the wildlife that ends up being the casualty. HWC is increasing in both frequency and severity nationwide and is expected to continue escalating. It is because of such cases many wildlife preserves and parks were formed, where it intended human impact on wildlife and vice versa can be minimized. But it did little to resolve the conflict because societal demands for natural resources were so great that only a small fraction of the land was set aside for the animals. Additionally, most national parks usually have lengthy edges where wildlife habitats interface with human settlements and it is here the conflicts become inevitable. Also, most of these protected areas (PA) are plagued with becoming islands of habitat, surrounded by intense pressures from settlements. It is even worse for the forested land that falls outside the purview of these PA's where apart from the obvious threat of human related activities; developmental works like roads, mining have altered the habitat beyond repair, thus forcing the animals to use human dominant landscape for their survival. Problem persisted as animals do not respect the boundaries and often venture into human settlements inevitably come in direct competition with humans.

Human Wildlife Conflict in India has witnessed different forms which differ from one state to the other depending on the species, and the geographical settings. In India like many of the other countries faced with HWC, the economic cost and intensity of the conflict appears to be on the increase in many areas. Some of these areas were facing conflict from time immemorial, but in modern era new areas were conflict were unheard of, are

also becoming victims of it and are constantly plagued with its associated impacts (Rajpurohit & Krausmann, 2002). Apathy towards wildlife has been on a rise alongwith intentional killing of wildlife by humans which is fast becoming a major and rapid threat to the wildlife population viability.

1.2: Bears and associated conflict with humans

Among carnivores, bear are considered the most diverse group of large mammals. They are generally classified into three genera: *Ailuropoda, Tremarctos* and *Ursus.* Currently there are eight known bear species, in the world which are Brown Bear or the Grizzly (*Ursus actors*), American Black Bear (*Ursus americanus*), Asiatic Black Bear (*Ursus thibetanus*), Polar Bear (*Ursus maritimus*) Sun Bear (*Helarctos malayanus*) Spectacled Bear (*Tremarctos ornatus*), Sloth Bear (*Melursus ursinus*) & Giant Panda (*Ailuropoda melanoleuca*) which cover more than 60 countries in 4 continents. In nature, Bears are known to be as “Opportunistic Omnivores” whose dietary patterns regularly varies from plant foliage, roots, and fruits to insect adults, larvae, and eggs; animal matter; and fish, which depends mainly on the habitat and the seasons. Many scholars believe that bears are the umbrella species in most of the ecosystems they inhabit and that conservation of bears and their habitat will preserve the most biodiversity in the area concerned (Servheen et al, 1990).

Despite the undisputed value, unfortunately, bear numbers are declining in most areas of their range. As Bear populations usually require large areas of land to survive they typically compete directly with

humans for resources such as space, food, security cover, and even life itself. Instances like killing or injuring livestock, damaging agricultural or forestry crops, or otherwise directly compete with people are frequently reported and some bear species are notorious for that. Some species have even been reduced in numbers by 50% or more in the past 100 years (IUCN/SSC Bear Specialist Group, 1999). As per the latest assessment by the IUCN Bear and Polar Bear Specialist Groups Six out of the world's eight species of bears (except the American Black bear and the polar bear) are threatened with extinction.

Till date, Scholars have not arrived at a universally agreed definition of the term "Human Bear Conflict" (HBC). Current research and literature all over the world mostly reflects wide and divergent opinions and is highly influenced by the perception of different stakeholders and their involvement in HBC reduction. To bring clarity to the issue World Society for the Protection of Animals (WSPA) have came up with the following definition:

"Any situation where wild bears use (undesirably) or damage human property; where wild bears harm people; or where people perceive bears to be a direct threat to their property or safety."

WSPA, 2009

Human Bear Conflict (HBC) is an International Issue as there is abundant evidence from varied regions and ecosystems of the world that treat this is as an acute problem. In India, although attacks on humans by large carnivores have been attributed primarily to six species which are Tigers,

Lions, Leopards, Himalayan black bears, Sloth bears and Wolves (Saberwal et al, 1994; Rangarajan et al, 2001; Athreya et al. 2004 Choudhry et al, Predator Alert, 2008) here we would be talking specifically on sloth bear, as it is the only species that generates much fear among the locals in the Central Indian Landscape than any other carnivore present in the region.

1.3 Sloth Bear- An Indian Subcontinent Specialist

In the past, Sloth Bear was known to be as the Bear Sloth, named by G. Shaw in 1791, calling it *Bradypus ursinus*, because the species was initially assumed to be a distant relative of the South American "Sloth" due to their shared characteristics (Kurten, B, 1976). It was only in the 18th century when a live sloth bear was shipped to Paris that the classification error was corrected and the name reversed to sloth bear. Meyer in1793 (Yoganand et al 1999), was the first to recognize this animal as a bear and not a sloth, and gave it an appropriate name *Melursus lybius*. Lydekker (1884, cited in Erdbrink 1982) felt that this species should be placed in the genus *Ursus*, On account of significant differences from other bear species, Erdbrink (1953) suggested recognition at a subgenerical level and named it *Ursus (Melursus) ursinus* Shaw, which holds true in the present years as well.

Among the 8 bear species, currently found, the Sloth bear is the most endemic to the Indian Subcontinent as it ranges widely in India, Sri Lanka, Nepal, Bangladesh and Bhutan. Sloth bear

favors a variety of habitats ranging from teak, sal, lowland evergreen and riverine forests along with tall grass areas on the floodplains. Specifically in terms of the forest type, it is the dry and moist deciduous forest together that holds the major proportion (about 90%) of the sloth bear population in India. Dry deciduous forest type accounts for about 50% of the population however; it is the moist deciduous forests where sloth bears appear to occur at higher densities as compared to other forest types (Yoganand *et al.* 1999).

In India presently, sloth bears have been found to have a patchy distribution that corresponds with the remaining forest cover although past records suggests that they were found almost in the same area as that of the present range, except that the present range has shrunk along its peripheries and has become fragmented overall, concurrent with shrinking forest cover and perhaps to some extent due to illegal hunting and bear body part trade (Garshelis *et al.* 1999a). The forests of the Western Ghats and the central Indian highlands are currently the only two strongholds of the sloth bear (Yoganand *et al.* 1999). Scholars have identified Sloth bear distribution to be reasonably contiguous forming 11 different blocks in central India where they occupy about 166,400 sq. km of forested habitat. Similarly, studies have indicated that India's largest sloth bear population is in the state of Madhya Pradesh where the bear species inhabit about 135,395 sq. km of forest (Rajpurohit et al, 2000).

Fig.1: Sloth Bear (*Melursus ursinus*) in Madhya Pradesh

For the Indian Subcontinent, sloth bears have accustomed themselves to their tropical, sub-tropical habitat and diet. Various selective pressures on the species have apparently forced it to evolve several paradoxical morphological features which are mostly concordant with the convergent evolution of mammalian anteaters (Redford 1987, Joshi *et al.* 1999) that includes low reproductive rate, solitary habits, extended parental care, extensive carrying of young by the mother, and a low basal metabolic rate (McNab 1992). Although some traits are primarily found in most bears, it is only the feature of carrying the young on their back that distinguishes the sloth bear from other omnivorous bears in the world. It has been argued that this behavior evolved because of predation pressure in the sloth bear habitat rather than a basic trait of myrmecophagy (Joshi *et al*. 1999). Additionally to suit the tropics, it has no underfur, but, it does have a long coat that helps it defend against insect bites, while dogging for them

and also exaggerate its size against its predators (such as tiger and leopard) or conspecifics as a defensive mechanism. Sloth bears also have a behavioral adaptation to avoid hot weather conditions in their habitat by reducing daytime activity and thus becoming crepuscular. (Yoganand et al, 1999) and in a way avoid human activity hours as well. It has also been suggested that the sloth bear's morphological and behavioral adaptations are mostly driven by food finding and are adapted for the hard times when the food is limited as the sloth bear has diverged towards a diet comprising a lot of insects, it has also retained the ability to feed on variety of foods, in conformation with its omnivorous ancestry (Laurie and Seidensticker, 1977). It is this adaptability function that has made it a successful mammalian species all over India.

International Union for Conservation of Nature (IUCN) has categorized Sloth Bear to have a "Vulnerable" status (Criteria: A2cd+4cd; C1) in the Red List of Threatened Species (IUCN Version 2010.4) and has described its population to have a declining trend. The rationale behind the status stems out from an unreliable population estimate and trend throughout India, where the population is supposed to be high, coupled with threats of continuing habitat loss and poaching. As per the Indian Wildlife Protection Act 1972, Sloth bears are completely protected and has been classified as a Schedule I species along with tigers and elephants (as amended in 1986). As per the law they cannot be hunted, but can only be killed in self defense or in special circumstances where they have caused irreparable damage. Additionally sloth bears also

enjoy legal protection under CITES listed as Appendix I where all trade and export of bear and bear parts is illegal anywhere in the world. However, on the ground sloth bears are only protected by a series of Parks and Reserves that were established mostly as part of Project Tiger. Beside these protections, there is little direct management for the Sloth bears in India, which highlights the sorry tale of its survival.

1.4 Human Sloth Bear Conflict in India

Most parts of India have been impacted by ever expanding human population accompanied by socio-economic inequality and underdevelopment, which has ultimately led to the destruction of the remaining forest habitat. With persistent threats like overgrazing, overharvest of forest products(cutting timber, lopping branches, collecting fruits and honey), establishment of monoculture plantations (e.g. teak, eucalyptus), expansion of agricultural areas, and settlement of refugees, has to a greater shrunk the sloth bear's range in recent times. With loss of forested tracts both in and out of PA's the populations have become fragmented, thereby leaving small, non-viable populations within the parks threatening its overall survival (Garshelis et al. 1999). With additional degradation to the forest type, also because of the above mention threats the natural food supplies of sloth bears have drastically reduced, which in turn increases the likelihood of bears seeking human-related foods, such as cultivated crops, fruiting trees, outside the forest. It is here the chances of encountering human exceeds, thus making both the bear and humans vulnerable to being attack by each other.

Fig 2: Victim of HBC in Madhva Pradesh

In India, bear attacks on human are caused by Asiatic Black Bear and the sloth Bear. It is the later species, which forms the majority of Human Bear Attack cases. Many old accounts of Indian wildlife lore describe incidents of mauling by sloth bears. Krishna Raju *et al.* (1987) indicated that there are still 20–30 mauling by sloth bears each year in the Indian state of Andhra Pradesh. Krausman et al (2000) has identified sloth bears as the most dangerous wild animal even in comparison to tigers because of its unpredictable and often aggressive nature towards human. Phillips (1984) commented that sloth bears are second only to rogue elephants as the most feared animal among jungle-villagers. In comparison to other states of India Human sloth bear conflict (HBC) in the state of Madhya Pradesh is considered the most menacing and require immediate steps to counter it (Garshelis et al 1999).

Conflict with sloth bear can be attributed to both direct and indirect effects from anthropogenic activities. With natural forest being degrades into scrubs leaving scarcity of food for bears to feed on sloth bears have grown their preference and have become more reliant on cultivated crops, which in many studies indicates compose 50% of the diet

(Garshelis 1999) and thus, force villagers to incur huge losses. Additionally, humans unintentionally provide high quality food for bears in the form of fruit bearing trees (Ber, Jamun), crops (Maize, Arhar) and vegetables (Cabbage, Tomatoes) along with other attractants such as Beehives etc. inside the village boundaries which are highly preferred by them. Bears are known to have excellent memories that allow them to locate seasonally available foods in their wild habitats. This characteristic also allows them to locate and exploit human food sources, to which they quickly become conditioned to and with passage of time becomes habituated (Ambarli, 2006) to it. This, in turn, has caused local people to fear and dislike sloth bears, often impending conservation measure and prompting greater killing of raiding individuals, which exemplifies conflict in the area.

Through our extensive survey, we witnessed that past strategies of wildlife management must be reevaluated, as most of them in practice do not hold ground in the present scenario. For an effective prevention and mitigation of conflict, it was felt that the methods must address empirical and traditional knowledge, which will provide insights about the species ecology and also the public acceptance of the bear. Therefore, the survey carried out attempted to identify and study the intricacies of Human Sloth bear conflict in the state of Madhya Pradesh taking into account all scenarios possible. But, testing all assumptions about the mechanisms that underlay conflict attacks in India by sloth bears on human and their resources required excessive information on population estimates, extensive behavioral patterns

and experimental research over a longer period of time, which still is in nascent stage in respect to this species. Thus, the Data available at present, permits only establishment of few hypotheses, most of them being speculative in nature.

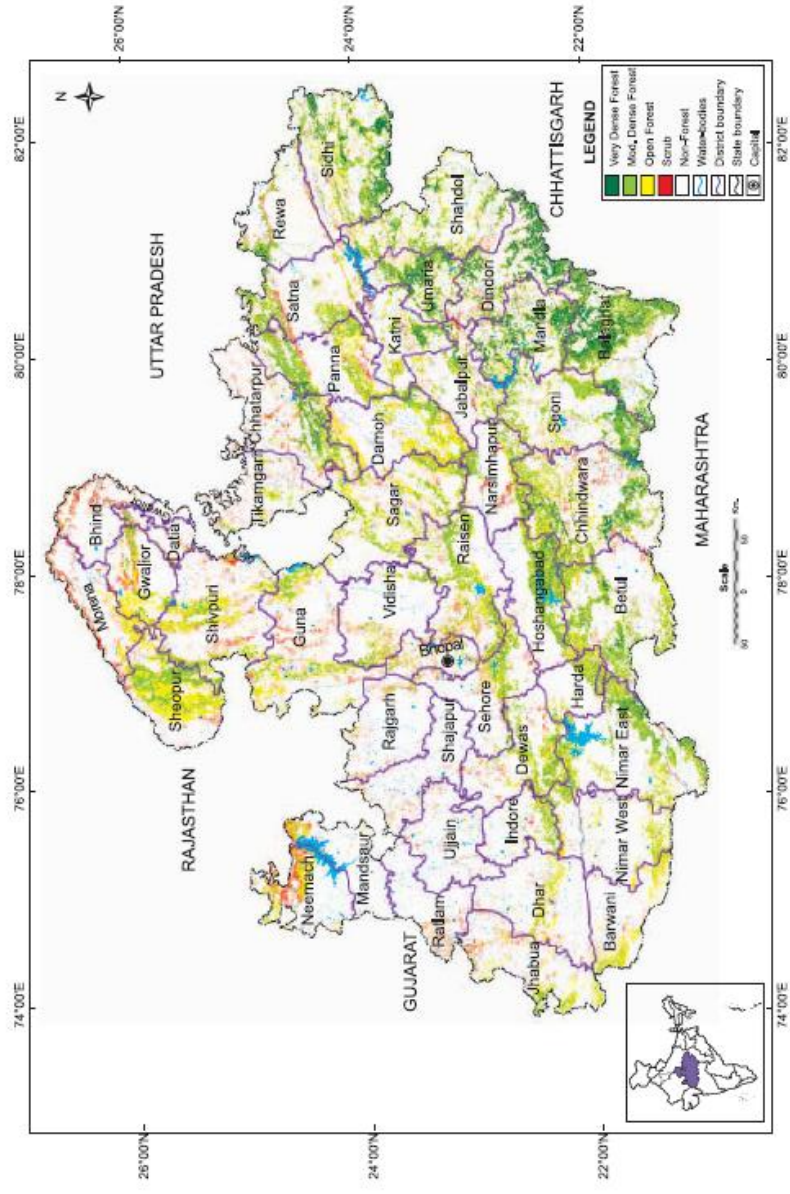
The main aim through this exercise, is to arrive at findings which can be developed into effective recommendations and in turn lead up to a pragmatic action plan for the state government to undertake mitigation in a holistic manner by bring all stakeholders into confidence.

2. PROJECT AREA

Located in the Central part of India, Madhya Pradesh is the second largest state of the country with an area of 30.82 million ha constituting 9.38% of the geographical area. Geographically, it is located between latitude N 21^{o}17' and 26^{o} 52' and longitude E 74^{o}08' and 82^{o}49' (Fig 3)

From the physiographic view the state of Madhya Pradesh can be divided into several regions. The northern region comprises low lying areas around Gwalior and to the north and north east of it, extending into Bundelkhand region. The northern plains reveal a homogeneous topography except for the deep ravines along the Chambal River. The Malwa Plateau, with its wide tableland lies between the Vindhyan barrier and the point just South of Gwalior. Walled in by the Vindhyas on the north and Satpudas in the south stretches the long and narrow Narmada valley. To the South of the valley

Fig 3: Administrative and Forest Cover map of Madhya Pradesh (FSI 2009)



lie the Satpuda ranges forming a large triangular area. It is the Satpuda ranges that form the watershed between the rivers draining into the greater Gangetic plains and the other streams that flow towards the south and west.

The drainage which is part of the peninsular drainage system has two distinct patterns, where one flows in the northwest direction towards the Arabian Sea and the other flowing in south eastern direction towards the Bay of Bengal; It is the Satpuda range that marks the dividing line. The important rivers of the state are Chambal, Betwa, Son and Narmada and all of them show radial drainage patterns.

Madhya Pradesh has distinct regional variation in terms of its rainfall and climatic conditions (Das, K., 2008). The region experiences a tropical climate with four seasons in a year: a) summer (March - June); b) monsoon (July - September); c) post monsoon (October-November); and d) winter (December – March). The temperature varies between 8-12^{o} C in winter and 42^{o}C in peak summer. About 90 per cent of the rainfall occurs from the southwest monsoon between the months of July and September. The rainfall ranges from 60 cm to 212 cm in different regions of the state with an annual average of 104 cm.

At the time of creation, there were 43 districts in the state of Madhya Pradesh. But In July'98, as a result of bifurcation and trifurcation of some of the districts, 16 more districts came into existence and thus the number of districts in the state rose to 61. On 1st November, 2000 the new state of

Chhattisgarh was carved out of Madhya Pradesh with an area of 135,191 Sq. Km. and 16 districts. After the Census of 2001, a new Division 'Shahdol' comprising of four districts namely Shahdol, Umaria, Anuppur and Dindori were carved out of Rewa and Jabalpur Divisions. During the decade five new districts were created in the state namely; Ashoknagar from Guna district, Anuppur from Shahdol district, Singrauli from Sidhi district, Burhanpur from Khargone district and Alirajpur from Jhabua district and at present the district numbers at 50 (Census, 2011).

"State of Forest" reports by the Forest Survey of India, Dehra Dun provided assessments of change in forest cover across India. Data for Madhya Pradesh is presented below, indicating that total forest cover in the State has increased by 1271 km^2 in 2009 since 2003 (After partition of Chhattisgarh).

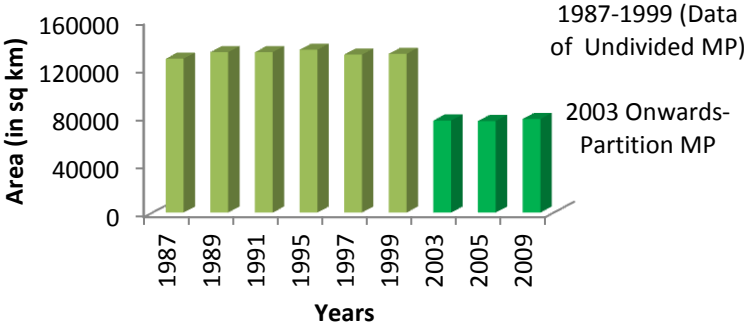


Fig 4: Graph showing the change in Forest cover in Madhya Pradesh

The state of Madhya Pradesh has the largest forest area in the country. As per the FSI report (2009) the recorded forest area of Madhya Pradesh is about 94,689 km^2 constituting 31% of the geographical area i.e. one third of the state area is covered by forest. Madhya Pradesh is also considered the only state in India, that has the largest area under dense forest in respect to Open Forest (OF) and Scrub Forest (SF). As per Champion and Seth Classification (1968), the state has 18 forest types groups which are Tropical Dry Deciduous, Tropical Moist Deciduous & Tropical Thorn Forest. On a broader view, the higher hills of the state have subtropical forest, the western and southern areas have dry deciduous teak (*Tectona grandis*) and the eastern areas have moist deciduous sal (*Shorea robusta*) forests. These forest are interspersed with Bamboo (*Dandrocalamus striticus*) and dry (*Acacia leucophloea, Anogeissus latifolia, Chloroxylon swietenia and Lagerstoemia parviflora*) and wet (*Terminellia tomentosa and Syzygium cumini*) species, and riparian forests are dominated by arjun (*Terminellia arjuna*) (Rajpurohit and Krausman, 2000). In terms of the Bio Geographic zones put forward by Rodgers and Panwar (1988), most part of Madhya Pradesh falls under 6A classification i.e. Central Indian Highland biotic province of the Deccan Peninsular Biogeographic zone.

Forests in Madhya Pradesh not only have an ecological value but a socio-economic role to play as well, where the local forest dwelling tribals and non tribal communities to a great extent mainly depend on the forests for their sustenance and

livelihood activities. It is estimated that that the sector generates employment opportunities to the tribal's to the tune of around 70 million man days (MPHuman Development Report, 1998). But, with increased population among the rural poor the biotic pressures over the forest have increased drastically and with forest resources not responding to this increasing trend, the old harmony between the forest and locals had been broken. Deforestation is one of the main manifestations of this disharmony. It is this wide gap in demand and supply which has amplified the pressure on the forest.

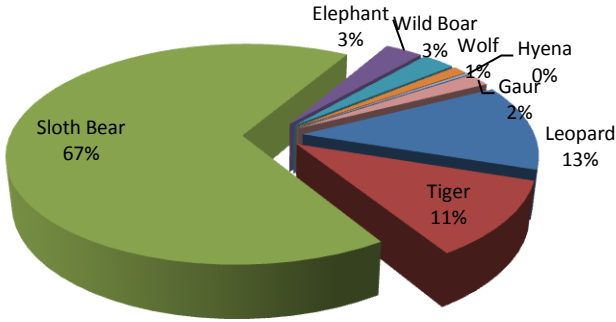
The state of Madhya Pradesh constitutes 6 percent to India's total population. In terms of population size, the state has moved up to 6th rank in this census from its 7th position in Census 2001. As per the Census, 2011, population of Madhya Pradesh has increased by 47.3 percent, slightly higher in percentage points as compared to the all India figure. Even the growth rate is higher by 2.7 percentage points compared to national average. The population density in the state stands at 236 persons per km^2 in Census 2011 as compared to 196 persons per km^2.

Madhya Pradesh as a state is a large geographical entity, Hence it is natural to find significant inter district variations in the pattern of land use. Total area of Madhya Pradesh is about 30, 8245 sq km and as per FSI, the percentage of forest cover has increased over the years. The land under recorded forest comprises of 31 % which makes it nearly one third area in the state, as required from the ecological point of view. Net Sown area in the state

is about 47.91% i.e. about 14,735 (000 ha). The differences in proportion of net sown area to total area thus, reflects the differences in geographical conditions and demographic pressures

2.1 Human Sloth bear conflict in Madhya Pradesh

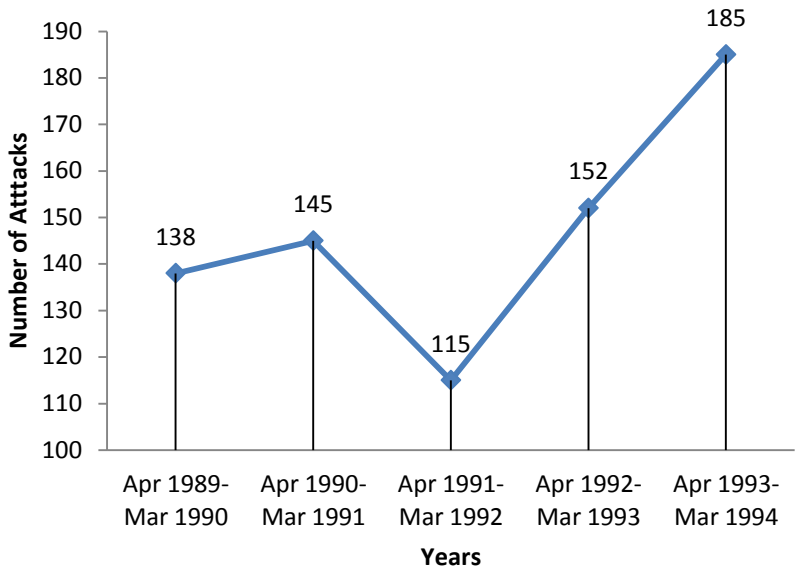
There have been different literatures and data which signifies that India's largest sloth bear population is in the state of Madhya Pradesh where it inhabits majority of the forest area. Most of the 10,000 sloth bears in India occur in the forests of Madhya Pradesh because tropical dry deciduous and tropical wet deciduous forests appear to be optimal habitat for them (Servheen, 1990, Rajpurohit et al, 2000). Additionally, over 50 million humans and their 35 million cattle's also depend on these forests which are declining rapidly, creating land use pressures for both humans and wildlife. With rapid conversion of forest into other uses along with excessive timber and NTFP extraction, it has adversely impacted sloth bear habitat (Cowan 1970, & Rajpurohit et al, 2000).



Source: Human sloth bear conflict in Madhya Pradesh, 2002, Rajpurohit & Krausman

Fig 5: Graph showing the human casualties by wild animals in Madhya Pradesh (1989-1990)

In the forest of Madhya Pradesh, the sloth bear is one of the most dangerous wild animals (Rajpurohit et al, 2000). Many human casualties occur when humans enter sloth bear habitat or when sloth bear enter agricultural fields. As per the data collected from Rajpurohit & Krausman, 2000, sloth bear has accounted for 67% of all human attack cases among species like Tiger, Leopard, and Wild Boar etc (as shown in Fig 5). Also the data signifies that between the years 1989 to 1994, the number of attacks has significantly increased as shown in the fig 6.



Source: Human sloth bear conflict in Madhya Pradesh ((Undivided), 2002, Rajpurohit & Krausman)

Fig 6: Graph showing the historical sloth bear conflict cases in undivided Madhya Pradesh (1989-1994)

Human sloth bear conflicts in Madhya Pradesh (Undivided Madhya Pradesh, including Chhattisgarh) was reported from 17 Forest Division and 13 Protected Areas, and it is observed that most attacks occurred outside the PA's (Appendix 8) .Even The ratio of human death to injury is also high i.e. 1:14.3 by sloth bears between the year 1989 to 1994, indicating to the level of conflict in the state (Rajpurohit & Krausman, 2000). It can therefore, be said that Human sloth bear conflict in Madhya Pradesh is an historic issue, but it is the intensity in recent years that has impeded the conflict mitigation and conservation of the bears in the state.

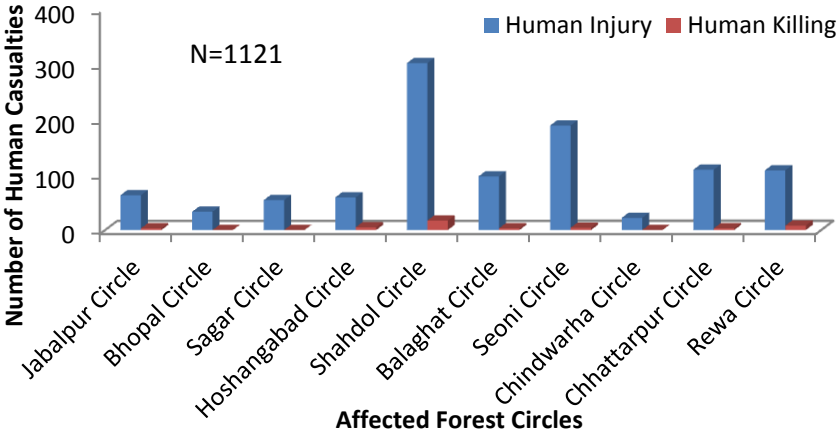
3. METHODOLOGY

In the initial stage, Human sloth bear conflict overall data was procured from the Madhya Pradesh Forest Department, Chief Wildlife Warden Office to identify specific sites of conflict. The data was then categorized into Forest Circles based on the locations. It was found that out of the 16 Forest Circles in the state, 12 are prone to Human sloth bear conflict. Out of the 12 Forest Circles, as per the data collected, the intensity and the number of Conflict were ranked and on the basis of this 10 Forest Circle were chosen for the Primary survey. The Human sloth bear conflict Affected 10 circles are shown in the table below:

Affected Forest Circle	Forest Division	Forest Division	Forest Division	Forest Division	Forest Division
Bhopal	Bhopal	Obaidullaganj	Sehore	Raisen	
Hoshangabad	Hoshangabad	Satpuda N. Park			
Sagar	North Sagar	Nauradih Sagar			
Chhatarpur	Chhatarpur	North Panna	South Panna	Damoh	
Chhindwara	Chindwara				
Seoni	Seoni	Narsinghpur			
Balaghat	North Balaghat	South Balaghat	Lamta Project		
Jabalpur	Jabalpur	Katni	Dindori	W.Mandla	E.Mandla
Shahdol	Shahdol	Umaria	Anuppur		
Rewa	Satna	Sidhi	Singrauli		

Table 1: Human sloth bear conflict affected Forest Circles. Note: Protected areas like Tiger Reserves & Wildlife Sanctuaries are not covered; All Forest Divisions are Territorial/ Regular Forests.

Apart from identifying the Forest Circles that are being prone to Human sloth bear conflict, data on the number of human casualties were also sought:



Source: MP Chief Wildlife Warden Office, 2010

Fig 7: Showing the affected forest circle in Madhya Pradesh, data from 2003-2007.

Based on this baseline data, HBC data was also collected from the respective forest divisions as well as the forest ranges to add to the existing data from the CWLW office. Based on this compiled data, primary survey in each of the following affected circles and their respective forest divisions and range were carried out. Further, the conflict was discussed with each community accessed, resulting in a snowball effect of adding to the baseline data recorded by the forest department (Fig 7). Secondary Data from the year 2000 was mostly available with the Forest Department (FD), but in some cases data trending back to 1990, also formed part of our baseline information. A total of 1,121

attacks (N) on humans by sloth bears throughout the affected parts of the state, spanning the fieldwork period of 10 months were recorded. In many parts of India, especially the Himalayan region reports of livestock damage by bears (Brown Bears) have been recorded, but no such account is present for sloth bears and i.e. why this particular type of conflict does not form part our study.

Before, proceeding to the field survey, different literature was sought related to the species and the characteristics of conflict it has been a part of off. Due to the relative small amount of information on the sloth bears in India, in comparison to the amount of work carried out on conflict tigers, leopards and elephants, it made it difficult to go with a preconceived notion on how and why the conflict is shaping in the state. Though, with the help of few scholarly articles on sloth bears, analyzing conflict scenarios by other species, views & perception from officials of the forest department, local resource persons, a number of hypotheses were developed to explain the increased conflict scenario with sloth bears in Madhya Pradesh in recent decades. Primary Hypotheses among these are (i) Habitat loss; (ii) Cultivable crops & fruiting trees (such as orchard fruits, sugarcane, maize, millets etc) provide more attractive habitat options than surrounding forests (especially in relation to Habitat loss) and (iv) increasing bear populations as a consequence of wildlife protection and enforcement over the past three decades which is resulting into increasing the problem animal population densities. Apart from these, some hypotheses were formulated, mainly focusing on identifying the characteristics and nature of sloth bear conflict spanning the entire state.

Fig 8: Surveying a HBC attack site in MP

The HBC field survey was categorized into two parts, based on the objectives. Firstly, to identify the spatial distribution of conflict in the state, the location of each attack villages was recorded using GARMIN ETREX Vista series GPS unit, making sure that the positional error reported is below 10m. This information was also useful, to identify the ecological setting such as Forest type, distance from forest, drainage, elevation etc. of the affected village. We acquired shape files of Sloth bear occupancy, upto beat level in Madhya Pradesh (courtesy: Wildlife Institute of India, Tiger Monitoring Phase 1 data), to get an overview of the distribution of sloth bear in the state and juxtaposed with the acquired Conflict GPS points. The Second part of the survey was to carry out a detailed interview survey based on a pre conceived questionnaire format. Semi-structured interviews were conducted with the victims or their next-of-kin to determine more details of the incident, so that possible drivers of conflict can be exposed. Information like Year, Date and Time were recorded to discover patterns in conflict trends, seasonality and diurnal distribution of the encounters with sloth bear. Additional Information like Extent of injury (EoI) caused, portion of the body attacked, age and sex-based differences, activity, size of the group at the time of encounter were explored.

Questions were also asked to determine the community's perception about the level and trend of these sloth bear conflicts in their region along with the effectiveness of present local or government techniques towards the threat. Assessments were made about the community's willingness to participate or expect could be done by the concerned authorities in order to mitigate the current levels of conflict. Such determinants were collected to understand whether they have bearing on conflict which differs from site to site. Therefore, in our field survey, we were able to collect details of 564 sloth bear conflict cases (n) i.e. 50.31% of total Secondary data collected (N=1121). Based on this sample, we carried out basic and correlative statistics; both to test certain hypothesis as well as to discover trends, causal factors, which could help in provide meaningful insights in developing a future plan for managing the Sloth bear conflict in the state.

3.1 GIS Methodology

Geographical Information Systems (GIS) are fast becoming an increasingly important tool in quantitative wildlife ecology. The data gathered from the process helps to provide insights about spatial usage by animals especially large mammals as human encroachment into wildlife habitats increases (Porten, 2005). In the past, GIS technology has only been used to study and quantify habitat use of black bears, but its application to conflict studies on sloth bears is largely unexplored till now.

Satellite remote sensing has enabled the acquisition of land use/land cover and vegetation information at different spatial and temporal scales. Vegetation instrument on-board SPOT 4 satellite with four spectral

bands – blue (0.43–0.47 mm), red (0.61–0.68 mm), infrared (0.78–0.89 mm) and short wave infrared (1.58–1.75 mm) at a spatial resolution of 1 km and temporal resolution of 1 day meets the requirement of vegetation mapping at a continental scale for vegetation mapping in south central Asia extending from 1.1°–37.5°N latitude to 60°–105°E longitude (Agarwal et al., 2003). The detailed classification scheme is given in Appendix 1. For the present study we used this data to understand the interaction of sloth bear conflict cases with different vegetation types throughout Madhya Pradesh.

The Human sloth bear conflict data collected, showed a large distributional pattern throughout the state, which made it difficult to standardize all the parameters leading up to conflict. Thus all these data were used to understand the basic pattern of sloth bear conflict in the state, for which many statistical tests and procedures were followed. As our main aim was to come up with an Action plan, a greater understanding of spatiotemporal trends of conflicts and their predictors is required, provided through these analysis which can help in efficiently allocating resources and apply targeted management wherever it is needed most.

We used Kernel density estimation as it is considered as an established method used in wildlife ecology to extrapolate point data to an entire study area allowing home ranges and habitat selection to be examined across a landscape (Worton 1987, 1989). It is a non parametric smoothening technique that determines densities based on a grid formation across the landscape. Each data point is given a respective probability density, and the intersection between these points and the rectangular grid are averaged across the

landscape by equation (adapted from Seaman & Powell 1996). For our specific use we used kernel density estimation outputs to describe the Utilization Distribution (UD) for the conflict activity among the sloth bears present in the region. For this, we calculated kernel with following formula:

$$\hat{f}(x) = [1/(nh^2)] \sum_{i=1}^{n} K\left\{\frac{(x - X_i)}{h}\right\}$$

Where *x* is a vector of x, y coordinates, *n* is the number of points, *h* is a smoothing parameter also known as the bandwidth, and the location of each observation *i* is represented by a vector *X* of the coordinates within the *K* kernel, a Gaussian function. The size of the neighborhood analyzed by *K* is controlled through the bandwidth *h*. The *h* value is important because it determines how smooth the utilization distribution will be, thus determining the surface's probability density estimates. We have identified the smoothening factor (h) as 1000 and resolution as 500. We created the kernel outputs using a fixed kernel density estimator in Hawth's Tools for ArcGIS.

The Kernel map prepared was than categorized into three time periods, i.e. 1990-2000; 2000-2005 & 2006-2010 based on the primary data collected through field survey. This was done to identify the changes in the extent of HBC cases across the conflict region.

4. RESULTS

The data collected from both Questionnaire survey and ground truthing, during the Human sloth bear conflict (HBC) survey in 10 affected forest circles of Madhya Pradesh, have been analyzed in great detail.

4.1 Historical Trend of HBC in Madhya Pradesh

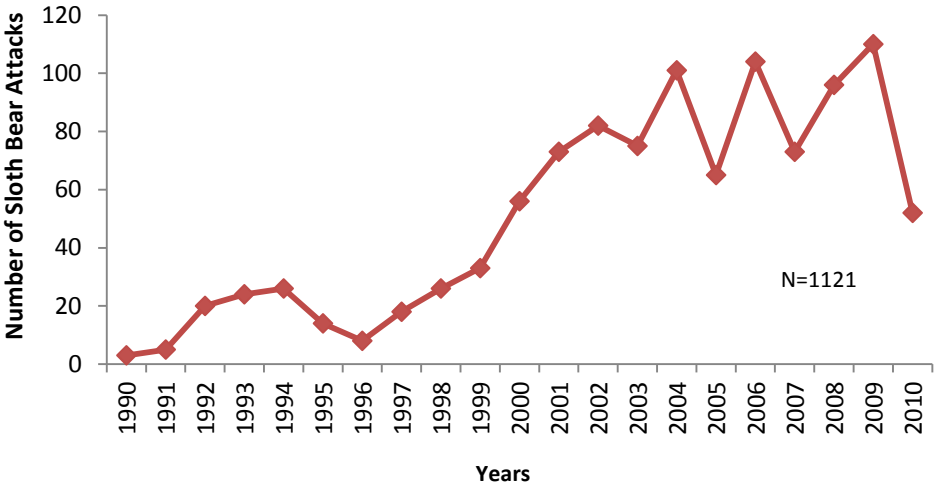


Fig 9: Year wise (1990-2010) trend of HBC cases in affected forest circles of Madhya Pradesh.

There has been an increase in the number of sloth bear conflict cases recorded during the period of 1990 to 2010 (Fig.9 and 11). A steep increase in HBC cases was clearly visible during the last decade (2000-2010), which actually comprise almost 84% of the total recorded cases (N=1121). As the Forest Department

records are yet to be updated for the year of 2010, there is a decreasing trend in HBC cases for this year (2010).

4.2 Monthly Pattern of Sloth Bear attacks

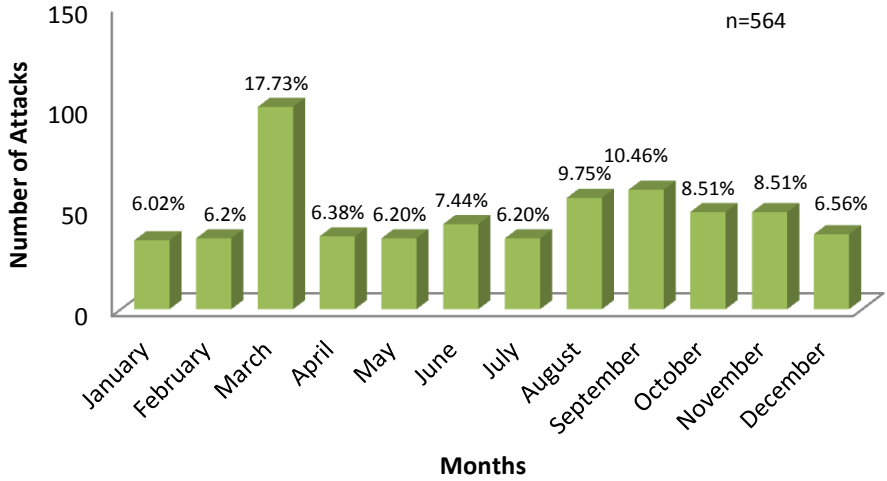


Fig 10: Month trend of HBC cases in affected forest circles of Madhya Pradesh.

The above graph (Fig. 10 & 12) indicates that sloth bear conflict is recorded in almost all the months but with varying intensity. Most HBC cases can be grouped under two seasonal peaks. The first peak occurs in months of February to May where a total of 206 cases i.e. 36.52% of the surveyed cases. The Second peak was observed to occur after the monsoon months i.e. August till November where it recorded 210 cases (37.23%).

Fig. 11

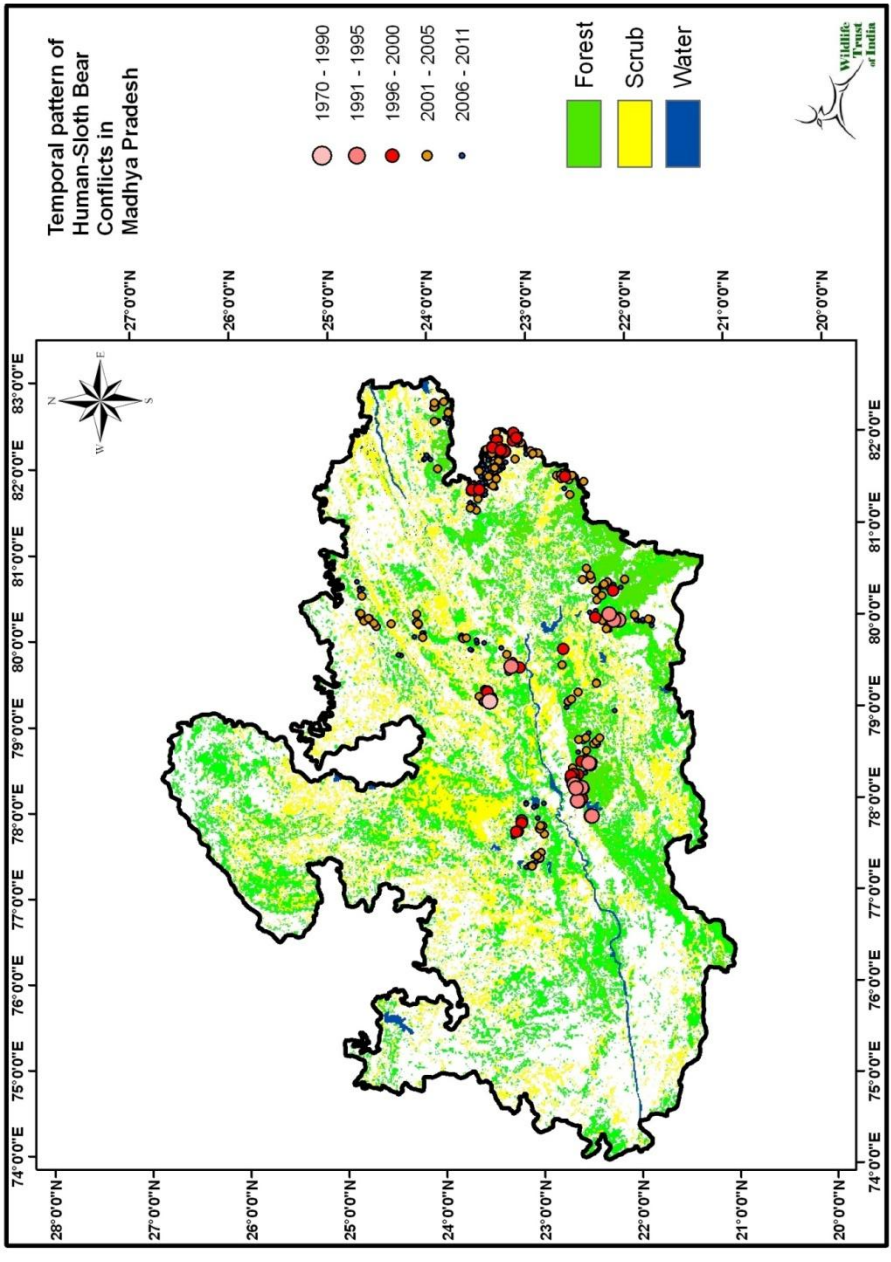
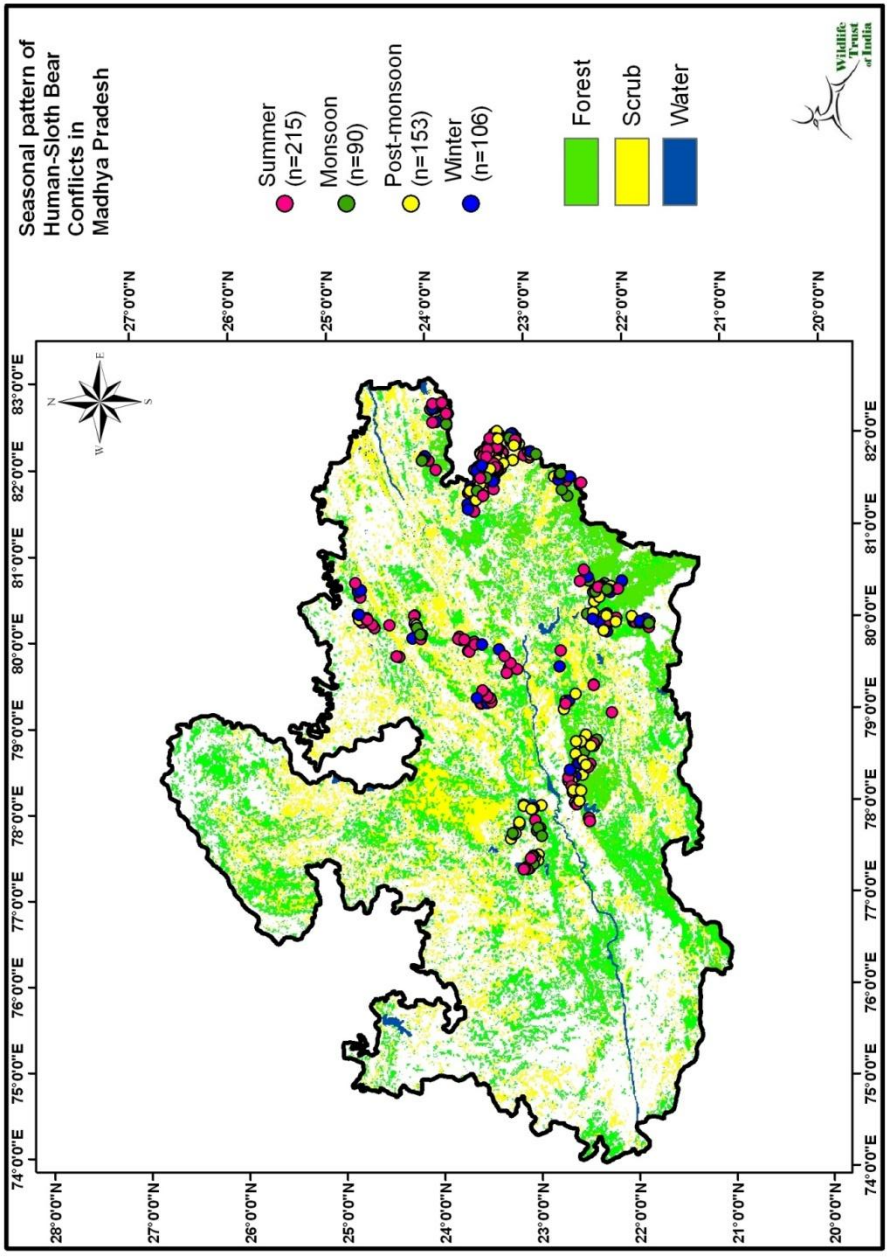

Temporal pattern of Human-Sloth Bear Conflicts in Madhya Pradesh
1970 - 1990
1991 - 1995
1996 - 2000
2001 - 2005
2006 - 2011
Forest
Scrub
Water
Wildlife Trust of India
74°0'0"E
75°0'0"E
76°0'0"E
77°0'0"E
78°0'0"E
79°0'0"E
80°0'0"E
81°0'0"E
82°0'0"E
83°0'0"E
28°0'0"N
27°0'0"N
26°0'0"N
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N

Fig 12:


Seasonal pattern of Human-Sloth Bear Conflicts in Madhya Pradesh
Summer (n=215)
Monsoon (n=90)
Post-monsoon (n=153)
Winter (n=106)
Forest
Scrub
Water
Wildlife Trust of India
74°0'0"E
75°0'0"E
76°0'0"E
77°0'0"E
78°0'0"E
79°0'0"E
80°0'0"E
81°0'0"E
82°0'0"E
83°0'0"E
28°0'0"N
27°0'0"N
26°0'0"N
25°0'0"N
24°0'0"N
23°0'0"N
22°0'0"N
21°0'0"N
20°0'0"N

high as compared to other months i.e. 100 cases (17%) out of 564 cases (± 2.92) in all the circles affected.

We further compared the impact of Mahua season (March & April) in relation to other season (Except March & April) with the number of attacks occurred. The result indicate that though the level of impact was less i.e. 24.13% in Mahua season ,as compared to 75.88% in all other season, the conflict intensity was recorded at 2.23 cases per day in Mahua months (60 days) while in other season it drops down to 1.407 cases per day.

4.3 Diurnal Pattern of Sloth Bear attack

The result provided by the diurnal pattern of attack indicates that, majority (87.4%) of sloth bear attack cases have occurred in the daylight hour between 6:30am-6:30pm in comparison to night (Fig.13). As one exceed in the time range, the number of conflict cases seem to take a dip except for a one time slot. It is observed that, out of the total sample size of 564 cases, 217 cases (38.47%) had occurred in the time ranging between 6:30am-9:30am with ± 6.49. For further analysis we even classified the time ranges into crepuscular hours in relation to the bear's activity pattern, which indicated that at dawn, time ranging 3:30am-6:30am & dusk, time ranging from 6:30 pm-9:30pm accounts for 8% and 2.83% of sloth bear attacks respectively, from the total sample size. The graph has been depicted below:

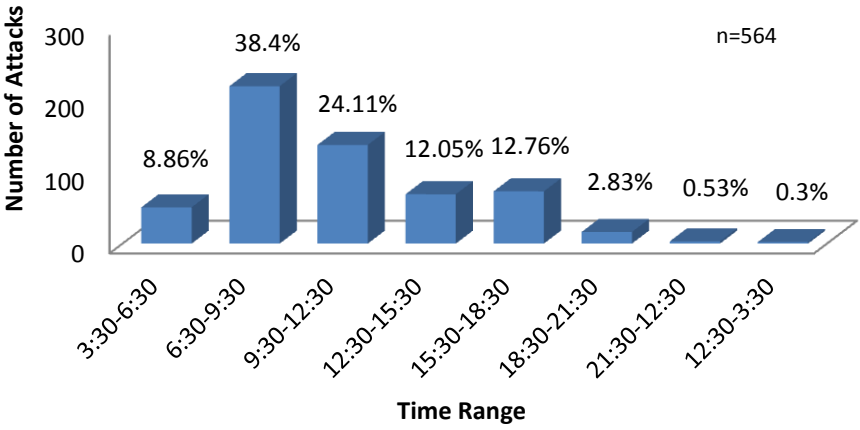


Fig 13: Diurnal Pattern (24 hrs format) of sloth bear attack taking mean number of attacks among all affected forest circles.

4.4 Location Of Conflict

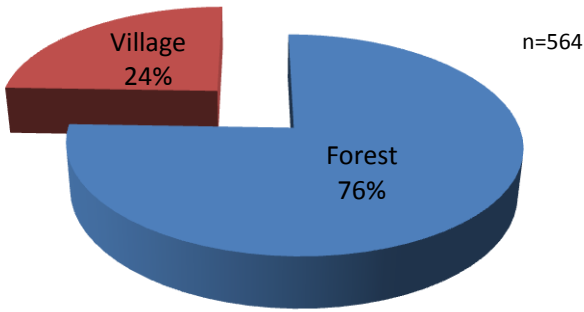


Fig 14: Pie Chart showing the locations of sloth bear attacks among all affected Forest Circles

HBC cases were categorized into forest and village as per their area of occurrence. The result indicated that 75.5% of the HBC cases occurred inside the forest boundary, in comparison to cases inside the village boundaries (Fig. 14).

4.5 Distance of sloth bear attacks from The village

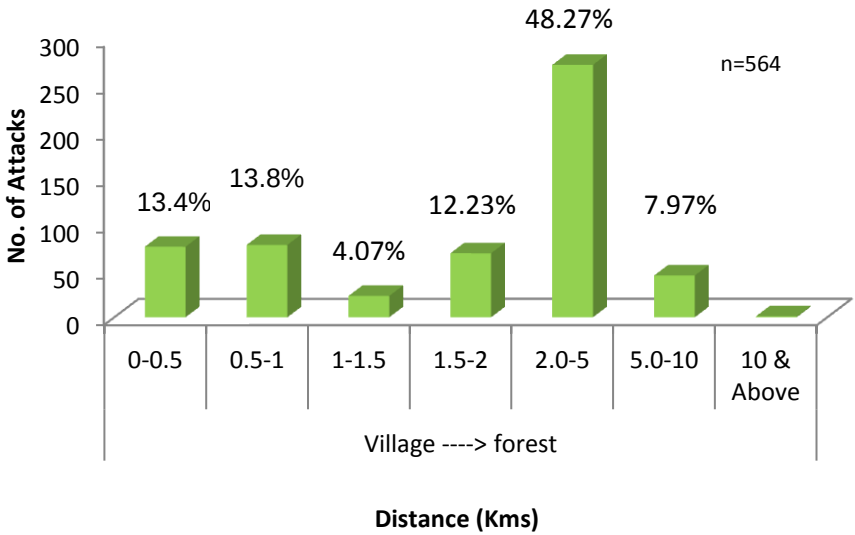


Fig 15: Distance of Attack cases from the village in all affected forest circles

The conflict cases were high in areas which were in close proximity to forest, irrespective of their management status. The result indicated that, at distance between 2 km to 5 km the highest attack cases were reported (Fig. 15). With recent incidences of sloth bear invading villages in certain forest circles of Madhya Pradesh, the result also shows that, 154 cases (27.3%) cases even occurred within a village distance of 1 km.

4.6 Activity of victim during sloth bear encounter

The activity pattern of each of the victim surveyed were recorded, and plotted in the radial graph for visual interpretation. Out of the 7 activity pattern identified, mostly those work which require a person to venture inside the forest, constitute the highest incidences of conflict as was also discussed above. The result highlights that, the victims who were in the forest for collecting fuelwood, were most prone to the conflict i.e. 26% of all the total cases administered, closely followed by victim who were herding livestock or were in the forest to search for their missing livestock, that accounts for 22.34% of the total cases in all the

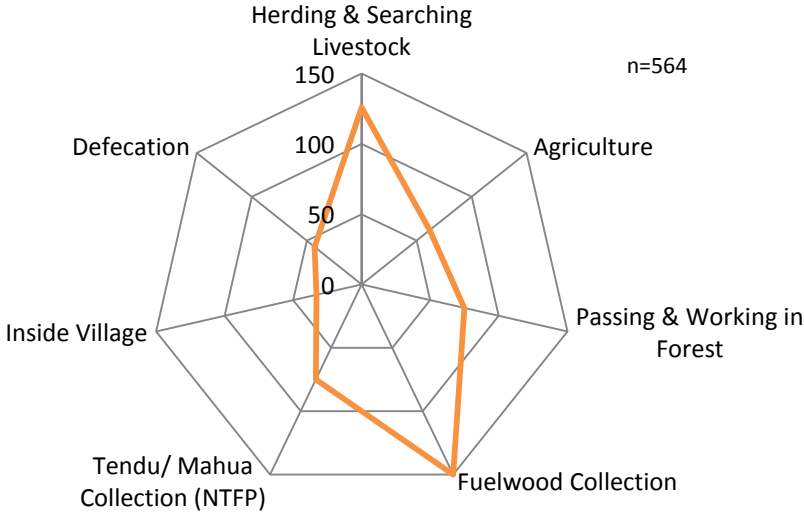


Fig 16: Radial Graph indicating Victims Activity during sloth bear encounters

affected circles (Fig 16). Against the popular belief, the collection of NTFP inside the forest only composed 13.29% of the total cases. Even locals who occasionally pass from one village to another through forest roads and forest guard patrolling or carrying out forestry work also became victims of HBC. 11 % occurred in agricultural fields. Even7.62% cases of Defecation constituted a major chunk of the conflict cases. Alarming number of sloth bear cases (5.85%) entering inside the human settlements were also recorded that constituted the “Inside Village” cases.

4.7 Extent of Injury & body part affected

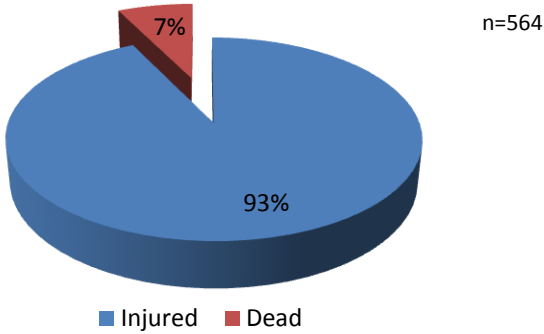


Fig 17: Pie Chart showing the Extent of Injuries in all the affected circles

The extent of injury caused was determined during interviews with victims. In terms of percentage, 93% (523 sloth bear attacks) of all the victims were found to be injured with varying degree of seriousness. Though only 7% (41 sloth bear attack) of the cases resulted into death of the victims (Fig 17).

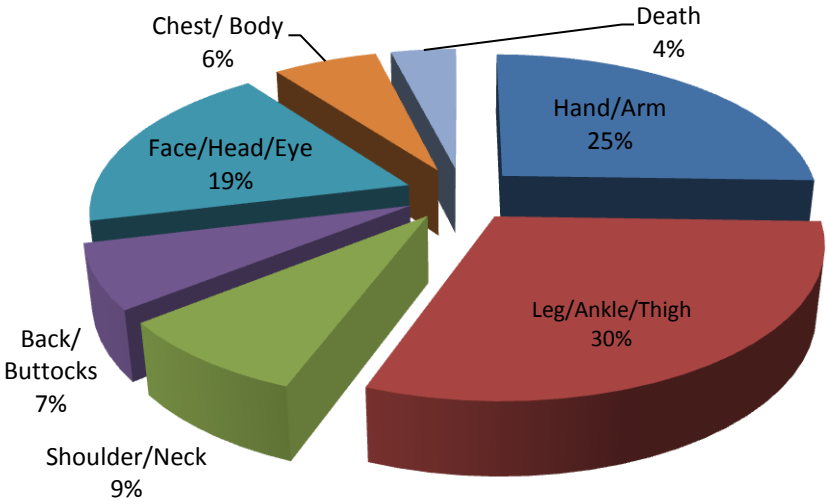


Fig 18: Pie chart indicating body part Injuries in all the affected circles

The part of the body attacked or injured was recorded for all the cases surveyed. The victims were found to receive multiple injuries when attacked by sloth bear. The result indicated that mostly limbs were targeted by the sloth bear. The Leg and Thigh portion of the body received maximum injury i.e. 30.21%, while Hand and Arm received 25.49% of all the victim cases. Chest and Back Injury were recorded as 6.29% & 6.88% respectively. Among the vital organs, face and eyes constituted majority of the cases (18.60%) while neck injury were recorded in 8.56% of the cases (Fig 18).

4.8 Number of sloth bear during attack

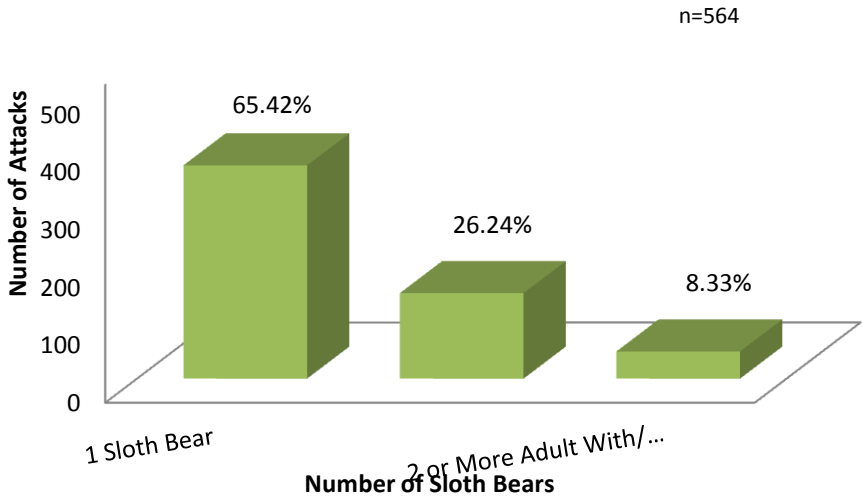


Fig 19: Number of Mean sloth bear during the encounter

The result put forward that out of the 564 cases administered; majority of cases (65.42%) involved only the single bear, in all forest circles combined. The female with cubs and larger groups have comparatively recorded fewer cases, i.e. 104 (±2.6) & 67 (±1.59) attack cases respectively. Among the cases of victims 83% were caused by a single sloth bear, while 17% occurred when either the sloth bear was with a cub or in group of two as shown in Fig 19.

4.9 Group structure of victim during encounter

On the basis of the result, the above graph (Fig. 20) indicates that cases of Sloth bear attacks appear to be

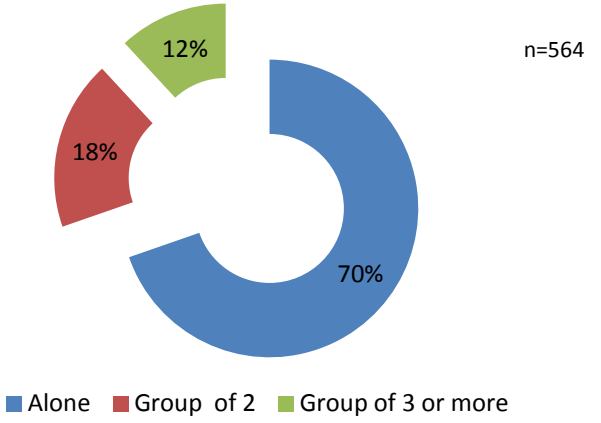


Fig 20: Human Group Structure at the time of Sloth Bear attack

high, when victims were found alone (70%), irrespective of their location. During the attack group of 2 and group of 3 registered 18% and 12% respectively.

4.10 Gender Ratio of Sloth Bear conflict

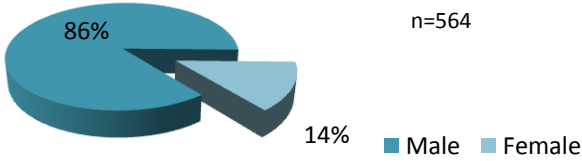


Fig 21: Pie Chart Showing the Gender Ratio of sloth bear conflict in all the affected Circles

The gender ratio, during sloth bear encounter seems too skewed towards more males than females. Among all the victims administered, majority of the victims

recorded were males that compose of 86% of the total sample (Fig 21).

4.11 Age composition during sloth Bear encounter

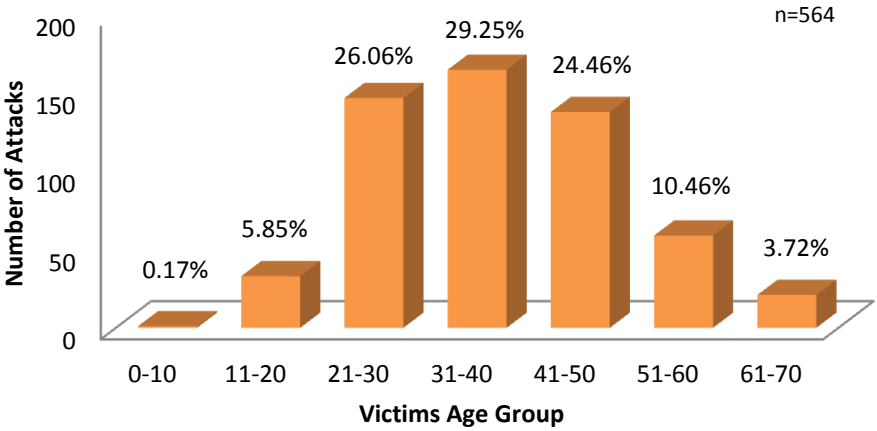


Fig 22: Age Structure of Victims during sloth bear encounter in all affected Circles

The graph (Fig. 22) indicates that it is the age ranging between 21 and 40 that comprises majority of victims. The result shows that among all the cases, the age group 31-40 scores the highest (29.25%) in comparison to the other age groups. Even age groups of 21-30, 41-50 & 51-60 compose a significant amount of the victim cases, 26.06% & 24.46% respectively. The age group of 11-20 & 61-70, indicates a minor composition, while 0-10 age group is the least significant contribution to the number of HBC cases (0.17%).

4.12 Initial response of victims to an sloth bear attack

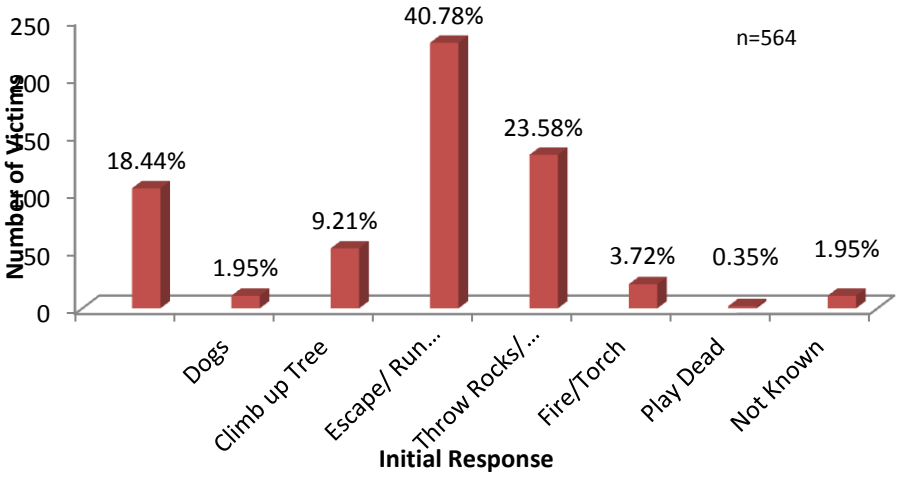


Fig 23: Initial Response of the victims towards a sloth bear attack in all affected circles.

The result indicates that majority of the victim adopted the escape strategy when charged by a sloth bear, that compose 40% of the total cases. Other responses like throwing rocks and shouting at the bear were also employed by the victims, which were recorded at 23.58% & 18.33%. 9.21% of the victim tried to climb a tree. The use of Fire Mashals and torches by 3.72% of the victims were also witnessed, in order to deter the bear from attack. 1.95% of the total sample victim suggested that, they did nothing; the dogs who were accompanying them came to their rescue, while 0.35% victims used the age old trick of playing dead. Out of the total sample size 1.95% suggested that they either they

were so scared to respond, or some response were not known by the next of kin, due to their death (Fig 23).

4.13 Desired mechanism to mitigate conflict

Affected victims were asked to elaborate on mechanisms that they expected to be implemented by the conflict mitigating agencies. Majority of the victims i.e. 22% out of the total sample indicated to the fact that the State Government and the Forest Department should look to improve the sloth bear habitat. However, 21% the victims were also in favour and looking forward to be a part of Awareness and Training Programs.

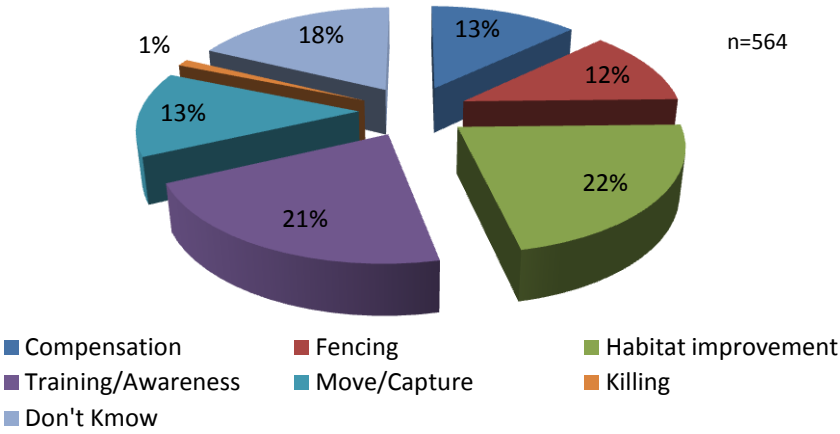


Fig 24: Pie Chart depicting the Victims views of desired mechanism to mitigate Conflict

Many victims suggested building up of fences in the forest so that bears were unable to reach the human settlement, which accounted for 12% of the victims surveyed. Out of the total sample, 13% each were of

the view that the forest department should rework their compensatory mechanism as well as look into the possibility of translocation or capturing problematic bears. Only 1% suggested killing the problematic bears, and the rest i.e. 18% did not have a view on how to mitigate the sloth bear conflict (Fig 24).

4.14 Land Use Land Cover of HBC Area

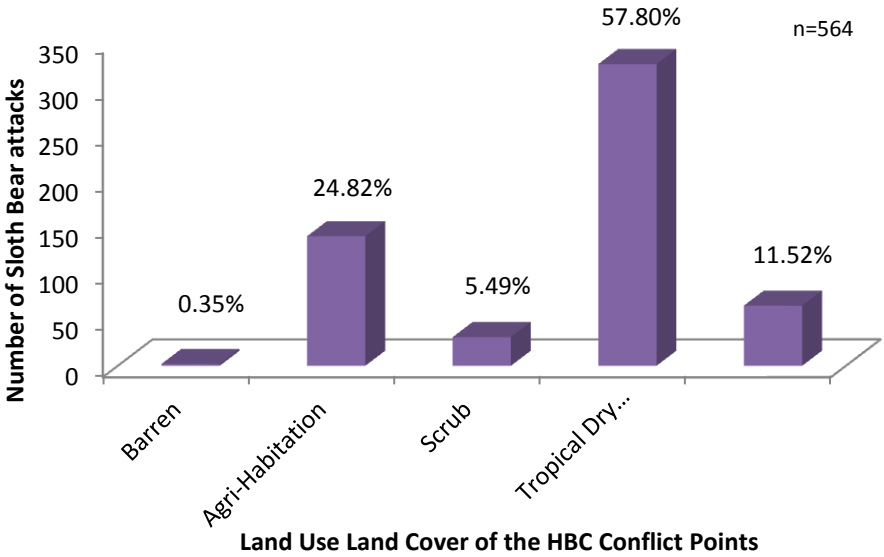


Fig 25: Bar graph depicting Human sloth bear cases with LULC scheme (SPOT-Vegetation data)

Plotting the GPS points of all the sloth Bear conflict cases on the map generated from the Land use Land cover classification of SPOT multi-temporal data (Aggarwal et al, 2003) indicates that majority i.e. 57.8% of the total cases (n=564) occurred in Tropical Dry

Deciduous forest [As per Champion and Seth (1968) Classification] of Madhya Pradesh. Similarly, Moist Deciduous, Scrub and Barren land was sound to be 11.5%, 5.49% and 0.35% forms part of all total HBC cases respectively. The data also shows that about 24.8% cases occurred in the Agri-Habitation land cover which is the major cause of concern and a potential threat to both human and bear population in their respective regions (Fig 25).

4.15 Forest Cover in relation to Human sloth bear conflict

Based on the Forest Survey of India (FSI) Reports i.e. 1991-2009, we used relationship & Linear Regression method (See Appendix- 7) to determine the relationship of forest class i.e. Dense [Moderate Dense Forest (from 2003 onwards) i.e. 40-70% canopy cover has been added to Dense Forest class in order to standardize the data for FSI data ranging from 1991-2009] and Open forest with the number of sloth bear attacks on humans in all the 10 affected forest circles. The results of the relationship are depicted in the graphs below

a) Bhopal Forest Circle

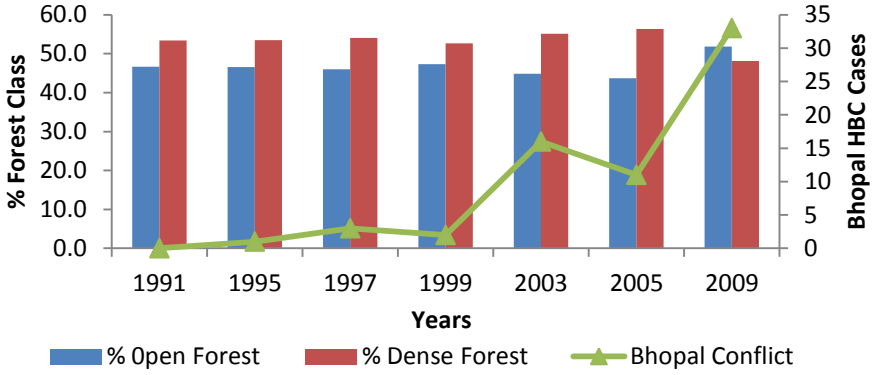


Fig 26: Human Sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Bhopal Forest Circle. (FSI & MPFD).

b) Hoshangabad Forest Circle

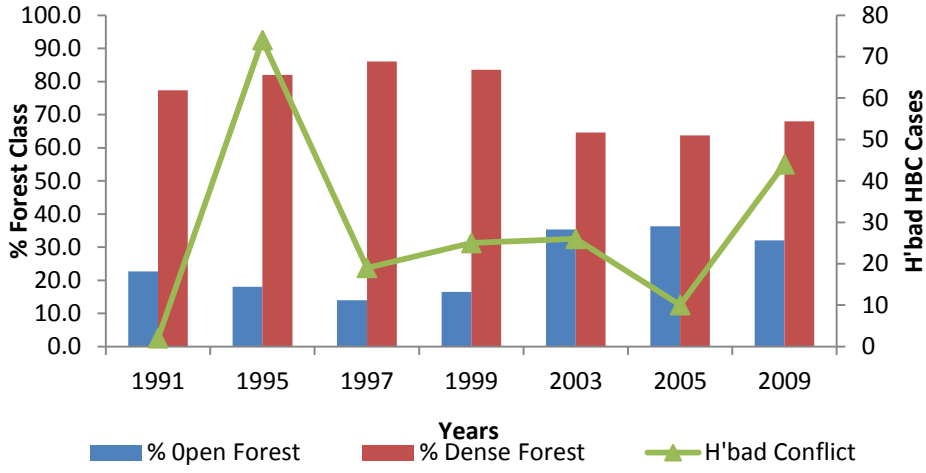


Fig 27: Human Sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Hoshangabad Forest Circle. (FSI & MPFD).

c) Shahdol Forest Circle

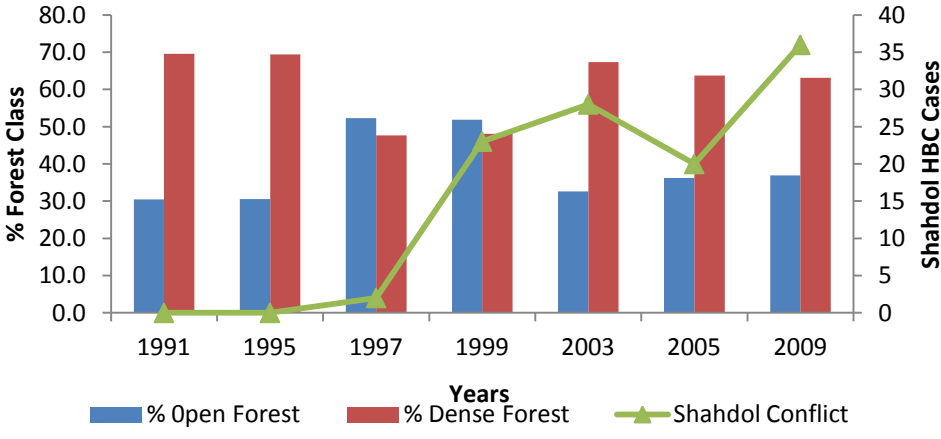


Fig 28: Human Sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Shahdol Forest Circle. (FSI & MPFD).

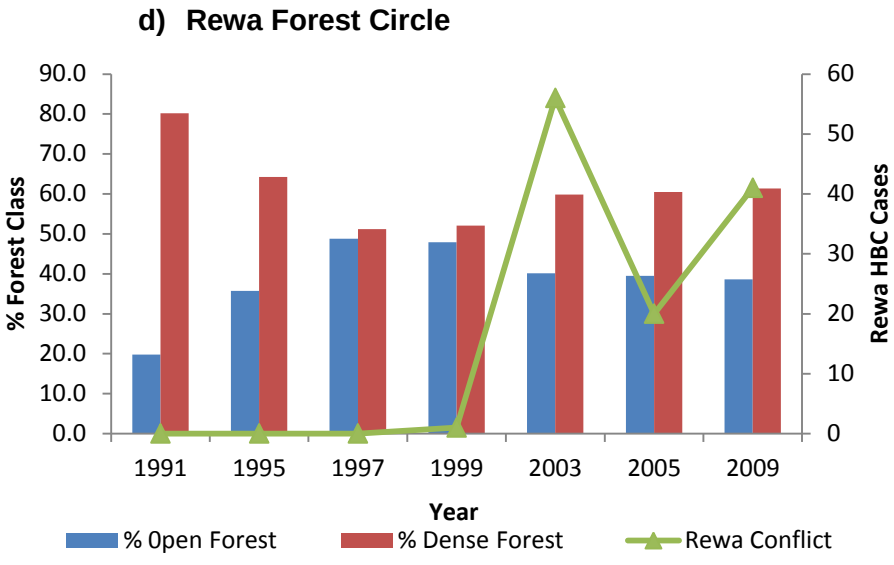


Fig 29: Human Sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Rewa Forest Circle. (FSI & MPFD).

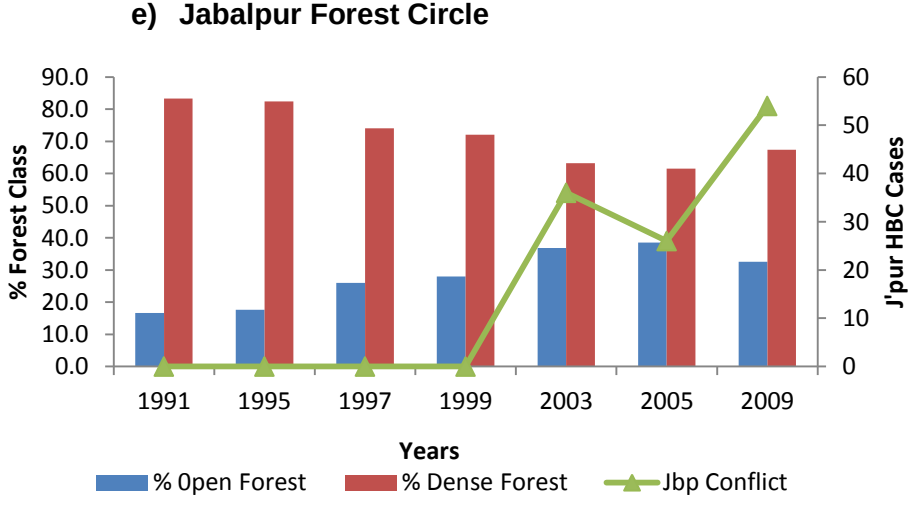


Fig 30: Human Sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Jabalapur Forest Circle. (FSI & MPFD).

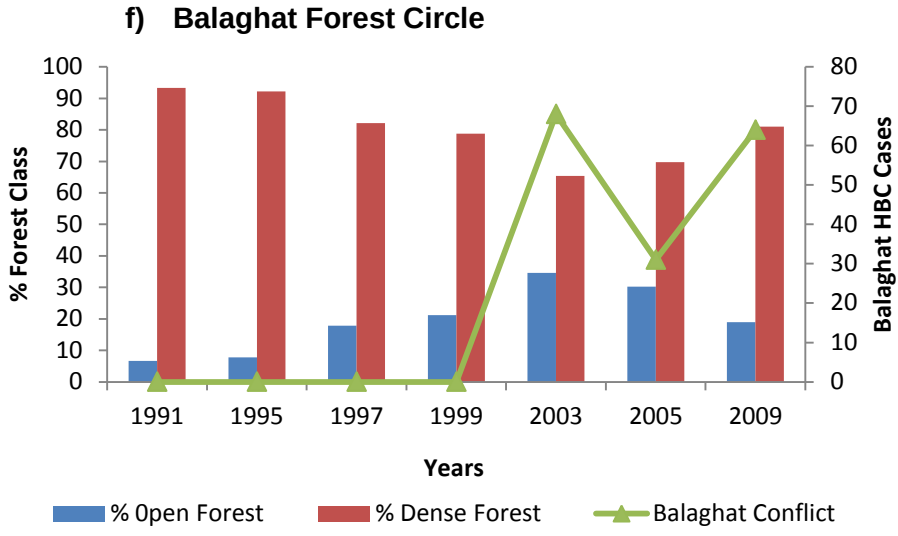


Fig 31: Human Sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Balaghat Forest Circle. (FSI & MPFD).

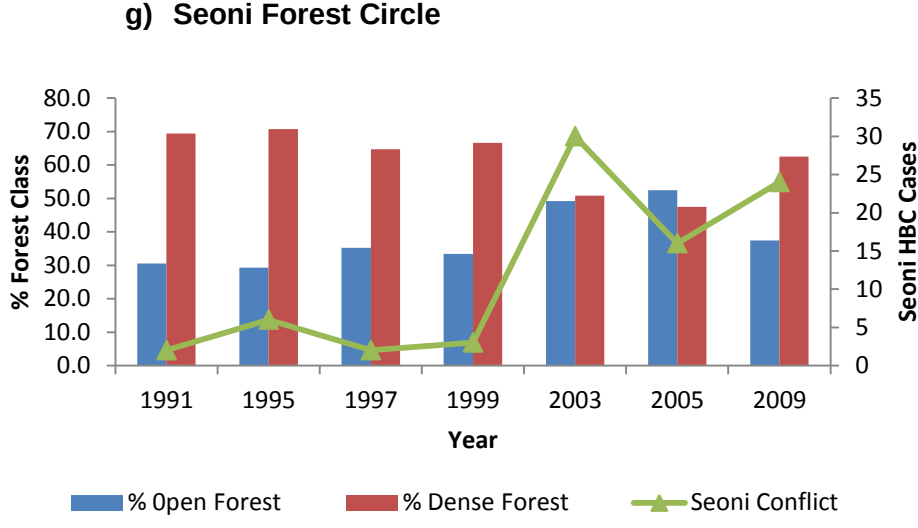


Fig 32: Human Sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Seoni Forest Circle. (FSI & MPFD).

h) Chhindwarha Forest Circle

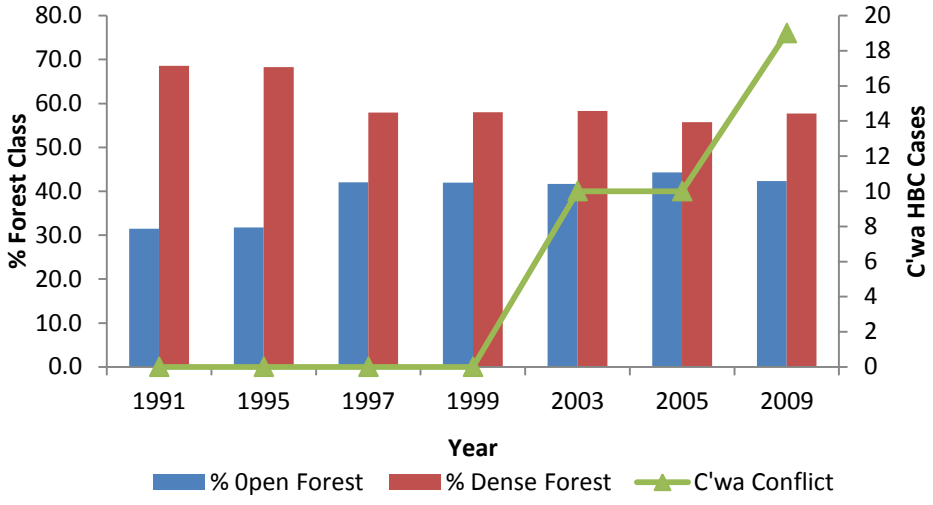


Fig 33: Human Sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Chhindwarha Forest Circle. (FSI & MPFD).

i) Chhatarpur Forest Circle

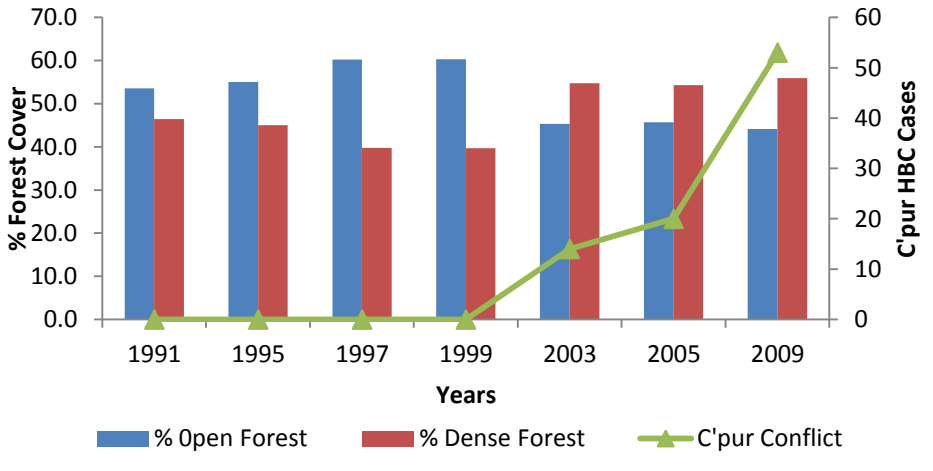


Fig 34: Human Sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Chhtarpur Forest Circle. (FSI & MPFD).

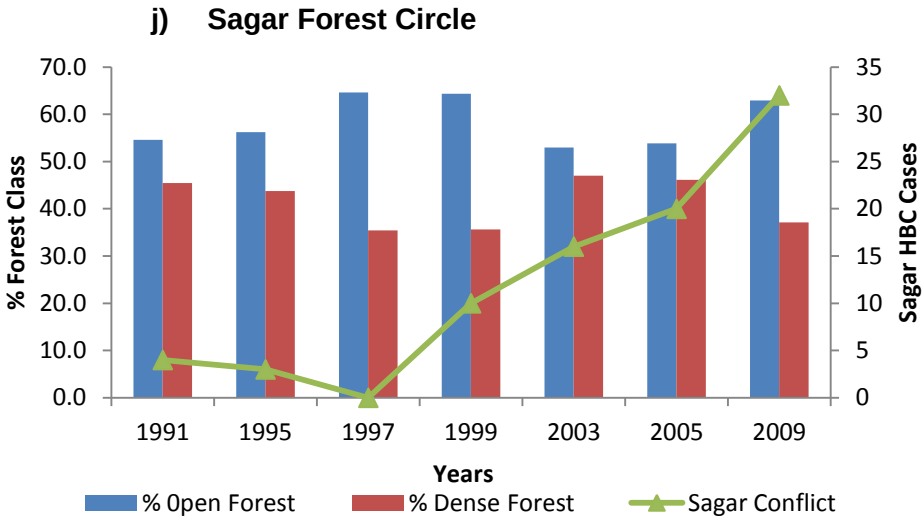


Fig 35: Human sloth Bear Conflict data with % Forest cover (Dense & Open Forest Type) in Sagar Forest Circle. (FSI & MPFD).

4.16 Kernel Data

As discussed before, the year wise trend indicates that level of HBC has increased in the state, but with the help of Kernal estimation, the data as represented in the graphical form (Fig.36. 37, 38) shows the coverage of HBC cases in different time period i.e. 1990-2000, 2001-2005 & 2006-2010. The Intensity is depicted in colour coded form i.e. Purple color shows high conflict, while Brown color indicates to the low conflict areas with 3D visualization. The peaks height and extent indicates to the intensity of HBC in that region while spread of the peak indicates the span of conflict.

Fig. 36- Human Sloth Bear Conflict Kernel Map of Madhya Pradesh (Year 1990-2000)

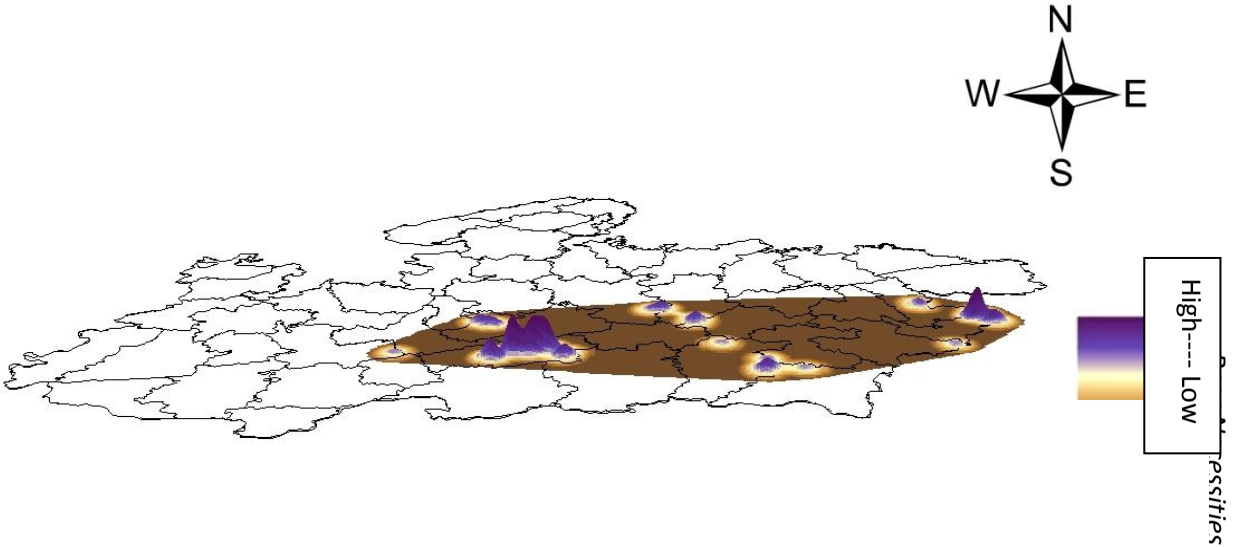


Fig. 37- Human Sloth Bear Conflict Kernel Map of Madhya Pradesh (Year 2001-2005)

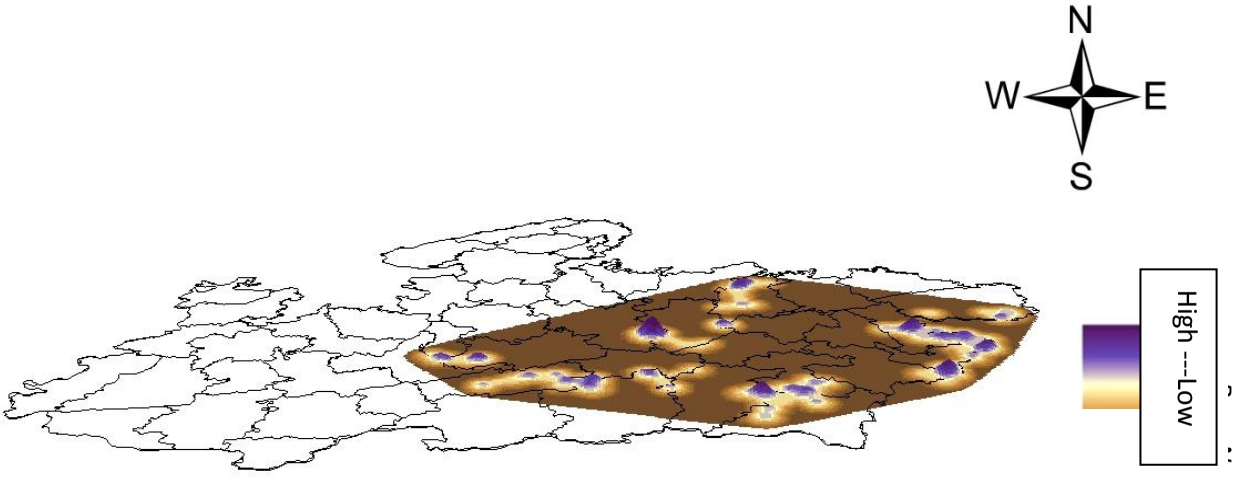
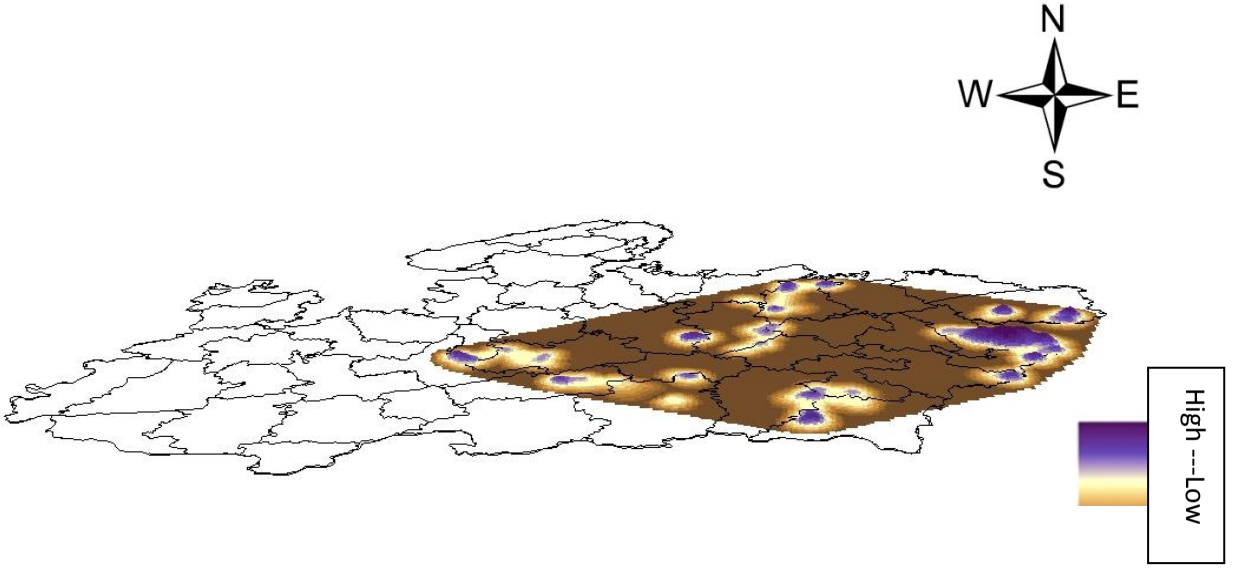


Fig 38- Human Sloth Bear Conflict Kernel Map of Madhya Pradesh (Year 2006-2010)



5. DISCUSSION

Human sloth bear conflicts throughout Madhya Pradesh are predicted to increase as human population, and natural food shortages increase in their forest habitat. Although, one more important component that plays a significant role is the trend of sloth bear population in these conflict areas, however with limited literature and lack of sound estimates, we were unable to correlate bear population with the increase in conflict cases. Therefore, we investigated other important trends & factors influencing the intensity of conflict in all the affected forest circles of the state.

5.1 Historical Trend

Through our extensive survey, we can now surely ascertain that the encounters with bears have increased almost exponentially since the last couple of decades i.e. from 1990. The result signifies that there has been an abrupt change from the year 1996. Such increase in the conflict cases could be due to the possibility of reasons such as, improved communication facilities, improvement in the reporting and record maintenance by the forest department, more media coverage and introduction of compensation etc.. However, we cannot say that it is all after the initiation of these advances especially compensation that the level of reported conflict has increased, as the compensation process was available long before 1990. So the rising trend that we witness here, can only be termed as actual increase in the conflict cases with human dependence on forest and its resources are ever expanding leading to inevitable scenarios of conflict. We even identified new cases and authenticated the existing cases recorded with the Forest Department, of all the cases, so there is

no denying the fact that sloth bear conflict is on the increase in Madhya Pradesh, for the "Temporal pattern of Human sloth bear conflict in Madhya Pradesh".

5.2 Seasonal And Monthly Pattern

To determine the seasonal pattern of attack, we divided each HBC case on the basis of season, i.e. Summer (March, April, and May), Monsoon (June, July and August), Post Monsoon (September, October and November) and Winter (December, January and February) as is depicted in the map. For further investigation, we focused on each season and the graph thus prepared indicates that conflict with Sloth bear is recorded in all the 12 months but with varying intensity. Two peaks were observed ranging from February to May & August to November. It was observed that the first peak of conflict coincides with the availability of food, especially fruiting species both inside forest and human settlement (as shown in Appendix-2). Sloth bear is the only bear known for their myrmecophagus adaptations but, like any other bear species, it is also an opportunistic omnivore and its diets vary seasonally. Studies in India indicates a lower reliance on termites and other insects, and a greater reliance on fruits due to a longer fruiting season in these parts (Schaller 1967; Johnsingh 1981; Iswariah 1984; Baskaran 1990; Gopal 1991). Studies carried on by analyzing the scats substantiate that, in early summer months of February and May, fruiting trees like Mahua, & Tendu compose most of their diet as they feed on their fallen fruits (Chauhan et al, 2003, Sircar, 2008 unpublished). As, most of the sloth bear movements depend on their feeding habit, it coincides with the local's collecting the same food resource, the conflict between these two distinct stakeholders becomes inevitable and this scenario is seen all across Madhya

Pradesh. Apart from the forest cases, sloth bears are also known to frequently explore, human habitation in search for food in these months, which inturn results in increased encounter with humans, occasional injury or death and damage to crops inside kitchen gardens like Maize etc. Even availability of water forces the bear to come in close contact with the human which also lead to conflict. The other peak, noticed in the month of August till November, can be inferred on the combined effect of excessive intrusion of locals for fuelwood, livestock herding after the monsoon, as well as increased availability of termites in the agriculture fields.

5.3 Diurnal Pattern

The diurnal pattern of attack implies that most conflict cases have occurred in the daylight hours, as compared to crepuscular hours, which is in contradiction to the sloth bears activity pattern. Studies indicate that sloth bears are crepuscular animals, a form of temporal avoidance which is more pronounced than spatial avoidance from threats like human, However, Females with cubs and sub adults of both sexes are recorded to be rarely active at night, a behavior change to avoid nocturnal predators as well as potentially aggressive encounters with other bears (suggested in Joshi et al, 1999, Garshelis, 1999 & Yoganand1999). Though, a considerable number of the cases have occurred in the dawn hours (3:00am-6:30am), which mainly accounts to the season of collecting Mahua inside the forest and partly when locals move out to defecate on the forest fringes. With dwellers moving inside the forest without any additional protection, they became highly prone to bear attacks. The conflict in the mid day hours (6.30am-12pm) have recorded the highest. It is believed, that extensive damage to the already degraded habitat and excessive collection of NTFP by the locals has caused

bears to face shortage of food resources and direct competition with humans for common food (Bargali et al, 2004) and therefore compel bears to move throughout the day in search for food. When locals venture inside the forest to collect fuelwood, herd livestock, NTFP collection or just passing through the forest, they accidently encounter sloth bear and gets into conflict. With such overlapping resource usage the conflict in the working hours of villagers becomes inevitable.

5.4 Location of Conflict

Sloth bear conflict cases in all the affected circles bring forth the result that most encounters have occurred inside the forest boundaries than village boundaries. Although, we have identified that not all circles have the same scenario. It was found that both Seoni and Shahdol Forest Circle have considerable cases recorded inside the village boundaries hinting to the fact that sloth bear are venturing out of their habitat in search for food and water thus, increasing the chances of fatal encounter. With such incidence threats of retaliatory killing of the problematic bear by the mobs become reality as recorded in many cases in the Shahdol circle. Therefore, the need is apparent, to improve the habitat quality and quantity of the forest, and altering the attractants inside the village boundaries to prevent the Sloth bear movement out of the forest towards settlements. On the other hand, Forest Circle like Hoshangabad, Chhattarpur, Bhopal etc high percentage of cases are recorded inside the village boundaries. One interesting feature that has been recorded in almost all circles is that cases of human venturing inside the reserved forest areas are also being compensated by the Forest Department. Although the ideology no doubt is to suppress the agitation of the

locals towards the sloth bear conflict and wildlife in general, it on the other hand actually promotes locals to move in those habitats to satisfy their daily needs, taking a unnecessary risks and also increasing the probability of conflict cases. To counter such incidence, it is needed that FD should aim to increase patrolling and manage the NTFP collection in a way that reduces the likelihood of locals actually coming in contact with bears. Locals should be made aware about the forest rules and regulations; so that illegal access can be curbed Hefty fines are required to be introduced for any defaulters.

5.5 Distance from Village

The distance between village and forest seems to be an important aspect in determining bear-human conflict (Satyakumar et al, 2008). The result indicates that with increasing distance from the forest, the conflict decreases. With majority of the affected villages lay in close proximity to forest, irrespective of its type, the bear attacks on the Trans boundary zone (2km-5 km) is found to be highest. But, with additional pressure faced from the habitat, the bears are now invading the villages to satisfy their basic needs, and thus increasing the chances of conflict. This is proved by increasing incidence of conflict recorded inside or in the immediate fringes of the village. Unless substantial modifications are carried out in the habitat type which can sustain bears, the attack cases inside the village will intensify claiming more human casualties.

5.6 Activity Pattern

Almost all the victims of sloth bear conflict in Madhya Pradesh are rural poor, those who depend on forest to meet their day to day needs. Even the result signifies this very fact that victims who were carrying out forestry

related work came in contact and was subsequently mauled by the sloth bear. If we see the ratio, majority of these victims were collecting fuelwood, herding livestock or just passing through the forest. As per the victim narration of the incidents, most of them suggested that while working the bear suddenly attacked. When asked about the reason many suggested that Sloth bears do move in daylight hours and often when they come face to face with humans they perceive them as threat resulting into an attack. Sloth bears rely on their aggressive nature in interactions with large dangerous species like tigers, leopards. This disposition also makes them a danger to people (Garshelis et al 2000). Collection of NTFP also constitute majority of the conflict cases in the month of February to June, Though the numbers of conflict are relatively low as compared to other season, the intensity levels in those confined month recorded to be high as almost all person irrespective of their age group carries out the activity. During our survey, we witnessed that Sloth bear crop raiding cases are very few i.e. confined to certain circles, but locals admit to be attacked by bears on their agriculture fields. We found that most of such cases have occurred when sloth bear either was in search for termites or water in the monsoon and summer months respectively. With the absence of proper toilets facilities inside the villages, the locals have to go on the fringes of the village boundaries to defecate and with sloth bear presence near the boundaries the victims become prey to sloth bear attacks.

5.7 Extent Of Injury

Most victims of sloth Bears attacks are injured rather than being killed, and as compared to other species causing conflict especially Elephants & Leopards they are very minimal. However, the level of agitation among the locals is high. This is because sloth bears are known for their potential to become aggressive toward humans (Laurie and Seidensticker 1977, Phillips 1984, Gopal 1991, Rajpurohit and Krausman 2000, Bargali et al 2005, Akhtar 2006, Ratnayeke et al. 2007). Sloth bears are also considered one of the most feared animals in the central Indian landscape because of its aggressive nature even in comparison to a Tiger, because they can attack without any apparent provocation (Gee 1964, as cites in Bargali et al, 2005) .As per the narration, almost all victims suggested that the bear attacked unexpectedly, and in response they tried to prevent it with their arms and legs. Thus, most of the body parts that got injured are the ones employed for defense and it involves both scratches and bite marks by the bear. Other vital organs such as face, neck and especially eyes are targeted by the sloth bear to cause disability at the time of encounter so that there is no counter attack from the human. However such an attack leads to a human being permanently handicapped for life. It was witnessed, Head injuries to human causes maximum cases of Death. Both Single and Female Sloth bear with cubs has been known to employ this technique in order to protect themselves and their cubs. Myths of sloth bear spitting in the eyes of victim is well known, where the victim suggested that just before the attack the bear spitted in their eyes and the mucous because of its irritant nature, temporarily blinds the victim and disable human response of counter attacking, which provides enough time for the bear to flee from the scene. However, the authentication of such claims was not made due to lack of scientific

data on this particular behavior. Any management steps to safeguard these kinds of attacks from the sloth bear, needs to protect the vital organs so that the resultant human casualty can be kept to its minimum, as human death act as an impediment to the values of conservation of wildlife among the local communities who share similar habitats.

5.8 Sloth Bear Numbers:

In contrast to the popular perception that it is the female with cub that mostly attacks human, the result from our survey indicates that it is the single bears who can be implicated for the majority of the attacks. This may be due to the reason that single sloth bear move greater distances to satisfy their demands for food and water, and due to excessive degradation and fragmentation to their habitat, they have been forced to alter their resting pattern and move through the day. This increases their chances of suddenly encountering humans who are also active in these periods resulting into surprise encounters leading to conflict. Female sloth bear with cubs also poses a considerable threat to the humans and it is known to attack even large group of people if it feels threatened.

5.9 Group structure of victims

It was observed that those victims, who were alone at the time of sloth bear encounter, were more prone to an attack, as compared the victims who were either in a group of two or more. In the months of NTFP collection especially Mahua, there is a race among the locals to cover maximum trees and for this each member of the family disperse and attain a specific tree spot alone in the forest. When a sloth bear arrives in those areas for its favorite food, on encountering a human it charge and

devoid of any protective tool, the human fall prey to bear mauling. Many victims on the other hand, who were in group have suggested that, when they were attacked by a bear, the fellow villagers nearby helped them save from a fatal attack by the bear.

Sharing the same habitat, Communities' encounter with sloth bear is evident but only a few of such encounters result in bear attacking humans. The locals add that, when they were in group the chances of bear attacking them reduces in comparison to when they were found alone as substantiated by the result we got. Therefore, it is best for the communities to venture into the forest in large groups which can reduce their vulnerability from a Sloth bear attack.

5.10 Sex composition of victims

The data gathered indicate to the fact that the victims of sloth bear are mostly adult males rather than the adult females. This is possibly because most males are laborers and to earn livelihood they mostly have to visit and devote longer times inside the forest. Also males are known to be more active in places and time that coincides with the bear movement (Bargali et al, 2005).This in turn increases the chances of encountering a sloth bear and fall prey to an attack. The females, on the other hand are known to stay at home more and move in larger groups which reduces their chances of being attacked. However, the cases of attacks on females are mostly recorded when they are in the process of collecting NTFP or herding livestock alone.

5.11 Age class of victims

Most cases observed and analyzed, suggest that it is the working class in the village i.e. the age group between 15 to 60 is highly prone to an HBC attack, as to earn a livelihood they had to make frequent trips to the forest as rural economy in these parts is largely dependent on forest. As discussed before, collecting fuelwood and NTFP being the prominent activities often brings the sloth bear and humans in close confrontation with each other. But in recent times, with bears invading villages, the chances of attacks on any age class becomes purely incidental, whether infants or teenagers (0-15 age group) or elderly (Above 60 age group).

5.12 Initial response of the victim

During the conflict survey it is found, there is lack of knowledge & competence on the part of locals on how to tackle the sloth bear conflict scenario. As most conflict occurs due to accidental encounter inside the forest, the preventive steps taken by the locals depend on their initial instinct rather than considering the bear behavior. It can also be inferred that many of the steps taken by the locals may even act as an instigator for much grievous injuries. This was evident in cases when locals admit they tried to run the bear off or try to evade the bear by shouting and throwing rocks, even if it is far off and hasn't seen him, which incidentally forces the bear to view human as a threat and it attack in retaliation. Dogs were used to counter the Sloth bear in some occasion. Though the efficacy of this seems perfectly suitable in some cases, other victim suggested that it is the dogs that have agitated the bear to attack or in some cases the dog fled the scene at the time of encounter.

Through the questionnaire survey, it was suggested to us that sloth bear attacks on most victim cases were unprovocative, which according to us can be linked to the victims underestimating the cause of the attack. Activities such as collecting fuelwood, herding livestock etc cause lots of disturbance inside the forest which if it occurs in the vicinity of a bear, compels it to view the disturbance as a threat and attack it source. This was evident when many victims suggested that the bear came out of the bushes suddenly and attacked him or her. Therefore, it is best to come up with certain protocol that needs to be followed when a person or a group of person venture inside sloth bear habitat in conflict prone sites.

5.13 Desired mechanism

The victims when asked about what they would want to be done to mitigate the rising situation of conflict in their area, majority where of the view that wild animals belong to the Forest Department and it is their duty to keep the animals away from the humans. With cases of killing and grievous injuries to their relatives, there is an undercurrent of apathy towards the sloth bear; and few have spoken about killing the sloth bears. Repercussion of founding guilty of killing a Scheduled 1 species is also well known, that has curtailed the killing spree as of now. But majority of the locals still possess at least the remnants of conservation ethics which if utilized immediately can help in mitigating the conflict to a great extent.

As per locals, a habitat improvement method is an absolute necessity that the forest department should look into, but being a long term measure, it would fail to curb the anger that exist at the moment. As a short term measure, respondents feel that government or the

forest department should focus on training and carry out awareness programs for both local communities and forest staff. Both locals and field staff of the forest department shared the need that concerned authorities should innovate and subsequent train them to use certain tools which not only prevents human mauling from the bear but can also without causing any damage, deter the sloth bear when encountered at a close range. Awareness programmes should be organized with an aim of delineating the knowledge about ecology and behavior of the sloth bear which lacks at the grassroots level, as well as dispelling the myths associated with Sloth bear which often becomes the root cause of conflict. It was also felt that, though FD is trying its level best to counter and mitigate the conflict with activities like curbing the level of forest fires, watershed management, moderating the NTFP collection inside forest (assigning each Mahua trees to definite families), some steps on the other are making their effectiveness counterproductive. By promoting Mahua and other fruiting trees inside the village boundaries, it is inviting the bears to move out of their habitats and explore the human settlement for food, increasing the probability of conflict rather than focusing on improving the habitat for sloth bear inside the forests. Compensation is also a point of contention, where the victims argue the FD could do much in comparison to the present scenario. The FD has reworked and has increased the amount of compensation for the death and physically handicapped cases of HBC, coupled with providing ex gratia to the victim. But, the victims feel that rather than the amount the process should be much effective and speedy. There is a need to work on the amount of ex gratia that is provided by the FD, as it merely covers the immediate cost of treatment and travelling to a big hospital.

HBC victims also suggest that there can only be one solution to the problem i.e. moving the problematic animal from the forest to any secure facility (PA). The capture of problematic bear is a workable option but the process is lacking in identifying the problematic individual among the non target individuals. Supported information like the ecological data of the area which it is transporting from and to is also required for a successful translocation as sloth bears are socially tolerant of other sloth bears as long as food is plentiful (Laurie and Seidensticker 1977, Joshi et al. 1999). Therefore, the steps to be implemented effectively require extensive scientific data, huge investment and skilled officials to carry out the task. Fencing mechanism though propagated by few has it flaws in the current setting, as most forest spaces are interspersed with human settlement, and with scatter household fencing is not a viable and feasible option. Also with most cases occurring inside the forest boundaries, installing fences would not solve the purpose.

5.14 Land Use Land Cover (LULC) Aspect In Human sloth Bear Conflict

The HBC cases in Madhya Pradesh were collaborated with the LULC data which indicates that most cases have occurred inside the forest mainly the Tropical Dry deciduous type with some in the Moist Deciduous type. As most resources are shared by the sloth bear and the communities living on the fringes of these forests, the encounters are inevitable. Apart from the forest cases, the second highest HBC cases were observed in the Agri-Habitation which is a major cause of worry for the administration. To tackle the problem of HBC, the

priority should be given to resolve the threat of sloth bear invading homes, and causing casualty so that public anger towards the species can be kept to minimum.

5.15 Forest class & Human Bear Conflict cases:

Linear Regression analysis depicted that, both Dense and Open Forest class (most resources of use by both Humans and sloth bear falls in these forest classes) as described by FSI, does not prove to be a determining factor to the cause of Human sloth bear encounters in parts of Madhya Pradesh.

As depicted in Appendix-7, all the 10 affected forest circles did not show any significant relationship with the type of forest cover and number of sloth bear attack cases. Thus, we can say that apart from type of forest, it is the extent of anthropogenic activities in and around the forest areas that might be the cause to many incidences of sloth bear attacks in these regions.

5.16 Kernel estimation

Creating separate kernels for the different time periods was an important step in the analysis of HBC as it depicted that conflict cases have increased in intensity, but more importantly in the area coverage in the state of Madhya Pradesh. Looking at the 3 different graphs one can make out that in the period 1990-2000, HBC cases were restricted to the villages which lie in the proximity to Protected areas for instance Satpuda TR in the Hoshangabad forest circle or Bandhavgarh TR (M.P) & Guru Ghasidas NP & Achanakmar TR (erstwhile MP, Chhattisgarh) in the Shahdol forest circle. But in recent years i.e. 2001-2005 & 2006-2010, it is viewed that the coverage of HBC has increased in other forest circles

covering most of the north eastern part of the state. Other notable feature that was witnessed through the temporal variation and conflict intensity 3D graphs was that apart from the PA's the HBC cases were also experienced in the territorial forest making the situation even more complex to be tackled.

6. RECOMMENDATION AND ACTION PLAN

Sloth bears are considered one of the most adaptable (sub tropical specialist with both omnivorous and *Myrmecophagous* diet) bear species found mostly in all forest patches of India. In recent times, most of their habitat falls in and around human dominated, agricultural landscapes thus, it becomes a complex challenge to ensure the peaceful coexistence of bears among high densities of humans. Simply placing sloth bears under Schedule-I of the Wildlife Protection Act has failed to address the issue.

It has been found that most wild animals have developed very situation specific responses through combination of learning and genetics which has made them successful in a said environment. However, some of these responses have become detrimental, complementing with the increasing trend of human-wildlife interface, which has led to conflicts with people (Knight et al 1998). Planning a proper mitigation procedure, should encompass the need to understand and differentiate such responses which are Attraction, Habituation & Avoidance. Attraction in wildlife management is defined as the strengthening of an animal's behavior because of positive reinforcement, and implies movement towards the stimuli, and mostly in the case of wildlife it projects the need for food,

shelter and security habituation on the other hand talks about diminishing a response to a repeated neutral stimuli. Most wildlife has been reported to get habituated to people and human made environment and sloth bears in Madhya Pradesh are no different to it. Though it has been stated that sloth bears are shy and avoid human presence, but when they invade settlements for food, it can be argued that sloth bears have become habituated to humans and their associated activities like NTFP collection and agriculture. Avoidance is the opposite of attraction, an aversion to negative consequences associated with a stimulus such as presence of roads may lead to wildlife aversion towards it (Knight et al 1998). Therefore, in order to manage conflict, differentiation between such wildlife responses should be made and efforts must be put to identify the causes and evaluate their consequences before implementing.

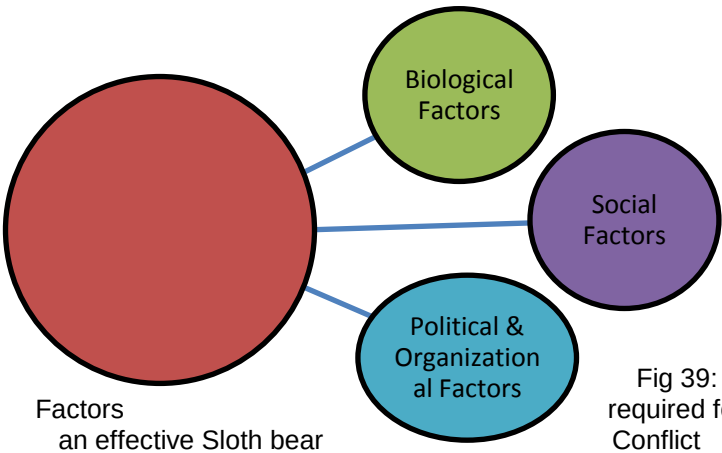


Fig 39: Factors required for an effective Sloth bear Conflict Mitigation Action plan.

For an effective action plan to mitigate sloth bear conflict, sound scientific data is of absolute necessity for

making management decisions related to problem bears and for sustainable managing bear populations (Fig 39). Although, some scholarly articles have propagated measures to keep the conflict level at check, most of such responses have been empirically generated in-situ and are often driven by local contingencies rather than by good science and planning. Additionally, precautions have to be taken, as simply replicating a successful management practices of a site on to an another will not always be fruitful, site-specific management plans are of utmost need as variation exists in the way the concept are understood and applied by researchers, and affected public as they are too embedded in different ecological, social, cultural and economic realities that prevail on the ground. Thus, an action plan to work successfully requires a holistic view on various factors, which has been shown in the figure earlier.

Considering the actual population growth rate of humans, increasing demand for natural resources and the growing pressure for access to land, it is clear that the human wildlife conflict cannot be eradicated completely from an area in the near future, however through proactive steps they can be managed urgently. In practicability management steps can be classified into Preventive and Mitigative strategies (Conover, R 2002), while the former talks about preventing the conflict occurring in the first place and take action towards addressing its root causes, the later attempts to reduce the level of impact and lessen the problem. Preparing an action plan to resolve and mitigate conflict should also try to envisage all the strategies into short and long term action points. The thrust of activities in the short term would be to assuage the feelings of the affected communities by providing immediate help; it

could be both in terms of ex-gratia and treatment of victims. While this is important, at a relatively longer term it is also necessary to build capacity at different levels, from the grassroots to the policy making levels so as to achieve a point where there is a reduced interaction between locals and wild animals.

Therefore, we have been able to formulate possible recommendations for mitigating the sloth bear conflict in the state with the help and suggestions drawn from the officials of the wildlife/ forest departments, the affected respondents of conflict cases and other bear/wildlife conflict mitigation specialists. For the sake of clarity, we have classified them in Human Specific & Bear Specific.

6.1 Human Specific

I) Expeditious, Effective and Efficient Compensatory Mechanism-

Human sloth bear conflict carries significant economic costs to humans and compensation is a measure which aims to alleviate conflict by reimbursing people for their losses. This measure was adopted so that immediate response to loss of life, and property caused by bears can calm people which will inturn prevent violent reactions towards the problem animal in particular and wildlife in general. At present in Madhya Pradesh, the compensation amount for an human killed by a bear or any other wildlife is Rs 1,00,000/-, for an Permanent Handicapped victim: Upto Rs 75,000/-, For an injured victim: Rs 500/- to Rs 1,000/- is paid as ex-gratia, while reimbursement is made on the full medical treatment.

However, its effectiveness has been a contentious issue due to its inefficiency and low rate of reimbursement

which has been argued in the state. Many respondents affirm that the mechanisms for claiming compensation, such as verification and approval procedures are very bureaucratic and often a very nominal portion of the claim finally reaches them. In Madhya Pradesh, the present compensation process lacks the amount paid for travelling from the place of attack, which are mostly inaccessible to the district hospital, coupled with the amount of work days the victim had to forgo if he has been hospitalized due to the sloth bear attack. Repeated instances of such nature even discouraged many affected persons from claiming compensation because of time and costs involves in the process. Most of the respondents even argue that claiming procedure for compensation is not known to them, which often results into getting a minimal amount that hardly cover up the losses.

On the flipside, Damage compensation is susceptible to misuse and exaggeration of damages where locals in their selfishness often misuse and inflate the claimed compensation amount often forcing authorities to scrutinize each and every detail, which makes the process even more lengthy and tedious for the victim. Moreover, recent studies have shown that compensation can be bad for conservation of animals since human wildlife conflict usually does not decrease, instead increases as it does not encourage villagers to protect their holdings and to coexist with wild animals. In Madhya Pradesh, a person is also entitled for compensation if he or she ventures into a reserved forest, which according to the forest rights is an offence. The Forest Department as an act of good faith do provide compensation just to keep the agitation levels at check amongst the affected, but fails to signify to the locals that, the area is no go zone and repeated cases

keeps on occurring. Additionally this is not a sustainable solution as it depends heavily on the final budget of the local governing bodies and the forest department.

It is proposed, that the monetary compensation is the only feasible option at present to subdue the agitation, there is an immediate need to rework and realign the current compensation amount and delivery mechanism.

A) In case of sloth bear attack on humans, it is recommended that a senior level forest officer preferably to the rank of Range Officer (RO) immediately visit the site and record details of conflict. A separate travel allowance should be provided to the forest guard investigating the conflict as well as facilitating the compensation delivery to the victim so that he can efficiently discharge the duties without any delay. A vehicle should be provided to take the victim to the nearest medical facility.

B) Payment of *ex-gratia* should be made fast and hassle free. The ex-gratia amount should be made mandatory to a sum of Rs 1,000/- to 5,000/-, depending upon the extent of injury, immediately (or preferably within 2 days from the day of attack) to be paid by the Divisional Forest Officer (DFO)/Range Office (RO) concerned from the floating fund to either the victim or their next of kin.

C) Inter sectoral cooperation with the State/ District Health Department is needed so that treatment procedural delay can be kept at a minimum. Even miscellaneous expenses that arise due to the complexities of treatment should be borne

entirely by the hospital itself. Governmental Departments like the State Tribal Departmental, Department of Social welfare etc. should also be taken into confidence, so that a mechanism can be put to place where the victim who may have been permanently disabled can be rehabilitated successfully and can be gainfully employed.

II) Detailed Collection of Human sloth bear conflict-

A strict procedure of collecting Human sloth bear conflict or any other wildlife conflict is warranted, so that future planning on the conflict management can be carried out efficiently. Information on conflict incidences should be collected systematically and recorded (preferably as a soft copy in a computer) in an appropriate format to aid decision-making. Data such as GPS location of Attack sites, Photographic evidence of the habitat, and the victim is of utmost important, which is lacking in Madhya Pradesh at the moment. A detailed POR register is to be maintained , providing details about the age, sex of the victim, narration of the incident, evidences of animal found, doctor's prescriptions and report detailed, post mortem report of the deceased victim, updated amount of compensation. Additional effort is also needed for Long term research, focused on estimating the population and abundance of sloth bear in high conflict areas should be taken up as a priority.

III) Awareness Generation & Involvement of People:

There cannot be any effective conflict mitigation steps until the local involvement and support of the people.

Most Awareness programmes often limit themselves to the affected locals, but a need is felt that awareness is required at all levels i.e. from community levels at the grassroots, to frontline staff of the forest department coupled with sensitization programs targeting decision makers, the legislature, bureaucracy, the Police and other associated sectors. The overall aim should try to focus on a participatory approach ensuring conservation and management of sloth bears in their region.

Sensitizing the media about the nuances of the problem of human-sloth bear conflict and wildlife in general should be an essential part of the awareness strategy. Media should contribute to diffusing the tense situation surrounding conflict with objective reporting aimed at highlighting the measures to mitigate conflict. Reporting mainly aggressive encounters with sloth bears can erode local people's tolerance and worsen the situation by forcing the Forest Department to take unnecessarily steps towards the species due to intense public pressure.

Points that needs addressing in Awareness Campaigns-

A. Sloth bear is a Schedule-1 Species under the Wildlife Protection Act, the cases of Retaliatory Killing and illegal trade should stop.

B. Deleterious encounters between sloth bears and humans often occur around parks because of inappropriate behavior on the part of people. The education & awareness of local people on bear facts and on the importance of bears in the nature thus becomes crucial.

    i) Sloth bear are shy and elusive animal, they only raid villages for food and water, and

therefore, they are not inclined to attack people.

ii) Sloth bears may attack in self defense; especially a mother with her cub and, therefore, it is advisable to avoid provoking them.

iii) Sloth bears has a varied diet, but prefer certain food, which are shared by the locals e.g. Mahua. Extra precaution & care should be taken while venturing inside the forest for NTFP collection. Moving in large groups could be useful in this regard.

C. Conversion of bear habitat for agricultural uses by people who have no other means to make a living is a difficult task to be made aware and sensitize. Therefore, information must include how people perceive, and how they assess risk. Stress has to be put on identifying the positive values of having bears in the forest.

D. Also, awareness and sensitizing measures should make sure government ministries/ departments and communities are informed about natural resource policies that affect bears, and should take necessary steps towards it.

IV) Training:

Training is an integral part for Conflict Mitigation, and like awareness programmes, it has to be applied at all levels dealing directly or in a position of managing the sloth bear conflict in the state.

A. Local Communities Training- At a Local level, changes in land use and to an extent cropping patterns significantly influence the intensity of human sloth bear conflict in the state of Madhya Pradesh. Changes through training programmes, in human behavior, manifested as new agricultural practices, has the potential to reduce the levels of conflict. For example, due to market driven economic forces agricultural changes has made it possible to grow millets in the kitchen garden and coupled with increasing instances of agriculture expansion and illegal encroachment, the land under forest is being hugely diverted forcing the bear to feed on home grown cash crops leading to scenario of conflict. Training on how to store NTFP products inside homes should also be an integral part.

   Similarly, training should be provided to change animal husbandry practices among the locals to switch from high populations of cheap, free-ranging native breeds of cattle to expensive, high-yielding breeds, which will exert low pressure on the forest for indiscriminate grazing, which in the longer run can secure a good habitat for the bears and avoid frequent invading among human settlement. Mobbing cornered predators or walking carelessly close to bears are examples of such behavior that can be also modified through training programmes. Thus, the need for proper training is immense so that locals unknowingly do not contribute in escalating the problem of conflict in their area.

B. Forest Training- Often, there is a view perceived by the locals that wildlife belongs to the Forest

Department and any case of wildlife conflict on human (economic & human loss), puts Forest Department as the main culprit (when failed to prevent damages) and has to face the heat of the public reactions as in many cases of conflict in Madhya Pradesh, when surveyed. Therefore, the need arise for the training of Forest Department officials to tackle conflict situation arising from sloth bears so that they can earn goodwill and trust of people especially residing on the forest fringe areas, which is a vital component.

Training in tranquilization, trapping, crowd management techniques, research and monitoring (pug mark, indirect signs etc), and on data entry, analysis and reporting need to be introduced at all levels, from Forest ranges to Forest Circle in the State Forest Department. As reported in the results of the semi-structured interviews, a majority of conflict incidents are reported to the Police, and it is often expected that the Police undertake immediate action to prevent further occurrences. Thus, Police Department should also be encouraged to attend training programs on dealing with such conflict situations. Infrastructure and capacity available at the State Forest Training Institute should be made available for these programs.

V) Creation of Conflict Mitigation Centre & Rapid Response Teams:

Immediate response is absolutely critical to manage all conflict situations. A trained Rapid Resource Team

(RRT) with a Mobile Intervention Van (MIV), capable of transporting injured or captured problematic bear and a 4 wheel vehicle consisting of an officer not below the rank of Assistant Conservator of Forests/ SDO, two experienced driver, one qualified veterinarian, and a minimum of five trained support staff, both from forest department and local communities may be formed in each of the identified conflict forest divisions. Specialized Training and state of the art equipment should be provided to them. Additionally community level Primary Action Team (PRT) is also required, based in each range, comprising of either paid/volunteer local members whose primary responsibilities would include isolation of animals involved in conflict and more importantly, in crowd control, to ensure that local communities do not attempt to tackle dangerous animals without supervision as it when most fatal encounters can take place.

For any conflict mitigation step, Pre-empting attacks can only become possible when there is mechanism for rapid information collection, processing and evaluation of the conflict situation. In respect to this, another measure that is being proposed is the setting up of centralized control system by the forest department, preferably in the office of Chief Wildlife Warden (CWLW) headed by a person preferably of the rank of CCF along with GIS & Computer professionals, to expedite the response time during a man-animal conflict scenario in the state, which may be called as “Conflict Mitigation Centre”. The system or cell would only be dealing with Human Wildlife Conflict cases with 24/7 availability, connected with telephone and SMS facility to report any type of bear conflict (Human Injured & Casualty, Invade home and damage property, retaliatory killing of problematic bears). Additional

training should be provided to the staff manning the Centre so that the information can be stored in pre-determined formats and immediately mapped to provide decision making authorities with the most current state of knowledge of a particular region.

VI) Promoting Extensive Research Work on the ecology & Behavior of Sloth bears:

An important component for any Conflict mitigation study should need to have a comprehensive detail on the population demographics and trends of sloth bear in the state. Although, we have tried to understand the overall view of the conflict scenario in the state, we were constantly short of accessing the sloth bear population data, which is an integral part of the study.

Although, an estimate on the sloth bear numbers can be collected from the census carried out by PA's for Tiger estimation but the assumed trend in a population can be inferred only by a suite of factors including changes in the spatial distribution of animals, the degree animals occupy in all high quality habitat, changes in the abundance of bear sign (including sightings) and bear parts in markets, and the frequency and locations of mortalities and property damage. Additionally, extensive research work is needed to obtain information on the habitat ability to sustain bears such as the size and shape of habitat blocks, presence of corridors that link them together, the distribution and phenology (seasonality) of bear foods, the availability of denning and security cover, and the human activities that impact these features.

Such elaborate information is deeply required and as most of the work of such nature is time consuming, tedious to carry out i.e. sometimes requiring many years of tracking radio-marked bears, both human and capital resources are immensely required. The Madhya Pradesh Forest (Wildlife) Department should focus on 2 distinct means of collecting, processing and analyzing the data necessary for detailed research:

A. Develop& Maintain capacity of the Wildlife Wing of the Forest Department which would be the simpler & least capital intensive method. The State forest department should train forest guards/rangers of both Wildlife and Territorial wing about the techniques of wildlife estimation, such that continuing body of data can be generated for analysis. It is suggested, that on the lines of a Tiger Census, a sloth bear census should be carried out in all the PA's as well as in Territorial forests, which has highest sloth bear conflict cases, based on camera traps, 100 to150 units, which can move from one site to another systematically. The advantage of this method lies in distinguishing the repeated offender of attack among different individuals, thus helping to direct actions against specific targets rather than use a purely reaction response which more often than not gets diverted towards non specific individuals. Cooperation should be sought from local communities in locations where the traps are to be used, to both inform them of the Forest Departments intentions of dealing comprehensively with conflict, while also minimizing the potential theft of the trap units.

B. Involvement of local educational institutions or wildlife organizations would help in the analysis of camera trap results, which are little complex studies.

   Even for training on wildlife estimation and management, expertise of wildlife organization can be used as well.

VII) Political Will & Forest Department Organizational Strengthening & Augmentation (Decision Making):

One of the most significant threats to a successful action plan to mitigate conflict is the lack of an organized approach. Poor organization and the inability to implement conservation in a timely fashion is as great a threat to bears as human actions that fragment and destroy bear populations and their habitat. It is only a strong administrative set up, backed by strong political will that will determine the implementation of action points as suggested, which is lacking at present in the MPFD.

The following Salient features that needs attention, so that Administration can work towards an Effective Action plan to conserve sloth bear and mitigate the associated conflict-

A. Identifying and Prioritizing threats and other issues affecting sloth bear population in Madhya Pradesh.
B. Developing methods and criteria to select projects and institutions that address threats/issues. Responsibilities have to be

assigned to organizations best suited to implement actions.

C. Establishing a time frame for implementation.
D. Allocating human and capital resources efficiently depending upon the prioritization of threats.
E. Modifying actions to have expected progress in established time frames according to the recommendations of monitoring and evaluation

The organizational setup should be flexible as well sensitive towards simultaneously considering the needs of locals as well as the bear (e.g. space, food, water, shelter, & ravel corridor) keeping in mind the cultural beliefs, values, threats and political considerations.

With national and state policies already prescribing forest diversion towards encroachment and developmental activities, habitat loss of bear and conflict becomes inevitable. But focus can be put on policies of land tenure, NTFP collection, tourism development and compensation schemes which come under MPFD, which are amendable and if managed properly can certainly bring down the bear conflict level to its minimum in the state.

Throughout the survey we witnessed, the forest department especially the territorial and the wildlife wing are shortly understaffed, a fact that is being acknowledged by the forest department and the affected victims alike. By filling up the remaining posts i.e. beat guards, the vigilance and response time towards conflict mitigation would improve and a sense of security will

prevail among the communities with the presence of these guards in the villages. Long term financial sustainability of those hired, has to be ensured, so that no unintended obstacle arise due to lack of funds. Forest & Beat Guards even argued that while patrolling the forest, they face many challenges in terms of mobility and communication facilities which hamper their delivery of duty. They also face resentment from local villagers, illegal timber mafia while curbing their activity, and with forest fines relatively lenient; most offenders escape by paying a nominal amount and often go back to the same lucrative profession of illegal felling. While patrolling, a beat guard lacks even the basics of protective gear and when faced with illegal settlers and forest criminals, they have to surrender. Another big issue that impedes on the working of a forest guard is the constant intrusion of political pressures from local leaders. Thus, the State Forest Department should take extra care of their ground staff, as it is they who hold the key for a successful implementation of any plan suggested in the centre.

As discussed earlier, even the creation of a Conflict Mitigation Centre/ cell would be useful in the current structure of MPFD, in devoting all their time and funds for mitigating wildlife conflict throughout the state, as it would be difficult for other Wildlife Divisions to be dedicate their resources towards conflict as at when it happens.

VIII) Inter Sectoral Cooperation for Conflict Mitigation:

The State (Wildlife) Forest Department should make efforts to involve all departments, wings and agencies of the government to use a well coordinated mitigation approach which has its basis in science, practicability, and capable of dealing with emergencies related to attacks. Department such as the Police, Health, Revenue, Tribal, Telecom along with inter forestry departments such as Production, Social Forestry, Territorial and Park should be taken into confidence and work together for a common aim.

6.2 Bear Specific

I) Management of the Problematic Bear:

With greater instances of attack cases inside the village boundaries, the intensity of Human Bear conflict has reached a new level in some parts of Madhya Pradesh. With limited availability of food and water inside forest, the bears have started raiding human houses for food and water, thus increasing the chances of encountering a human, even if the raids are in dusk and dawn. Many cases of human and sloth bear killing have been recorded, when a sloth bear in search of fruit bearing trees entered a house and injuring a human after which a mob, in retaliation killed the bear.

In order to mitigate conflict, such scenarios should have to be tackled more professionally. As discussed earlier, in management a conflict situation can be managed based on Preventive and Reactive techniques applied in the region.

A. Preventive Methods: It is a new approach to conflict bear management, as it offers a much needed alternative from using lethal control kill or causing irreparable harm to the animal. Such Management efforts mainly focus on elimination of situations that create the potential for human bear conflicts, in particular, bear use of non-natural food sources outside their habitat ranges. This can be achieved by modifying the behavior of the bear by negative conditioning. The aggressive use of fear provoking stimuli such as repellents and deterrents, diversion can reduce a bear's desire to approach humans and non-natural food sources.

    a) Fear Provoking Stimuli: The optimal foraging theory or OFT (Mc Arthur & Pianka, 1966) suggests that animals forage in a way that maximizes their nutritional intake. However, animals have to ignore some good foraging behavior because it is too risky to exploit them. As animals need to find food as well as avoid predation, they often exhibit risk aversive foraging, as sloth bears have specifically altered their home raiding at night. We can exploit this animal's tendency to reduce conflict scenarios in a region. Fear Provoking Stimuli are any objects that increase an animals' wariness or fear. Some of the methods which can experimented upon in Madhya Pradesh are:

        i) Visual Stimuli: Sloth bears are relatively shy in comparison to other wild animals found in the forests of Madhya Pradesh, and try to avoid human presence as far

as possible. Some visual stimuli can be installed to keep the bears out of human harm way. Especially, as most bear raid occur in night, installations of Streetlights and flashbulbs inside the villages can be used as visual deterrent. Even locals when they visit forest, for NTFP collection at night or dawn hours, use of flashlights, strobe lights, high powered torches and other bright lights can be used to deter bears. This will indicate human presence and bears would feel less secure than when under the cover of darkness and would in the future try to avoid such areas. Streetlights can be provided by the Forest Department in lieu with the State electricity Board, and High powered torches can also be distributed in high conflict "Hot spots".

Though, there are different Visual techniques to avert wild animals (big mammals) used all round the world, their effectiveness will not hold ground in respect to bears as they have poor eyesight.

ii) Auditory Stimuli: Several fear provoking stimuli are based on auditory stimuli or sound. There are many ways to produce loud sounds, including the use of firecrackers. Another concept that has been effective in mitigating close encounters with bears (Grizzlies and Black Bear) is the use of Signal Horns (though expensive) or locally made

sound emitting device like Can filled up with pebbles, Banging pots and pans, a technique which might be effective for locals who often visits forest for livelihood opportunities. It is even recommended, that while visiting forest, groups of people should make loud noises (Talking loudly or whistling), so as to determine their presence in the area, so that a bear nearby can get enough time to respond and leave rather than startling over a threat in human.

Although like any other method, it has its disadvantages, as some times due to the use of firecrackers and sudden loud noise, can agitate a bear, making it disoriented and aggressive towards whoever is in proximity. Another disadvantage is that to use an auditory stimulus, someone as to be present to fire it, thus becoming labour intensive.

iii) Olfactory Stimuli: Odors can also be used to repel animals. Sloth bears like any other bear species have the gift of acute smell to compensate it for poor eyesight, thus use of olfactory stimuli has the potential to be very effective in the Indian Scenario. Use of bear pepper spray can has been successful when hikers in close encounters with grizzlies have used them. Such cans have not been introduced to India (although chili bombs have been used to mitigate Human Elephant Conflict in many parts

of India), but a similar method must be put into use. Local innovation is required in this regard. Even growing of capsicum based crops coupled with unpalatable crops on the village fringes can to an extent deter sloth bear raiding on kitchen garden. Locals also believe that sloth bear resist the smell of goats and does not raid house, which has goats as a livestock. Though, this statement cannot be verified in the survey period, research can be undertaken in this regard as many studies have already proved that certain animal odors can repel particular species. By identifying the active ingredients, it can be possible to produce a synthetic spray for a better usage. Local scientific institutions help can be sought to develop and test these measures.

iv) Use of Dogs: Live dogs can be used as fear provoking stimuli to scare wildlife. According to scholars, the utilization of domestic guard dogs has tasted success in managing conflict from coyotes and Black bear (Treves & Karanth, 2003). In our survey, we came across many cases where the dogs have saved their masters from sloth bears, but interestingly it is also noted that, some of the attacks have been triggered by Dogs, often agitating the bear causing it to attack. Many respondents even argued that, even the presence of dogs sometimes could not help defend attacks, as often dogs flee

when encounter a bear. Another important trend that was observed, the effectiveness of dogs against bears inside forest changes in comparison to be in the village, where dogs are most effective. Considerable time, effort and money is also required which sometimes undermine the effectiveness of this method. Therefore, we cannot fully determine the success of guard dogs in a conflict scenario as it depends on factors, which are yet to be identified.

v) Hazing: It is defined as an immediate management response to a conflict situation, by using negative reinforcement, to move an animal out of an area or discourage an undesirable activity. Chasing animals away from agricultural lands and homes is the most common and locally available method used by humans living on the fringes of Madhya Pradesh forest. But, its drawbacks outweigh the effectiveness as it is highly labour intensive because the problematic bears have to be chased away as soon as they arrive, and many chases may be required before the animals stop returning. It is also a non viable option as it requires hiring of persons specifically for this, which makes it expensive. Often, it is the non working class, like the teenagers and elderly who are entrusted with guarding tasks which often deteriorate the effectiveness of the method. Thus, proper mechanism and

training is required to collectively carry out hazing in a community to make it impactful in dealing with conflict cases with bears. Dogs can add an extra frightening dimension to such human patrols.

b) Management of Bear Attractants: In order to mitigate conflict, it has been argued that it is much easier to keep food away from bears than it is to teach a food conditioned wild bear to stay away from unnatural food that it has learned to crave. Securing attractants is the single best way to keep human safe, prevent damages and avoid killing of problematic sloth bears. Forest Department should try to deter from planting attractive fruiting species like Mahua, Ber, and Guava in the village peripheries and instruct villagers to do the same in their kitchen gardens unless satisfactory trees are planted in the bear's habitat range.

Good standards of waste management are important in the rural set up of Madhya Pradesh to avoid attracting sloth bears to human settlements and to prevent wild populations being augmented and artificially sustained by human induced food availability. Each stage of waste handling should be addressed, from collection to transportation to disposal. Efforts should also aim for proper storage of food inside the houses, so that the odor doesn't act as an attractant for the bears.

c) Barriers: Establishing physical barriers against animal movement into human settlements is an effective technique deployed for centuries. Such barriers may include trenches, walls and fences or biological barriers. Many respondents even asked for this method, to mitigate conflict, but barrier use specifically for bears does not holds true. In India, most forest lands are interspersed with human habitation, to completely corner off forest from the villages is an unimaginable and expensive task even for the State Government. Even, wherever Barriers have been used, they show limited success, because the establishment and maintenance require huge investment. The purpose of the method also gets negated when people venture into forest, undermining the distinction between human and bear habitat, established by the barrier.

The main problem with most fear provoking stimulus is that animals soon learn that they pose no real threat and then ignore them. Also bears are behaviorally complex mammals and individual responses to repellents and deterrents should be expected (Gillin et al. 1992 as cited by Dolson.S, 2000). Factors affecting a bear's response to such treatment include temperament, dominance, reproductive status and past experiences with humans. Thus any method use must be implemented strategically and take into account the site and situation specifics for its effectiveness.

Reactive methods such as, translocation and Culling can be used in conjunction with these non-lethal methods, when problem bears fail to respond suitably to negative conditioning or when bear behavior is believed to pose an immediate threat to human safety.

B. Reactive Methods: When a bear invades human dominated landscape, conflict becomes inevitable. It is when management of mob becomes important, but care has to be taken about the conflict animal as well. The objective should be to give the animal enough space and opportunity to return to its habitat, and situation specific rescue measures can be undertaken. If the animal is in an open area surrounded by people, all attempts should be made to keep the crowd and local people from approaching near the animal, and the animal should be allowed to escape under the cover of darkness, or an escape route towards the forest should be kept open. Drug immobilization should be avoided in situations where the animal is in the open, and especially a certified veterinarian is not present, since a darted animal in the open can retaliate and injure people when agitated, as was the case in a village of Shahdol District in Madhya Pradesh.

   When managing a Problematic Bear as a reactive strategy, The Forest Department should look at 3 main options:

   a) Lethal Control: Lethal control are normally used as a “corrective “mode, meaning that it

is employed only after a damage has begun and are used as a last resort, only after potential nonlethal means to solve the problem have been tried unsuccessfully. In case of repeated fatal attacks on humans by a bear, the use of lethal control (through gun shooting only) is warranted by the Wildlife Protection Act, even for a Schedule-1 species. In such a case, it is required that the RRT's be immediately mobilized to undertake the task of identifying the responsible individual and its rapid elimination by a qualified veterinarian, rather than wait for subsequent incidents to occur. However, such cases are very rare in Madhya Pradesh, and often actions are taken under public and political pressure, which should be avoidable at all cost. Another problem with the lethal technique is the danger that the wrong individual will be killed and at present scenario of the state, this approach does not hold ground as there are very few ways a problematic bear can be distinguished from a regular bear, by just witnessing it. Efforts have to be put, in the application of non lethal techniques over a long period of time to display it effects.

b) Translocation: It mainly consists of transporting live captured animals to a location different from their capture site and releasing them. In wildlife management. In wildlife damage management, translocation has been used either to remove individual animals responsible for depredation or to reduce populations in specific areas. Often, it

is viewed as a favored mechanism to reduce conflict from a site. Unfortunately, the biological realities of translocation are quite different and this makes it quite a controversial technique. Some wildlife species have a strong homing instinct, and bears in general are a classic example of it (Campbell, 1999). Upon release, the species tends to travel in the direction of their capture site and can cover extensive distances in an attempt to reach it, navigating through a dense human landscape which inturn can lead to increase in conflict incidences rather than reducing them. Therefore, it is best to avoid translocation of bears, to a certain extent.

c) Bear Rescue Centre's: The establishment of Rescue centres would help in moving the problematic bears from the conflict "hot spot". This would put faith in locals towards the Forest Department and a sense of security will prevail and additionally the demands of animal activists would be met. Such centers thus can be set up in each of the affected circles. Although, such a plan looks inviting, it is not a long term solution to the problem of conflict. Even the Rescue centers have inherent problems where one has to decide on the maximum capacity to deal with number of animals (the conflict will keep on occurring in one form or the other) and the long term costs associated with maintaining animals in permanent captivity, especially given the lack of funds with the Forest Department.

II) Habitat Improvement & Manipulation:

This is a long term measure, and Forest Department along with the affected communities should work towards attaining this goal, so that conflict between bears and human are checked permanently. It is a proven fact, that conflict is more intense when natural food supplies are low. Therefore, Human wildlife conflict can be avoided or reduced by making habitat changes. This can be achieved by: changing the resource itself or the way it is managed; by modifying the habitat where the resource is located and by changing the surrounding landscape. Efforts have to be made to slowly bring about a reduction in locals dependence of forest by providing alternative sources. Community based projects would be helpful in this regard as in the case of one community based forestry project in Orissa was marked by the recent sighting of a sloth bear (Garshelis et al, 2000). As forested lands outside the reserves continue to shrink and decline in quality due to human activities, more land needs to be protected. All major threats to the habitats must be steadily removed so that no “push factors” can force the animal to move out of his habitat range. Buffers and Corridors must be established and strengthened, between extant patches of forest in order to provide a safe way for their dispersal, rather than forcing them to use degraded or human landscape, which would inevitably cause losses either to human or bear population.

Although, we have highlighted certain action points, but the list is not exhaustive, as some scenarios of conflict can arise abruptly which may not have been pre-empted before. Even, certain approaches may have effectiveness in one scenario of conflict but can also have detrimental effect in another scenario. Therefore, each approach would have to be extensively analyzed for their strength, based on testing in the field and evaluation originating from practical experimentation. As conflict scenario is a dynamic entity affected by several factors the most sensible approach to address human bear conflict is to implement a combination of different approaches while fostering rapid development and use of innovative approaches to address future issues and eradicate the problem.

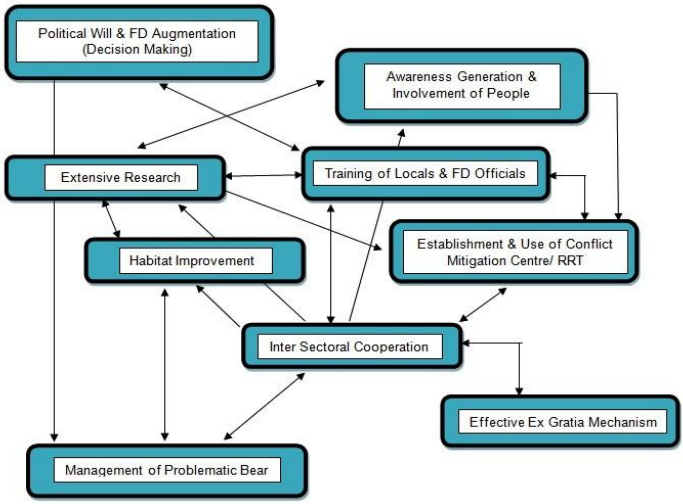


Fig 40: Linkages between different Action plans for an effective functioning.

A flow identify the lin the flow is circ ses and actions feedback on each other. Therefore, there is a need to be adaptive and take necessary steps which

have to be in lieu with the current economic and cultural context of the region and have support from all quarters.

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APPENDIX I

Appendix1: Table showing Champion & Seth vegetation type, 1968 (Aggarwal et al,2003)

Sl. No	Vegetation Type	General composition
1	Tropical wet evergreen forests	Dense Tall forests, entirely evergreen or nearly so
2	Tropical semi evergreen forests	Domants includes deciduous species but evergreens predominants
3	Tropical Moist deciduous forest	Dominants mainly deciduous but sub-dominants and lower story largely evergreen top canopy even and dense but 25m high
4	Tropical dry deciduous forest	Entirely deciduous or nearly so top canopy uneven rarely over 25 m high
5	Tropical throny/ scrub forests	Deciduous with low throny trees and xerophytes predominats top canopy more or less broken, less than 10 m high
6	Tropical dry evergreen forest	Hard leaved evergreen trees predominates with some deciduous emergent often dense but usually under 20 m high
7	Littoral and swampy forest	Mainly evergreens of varying density and height but always associated predominantly with wetness
8	Subtropical broad-leaved hill forests	Broad-leaved largely evergreen high forests
9	Subtropical pine forests	Pine associated predominates
10	Subtropical dry evergreen forests	Low xerophytic forest and scrubs
11	Montane wet temperate forests	Evergreen without coniferous species
12	Himalayan wet/ moist temperate forests	Evergreen forests mainly scleriphyllous oak and coniferous species
13	Himalayan dry temperate forests	Coniferous forests with sparse xerophytic undergrowth
14	Sub-alpine forests	Stunted deciduous or evergreen forests, usually close formation with or without confers
15	Moist alpine	Low but often dense scrub of evergreen species
16	Dry alpine	Xerophytic scrub in open formation mostly of deciduous in nature

APPENDIX II: Table showing the availability of Non Timber Forest Produce & other eatables throughout all months, utilized by both Sloth bear & Communities

Food Item	S. Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Aonla	*Emblica officinalis*												
Bel	*Aegle marmelos*												
Ber	*Ziziphus mauritiana*												
Char	*Buchanania lanzan*												
Harra	*Terminalia chebula*												
Jamun	*Syzygium cumini*												
Kosam	*Schleichera oleosa*												
Mahua	*Madhuca indica*												

Mushroom	*Various spp.*												
Tendu	*Diospyros melanoxylon*												
Amalatas	*Cassia fistula*												
Mango	*Magnifera indica*												
Macai	*Zea mays*												
Honey	N.A												
Termites	N.A												

	Non Availability
	Availability

APPENDIX III: Possible tools to deter sloth bears

Human sloth bear conflict in Madhya Pradesh is generally viewed to be caused by “problem” bears. But the truth is that most bears that come into conflict with humans living on the fringes are simply looking for food not trouble being shy and elusive. Conventional methods like relocation and culling can work to reduce human bear conflicts over the short period by temporarily removing bears, but they fail to resolve the problem over the long term. To achieve a level of coexistence, communities must address a number of measures like bear proofing waste systems and eliminating attractants, as well as authorities initiating effective and consistent educational programs; and stepping up enforcement. However, no matter how prepared a community is human bear conflicts will continue to occur until the time the habitat is degraded in both quantity and quality. Although Habitat improvement is a long term measure, one can grant the use of non-lethal bear management techniques to counter the conflict. But, before using the tools, there is a need to make sure that, the bear is actually in position to cause physical damage to the victim in an encounter. Certain behaviors like huffing, staring, paw swatting, standing upright & bluff or false charge can work as clues to prepare the victim well before the actual attack. As discussed in the previous chapter a range of tools and techniques have been put to use in countries plagued by other species of bear namely, Grizzlies and black bears , so that one can deter bears from attacking humans. Therefore, the applicability here in India on sloth bears has to be experimented, before they can be put to use in the field.

1) Most villagers in order to collect NTFP move in dusk and dawn times and sloth have been known to use the night as a cover for movement. Often due to its shaggy black coat, the presence is not accounted by the villagers. Thus, simple Light Emitting tools like High Powered Torches, flashing lights or fire mashals (fire sticks) is warranted, when one venture inside the forest in the night. However, the use of the fire mashals is not recommended to a great extent as it can cause forest fires, if handled inappropriately.

2) Noise Deterrents have been widely popular to deter bears as it works by making a loud, unpleasant sound that causes the bear to be uneasy and move away. If alone, carrying a radio tuned to a talk show, or making loud noise in a group can persuade a bear to leave the area. It's the human voice that has been tested to deter rather than music. Other tools like Air horn, a device which produces loud noise by means of compressed air; and Vehicle sirens has the potential to be used effectively in the Indian scenario to deter sloth bears. Similarly, local devices like "Ghatkundi" which emits loud noise when banged on the ground, crackers, as well as Can filled with pebbles make effective noisemakers and thus, can be put to test to estimates their effectiveness.

Thus, Noise deterrents are advantageous as a villager can use them from long distance from the bear. Furthermore, they cause neither harm nor injury to the bear when correctly used.

3)  Unlike most physical deterrents, the use of water when diluted with vinegar as an olifactory stimulus has also found its success in deterring bear. A large toy water gun can be used to blast the solution in the face of bear, avoiding a direct blast into the eyes.

4)  Stones similarly a size of golf ball can be used to be thrown with the help of Slingshots. Caution has to be taken that the user should not aim at the face, but rather aim at the rump of the bear.

5) Studies indicate that bears nose is 100 times more sensitive than a humans. Taking this into account, Bear Sprays are widely used in averting human damage from Grizzlies and Black Bears in North America. Bear spray is considered a good last line of defense when attacked by a bear in these parts.

   Bear spray, also known as pepper spray, is a combination of a propellants and an active ingredient called oleoresin capsicum. It is an inflammatory agent that upon contact with mucous membrane causes symptoms like burning, tearing swelling in the eyes and nose and instant inflammation of throats and lung

tissues. The result is pain, but only temporary. Toxicity tests have shown no lasting harm on the skin and eyes of the animals they are being used. The ingredients are packed into a canister with a trigger & safety lock to make sure that no unwanted sprays occur. The spray is found to be most effective when they are directed towards the eyes and nose of the approaching bear, which causes bear to deter their current activity, in this case the attack.

However, the spray is only found to be effective for a short time. Thus, it is prescribed to leave the area immediately. Other important factors that determine the effectiveness of bear spray are wet or rainy weather, extremes of heat or cold and strong winds as using bear spray on windy days can blow the spray back to the user and temporarily disable him and make him more prone to the attack.

Studies have shown that bears learn to ignore such devices over time and figure that they do not cause any harm, Therefore, tools that randomly produce a different noise each time they are activated or have lights that flash in different patterns are more effective than something with a single repetitive mechanism. However these tactics ultimately depend upon variables like the age, dominance, sex, breeding status, physical condition, personality of the bear, its prior experiences with humans, the continued availability of anthropogenic

food sources and attractants, the availability of natural foods, and most importantly the manner in which aversion techniques are applied (Responding to Human Black Bear Conflicts, Bear Smart Society, 2010).

The Madhya Pradesh State Government & the Forest Department should try to first test all these devices in test conditions, proceeding to an actual field experiments, to test their efficacy and feasibility. If tested positive, these tools should be produced at a mass scale so that they can be provided to the needy with adequate training and expertise in handling because, if these tools are used improperly they can cause injury to the bear as well as the user himself.

APPENDIX IV: Dealing with Sloth Bears

Here we try to establish certain guidelines that would help in preventing Sloth bear attacks on humans, while venturing into forest.

- If you are venturing into a sloth bear habitat, there is a need to avoid crepuscular period as bears are most active at this time.
- It is best to move in large groups while going inside the forest, Always try to make loud noises and look for bear signs. This will avoid surprising the bear, as it is witnessed that most bear attacks occur when humans stumble upon and startle a bear. It is also advised not to carry food items and if it necessary, it should be properly stored, so that odors don't come out.
- If a sloth bear is sighted there is a need to fight the urge to run. Sloth bears though look bulky, but can sprint at estimated speeds up to 50 km/h for shorter distances. Running away from the Sloth bear may trigger its hunting or pursuit response and it is for certain that it will run you down. Even traditional way of avoiding bears i.e. climbing a tree to escape does not hold ground as sloth bears are excellent climbers.
- The only option is to stay calm and quickly check to make sure , that you are not unintentionally blocking the sloth bears avenue of escape
- Also watch out for any signs of cubs and make sure you never get between a female bear and her cubs. If you inadvertently do, move out of the danger zone as quickly as possible; remember not to turn backs on bears while doing so.

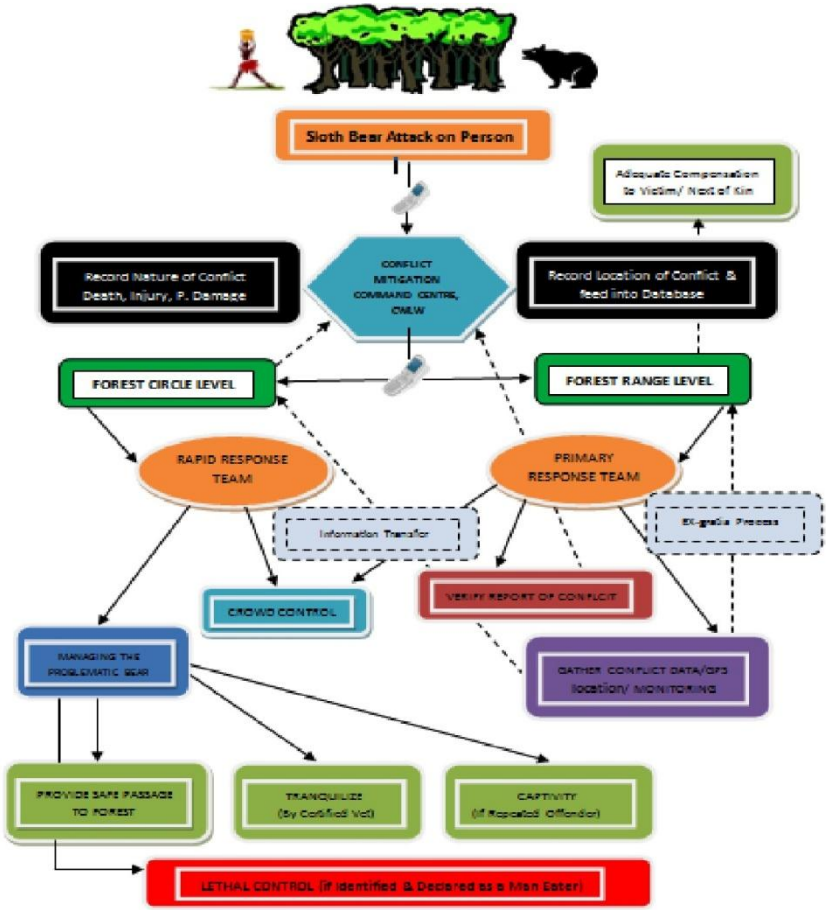
- Try to move slowly out of the way or back away slowly, being careful not to trip, preferably to stay upwind of the bear.
- If you are found upon in the downwind, and the bear doesn't known of your presence yet, try to make as little noise possible and proceed back stepping.
- If the sloth bear has seen you (sloth bears have highly tuned smelling sense) and is not charging, leave the bear as it may. Don't do anything, but do keep an eye till he appears to be dangerous.
- Often bears will bluff charge, which is a warning the human (threat) to back off, which one should comply.
- Try not to stare into bear eyes as the sloth bear may interpret direct eye contact as aggressive behavior. It is better to avert your eyes and turn the head sideways, which is a more submissive pose.
- If the sloth bear is found charging towards you and is not a mock charge, wave your arms, yell and make as much noise as possible (if in a group), or throw rocks (if alone) to scare it away. This will allow the bear to identify you as a human and a bigger threat to actually charge, which is an immediate instinct of the bear (aggressive towards threats).
- Should the worst happen and the bear grab you, do not play dead as it may invite severe mauling. Yell and shout back and let the bear know that you will not be attacked so easily. Either try to bundle up and protect all your vital organs, especially head, eyes, neck with arms, while lying on your stomach or lie on your side in a foetal position with your legs and head tucked

into your chest. Any bag u might be carrying can also act as a shield

- Another option is to hit with whatever is in your hand (stick, axe or stone) especially on the bear nose that has been recorded to deter bears.
- Don't move or get up until you are certain the bear has moved a distance away.
- If you have sighted a bear in the vicinity there is a need to raise an alarm and let your fellow men know immediately. Stop whatever you are doing, get together in a cleared area and brace up for any attack.

Apart, from these points of evading sloth bear attacks, always remember that you are invading the bear's habitat and it is you who pose a greater threat to their peace, safety and security, not the other way around. And last but not the least, respect Bears and their habitat and it's highly unlikely you will face the situation of conflict.

APPENDIX V:Protocol to be followed when attacked by Sloth Bear



APPENDIX VI:

High Priority Villages in Madhya Pradesh (Based on primary data)

S.No	Forest Circle	Forest Division/Range	Village Name	History of Attacks
1.	Jabalpur	Dindori FD/E.Karanjiya	Chauradadar	27 cases (incl 2 deaths)
2	Rewa	Sidhi FD/ Mohan	Tansar	12 cases (4 death)
3	Rewa	Singrauli FD/ Marha	Jeer	6 cases (1 death)
4	Seoni	South Seoni/Ugli	Mohbarra	6 cases (1 death)
5	Shahdol	S.Shahdol/Khhanaudih	Mitaura	5 cases (1 death)
6	Hoshangabad	Sohagpur Range	Pathrai	5 cases (2 death)
7	Hoshangabad	Sohagpur Range	Nimora	5 cases (1 death)
8	Balghat	S.Balaghat/ Lalbarra	Chikhla badi	3 cases (1 death)
9	Shahdol	Anuppur, Kotma Range	Jhimar	6 cases
10	Chhattarpur	South Panna, Kalda	Mahuadol	6 injuries

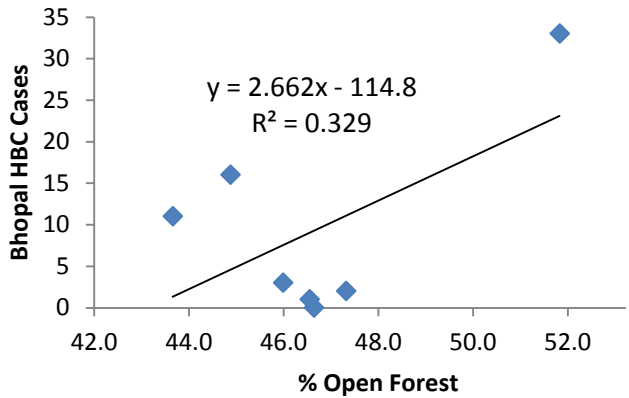
Forest Classification Scheme:

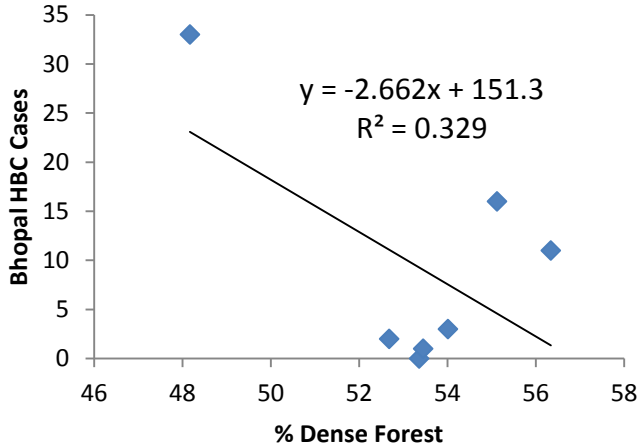
Forest Class	Canopy Density (%)
Very Dense Forest	70% and Above
Moderate Dense Forest	40%-70%
Open Forest	10-40%
Scrub	10% or less
Non Forest	Area not included

APPENDIX-VII

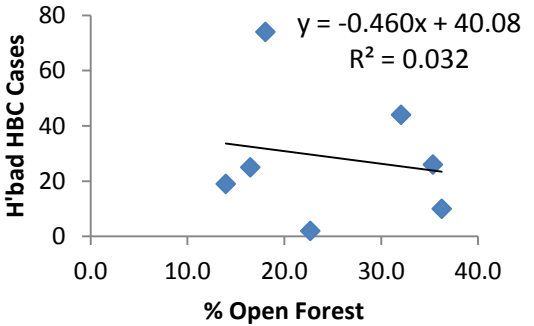
Linear Regression Graphs for Forest class and sloth bear conflict in affected forest circles of Madhya Pradesh.

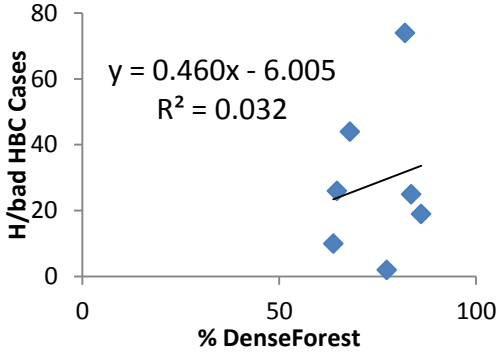
1) Bhopal Forest Circle



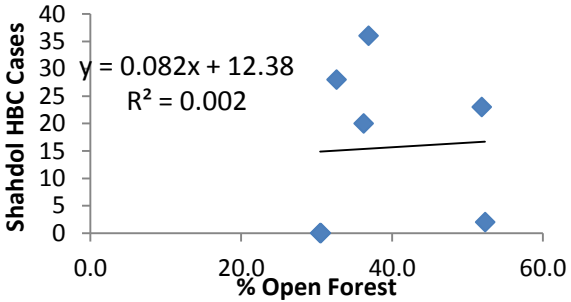


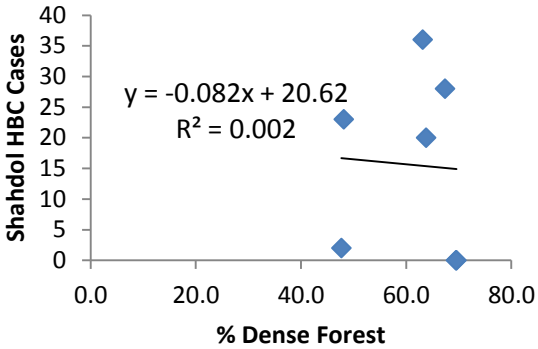
2) Hoshangabad Forest Circle



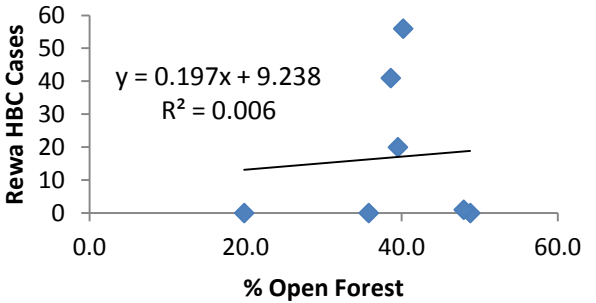


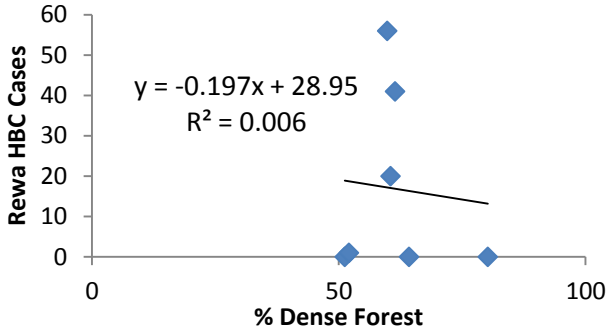
3) Shahdol Forest Circle



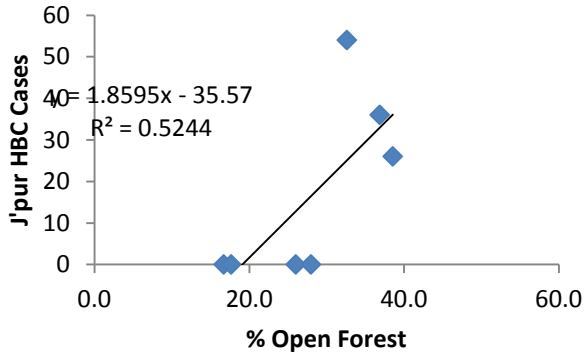


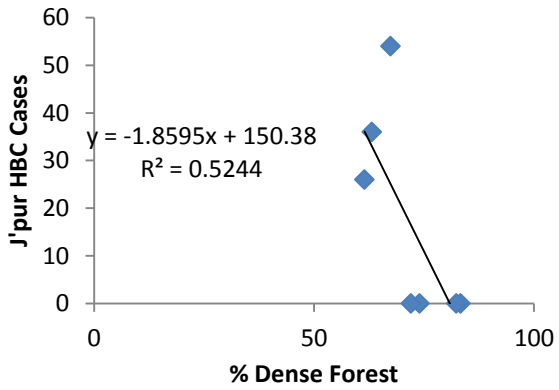
4) Rewa Forest Circle



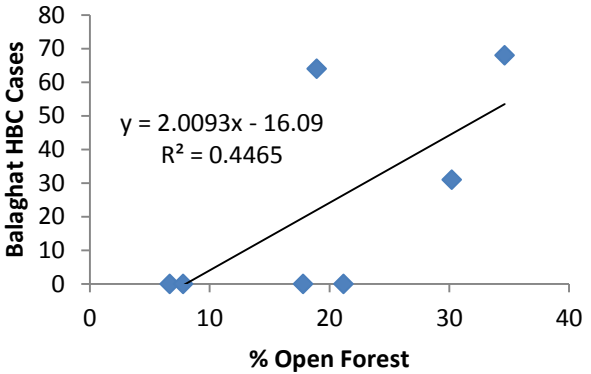


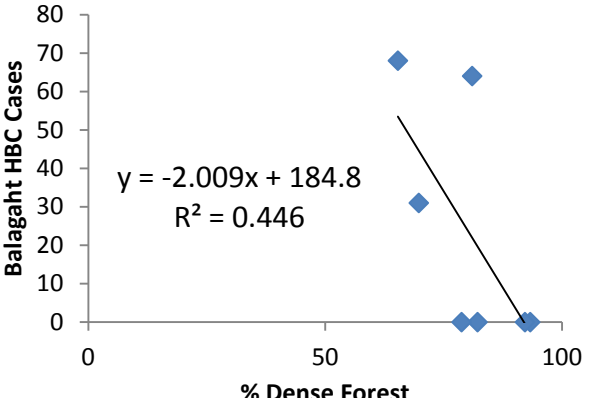
5) Jabalpur Forest Circle



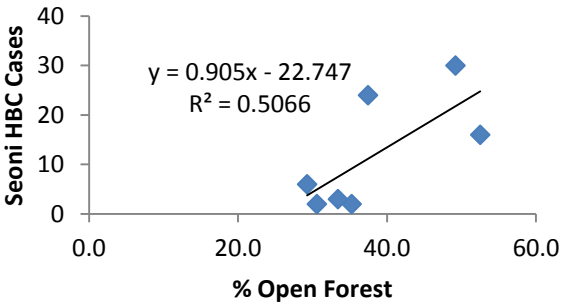


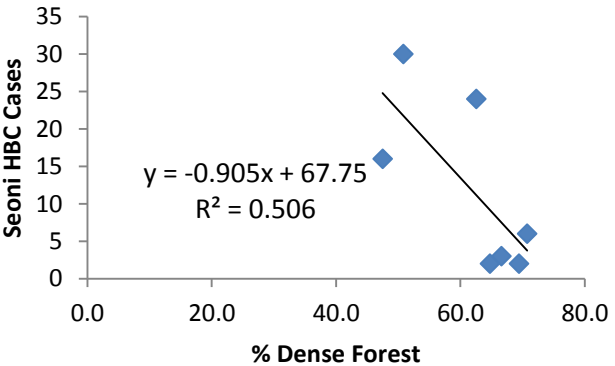
6) Balaghat Forest Circle



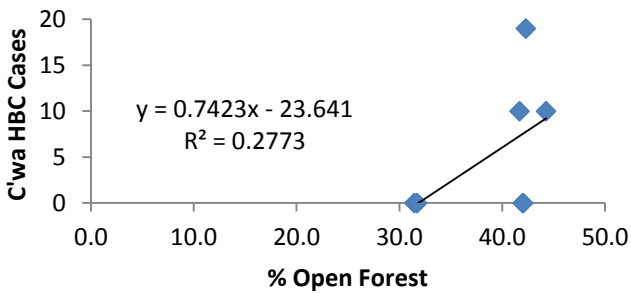


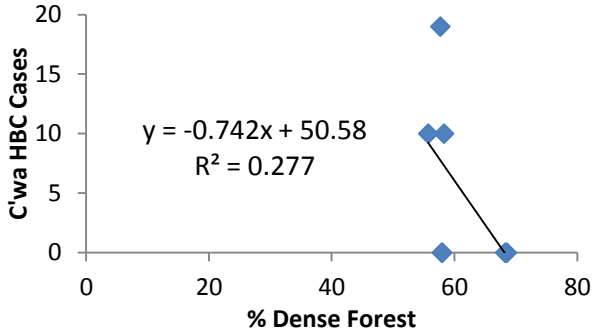
7) Seoni Forest Circle



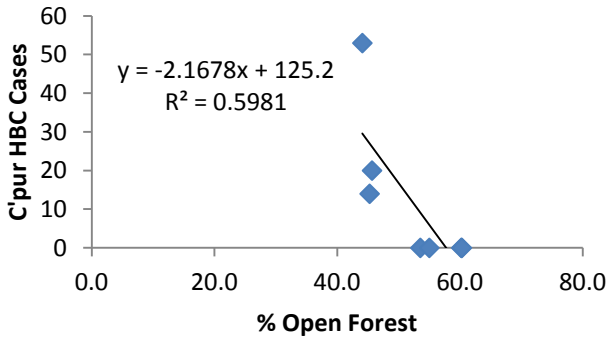


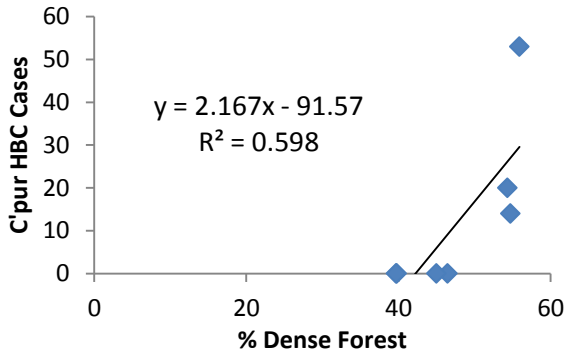
8) Chhindwarha Forest Circle



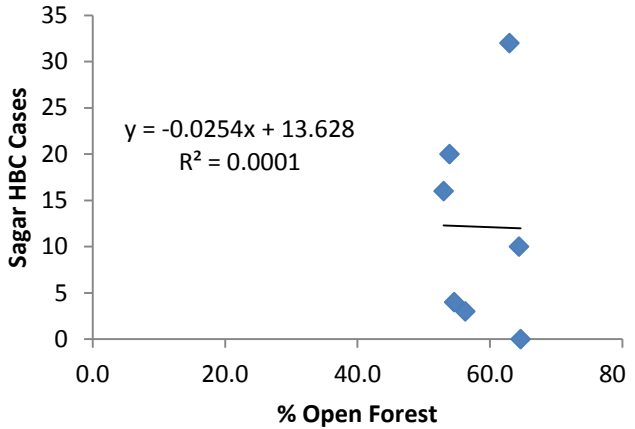


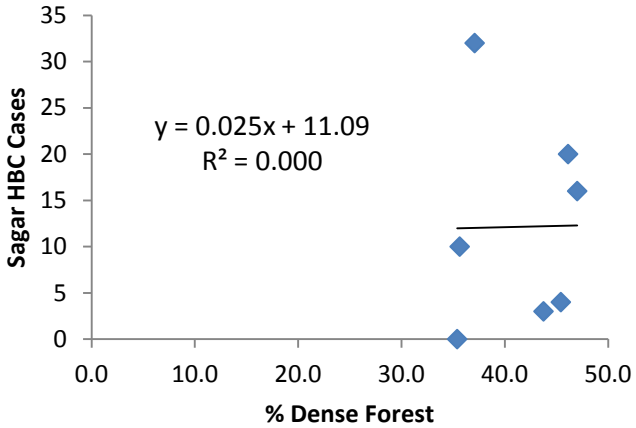
9) Chhatarpur Forest Circle



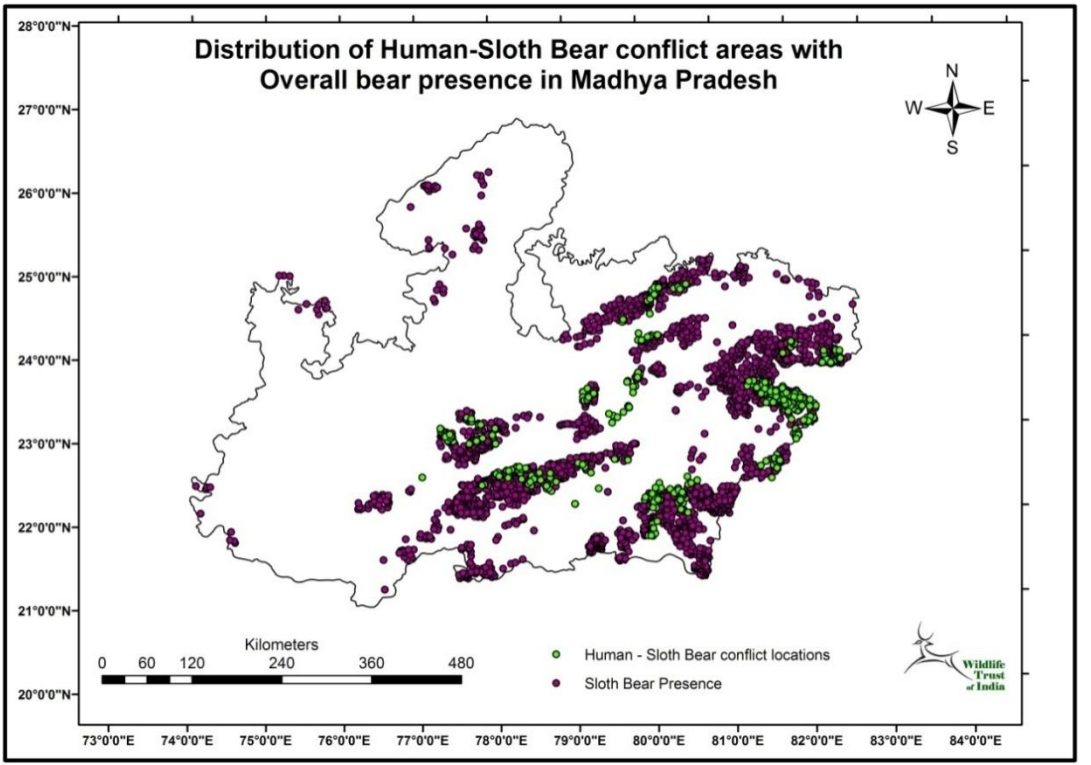


10) Sagar HBC Cases





APPENDIX-VIII



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‘Bear Necessities’ discusses the need for a scientific approach to understand the human-bear conflict that is on the upswing since the past few years. This report documents areas of varying intensities of conflict between humans and sloth bears in the central Indian State of Madhya Pradesh and recommends some short and long-term measures to mitigate this conflict.

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