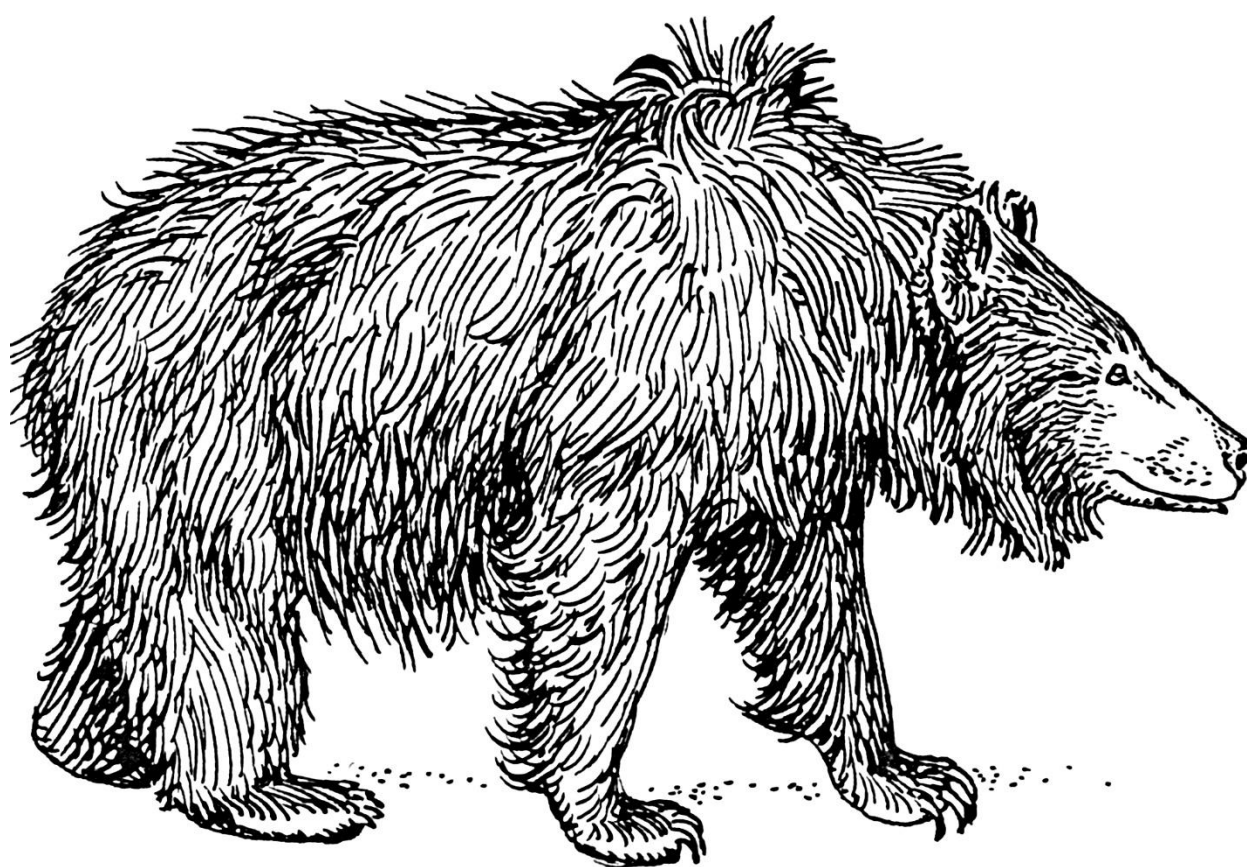


SLOTH BEARS OF MIRZAPUR



**DEBADITYO SINHA
LAXMI GOPARAJU
SHIVA KUMAR UPADHYAYA
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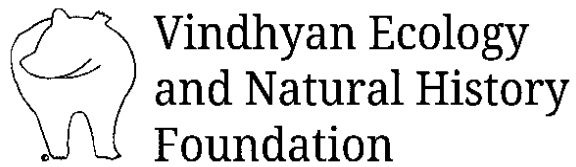
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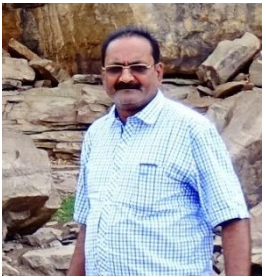
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FOREWORD

Seasonally dry tropical forests are home to a wide variety of unique wildlife that must struggle to survive under harsh conditions and adapt to months of little rainfall followed by a brief season of heavy rain. With more spaces between trees and lush green ground cover during the rainy season, larger mammals are more prominent in a dry tropical environment. Sloth Bear is one such species which is particularly confined to seasonally dry forests India. These forests are themselves one of the most endangered ecosystems due to frequent fire, overgrazing and exotic species invasion, biomass removal, extraction of minerals, quarrying, etc. Estimates indicate that approximately 40 percent of the seasonally dry tropical forests in India are degraded.

Sloth Bears are considered vulnerable animals as they are threatened by this habitat degradation and loss. Once they were captured for public entertainment, but due to a creation of general public awareness, demand for ‘dancing’ bears have now drastically reduced in India. However, they are occasionally hunted due to their aggressive behaviour and destruction of crops. Sometimes, they are also poached for use in Chinese medicines. Because of all these, Sloth Bears are placed in Red List Vulnerable Category and are provided legal protection by listing in Schedule I of the Indian Wildlife Protection Act, 1972. They are also listed in CITES Appendix I. Although reliable population estimates are not available for the species, Sloth Bear populations are assumed to be declining throughout the country due to continued habitat loss and degradation.

It is my firm belief that conserving tropical dry forests is essential for the survival of Sloth Bear populations. We also need steps to mitigate human-bear conflicts by generating a better understating of species behaviour. As effective conservation of wildlife in tropical dry forests requires the preservation of large and continuous areas of forest, we have to identify critical habitats and corridors used by Sloth bears. In this regard, present study report on Sloth Bear Habitat by Vindhyan Ecology and Natural History Foundation in support of World Wide Fund for Nature-India is highly commendable. My experiences in Vindhyan Highlands reveal that the area is an important habitat for Sloth bears. However, these are constantly under threat due to anthropogenic pressure. I strongly feel that the recommendations incorporated in the report are practical one and adaptation of the same will result in better conservation of the species.

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The authors are highly grateful to the villagers and forest working people who gave their valuable time, support in field and also sharing their knowledge. A greater share of credit goes to them who have actually helped us identifying the sloth bear habitats, recording their signs and understanding the problems faced by the forests.

The authors also wish to thank their family, friends and well-wishers for their moral support and help.

Debadityo Sinha
Principal Investigator

SUMMARY

The forests in Mirzapur district are under managerial jurisdiction of two separate forest divisions- Mirzapur Forest Division and Kaimur Wildlife Division. The present study is carried out in Mirzapur Forest division except the forests coming under jurisdiction of Kaimur Wildlife Division. The Mirzapur forest division consists of eight forest ranges namely Marihan, Sukrit, Chunar, Wyndham Fall, Patehara, Lalganj, Mirzapur and Dramadganj forest ranges. Patehara and Dramadganj are in vicinity of Kaimur WLS's Halia range, while Sukrit range is in vicinity of Chandraprabha WLS situated in neighbouring district Chandauli.

In the study, the Marihan-Sukrit-Chunar landscape (MSC) and Patehara-Halia-Dramadganj (PHD) landscape emerged as two important forest areas in Mirzapur district in terms of biodiversity richness. The forest in Lalganj, Mirzapur and Wyndhamfall ranges are also important but since these are severely degraded, efforts are required for conservation of these three forest ranges to ensure free movement and survival of animals from neighbouring forest ranges.

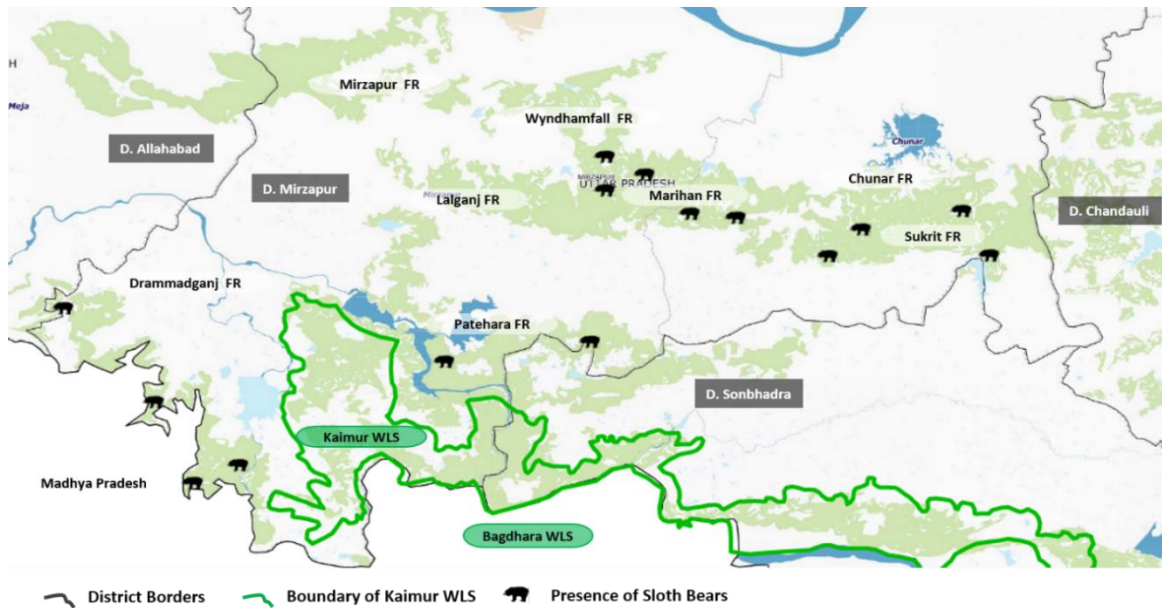
In this study, the sloth bear areas were first analysed based on the secondary information available with Mirzapur forest department and information collected from villages located around the forests. An off-site habitat analysis using remote sensing was then done to identify potential sloth bear habitats and movement areas based on parameters such as terrain, nearness to water sources, continuity of forests, distances from human habitation, etc. The survey sites were then selected based on our discussion with forest staff, with primary concern being security and accessibility by motor vehicle while ensuring that a representative area of every possible sloth bear dominated forests could be surveyed. The ground-truthing survey was done for different forest beats within five forest ranges (Marihan, Sukrit, Chunar, Patehara and Dramadganj) in the month of February, 2016. The presence of sloth bears was mainly assessed using their scat, scratch mark and typical bear dug out. Man-bear conflict is quite commonly reported in most of the areas surveyed. In majority of the cases, the confrontation with the animal occurred inside forests during collection of fuelwood and fruits such as Mahua by villagers. Bear attacks are also reported near village water sources during morning defecation. Some of the key man-bear conflict prone areas are Rajapur and Sarso Semri (Marihan range), Bhavanipur (Sukrit range), Sarsawa (Patehara range) and Banjari Kala (Dramadganj range). The problem of man-bear conflict is quite complicated and becoming serious conservation issue. The main driver seems to be the increasing competition for habitats and resources between men and bears. A possible region wise explanation for the man-bear conflict is discussed in details with help of recent satellite images in [Chapter 6](#) of the report.

Table 1 Summary of Survey Findings

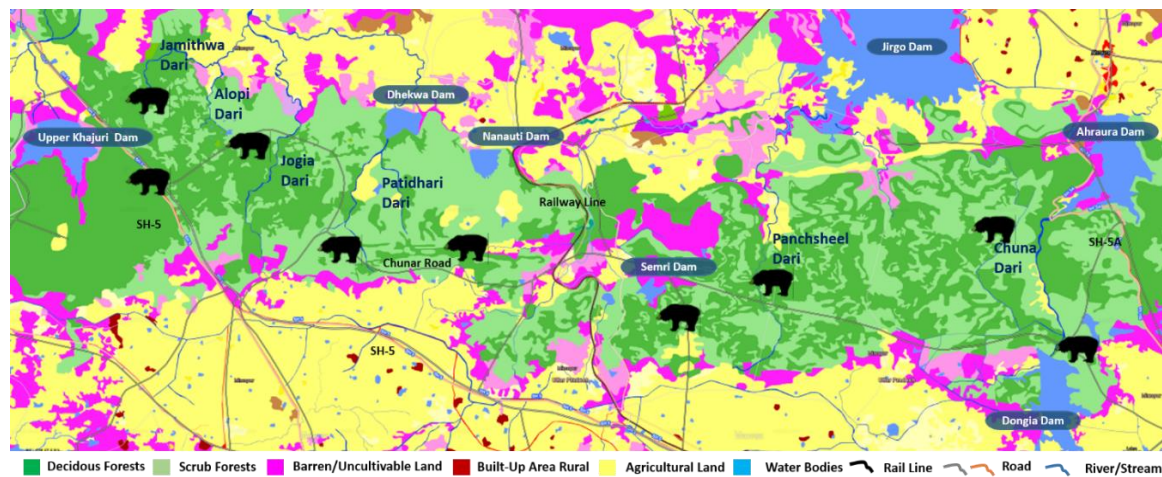
Range	Presence of Sloth Bear Signs		Other Important Schedule I or/and Endangered Animals (source: Forest Dept. records and villagers survey)
	Total sighting/total distance	Frequency (per km)	
Marihan	55/11 Km	5	Leopard, Blackbuck, Chinkara, Mugger Crocodile, Egyptian Vulture, Bengal Monitor, Sambhar etc.
Sukrit & Chunar-Sakteshgarh	142/12 Km	11.8	Leopard, Sambhar, Chinkara, Chital, Bengal Monitor etc.
Patehara	26/4.25 Km	6.1	Leopard, Swamp Deer, Chinkara, Chital, Mugger Crocodile, Bengal Monitor etc. Tiger*- occasional (sighting frequency: once in a year or two)
Dramadganj	16/4.9 Km	3.3	Leopard, Chital, Blackbuck, Blackbuck, Mugger Crocodile, Bengal Monitor etc. Tiger*- occasional (sighting frequency: once in few months)
*reported based on sightings by villagers living in and around the forests who were able to tell the difference between leopard and tiger.			

Following are maps showing Sloth Bear habitats, forests ranges and Bhuvan Land Use Land Cover maps of 2011-12 showing different land uses, important drinking water sources, streams etc for Marihan-Sukrit-Chunar and Patehara-(Halia)-Dramadganj region.

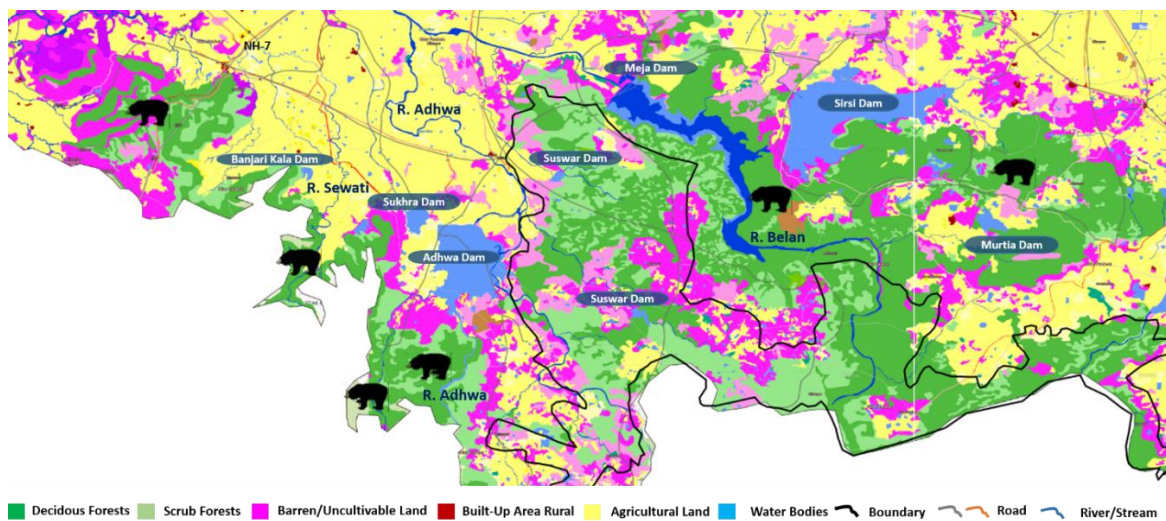
Sloth Bears of Mirzapur, 2017



Map 1 Sloth Bear habitats and forest ranges of Mirzapur (base map: Bhuvan, GoI)



Map 2 Important drinking water sources, streams and other land uses in Marihan-Chunar-Sukrit landscape.



Map 3 Important drinking water sources, streams and other land uses in Dramadganj-Patehara landscape.

The following table shows the major drinking water source in each forest range (also shown in the LULC maps above).

Table 2 Major Drinking Water Sources in each Forest Ranges

Range	Drinking Water Sources	
	Seasonal Streams	Perennial Sources
Marihan	Jogiadari, Alopi Dari, Jamithwa Dari, Patidhari Dari. (<i>Dari: River in local language</i>)	Dhekwa dam, Nanauti dam, Semri dam, Dongia dam, Upper Khajuri dam. Small check dams created by forest department.
Sukrit & Chunar-Sakteshgarh	Chuna Dari, Panchsheel Dari	Pools formed below the waterfalls at Chuna Dari and Panchsheel Dari, Dongia Reservoir, Semri Reservoir Small check dams created by villagers.
Patehara	River Bakahar, River Belan	Sirsi Reservoir and Meja Reservoir Small pools on rivers.
Dramadganj	River Adhwa, River Sewati	Adhwa reservoir, Sukhra Reservoir, Banjari Kala Reservoir, ancient baoli and artificial ponds created by local people.

Degradation of forests ecosystems and fragmentation of habitats at landscape level are the main threats the wildlife of Mirzapur is facing today. There has been considerable land use/land cover change in this region which can be attributed to the unregulated developmental activities, uncontrolled agricultural expansion and unplanned mining activities in and around the forest areas, thus creating unprecedented pressure on the wildlife habitats and their movement pathways. Roads, railway corridor and canals are some of the major linear disturbances responsible for fragmentation of habitats and greatly reducing the accessibility to resources necessary for survival of the wild animals. Invasion by exotic species of plants such as *Hyptis suaveolens* and *Lantana camara* in the forest areas are also indicator of the deteriorating health of the forests and the ecology of the area.

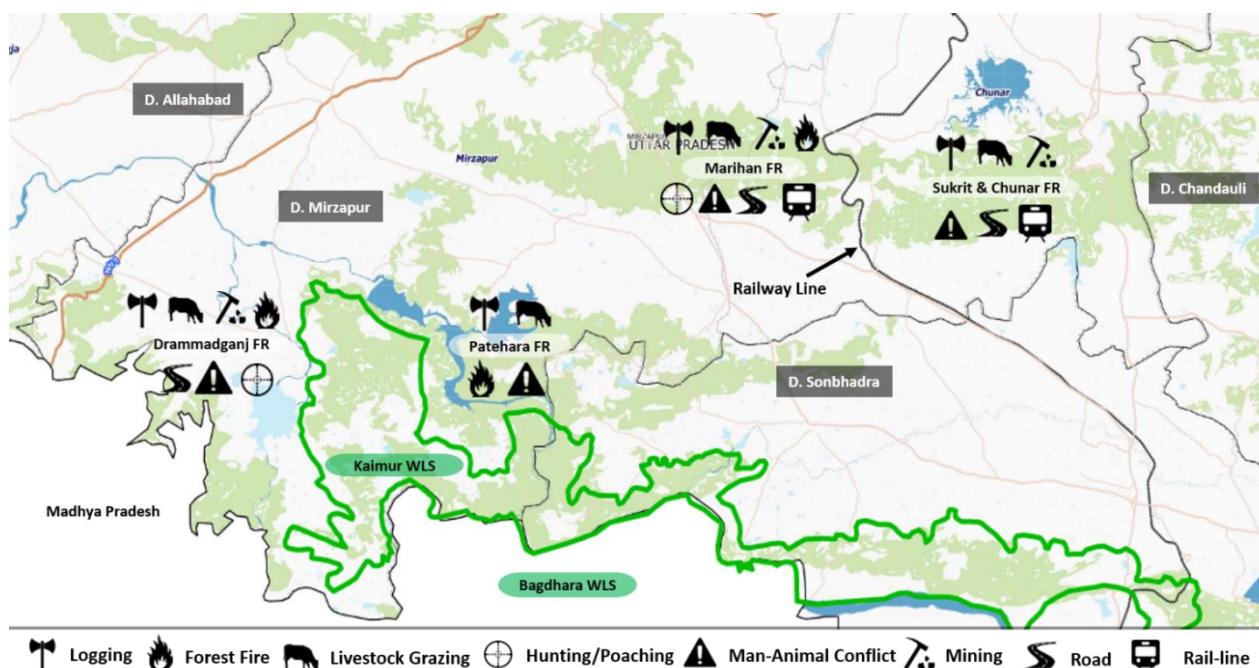
Human interference in the forests is also found to be very high in the district. Logging activities and livestock grazing were found to be unregulated in most of the forest ranges with an

exception of Marihan range where grazing activities seems to be controlled to some extent. Forest fires are very common in the forests. Hunting of animals including Scheduled animals are reported from some forest ranges. Reports of wild animals being injured or killed out of rage by villagers are not uncommon in the region. Monitoring of the forests and wildlife was found to be negligible in all the forest ranges, primarily due to lack of staff in the forest range offices. A summary of different threats observed for each forest ranges is presented below:

Table 3 Summary of Threats observed in each forest ranges

S.No.	Threats	Marihan	Sukrit	Chunar	Patehara	Dramadganj
1	Land Use/Land Cover Change	Y*	Y*	Y*	Y*	Y
2	Logging	Y	Y*	Y*	Y*	Y
3	Livestock Grazing	Y	Y	Y	Y	Y
4	Mining	Y	Y*	Y*	N	Y
5	Linear Disturbances	Y*	Y*	Y*	N	Y
6	Forest Fires	Y*	Y	Y	Y	Y*
7	Hunting	Y	-	-	-	Y
8	Wildlife Conflict	Y*	Y	Y	Y	Y*
9	Invasion by Exotic Species	Y*	Y*	Y	-	-

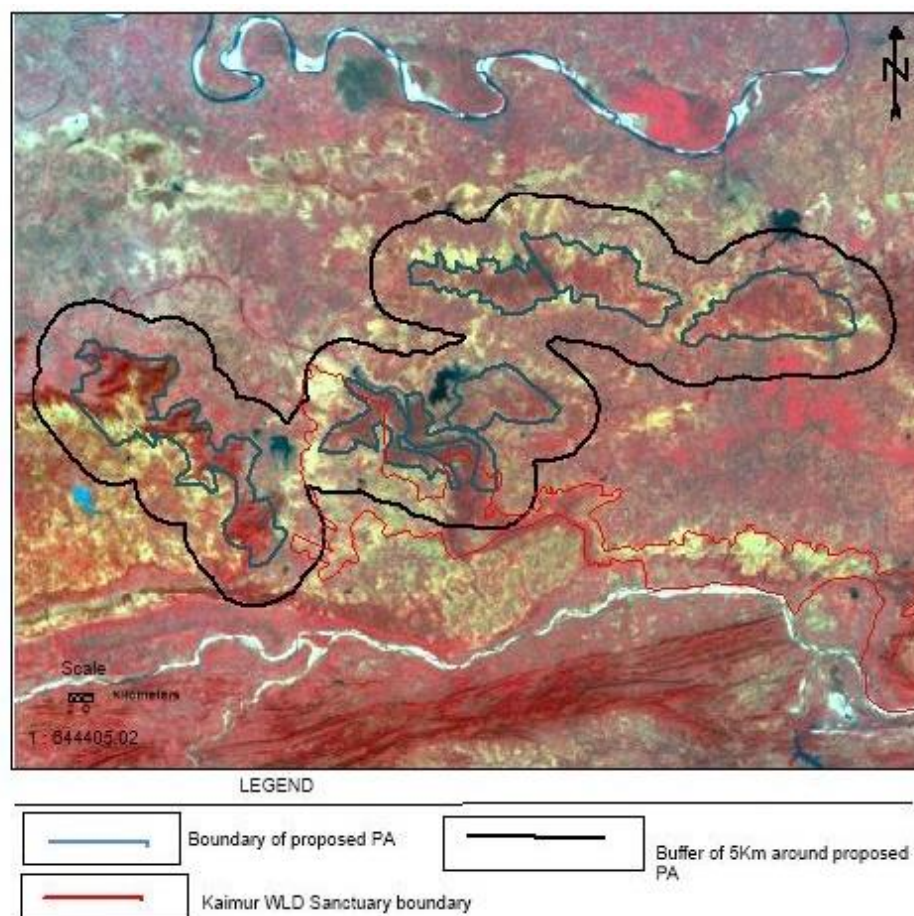
Y: Yes, N: No, *very serious problem, - : not reported during the survey



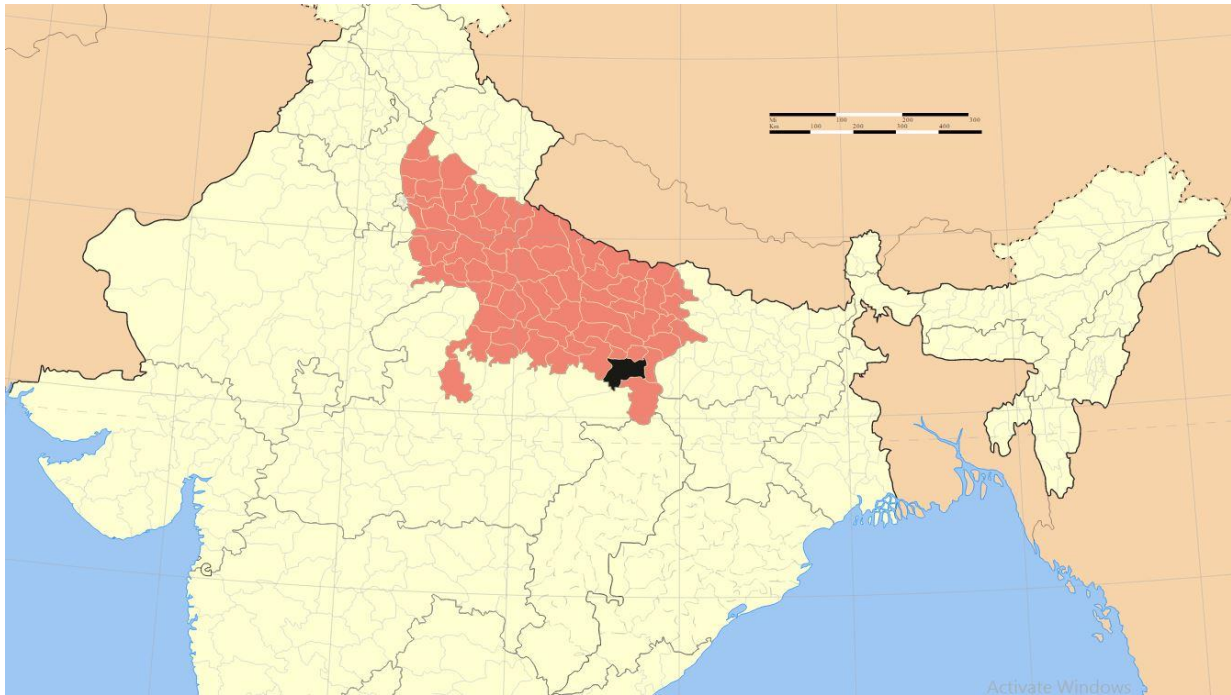
Map 4 Major threats faced by different forest ranges in Mirzapur

Given the present condition, the forests of Mirzapur are getting fragmented at a very fast pace. The current rate of decline in wildlife populations available with forest department records clearly indicates that in coming years, we may see a local extinction of not only

sloth bears but several other protected species if immediate steps are not taken for its protection. Defragmentation of the forests, improving the forests connectivity and protection of the watershed areas are must to conserve the remaining wildlife. This should be complemented by strict monitoring measures as well as legal protection to the wildlife areas. A network of protected areas with at least 5 km buffer area is also proposed in the report in detail. This calls for great administrative reforms and ensuring alternative livelihood to local residents as well. There is a huge scarcity of manpower with the forest ranges, resulting into poor monitoring. Thus more forest staff is required to be recruited with respectable salaries. We hope this report will be helpful to the government in taking effective steps for conservation of the great Vindhyan landscape of Mirzapur which was once known for its rich forests and great diversity but is facing huge anthropogenic pressure today.



Map 5 A proposed protected area map based on critical sloth bear habitats with 5 km buffer proposed Protected Area with reference to Critical Sloth Bear Habitats in Mirzapur Forest Division and Kaimur Wildlife Sanctuary in Mirzapur. (Top: Marihan-Sukrit-Chuna)



CHAPTER 1: INTRODUCTION

1.1 ABOUT MIRZAPUR

District Mirzapur, Uttar Pradesh (India) has a special historical importance in terms of its cultural as well as natural heritage. Mirzapur (*Mirzapore* as named by British) was one of the key places during British rule and most of the prominent places in the district are named after British officers. For eg. Names of Wellesleyganj, Teliaganj, Duncanganj, Robertsganj (now in Sonbhadra) were all named after British officers. It was also one of the major business port on River Ganga during that time. Most of the administrative buildings till date are ones which are constructed by British officers which shows that the district was once very popular administrative and business centre.

Mirzapur was once the richest wildlife areas of India and has been known for its rich wildlife heritage. Forests of Mirzapur and Kumaon used to be free hunting ground in Uttar Pradesh for British officers and Kings. Lord Wyndham, who served 30 years as a collector of Mirzapur is historically known for killing more than 500 tigers and his associate Mohan was termed as the most knowledgeable tiger expert and hunter at that time. Lord Wyndham was also close friends with Jim Corbett, The Wyndham fall, which is the region's most popular water fall is named after him (*Jaleel, 1997*).

A very good description of the wildlife heritage of Mirzapur can be seen in the book 'In the Districts of the Raj' (1992). The author *Y. D. Gundevia*, who was posted as District Collector of Mirzapur next to Lord Wyndham writes:

"Mirzapur had the reputation of being a first-rate shikar district. Was that why no Indian had been posted to Mirzapur as collector till the October of 1939? In all the tarai districts of south of Nepal there were more than three or four forest reserves which were really nothing but game reserves. Jim Corbett had shot all his man-eaters in Nainital. But I am sure there must have been more tigers in an around Mirzapur than in all the tarai districts put together....."

.... All over the Vindhyan plateau-if one traversed by car from Mirzapur to Robertsganj-there was plenty of game. There was any amount of sambar and cheetal, any amount of wild boar and everything else in the antelope family. As one reached the Kaimur ranges one even came upon the black sloth bear here and there."



Image 1 Governor Maurice Hallet and Lady Hallet at Wyndham Falls (Source: Gundevia, 1992)

Another historical account of wildlife of Mirzapur can be found in the 'Journal of Bombay Natural History Society, 1918', an excerpt quoted here:

"On 28th December 1912, during a sambhar beat in lijiht jungle about 25 miles S. of the Ganges, a small animal that I did not recognize came out at very close range. I blew a large piece of its back away with a 600 Express but it made ofl' and took refuge in a small nala where it was shortly after- wards despatched with a shot gun. It proved to be a female lynx {^F. caracal)

I saw not long ago in the possession of a friend a very fine skin of a cheetah {C.jubatus) that had been killed in 1916 by villagers about 30 miles South of Mirzapur, which is on the Ganges near Benares. I think about 5 have been obtained in the last 25 years, one being shot while it was in the act of stalking a sambhar."

The district Mirzapur, which used to be a British headquarter of Central India, lost its popularity post-independence and the region underwent heavy pressures from industries and mining groups. While Sonbhadra became power capital of India after construction of Rihand dam (in 1962), district Mirzapur remained under the shadow of politicians and local mafia who mined the hills for the highly valuable Kaimur sandstone.

The district Mirzapur gained national prominence when the south campus of Banaras Hindu University was established in the beginning of 20th century. The areas which were earlier lesser known and biodiversity-rich suddenly faced a kick from variety of developmental activities. Before that, this region was comparatively pristine than its surrounding districts Allahabad, Varanasi and Sonbhadra.

Though, we get glimpses of the wildlife heritage of Mirzapur in historical texts, and have sufficient knowledge among locals but very few or negligible published documented work is found for the wildlife diversity of Mirzapur forests since the British Raj. In fact, very less scientific studies have been done in tropical dry deciduous forests as compared to rainforests and temperate forests (*Raghubanshi & Tripathi, 2009*). Most of the scientific studies on biodiversity in Mirzapur is focussed on medicinal plants and forest ecology, but hardly any published document on wildlife can be traced in modern India. Due to this ignorance, we have already lost several wildlife habitats and species. Sloth bear, being the flagship and the most important animal which has historically inhabited these forests, we decided to do a comprehensive review of the status of sloth bear in Mirzapur and identify their habitats, movement and threats in present time. We have also attempted to suggest few recommendations to improve the wildlife habitat which we believe will help the State and Centre to understand the problem and take the necessary action. We believe this study will be the pioneer in the wildlife history of Mirzapur and will help the authorities and planners taking measures in protecting this species which is not only protected under law but is endemic to Indian subcontinent.



Image 2 A Sloth Bear in Daroji Sloth Bear Sanctuary, Karnataka (Photo: Avijit Ganguly)

1.2 ABOUT SLOTH BEAR

Sloth Bears are classified under carnivorous mammals (Order: *Carnivora*) and subtype Bear (*Ursidae*). There are two subspecies found- *Melursus ursinus ursinus* which is endemic to Indian subcontinent and *Melursus ursinus inornatus* which is endemic to Sri Lanka (Pocock, 1933).

A. DISTRIBUTION

The sloth bear is endemic to the Indian subcontinent, mainly in India, Nepal, Bhutan, and Sri Lanka (Garshelis, 2008). They are now extinct from Bangladesh (Islam, 2013). In India, the sloth bear habitats are mostly found in Deccan Peninsula, Western Ghats and till foothills of Himalayas extending till North Eastern India. They are known to co-exist with Asiatic Black Bears (Northern Himalays) and Malayan Sun Bears (North Eastern Himalayas) as well.

Sloth bears inhabit a wide variety of habitats, including grasslands, thorn scrub, sal (*Shorea robusta*) forest and moist evergreen forest (Garshelis et al., 1999). In terms of area, over 90% of the area where Sloth Bears occur is Moist and Dry Deciduous forests. About 30% of the forest remaining in India are of dry deciduous type, and these forests hold about 50% of the sloth bear population. The Western Ghats range and central India are the only strongholds of distribution, in terms of population abundance and habitat availability (Yoganand et al., 2006).

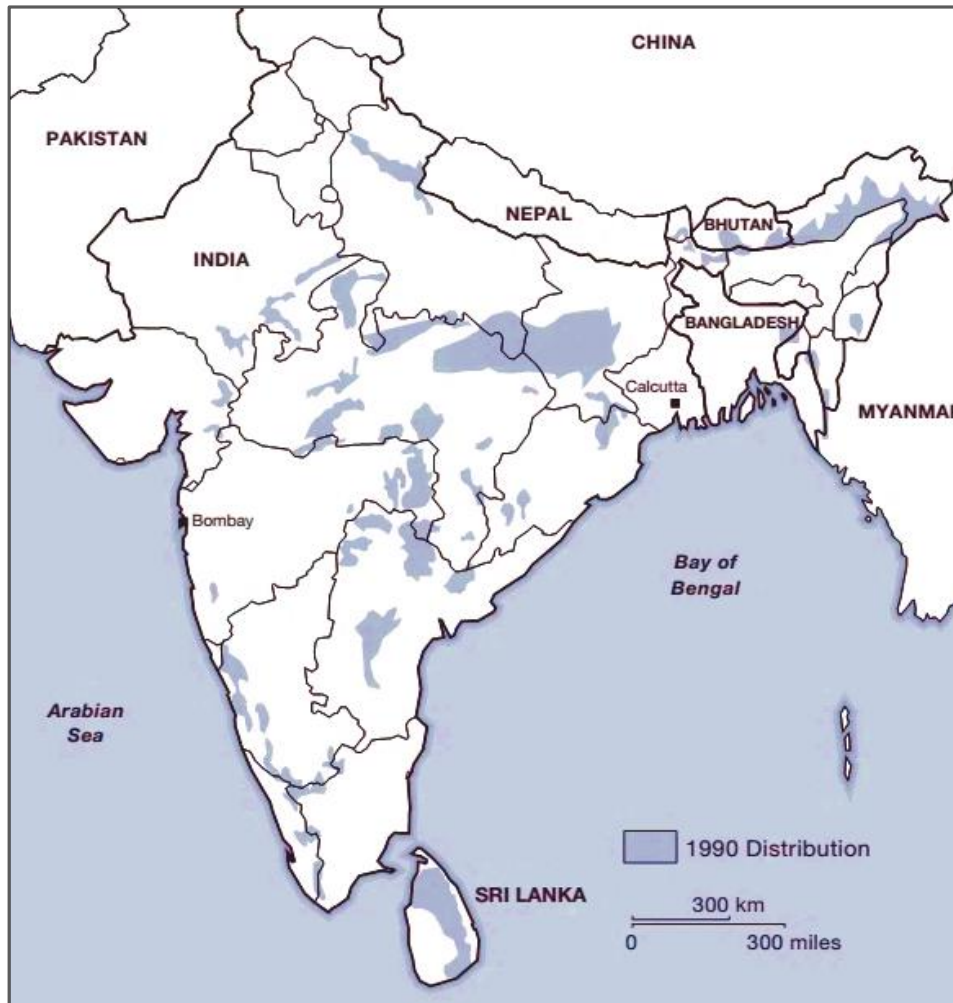


Image 3 Sloth Bear Distribution Map (Garshellis et.al. 1999)

B. FEEDING HABIT

Sloth bears subsist primarily on termites, ants, and fruits. This is the only species of bear adapted specifically for myrmecophagy i.e. ant and termite-eating (Laurie and Seidensticker 1977, Joshi et al. 1997, Sacco and Van Valkenburgh 2004). The ratio of insects to fruits in the diet varies seasonally and geographically (Baskaran et al. 1997, Joshi et al. 1997, Bargali et al. 2004, Sreekumar and Balakrishnan 2002). The diet of the sloth bear consists mostly of social insects and fruits. These are predominantly ground-living ants and termites that are common and found in large colonies, and sugar-rich fruits of commonly occurring plants that produce large fruit crops. They climb trees to feed on honey-bee hives and sometimes to feed on fruits (Laurie and Seidensticker 1977). But usually fallen ripe fruits are eaten off the ground. Sloth bears break into termite mounds with their front claws, suck in the termites and blow away the debris, and also feed on the 'cartons' which hold the termite brood. They turn over rocks and logs to feed on ant and termite colonies. They also dig as deep as 1.5 m into ground to feed on large underground colonies of social insects.

Fruits of *Zizyphus mauritiana*, *Ficus glomerata*, *Diospyros melanoxylon*, *Buchanania lanzan*, *Cassia fistula*, *Aegle marmelos*, *Lantana camara*, *Grewia asiatica*, *Cordia domestica*, *Syzigium cumini*, *Phoenix humilis*, and flowers of *Bassia latifolia* are eaten frequently where these plants occur commonly. The availability of fruits varies with the season as do abundance and nutrient quality of social insects. The diet of the sloth bear follows these patterns of food availability (Yoganand *et.al.* undated).



Image 4 Remains of soil dug out by Sloth Bear during the survey (Photo: Debadityo Sinha)

C. HOME RANGE AND BEHAVIOUR

Very less studies have been done on home range of Sloth Bears in India. However, studies on sloth bear home range has been done for Royal Chitwan National Park, Nepal (Joshi *et.al.* 1995). The annual home range for male and female sloth bears at Chitwan National Park was found to be 14.4 sq.km and 9.4 sq.km respectively. The lowest home range in male sloth bear was found to be 2.2 sq. km (dry season) and 2.3 sq.km (wet season) while the female counterparts had lowest home range of 1.6 sq.km (dry season) and 2.3 sq.km (wet season). The maximum home range of male sloth bear was found to be 13.5 sq.km (dry season) and 21.8 sq.km (wet) while the female counterparts had 13.6 sq.km (dry season) and 18.2 sq.km (wet season). The Home range length were found to be ranging from 2.8 km to 6.9 km in the same study.

In another study done on sloth bear species found in Wasgomuwa National Park, Sri Lanka (Ratnayake *et.al.* 2007) shows that the mean 95% fixed kernel home ranges were 2.2. sq.km and 3.8 sq.km for adult females and males, respectively.

The reason for such small home range in above two studies as compared to other obligate myrmecophages can be attributed to its highly flexible feeding habits. Being mobile and opportunistic, ursids shift their area of use in accordance with changes in abundance and

distribution of foods. Home range shifts, corresponding with changes in food availability, have been documented for brown bears (*U. arctos*) (LeFranc *et al.* 1987), polar bears (*U. maritimus*) (Ramsay and Andriashek 1986, Garner *et al.* 1990), Asiatic black bears (*U. thibetanus*) (Hazumi and Maruyama 1987, Reid *et al.* 1991), and American black bears. Seasonal shift in home range is observed in Chitwan, but still the ranges were small as compared to other ursids. This may be because social insects remained dominant diet in sloth bear as observed from scats in Chitwan (98% in dry season, 80% in wet season).

For bears that remained in alluvium throughout the year, expansion of home range boundaries during the wet season may have been necessary to compensate for the loss of feeding sites that became saturated. For bears that moved to the sal forests, migration back to alluvium for the dry season may have been spurred by dry, hard soil conditions in the uplands that, like saturated soil in lowlands during the monsoon, impeded bear's ability to excavate termites, including those in mounds (Davidar 1983, Iswariah 1984) and underground colonies. Despite sloth bear's adaptations for digging, their foraging efficiency may be affected by mound hardness and depth of termites, as these factors seem to influence diet selection even among more specialized myrmecophages (Redford 1985). Range shifts of bears at the end of the wet season also may have been prompted by a greater biomass of prey in alluvium, compared with sal, especially during the dry season (Joshi *et al.* 1995).

It has also been found that sloth-bears, though solitary by nature are quite tolerant to other sloth bears within their home range and they are known to live in harmony with each other's even in absence of food. Sloth Bears are very vocal, using a wide repertoire of sounds. They use howls, roars, yelps and squeaks. They also use facial expressions and body language for communication with one another. One of their vocal calls is very rarely used and may be a long distance communication signal. A "huffing" sound is used as a warning and a "chuffing" sound is used as a non-aggressive "voice" when the bear is distressed. High intensity threats include roars, squeals and screams. Cubs yelp when distressed and a female with cubs uses a grunting "whickering" sound to communicate with them. (Hadley, 2008)

Though above cited studies have been done on sloth bears in Himalayan region and Sri Lankan forests where the topography has some similarity but given the differences in abundance of food, soil quality, hardness, climate and protection regime-the same cannot be guaranteed to be same for Mirzapur. However, these studies help us understand the behaviour pattern of sloth bears and also raise hopes of their survival in harsh conditions and fragmented habitats due to their small home range.

D. BREEDING

Sloth bears typically breed during June–July, and cubs are born during November–January (Jacobi 1975; Laurie and Seidensticker 1977; Garshelis 1999; Joshi 1999), after a period of delayed implantation (Puschmann *et al.* 1977). However, breeding and birthing may occur at other times of the year (Laurie and Seidensticker 1977; Gopal 1991). Cubs

are born in protected dens (e.g., excavated holes or natural hollows). Females remain in dens for 2–3 months, and during this period rarely come out to eat (*Jacobi 1975; Joshi 1996*). A litter size of two is most common (*Laurie and Seidensticker 1977; Phillips 1984; Gopal 1991; Joshi 1996*); litters of one have been observed, although some may represent two cub litters with early mortality (*Joshi 1996*). Cubs are routinely carried on the mother's back from the time they leave the den until they are about nine months old (*Heath and Mellon 1983; Joshi 1996*). Cubs stay with their mothers for 1.5 or two years, splitting up just before the breeding season (*Joshi 1996*). Thus, females breed at either two or three year intervals. Females may breed first when four years old, but do not necessarily produce cubs following their first breeding season.

CHAPTER 2: SIGNIFICANCE OF THE STUDY

The dry tropical ecosystems are among the world's most threatened, and the dry deciduous forest of India is being progressively converted to scrub, savannah and grasslands through industrialization, agriculture, fuelwood collection, lopping of trees for fodder and severe grazing/browsing. This habitat destruction threatens the survival of many species (*Sagar & Singh, 2004*).

State of Uttar Pradesh has just 6.88% of its geographical areas as forests which is far below than the national forest cover of India which is 21.24% and the state's share in India's forest area is just 2.12%. Out of total 16, 582 sq.km. of the area recorded as forest area in Uttar Pradesh, 12,071 sq.km is Reserved Forests, 1,157 sq.km is Protected Forests and 3,354 sq.km is unclassified forests. What is interesting is that the largest share of the total forest cover of Uttar Pradesh consists of northern dry mixed deciduous forests (34.94%) which are found in the Vindhyan range mainly in the districts Sonbhadra, Mirzapur, Chandoli and Chitrakoot of the state. In terms of percentage of geographical area under forest cover, Sonbhadra (37.48%), Chandauli (22.20%), Mirzapur (19.18%) and Chitrakoot (18.56%) ranks highest among the 68 districts of Uttar Pradesh (*Forest Survey of India, 2015*).

The Vindhyan highlands have been known as 'Sonaghati' (golden valley) due to the richness of the natural resources and natural indigenous herbs (*Singh et al. 2002*). These forests found in this districts where old sal trees are found are of great significance for the state and the nation. But, what ails these regions are the over-dependence on livestock due to low soil quality and limited rainfall to support agriculture; expansion of agricultural fields into the forests due to availability of fertile nutrient rich soil and water sources, and to a great extent due to the availability of economically important natural resources found in this region like coal, Kaimur sandstone, laterite, granite, limestone etc. Also, due to limited income sources, local people are traditionally dependent on forest produce and sandstone mining for their livelihood which has degraded many forest areas. Due to the dry deciduous in nature, these forests once disturbed are dominated by *Acacia* and *Zizyphus* and are often categorised as wasteland, fallow land, *jhari van* or even as barren in local revenue records. Since the beginning of 20th century, these dry deciduous forests are facing huge threat of land conversion. Mirzapur is the most affected district because of its location which is heart of three distinct economic centres-Allahabad, Varanasi and Robertsganj with well-developed highways and railway connectivity. The district also lies equidistant from New Delhi and Kolkata railway line. It was once a major port on River Ganges few decades ago which is set to be revived by the National Waterways-1 project of Indian government. Due to all these external factors, Mirzapur is facing a huge push for development. The rates of land are not only low but available in plenty in the district. As the Mirzapur town is already congested to allow any new development, the areas which are near the forest areas are eyed by real estate developers.

A number of universities (already functional 2700 acres of BHU South campus and proposed Mulayam Singh Yadav University), townships (Shine City, Mountain city, Wyndham Hill City etc.), religious settlements (*ashrams*), thermal power plant (1320 MW, 875 acres in Dadri Khurd) are being planned in and around these forest ranges.

Forest range like Lalganj, Wyndhamfall and Mirzapur are the live examples of how irresponsible and unplanned development activities can destroy a whole forest range. Forest ranges Marihan, Sukrit and Chunar are now facing the same pressure and the process has already started due to their proximity to SH-5 and SH-5A.

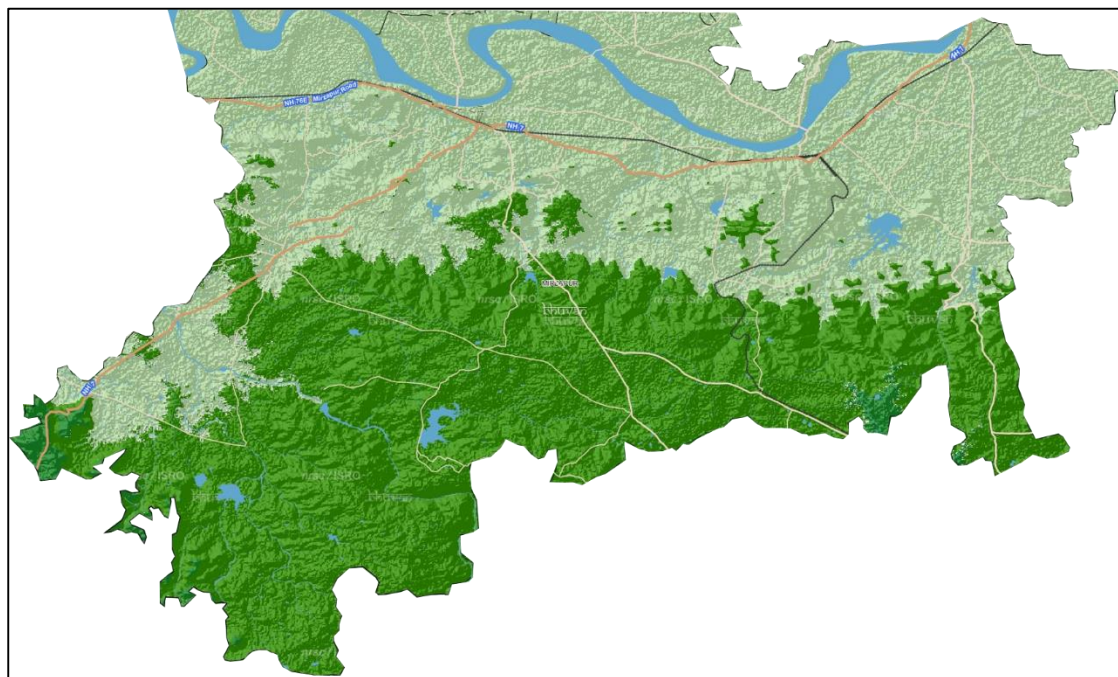
Saying all these, legal protection of forests from conversion of land use can never be achieved until we outline the significance of these forests. We have been observing the developmental paradigm of these forest ranges since past 5-6 years and we realized that the ignorance of the authority cannot be blamed only to the corruption and political pressure, though they are very important drivers in the loss of forest areas. But, what we realized is lacking from every level of governance and development planning of this district is lack of knowledge of wildlife and biodiversity which is unique to this landscape. It is due to this knowledge gap and lack of any reliable documentation, many of the important wildlife areas, corridors and areas essential for survival of fauna are diverted for other developmental purposes. This study is the first attempt to outline the areas of importance for wildlife survival in district Mirzapur. Sloth bears are majestic big mammal which is unique of all bear species due to its habits, agility to adapt in highly stress conditions and relatively lesser home range. For eg., they are the only bear species which is adapted to eating ants and termites and they never hibernate. It is also endemic to Indian subcontinent and shares same protection status as tigers in India-Schedule I under Wildlife Protection Act, 1972. IUCN Red List categorized Sloth Bear as 'Vulnerable', which means they are facing a high risk of extinction in the wild. Sloth bears are primarily found in deciduous forests and are adapted to live in semi-arid conditions and scrublands. Sloth Bears are flagship species in Mirzapur which can help indicate the overall health of the forests and ecosystem. Therefore, for the unique landscape found in Mirzapur, the protection of the unique sloth bear will ensure protection of entire forest community and healthy ecosystem. Due to rapid degradation of forests, encroachment of scrublands and conversion of land for other developmental purposes, the remnant forests are the only breeding and feeding ground of sloth bears in Mirzapur. Until or unless we collect reliable scientific evidences of the presence of sloth bears and protect their habitat and corridor paths, the threat of extinction of sloth bear from Mirzapur is inevitable. Therefore, this study is highly significant given the fact that it is also the first wildlife study being done in Mirzapur. We hope that this study in itself will speak of the significance of the forests of Mirzapur for wildlife.

CHAPTER 3: DESCRIPTION OF STUDY AREA

3.1 CLIMATE AND TOPOGRAPHY

Mirzapur district is surrounded by districts Allahabad, Sant Ravidas Nagar, Chandauli, Varanasi, Sonbhadra of Uttar Pradesh and district Rewa of Madhya Pradesh. River Ganga flows through the northern boundary of the district. The district also marks the advent of the Vindhyan hill range from the Gangetic plain. The elevation ranges from approx. 70 meters near river Ganga (northern boundary) to as high as 400 meters near Dramadganj and Kaimur WLS in south. The biogeographic sub-zone is called Vindhya under zone Deccan plateau.

The forests of this region can be classified as tropical dry deciduous forest (*Champion & Seth, 1968*). According the Champion and Seth's classification of forests types of India, the various types and sub-types of forests of Vindhyan region witness 5A/C3 and 5B/C2 types of forests, i.e., Southern and Northern Tropical Dry Deciduous Forests respectively (*FRI, 2016*). On average the TDFs are located in mean height of approximately 310 m.a.s.l., on mean slopes of approx. 5.5 % with no obvious preference for slopes with a specific aspect. The climate of the area is characterized by long and intensely hot summer, low rainfall and a short mild winter. The hot weather usually begins from middle of March and extends to the break of the monsoon in the month of June-July. The summer temperature goes up to 48° C in May-June. However, the average temperature varies from 8° C to 34° C. The rainfall varies from 750 mm. to about 1200 mm.



Map 6 Terrain Map of District Mirzapur (<http://bhuvan.nrsc.gov.in>)

Most of the rainfall occurs in the months of June, July and August. There are little winter rains, which occurs generally in January and February and are sometimes substantial, fairly regular as compared with other parts of Uttar Pradesh (FRI, 2016).

The terrain is undulating with small and medium height hills in between. There is rocky sandstone layer beneath the soil and in some places they are exposed to surface as well. Many small streams and rivulets passes through the entire hilly terrains.

3.2 VEGETATION

These forests occur on underlying rocks, which are, generally, sand stone and shale (FRI, 2016). In some places old growth can be seen in the elevated areas (~200 m and above) with tree height reaching up to 10-15 meters. The areas in elevations lower than 190 m shows mixed type of forests, dominated by shrubs and medium height trees. There are several patches where clearings of forests can be easily observed.

The flora is dominated by tree species such as *Shorea robusta*, *Tectona grandis*, *Butea monosperma*, *Boswellia serrata*, *Anogeissus latifolia*, *Terminalia arjuna*, *Lagerstroemia parviflora*, *Hardwickia binnata*, *Acacia catechu*, *Zizyphus glabberimma*, *Diopsyros melanoxyton*, *Pterocarpus marsupium*, *Holorrhena antidysenterica*, *Emblia officinalis*, *Synzygium cumini*, *Madhuca longifolia* etc. (Chaturvedi et.al. 2011a).

Most of the plant species are known for medicinal importance and have been traditionally used for treating ailments. Singh & Narain (2009) reported 183 plant species belonging to 158 genera and 60 families in Mirzapur which are used by local tribes to treat various ailments.

Some of the common plants reported by Forest Department, U.P. (FRI, 2016) are as follows:

Trees: Dhau (*Anogeissus latifolia*), Asna (*Terminalia tomentosa*), Tendu (*Diospyros melanoxyton*), Jhingan (*Lanea coromandelica*), Kakor (*Zizyphus xylopyra*), Khair (*Acacia catechu*), Piyar (*Buchanania lanzan*), Siddha (*Lagerstromia parviflora*) and Salai (*Boswellia serrata*), in patches, is commonly noticeable feature. Other species found locally in irregular mixtures are- Kurraiya (*Holarrhena antidysenterica*), Aonla (*Emblia officinalis*), Amaltas (*Cassia fistula*), Beejasal (*Pterocarpus marsupium*), Parsiddha (*Hardwickia binnata*), Chiula/Dhak (*Butea monosperma*), Kardhai (*Anogeissus pendula*), Semal (*Bombax ceiba*), Arjun (*Terminalia arjuna*), Bahera (*Terminalia bellerica*), Papad (*Gardena latifolia*), Kurlu (*Sterculia urens*), Sal (*Shorea robusta*), Harr (*Terminalia chebula*), Jamun (*Syzygium cumini*) Neem (*Azadirachta indica*), Haldu (*Adina cordifolia*), Chilbil (*Holoptelia integrifolia*), Mamar (*Eleodendron glaucum*), Domsal (*Miliusa vellutina*), Ber (*Zizyphus mauritiana*), Kathmahuli (*Bauhinia racemosa*), Khaja (*Bridelia retusa*), Phaldu (*Mitragyna parviflora*), Dhusar (*Ficus ornotiana*), Galgal (*Kaklospermum religiosum*), Farhad (*Erythrina suberosa*) and Bel (*Aegle marmelos*) etc. Because of irregular mixture of these species, top and middle canopies are not noticeable together, in general.

Shrubs- Kharhar (*Gardenia turgida*), Sehur (*Euphorbia nibulai*), Marorphali (*Helicteres isora*), Bhela (*Semecarpus anacadium*), Karaunda (*Carissa spinarum*), Kataiya (*Flacourtia indica*) etc. are found in preponderance.

Grasses- Churanth (*Heteropogon contortus*), Kans (*Sacchrum spontaneum*), Dhavlu (*Crysopogon fulvus*), Khus (*Vetiveria zizanoides*), Bagai (*Eulaliopsis binata*). Main climbers are- Makoi (*Zizyphus oenoplia*), Kuchi (*Acacia piñata*).

There are number of commercially important fruit bearing trees which are found naturally growing in the forests such as *Buchanania lanzan* (Chiraunji). The fruits of trees like *Madhuca longifolia* (Mahua) is traditionally harvested by tribal communities to produce an indigenous wine and is also dried for use as raisin. Leaves of *Diopsyros melanoxylon* (Tendu) is used for production of *bidi* (a type of indigenous cigarette).



Image 5 Forests in Sukrit Range, Mirzapur (Photo: Debadityo Sinha)



Image 6 Savannah Forests in Marihan Range (Photo: Debadityo Sinha)



Image 7 Forests in Dramadganj range, Mirzapur (Photo: Debadityo Sinha)

3.3 WILDLIFE

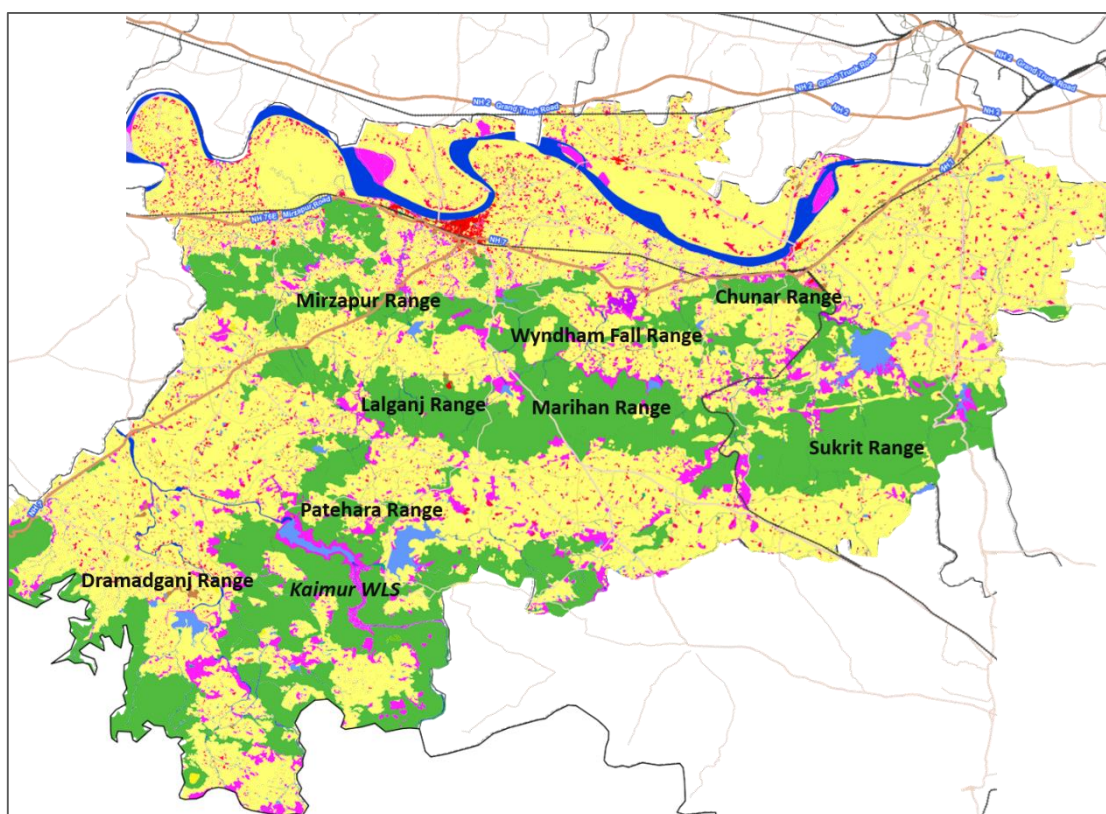
There are two forest divisions in Mirzapur-

- Mirzapur Wildlife Division-Kaimur WLS (Under CCF-Kanpur)
- Mirzapur Forest Division (under CCF-Mirzapur)

The present study is being undertaken in the Mirzapur Forest Division which is further divided into 8 forest ranges:

- i) Mirzapur Range
- ii) Marihan Range

- iii) Wyndhamfall Range
- iv) Lalganj Range
- v) Chunar Range
- vi) Sukrit Range (nearby Chandraprabha WLS)
- vii) Patehara Range (adjoining KWLS-eastern boundary)
- viii) Dramadganj Forest Range (nearby KWLS and Border of M.P.)



Map 7 Forest Ranges and Land Use Land Cover Map of District Mirzapur (bhuvan.nrsc.gov.in)

As per the information collected from Divisional Forest Office-Mirzapur under Right to Information Act, 2005, the following animals are found in the following forests ranges as per wildlife census 2013 undertaken by the office:

Table 4 Wild animals found in different forest ranges as per official records

Species	Mirzapur	Wyndham-Fall	Chunar	Sukrit	Marihan	Patehara	Lalganj	Drammad-ganj
Sloth Bear	+	-	+	+	+	+	-	+
Mugger Crocodile	-	-	-	-	+	+	-	-
Chinkara	-	+	-	+	-	+	-	-
Blackbuck	-	-	+	-	+	-	-	+
Sambhar	-	-	+	+	+	+	-	-
Chital	-	-	+	+	-	+	-	+

Sloth Bears of Mirzapur, 2017

Bengal Monitor	+	-	+	+	+	+	+	+
Hyena	+	-	+	-	-	+	+	-
Wolf	-	-	+	+	-	+	+	-
Jackal	+	+	+	+	+	+	+	+
Fox	+	+	+	+	+	+	+	+
Porcupine	+	-	+	+	+	+	+	+
Jungle Cat	+	-	+	+	-	+	+	+
Swamp Deer	-	-	-	-	-	+	-	-
Peafowl	+	+	+	+	+	+	+	+
Nilgai	+	+	+	+	+	+	+	+
Langur	+	+	+	+	+	+	+	+
Rhesus Monkey	+	+	+	+	+	+	+	+
Wild Boar	+	+	+	+	+	+	+	+

During our field study, we came to know about several wild animals which were unreported from some particular forest range (though reported present by forest dwelling people). For eg. animals like leopards have been shown as nil from the entire division which is not true. Further, we came to know that the 2013 wildlife census were carried out around the months of June by the forest staff of the respective range offices based on footprints of animals. In our detailed conversations, we concluded that the presence of animals is rightfully noted by the forest staff as some of them were quite experienced with local wildlife, but absence of animals cannot be agreed upon as there has been no year-long continuous wildlife survey using advanced technology (such as camera traps) ever done for different seasons.

CHAPTER 4: METHODOLOGY

The study was done in following steps:

1. Identification of sloth bear areas (April-May, 2015)

- i) Information was accessed from Divisional Forest Office about the forest ranges, where sloth bears are reported.
- ii) Village surveys were undertaken to identify sloth bear areas. Survivors of man-bear conflicts were also interviewed to understand the most probable areas where evidences of sloth bears can be found.
- iii) Informal interviews of forest guards of different Range offices were conducted to confirm the sloth bear presence in their area.

2. Off-site habitat suitability survey (November-December, 2015)

- i) It was done by studying satellite imagery, terrain, nearness to water sources, continuity of forests, distances from human habitation etc. All the possible areas which were suitable for sloth bears and other wildlife were analysed and noted.
- ii) The previously identified sites and potential sites were discussed with forest guards to discuss likelihood of visiting the areas.
- iii) The survey sites were selected mainly based on accessibility by two-wheelers, areas which have less undulating terrain, and which are in continuous with larger forest landscape and are far from nearest human interferences.

3. Ground truthing survey (February-2016)

- i) Ground truthing surveys were carried out in the pre-decided sites inside forest areas with help of local forest department staff and villagers.
- ii) Transects were restricted to 2 Km in length and within 50 meters along both the sides the trails to avoid unwelcomed confrontation with any wild animals including sloth bears who are known for attacking unprovoked. In some cases, we went close to sloth bear dens, only when accompanied by local villagers and after assured that the bears are sleeping (during afternoon).
- iii) The evidences of sloth bear were collected based on 3 signs- claw marks on trees, scats (identified by presence of insects and fruits) and most common evidences of soil dug by them for eating ants/termites which can be easily identified by the way they are being dug and prominent marks of their claws. GPS coordinates of the observations were recorded.
- iv) Distribution maps were prepared using False Colour Composite (FCC) satellite image of the forest areas dated 15.12.2015 accessed from USGS LANDSAT.



Image 10 Local field assistants looking for sloth bear inside the den, Sukrit Range (Photo: Debadityo Sinha) Scat of Sloth Bear, Marihan range (Photo: Debadityo Sinha)



Image 11 Scratch mark by claws of Sloth bear, Marihan range (Photo: Mukesh Kumar)



Image 8 Scats of Sloth Bear, Marihan range (Photo: Debadityo Sinha)



Image 9 Soil dug out by sloth bear, Dramadganj range (Photo: Debadityo Sinha)

CHAPTER 5: FIELD OBSERVATIONS

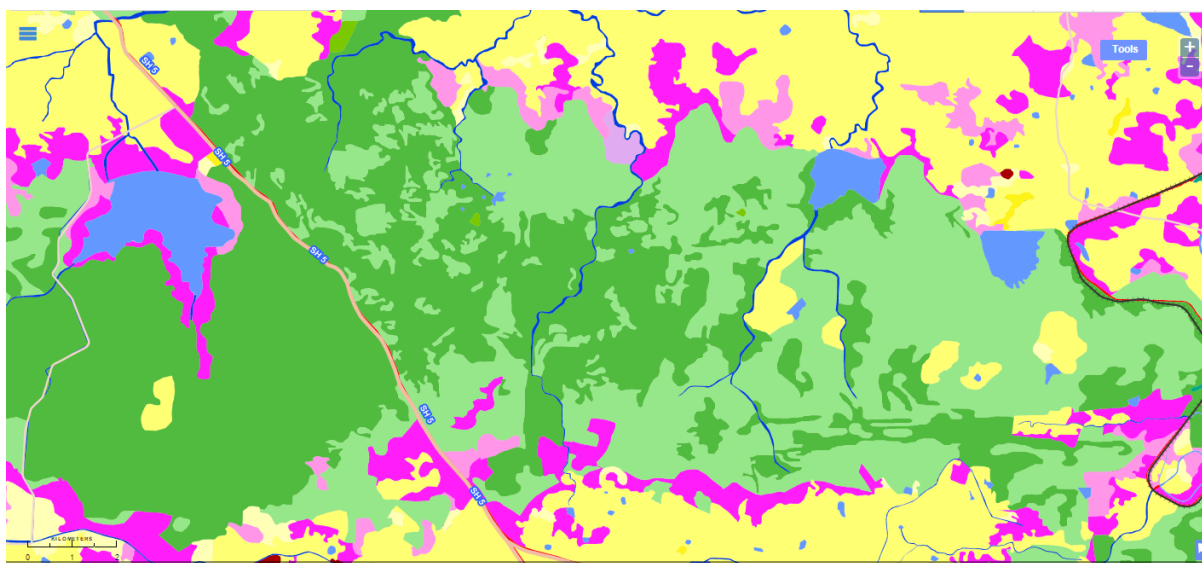
The Marihan-Sukrit-Chunar landscape (MSC) and Patehara-Halia-Dramadganj (PHD) landscape are two important forest areas in Mirzapur district act as an important wildlife refuge. Both of the landscapes are similar but with varied degree of topography and anthropogenic pressure.

The forest ranges Lalganj, Mirzapur and Wyndhamfall is kept separate because of the highly fragmented status of forests and great level of disturbances, but are important for free movement of wild animals. These three forest ranges fall under transition zone between Gangetic plains and Vindhyan range and is highly disturbed, degraded and fragmented. Wyndhamfall range adjoins Marihan and Chunar range, while Lalganj adjoins Marihan, Patehara and Mirzapur range. These 3 forest ranges are however very important as shock absorbers and act as natural buffer with urban, semi-urban and other human settlements from the critical wildlife areas of MSC and PHD landscapes. These 3 forest ranges have some patches of isolated forests which still support some wildlife, but are at high risk of losing wildlife due to severe anthropogenic disturbance.

5.1 MARIHAN FOREST RANGE

The forests of Marihan is undeniably the most vivid of all forest ranges in Mirzapur due to the variety of landscape features found in this range like grassland, savannah, scrub forests, mixed deciduous forests and dense deciduous forests interspersed with short heighted hills and numerous rivers which originate from here. While most of the forest areas near periphery are increasingly getting disturbed and facing immense pressure from land use change activities- there are still remains of pristine forested hills in this range due to their inaccessibility by vehicles and by grazers. Other reason may be attributed to the fear of wild animals especially sloth bears and leopards due to which local villagers avoid going in such forests.

A. TOPOGRAPHY



Map 8 LULC Map of Marihan Forest Range (<http://bhuvan.nrsc.gov.in>)

This landscape has short to medium height hills, with less steep slopes. The elevation varies between 170-250 meters. Though the sub-surface layer is rocky sandstone, but soil layer is still found intact in most places. Dense canopy can be seen in most of the hills. In some pockets, old growth forests are also found. Most of the plain areas in between the hills were found to be degraded/mixed deciduous forests interspersed with grasslands and scrub forests dominated by *Zizyphus*, *Acacia catechu* and bamboo. *Hyptis suaveolens* (bantulsi/bush mint) invasion is very common in this forest range.

B. SOURCES OF WATER

There are several small order rain fed seasonal rivers, and naturally collected rainwater within the aquifers which flows year-round through some rock crevices, which provides the essential drinking water requirement of wild animals. The forest range forms important catchment and source of many such rivers.

This landscape has several waterfalls, which also shows the steep variations in the elevation at some places. These waterfalls and rivers stores water as series of ponds (See image 12) which are used in dry seasons by the animals. Some of the lesser known water falls-cum-rivers found inside the forests are Jogiadari, Alopri Dari, Jamithwa Dari, Pahiti dari etc which can be said as lifeline of the wild fauna.

Several small check dams could be found in villages inside the forests. Forest department staff has also created few small ponds and check dams in some of the areas to facilitate collection of rainwater for use in dry season. Dhekwah dam, Nanauti dam and Upper Khajuri dam are the major irrigation dams built in this forest range which are now integral part of the ecosystem and serves as source of drinking water in dry seasons.



Image 12 Jogi dari, Marihan Range (Photo: Debadityo Sinha)

C. CONTINUITY

WITHIN THE FOREST RANGE: The Marihan forest range in itself is quite large in area, scattered but continuous in itself via several thin forest corridors interspersed with agricultural fields and fallow lands. The approximate area of this forest range may be between 175-200 sq.km. The south of SH-5 lies the Patewar forests which adjoins Upper Khajuri Reservoir. In between the Darhram beat and Sarson beat, there are several rural settlements with agricultural fields and large fallow lands. The villages like Sarso, Semri and Rajapur, is infamous for man-bear conflicts.

There is a continuous stretch of hill forests in Darhram, most of which is inaccessible by both local people and forest department staff, and which extends up to Sarso and Lahaura beat. This continuous stretch of forests seems to be the core wildlife habitat of Marihan range. This small area is naturally protected because of the difficult terrain and fear of wild animals.

WITHIN OTHER FOREST RANGES: The continuity of Marihan forest range with other forest range is very limited. This is because the northern side of the range is dense populated rural settlements and the under-construction Ban Sagar canal acts as the northern boundary of the forests and the same also traverse through the eastern side of the range along Chunar-Rajgarh road. The south of the range is traversed through SH-5, beyond which there are forests of Belan beat-Patewar till Upper Khajuri reservoir. The forests of Patewar extends till Bahuti forests under Lalganj range beyond which there are densely populated rural settlements. Towards south of Marihan range, the SH-5 bends towards south east from where it is joined by Chunar-Rajgarh road which may be termed as eastern boundary of Marihan forest range. Towards east of Chunar-Rajgarh road lies the Chunar range and Sukrit range. There is little or no vegetation cover on western side (Marihan) of Chunar-Rajgarh road. However large tracts of fallow land could be seen interspersed with agricultural land. The forests of Chunar and Sukrit range shares boundary with Chunar-Rajgarh road on eastern side, but they are heavily disturbed by mining activities and the forest is highly degraded. One railway line called Chunar-Churk link also goes through this range near the Chunar-Rajgarh road.



Image 13 Chinkara spotted in Marihan forest range, inside the proposed site for Dadri Khurd thermal power plant of Welspun Energy (Photo: Debadityo Sinha)

D. STATUS OF PROTECTION

FOREST STAFF: The forest range was found to be regularly monitored, and the forest guards seems to know their area very well. There is weekly monitoring done by the Forest Ranger as informed by the forest guards and watchers. The Forest Ranger informed that the number of range staff is highly inadequate to protect such large area of forests, and therefore the forest watchers and forest guards have loads of responsibilities. He showed

the concern of increasing encroachments near water sources present in the forests which has great impact on survival of wild animals.

EFFORTS: The forests were found to be protected by temporary boundary wall created using layer of stacked rocks. It served two purposes- protection from livestock grazing and also demarcation of forest boundary preventing unwanted encroachments. There was considerable fear of forest staff among the locals, which could be understood from the way loggers ran away leaving their axe and cycle on several occasions seeing us (with forest guards) inside the forests.

ATTITUDE OF PEOPLE: Local villagers were obedient to forest guards during our survey. However, we were informed that encroachments in forest areas is a big challenge to the forest department. The forest range staff informed that they regularly keep check, but due to lack of administrative support from local authorities and various political reasons- it is often difficult to remove the encroachments. We tried to interact with some local people, and they told us that the landless labourers and sometimes the succeeding generation does not find enough spaces inside their village to set up their family and livelihood and therefore they start settling in open spaces inside the forests.

E. SIGNIFICANT DISTURBANCES:

Marihan forest range has been long known for bear habitat especially forests of Darhram where people at a time stopped going due to fear of bears. Due to lack of any stable income source and increase in population, the deforestation rate is very high and the pressure is increasing as forest areas are getting constricted with time. Forest fires are reported every year from this forest range. Overgrazing by livestock is also one of the severe disturbance agent which not only disturb the wild animals in the forests but also led to compaction of soil. Situations also changed in recent decade due to expansion of agricultural fields inside the forests which have reduced the wilderness area significantly constricting the habitat within a small radius and creating gaps in between forest patches. A counter-effect is also observed where villagers have stopped growing crops due to increased raid by deer species and wild boars in those areas, incurring heavy losses to farmers. This has given rise to another problem-farmers selling their land to real estate developers at cheaper prices. Now, such areas which are at periphery of forests, and few within the forests are acquired by companies to set up big projects such as townships, institutes, colleges etc. (*See Example 1: Development of Marihan as Ex-Urban town of Mirzapur, [Pg 60](#)*)



Image 14 A stone crusher in Marihan range (Photo: Debadityo Sinha)

F. THREATS/CHALLENGES:

The most significant threat looming over Marihan forest range is fragmentation of the continuous forests into several small island forests and losing out of the forest corridors with other forests in vicinity. Grasslands and scrub forests, though highly suitable habitat of sloth bear and deer species are highly prone to land-use conversion for developmental purposes. Mining activities are prevalent near the SH-5 and the blasting activities along with other alteration to land, has led to significant irreparable loss to wildlife habitats and movement.

Several townships namely Shine City Wyndham, Spazio Mountain Heaven City etc have recently come up in the abandoned agricultural lands which were once forests. There are several schools and institutes already operating and one Mulayam Singh Yadav University is proposed in this forest range. All these projects are planned on existing forest like area adjoining SH-5. These sites were reportedly mentioned as revenue land, though having similar forest like area as in adjacent areas. These projects, when completed will completely isolate the forest range from its southern part of the forests ie. Patewar.

The proposed 2x660 MW Imported Coal based Thermal Power Plant of M/s Welspun Energy U.P. Pvt Ltd is also proposed within the Darhram forests of the range, a critical wildlife habitat. Most of the project site is grassland, forests interspersed with small patches of agricultural fields. The project will also bifurcate the Marihan range further due to the 20 km proposed railway corridor till Sarsongram and 2 km road inside forests till SH-5.

Hunting of animals is also a problem in this forest range. Though forest department staff claimed there is effective control on hunting and poaching of animals, we came to know from local villagers that wild boars are regularly hunted. It was informed by a local villager during our field visit that few weeks ago (around December-January) a sloth bear was killed by explosives kept inside some food item (a bait used for hunting wild boar). It was informed that it is a regular practice to hunt wild boars using such techniques. We were informed by a local villager that last year (around March, 2015), a sloth bear was killed as a result of electrocution which was then buried. Such incidences of accidental killing of Scheduled animals are hardly reported to Forest Department.



Image 15 Signs of blood-spill found inside forests of Marihan range (Photo: Debadityo Sinha)

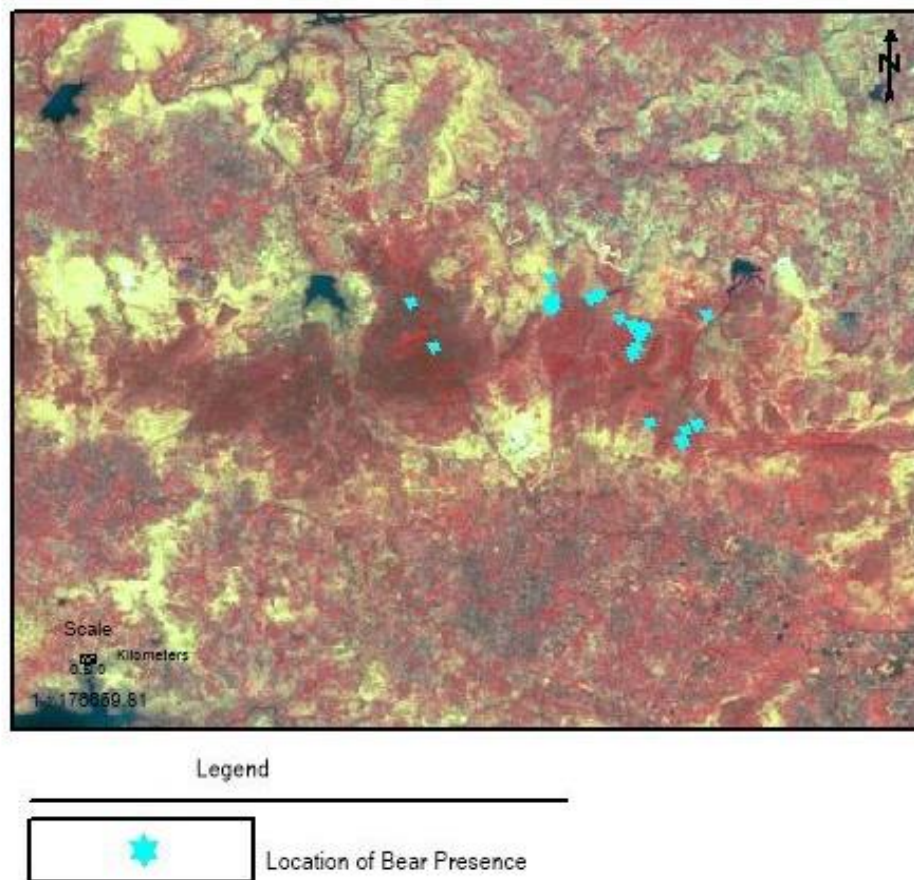
G. SURVEY RESULTS:

Our survey was carried out in following sites which were selected for survey based on our analysis, secondary information and interviewing local villagers. 2.5 km walk was undertaken by foot for each survey location on the pre-existing trails inside the forest areas accompanied by forest guard. In difficult terrains, the trails are limited to accessible areas only. During the survey we also spotted Chinkara, Blackbuck and Egyptian Vulture in this forest range. The presence of sloth bears is confirmed by the evidences and is summarized in the table below.

Table 5 Evidences of Sloth Bears in Marihan Forest Range

S.No	Forest Beat	Trail distance (km)	No. of evidences	Frequency (no. of signs/km)
1	Dadri	2.5	16	6.4
2	Darhi Ram-(two trails)	5	25	5
3	Lahaura-Darhiram	2.5	10	4
4	Kotwa*	0.5	1	2
5	Bela-Patewar*	0.5	3	6
6	Sarso	1	9	9
	Cumulative	11	55	5

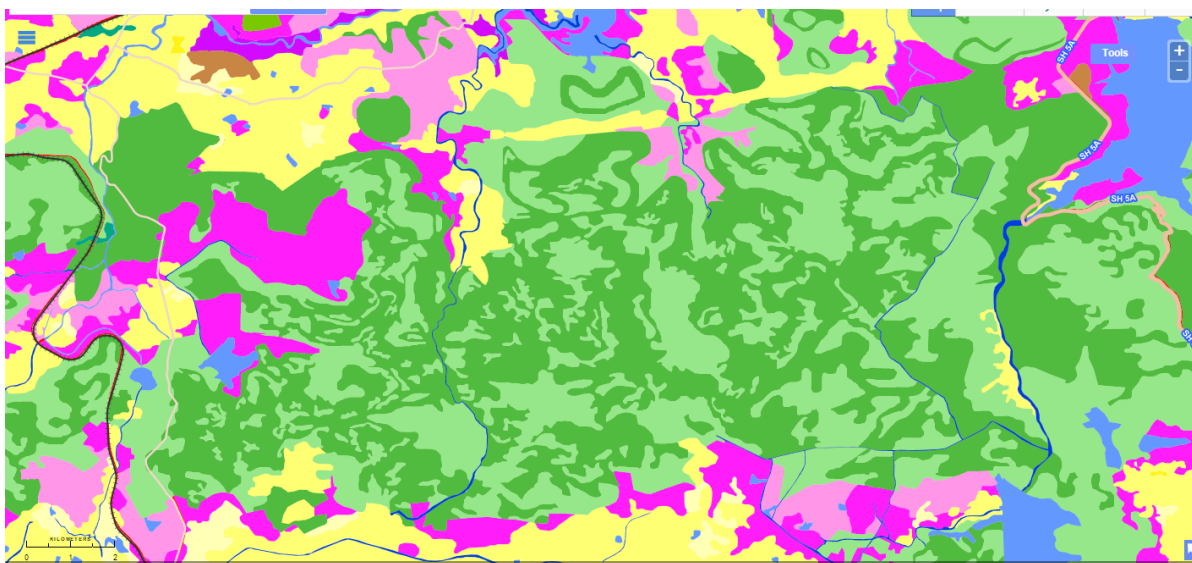
*Reason for small trail: Kotwa: on a hill, Patewar: Dense forests, for safety reason



Map 9 Marihan Forest Range (with some portion of Lalganj forest range) as seen in LANDSAT OLI False Colour Composite Map

5.2 CHUNAR AND SUKRIT FOREST RANGE

A. TOPOGRAPHY



Map 10 LULC Map of Chunar and Sukrit Range (bhuvan.nrsc.gov.in/)

Chunar and Sukrit are two different forest ranges but in continuous with each other. Chunar range starts from the south of River Ganges and extends till Wyndhamfall, Marihan and Sukrit range. Siddhanath Dari is one of the famous religious waterfall which falls under Chunar range. The elevation of the forest areas varies between 200-300 m.

Sukrit: A significant portion of Sukrit forest range is inaccessible, and those accessible are highly disturbed with human interference. Some portions of Sukrit range are severely invaded by *Lantana camara*, especially the areas near the mining stretch. Canopy cover increases while we move inside 6-7 km from SH-5A. Bamboo is highly dominant in foothills. Some patches of the forests were found to be pristine with good diversity of trees such as Chiraunji, Kutaja, Mahua etc.

Chunar: Chunar range is severely degraded near its periphery towards Ganga. These denuded hills and fragmented patches of forests are interspersed with number of small active and abandoned mines of approx. 20-50 meters in radius. Most of the Chunar range gave appearance of scrub forests and soil layer severely compacted. Some dense canopy with fairly good soil layer could be observed in Sakteshgarh beat, where sloth bears are also reported.

B. SOURCES OF WATER

Jargo reservoir is one of the major irrigation dam in this region which lies north of Chunar range. Chuna Dari and Panchsheel Dari are two important natural waterfalls inside the Sukrit forest range, the latter is less popular and therefore not visited much by outside people. There are several small streams with brackish water which serve as drinking

water source for the animals in dry season. Dongia reservoir in Talar beat serves as an important drinking water source for Sukrit range. There are several small mountainous streams which impound water within their valleys in small ponds like structure. There are number of villages deep inside the forests, who have also constructed small check dams and ponds for irrigation purposes.



Image 16 Panchsheel Dari, Sukrit Range (Photo: Mukesh Kumar)



Image 17 Chuna Dari, Sukrit (Photo: Debadityo Sinha)



Image 18 A river flowing through the Sukrit forests (Photo: Debadityo Sinha)

C. CONTINUITY

WITHIN THE RANGE: Chunar and Sukrit forest range is continuous with each other. The total area of Sukrit (125-150 sq.km) and Chunar (approx. 150-175 sq.km) is approx. 275-350 sq.km in area. There are several small villages inside the forests mainly inhabited by tribal and forest dweller communities. The Sukrit and Chunar forest range



Image 19 A jackal spotted near Panchsheel Dari (Photo: Debadityo Sinha)

is bordered by SH-5A on eastern side and Chunar-Rajgarh road on western side. There is a portion of the Sukrit range which is on the other eastern side of the SH-5A and extends till Chandraprabha WLS in district Chandoli.

WITHIN THE LANDSCAPE: Chunar and Sukrit range is adjacent to Marihan forest range and separated by Chunar-Rajgarh road.

D. STATUS OF PROTECTION

FOREST STAFF: The forest department staff were cooperative during the survey but they showed their helplessness in controlling mining and logging activities inside the forest due to lack of support from the local administration. In contrary to Marihan forest range, here the forest staff were scared of local villagers. The reason they give for the same is due to the fact that there have been several incidences in past where clashes between government officials and local villagers took place. It was informed that 2 forest staff were killed few years ago near Panchsheel Dari. They also reminded us of the Bhavanipur incident (1st March, 2001) where police claimed to shot down 16 Naxalites in the area. Political pressure from local leaders are very much dominant in this range and discourages any strict action from forest staff deputed on site.

The forest staff who accompanied us did not have good knowledge of their areas. We were accompanied by some local tribal persons who helped us during our entire survey in Sukrit range.

EFFORTS: There was a common belief among all forest staff of Sukrit forest range that there are Naxalites living in the forests, and therefore they avoid going inside forests frequently. They informed that they do monitoring only once in 2-3 months only when asked by senior officials. They always go in groups and avoid going there in late evening.

During our field survey, logging and mining activities were carried out by villagers openly without any fear in areas of both the forest ranges. This shows, there is no control of any kind from the forest staff. The primary reason is lack of support from the administration, lesser number of forest guards, fear of damage to life and property and submission to local political forces.

ATTITUDE OF PEOPLE: We got very limited opportunity to interact with villagers except during our field survey. The villagers residing inside these forests are mainly forest dependent communities. Surprisingly, they also knew where sloth bear lives, and were kind enough to show us some of the sloth bear dens. It was also surprising to know that local people were not much scared of sloth bears while going to the forests. They informed that they know where sloth bear lives, and what time they sleep, move etc. They generally avoid such known places, and generally come back to home before 5.30 PM as soon sunshine starts diminishing.



Image 21 A freshly chopped tree, on left: forest department staff looking at the logger, Sukrit Range (Photo: Debadityo Sinha)



Image 20 & 21 There were numerous small mining sites inside Chunar and Sukrit range (Photo: Debadityo Sinha)

E. SIGNIFICANT DISTURBANCES:

Increasing population, and influx of people from other villages is leading to increase in encroachments of forest areas. It was informed that due to availability of easy land and less administrative control, people from other places are also slowly occupying the forests and villages inside the forests. People are generally dependent on agriculture, forest produce and livestock for their livelihood. Therefore, as population is increasing, the dependency on forest resources have also increased and number of domesticated livestock is also increasing. All of these factors are leading to unsustainable logging,



Image 22 An ashram being built inside the forest, Sukrit Range (Photo: Debadityo Sinha)

compaction of soil, mining activities and expansion of agricultural fields to forest areas all of which affect the wildlife to a great extent. We also found number of religious ashrams in both of these forest ranges.

F. THREATS/CHALLENGES:

The most significant threat in this landscape is illegal mining activities, land use conversion and rampant logging activities going on in the forest areas and the helplessness of forest staff to control it. Old growth trees were observed to be chopped off from stem in many places, which can be counted as serious threat to forest regeneration. The lackadaisical attitude of administration towards protection of Sukrit and Chunar forest is coupled with strong political influences of local leaders which has suppressed the authority of the forest staff in these 2 ranges.

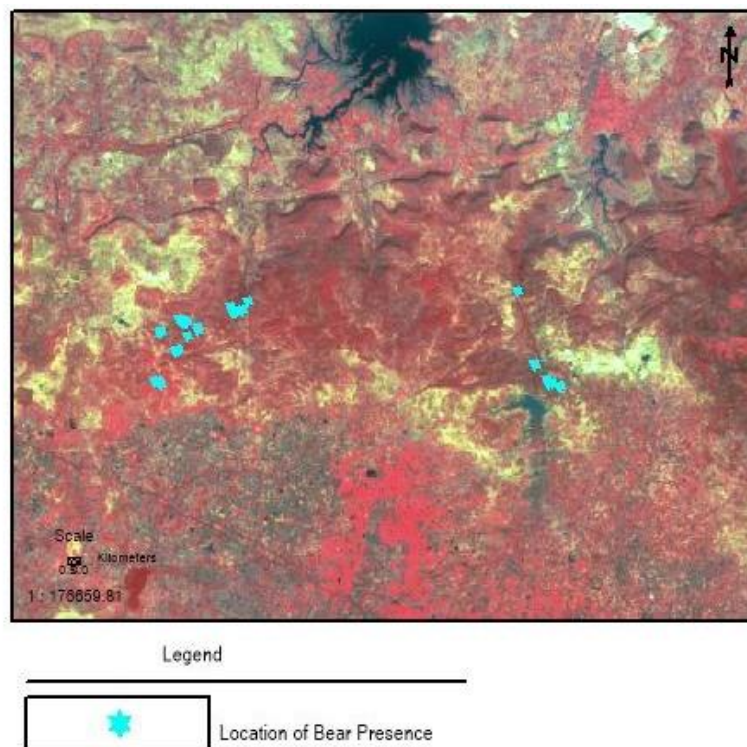
G. SURVEY RESULTS:

Both Chunar and Sukrit range spreads over a very large area, but is highly disturbed due to deforestation and mining. Our survey was highly limited due to unwillingness of forest staff to go into deep forests as they showed concerns because of several criminal incidents in these forests in past. Even, we could not dare to go into those forests in Sukrit range because they were not only dense in some places but also had difficult mountainous terrain, rocky trails and mobile network was also very poor. Certainly, we were not prepared to go into such areas without proper guidance and hence avoided. From satellite imagery, we could take note of a continuous mountainous forest patch approx. 11 km long and 5 km wide in Sukrit forest range which seems to be densely covered by vegetation. This forest can be said the largest continuous forest patch of this landscape. Seeing the results which we got from our survey in periphery areas, we can be very much assured

that this mountainous forest range in the interior has very rich wildlife and core habitat. An Indian Jackal (also confused with Indian Wolf) and a Leopard was also spotted near Panchsheel Dari.

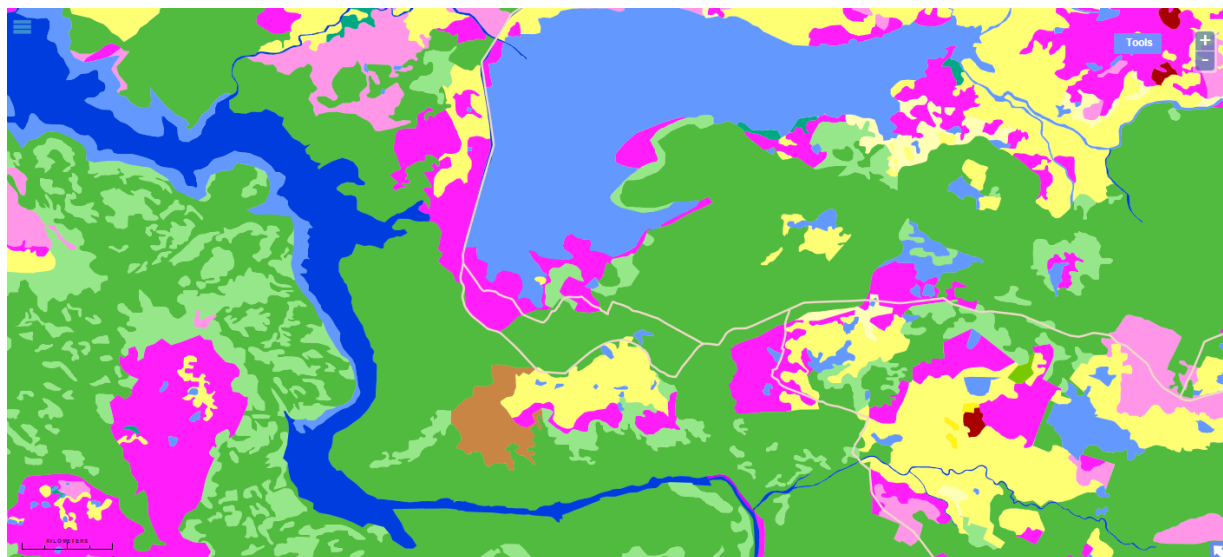
Table 6 Evidences of Sloth Bears in Chunar & Sukrit Forest Range

S.No.	Forest Beat	Trail distance	No. of evidences
1	Madhupur	2	15
2	Talar	2	7
3	Jungle Mohal Purvi	2	67
4	Jungle Mohal Paschimi	2	27
5	Sakteshgarh	2	23
6	Bhawanipur	2	3
	Total	12	142



Map 11 Sukrit Forest Range (including some portion of Chunar range) as seen in LANDSAT OLI False Colour Composite Map

5.3 PATEHARA FOREST RANGE



Map 12 LULC Map of Patehara Range (bhuvan.nrsc.gov.in/)

A. TOPOGRAPHY

Patehara range can be said to be the most fertile of all forest range in Mirzapur. The main reason is because the forest range is encircled with two major rivers-Belan and Bakahar, both having their own natural history and known for rich aquatic biodiversity. Meja Dam and Sirsi Dam are among the biggest dams in Mirzapur and are constructed on River Belan and Bakahar respectively. Most of the areas alongside the rivers and reservoirs are under cultivation. In some stretches, there are mountains alongside rivers giving an appearance of gorge or canyon like topography. Kaimur Wildlife Sanctuary lies on the western side of Patehara forest range and is continuous with it. Sirsi fall is a major tourist attraction which is on river Bakahar. However, the main water fall area is closed for tourists due to several accidents happened in past where people died after being attacked by honey bees and falling into the river.

B. SOURCES OF WATER

The Patehara forest range is richest in annual water resources out of all forest ranges found in Mirzapur division. River Belan and River Bakahar flows through Patehara forest range, both of which are major rivers of the district. Meja reservoir and Sirsi Reservoir on these two respective rivers.



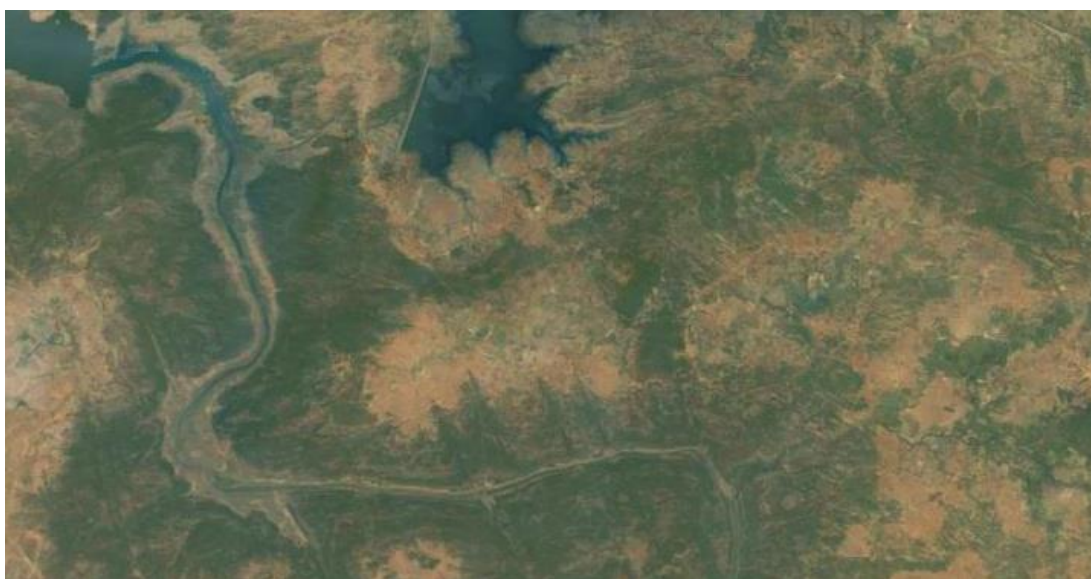
Image 24 A river flowing through the forests which joins river Bakahar downstream, Imliapokhar-Patehara range (Photo: Debadityo Sinha)



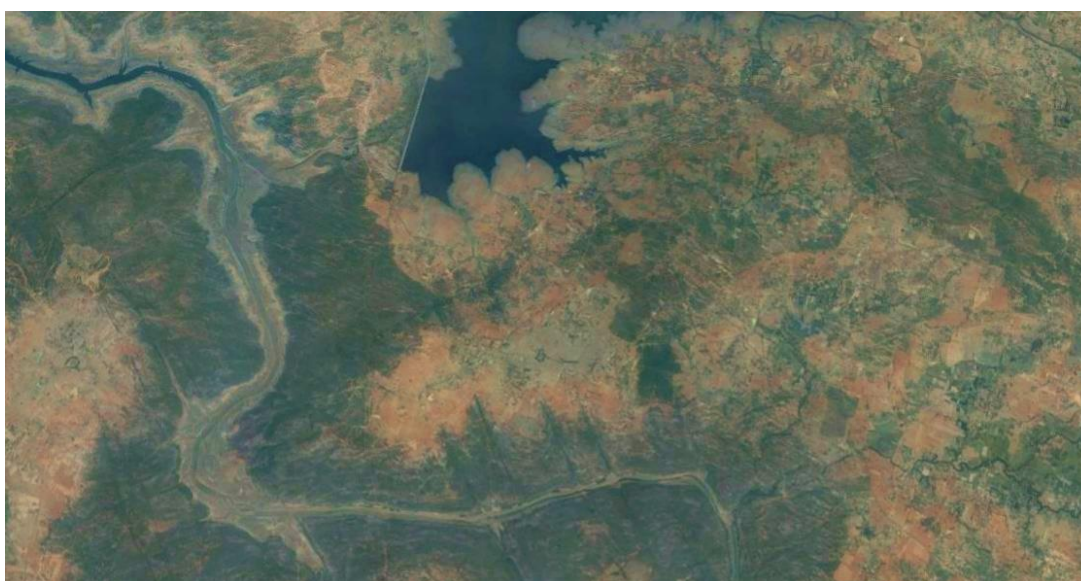
Image 23 River Bakahar near Sirsi Fall, sloth bears are reported here by villagers (Photo: Debadityo Sinha)

C. CONTINUITY

WITHIN THE RANGE: Patehara forest range is highly fragmented and the main reason is agricultural expansion and encroachment in forest areas. Leduki and Imlipokhar are two forest beats of Patehara which have the remnant forests. While Leduki is continuous with Kaimur WLS and river Belan, the Imlipokhar beat is isolated patch of forest with very limited connectivity with other forests. There is a huge agricultural farms between Leduki and Imlipokhar forests, which came up recently. Forest staff informed that agricultural encroachment is the single greatest challenge in this landscape. The Imlipokhar and Leduki forests were once connected with forest corridor which is lost in recent years due to illegal encroachments. Presently Leduki forests (eastern bank of Belan) and Imlipokhar (southern bank of Bakahar) has been constricted to merely two patches of approx. 20-25 sq.km each.



Map 13 Google Map Imagery showing the continuity of Patehara forests in November, 2007



Map 14 Google Map Imagery showing the loss of Patehara forests and continuity as on November, 2015

WITH OTHER FOREST RANGES: Patehara range is continuous with Kaimur Wildlife Sanctuary Division which is west to river Belan. There is frequent movement of animals to and fro in between these two forest ranges. Though administrative boundary of Patehara forest range extends till Marihan and Lalganj, but forest continuity is nearly lost and disturbances are too high now to call them continuous with Patehara.

D. STATUS OF PROTECTION

The Patehara forest range has less populated villages as compared to Marihan, Sukrit and Chunar range. Most of the forest areas are remotely located and therefore problem of population influx is not significant issue yet.

FOREST STAFF: The forest staff were cooperative with us. However, the forest guards at Leduki beat informed that the number of forest staff is highly inadequate to deal with encroachment of forests and other illegal activities.

EFFORTS: Illegal logging activities is quite prevalent in this range. The forest staff complained about political pressures due to which they feel helpless sometimes to take strict action.

ATTITUDE OF PEOPLE: In lack of proper monitoring, the forest areas are under immense threat of encroachment and deforestation. There are many areas in Patehara forest range which were informed to be encroached by local people for agricultural activities and houses. Incidents of hunting were not informed by anyone. One reason may be because this range is in remote location and quite far from state highways.



Image 25 Invasion of forests for agriculture, Leduki-Patehara range (Photo: Debadityo Sinha)

E. SIGNIFICANT DISTURBANCES:

Agricultural expansion, livestock grazing and deforestation is the most significant disturbance observed in the Patehara forest range. Incidents of forest fires is also occasionally reported from this range.

F. THREATS/CHALLENGES:

The Patehara forest range due to its remote location, has very limited access from outer world. Due to availability of water in dry seasons, Patehara forest range is highly critical for survival of wild animals in nearby forests and protected areas and there is frequent movement of animals into Patehara range. Here forest fragmentation is more of a serious concern than forest degradation. Clearing and encroachment of forests for agriculture is the major challenge of this forest range. We were informed by the forest staff and villagers that they have often spotted tigers roaming in this range during summer months, which may be attributed to the presence of water sources nearby. River Bakahar, Belan and other streams in this landscape are also known for breeding population of Mugger Crocodiles and livelihood support of number of fishermen who are dependent on the rivers. Mirzapur Forest Division record also shows presence of Barasingha (Swamp Deers) in this forest range, which the local forest guards also confirmed to be present. Therefore, this range is highly critical for survival of several endangered wildlife and that's why it is highly critical to protect this landscape. The loss of forest area must be monitored and efforts must be taken to restore the continuity of forests.



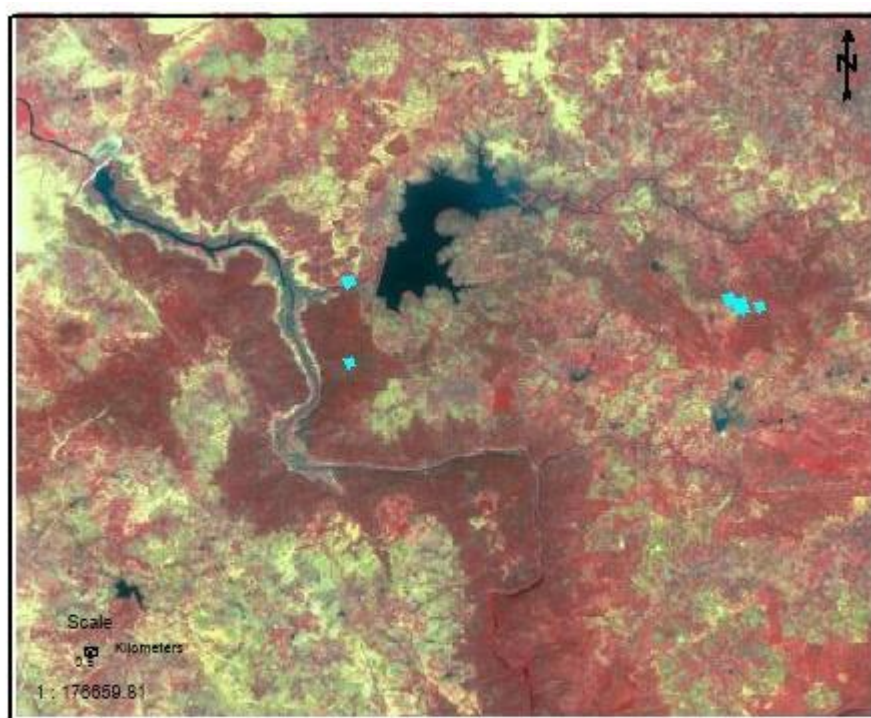
Image 26 River Bakahar and its aquatic fauna is lifeline of Patehara range (Photo: Debadityo Sinha)

G. SURVEY RESULTS:

The survey was carried out only in 2 beats as presence of bears in these two beats were reported in our preliminary survey.

Table 7 Evidences of Sloth Bears in Patehara Forest Range

S.No.	Forest Beat	Trail distance	No. of evidences
1	Implipokhar	2.25	22
2	Leduki	2	4
	Total	4.25	26



Legend

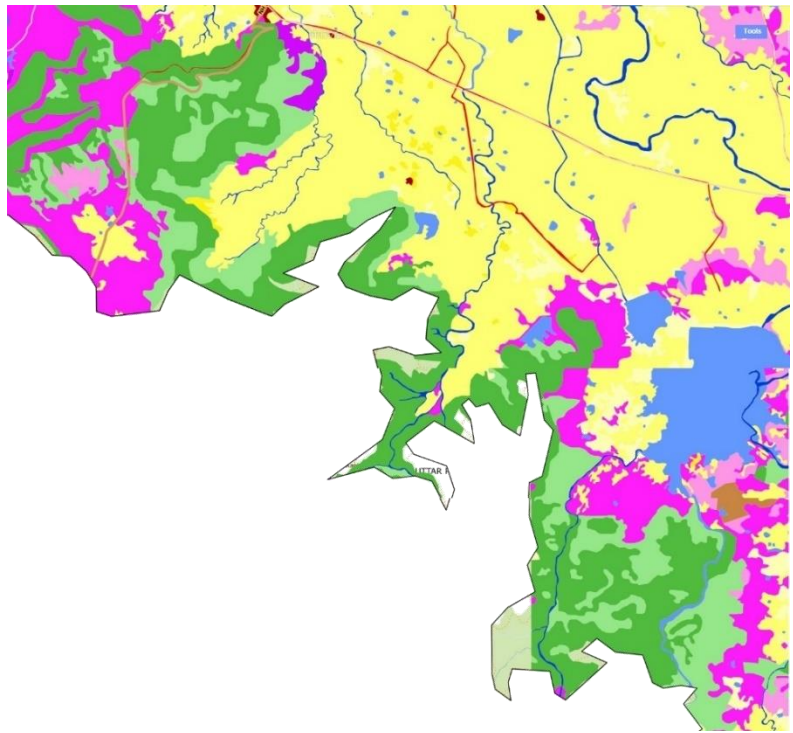


Map 15 Patehara Forest Range (including some portion of Kaimur Wildlife Sanctuary-west of River Belan) as seen in LANDSAT OLI False Colour Composite Map.

5.4 DRAMADGANJ FOREST RANGE

A. TOPOGRAPHY

Forests of Dramadganj range are at higher elevation than other forest ranges of Mirzapur. Dense old growth can be observed in this mountainous forest range. The western boundary of Kaimur WLS touches the Dramadganj Forest Range. There are numerous agricultural fields in foothills, but phenomenon of landscape change is not fast as other forest range. The main reason for comparatively better density of forests may be attributed to the steep slopes and higher



Map 16 LULC Map of Dramadganj Range (bhuvan.nrsc.gov.in/)

mountains in this range. At several places, we found remnants of small-scale mining activities. These forests are mostly inhabited by tribal people. Their livelihood is highly dependent on forest resources and some of the old gardens of Mahua can be seen in this range. Halia range, which falls under protected area-Kaimur Wildlife Sanctuary is continuous with Dramadganj forest range. The elevation varies between approx. 175-400 m in this forest range.

B. SOURCES OF WATER

River Sewati is the main river and forms the lifeline of the forest communities. River Adhwa flows near the eastern side of the mountains. The main water sources of this forest range are natural streams and rivers which flows through it. River Sewati flows through the mountains and river Adhawa flows adjacent to the outer boundary of the forest range. There are two dams-Banjari Kala dam and Sukhra dam adjoining the mountains. There is

one barrage (adjoining) and one dam (at 7 km) on river Adhwa. We also spotted one ancient water harvesting structure like 'baoli' within the forest.



Image 27 A 'baoli' like old structure found in Songadha-Dramadganj range (Photo: Debadityo Sinha)

C. CONTINUITY

WITHIN THE RANGE: Dramadganj forest range lies on the western side of Kaimur WLS and shares boundary with Halia range of the sanctuary. These hills are well connected with each other, but interspersed with agricultural settlements near foothills and rivers.

WITH OTHER FOREST RANGES: This forest range has series of dense forested mountains which continues till Madhya Pradesh and runs continuously until Ranipur WLS for approximately 100 km in length. The same forest continues further to Panna National Park. Both of these protected areas are known for tigers.



Image 28 General topography of Dramadganj forests (Photo: Debadityo Sinha)

D. STATUS OF PROTECTION

The forests of Dramadganj is still used as free hunting ground by people which could be understood from incidents in past and as told by local villagers.

FOREST STAFF: The forest staff were cooperative. They have established good communication with local villagers which help them monitor the forests which are practically impossible to regularly monitor due to limited infrastructure, staff and inaccessibility. The forest staff and local villagers seemed to have friendly relation in this forest range.

EFFORTS: During survey, the forest staff struggled in finding ways inside the forests, which shows they are very less frequented with the forests. We were informed that there is acute shortage of staff in the range, and the forest guards are given administrative responsibilities as well due to which they have to remain most of the time in their offices and could find very less time to make visit to forest areas. They informed that only during plantation activities and emergency situation, they go to the forests.

ATTITUDE OF PEOPLE: We found the local people quite aware of the presence of wild animals. A sense of discomfort was present in all people we interacted who were very angry over the nuisance created by sloth bears in their village, especially Banjari where confrontation with sloth bears are not a new phenomenon. However, these tribal settlements are evolved to live with wild animals and they see these conflicts as part of their lives now. A group of tribal women told us that bears are regular visitor in their village during season of Mahua and that is why most of the houses are fenced, to avoid sloth bears.

We were also informed by the local villagers that there are illegal mining activities being carried out on *pahadi* (hills) which damages the sloth bear dens and disturbing their natural habitats. They blame this as one of the reason bears are forced to attack human beings. According to them, '*babus*' (can be interpreted as people with shirt- trousers on vehicle, accompanied by some people) often goes to those forests for hunting animals.

E. SIGNIFICANT DISTURBANCES:

Deforestation, grazing and hunting are the main disturbances in this forest range. Few small abandoned mine spoils could be observed in Dramadganj forest range. Mining activities could be seen on some mountain tops. We were informed that there was rampant mining going on in this range and it was stopped only few years back after a court order. Livestock grazing is common in the Dramadganj range. Most of the forest areas lie in mountainous region, and therefore agricultural expansion is limited to only foothills. There are few agricultural settlements of tribal people in Banjari which extends till the forests. As most of the human settlements are located near river banks at foothill of mountains, therefore the villagers directly compete with the animals for water and is also disturbance to free movement of animals. NH-7 passes through these mountains and is one of the linear disturbance. Forest fire is also reported to be one of the significant disturbances of this forest range.



Image 29 Forest Fire in Dramadganj range (Photo: Amar Ujala, Mirzapur - 25th April, 2016)

F. THREATS/CHALLENGES:

The Dramadganj forest office is located in Dramadganj market, while the forest areas are located at far off distances. The monitoring of forests is very poor and the number of staff is highly inadequate to manage the entire forest range. The landscape change is caused by Ashrams which started establishing in the forests in recent years. These ashrams not only cleared forests, but once inaccessible areas are now heavily disturbed by vehicular movement and influx of people.

During our visit, we came to know that hunting of wild animals including sloth bears has been observed in recent past. It was informed by local forest staff that couple of years before, two sloth bears were shot dead by hunters in this forest range. Incidences of leopard entering villages is reported often. We were informed by few forest staff that they have spotted tiger in the forest range on several occasions. We confirmed the same with villagers during our survey, and received mixed response from same locations. People who have seen tigers reported they have spotted tiger at least once in a year. Most of the people who witnessed tiger could distinguish between leopard and tigers from the pattern of marks on skin. This fact made us curious and we believe a detailed survey of the region must be done by an experienced tiger expert.



Image 30 During survey of Babura-Dramadganj range, one of the most difficult trails. (Photo: Debadityo Sinha)

A very serious observation we made during our visit was about sale of bear private parts for increasing sexual power. We were told that there is a local belief that the bone found inside penis of a bear has magical aphrodisiacal powers which can delay the semen ejaculation in human males and therefore gives extraordinary sexual pleasure. Though it was very difficult to collect evidence for the same, but we came to know from one person in Dramadganj that such bear parts can be made available on demand. Though forest

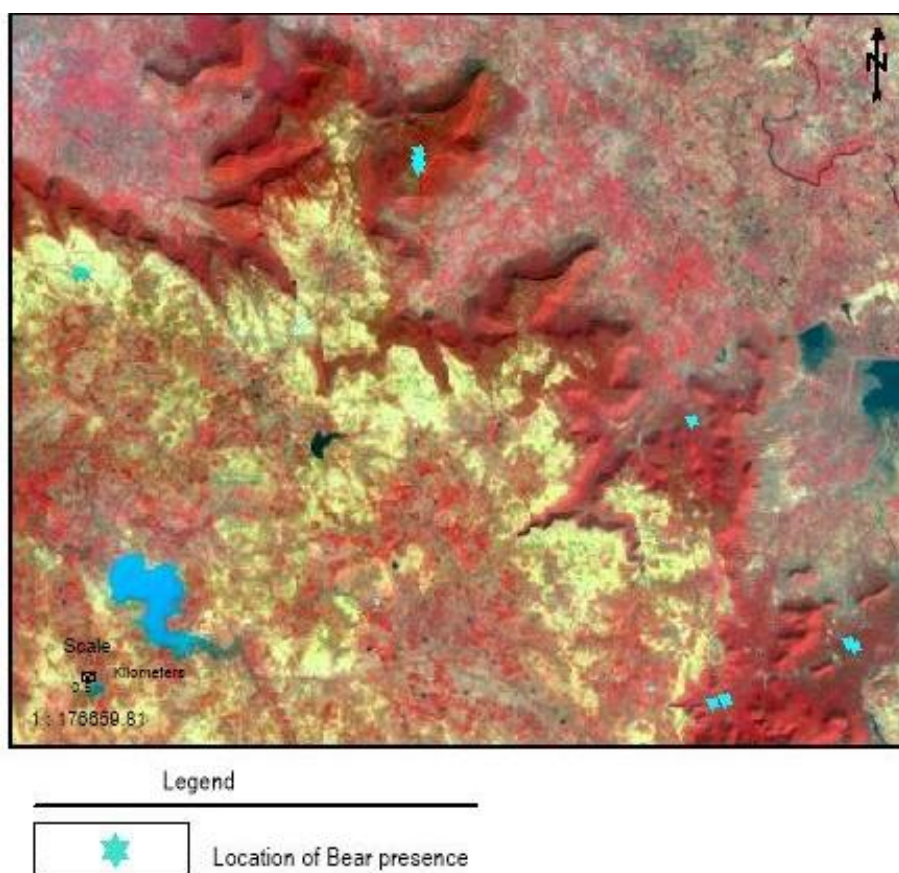
range staff dismissed any possibility of hunting bears for parts, but they admitted to be aware of the local belief regarding the use of the penis-bone of bears.

G. SURVEY RESULTS:

We found the forest areas of Dramadganj range the most difficult to survey. The forests are not only vast in area, but are quite dense in some parts that it was difficult to walk through because of the difficult terrain. We had to limit our survey only to certain parts of the forests which were less dense, have lesser terrain and accessible by motorcycle (mostly near periphery of forests). Therefore, the number of evidences were significantly lesser despite the forest range in itself being vast and very suitable habitat for wildlife.

Table 8 Evidences of Sloth Bears in Dramadganj Forest Range

S.No.	Forest Beat	Trail distance	No. of evidences
1	Songadha Paschimi	2	6
2	Songadha Purvi	1	4
3	Banjari	0.4	3
4	Babura	1.5	2
	Cumulative	4.9	16



Map 17 Dramadganj Forest Range- as seen in LANDSAT OLI False Colour Composite Map

CHAPTER 6: ASSESSING THE SLOTH BEAR ATTACKS

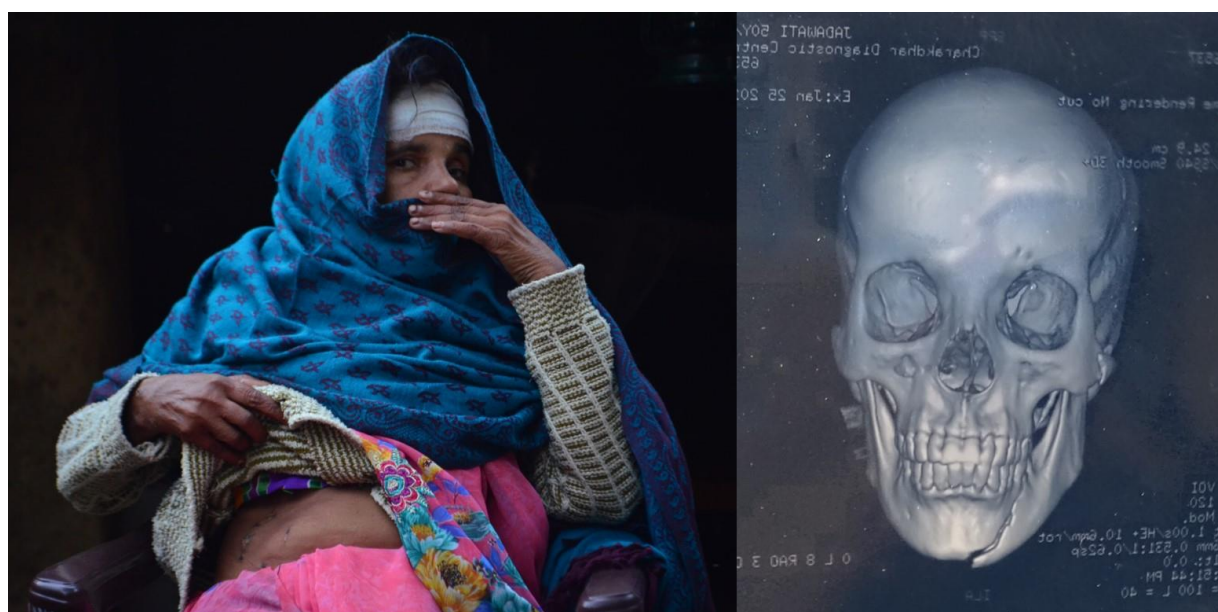
Human wildlife conflict has emerged as a major challenge to conservation efforts as human populations grow and compete with wildlife for space and resources. Although the broad causes and effects of human wildlife conflict share similarities, the nature and intensity of conflict often varies with the biology of the wildlife species concerned, its distribution relative to critical resources and human occupied spaces, and the social and economic characteristics of human communities experiencing conflict (*Distefano 2003*). Attacks on human beings by Sloth Bears, Leopards and Wolves are the most common of all man-animal conflict in Mirzapur forest division.

In the forests of central India, the sloth bear is one of the most dangerous wild animals (*Pillarisett 1993, Rajpurohit 1996*). Humans compete directly with bears by consuming the bears' food resources (*Rajpurohit 1996*). Because of extensive damage to already degraded habitat and collection of Non-timber forests produce (NTFP) by the locals, bears face a shortage of food resources and direct competition with humans for common food resources (*Murthy and Sankar 1995, Rajpurohit and Chauhan 1996*). Some species of importance to bears are also collected by villagers, including flowers and fruits of Mahuwa, and fruits of bel, char (*Buchanania lanzan*), jamun, and tendu (*Diospyros melanoxylon*). Collection of NTFP not only disturbs bears but also limits their availability for bears (*Bargali et al. 2004*).

They are unpredictable, especially females with cubs, which will attack humans readily if they perceive their cubs to be threatened (*Prater 1980, Pillarisett 1993*). However, most of the sloth bear attacks are defensive in nature only and it stops attack when the person falls down or become senseless. *Bargali et al. (2005)* reported that individuals who fought off the bear were seriously hurt and sometimes died from the attack. The suddenness of sloth bear attacks more closely resembles attacks by grizzly bears in response to surprise encounters with humans (*Herrero and Fleck 1990*). Except few cases, most of the attacks in Mirzapur happens in early morning hours only. There are three reasons for this- villagers go for defecation in early morning hours to areas near to water streams, for collection of Mahua fruits and fuelwood in early morning hours. In dry seasons, the bears often visit nearby villages in search of water and fruiting trees (especially Mahua) which overlaps with the same timing. While most of the attacks happen during collection of Mahua, one attack is reported while defecation and two attacks on women were during afternoon when the women were returning with head load.

Table 9 Reports of man-bear conflicts in Mirzapur which are reported during 15th October, 2015-15th April, 2016

#	Name	Age-Gender	Fate	Place	Forest Range	Purpose	Date	Time (Approx.)
1	Heeramani Kol	40 M	Injured	Banjari Kala	Dramadganj	Defecation	12/4/2016	05.00 am
2	Vikesh Behelia	40 M	Dead	Banjari Kala	Dramadganj	Mahua collection	11/4/2016	05.00 am
3	Gokul Maurya	45 M	injured	Banjari Kala	Dramadganj	Mahua collection	11/4/2016	05.00 am
4	Sunil K. Yadav	35 M	Injured	Bhavanipur	Sukrit	Mahua collection	3/4/2016	03.00 pm
5	Jarauti Devi	40 F	injured	Rajapur	Marihan	Fuelwood collection	25-01-2016	12.30 pm
6	Panna Devi	55 F	Injured	Sarsawa	Patehara	Fuelwood collection	28-10-2015	12.00 pm

**Image 31 Jarauti Devi, who was attacked in Marihan forest range in January, 2016 with X-ray of the fractured jaw (Photo: Mukesh Kumar)**

The above mentioned places- Rajapur (Marihan), Bhavanipur (Sukrit), Sarsawa (Patehara) and Banjari Kala (Dramadganj) are the most active man-bear conflict affected areas. Sarso-Semri (Marihan) is also known for man-bear conflicts. Since past several years, nearly all of sloth bear attacks are reported from these selected regions only.

While the man-bear conflicts in Marihan, Sukrit and Patehara is confined to forest areas- most of the man-bear conflicts in Dramadganj is reported to have occurred near the villages.

After this survey and analysis of regional topography, the reasons for the man-bear conflict can be correlated to several factors and can be avoided by taking some measures. Following are the possible explanation of man-bear conflicts in two landscapes reported recently.

6.1 EXPLANATION FOR ATTACKS 'INSIDE' FORESTS OF PATEHARA, MARIHAN AND SUKRIT



Map 18 Location of Sarsawa, Patehara Forest Range on Google Earth imagery

In Patehara range, as discussed in previous sections, the connecting forests between Leduki and Imliapokhar beat is now highly disturbed and significant portion is converted to agricultural lands. As a result, the Imliapokhar beat is not only becoming degraded but is also becoming isolated with its historical forest range. This has caused significant disturbance to wildlife habitats, constriction of home range and restriction to movement of bears. The woman who was injured in October, 2015 was attacked in Sarsawa which is part of this degraded forests in Imliapokhar beat.

6.2 EXPLANATION FOR ATTACKS INSIDE 'FORESTS' OF MARIHAN AND SUKRIT

Sarso-Rajapur and Bhavanipur villages lie on the periphery of forest areas of Marihan range and Sukrit range and are separated by Chunar-Rajgarh road, Chunar-Churk rail link and an under-construction canal in between. The sloth bears which once used the entire Marihan and Sukrit range are now divided into several meta-populations due to loss of the connectivity between these forest areas. With increasing disturbance, fragmentation and landscape change in Marihan and Sukrit range, the bears are forced to live in the remaining small patches of forests which are not only interspersed with villages and agricultural farms but are also facing huge competition of resources from local villagers who are dependent on these small forest patches for their fuelwood, livestock grazing and other non-timber forest produce (NTFP) requirement. It is because of this reason, the forests in these forest range are very much frequented by human beings and result in unwelcomed confrontation with bears which often proves dangerous for both of them.

Sarso-Rajapur and Bhavanipur villages lies on periphery of forest areas of Marihan range and Sukrit range and is separated by Chunar-Rajgarh road, Chunar-Churk rail link and an under-construction canal in between. The sloth bears which once used the entire Marihan and Sukrit range is now divided into several meta-populations due to loss of the connectivity between these forest areas. With increasing disturbance, fragmentation and landscape change in Marihan and Sukrit range-the bears are forced to live in the remaining small patches of forests which are not only interspersed with villages and agricultural farms but are also facing huge competition of resources from local villagers who are dependent on these small forest patches for their fuelwood, livestock grazing and other NTFP requirement. It is because of this, the forests in these areas are very much frequented by human beings and result is frequent confrontation with bears which often proves dangerous for both of them.



Map 19 Locations of Rajapur, Sarso and Bhavanipur villages in Marihan and Sukrit range on Google imagery

6.3 EXPLANATION FOR ATTACKS IN 'VILLAGE' BANJARI KALA

In Dramadganj, the forest range is quite large and continuous with each other and therefore interaction of wild animals and human beings may not be expected to be much frequent. However, Dramadganj range has been infamous for intrusion of animals into villages. There have been incidences where bears have been killed. There may be many unreported incidents of such conflicts and the actual numbers may be high. During our survey, we found Banjari Kala as the most vulnerable to animal intrusions because of its topographic location. The above map shows how Banjari village comes right between the continuous forests. As we know that though, sloth bears like hilly slopes but they require soft soils to dig out ants and termites and there is continuous movement between hills and plains depending on season. Banjari Kala is situated on banks of a river Sewati which flows through this montane forests. There are massive mining activities on top of the mountain south to it.

Therefore, the village acts as direct competitor of sloth bears for food and water source. Due to mining activities going on in the southern part of this forests and dense human settlement in northern side, the animals are greatly forced to restrict their movement only through the fallow lands in Banjari Kala for their movement as it is the only available corridor for them to move in between forests. Secondly, the bears are also attracted to this village because of availability of natural source of drinking water (River Sewati) and abundance of Mahua trees.



Map 20 Google Earth imagery showing mining activities on top of Banjari Kala hills

6.4 HOW TO BE SAFE FROM SLOTH BEAR ATTACK?

Sloth bears are generally shy and avoid human confrontation. The mammal is nocturnal and sleeps during day time inside their den. However, if confrontation with human being happens by chance, it can attack unprovoked. Sloth bears have a formidable reputation for inflicting serious injury to humans, often to the head and face. Humans mauled by sloth bears may die or experience permanent physical disability and subsequent social and economic hardship. Thus, the sloth bear is one of the most feared animals throughout its range (*Phillips 1984b; Rajpurohit and Krausmann 2000; Ratnayeke 2007*). For bears, consequences are also severe because humans often kill bears from fear, self-defence, or retaliation, and every attack erodes local support for their conservation (*Chauhan 2006; Ratnayeke et al. 2006*). *Ratnayeke (2014)* suggested following measures to reduce conflict with sloth bear and keeping ourselves safe if unexpected confrontation occurs with the bear:

- i. Bears frequently rest up in dense thickets and rock outcrops during the day. Humans moving through these types of habitat should be acutely aware of a possible encounter with a bear.

- ii. Although groups do not guarantee safety, and fear of bears greatly tests human courage, vast majority of attacks the presence of another human is a mitigating factor and likely reduces the severity of injuries. Staying in close-knit groups and not fleeing an encounter will decrease the likelihood that any one person in the group will experience an attack, or that a bear will initiate or persist in an attack.
- iii. People who encounter a sloth bear that slowly approaches and seems unaware of their presence should attempt to quietly move out of the way.
- iv. In encounters involving a bear that is aware of humans but without an immediate charge (e.g., bear rears up in a threat display), humans may slowly back away. If the bear charge, physical contact with the bear may be thwarted by staying close together.
- v. A person ambushed at close range, or knocked down by a charging bear, may decrease risk of injury or death by using the positions recommended by *Herrero (2002)* in case of grizzly bear attacks due to sudden encounters: balling up and laying on the side, knees against forehead, elbows meeting at forehead, and hands locked around the back of the neck or lying face down on the ground with hands locked behind the neck and arms protecting the face.

CHAPTER 7: MAJOR THREATS

Anthropogenic disturbance oriented degradation is irreversible in nature and it may reach the upper limit of the intermediate disturbance hypothesis, where most species may go locally extinct (*Anitha et.al., 2008*). Degradation of forests ecosystems and fragmentation of habitat (at landscape level) are the highest threat all the forest ranges of Mirzapur are facing.

Forest fragmentation occurs when large contiguous forests are perforated by small holes or broken up into edges and smaller patches to form a non-forested matrix of open spaces. Having evolved within the ecosystems of large intact forests, many species are ill-adapted to life outside the forest interior, either in forest edges or in the patches carved from it. Habitat fragmentation is a key conservation concern and is strongly associated with the loss of biodiversity (*Oloff and Ritchie, 2002; Fahrig, 2003*).

Habitat fragmentation is usually a time driven process that is innocuously initiated by human habitation or man induced habitat alteration and which eventually accelerates and results in complete isolation of once contiguous habitat. Populations thus isolated face survival pressures through increased competition for food and space and obligated risks in relation to disease outbreaks and episodic calamities such as fire and flood. Over a long interval of time span, species inhabiting isolated habitats also face the risk of extinction through mechanisms such as excessive inbreeding (*Joshi & Singh 2008; Weiss 2006, Rathore et.al 2012*). Some of the major threats which are leading to forests and habitat fragmentation are discussed as follows:

7.1 LANDSCAPE CHANGE

Landscape change is mainly induced by land use change driven by human activities. Land-use change is cited as the main driver of habitat loss and fragmentation (*Sala et al. 2000; CBD 2010*), thereby threatening many species (*Barnosky 2008; Ehrlich and Pringle 2008; Vignieri 2014*). Whether by chance or design, small fragments of forest typically persist in the aftermath of deforestation, effectively islands within a sea of agriculture, urbanization, or other modified lands that are unsuitable for most forest species. Many of the species that originally occupied the forest will disappear from these isolated fragments, but this loss occurs over a relaxation period until a new, more depauperate equilibrium community is reached. (*Gibson et.al., 2013*)

While some species can persist in fragmented landscapes, or even benefit from fragmentation, many species become more vulnerable because their populations are smaller (*Cagnolo et al. 2006*), they are more prone to overexploitation (*Michalski and Peres 2005; Bennett and Saunders 2010*) and edge effects (*de Casenave et al. 1995; Gascon et al. 2000*), and their capacity to adapt to environmental change is lower (*Travis 2003; Brook et al. 2008*).

Isolation of forests is one of the major factor of local extinction of sloth bears in other forest areas of India. It was found that 69% of the extirpated areas are highly isolated (>20 km) or moderately (5-20 km) isolated. Isolation results into decline or extirpation of sloth bear population due to several induced impacts such as human caused habitat degradation and killing, and by limiting growth of populations and immigration of Sloth Bears from adjacent areas. (*Yoganand et.al. 2006*)

The main drivers of land use changes in Mirzapur has changed in recent years, where outside drivers are now more invasive than internal drivers. Since last decade this region is undergoing phenomenal change and rapid developmental pressures. There has been considerable land use/land cover change in Mirzapur. Increasing urbanization and agricultural expansion have been the main reasons and have increased pressure on the forests of Mirzapur (*Goparaju & Sinha, 2015*).

The main reasons for landscape change in this forest division is further explained below.

1) URBANIZATION

Urbanization is a serious problem in the forest ranges which are nearer to highways and local tehsil headquarters. The kind of urbanization sprawl which is trending in such areas which are far from the urban areas of the district can be termed as type of exurban development. Exurban development and associated infrastructure can lead to habitat fragmentation, homogenization of animal and plant communities, and increased human-wildlife conflict (*McKinney, 2006*). Habitat fragmentation from dispersed housing development can alter animal movement patterns and behaviour, cause “pileup” or overlap of home ranges, and reduce animal fitness by intensifying inter- and intra-specific interactions (*Riley, 2006*). In addition, exurban development may also disproportionately impact protected lands and could decrease their conservation value (*Knight et al., 1995; Leinwand et al., 2010; Radeloff et al., 2010*). Exurban development is one of the greatest threat because of the commercial stake involved of the people who often have deep political roots, administrative influence and sometimes linking them with development for national importance. Poor planning, inaccurate demarcation of forest lands, outdated revenue records (which are sometimes manipulated or changed), lack of bureaucratic efforts, poor knowledge of forests & wildlife and influence of regional leaders play a very significant role in failure to control or regulate such activities in the forest areas. The effects of such activities are always irreversible and cause irreparable damage to the landscape leading to local extinction of wild animals.

EXAMPLE 1: DEVELOPMENT OF MARIHAN AS EX-URBAN TOWN OF MIRZAPUR

In the year 2005, Prof. Panjab Singh, the then Vice Chancellor of Banaras Hindu University took a stand to develop the University's farm at village Barkachha into Rajiv Gandhi South Campus which is now developed into a 2700 acres of university campus in Mirzapur forest range which used to be 'forests'. This led to rapid acquisition of land near



Image 32 BHU South Campus, Barkachha, Mirzapur (Photo: Anonymous from Internet)

the campus by other real estate developers and businessmen from surrounding districts. Due to availability of large areas of land which were not recognized as forests in revenue records, the purchase of land did not attract much problem for them. Due to hilly terrain and dry climate, the rates of land were also lower than adjoining districts. After the year 2010, there were number of lands being cleared near SH-5, specially near the University Campus. Places like Belahada and Marihan which were once local markets soon started developing and modes of public transportation also improved. As public transportation improved, people started seeing Marihan as next ex-urban destination in Mirzapur due to its locality on SH-5, nearness to Mirzapur city, pre-existing infrastructures like police station, market, hospital, schools, Tehsil office etc coupled with the fact that Marihan is also the administrative headquarter of Marihan sub-district of Mirzapur.



Image 33 Proposed Mulayam Singh Yadav University, Marihan (Photo: Debadityo Sinha)

In 2011, Welspun Energy U.P. (Pvt.) Ltd proposed to establish a 1320 MW coal based thermal power plant in village Dadri Khurd which falls inside Marihan forest range. The EIA documents stated that 875 acres of land is already purchased from farmers and government. The project got Environmental

Clearance in the year 2014. In the year 2013-14, few companies proposed townships near the Dadri Khurd Thermal Power Plant in the same range. There are several big townships which have put their signboards with the names- Vindhya Mountain City (Spazio Infracity Pvt. Ltd.), Mountain Heaven Windom Fall (Shine City Infra Project Pvt Ltd) etc. These areas which were once forests in reality and continuous with the Marihan forest range are now transferred for such developmental projects. Due to proposal of such developmental projects in this

area, many more small to medium developmental projects are coming up. The latest example is of Mulayam Singh Yadav University which is also under construction clearing such forests. The stretch of forests adjoining SH-5 from BHU South Campus in Barkachha till Marihan tehsil office (approx. 15 km) is severely affected by development nostalgia and will further limit the wildlife habitat and movement. Unfortunately, the same areas also form source of several rivers, impact on which is bound to affect the entire ecosystem of the forest range, including those areas which are far from these developmental sites. The rapid rate of conversion of forests for such ex-urban developments which happened post 2005 are not only irreversible in nature and caused irreparable damage to the entire landscape and wildlife, but the cumulative impact of all of these projects is bound to multiply the negative impacts beyond the point of our assessments and beyond which we may not be able to get restore the natural wilderness as it existed or remaining present day.



Image 34 Proposed Shine City, Marihan (Photo: Debadityo Sinha)



Image 35 Proposed Spazio Infracity, Marihan (Photo: Debadityo Sinha)

During our survey we got signs of sloth bears inside the project boundary of proposed Dadri Khurd Thermal Power Plant and high presence in areas adjoining the proposed site. Similar signs were also observed in the Patewar forests which is south of SH-5 near Upper Khajuri reservoir which indicate that the animals have been using these forests and grasslands frequently for accessing food and water. Chinkara were found grazing inside the proposed site of thermal power plant as well which shows these areas are favoured much by the wild

animals. We were able to spot Blackbucks, Bengal Monitor and Egyptian Vulture in the surrounding areas of the project site. There is no doubt, such haphazard and unplanned development practices will take huge toll on the landscape once these projects start construction and become operational.

There are several religious shrines in this landscape, and in recent years several new ashrams have come up in the forest areas. This has led to frequent movement of people and vehicles inside the forest areas causing disturbances to the wildlife.

II) AGRICULTURAL EXPANSION

Agricultural expansion is one of the serious problem the forested areas of Mirzapur, particularly in the forests of lower elevation (<200 m) and forests near rivers and reservoirs. Because of hilly terrain and low-nutrients soil, there is limitation of land where prime cultivation can be done. Cultivation of crops is further constrained by availability of water. As most of the forests in Mirzapur are catchment of many rivers and numerous streams originate from these forests, people and government started construction of check dams and barriers on such streams and rivers to facilitate irrigation. As these forest are quite pristine in nature, the soil quality is found to be quite favorable compared to other old fallow lands where nutrients are exhausted. This attracts the local villagers to clear the forests and start cultivation of crops nearer to these dams. These activities had a great cascading effect on forests, as these agricultural farms soon turned into settlements with infrastructures similar to a village. All of these villages also have access to those areas of forests which were earlier untouched and disturbance occurs in the form of fuelwood collection, grazing, logging etc. Due to dry deciduous climate, the agricultural activity is also restricted to only wet season and until November-December, when the reservoirs have water to sustain crops. Therefore, people living away from such water sources started rearing livestock, which appeared to be very much favorable because of freely available forest land for grazing and dams for water requirements. Cattle camps can be easily observed inside these forests where people from nearby villages go to forests for few months and make a temporary hut where they keep their cattle and maintain them. These camps often have 2-3 number of dogs accompanying them, which further aggravates the disturbance to free ranging wild animals. These led to a very huge cumulative impact on the forests and great level of disturbances to wildlife.

The impact of agricultural expansion is 4 fold- first it comes after clearing forests thus encroaching wildlife habitats, second the cumulative impact on surrounding forests and wildlife for the reasons as mentioned in previous para; third impact is loss of soil quality and alteration to hydrology; and fourth obstruction of the movement of wild animals to water sources.

Cultivation causes an increase in bulk density as compared to soil found in forest ecosystems which means higher runoff, lower water infiltration and the soil becoming unfit for natural regeneration of forests. *Tripathi & Singh (2013)* found that cultivation caused significant decrease in WHC, sand and clay content of the soil and severe reduction in the organic C, total N and P content of the soil. Cultivation also caused significant decline in mean annual nitrification and N-mineralization and decline of microbial C & N by up to 50%.

Agricultural expansion within forest areas (especially where water availability is dependent on rainfall) has been observed only for few number of years until the site has ecological conditions enough to support cultivation. After the farm owner realizes that the site is not suitable for agriculture, he abandons the site which turns fallow land or he sells it to real estate developers. In our survey, we found that abandonment of farmland does not always necessarily mean that the site has lost its good soil quality or water is scarce. We found that most of the cultivators within Marihan and Sukrit range refrains from cultivation because of the increasing raids of crops by wild animals especially wild boars, nilgai and other deer species. As most of the farmers are quite poor, they show their inability to permanently fence their farms. However, we also observed few farms which are fenced by wires. We also found few ashrams which do cultivation within bricked walls.

In those abandoned farmlands which has rich soil condition, over the years, natural regeneration occurs and the site soon turns into grasslands or shrublands (often mistakenly recorded as wasteland) and in some cases mimic natural forests found in this region as well. Often these secondary forests have been seen to act as highly suitable feeding grounds for animals as the grasses and *Zizyphus* seeds quickly grow on such lands.

III) MINING

Mining not only create permanent scar on land by removing vegetation and topsoil from a site. The sound pollution from open-cast mining activities has a significant impact on the biophonical soundscape of a neighbouring forest.



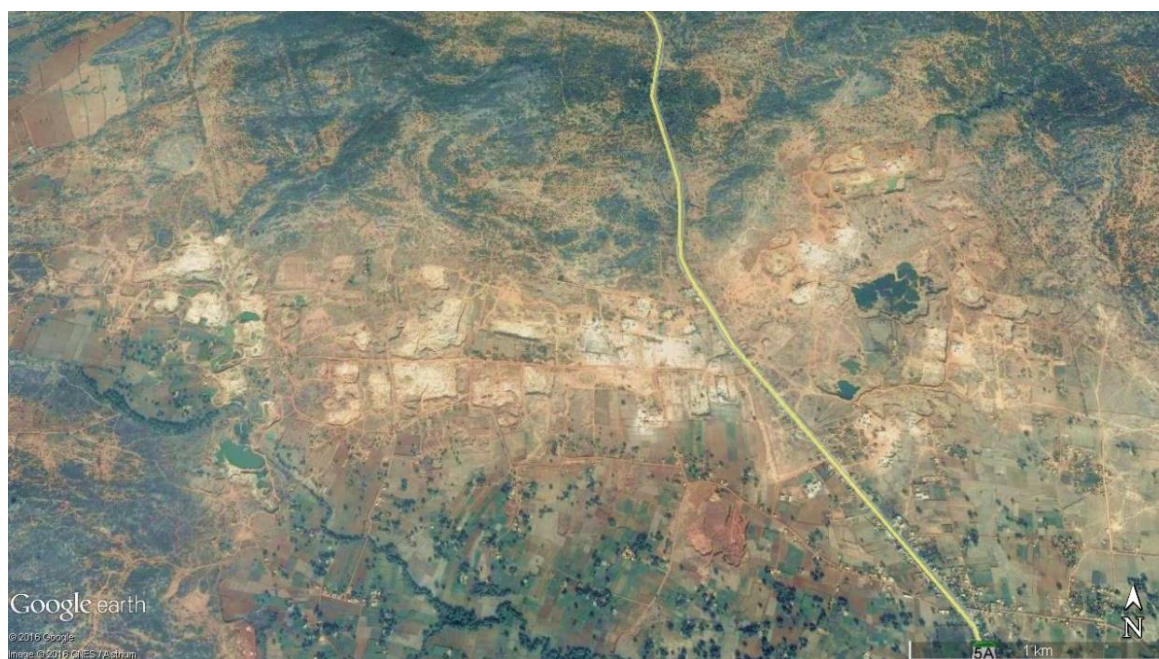
Image 36 A stone quarry near SH-5A in Sukrit Range (Photo: Debadityo Sinha)

Open-cast mining is known to produce high sound pressure levels through exploratory and production drilling, blasting, cutting, handling of materials, ventilation, crushing, conveying, ore processing and transportation (Donoghue, 2004). Many species exhibit behavioural changes including avoiding noisy areas during foraging

(Miksis-Olds *et al.*, 2007; Schaub *et al.*, 2008) and other daily activities (Sousa-Lima and Clark, 2009; Duarte *et al.*, 2011). Area avoidance and acoustic compensatory mechanisms to reduce or offset the effects of noise may alter the acoustic complexity of a community in a given location, resulting in a decrease in species' abundance (Bayne *et al.*, 2008) and/or diversity (Proppe *et al.*, 2013) at noise-polluted sites.

Forests of Mirzapur is badly hit by numerous mines due to presence of highly valuable Kaimur sandstone beneath. Wyndham fall and Chunar range is the worst affected forest range, where control of such sporadic small scale mining activities has been a tough challenge for the authorities. During our survey, we found innumerable small scale mining areas in Chunar & Sukrit range. The Forest Ranger of Chunar range showed his inability to control the mining activities because of lack of administrative support from other departments and also because of the immense political influence which are often linked to Ministers. He is aware of the fact that due to mining activities, the big mammals have disappeared from the forests. In Marihan range, there are few mining sites near SH-5, however we could not find any mining activity deep inside the forest.

Large continuous tract of mining inside forest areas are observed in Sukrit (near SH-5A) and Dramadganj range (near Banjari Kala village). Few abandoned mining sites were also observed in Dramadganj forest range (Babura beat). Most of the mining activities in Dramadganj were found to be on hill top. In all the forest range, the department staff were very much aware of mining and the ill-effects they have on their forests, but they all showed their incapability to completely stop it until there is strong administrative support and political will.



Map 21 Google Earth Imagery showing the continuous patch of stone quarries within Sukrit forest range

7.2 DEFORESTATION/LOSS OF FORESTS

Rapid deforestation poses a major threat to tropical forests (*Gibson et.al., 2013*). Apart from opening up forests to many abiotic and biotic influences, fragmentation can affect species dispersal and migration through its effects on forest connectivity. Having evolved within the ecosystems of large intact forests, many species are ill-adapted to life outside the forest interior, either in forest edges or in the patches carved from it (*Tole, 2006*). One of the main reason for deforestation in Mirzapur is because of over-dependence on forests for livelihood. In a survey done in sub-district Marihan in Mirzapur, it was reported that 92.86% of households are dependent on fuelwood for cooking purposes with average requirement of fuelwood per family is 6.87 Kg per day (*Sinha, 2011*). Owing to the fact that Mirzapur- Sonbhadra region has the largest area of land under forests and has very poor monitoring, it is undoubtedly has become a centre for fuelwood export and commercial wood for neighbouring districts. We also observed old trees being cut from stem in some of the forest areas. In Dramadganj range, during our survey the forest staff caught local villagers red-handedly with two bi-cycles with at least 400 kg of wood each and confiscated the same. Similar aggressive counter-action was also observed in Marihan forest range. However, in both of the cases, no formal complaints were reported on humanitarian grounds and they were left after being strictly warned and noting their name and address. During our survey, we have also observed deforestation carrying out openly, in some cases in presence of forest department staff as well (in Sukrit & Chunar range).

Goparaju & Sinha, 2015 reported that in Mirzapur, very dense forests (>70% canopy) present in the year 2010 has disappeared in the year 2013. However, the dense forests (>40% canopy), scrubland, grassland and agricultural lands have increased in 2013.

EXAMPLE 2: DEFORESTATION OF WYNDDHAMFALL RANGE AND BARKACHHA FORESTS

During our survey, we interacted with few local tea stall owners who have been running their shops since past many years in Belahada Mode (1 km from BHU South Campus, Barkachha). We were surprised to know that Sloth Bears, Sambhars and Leopards were used to found even upto Barkachha forests until 6-7 years ago, but after establishment of BHU South Campus and subsequent development of the area the forests became very much disturbed and they have hardly spotted any Sloth Bear or Sambhar in the area. The forest department staff told us that Sambhar deer were used to be spotted easily in Marihan forests until last 3-4 years, but now they are hard to spot. We were informed by a known local resident of Barkachha that a Leopard was killed 3-4 months ago (in year-end of 2015) and villagers buried the animal and according to him that incident was never reported to Forest Department. He added similar incidents has occurred in the past as well. We were also informed by the students of BHU South Campus that few months ago a full grown Bengal Monitor was killed by Hostel attendants of Vindhyachal Hostel in the campus. We were further informed that Kraits and Cobras whenever spotted inside the campus

are killed by the attendants and guards. Though Barkachha has denuded hills with very less forest cover, but the fact Lower Khajuri Reservoir is situated in Barkacchaa which is adjoining Wyndhamfall range where large tracts of severely degraded and denuded hills are found, during dry seasons animals often cross through the Wyndhamfall range to the water reservoir to access water.

7.3 EXCESSIVE GRAZING

Excessive grazing in a forests may reduce structural complexity and species richness resulting in deleterious changes (*Milner et al., 2002; Mysterud and Østbye, 2004; Pollock et al., 2005*). The development of tree seedlings to maturity or attaining canopy status is prevented by grazing (*Hester et al., 2000*), adversely affecting the continuity of entire forest ecosystems (*Pulido et al., 2001; Mountford and Peterken, 2003; Plieninger et al., 2004; Dufour-Dror, 2007*). According to *Pulido and Díaz (2005)*, the main direct damage seems to occur at the 'seedling emergence and establishment stage' when livestock graze, browse or trample the seedlings. This prevents recruitment of juveniles (*Hester et al., 2000*). When the regeneration process is continuously hampered, it may then lead to progressive decay of the forest cover (*Leiva and Fernandez-Ales, 2003; Quézel and Médail, 2003; Plieninger et al., 2004; Dufour-Dror, 2007*). Unlike seedlings, juveniles may not be killed straightway when browsed, however, their development can be severely hampered as the maximum efficiency of photosynthesis is reduced by having insufficient leaf area of photosynthetic tissue (*Putman, 1996*). According to *Belsky and Blumenthal, 1997* the effects of livestock grazing and trampling on vegetative cover vary with rainfall, slope, soil stability and vegetation type, as well as with animal density, season of use, duration of use and animal distribution.

Chaturvedi et.al., 2012 carried out a study on effect of grazing and harvesting on forests in this landscape and found that number of newly damaged juveniles was greatest in June and lowest in September. They reported that in the TDF found in this region, grazing/browsing by livestock and harvesting by humans are the major causes of damage to juvenile trees, in addition to the long drought periods within the annual cycle. The site which had the greatest level of disturbance in terms of damaged juveniles, also contained the lowest number of species and juvenile stems.

Grazing also leads to higher soil compaction and erosion of topsoil further deteriorating the soil conditions which won't support natural regeneration of forests.

The conversion of forest to pasture causes changes in topsoil morphology, increased water erosion, mass movements, soil compaction by trampling and alteration of the hydrologic cycle, among others (*Oram, 1990*). Trampling causes changes in physical soil properties. Infiltration is reduced, while runoff, erosion and bulk density increase (*Rouzi and Hanson, 1966; Blackburn et al., 1982; Van Haveren, 1983; McCalla et al., 1984; Reátegui et al., 1990*). The subsurface layer (usually at 5–10/15 cm depth) can be also affected by compaction, as reported for grazed pastures in tropical conditions (*Chauvel et al., 1999*).

As per 19th National Livestock Census (2012) the total number of livestock in district Mirzapur is reported to be 956259 which was reported in 18th National Livestock census (2007) as 898232. This means every year 11,605 livestock are added. With increasing number livestock population and reduction in forest quality and quantity, it is imperative that the remaining forests are highly susceptible to impacts from excessive grazing.



Image 37 Grazing by domestic goat, sheep and cow were found to be common in the forest areas. (Photo: Debadityo Sinha)

7.4 ROADS, RAIL & CANALS

Roads are a large threat to some wildlife populations. Most studies of the effects of roads on wildlife focus upon animal-vehicle collisions (*Forman et al. 2003*). However, it has also been suggested that roads act as complete or partial barriers to movement for some species (e.g. *Oxley et al. 1974*; *Mader 1984*; *Swihart&Slade 1984*; *Brody &Pelton 1989*; *Burnett 1992*; *Rondinini & Doncaster 2002*; *Shine et al. 2004*; *Whittington et al. 2004*). Such a barrier effect could fragment habitat and reduce population persistence by reducing recolonization of empty habitats and/or limiting immigration. (*McGregor et.al., 2008*) *Jaeger et al. (2005)* discussed three types of possible road avoidance and argued that the type of avoidance largely determines the mechanism and strength of road effects on a population. The three types of avoidance behaviour are: (i) animals may avoid the road itself as it is a hostile environment onto which they will not venture (called 'road surface avoidance'); (ii) animals may avoid emissions from traffic such as fumes or noise, keeping them some distance away from the road ('general traffic avoidance' or 'noise avoidance'); or (iii) animals may avoid individual vehicles, waiting for a break in traffic before attempting to cross the road ('car avoidance').



Image 38 SH-5 cutting through the Marihan forest range (Photo: Debadityo Sinha)

SH-5 (Mirzapur-Roberstganj) and Chunar-Rajgarh road has severely impaired the landscape connectivity of the continuous forests of Marihan range. The under construction Bansagar canal on northern and eastern side of the range will further restrict the range's free connectivity with other landscape. Though various rivers are found in the entire forest range, but these rivers do not hinder wildlife movement as the water flow in such rivers are limited only to wet season and during dry season, they allow free movement of animals. This is not in the case of artificial water canals which flows year round with significant depth restricting animals from crossing it. The 20 km railway corridor proposed by Welspun Energy U.P. (Pvt.) Ltd from Sarsogram to Dadri Khurd will further fragment the entire forest range in two halves which will severely affect the wildlife habitat and movement in this range.

Similar bifurcation of forest is seen in Sukrit range and Dramadganj range where SH-5A and NH-7 respectively cuts through the forests making it difficult for wild animals to cross the road due to movement of traffic day and night. This has greatly hampered the free movement of wild animals from neighbouring wildlife areas.

In all cases, we have observed significant land use change in areas around the roads. For eg. There are sandstone mines which came up recently in Sukrit range adjoining SH-5A and numerous illegal mines also opened up in surrounding areas. The forest areas around

roads are cleared for development of residential colonies, shops and petrol pumps which cumulatively add up to the forest-gap creating great hindrances to not only movement of animals but also increasing the habitat fragmentation. This phenomenon is becoming a reason of local extinction of animals as the ecological niche of the animals are greatly reduced due to constriction of home range, restriction of migration and increasing inter-specific as well as intra-specific competition.

7.5 FOREST FIRES

Forest fires are common in the forests of Mirzapur. The forest fires occur mostly in dry seasons. Local villagers believe that plantation of bamboo is the main reason that fire ignites easily in the forest ranges. Forest department staff had mixed explanation of such fires, and they claimed that in few incidents in past they have got evidences of human induced fires like presence of burnt bidi or match sticks from the fire affected areas. In Patehara forest range, a forest guard informed that forest fires are also used as a tool to clear and encroach forests for agricultural uses.

Human induced forest fires is common in most tropical dry forests. Many scientists agree that almost all of them are caused by humans (*Brandis 1897; Pyne 1994; Bahuguna and Upadhyay 2002; Semwal et al. 2003*), some unintentionally, but the majority are assumed intentional. 95% of forest fires are caused either by negligence or unknowingly by the human being (*Satendra & Kaushik, 2014*).

One of the dominant motivations to ignite fire in Indian TDFs is to increase the availability and quality of grasses for pasture use. Possibly of equal importance on a global level is the utilization of fire to facilitate hunting. Hunters use fire in two ways: (i) to drive prey to where it can be easily killed (*Lewis 1989*) and (ii) to prepare hunting grounds by attracting prey to the fresh flush of grasses (*Laris 2002; Mistry et al. 2005*). Moreover, burned sites make hunting easier because the animals are easier to see. Fire was used by early inhabitants of India for hunting (*Goldammer 1993; Satyendra & Kaushik, 2014*).

The most famous and often-cited example is the use of *Diospyros melanoxylon* tree leaves (tendu leaves) that function as cigarette paper for the small Indian cigarettes called “beedis” (*Saigal 1990; Goldammer 1993*). Fire is applied to the forest in the dry season (mainly April–May) so that the trees produce new leaves which can be harvested once they are fully green (*Hunter 1981*).

A product that does not depend mainly on the modification of vegetation is the ash production by the burning of (mainly) forest land adjacent to agricultural areas which can serve to fertilize the agricultural areas when the ash gets transported by water—especially on slopes—or by wind (e.g., *Vayda 1996; Shaffer 2010*). *Pyne (1994)* states that this was a common practice prior to the British period and *Roveta (2008)* found evidence for such fire application among the Soliga tribe in the Biligirirangan Hills, Karnataka. However, for India this relation hardly appears in the available literature and is not known what proportion of this application holds among other reasons for forest fires.

There is abundant evidence that high fire frequency hinders woody plants from establishing in savannah and TDF ecosystems (e.g., *Hopkins 1992; Setterfield 2002; Favier et al. 2004; Sankaran et al. 2008; Ratnam et al. 2011*) while the season in which fire occurs influences the density and composition of the regenerating species (e.g., *Bond and van Wilgen 1996*).

Frequent fires seem to maintain a soil seed bank of short term plant species (Graminoids) over life forms with a longer-term life cycles like broadleaved herbs and woody plants (*Gashaw et al. 2002*). Fire also promotes fire-tolerant species (*Furley et al. 2008*). This selective attribute of fire also reduces tree seedling species diversity as *Saha and Howe (2003)* found in a TDF in central India and *Verma and Jayakumar (2015)* as well as *Kodandapani et al. (2009)* report from TDF of the Western Ghats.

An increase in fire intensity and frequency leads to the transformation of forests to savannah or grasslands. An area locally affected by wildfires may substantially lose short-term water retention if heavy rainfall occurs after the dry period.

Fire also affects the biodiversity and therefore the functions of ecosystems, especially those depending on species interaction like pollination and dispersal.

7.6 HUNTING

In almost all forest ranges where wildlife is present we found that hunting is openly practiced. Mirzapur has been a traditional hunting ground during British government and there was a time when the district had abundance of Cheetahs, tigers, leopards, sloth bears, caracals and several species of antelopes which diminished slowly mainly due to hunting and habitat loss. We were shocked to realize that hunting activities are going unabated in these forest range till now. Wild boar and deer species are mostly hunted by people. We also got information from the villagers that people from nearby cities come in vehicles during night, often accompanied by trained dogs to hunt herbivores.

There is no reason to disbelieve the same because we also got to know from forest department that the forest guards generally avoid going in forests after sunset due to fear of Naxalites and that may have resulted into unchecked entry of the hunters into the forests of Mirzapur. There are also occasions where villagers kill wild animals like leopard, hyena, fox and sloth bears in an unexpected confrontation. A large number of such incidences go unreported.

We were informed by some local people that a sloth bear was killed in a village in Marihan range around January-February, 2016 by a food item packed with explosive which is usually used to kill wild boar. A forest guard informed that a person was arrested in Chunar 2-3 years ago, who was selling a sloth bear cub he poached from Marihan forest range. A local shopkeeper of Barkachha informed that a leopard was killed by villagers in Barkachha (approx. 10 km from Marihan) around December, 2015 and was buried. A tea stall owner at Marihan informed that a person was killed in March, 2015 by an electric wire which was laid to kill wild animals. Very recently, a hyena was killed by villagers due

to the fear that it will lift their livestock and children. The forest staff of Dramadganj range informed that 2 sloth bears were shot dead few years ago which was believed to be due to unexpected confrontation by people who went for hunting herbivores. There was common unanimity among all people we interacted about hunting of animals in forests, especially of wild boars. We are also sceptical of these reserve forests serving the illegal market dealing with trade of sloth bear parts.



Image 39 A Hyena which was killed by villagers on 27th March, 2016 near village Bhadauli, Mirzapur (Photo: local journalist)

7.7 EXOTIC SPECIES

Invasion of species may lead to local declines (*Islam, 2001*) and even extinction of native species (*Pimm, 1986*) thus altering species richness in the forest fragment (*Carey et al., 1996*). Invasive species can alter ecosystem function by changing disturbance frequency or intensity (*D'Antonio and Vitousek, 1992; Fensham et al., 1994; Smith, 1994; Mullett and Simmons, 1995*), altering trophic structure (*Cross, 1982; Hobbs and Mooney, 1986; Braithwaite et al., 1989*) and changing resource availability (*Vivrette and Muller, 1977; Vitousek and Walker, 1989; Boswell and Espie, 1998*). Among these factors, disturbance may favour invasions by disrupting strong competitive-species interactions (*Fox and Fox, 1986; Crawley, 1987*) and locally increasing different limiting resources (*Hobbs, 1989*).

A. LANTANA CAMARA

Lantana (*Lantana camara L.*) has spread in almost all the fragmented areas in the Vindhyan dry deciduous forest, and has been ranked as the highest impacting invasive species (*Batianoff and Butler, 2003*), because it possesses great potential to escape

cultivation and have deleterious effect on species richness (*Islam, 2001*). In India it was introduced in early nineteenth century as an ornamental plant (*Sharma, 1988*), but now it is growing densely throughout India (*Sharma et al., 2005 a, b*).

Light availability on the forest floor has been recognized as a key factor that influences intrinsic traits of inhabiting species (*Jones et al., 1994; Walters and Reich, 1996*). The dense cover created by vertical stratification of lantana may reduce the intensity or duration of light under its canopy and thus decrease the herbaceous cover. *Sharma and Raghubanshi (2011)* reported that Lantana is not found in forests where the canopy cover was at least 63%.

It is likely that herbs are influenced by the amount of light that reaches the forest floor, and this may be probably one of the mechanisms responsible for the decline of herbaceous vegetation. *Sharma and Raghubanshi, 2006 & 2007* advocated that the growth architecture pattern of lantana is such that it prevents the light penetration to the forest floor, leading to the decline of tree seedlings and possibly the herb flora.

Lantana also possesses the capability to trap wind-blown litter. This trapping of litter is also dependent on lantana cover, as denser the lantana cover, greater the trapping potential. So, more organic matter accumulates/builds up with increasing lantana cover.



Image 40 Invasion of Lantana in Sukrit Forest Range (Photo: Debadityo Sinha)

Accumulation of litter beneath the lantana canopies builds up soil organic matter. Accumulation of soil N closely follows that of soil organic matter because, on average 99% of the N in terrestrial ecosystem is organically bound (*Rosswall, 1976*). *Raghubanshi (1992)* reported strong positive relation between total N content and organic C content of soil in the dry deciduous forest ecosystem. This self-perpetuating changed

microhabitat could probably provide lantana with increased resource leading to its successful proliferation. Therefore, the presence of *L. camara* in the dry deciduous forest alters the spatial pattern of herbaceous layer vegetation and also changes the microhabitat conditions which could probably help towards its successful proliferation.

B. HYPTIS SUAVEOLENS



Image 41 Hyptis invasion as appears in dry season, Marihan (Photo: Debadityo Sinha)



Image 42 Hyptis invasion as appears after monsoon, Marihan (Photo: Debadityo Sinha)

Hyptis suaveolens or Bushmint may be considered as one of the most serious invaders in the Vindhyan dry deciduous forest of India after *Lantana camara* (Sharma *et al.* 2008). Locally known as *Bantulsi*, it is an erect annual woody herb, commonly 1 m in height (maximum height = 1.5 m), and reproduces by seed (Willis, 1973). It is one among the world's most noxious weeds, which are invading natural ecosystems across tropical and sub-tropical regions of the world (Afolayan, 1993; Sarmiento, 1984; Wulff and Medina, 1971). It is a native of tropical America. Because of its widespread occurrence in the tropics, it is now regarded as a pan-tropical weed. In India, Bushmint occurrence is reported from

North-East India, Vindhyas, Deccan Peninsula, and Andaman and Nicobar Islands (Wealth of India, 1959; Yoganarasimhan, 2000).

Hyptis suaveolens is a prolific seed producer and dense infestations can yield up to ~3000 seeds m⁻², forming persistent propagule banks within a short period. The seeds are slightly notched and they are protected by spined burrs that help in the seeds' dispersal through animal fur (Stone 1970; Parsons & Cuthbertson 2000). It is found on a variety of habitats, like railway tracks, roadsides, foothills of open forests, and forest clearings, and

can heavily invade wastelands, particularly on arid and rocky substrates (*Verma & Mishra 1992; Mudgal et al. 1997*).

Raizada (2006) suggested that species loss in the area occupied by *H. suaveolens* was related to its unpalatability to livestock and, thus, selective avoidance, resulting in other species being heavily used as fodder by livestock. (*Sharma et.al., 2009*)

In its native range, the local dominance of bushmint in savannahs was associated with the anthropogenic disturbances viz., removal of vegetation, fire, over-grazing, and tillage (*Holmes 1969; Wulff 1987*). It was widely present in the areas where mechanized agriculture and intensive cattle raising were practiced (*Holmes 1969*). In the invaded range, it is commonly found alongside roads and water courses, open forests, and the over-grazed pastures. Bushmint forms large thickets and is believed to produce allelochemicals, which impede seed germination of native species. The traits which make bushmint a potent invader are: prolific seed production (*Raizada 2006*), high dispersal ability (*Parsons and Cuthbertson 2000*), phenotypic plasticity to a variety of habitats (*Sharma and Raghubanshi 2009*), proliferation from perennial rootstocks (*Raizada 2006*), unpalatability to livestock (*Holmes 1969*), and probable allelopathy effects on native species (*Raizada 2006*).

We found *Hyptis* invasion very prevalent in Marihan range and Patehara range as compared to other forest ranges. In both cases, they were more dominant in periphery areas and where large openings were present.

CHAPTER 8: MYTHS

8.1 MOST OF THE CONFLICTS ARE RESULT OF ANIMALS MISTAKENLY STRAYING FROM NEIGHBORING PROTECTED AREAS

Whenever there are any incidences of leopard or sloth bears conflict with human beings it is often claimed that the animal must have wandered from neighboring protected areas and not from our forest areas. This assumption is so commonly followed that in all of the forest census carried out till date by Mirzapur forest division, the number of leopards have been shown as zero. This may be attributed to the additional burden of responsibility which will come on the range staff if their range is declared to be habitat of many Schedule I species. During our survey, most of the villagers we interacted in Marihan, Sukrit, Patehara and Dramadganj forest range admitted that these forests are inhabited by leopards and sloth bears. In Dramadganj range, we also got several reports of sighting of tigers from villagers, but they are made to believe that tigers come from neighboring forests of M.P. and it is not a natural habitat. We found it very hard to believe this explanation by forest staff firstly because it is mere assumption and secondly because there has been no scientific study ever done by any reputed wildlife institute in this forest division.

The same rationalization is given when there is man-wildlife conflict in forest ranges adjoining protected areas. For e.g. In Patehara and Dramadganj range, whenever there are incidents of leopard straying into villages, the forest staff creates an impression in the public that the animals came from Madhya Pradesh jungle or Kaimur WLS, and it has been scared back into the forests from where it came from. Though this might be the easiest way to shred responsibilities off the shoulder, it is a very dangerous practice as it makes the villagers and animals more vulnerable for conflicts in future. The local media also plays a damaging role by not only being insensitive to wild animals but also spreading hate against wild animals among the local citizens. For eg. in recent events of sloth bear attacks in Dramadganj, one newspaper even said that forest department failed to capture the sloth bear and instead distributed compensation.¹ Such kind of reports published by reputed newspaper is bound to increase the probability of causing harm to wildlife by instigating unnecessary revulsions in general public. Instead they should be actively engaged to spread awareness on forests and ways to evade confrontation with wild animals.

Reports of Mugger crocodiles entering village ponds and wells have been reported from Marihan, Sukrit, Dramadganj and Patehara range as well. The captured mugger crocodiles are either released into nearby reservoirs such as Upper Khajuri and Meja. There has been no clue what happened to the rescued crocodiles after that as no one tracked them thereafter. In one the incidents, a leopard released in Patehara range became problematic for villagers living near Patehara range and there has been several incidents thereafter when the leopard tried to attack villagers and lifted animals. In none of the cases where animals are captured, forest department

¹ <http://www.jagran.com/uttar-pradesh/mirzapur-13859948.html>

staff could confirm from where the animals came from and nor the animals were geo-tagged to monitor their behavior and survival.

There is also a great confusion on the habitat of Mugger crocodiles in Mirzapur as they have been rescued from nearly all forest ranges, which proves they are widely distributed in Mirzapur. From local people we could get confirmed information that River Bakhar, River Belan (Patehara range) and connected streams are the main habitat of Mugger Crocodile as they can be seen in abundance during rainy seasons in both of these rivers. The same has been confirmed by all forest range staff of Patehara as well. A forest staff of Marihan range claimed that he has spotted Mugger Crocodiles in Panchsheel dari (Sukrit Range) 2-3 years before. A senior journalist told us that Mugger Crocodiles used to be found in most of the village ponds till last decade and now they can be seen in few reservoirs basking under sun. As most of the reservoirs are mostly built on some seasonal streams/rivers, we can assume that some of these reservoirs and dams may have some isolated populations of Mugger crocodiles which often stray into nearby villages. We recommend preparing a herpetofauna inventory of Mirzapur forest range with help of an experienced herpetologist.

It is a high time the Mirzapur forest division must acknowledge the presence of wildlife in their forests and proudly take initiatives to protect and improve their habitat to reduce such conflicts. Media must be educated enough of the importance of the forests for wildlife so that their wide outreach can be used to develop sensitivity among local villagers to wildlife and the importance of their protection. If we are scared to admit the presence of wildlife in our own forest range, it will not show the lack of interest of the department and escape from responsibility but will be very dangerous for the wild animals who inhabit these forests.

8.2 LANDSCAPE CHANGE HAS NOTHING TO DO WITH DECREASE IN WILDLIFE

We found this reasoning very commonly given by the forest department staff when they are asked about the impact on wildlife due to mining, construction of roads and other non-forest activities. Their first reason to justify such diversion of forest lands has been the same-the animals will adjust by migrating to other forest areas and there will be no loss to wildlife population. Another assumption often made while diverting forest areas for other activities are that the forest areas are not habitat of any important animals and no animal movement is observed. Such observations are often made by conducting a site visit and the conclusion is made based on their direct sighting experience. We found this exercise very vague as most of the animals found in forests are not only shy of human presence but are nocturnal as well. While we found no good reason to rely on such site visits, we found this practice highly perilous as such decision has a very outsized cumulative impact on the entire landscape and underestimate the habitat suitability for wildlife which leave the wild animal species highly vulnerable.

CHAPTER 9: RECOMMENDATIONS

9.1 PROTECTION & CONSERVATION OF HABITATS & CORRIDORS

Extinctions can be averted by reducing deforestation rates and reforesting fragmented forest landscapes. Preserving or restoring connectivity is therefore increasingly recognized as a key goal for land-use and conservation planning (*Vos et al. 2008*). Since the habitat quality and quantity are considered to be the primary factors that determine the size and health of wildlife populations, *Hall et al. (1997)* defined habitat quality as “the ability of the environment to provide conditions appropriate for individual and population persistence”. Therefore, good quality wildlife habitat is one that can provide food, water, vegetation covers and space for wildlife species, where wildlife species can hide, rest, move about, and mate (*Yarrow, 2009*). Following are few of the measures which we recommend to be taken as soon as possible to maintain the existing habitats suitable and improve.

A. DE-FRAGMENTATION OF FORESTS & IMPROVING LANDSCAPE CONTINUITY

Human-induced large-scale fragmentation and degradation of natural forests in protected areas (PAs) as well as outside PAs either shrinks wildlife habitat or breaks the continuity of genetic exchanges amongst spatially isolated wildlife populations, and thus causes significant biodiversity loss (*Hanski, 1989* and *McNeely et.al., 1995*). In such conditions, corridors and connectivity provide an array of ecological and environmental benefits in such a way that corridors link passages or avenues where wide ranging animals can move safely, plants can propagate, genetic interchange can occur, populations can move in response to environmental changes and natural disasters, and threatened species can be replenished from other areas (*Crooks and Sanjayan, 2006*). Landscape ecology conceptualizes connectivity as a gradient of critical thresholds, ranging from the large intact forest to the small unconnected forest patch. Landscape ecologists have long observed that animals naturally use corridors between forest patches. Connectivity also is important for the persistence of populations (*Fahrig and Merriam 1985*). Thus, species survivability in disturbed forests may be threatened if forests are fragmented in a way that decreases their connectivity (*Wegner and Merriam 1979*).

Landscape connectivity can be defined as the degree to which the landscape facilitates movement across its existing resources (*Taylor et al., 1993*). It can be considered as an emergent property of the landscape that results from the interaction between landscape structure and landscape function (*Leitao et al., 2006*). As *Crooks and Sanjayan (2006)* explained, we can identify two primary components of connectivity: structural, i.e., the spatial arrangement of different types of habitat or other elements in the landscape, and functional, that refers to the behavioural response of individuals, species, or ecological

processes to the physical structure of the landscape, which is ignored by structural connectivity approaches (*Taylor et al., 2006; Tischendorf and Fahrig, 2000*).

The lack of landscape connectivity and the subsequent isolation of habitat patches can interfere with pollination, seed dispersal, gene flow and wildlife migration and breeding, among other ecological processes (e.g. *Crooks and Sanjayan, 2006*). Enhancing landscape connectivity is a key part of modern biodiversity conservation strategies worldwide, and may be one of the best responses to counteract the potentially adverse effects of habitat fragmentation and facilitate the shifts in the natural ranges of species due to climate change (*Taylor et al., 1993; Hannah et al., 2002*). However, Connectivity should not be viewed as the only possible response to landscape change but just as a part of a broader set of available conservation management options (*Bennett et al., 2006; Hodgson et al., 2009; Saura and Rubio, 2010*). In particular, the amount of habitat has been recognized as the major determinant of species abundance and persistence, usually outweighing the role of spatial configuration per se (*Fahrig, 2003*), although depending on the cases the effects of habitat loss may be exacerbated to different degrees by the fragmentation of the remnant habitat network (*Andrén, 1994; Radford et al., 2005; Betts et al., 2006*). Much of the global conservation policy on endangered species is centered on land allocation schemes for securing source populations (*Walston et.al., 2010*), promoting and maintaining connectivity between fragmented populations (*Margules and Preseey, 2000; Prugh et.al., 2008*).

Therefore, we suggest the following measures

- i) There should be demarcation of ecologically fragile zone in the district where the developmental activities should be complete banned. No purchase or sale of land should be allowed in those areas.
- ii) The degraded forests must be first given protection from further disturbances and should be used for development of buffer zone by planting native fruit bearing trees.
- iii) The grazing activities must be restricted to existing fallow lands and abandoned agricultural fields after identifying them. The land owners may be given an incentive to grow palatable grass and pasture lands on them, especially for grazing during dry seasons. This will significantly reduce disturbance and enhance the forest regeneration.
- iv) The mining activities inside forest areas and corridors shall be immediately stopped, and the mine spoils should be restored by putting soil layer to facilitate natural regeneration. Short lived light tolerant fruit producing plants must be encouraged for initial phases of plantation on such lands to develop canopy cover so that invasion by exotic species is controlled. Thereafter, long-lived shade tolerant species of plants shall be planted. The restoration process takes long time (at least 10-15 years) and therefore these sites should be properly protected from disturbances till the trees attain a significant height and become forest like.
- v) In some cases, the rehabilitation of villages may be inevitable in places where such settlements came up in recent years. But, in places where tribal people have been

living historically, smart allocation of village resources will help reduce the problem and in long run may solve the crisis completely. For eg. The problem of man-animal conflict in Banjari Kala is expected to remain in coming years if present situation remains same (refer para). This village has the highest number of intrusion of wild animals and in some cases it has been fatal for animals and human lives both. The main reason for the intense man-animal conflict seems to be the forced movement of wild animals through this village which is preferable due to high level of disturbances from other routes. To solve this crisis, we have to develop more suitable route for the wild animals which they will prefer over human habitations. This can be achieved by allotting land for forest restoration at foothills of Banjari Kala which shall be completely protected from any kind of human disturbances. As Banjari Kala is surrounded by dense forests and is known for big carnivores like leopard, sloth bears and sometimes tigers-we suggest at least 2 km of continuous patch of land (between 24°45'32.17"N 82°12'45.71"E to 24°46'25.56"N 82°13'15.65"E) lying in the valley be completely protected from any human disturbances and restoration of forests should be done. The floodplains of river Sewati (500 meters from river bank on both sides) should be protected in this particular stretch. As this area is fertile due to presence of river-and is contiguous to dense forests-the natural regeneration process will be the most preferred way of forest restoration. As animals generally avoid disturbed areas, it is expected that if forests are restored in this river valley stretch it will significantly reduce the incidents of wild animals straying into villages.

B. IMPROVEMENT OF WILDLIFE CORRIDORS

Ecological processes that formerly operated over large spatial scales may no longer be effective within restricted boundaries of protected areas (*Beale et.al., 2013*). The ecological consequences of fixed boundaries not delimiting a fully functioning ecological system are considerable, and are the ultimate cause of many later problems (*Pienaar, 1983*). Notably, the seasonal routes of migrant mammals are cut, usually leading to smaller resident populations and vegetation change generated by year-round grazing pressure and disruption of fire patterns. Infrequent, but vital, movements in response to extreme conditions (e.g. to rarely used drought refugia) become impossible, leading to increased variation in annual survival (*Shrader et al., 2010*).

The idea of wildlife corridors was probably proposed for the first time by *Wilson and Willis (1975)* as a means of conserving biodiversity based on the theory of island biogeography. A wildlife corridor has been defined as a "linear landscape element which serves as a linkage between historically connected habitat/natural areas, and is meant to facilitate movement between these natural areas" (*McEuen (1993)*). While the utility of wildlife corridors has been debated (*Simberloff and Abele, 1976; Simberloff and Cox, 1998; and Simberloff et.al, 1992*) it is largely believed that wildlife corridors facilitate animal dispersal from isolated habitats and help counter biological processes that lead to species extinction.

Beier & Loe (1992) observe that the critical features of a wildlife corridor are not its physical traits such as its length or width or vegetation but rather how well a particular piece of land fulfils several functions like survival of species, facilitation of travel, migration, mate finding of wide ranging animals, propagation of plants, genetic interchange, movement of populations in response to environmental changes and natural disasters and re-colonization of habitat areas by individuals.

Therefore, we suggest following measures:

- i) Construct wildlife overpass or underpass in those forest areas where the removal of disturbances is inevitable such as the existing highways, canals and railway links. For eg. Between Sukrit and Marihan range where Bansagar canal, Chunar-Rajgarh road and Chunar-Churk railway line has created barriers between these two forest range. The Patewar forests which is separated from rest of Marihan range by SH-5 should be reconnected from Darhira beat. Similar corridors will be required for other areas in different forest range.
- ii) Reclaim the lost corridors and forest connectivity by removing the encroachments or any other land use change which occurred on historical forest areas which connect different forest areas. For eg. the lost forest connectivity of Leduki and Imliapokhar ([map 13, 14](#)) must be restored without any delay.
- iii) Stepping Stone forests must be developed and protected in-between different forest ranges. This must be done along with creation of corridors which can facilitate movement of animals without any human interference. We recommend acquiring the existing fallow lands within the forest areas by forest department, and facilitate natural forest regeneration with short living pioneer species native to this place initially.
- iv) Open spaces such as grasslands and scrublands within and around the forests are favoured by Chinkara, Blackbuck and is important as Sloth Bears also prefer such areas for habitat and food. Such grasslands and scrublands should be identified and protected. Access to water sources shall be protected from any alteration and future disturbances.

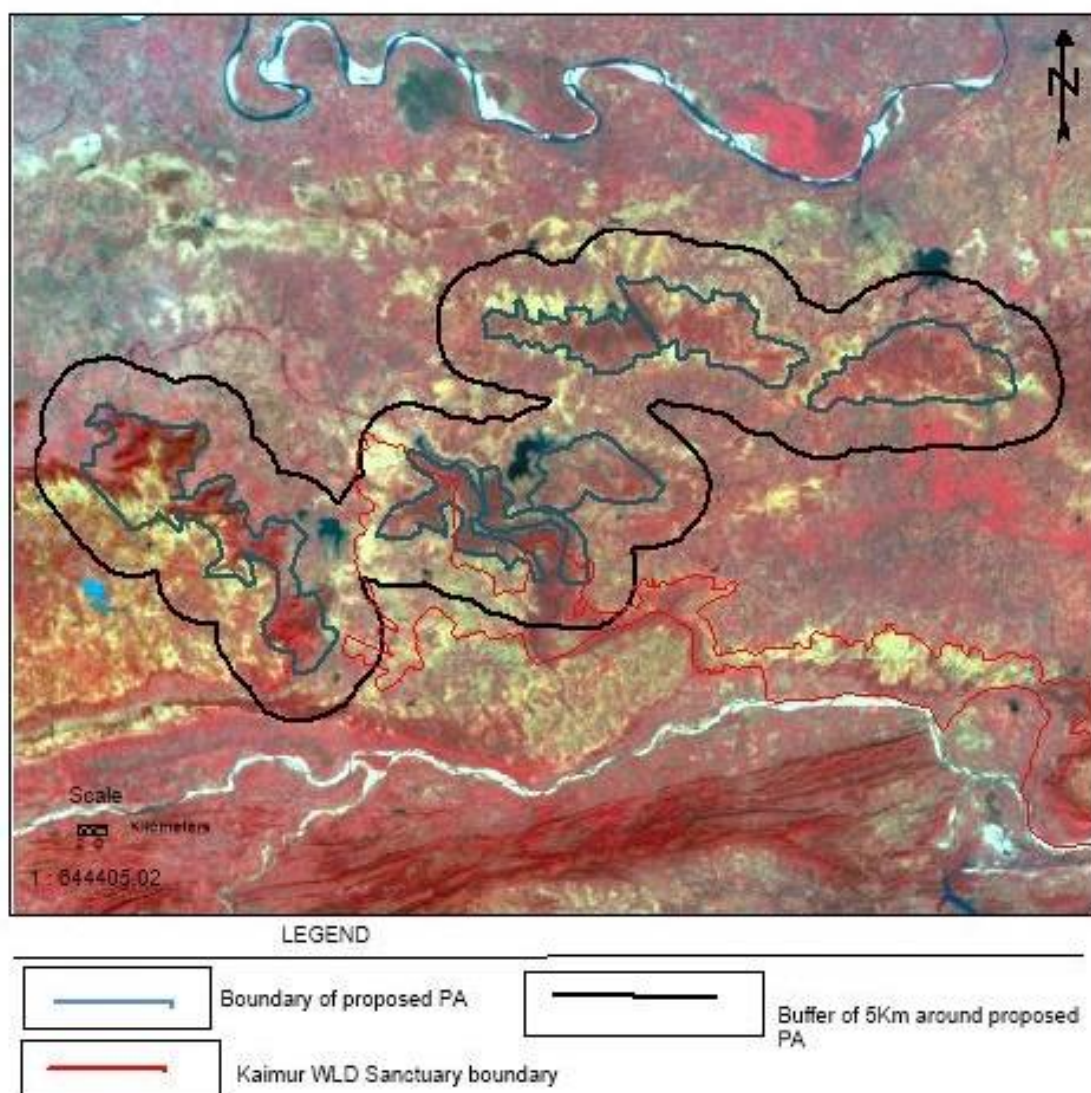
C. CONVERT CRITICAL WILDLIFE AREAS INTO PROTECTED AREAS WITH SUFFICIENT BUFFER

Though Kaimur Wildlife Sanctuary is a notified protected area, but the sanctuary has lost most of its forests and there are only few patch of forests which is suitable for wildlife. On the other hand, the forests on both sides of river Belan are quite dense and is also the last refuge of the wild fauna found in this landscape. Therefore, we suggest to include the forest areas in Halia range and Patehara range as shown in the map (see [map 22](#)) to be included under the protected area of Kaimur WLS.

The Marihan-Sukrit-Chunar landscape and Dramadganj range are two other forest areas which we propose to be declared as 'Protected Area' as these forests are highly critical

for survival of wildlife and due to high developmental pressure, significant areas of this forests are already lost to variety of land use change. Those remaining are highly fragmented and getting degraded very fast. These forests are not only rich in several Schedule I fauna, specifically sloth bears, but they are also very rich in diversity of medicinal plants unique to this region. The wildlife census conducted by Mirzapur Forest Division itself shows that the wildlife population is getting reduced at an alarming rate. Due to hilly terrain and dry climate, these forests are ecologically very fragile and very sensitive to disturbances. Therefore, for the reasons explained in this report we suggest these landscapes must be protected under strict legal enactments such as Wildlife (Protection) Act, 1972 (see [section 9.4](#)). If immediate action is not taken, then similar to tigers, sloth bears will be the next to become extinct from jungles of Mirzapur.

Based on our survey and analysis, we propose the following areas to be given protection as critical wildlife habitats.



Map 22 Critical Sloth Bear Habitats (referred as proposed PA) in Mirzapur including Halia range of Kaimur Wildlife Sanctuary Division. Top: Marihan-Sukrit-Chunar range, middle: Patehara range, bottom/right: Dramadganj range

The estimated area of the forests which are proposed under protected area in above map is provided below:

Table 10 Estimated area of core habitats and proposed PA

S.No.	Forest Range/Beat	Estimated Core Habitat (sq.km)
1	Marihan	65
2	Sukrit	122
3	Imlipokhar	22
4	Leduki (East to R. Belan)	27
5	Halia* (West to R. Belan)	42
6	Dramadganj	145
	Total:	423
	Landscape	Approx. Area of the Proposed PA (sq.km.)
1	Marihan-Sukrit-Chunar	540
2	Extension to Kaimur WLS	320
3	Dramadganj	250
	Total:	1110

*This forest patch is the densely forested area which is adjacent to Kaimur WLS and lies on western bank of River Belan. The draft notification on Eco-sensitive zone of Kaimur WLS showed it as outside of the sanctuary boundary. Therefore, we have included this patch as well.

9.2 PROTECTION OF WATERSHEDS AND RIVER CATCHMENTS

Forest boundaries often exclude the catchments of the rivers flowing through them, and hence are vulnerable to Marihan the consequences of land use outside of their boundaries altering flow and water quality. Around the world, there are efforts being taken to protect the watershed areas and catchment of rivers. Adequate protection and management of watershed components is a priority for both conservation and humanitarian reasons (Beale *et.al.*, 2013). This will not only help maintaining the hydrological cycle of the area, but will also have significant impact on human lives as protected catchment and watershed will ensure improved water flow in downstream and less erosion of land which will result into less siltation downstream. As Mirzapur has a long dry season and water availability is a major concern, the importance of protecting and conserving the watersheds shall be of utmost importance. It is recommended that all such watersheds and sources of rivers are well protected and no human activities may be allowed in areas surrounding the streams which are within and near to forests as they are also vital for survival of wild animals. The allotment of land along river banks and river beds should

be regulated and a portion of land must be protected for use by wild animals where agricultural farming should not be allowed.

9.3 ADMINISTRATIVE REFORMS

A. IMPROVING GROUND MONITORING

During our survey, we found the number of ground staff are highly inadequate in number. Most of the forest watchers are temporarily hired at a meagre wage of Rs. 3,500 per month. These forest watchers are not even given any vehicle and arms to protect themselves in any adverse situation. There is 1 forest watcher in one forest beat, sometimes 1 per two beat. Forest watchers and forest guards are also overburdened with administrative tasks in range offices and nurseries which results into very few time spent in the forests. In some cases, we also observed that forest guards are recruited from far off places who have never worked in remote forest areas before and therefore avoid going to forests. Most of the existing forest guards and watchers are quite old as according to them there has been no recruitment of forest staff in past several years. Therefore, we suggest following measures:

- a) There should be immediate permanent recruitment of forest staff who are young, and who belong to local region.
- b) The forest staff should be trained for using latest technologies like using GPS, remote sensing and other applications to monitor their forest areas.
- c) A division wise remote sensing and GIS based monitoring of deforestation and encroachments of forests must be initiated as soon as possible.
- d) Camera traps shall be placed in strategic locations to monitor wildlife movement and other illegal activities inside the forests and adjoining area.
- e) Information boards, barricades and checkpoints must be placed on roads near such forest areas to check the illegal activities such as mining and logging.

B. IMPROVING INFRASTRUCTURE OF RANGE OFFICES

We realized that forest ranges which are quite far from Mirzapur city (where the Divisional office is located) have the poorer monitoring of forests. This was evident from the range like Dramadganj, Chunar and Sukrit where the forest staff themselves seemed to be not acquainted with their own range. The situation was better in Marihan range which is the nearest to the Mirzapur city and Marihan itself being a sub-district headquarter. One of the important factor is absence and presence of forest range officer in their range offices. We found the Patehara, Dramadganj and Sukrit range offices very ill-maintained and most of the rooms abandoned because they are in very bad state. Some of the beat offices in forests even don't have toilet and drinking water facilities. The forest guards are forced to do open defecation and drink iron loaded water of hand pumps which turns yellow if kept in open. None of the range offices we visited even had working computer or internet connectivity. In our view, all the range offices and beat offices need

major rejuvenation so that range officers and forest guards would not feel like being punished for their duty.

C. IMPROVING INTER-DEPARTMENTAL COOPERATION AND SUPPORT

Apart from very poor ground monitoring staff and low strength of forest guards in each range, what seems to be serious challenge in protection of the forests are non-cooperation of police department, mining department and district administration. The forest department's baseline staff feels helpless when they are not given importance and police refuse to act even when information is sent to local police departments by forest staff. The Forest watchers being temporary staff are often underestimated by police, and the defaulters.

Therefore, we suggest state government should take aggressive steps to increase the cooperation between district administration and forest department for immediate action on illegal activities noticed inside the forests.

D. INVOLVING SCIENTIST & SOCIAL EXPERTS IN MANAGEMENT

The reluctance of managers to take scientific research seriously may have reflected a perceived lack of relevance of many scientists' research agendas and general distrust between the scientific and practitioner communities. Recognising that the failure to respond promptly to observed declines reflected an institutional problem, a programme of adaptive management based on "thresholds of concern" was developed and implemented to ensure active cooperation between the two communities (*van Wilgen and Biggs 2011*).

We found practically no involvement of scientists in management of forest areas. The entire management and planning for maintaining the forests including selection of plantation species is decided by the forest guards and forest rangers. We were told that the seeds for plantations are sent by Wildlife Institute of India, however, they could not tell if WII is also monitoring the success of plantations themselves on site. We were quite surprised by the fact that Banaras Hindu University and Allahabad University, both being pioneer institutes in ecology and forestry are never consulted. We also found this assumption quite prevalent among few forest department staff that 'scientists lack on-field experience and limitation we face and hence they cannot give us best suggestions on our forests'. This avoidance of scientists from the forests, is hardly understood by us in general terms.

Therefore, we recommend the Forest Division to establish a healthy relationship with the Professors and researchers of Banaras Hindu University, Allahabad University and other institutes who have extensively worked on the forests and wildlife of Mirzapur.

State government should mobilize funds for research on the unique dry deciduous landscape of Mirzapur. We recommend a dedicated 'Dry Deciduous Research Institute' in Mirzapur.

9.4 INCREASING LEGAL PROTECTION

The present state of wildlife which has survived a number of disturbances in the past may be attributed to the fact that the habitat area was quite large and the animals were able to migrate to and fro within the landscape. But now, we are also losing out the extent of the wildlife habitats and the connectivity among the landscapes. The forests are getting isolated and the wild animals have less access to neighbouring forests making them highly prone to extinction. The threat of extinction looming over the wild animals of Mirzapur forest division can be understood from the Forest Department's own census which shows drastic change in wildlife population in the district:

Table 11 Decrease in Schedule I protected animals in Mirzapur between 2011-2013

Species	Population in 2011	Population in 2013	% Decrease
Chinkara (Sch I)	277	117	58
Blackbuck (Sch I)	129	82	36
Sloth Bear (Sch I)	211	114	46
Sambar	248	88	65

Sch I: Schedule I under Wildlife (Protection) Act, 1972

The situation is alarming, and the immediate attention should be given on protecting the habitats from land use conversion. Though these forests are protected as 'Reserve Forests' but they hardly help in protecting the wildlife which are inhabitant of these forests. At the same time, we have to also take care of the forest dependent communities whose livelihood is completely dependent on forest services.

Therefore, we recommend the following solution to existing problem.

- i) The entire forest range of Marihan, Chunar, Sukrit, Patehara, Dramadganj be declared as **Biosphere Reserve**.
- ii) Marihan range (all blocks), Sukrit Range (all blocks) and Chunar Range (Sakteshgarh and Amlia block) has high level of residential wildlife. The presence of water sources, plains and hills is the reason the animals have accessible food sources and also find it suitable for their habitat. We propose these combined landscape be declared as **Wildlife Sanctuary/National Park** with sloth bear as the flagship species.
- iii) To protect the forests of Patehara range is highly crucial not only for the inhabited animals but also for neighbouring forest areas-the Leduki and Imliapokhar blocks be included as **extension to Kaimur Wildlife Sanctuary**.
- iv) The entire Dramadganj forest range has very good forests and has a large tract of old mountainous forests. Such forest areas are highly suitable for wildlife and deserved to be declare **Wildlife Sanctuary**.

- v) Rest of the blocks in Chunar range, Wyndhamfall range, Lalganj range be developed as buffer zone of the sanctuary. These degraded forest lands will require extensive scientific knowledge to restore the forests and establish corridor with nearby sanctuaries like Chandraprabha WLS and Kaimur WLS.

9.5 ALTERNATE LIVELIHOOD

Any conservation plan which fails to account the local needs and livelihood requirement is bound to become inefficient in long terms. On the other hand, excessive extraction of forest resources (for eg. fuel and fodder) will be highly unsustainable and will neither serve the purpose of ecology nor livelihood of people. Therefore, there is a need to develop alternative livelihood options for people to reduce the pressure on forests in a scientific manner.

The tree species commonly preferred for firewood in the present area are *Anogeissus latifolia*, *Zizyphus glaberrima*, *Lagerstroemia parviflora* and *Hardwickia binata* (Upadhyay & Srivastava 1980; Harikant & Ghildiyal 1982; Singh & Singh 1989). Occasionally, *Boswellia serrata* and *Adina cordifolia* are also used for firewood (Singh & Singh 1989). *H. binata*, *B. serrata*, *Dalbergia sissoo* and *Holoptelia integrifolia* are generally lopped for leaf fodder. (Sagar and Singh, 2004).

While Sinha, 2011 reported that 92.86% of households in this region are dependent on fuelwood for cooking, Singh and Singh 1992 reported that 38% of the fuelwood fetched from forest is marketed for buying food grains.

To fulfil fodder requirements, village pastures have to be developed with a mixture of grasses and legumes, which will help to reduce the grazing pressure on remnant forests. Selected fodder tree species such as *Hardwickia binata* could be a component of such pastures. Singh and Singh (1992) recommended 1.6 ha of pasture per hectare of cultivated land. Concepts of rotational (deferred) grazing may be applied for grazing management in these forests. Systematic fuelwood plantations of fast-growing trees on the village commons, or setting aside selected forest compartments exclusively for raising high density short rotation fuelwood or energy plantations, can be a viable strategy to ease the anthropogenic pressure on natural forests. Singh and Singh (1992) recommended 0.7 ha of woodlot per hectare of cultivation. Development and value addition of wild-edible fruits and augmentation of medicinal plants through seeding on the forest floor are some of the other alternative livelihoods which can be provided to local residents (Sagar and Singh, 2004). Also, the farmers shall be trained for growing less water demanding crops such as pulses and medicinal plants in their farms which will help improve economic condition of the farmers, therefore reducing the dependence of fuelwood. Animal husbandry shall be allowed only to a certain extent depending on the carrying capacity of the forests and pasture lands available. During our survey we found numerous beehives inside the forests. Therefore, beekeeping can be a very good alternative

livelihood support of local people which should be promoted by the district administration.



Image 43 Beehives near Sirsi Fall, Patehara because of which the public entry to the water fall is recently banned for tourists. Similar beehives were found in all forest ranges. (Photo: Debadityo Sinha)

CHAPTER 10: CONCLUSION

Sloth Bears and many other wild animals were once reported to be very abundant in the district which is evident from the writings of British officers who used the forests as free hunting ground. Most of the large mammals which used to inhabit forests of Mirzapur are locally extinct now or near extinction due to fragmentation of forests and high anthropogenic pressures. Sloth bears due to their unique adaption to survive dry conditions, flexible food habits and relatively smaller home range have been successful to survive in the remaining forests of Mirzapur. However, their population in the district is found to be decreasing at a very high rate in recent years. There was an urgent need to document the remaining sloth bear habitats and corridors in Mirzapur so that required steps for their conservation can be taken before they become extinct from the district, and therefore this study was undertaken. Presence of sloth bears were recorded in most of the forest ranges-Marihan, Sukrit, Chunar, Patehara and Dramadganj. The number of evidences recorded during the survey shows that these forest ranges have fairly good presence of sloth bears. However, most of the forest areas are highly disturbed by anthropogenic activities such as stone mining, deforestation, livestock grazing, forest fires etc. which have led to fragmentation of the forest range and loss of continuity of forests. Other threats include loss of habitat due to land use change (conversion of forest for agriculture, development of townships, thermal power plant etc.), hunting of animals, linear projects (roads, railways, canals) and invasion by exotic species (*Lantana* and *Hyptis*). Nearly all of the sloth bear attacks on human beings have occurred in areas where the forest degradation is higher and the villages which are settled near the forest corridors. The conflicts are result of direct competition for fruits (such as Mahua), water resources (rivers/streams) and space (forests) between sloth bears and local forest dependent people.

The monitoring of forests except few forest beats are very poor because of inadequacy of ground staff and political pressures. Forest ranges like Chunar and Sukrit are heavily affected by mining and logging activities, all of which are done openly in presence of forest staff. Marihan forest range is facing the highest threat of fragmentation of forests and high risk of local extinction due to ex-urban development in this range. Patehara forest range is facing threat from agricultural expansion in the region which has severely affected the forest quality and continuity. Hill-top mining is the major threat to the wildlife in Dramadganj forest range. Hunting of animals like wild boar, and antelopes are also reported from these forest ranges including Schedule I species like sloth bear and leopard.

De-fragmentation of forest, improving landscape continuity & wildlife corridors, improving administrative infrastructure and protection of watersheds/river catchments are some of the immediate measures required to protect these forests and the remaining wildlife. However, in present scenario-without giving legal protection (such as status of

‘Protected Area’) to critical wildlife habitats, the survival of the wild animals in such disturbed landscape may not be ensured. This should be complemented with other initiatives such as providing alternate sustainable livelihood options to local people as discussed in the report.

CHAPTER 11: REFERENCES

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“Mirzapur, once a first-rated shikar district, has been known for its great wildlife heritage. However, this region never received the deserved attention by the government and wildlife fraternity. Due to lack of scientific studies on wild fauna and serious conservation efforts by the government, the region is now under severe threat. This report is the first published work on distribution of any terrestrial wild animal in district Mirzapur of Uttar Pradesh. This not just include ground truthing data on distribution of Sloth Bears, the flagship species of forests of Mirzapur, but also gives an insight into the conservational threats, challenges and the possible solutions. This document is expected to be an eye-opener for government, policy planners, wildlife managers, researchers as well as general nature lovers.”

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