



**GOVERNMENT OF WEST BENGAL
DIRECTORATE OF FORESTS**



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Office Order No.: 02-CS(COR)/14-2024

Date: 14 / 05 / 2024

ORDER

The Wildlife Conservation Plan (WCP) submitted vide CCF, Central Circle's memo no. 672/3A-1 dated 13/05/2024 against the diversion of 338.74 ha of forest land under Bankura (North) Division for Barjora North Coal Mine Project for an amount of Rs. 90,13,54,162.00 crores is hereby approved.

Encl.: As Stated Above

Yours faithfully,

(Debal Ray)

Principal Chief Conservator of Forests, Wildlife
& Chief Wildlife Warden, West Bengal

Memo No.: 1395(6)/WL / 2M-167/ 2016

Date: 14 / 05 / 2024

Copy forwarded (along with the approved WCP) for information and necessary action to:-

1. The Additional Chief Secretary to the Govt. of West Bengal, Department of Forests.
2. The Principal Chief Conservator of Forests & HoFF, West Bengal.
3. The PCCF & Nodal Officer, FCA, Govt. of West Bengal.
4. The Chief Conservator of Forests, Central Circle, West Bengal. This has a reference to his memo no. 672/3A-1 dated 13/05/2024.
5. The Divisional Forest Officer, Bankura (North) Division, West Bengal.
6. The Director, Mining, West Bengal Power Development Corporation Ltd., Bidyut Unnayan Bhawan, Sector-III, Saltlake, Kolkata.

Principal Chief Conservator of Forests, Wildlife
& Chief Wildlife Warden, West Bengal

**WILDLIFE CONSERVATION PLAN
FOR THE FOREST OF BARJORA
NORTH COAL MINE AREA OF
338.74 HA**

Prepared By:

**Bankura (North) Division, Central Circle
Directorate of Forest
Government of West Bengal**

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CHAPTER 1: INTRODUCTION

1.1. General Information:

Bankura is situated between 22° 38' and 23° 38' north latitude and between 86° 36' and 87° 46' east longitude. It has an area of 6,788 square kilometers (2,621 sq mi) and it is somewhat triangular in shape.

Bankura district has been described as the "connecting link between the plains of Bengal on the east and Chota Nagpur plateau on the west". The district is generally characterized by undulating topography and presence of lateritic soil of low fertility; however, the eastern and southern part of the district is more productive than the western part. The quality of the soil of uplands is poor for growing cash crops; on the other hand, the lowlands have fertile soil. Loam and clayey soil exist in the blocks of Indus and Kotulpur of Bishnupur sub-division. The northern part of the Sonamukhi block has high content of alluvium soil and suitable for the cultivation of paddy, wheat, potato, oilseeds etc.

The district is one of the most under developed districts of the state of West Bengal with levels of low industrialization and high dependence upon agriculture. The rate of growth of small scale industries is also not at all satisfactory. The small-scale industries are mainly based on processing of local resource. However, the district is moderately rich in the fields of handloom and handicraft. The district has been placed in category 'C' as per State Government's incentive scheme.

1.2 Topography:

The district is covered by crystalline rocks of Precambrian age. Granite, Granite gneiss, mica schist, anorthosite, shale, quartzite, sandstone, limestone etc. are the principal types of rock in this district. The area lies within a thick mantle of laterite, generally mountainous and with undulation. Bankura according to the elevation and topography, the district can be divided in three categories -

- **High hilly region:** The areas as Saltora, Mejia, Khatra, Ranibandh, Gangajalghati etc., collectively cover 176915 Ha and are located in this region of higher elevation and hard rocks.
- **Uneven lands:** Bankura, Barjora, Chhatna, Onda, Simlapal, Taldangra, Raipur, Sarenga etc., are located in such uneven lands along with areas of hard rock ring and they cover 150611 Ha as whole.
- **Even alluvial lands:** The landmass with evenly distributed alluvium is found mainly in Bishnupur, Sonamukhi, Patrasayer, Indus, Joypur, Kotulpur etc., which covers 56970 Ha. Bankura consists of two different tracts. The western portion marks the gradual descent from the table land of Chhotanagpur to the delta of lower Bengal, consisting largely of spurs projecting from the western table land and of low swelling ridges. However, there is no marked ridge of hills. In the central portion of the district there are rolling downs eventually merging with the alluvial plains. Biharinath which is located near Saltora is the highest hill of the district having height of 1480 feet (451 meters). Susunia is the second highest hill of Bankura having height of 1450 feet (442 meters).

1.3 Boundary:

Bankura district is surrounded by the district of Midnapore and Hooghly in the east, Purulia in the west, Burdwan in the north and Purulia and Midnapore in the south. River Damodar separates Bankura

from Burdwan district in the north. The south-eastern part of the district is bounded to certain extent by Hooghly district.

1.4 Geology:

The greater portion of the district consists of a rolling country covered by laterite and alluvium. While metamorphic or gneissose rocks are found to the extreme west, to the east there is a wide plain of recent alluvium. Strong massive runs of hornblende varieties stretch across the region in tolerably continuous lines, the general strike being nearly east and west. The most characteristic geological feature of the district is the area of laterite and associated rocks of sand and gravel. At some places one finds hard beds of laterite. At other places it is decomposed and reorganized. Locally, the ferruginous rock is called kankar. The calcareous concretions, commonly used as the sources of lime, are known as ghutin. The Gondwana system is represented in the northern portion of the district, south of the Damodar, between Mejia and Biharinath Hill. The beds covered with alluvium contain seams of coal belonging to the Raniganj system.

1.5 Soil:

Groundwater Resources Assessment and Management of the Bankura District, CSME, 1993 categorized the soil of Bankura district broadly into three principal types viz., (i) Red soil, (ii) Alluvial soil and (iii) Laterite soil.

Typical red soil has limited distribution in the south central, southeastern and south western parts of the district covering Bishnupur, Kotulpur and Raipur blocks respectively. They are the red colored sedentary soil i.e., formed from residual parent materials and found mainly on laterites supporting Sal vegetation. They are also found along the margins of small hills bare of vegetation. They are free from calcium carbonate (CaCO_3), low in base exchange capacity and have a highly unsaturated base. They may be derived from laterites by a process of 'resilicification' by ascending ground water but cannot be grouped either as laterites or laterite soil. Brown soils form a group within this class which are also sedentary in nature, mainly derived from rocks like sandstone, granite gneiss and schist. The alluvial soils, which have wide distribution in the east-central and southeastern parts of the district, are grouped according to soil association as Damodar-Rajmahal riverine, Damodar flatlands, Damodar highlands etc. The older alluvial amongst them is unaffected by floods and siltation and show profile development, whereas the younger or newer alluvial, found mostly in the Damodar flatland areas are enriched by silt deposition during floods. Such areas are characterized by high water table, a heavy sub-soil and occurrence of brown concretion at lower depths. The laterite soils have wide distribution in the south-central to the south western part of the district. Such soils are distinguished from the red soils by the occurrence of ferruginous concretions in a definite layer, whereas in the red soils they are distributed throughout the profile.

1.6 Climate:

The climate, especially in the upland tracts to the west, is much drier than in eastern or southern Bankura. From the beginning of March to early June, when the monsoon sets in, hot westerly winds prevail, the thermometer in the shade rising to around 45 °C. The westerly winds die down around sunset and allow cool winds to blow from the south. Kal Baisakhi is frequent during this period and helps to mitigate the excessive heat. The monsoon months, June to September, are comparatively pleasant, as the weather

is not as sultry as in other parts of Bengal. Winters are pleasant with temperatures dropping down to below 27 °C (81 °F) in December.

1.7 Rainfall and Humidity:

Rainfall in the district of Bankura is generally scanty even though good rainfall occurs on the eastern part of the district. The average annual rainfall ranges between 130 cm to 140cm. Relative humidity is generally high throughout the year. Average percentage of humidity varies from 50 in April to 82 in August (Nandi et. al., 2007).

1.8 Rivers:

The rivers of the area flow from the north-east to the south-west in courses roughly parallel to one another. They are mostly hill streams, originating in the hills in the west. The rivers come down in floods after heavy rains and subside as rapidly as they rise. In summer, their sand beds are almost always dry. Damodar River forms the northern boundary of the district with Bardhaman district for about 72 kilometers and then flows into Bardhaman district. Floods in the Damodar rarely do much damage to the district. Sali River which drains the northern part of the district is an important tributary of the Damodar. Amongst the other rivers flowing through the district, the most important is Dwarakeswar River. It has many branches or old beds in Onda and Bishnupur police station areas. The main tributaries of Dwarakeswar River are the Gandheswari, the Kukhra, and the Birai. Other major rivers are Shilabati River and Kangsabati River, both of which enter the district from Purulia district, run along a short course in the territory and then enter Paschim Medinipur district. Gandheswari River is a tributary of Dwarakeswar River and flows in Bankura district. Flowing south-west of Susunia Hill and north of Bankura it joins the Dwarakeswar near Bhutsahar. It is subject to sudden flooding during rains. There are some small but picturesque waterfalls along the course of the Shilabati near Harmasra, and along the course of the Kangsabati in the Raipur area. Amongst the minor rivers in the district are Jaypanda, a tributary of Shilabati, and Bhairabanki. Mejia Beel is a large swamp formed by the overflow of the Damodar. There are several small tanks or artificial lakes developed by the former rajas, in and around Bishnupur.

Kangsabati Project was started during the second five-year plan period (1956–1961). The dam across the Kangsabati has a length of 10,098 metres (33,130 ft) and a height of 38 metres (125 ft). Apart from this dam there are two pick up barrages in the Shilabati and the Bhairabanki. There is a proposal for the construction of a dam across the Dwarakeswar. The preliminary project report on Dwarakeswar Gandheswari Reservoir was received in Central Water Commission in January, 2004 for which 'in-principle' consent of Central Water Commission for preparation of detailed Project Report has been conveyed to the State Government in March, 2004.

1.9 Demography:

As per 2011 census of India, Bankura District has a population of 3,596,674 out of which 1,838,095 are males and 1,758,579 are females. Total literate persons in the district are 2,232,992 out of which 1,299,337 are males and 933,655 are females. People living in Bankura District depend on multiple skills. Total workers are 1,466,220 out of which men are 1,050,822 and women are 415,398. Total 238,179 persons depend on agriculture as cultivators, out of which 226,414 are men and 11,765 are women. 303,270 persons work in agricultural land as labor, out of which men are 219,998 and 83,272 are women. Bankura District sex ratio is 957 females per 1000 number of males.

1.10 History of the Area:

The earliest sign of human habitation in the area was at Dihar. By about 1000 BC chalcolithic people had settled on the north bank of the Dwarakeswar.

In later pre-historic times this area was inhabited by various Proto-Australoid and a few Proto-Dravidian tribes. The tribes were spread across different strata of development – food gathering, hunting, animal rearing and agriculture. Bankura district was part of Rarh in ancient times.

From around 7th century AD till around the advent of British rule, for around a millennium, history of Bankura district is identical with the rise and fall of the Rajas of Bishnupur.

Ramesh Chander Dutt wrote in the late 19th century, "The ancient Rajas of Bishnupur trace back their history to a time when Hindus were still reigning in Delhi, and the name of the Muslims was not yet heard in India. Indeed, they could already count five centuries of rule over the western frontier tracts of Bengal before Bakhtiyar Khilji wrested the province from the Hindus. The Muslim conquest of Bengal, however, made no difference to the Bishnupur princes.....these jungle kings were little known to the Muslim rulers of the fertile portions of Bengal and were never interfered with. For long centuries, therefore, the kings of Bishnupur were supreme within their extensive territories. At a later period of Muslim rule and when the Mughal power extended and consolidated itself on all sides, a Mughal army sometimes made its appearance near Bishnupur with claims of tribute and tribute was probably sometimes paid. Nevertheless, the Subahdars of Murshidabad never had that firm hold over the Rajas of Bishnupur which they had over the closer and more recent Rajaships of Burdwan and Birbhum. As the Burdwan Raj grew in power, the Bishnupur family fell into decay; Maharaja Kirti Chand of Burdwan attacked and added to his zamindari large slices of his neighbor's territories. The Marathas completed the ruin of the Bishnupur house, which is an impoverished zamindari in the present day."

The area around Bishnupur was called Mallabhum. The core area would cover present day Bankura police station area (excluding Chhatna), Onda, Bishnupur, Kotulpur and Indas. In olden days the term was used for a much larger area, which probably was the furthest extent of the Bishnupur kingdom. In the north it stretched from Damin-i-koh in Santhal Parganas to Midnapore in the south. It included the eastern part of Bardhaman and parts of Chota Nagpur in the west. Portions of the district appear to have been originally the homes of aboriginal tribes. The Khatra region was Dhalbhum, the Raipur region was Tungbhum, and the Chhatna region was Samantabhum. They were eventually overshadowed by the Malla kings of Bishnupur. There also are references in old scripts to Varahabhumior Varabhum (present day Barabhum) on whose borders run Darikesi river and Sekhara mountain (probably present day Pareshnath).

Adi Malla was the founder of the Malla dynasty. He ruled in Laugram for 33 years and has been known as the Bagdi Raja. He was succeeded by his son, Jay Malla, who invaded Padampur and captured the fort, then the center of power. Jay Malla extended his domains and shifted his capital to Bishnupur. The subsequent kings steadily extended their kingdom. Among the more renowned are Kalu Malla, the fourth in line, Kau Malla, the sixth in line, Jhau Malla, the seventh in line and Sur Malla, the eighth in line, who defeated the Raja of Bagri, a place now in northern Midnapore. He was followed by 40 other kings, all of whom were known as Mallas or Mallabaninath, which means lords of Mallabhum or Mallabani. Family records show that they were independent of foreign powers.

Bir Hambir, the 49th ruler of the Malla dynasty who flourished around 1586 AD and ruled in 16th-17th century was a contemporary of the Mughal emperor Akbar. Bir Hambir was both powerful and pious. He was converted to Vaishnavism by Srinivasa. There is mention in two Vaishnava works, Prem-vilasa of Nityananda Das (alias Balaram Das) and Bhakti Ratnakara of Narahari Chakrabarti, about Srinivasa and

other bhaktas (devotees) being robbed by Bir Hambir, when they were travelling from Vrindavan to Gaur with a number of Vaishanava manuscripts. However, Bir Hambir was so moved by Srinivasa's reading of Bhagavata that he converted to Vaishnavism and gave Srinivasa a rich endowment of land and money. He introduced the worship of Madan Mohan in Bishnupur.

Raghunath Singh, who followed Bir Hambir, was the first Bishnupur Raja to use the Kshatriya title Singh. It is said that he was conferred upon with this title by the Nawab of Murshidabad. Bishnupur kingdom had entered its golden age. With exquisite palaces and temples built during the period that followed Bishnupur was reputed to be the most renowned city in the world, more beautiful than the house of Indra in heaven. However, it has also been recorded that while these royal patrons of Hindu art and religion were busy building temples they had lost much of their independence and sunk to the position of tributary princes. Raghunath Singh built the temples of Shyam Rai, Jor Bangla and Kalachand between 1643 and 1656.

Bir Singh built the present fort, the temple of Lalji in 1658, and seven big lakes named Lalbandh, Krishnabandh, Gantatbandh, Jamunabandh, Kalindibandh, Shyambandh and Pokabandh. His queen, Siromani or Chudamani, built the temples of Madan Mohan and Murali Mohan in 1665. He walled up alive all his sons, eighteen in number. The youngest, Durjan, alone escaped, having been kept in hiding by the servants.

Durjan Singh built the Madan Mohan temple in 1694. According to family records, the kings of Bishnupur continued to pay tribute to the Muslim rulers but they were free to do things internally. There was no interference by the Muslim rulers in the internal affairs of Bishnupur. This is also confirmed by Muslim historians. The status of the Raja of Bishnupur was that of a tributary prince, exempted from personal attendance at the court at Murshidabad, and represented there by a resident.

The Bishnupur Rajas who were at the summit of their fortunes towards the end of the 17th century, started declining in the first half of the 18th century. First, the Maharaja of Burdwan seized the Fatehpur Mahal, and then the Maratha invasions laid waste their country.

Gopal Singh (1730-1745) was a pious king but was not fit to cope with the difficulties that faced his kingdom. He issued an edict that people of Mallabhum should count their beads and chant Harinam (name of God) every evening at sunset.

While they failed to take the fort and pillage the treasury, the Marathas harried the less protected parts of the kingdom. The Maratha chief, Sheobhat, made Bishnupur his headquarters in 1760 during the invasion of Shah Alam. The Marathas fell with their heaviest weight on border principalities such as Bishnupur and Birbhum. Exactions of a hundred sorts reduced the once powerful kingdom to poverty. The tenants fled and the country became desolate.

Chaitanya Singh was another pious ruler unfit to face the difficulties. As he was too involved in religious matters he did not have time for administrative matters. He faced internal feuds. Damodar Singh, a cousin of his, tried to gain power. He was able to convince the court at Murshidabad about his capabilities. Initially, Siraj ud-Daulah lent him forces but he was unable to capture Bishnupur. Later, after the British defeated Siraj, Mir Jafar lent him stronger forces. He succeeded in taking Bishnupur, and Chaitanya Singh escaped to Kolkata with the idol of Madan Gopal, but the British restored the latter to power. However, intrigue and litigation continued for many years. Litigation ruined the Bishnupur Raj family and eventually in 1806, the estate was sold for arrears of land revenue and bought up by the Maharaja of Burdwan.

Bishnupur was ceded to the British with the rest of Burdwan chakla in 1760. The Marathas had laid the country waste and famine of 1770 completed the misery of the kingdom. A large section of the

population was swept away, cultivation fell, and lawlessness spread. The once powerful king had been reduced to the status of a mere zamindar. In 1787, Bishnupur was united with Birbhum to form a separate administrative unit, the headquarters was shifted to Suri, and a rebellious situation prevailed. The situation was so bad that the people of Bishnupur came to be known as Chuars or robbers. Bankura continued to be one district with Birbhum till 1793, when it was transferred to the Burdwan collectorate.

In 1879, the district acquired its present shape with the thanas of Khatra and Raipur and the outpost of Simlapal being transferred from Manbhum, and the thanas of Sonamukhi, Kotulpur and Indas being retransferred from Burdwan. However, it was known for sometimes as West Burdwan and in 1881 came to be known as Bankura district.

CHAPTER 2: FLORA & FAUNA

2.1. Floral Diversity:

There are many trees, shrubs, herbal species found in the district. The following tree species are noticeable in the district, viz., Akashmoni (*Acacia auriculiformis*), Mango (*Mangifera indica*), Arjuna (*Terminalia arjuna*), Bot (*Ficus benghalensis*), Bel (*Aegle marmelos*), Chhatim (*Alstonia scholaris*), Haritaki (*Terminalia chebula*), Jarul (*Lagerstroemia speciosa*), Jhau (*Casuarina equisetifolia*), Kadam (*Anthocephalus cadamba*), Kendu (*Diospyros melanoxylon*), Raktamandar (*Erythrina stricta*), Mahua (*Madhuca longifolia*), Neem (*Azadirachta indica*), Palaash (*Butea monosperma*), Piasal (*Pterocarpus marsupium*), Sal (*Shorea robusta*), Tamal (*Diospyros tomentosa*) etc. Akanda (*Calotropis gigantea*), Bantulsi (*Ocimum sanctum*), Dhutura (*Datura stramonium*), Karabi (*Nerium odoratum*), Kul (*Zizyphus xylopyrus*), Nilkantha (*Clitoria ternatea*) etc. are some of the noticeable shrubs and herbs species found in the district. An exhaustive list has been attached in Annexure 1.

2.1.1 Medicinal Plants and Plants of Economic Importance:

For time immemorial, certain floral species of the forest have provided human with their usefulness due to either their medicinal qualities or economic value or both. From the study area, we have documented similar type of floral species that have medicinal usefulness and/or economic importance, thus having immense importance to the everyday life of the local inhabitants. They are attached in Annexure 1.

2.1.2 Ethnobotanical Aspect:

Ethnobotany is the study of a region's plants and their practical uses through the traditional knowledge of a local culture and people. An ethnobotanist thus strives to document the local customs involving the practical uses of local flora for many aspects of life, such as plants as medicines, foods, intoxicant and clothing. Richard Evans Schultes, often referred to as the "father of ethnobotany", explained the discipline in this way: *Ethnobotany simply means ... investigating plants used by societies in various parts of the world.*

Some wild plant species have been consumed by tribes of Bankura over time immemorial which have been listed in Annexure 2.

2.2. Faunal Diversity:

The Bankura district is having a poor fauna in regard to the number of species as well as in their population. The continuous deforestation followed by human encroachment in the area is the main cause for it.

From our study area at the Barjora (N) Coal Mine area, we have prepared a detailed checklist of insects, amphibians, reptiles, birds and mammals. Under insects at Annexure 3, 4 and 5 respectively, we have listed nearly 80 species of butterflies, 28 species of dragonflies as well as damselflies and over 100 species of spiders. Under the category of reptiles at Annexure 6 we have listed 22 species of snakes, geckos, lizards and chameleon, all total. Annexure 7 comprises of the about 116 species of avifauna and lastly Annexure 8 is the list of about 16 recorded mammalian diversity from the study site, through direct and indirect sightings. Annexure 9 covers the details of Lesser Mammals recorded in Bankura in a recent survey.

CHAPTER 3: CURRENT HABITAT QUALITY

3.1 Habitat Quality Analysis (HQA):

Habitat quality usually is defined in terms of the contribution of resources to survival and reproduction of individuals (i.e., fitness) and to persistence of populations. Evaluating wildlife habitat requires consideration of physical features of the landscape including microclimate, structural and community relationships of the vegetation, and the physiology and behavior patterns of the target organism.

Within the study area of 338.74ha, the targeted floral species for habitat quality analysis are Sal (*Shorea robusta*), Piyal (*Buchanania lanzan*), Mahua (*Madhuca longifolia*) and other native tree species and the targeted organisms for the same are Asian Elephant (*Elephas maximus*), Indian Pangolin (*Manis crassicaudata*), Himalayan Porcupine (*Hystrix brachyura*), Indian Wolf (*Canis lupus pallipes*), Golden Jackal (*Canis aureus*), Bengal Fox (*Vulpes bengalensis*), Striped Hyena (*Hyaena hyaena*), Small Indian Civet (*Viverricula indica*) and Asian Palm Civet (*Paradoxurus hermaphroditus*).

The habitat consists of various strata of flora – trees, climbers, shrubs and herbs. Moreover, the habitat is undulating with the presence of waterbodies which act as habitats for a variety of organisms. With this background, Habitat Quality Assessment was carried out for various species.

3.1.1 HQA for Sal, Piyal, Mohul and other native tree species:

At the study site, it was noticed that due to the plantation of tree species like Sonajhuri/ Akashmoni, native tree species like Sal, Piyal and Mohul has been eradicated (either completely or partially) and the process of gradual eradication of native floral species is still ongoing.

Rate of eradication of native floral species, within 500m → noticeable
within 250m → moderate
within 100m → drastic

Moreover, within the deep forest area, availability of undergrowth is minimal to none.

3.1.2 HQA for Asian Elephant:

Inside the study area, more than one water body has been located. Abundant elephant fodder was also noted. The habitat quality is good for the elephants to sustain. However, there's scope to enrich the habitat and increase the fodder availability for elephants.

3.1.3 HQA for Indian Pangolin:

Pangolins are insect eaters and usually prefer to stay in damp or moist regions, close to ant or termite mounds. Within the study site although a number of damp places had been marked, but no termite or ant mounds were marked nearby. Thus, the habitat quality is extreme for a pangolin population to sustain in this area.

3.1.4 HQA for Bush Porcupine:

In general, Porcupines are herbivores feeding on a variety of natural and agricultural plant material including roots, bulbs, fruits, grains, drupe and tubers, along with insects and small vertebrates. The habitat quality within the study site is favorable for the porcupines to sustain.

3.1.5 HQA for Indian Wolf:

Normally the diet of Indian Wolf consists of rodents, poultry and goats. In the study site not enough prey population was found for sustaining a considerable population for Indian Wolf. However, in the study on Lesser Mammals conducted in Bankura (Annexure 9), evidences in favor of Indian Wolf were recorded.

3.1.6 HQA for Golden Jackal:

Normally the diet of Golden Jackal consists of rodents and birds that dwell near/at the ground. Once the habitat was good enough to sustain a considerable population of this species but currently the quality of this habitat is gradually declining. Still, in the study on Lesser Mammals, significant signs were encountered for Golden Jackal.

3.1.7 HQA for Bengal Fox:

In general Bengal Fox has an omnivorous diet consisting of rodents, birds/birds' eggs, small reptiles/reptiles' eggs, insects and even fruits. The highest number of signs encountered in the study on Lesser Mammals were that of Bengal Fox.

3.1.8 HQA for Striped Hyena:

Striped Hyenas are mainly scavengers whose diet consists of carrion and human refuses along with small animals like wild boar and hare. The quality of the habitat at our study site is not favorable to sustain the Striped Hyenas. However, in the adjoining block of Saltora, signs of Striped Hyena have been encountered.

3.1.9 HQA for Small Indian Civet:

Small Indian Civets are insectivores but their diet also includes rodents, snakes, birds and even carrions. The habitat quality is moderate for the sustenance of the animal.

3.1.10 HQA for Asian Palm Civet:

Asian Palm Civets are omnivores with varied diet including fruits to small mammals and insects. The quality of the habitat is good for the sustenance of the Asian Palm Civet.

3.2 Sample site-wise discussion:

For habitat quality analysis the study area of 338.74 ha has been segregated into 15 sample sites, where each sample measures around 50mX50m. Based on the survey, the habitat of the area has been classified under 3 categories, which are as follows –

- TYPE I (Dense forest cover, around 100 ha): Forest cover is very thick and is capable of sustaining elephant herds.
- TYPE II (Moderate forest cover): Forest cover is considerable but due to frequent human interference and cattle grazing undergrowth level is highly degraded.
- TYPE III (Low to almost no forest cover): Forest patch is almost invisible. No wildlife movement recorded during study time and wildlife sustenance is impossible.

CHAPTER 4: WILDLIFE MOVEMENT

4.1 WILDLIFE MOVEMENT:

The field of movement ecology has grown rapidly in the last decade due to a number of recent technological and analytical advances in tracking animal movement (Tomkiewicz et al., 2010). Alongside the growth in technological advances have been advances in conceptual frameworks that aim to unify research in animal movement (Nathan et al., 2008) and incorporate movement into biodiversity research (Jeltsch et al., 2013). This growth has provided a number of benefits for conservation and management, such as improving our understanding of habitats important for wildlife and the area traversed by wide-ranging species (Hebblewhite and Haydon, 2010). However, it has also highlighted a number of challenges for conservation, such as maintaining connectivity, both within the landscape and for species with wide-ranging movements like nomadic or migratory species (Sanderson et al., 2002; Martin et al., 2007; Runge et al., 2014). At the same time, studies have revealed that traditional approaches to conservation, such as protected areas, may be inadequate due to reasons like the spatial scale of a species movements (e.g., Thirgood et al., 2004), conflicts with stakeholders (e.g., Symes et al., 2015), or available finances (e.g., Carwardine et al., 2008; Chadés et al., 2015). Traditional approaches will continue to have a vital role in conservation planning, however their effectiveness may be improved if they are combined with strategies that are flexible in time and/or space (Runge et al., 2014; Chadés et al., 2015; Tulloch et al., 2015).

4.2 Recorded Wildlife movement inside the Project area:

During the field work in the Area, the movement of Golden Jackal (*Canis aureus*), Small Indian Civet (*Viverricula indica*), Asian Palm Civet (*Paradoxurus hermaphroditus*), Indian palm squirrel (*Funambulus palmarum*), Indian Gray Mongoose (*Herpestes edwardsii*), Rock Python (*Python molurus*), Russel's Viper (*Daboia russelii*) and many other insect and avian fauna have been documented, which are noted in the checklist.

Following methodologies have been applied during the field work,

- Line Transact
- Point Transact
- Quadrature Transact
- Pit fall Trap
- Camera Trapping
- Questionnaire Survey

4.3 Baseline Survey of Lesser Mammal distribution in Bankura

In the Baseline Survey of Lesser Mammal distribution in Bankura, signs were encountered for Golden Jackal, Bengal Fox, Indian Grey Wolf, Jungle Cat, Small Indian Civet along with many other mammals. Complete report has been attached in Annexure 9.

4.4 Elephant movement and conflict zones:

Major wildlife movement recorded from the study area is that of the Asian Elephants which follow a defined route from Radhanagar to Gangajalghati over Patrasayer, Sonamukhi, Beliatar and Barjora (the project site) traversing a distance of roughly 65km.

As per the present trend (2022-23 & 2023-24), a herd of Elephants enter the Division in September and continue to remain till the end of Winter months. In the meantime, another herd enters the Division during the winter months. At its peak, a herd of 70-90 elephants stay in the Division during these months.

During the rest of the year, residential elephants numbering from 1-6 stay in the Division.

Current Elephant Movement:



Fig: Current elephant movement route in Bankura North Forest Division.
Light Blue Line: Current Elephant Movement Route; Yellow Line: Existing Forest boundary; Red Polygon: Project Area inside Forest

This is the current route of the elephants. From the Dwarakeswar River, elephants come to the Patrasayer Range of Bankura North Forest Division from Bishnupur Division. Elephants particularly cross the river from Radhanagar and traverse a 16 km long route which is the non-forest area including the agricultural fields, barren lands, human traversing path etc. After a few moments halt, the herd moves towards the forest patch of Sonamukhi range. From there the herd moves towards Beliatore and enters the forest patch of Barjora. But sometimes movement also occurs from Patrasayer to Purba Bardhaman directly.

In the current movement route, the stay duration of the herd across the year is as follows:

Patrasayer : 1 – 3 days (seldom)

Sonamukhi : 3- 7 days

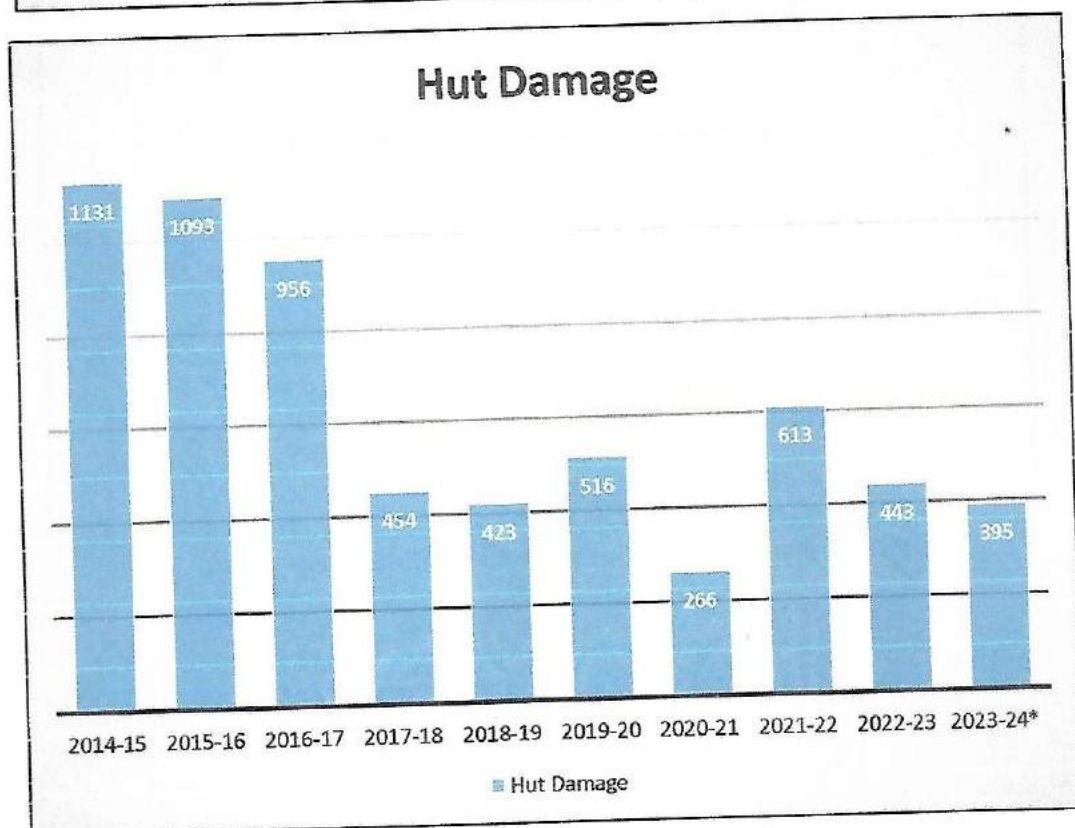
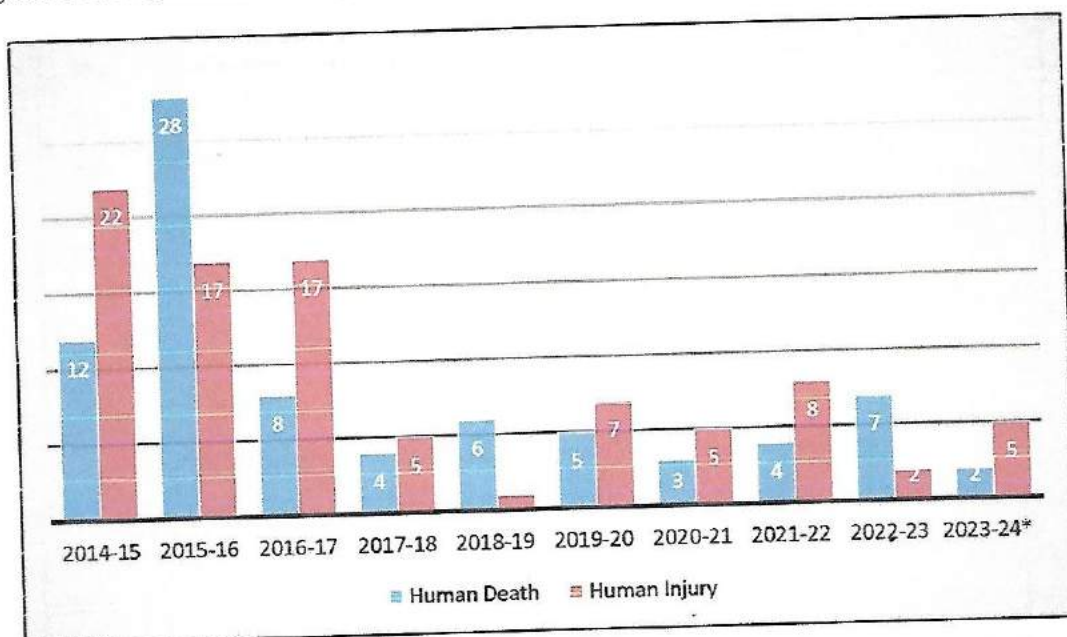
Beliatore : 7 – 10 days

Barjora : 65 – 90 days

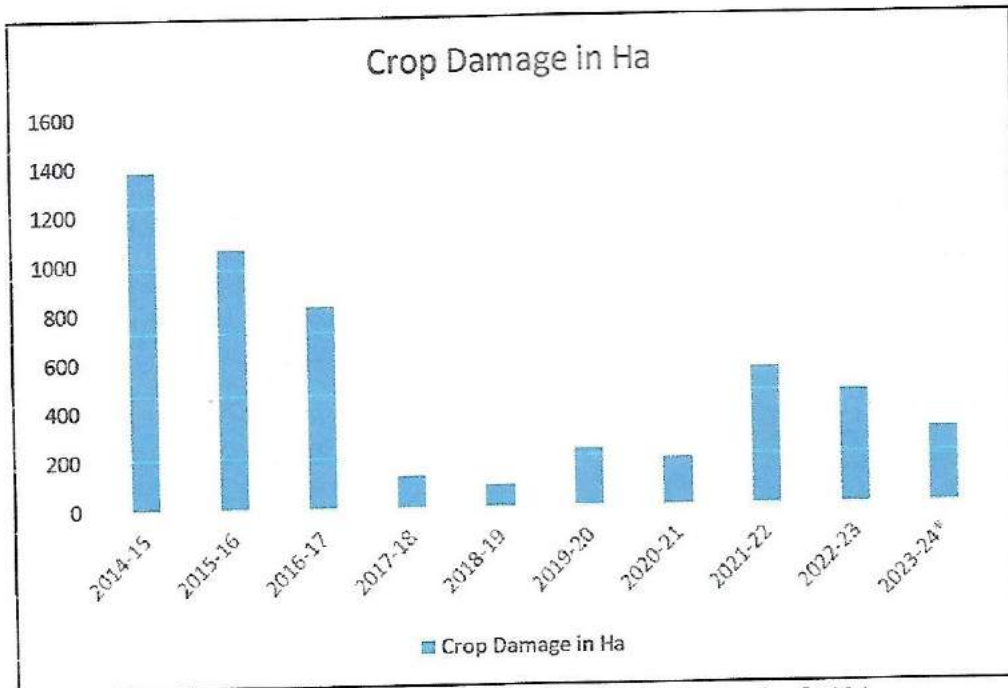
Human Elephant Conflict in Bankura North Division

India has the largest Asian elephant population and it is also one of the most densely populated countries hence it is apparent that humans and elephants compete for natural resources.

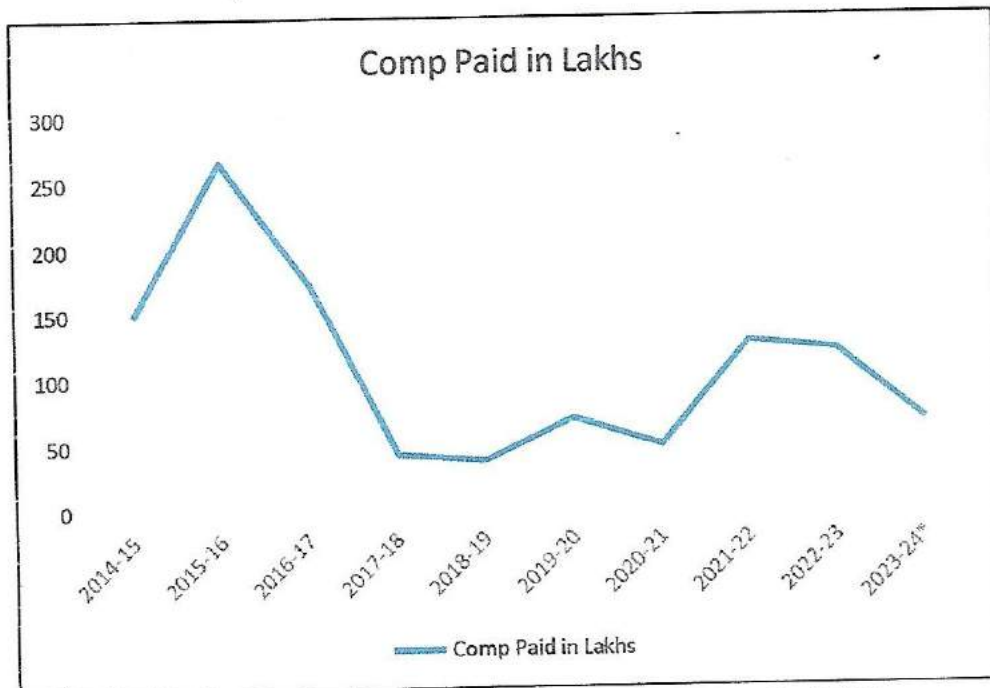
In the South West Bengal, the human elephant conflict continues unabated. In Bankura North Division, the conflict is a recurring phenomenon with some years witnessing quite high HEC as depicted in the diagram below.



*In the year 2023-24 the data is up to February Month of 2024.



*In the year 2023-24 the data is up to February Month of 2024



*In the year 2023-24 the data is up to February Month of 2024

Reasons behind the Increase in Human Elephant Conflict in South West Bengal:

The increase in HEC in the South West Bengal is a combination of multiple factors.

With the involvement and active cooperation of the JFMCs, forests of South West Bengal have been revived. However, the forests of South West Bengal predominantly consist of 3 species – Sal, Akashmoni & Eucalyptus. There is scope to enrich the forests with miscellaneous, fruit & fodder species.

Fragmented nature of forests increases the scope of Human-Elephant interface. Being long ranging and migratory, Elephants can move up to 40 km in a day, which invariably means Elephants passing through non-forest area. Most of the forest area in Bankura lies at a slightly higher elevation compared to the agricultural fields. There is an elevation difference of more than 10 m between adjacent forest land and agricultural fields. This means that the water flows away from forest area rendering the forest area dry and vulnerable to fire. Elephants prefer waterbodies that are large enough for a herd i.e. more than 2 Ha. Elephants have been frequently observed moving closer to waterbodies in search of water. Since many of the large waterbodies are situated in non-forest area, it attracts the elephants leading to Human-Elephant Interface.

South West Bengal is densely populated with decadal growth of population exceeding 10%. Increased Human-Elephant Interface leads to accidents even causing human deaths & injuries. Sometimes retaliatory measures lead to electrocution of Elephant(s) as well. Elephants use the forests as shelter during the day while moving out to crop fields during night for food/fodder requirement.

CHAPTER 5: ABOUT THE PROJECT AND MITIGATION STRATEGIES

5.1 Brief Overview of the Area of Work – Barjora (N) Coal Mine Area:

Barjora is a census town in the Barjora CD block in the Bankura Sadar subdivision of the Bankura district in the state of West Bengal, India.

Barjora is located at 23.43°N 87.28°E. Physio geographically, this area is part of the Bankura Uplands in the west gradually merging with the Bankura-Bishnupur Rarh Plains in the north-east. The western portions are characterized by undulating terrain with many hills and ridges. The area is having a gradual descent from the Chota Nagpur Plateau. The soil is laterite red and hard beds are covered with scrub jungle and Sal wood. Gradually it gives way to just uneven rolling lands but the soil continues to be lateritic. There are coal mines in the northern part, along the Damodar River. It is a predominantly rural area with 89% of the population living in rural areas and only 11% living in the urban areas.

The Project proposed is Barjora North Coal Mine of West Bengal Power Development Corporation Ltd. Total proposed mining area is 683.04 Ha, out of which 338.74 Ha falls under forest area. The current proposal is with respect to diversion of this 338.74 Ha of forest land. The total project cost is Rs. 918.58 crores, and the time period for which the diversion is sought is 22 years. It is pertinent to mention that a coal mine operated by WBPDC abuts the forest on the northern boundary.

5.2 Mitigation Strategy

- Developing the proposed Compensatory afforestation areas as Wildlife habitats.
- Developing waterbodies to increase water retention, modify microclimate and provide water to wildlife.
- Soil Moisture Conservation Plan to minimize soil erosion and increase water retention.
- Wildlife Conservation Plan to offset the impact of loss of vegetation, wildlife habitat and biodiversity. Measures shall be proposed to develop Wildlife habitats and enhance biodiversity through plantation models and conservation measures i.e. fire prevention measures. The plan should also encompass measures to deal with situations arising due to Human- Elephant conflict.

5.3 Objectives of Wildlife Conservation Plan

- Minimize Human-Wildlife conflict by incorporating Wildlife Management Planning strategies.
- Enhance biodiversity and develop Wildlife Habitats for Elephants and other fauna through Habitat enrichment measures and fire protection measures.
- Promote research and documentation.
- Equip staff with skill through training and providing support through welfare measures.
- Livelihood support to forest fringe villages.

Development of Wildlife Habitats is a major component of the Wildlife Conservation Plan. The next chapter shall deal with the background and justification for such an intervention.

CHAPTER 6: DEVELOPMENT OF WILDLIFE HABITATS

6.1 Introduction

With better forest cover and increased awareness, the forest has become a refuge to a variety of wildlife. Elephant movement is a frequent phenomenon with a set yearly pattern. Along with the megaherbivore, the number of other mammals is also on the ascendancy. In the recently concluded Baseline Survey on Lesser mammals, a number of mammals namely Bengal Fox, Golden Jackal, Indian Grey Wolf, Small Indian Civet, Jungle Cat have been encountered through sign survey (Appendix 9).

Any loss of forest cover and vegetation shall have a concomitant effect on the wildlife thriving upon the habitat.

As discussed in Chapter 4, the main strategies in development of Wildlife Habitats shall be:

- Connecting the adjoining forests.
- Development of large waterbodies (more than 2 Ha in size)
- Enhancing the biodiversity through various plantation models
- Preservation of existing flora and fauna through fire prevention

1. Energized fencing

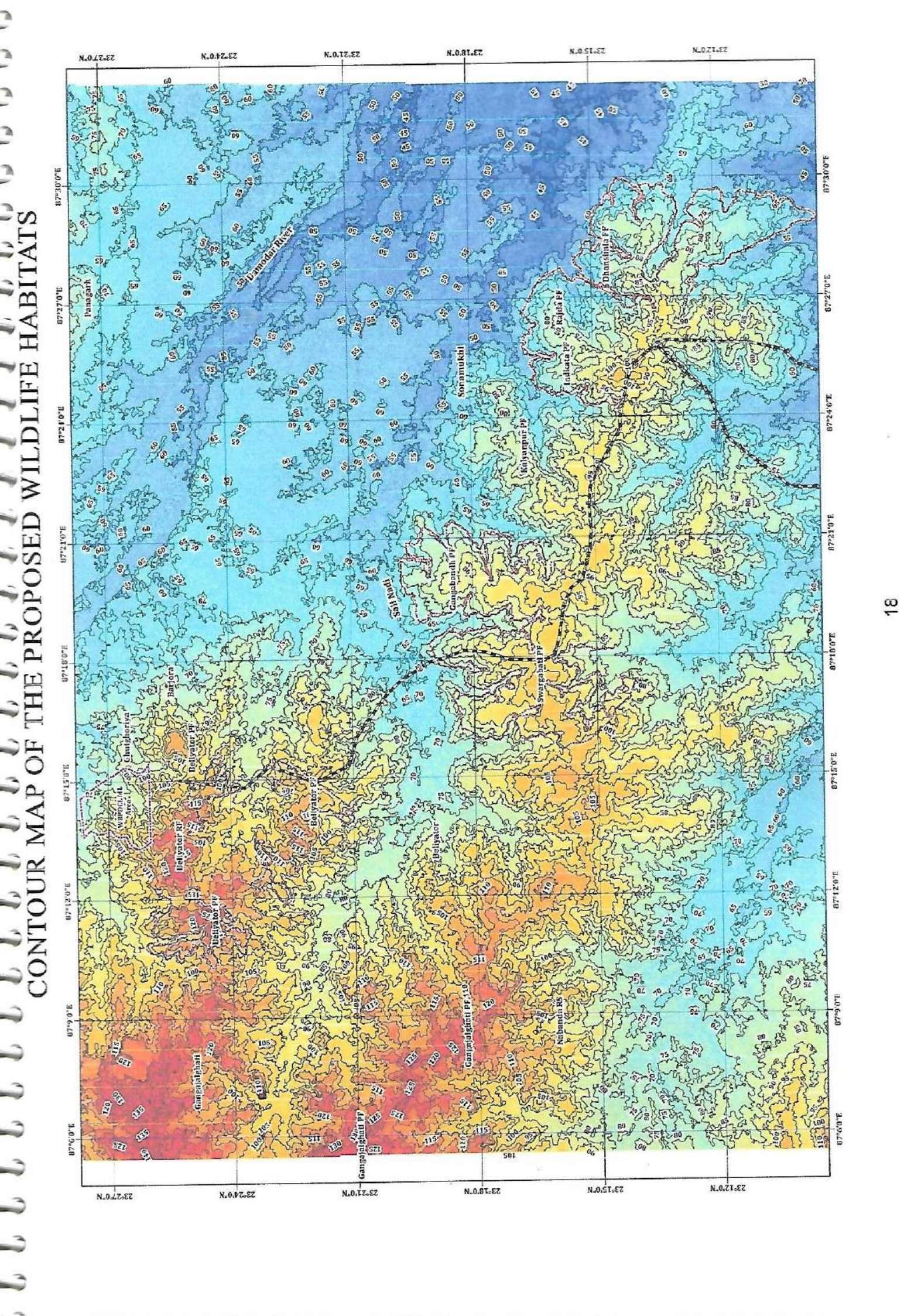
3 sides of the proposed Microhabitat shall be fenced using Energized fencing. The main objective of fencing is to protect the nearby villages as well as reduce Human-Elephant Interface. The aim is also to prevent the Elephants from venturing into non-forest area as Damodar River is hardly 10 km from some of these non-forest areas. The project envisages development of 250 km of Energized fencing in phases. The height of the energized barrier shall be a minimum of 8 feet above the ground.

2. Development of large Waterbodies

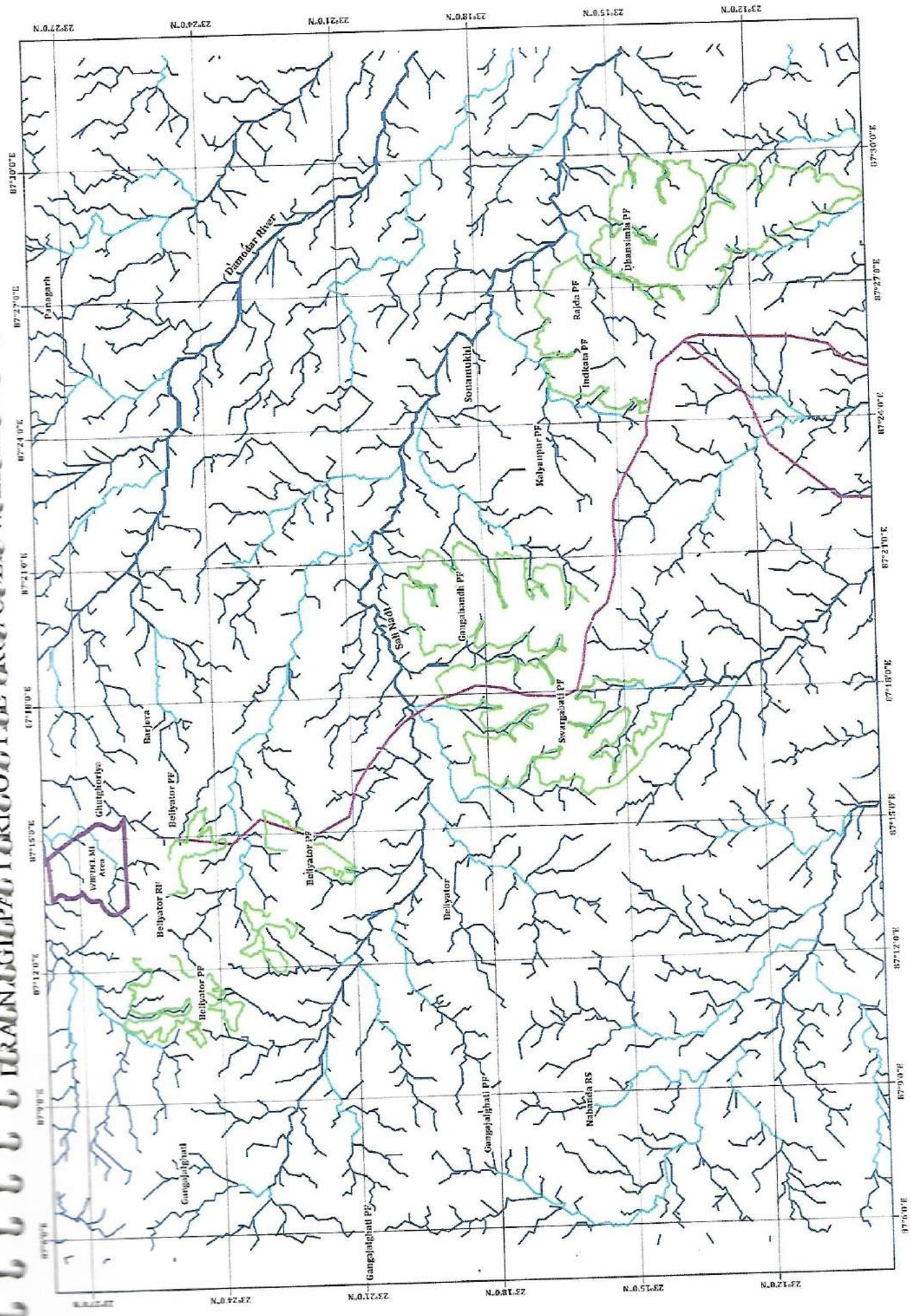
By analyzing the contour, drainage map and field inspection, a total of 14 Waterbodies have been proposed as part of proposed Wildlife Habitats. The waterbodies shall not only be a source of water for all the wildlife but it is also envisaged that waterbodies shall modify the microclimate of the forest patch.

Contour and Drainage maps along with proposed area maps have been attached herewith:

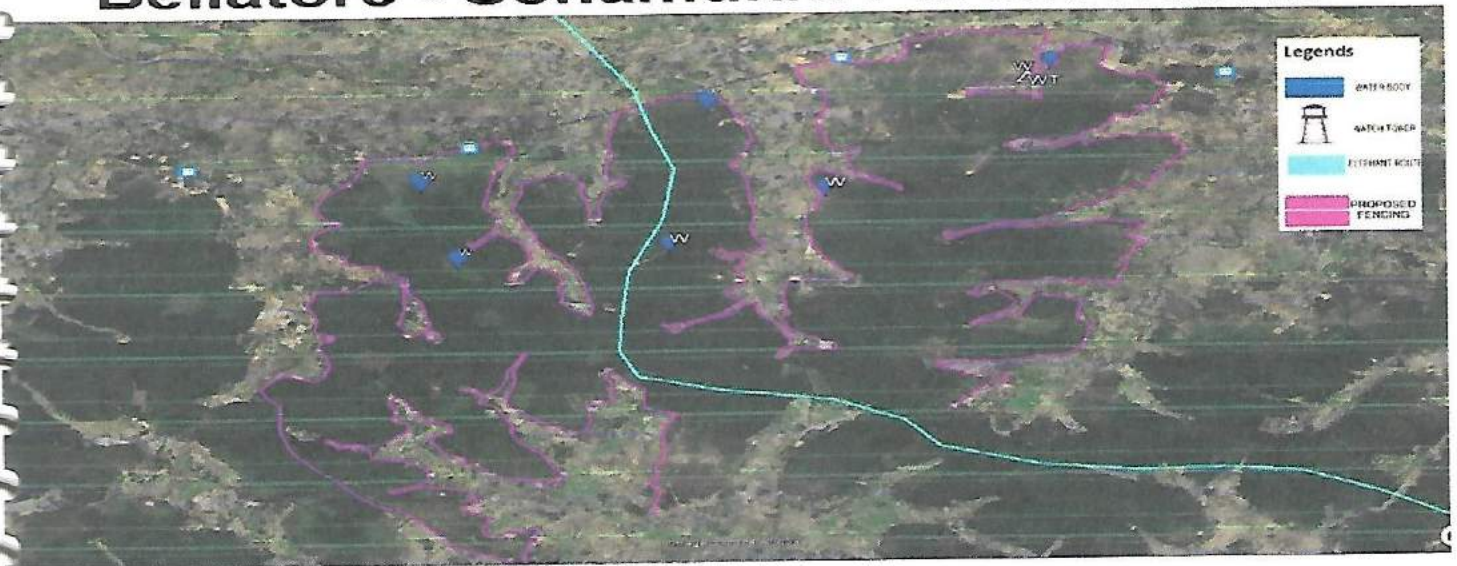
CONTOUR MAP OF THE PROPOSED WILDLIFE HABITATS



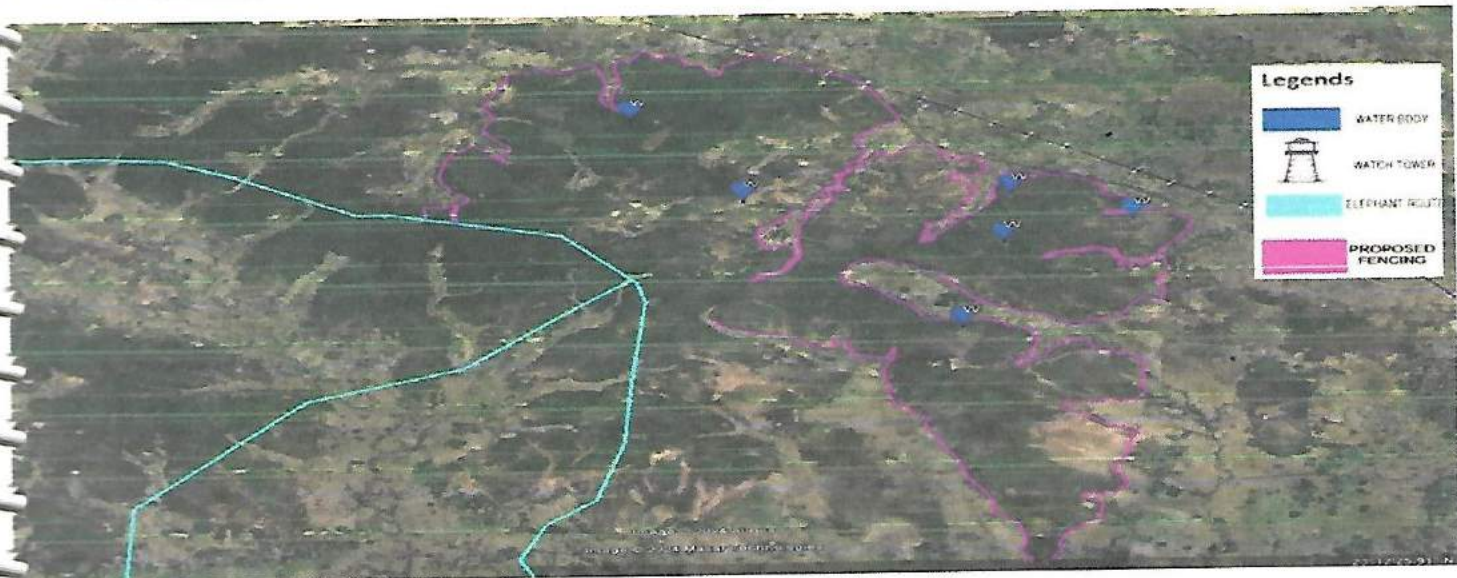
IRAN, GI, PA, T, R, N, O, T, E, R, C, P, C, E, W, L, I, T, E, 3, I, A, I, T, T, S, C



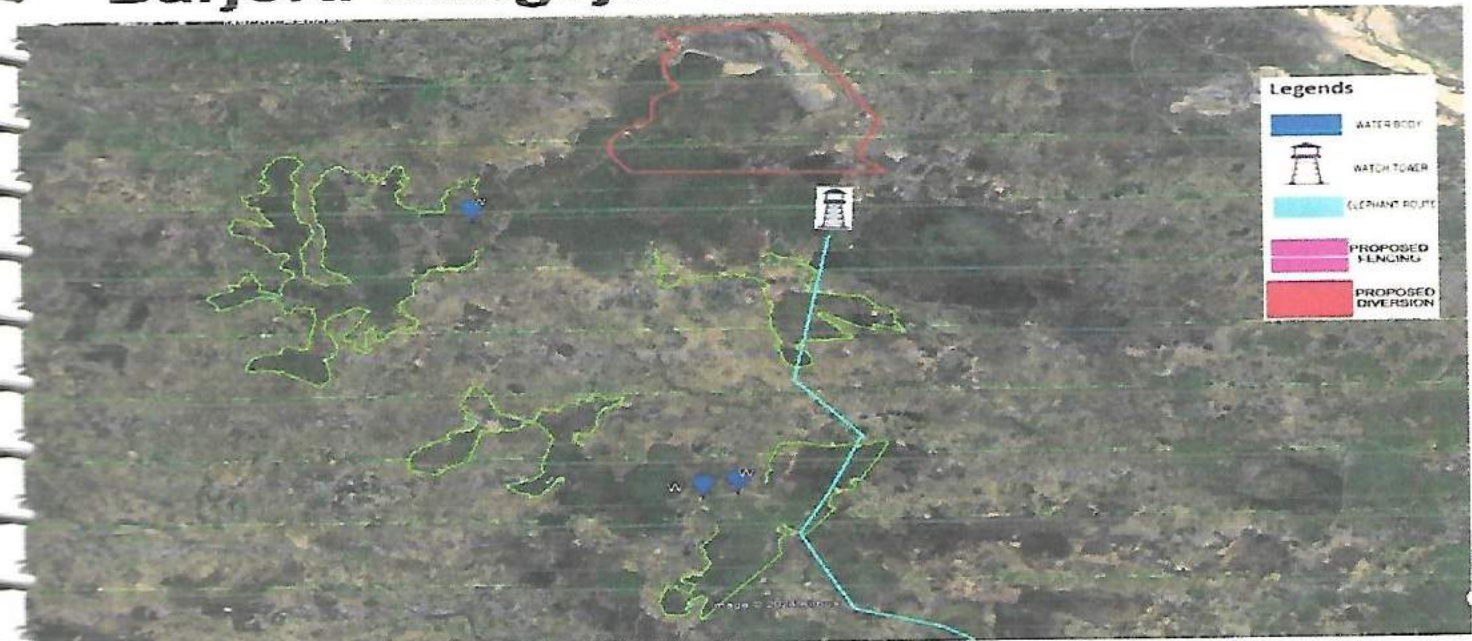
Beliatore - Sonamukhi Forest Habitat



Sonamukhi Patrasayer Forest Habitat



Barjora Gangajal Ghati Forest Habitat



3. Enhancing the biodiversity through various Plantation models

- Plantation of wild banana shall be taken up in patches where water availability is sufficient. Slips with spacing of 2 m shall be planted. Wild sweet potato shall be planted along a 50 m edge abutting the wild banana plantation. The plantation shall be protected for the first 3 years after which the area shall remain accessible to the elephants and other wildlife.
An advantage with wild banana and wild sweet potato is the ease of propagation. Once established, both wild banana and wild sweet potato tend to propagate through new slips and stems.
- Grass plantation shall be taken up through spraying of seeds. The Plantation shall be protected for the first 3 years after which the area shall remain accessible to the Wildlife.
- Gap Plantation: In some of these areas, there are some miscellaneous and shrubs species present. Hence miscellaneous plantation may not be possible in these areas. For such areas, gap plantation with a density of 200 and 625 seedlings/Ha shall be taken up. It is proposed to plant 1000 Ha with Gap plantation. Tall seedlings of select species namely Kathal, Dumur, Kachmola, Pial, Piasal and fruit seedlings shall be planted.
- Block Plantation: In order to cover smaller patches of land and implement various plantation models, block plantation shall be taken up. The block plantations shall include:
 - Plantation consisting of only fodder based miscellaneous species. Tall seedlings of Kathal, Ficus spp, Kachmola, Pial, Piasal, Mohul, Bael and other fruit/fodder seedlings shall be taken up in this patch with a density of 1600 seedlings/Ha.
 - Bamboo plantation of various species shall be taken up in this patch.
 - Plantation consisting of miscellaneous species in the 1st year and planting of shrubs in the 2nd year shall be taken up in this patch. Under this plantation model, planting of miscellaneous species shall be done at a distance of 3 m, while shrubs shall be planted at the center of 4 miscellaneous seedlings i.e. 2.12 m from each of the miscellaneous seedling.
- Boundary/Strip Plantation: Such plantation shall be taken up on the boundary/edges of the forest as well as along the boundary of waterbodies. The seedlings shall be planted at a gap of 4 m, and the species may cover Kathal, Ficus spp, Kachmola, Pial, Piasal, Mohul, Bael, Taal, Khejur, Kul, Bamboo and other fruit/fodder species. This shall also include Industrial shelterbelt plantation in order to contain the polluting effects of industries. Sisal plantation shall also be taken up along boundaries in some forest patches to arrest movement of wildlife towards non-forest area.
- High density plantation at mine boundaries/urban interface/highway to offset the pollution.
- Brushwood plantation at staggered Contour trenches and boundaries/edges.
- Semi aquatic flora management: Plantation of aquatic plants like Nymphaea spp in marshy areas i.e. edges of waterbodies shall help arrest the growth of weeds as well as provide food and shelter to various fauna. Even elephants have been observed to feed upon these aquatic plants.
- Avifauna friendly plantation: Plantation of species such as Tetul, Siris, Ficus spp., Acacia planifrons shall be taken up in vicinity of waterbodies for migratory birds.

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CHAPTER 7: WILDLIFE MANAGEMENT PLANNING

Wildlife conservation is the practice of protecting plant and animal species and their habitats. As part of the world's ecosystems, wildlife provides balance and stability to nature's processes. The goal of wildlife conservation is to ensure the survival of these species and to educate people on living sustainably with other species.

Conservation planning is the process of locating, configuring, implementing and maintaining areas that are managed to promote the persistence of biodiversity. It deals with the identification of geographic priority areas that contain species, habitats or processes essential to achieving the conservation goals of a region or country (Margules and Pressey, 2000). The assessment and planning cover a radius of 40 km centering the 338.74ha of forest cover of the Barjora coal mine area of WBPDCCL. However, it covers mainly the southern and eastern part due to geographical limitation.

7.1 Wildlife Management Planning:

One of the major aims of Wildlife Management Planning is to reduce Human-Wildlife Conflict. The Plan shall include mitigation strategies to develop the habitats suited to Wildlife, which in turn, shall ensure that Wildlife stay and utilize the forests for the major duration of the day. The plan shall also include infrastructure that shall aid in observation and quick response. Finally, the plan includes equipment and necessary amenities for wildlife management. This support is crucial in equipping the staff to observe and document wildlife movement, besides aiding the staff to deal with emergency situations.

7.1.1 Proposed Wildlife Conflict Mitigation Planning:

Various strategies shall be discussed herewith.

The aim of the Wildlife Management Planning is to develop Wildlife Habitats in other forests of Bankura North Division, reduce Human-Wildlife Interface and equip the staff as well as forest fringe population to deal with Human-Wildlife Conflict effectively.

7.1.1.1 Solar Fencing:

Solar Fencing are a type of "Energized/Power Fencing" which is a world recognized tool to mitigate elephant and other wildlife depredation. Energized fencing is a cost-effective method to act as a barrier to the movement of Elephants, which in turn, helps to save human lives and property through reduction of Human-Elephant Interface. A provision for 250 km stretched, 12 ft high and 3 wired solar fencing along with its 5 years maintenance has been incorporated for the study area to monitor and restrict elephant movement within the forest cover.

7.1.1.2 Double Strand Fencing:

This particular fencing is quite similar to parallel strand solar fencing, where the distance between two parallel strand is 5 meter and the distance between two consecutive poles is 10 meters. Double Strand Fencing will be done along the northern margins of Sonamukhi-Patrasayer ranges so that no wildlife movement occurs toward the township of Bardhaman and another similar type of fencing will be done along the western margin of Gangajalghati range in order to restrict wildlife movement towards Mejia. A provision for 25 Km stretched, 12 ft high and 3 wired double strand fencing along with its 5 years of maintenance has

been incorporated for the study area to monitor and restrict elephant movement towards Mejia and the township of Durgapur and Galsi, Budbud side of Bardhaman district.

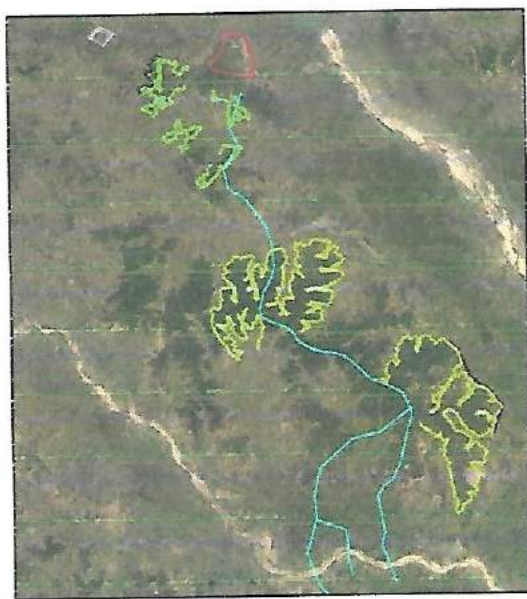


Fig: Red polygon is the project area; Green Path is proposed Solar Fencing and Black Path is the proposed double strand Fencing

7.1.1.3 Forest Chawki:

In the entire forest patch, the distribution of Forest Range and Beat Office is not strategically placed to handle and mitigate the issues of human-elephant conflict. That is why, the necessity of forest chawki in two places is very important. The major function of this chawki will be to carry out surveillance along the forest cover to monitor the activity of elephant as well as other animals, along with providing basic accommodation facility for the forest staff during elephant movement.

We are proposing the construction of 2 forest chawkis along the entire landscape of the Division, one will be at Ladunia ($23^{\circ}19'20.65''\text{N}$, $87^{\circ}20'10.30''\text{E}$) and the other at Mukherjee Bandh ($23^{\circ}25'14.7''\text{N}$, $87^{\circ}14'59.9''\text{E}$). This Chawki will be of height 20 ft, length 10ft and width 15ft, along with a room with open kitchen and attached toilet. A 10 years long maintenance for this facility has been incorporated in the planning. Judging by the actual field condition during the construction of the forest chawki, the location may change up to 500 m from the said point in any side.

7.1.1.4 Machans:

We are proposing 10 modern machans inside the study area which will be used for wildlife movement and activity. In these machan, at most 2 persons can seat together and study the wildlife movement inside the forest area. These Machans will be 18 ft high, with four pillars which will be at 6 feet distance from each other. One steel stair will be there for climbing on the top of the machan.

7.1.1.5 Vegetative Fencing:

To control the elephant movement, along with strengthening the solar fencing, vegetative fencing is very important. Vegetative fencing with high density planting of native species and bamboo shall be taken

up. To produce a dense natural fencing to restrict the movement of Elephants towards the mine boundary as well as to dissipate the sound, a 2 km long, 50m wide vegetative fencing of 10 ha area shall be taken up. This shall also help to reduce the vibration which shall be caused during the mining inside the proposed forest area of Barjora coal mine. A maintenance for 5 years has been included in the planning that will ensure success to this plantation method.

7.1.1.6. Necessary amenities for wildlife management:

7.1.1.6.1 Vehicles for Wildlife Management

We are proposing to allot certain specific vehicles for elephant management or for the quick response team like an elephant relocation vehicle which will relocate the elephants, when necessary, along with 2 Airavat, which will be used during elephant tracking. 10 vehicles have been proposed for the Wildlife Management team in order to facilitate faster movement and response time during Human-Wildlife conflict situations and Rescue & Release operation.

7.1.1.6.2 Equipment for Wildlife Management Teams

Some necessary amenities which are certain crucial equipment like boots which will be used during field work, walkie-talkie instant communication among field staff while in field; search lights for night time field works and patrolling, GPS for path tracking and recording particular locations during any sort of survey work, head gears for night time field visit and wildlife tracking within forest cover, squeeze cages for small mammal transportation, tranquillizing guns & medicines for handling conflict issues whether inside the forest or close to human settlements, medicine for wildlife treatment and first aid to provide immediate attention to the rescued animals, snake catcher, tong, snake rescue bags etc.

7.1.1.6.3 Camera Traps

It is proposed to procure 100 Camera traps for monitoring of Wildlife.

7.1.1.6.4 Radio Collars for Elephants

It is proposed to procure 10 Radio Collar devices for Elephants. These shall aid in tracking of Elephants in Conflict prone areas and help in studying the movement pattern of Elephants.

7.1.1.6.5 AI Cameras for Wildlife Tracking

It is proposed to procure 50 AI Cameras for Wildlife Tracking and sending real time alerts on the movement of Wildlife, which shall help in the management of Human-Wildlife Conflict.

7.2 Habitat Enrichment:

In view of myriad challenges namely Human-Wildlife conflict and emerging challenges arising out of climate change such as loss of biodiversity and microclimatic change, it is crucial that habitat enrichment measures are taken up. This shall inter alia focus upon increasing the green cover, covering the blank/degraded area and enhancing biodiversity through introduction of diverse and native species. Major components of the Habitat Enrichment measures are discussed herewith. Various plantation models have already been deliberated upon in Chapter 6.

7.2.1. Waterbody:

Wildlife need water for drinking and other purposes. This assumes even more importance for mega

herbivore such as Elephants. In the Bankura North Forest Division area, there is a huge scarcity of water storage throughout the year. Since the terrain of Bankura is almost flatland, creation of water body is very important to hold/conserves water.

In the entire Division, it is proposed to excavate 14 waterbodies within the forest area in the following location:

Sr. No.	Range	Mouza	GPS Coordinates
1	Barjora	Kharari	23°22'21.41"N, 87°14'24.39"E
2	Barjora	Dakasini	23°22'18.18"N, 87°14'8.66"E
3	Beliatore	Swargabati	23°17'57.68"N, 87°16'34.52"E
4	Beliatore	Swargabati	23°17'8.45"N, 87°16'50.78"E
5	Beliatore	Nitynandapur	23°18'51.51"N, 87°18'22.06"E
6	Beliatore	Saulia	23°17'20.55"N, 87°18'10.36"E
7	Beliatore	Saulia	23°17'57.45"N, 87°19'8.69"E
8	Sonamukhi	Hamirhati	23°19'20.78"N, 87°20'31.85"E
9	Sonamukhi	Indkata	23°15'43.38"N, 87°25'41.90"E
10	Sonamukhi	Ranibandh	23°14'33.43"N, 87°26'35.50"E
11	Patrasayer	Chak Patrasayer	23°14'41.58"N, 87°28'36.29"E
12	Patrasayer	Chak Patrasayer	23°14'0.26"N, 87°28'34.30"E
13	Patrasayer	Chak Patrasayer	23°14'21.40"N, 87°29'32.34"E
14	Patrasayer	Radhadamodarpur	23°12'47.87"N, 87°28'17.74"E

Location might change up to 500 meters on any side depending upon field situation during the construction of water body. Phase wise expansion of these waterbodies shall be taken up.

7.2.2. Plantation:

The plantation will be done focusing upon the native plant species that are fodder for Wildlife in the area. Tall seeding plantation will be done so that survival rate of the plants remains maximum. This specific plantation will gradually minimize elephant raid into the crop fields and human habitation nearby, which in turn will diminish human elephant conflict. A proposal for 800 ha of such plantation has been included in the planning. In order to ensure success of this particular plantation, solar fencing will be done along with maintenance in the initial 3 years.

Various plantation models have been discussed in Chapter 6. Block plantation will be done at the ranges of G Ghati, Barjora, Bankura North, Sonamukhi, Beliatore and Patrasayer. Miscellaneous plantation will be done focusing upon native tree and fruit-bearing plant species.

7.2.3. Selective Felling:

There are certain forest areas within the Division like Swargabati, G Ghati, Indkata and Shitla where forest cover is very dense and mainly predominated by a single species, Sal in this case. So selective felling will help creating space for other species plantation like Piyal, Bel, Jackfruit, Mahua etc. which are excellent fodder for elephants who regularly visit these areas. Moreover, through this activity the forest habitat, will be gradually enriched thus creating a stable biodiversity and ecological balance within the forest. Glades shall also be developed in some of these patches.

7.2.4. Development of Habitat:

We propose to develop the habitat over an area of 1000 ha, along the entire landscape of the Division. Gap plantation will be done all over the Division wherever tree density is sparse. Through this activity, the aim is to enrich the biodiversity along with increasing the green cover. Out of the 1000 Ha enrichment

plantation, 500 Ha plantation shall be taken up with a density of 200 seedlings/Ha, while 500 Ha plantation shall be taken up with a density of 625 seedlings/Ha. The selection of the area will be done in respect to the forest cover density in the study area. The maintenance of this habitat enrichment activity will be done for the initial 3 years.

7.2.5. Fodder Nursery:

The fodder nursery is focused to grow particularly the elephant fodder plants. In the southern West Bengal, there is no such fodder nursery for elephant and this facility will help in fodder plantation, not only in this Division, but also in other divisions where there is elephant population and movement.

We propose this nursery facility to have a capacity of raising 2 lakhs saplings of native floral species along with regular maintenance for 10 years. Some of the major fodder saplings that will be raised in this facility are Elephant Guava, Bel, Jackfruit, Arjun, Katbel, Chalta, Wild Mango, Wild Banana, Piyal, Bamboo etc. In the year of its inception, 1 lakh seedlings shall be raised.

In addition to tree species, the nursery shall also endeavor to raise grass species and shrubs. It shall encompass the complete floral spectrum from the view of Wildlife habitat enrichment. It is endeavored that mass multiplication of fast growing fodder species shall take place.

7.3. Monitoring and Research Work:

This particular aspect is important and necessary to address vital issues like elephant and other wildlife movement, conflict pattern, behavioral changes in the animal population, inter- and intra- species level interaction, resource utilization and their impact on the forest cover and various other topics. For this, regular basis monitoring works in field and scientifically recording and documenting these observations will help address larger issues to conservation initiative for not only the elephants, but also other wildlife thriving in this Division.

7.3.1. Thermal Drone:

For areal monitoring of elephant movement as well as other wildlife movement, this gadget will effectively serve its purpose of capturing and recording thermal images of the animals. 2 such thermal drones have been proposed for the project area.

7.3.2. Central Control Room:

A proposal for such a premises has been given where a control unit will be present to monitor and carry out any research or monitoring works. All the research-based works, data analysis and storage of data will be done here and shall be stored with backups. This facility will be constructed in the Division. Moreover, this facility will have gadgets like big screen monitors, high configuration computer system, printers, cloud for storing raw as well as analyzed data, software for various scientific data analysis etc. Adding to this, live GIS based thermal data of the entire forest cover will be present that will help in combating forest fire incidents. Apart from carrying out various research-based works, this facility will also have accommodation facility for two researchers who will be responsible for the carrying out and publishing various research and innovative conservation plans for the wildlife of the Division. A provision has been included for the hiring of researchers for running the Control Room.

7.4 Training and Awareness Program:

Properly trained and aware field staffs and villagers, who support and help the forest department at the time of need, are required in order to effectively manage Wildlife. So, this particular program is of special importance in order to educate and properly equip the departmental staffs and villagers, especially the inhabitants residing at the forest fringes and vulnerable stretches.

7.4.1 Workshops:

These workshops are meant to educate the staffs and villagers, who support the forest department at the time of need, about wildlife behavior, conflict management, handling of wildlife during rescue or injury and creating awareness of illegal activities like poaching and trafficking of wildlife and other like aspects. So, a proposal for 6 workshops/year has been included that will be held annually for 10 years.

7.4.2 Awareness Program:

A routine awareness program and campaign will be carried on to address issues like illegal wildlife poaching and trading, including adopting various human elephant conflict mitigation measures. Throughout the year about 15 such awareness programs have been proposed for 10 years.

7.5 Forest Fire Protection:

Forest fire is a very common event especially in dry deciduous forest areas like Bankura. Fire incidents reduce the undergrowth as well as affect the regeneration. Fire incidents also pose a danger to wildlife by reducing the shelter, destroying young ones and rendering them vulnerable. In view of increased frequency of extreme climatic events, a focused approach to forest fire prevention is required.

7.5.1 Forest Fire Management:

For a period of 5 months, 70 persons (2 persons/Beat) shall be engaged who will keep a constant vigil so that no case of forest fire occurs and respond in case of fire incidents.

7.5.2 Equipment:

In order to combat forest fire at the project site, a proposal has been given to make provision for acquiring certain items like fire dress, boots, headgear, fire blower, fire extinguisher, fire rammer, fire rocker, crowbar and other related items.

7.6. Alternative Livelihood:

The people in the study area often face huge crop damage due to crop raiding activities by the elephants, especially during the harvesting time.

Moreover, the people depend upon the forest for various livelihood activities. Loss of the adjoining forest shall affect the forest fringe villagers. Hence, livelihood support is envisaged to offset the negative effects of the loss of forest.

7.6.1 Elephant Management Team:

Elephant management teams shall be formed in each of the 5 villages chosen for livelihood support. Besides alerting the villagers about the presence of Elephants, the activity shall also ensure that some villagers remain engaged in gainful employment.

7.6.2 Solar Light at villages:

Often the human settlements at/around the fringe area are immersed in complete darkness after the sunset. During those hours any wildlife activity, least to mention the movement of elephants which is imminent in the region, often goes unnoticed resulting in accidents due to Wildlife. Hence, it is proposed to install 75 solar lights in the 5 forest fringe villages.

7.6.3 Stakeholder Meeting Centre with Common Toilet and Submersible Pump:

We propose the construction of 5 Stakeholder Meeting Centre with toilet and submersible water

pumping facility where any awareness programs and/or training programs will be conducted by the Forest Department on a regular basis by the involvement of both the departmental staff and local inhabitants. The facility may also be used by local SHGs for meetings and other activities.

7.6.4 Livelihood Generation through crop training:

The villagers shall be trained in various alternate cropping techniques, which shall be wildlife friendly as well as ensure increase in income.

CHAPTER 8: DETAILED BUDGET

Sl.No.	Item of work	Description	Quantity	Unit	Rate/Unit	Total Amount
1. Wildlife Management Planning	Solar Fencing with 10 Years AMC	250 Km long, 12 feet high, three wire line	250	in KM	₹ 3,00,000.00	₹ 7,50,00,000.00
	Double Strand Solar Fencing with 10 Years AMC	25 Km long fencing will be done	25	in KM	₹ 3,00,000.00	₹ 75,00,000.00
	Construction of the forest chawki	20 feet high, 10 feet long and 15 feet wide 1 room with open kitchen space and attached toilet	2	in numbers	₹ 35,00,000.00	₹ 70,00,000.00
	Machan	18 feet high, with four pillars which will be at 6 feet from each other. One steel stair will be their for climbing	10	in numbers	₹ 3,00,000.00	₹ 30,00,000.00
	Vegetative Fencing	2 Km long, 50 meter wide which is 10 Ha	10	in Ha	₹ 5,00,000.00	₹ 50,00,000.00
	Maintenance of Vegetative Fencing	10% of the entire value per year	5	in year	₹ 5,00,000.00	₹ 25,00,000.00
	Vehicles for Elephant Management during HEC	Airavat	2	in numbers	₹ 26,00,000.00	₹ 52,00,000.00
	Vehicle for Elephant relocation	Vehicle for Elephant relocation	1	in numbers	₹ 100,00,000.00	₹ 1,00,00,000.00
	Vehicles for Wildlife Management including Rescue & Release	A total of 10 vehicles	10	in numbers	₹ 20,00,000.00	₹ 2,00,00,000.00
	Equipment for Wildlife Management Teams	Boots, Search Lights, Walkie Talkies, GPS, Snake Rescue Kit, Head Gears, Squeeze cages, Tranquilizing guns & medicines etc.	10	in years	₹ 20,00,000.00	₹ 2,00,00,000.00
2. Development of Wildlife Habitat	Camera Traps	For Wildlife monitoring	100	In numbers	₹ 25,000.00	₹ 25,00,000.00
	GPS Collar for large mammals	For Wildlife monitoring and conflict reduction	10	In numbers	₹ 5,00,000.00	₹ 50,00,000.00
	AI Cameras for Wildlife Tracking	For Wildlife monitoring and conflict management	50	In numbers	₹ 40,000.00	₹ 20,00,000.00
	Construction of Waterbodies for Wildlife	Waterbodies for wildlife	14	in numbers	₹ 1,50,00,000.00	₹ 21,00,00,000.00
	Plantation of fodder/fruit in various models	Plantation through various models	800	in Ha	₹ 2,00,000.00	₹ 16,00,00,000.00
	Maintenance of the Plantation	10% of the entire value per year	3	in year	₹ 1,60,00,000.00	₹ 4,80,00,000.00
	Development of Habitat including maintenance	Enrichment of habitat for wildlife through Gap Plantation	1000	in Ha	₹ 50,000.00	₹ 5,00,00,000.00
	Fodder Nursery Preparation	A nursery with 2 lakh sapling capacity	1	in numbers	₹ 5,00,00,000.00	₹ 5,00,00,000.00
	Thermal Drone with 10 Years AMC	For areal monitoring	2	in numbers	₹ 17,00,000.00	₹ 34,00,000.00
	Central Control Room	Including building construction	1	in numbers	₹ 1,50,00,000.00	₹ 1,50,00,000.00
3. Monitoring and Research Work						

	Data creation, analysis and storage devices	Including hiring of researchers	10	in year	₹ 10,00,000.00	₹ 1,00,00,000.00
	Training Workshops	For 10 years	60	in numbers	₹ 1,20,000.00	₹ 72,00,000.00
	Awareness programmes, signages	For 10 years	150	in numbers	₹ 40,000.00	₹ 60,00,000.00
4. Training and Awareness Programmes	Forest fire management- Fireline maintenance to prevent wildlife straying	Engage 70 persons for 5 months	10	in year	₹ 35,00,000.00	₹ 3,50,00,000.00
5. Fire Protection	Forest Firefighting Equipment	Fire dress, boots and headgear, fire blower, fire extinguisher, fire rammer, fire rocket, crowbar	10	in year	₹ 5,00,000.00	₹ 50,00,000.00
	Elephant Management Team	elephant management team in all the 5 villages forest adjacent villages	10	in year	₹ 5,00,000.00	₹ 50,00,000.00
	Solar Light in the villages to prevent Human Wildlife Conflict	Installation of solar light in the forest adjacent 5 villages	75	in numbers	₹ 25,000.00	₹ 18,75,000.00
	Stakeholder Meeting Centre	Stakeholder Meeting Centre with common toilet and submersible pump for water supply	5	in numbers	₹ 50,00,000.00	₹ 2,50,00,000.00
6. Alternative Livelihood	Livelihood Generation through providing proper training and guidance	provide proper training to the farmers so that they can harvest high yielding crops in their agricultural field. And ensure minimal crop damage from elephants as per the choice of seeds.	5	in numbers	₹ 2,00,000.00	₹ 10,00,000.00
Sub total (in Rs.)						₹ 79,71,75,000.00
Cost Escalation due to annual inflation calculation (in Rs.)						₹ 10,41,79,162.00
Total (in Rs.)						₹ 90,13,54,162.00

Note: Annual inflation rate of 6% is taken into account to calculate revised amount due to annual inflation. Year wise break up is shown in the table.

Year wise Distribution of Work

S. No.	Item of Work	Y1		Y2		Y3		Y4		Y5		Y6		Y7		Y8		Y9		Y10	
		Qty.	Total Amount	Qty.	Total Amount	Qty.	Total Amount	Qty.	Total Amount	Qty.	Total Amount	Qty.	Total Amount	Qty.	Total Amount	Qty.	Total Amount	Qty.	Total Amount	Qty.	Total Amount
1	Solar Fencing with 10 Years AMC	50	1,50,00,000	50	1,59,00,000	50	1,68,54,000	50	1,78,65,240	50	1,89,37,154										
2	Double Strand Solar Fencing with 10 Years AMC	25	75,00,000																		
3	Construction of the forest chawki			1	35,00,000	1	37,10,000														
4	Machan	1	3,00,000	1	3,18,000	1	3,37,080	1	3,57,305	1	3,78,743	1	4,01,468	1	4,25,556	1	4,51,089	1	4,78,154	1	5,06,844
5	Vegetative Fencing	10	50,00,000																		
6	Maintenance of Vegetative Fencing	1	5,00,000	1	5,30,000	1	5,61,800	1	5,95,508	1	6,31,238										
7	Vehicles for Elephant Management during HEC	1	26,00,000	1	27,56,000																
8	Vehicle for Elephant relocation	1	1,00,00,000																		
9	Vehicles for Wildlife Management including Rescue & Release	2	40,00,000	2	42,40,000	2	44,94,400	2	47,64,064	2	50,49,908										
10	Equipment for Wildlife Management Teams	2	40,00,000	2	42,40,000	2	44,94,400	2	47,64,064	2	50,49,908										
11	Camera Traps			50	12,50,000	50	13,25,000														
12	GPS Collar for large mammals	10	50,00,000																		
13	AI Cameras for Wildlife Tracking	50	20,00,000																		
14	Construction of Waterbodies for Wildlife	4	6,00,00,000	4	6,36,00,000	4	6,74,16,000	2	3,57,30,480												
15	Plantation of fodder/fruit in various models	160	3,20,00,000	160	3,39,20,000	160	3,59,55,200	160	3,81,12,512	160	4,03,99,263										
16	Maintenance of the Plantation	160	32,00,000	320	67,84,000	480	1,07,86,560	480	1,14,33,753	480	1,21,19,778	320	85,64,644	160	45,39,261						

17	Development of Habitat including maintenance	100	50,00,000	100	53,00,000	100	56,18,000	100	59,55,080	100	63,12,385	100	66,91,128	100	70,92,596	100	75,18,151	100	79,69,240	100	84,47,393
18	Fodder Nursery Preparation	1	5,00,00,000																		
19	Thermal Drone with 10 Years AMC	1	17,00,000	1	18,02,000																
20	Central Control Room	1	1,50,00,000																	16,89,479	
21	Data creation, analysis and storage devices	1	10,00,000	1	10,60,000	1	11,23,600	1	11,91,016	1	12,62,477	1	13,38,226	1	14,18,519	1	15,03,630	1	15,93,848	1	16,89,479
22	Training Workshops	6	7,20,000	6	7,63,200	6	8,08,992	6	8,57,532	6	9,08,983	6	9,63,522	6	10,21,334	6	10,82,614	6	11,47,571	6	12,16,425
23	Awareness programmes, signages	15	6,00,000	15	6,36,000	15	6,74,160	15	7,14,610	15	7,57,486	15	8,02,935	15	8,51,111	15	9,02,178	15	9,56,309	15	10,13,687
24	Forest fire management- Fireline maintenance	1	35,00,000	1	37,10,000	1	39,32,600	1	41,68,556	1	44,18,669	1	46,83,790	1	49,64,817	1	52,62,706	1	55,78,468	1	59,13,176
25	Forest Firefighting Equipment	1	5,00,000	1	5,30,000	1	5,61,800	1	5,95,508	1	6,31,238	1	6,69,113	1	7,09,260	1	7,51,815	1	7,96,924	1	8,44,739
26	Elephant Management Team	1	5,00,000	1	5,30,000	1	5,61,800	1	5,95,508	1	6,31,238	1	6,69,113	1	7,09,260	1	7,51,815	1	7,96,924	1	8,44,739
27	Solar Light in the villages	15	3,75,000	15	3,97,500	15	4,21,350	15	4,46,631	15	4,73,429										
28	Stakeholder Meeting Centre	1	50,00,000	1	53,00,000	1	56,18,000	1	59,55,080	1	63,12,385										
29	Livelihood Generation through providing proper training and guidance	1	2,00,000	1	2,12,000	1	2,24,720	1	2,38,203	1	2,52,495										
Year Wise Total		-	23,51,95,000	-	15,72,78,700	-	16,54,79,462	-	13,43,40,650	-	10,45,26,777	-	2,47,83,939	-	2,17,31,714	-	1,82,23,998	-	1,93,17,438	-	2,04,76,484
Total (in Rs.)																					

₹ 90,13,54,162.00

ANNEXURE 1

List of Medicinal Plants:

Local Name	Scientific Name	Family	Medicinal Uses	Economical Uses
Aam	<i>Mangifera indica</i>	Anacardiaceae	<p>Various parts of plant are used as a dentifrice, antiseptic, astringent, diaphoretic, stomachic, vermifuge, tonic, laxative and diuretic and to treat diarrhea, dysentery, anaemia, asthma, bronchitis, cough, hypertension, insomnia, rheumatism, toothache, leucorrhoea, haemorrhage and piles. All parts are used to treat abscesses, broken horn, rabid dog or jackal bite, tumour, snakebite, stings, datura poisoning, heat stroke, miscarriage, anthrax, blisters, wounds in the mouth, tympanitis, colic, diarrhea, glossitis, indigestion, bacillosis, bloody dysentery, liver disorders, excessive urination, tetanus and asthma. Ripe mango fruit is considered to be invigorating and freshening. The juice is restorative tonic and used in heat stroke. The seeds are used in asthma and as an astringent. Fumes from the burning leaves are inhaled for relief from hiccups and affections of the throat. The bark is astringent, it is used in diphtheria and rheumatism, and it is believed to possess a tonic action on mucus membrane. The gum is used in dressings for cracked feet and for scabies. It is also</p>	

			considered anti-syphilitic. The kernels are converted into flour after soaking in water and eliminating the astringent principles. Most parts of the tree are used medicinally and the bark also contains tannins, which are used for the purpose of dyeing.	
Amra	<i>Spondias mangifera</i>	Anacardiaceae	In Ayurveda the plant is used for the treatment of diarrhea, irregular menstruation, anorexia, indigestion and nausea.	
Cashew	<i>Anacardium occidentale</i>	Anacardiaceae	The leaves are used as treatment for reducing fever, malaria, toothache, and gum problems. The bark is used to reduce blood sugar levels and to detoxify snake bites. Cashew syrup is used as relief from coughs and colds.	
Karchmola	<i>Lannea grandis</i>	Anacardiaceae	It is used as folk medicine to treat fever, dyspepsia, general debility, gout, dysentery, sore eyes, leprosy, sprains, ulcers, inflammations, Impotency, wounds and more disorders. Generally leaves, bark, stem and gum of <i>Lannea coromandelica</i> are used to treat an assortment of diseases.	
Piyal	<i>Buchanania lanzan</i>	Anacardiaceae		Seeds are edible to humans and are used as a cooking spice primarily in India.
Aash gach	<i>Lannea coromandelica</i>	Anacardiaceae	Used as folk medicine to treat fever, dyspepsia, general debility, gout, dysentery, sore eyes, leprosy, sprains, ulcers, inflammations,	

			Impotency, wounds and much more disorders. Generally leaves, bark, stem and gum of <i>Lannea coromandelica</i> are used to treat an assortment of diseases.	
Nona	<i>Annona reticulata</i>	Annonaceae	Used as source of medicine and also for industrial products. It possesses several medicinal properties such as anthelmintic, analgesic, anti-inflammatory, antipyretic, wound healing and cytotoxic effects. It is widely distributed with phytochemicals like tannins, alkaloids, phenols, glycosides, flavonoids and steroids.	
Chatim	<i>Alstonia scholaris</i>	Apocynaceae	The bark paste is applied locally in chronic skin ulcers. It is given in postnatal conditions to mothers for increasing lactation. It also increases digestive power and is also given in fever as an antipyretic. This plant is one of the best home remedies for high fever.	
Gabdi	<i>Cochlospermum gossypium</i>	Bixaceae	It is used as anti microbial, anti bacterial anti carcinogenic, antioxidant, and Hepato protective activity, and also used as stimulant, sedative and is useful in cough, gonorrhea, Syphilis and trachoma.	
Shimul	<i>Bombax ceiba</i>	Bombacaceae	Various palnt parts are used in curing wounds, diarrhoea, constipation, piles, urinary disorder, gynecological disorder etc.	
Lashora	<i>Cordia myxa</i>	Boraginaceae	The plant possessed analgesic, anti-inflammatory,	

			immunomodulatory, antimicrobial, antiparasitic, insecticidal, cardiovascular, respiratory, gastrointestinal and protective effects.	
Arjun	<i>Terminalia arjuna</i>	Cambretaceae	Used for asthma, bile duct disorders, scorpion stings, and poisonings. The bark of <i>Terminalia arjuna</i> has been used in India for more than 3000 years, primarily as a heart remedy.	
Neuri	<i>Elaeodendron glaucum</i>	Celastraceae	The dried and powdered leaves are used as sternutatories. They are also burnt and the smoke used as a fumigant in the treatment of certain nerve diseases, particularly to rouse women from hysteria. The powdered leaves are used as a snuff to relieve headaches. The bark is astringent and is also considered poisonous. The fresh root bark is rubbed into a paste with water and applied as a poultice on swellings. The root is said to be specific against snake-bite.	
Asan	<i>Terminalia elliptica</i>	Combretaceae		The wood is used for furniture, cabinet work, joinery, paneling, specialty items, boat-building, railroad cross-ties (treated), decorative veneers and for musical instruments (e.g. for guitar fretboard). The leaves are used as food by <i>Antheraea paphia</i> (silkworms) which produce the tassar

				<p>silk (Tussah), a form of commercially important wild silk. The bark is used medicinally against diarrhoea. Oxalic acid can be extracted from it. The bark and especially the fruit yield pyrogallol and catechol to dye and tan leather.</p>
Daw	<i>Anogeissus latifolia</i>	Combretaceae		<p>Its leaves contain large amounts of gallotannins, and are used in India for tanning and firewood. The tree is the source of Indian gum, also known as ghatti gum, which is used for calico printing among other uses.</p>
Haritaki	<i>Terminalia chebula</i>	Combretaceae	<p>Widely used in the traditional medicine of India and Iran to treat diseases that includes dementia, constipation, and diabetes.</p>	
Ankura	<i>Alangium lamarckii</i>	Cornaceae	<p>In Ayurveda the roots and the fruits are used for the treatment of rheumatism and haemorrhoid. Externally, it is used for the treatment of bites by rabbits, rats, and dogs. The root-bark is also used in traditional medicine skin problems and as an antidote for snake bite. The root-bark is also used to expel parasitic worms (Platyhelminthes) and other internal parasites from the body. It is used as an emetic and purgative as well.</p>	<p>The wood is said to be hard and close-grained because of which good finishing is possible. It is used to make Ornamental work, pestles and rollers and also is good as a fuel wood. The stems because of its sharp ends are used as a spear in Kenya. The twigs are also used as tooth brush in India. It is</p>

				considered to be good for making musical instruments and for making furniture as well.
Sal	<i>Shorea robusta</i>	Dipterocarpaceae	It is used as an astringent in Ayurvedic medicine.	one of the most important sources of hardwood timber in India. The wood is resinous and durable, and is sought-after for construction, although not well suited to planning and polishing. The wood is especially suitable for constructing frames for doors and windows. The dry leaves of sal are a major source for the production of leaf plates. Sal tree resin is known as sal dammar or Indian dammar. It is burned as incense in Hindu ceremonies, and used to caulk boats and ships. Sal seeds and fruit are a source of lamp oil and vegetable fat. The seed oil is extracted from the seeds and used as cooking oil after refining.
Tamal	<i>Diospyros tomentosa</i>	Ebenaceae	Used extensively in Indian traditional	

			medicine to treat for a variety of diseases including diarrhea, cholera, dysentery, intermittent fevers, bleeding gums, bronchitis, carbuncles, cough, cramps, pneumonia, syphilis, tumors, etc.	
Pithali	<i>Trewia nudiflora</i>	Euphorbiaceae	Used for various diseases including blood and neuronal disorders. Leaves and its decoction are also applied to swellings and in healing of wounds and injuries. Bark is used for the treatment of enlarged thyroid. Decoction of the root is stomachic and alterative and used in flatulence, gout and rheumatism.	
Sindure	<i>Mallotus philippensis</i>	Euphorbiaceae	According to Ayurveda, leaves are bitter, cooling and appetizer. Fruit is heating, Purgative, anthelmintic, vulnerary, detergent, matura nt, carminative, alexiteric and useful in treatment of bronchitis, abdominal diseases, spleen enlargement etc.	
Sankata	<i>Acacia suma</i>	Fabaceae	Used as antihemorrhagic, antiinflammatory.	
Akashmoni	<i>Acacia auriculiformis</i>	Fabaceae		This plant is raised as an

				<p>ornamental plant, as a shade tree and it is also raised on plantations for fuel wood throughout southeast Asia, Oceania and in Sudan. Its wood is good for making paper, furniture and tools. It contains tannin useful in animal hide tanning. In India, its wood and charcoal are widely used for fuel. Gum from the tree is sold commercially, but it is said not to be as useful as gum arabic. In Thailand the small fresh leaves are eaten, often with nam prik chili sauce or papaya salad. The tree is used to make an analgesic by indigenous Australians.</p> <p>Extracts of <i>Acacia auriculiformis</i> heartwood inhibit fungi that attack wood. Aquous extracts of <i>Acacia auriculiformis</i> show developmental inhibitory effect</p>
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				(the melon fly).
Chapot Shiris	<i>Dalbergia lanceolaria</i>	Fabaceae	The bark of the tree is traditionally used as an analgesic and anti-diarrhoeal.	Because it produces new stems (ramets), it is recommended for reforestation projects on degraded land where seeds are unlikely to grow successfully.
Karai	<i>Albizzia procera</i>	Fabaceae	Commonly used in traditional medicines. The bark contains tannins and a reddish gum and can also be used to make a poison. The leaves are used to treat ulcers and have insecticidal properties.	
Madar	<i>Erythrina stricta</i>	Fabaceae	Used in Indian indigenous systems as a remedy for rheumatism, stomach-ache, asthma, dysentery, contact dermatitis, eczema and skin infections. The stem bark is crushed in water and applied locally to the body in order to destroy lice.	
Minjiri	<i>Cassia siamea</i>	Fabaceae	Used for the treatment of typhoid fever, jaundice, abdominal pain, menstrual pain and is also used to reduce sugar level in the blood. Ethno medicinally it is used as laxative, blood cleaning agent, cure for digestive system and genitourinary disorders, herpes and rhinitis.	
Palash	<i>Butea monosperma</i>	Fabaceae	The tree comprises anti-diarrheal, anthelmintic, anti-diabetic, anti-stress, hepatoprotective, antifungal, astringent, aphrodisiac, laxative, anti-inflammatory	

			and antioxidant qualities. The flowers and leaves are diuretic, aphrodisiac, astringent and increase the flow of blood in the pelvic region. The seeds of the tree have purgative, diuretic to stimulate the production of urine and anthelmintic i.e. anti-parasitic properties. The seed powder is used in the case of intestinal parasites. Palash tree bark yields a gum which is known as kino, that houses astringent properties to treat haemorrhoids.	
Panjan	<i>Ougeinia oojeinensis</i>	Fabaceae	The plant has found applications in pharmaceuticals. The bark used as astringent, acrid, cooling, stimulant, anti-inflammatory, constipating, urinary astringent, anthelmintic, sudorific, depurative, styptic, febrifuge and rejuvenating.	
Piasal	<i>Pterocarpus marsupium</i>	Fabaceae	Leaves used in fractures, constipation, hemorrhages skin diseases, depurative, ophthalmology, leprosy, rectalgia, and leucoderma, rheumatoid arthritis, skin diseases, external use for sores, boils, stomach pain and gastrointestinal disorders. Bark used as diuretic, cholera, dysentery, stomachache, tongue diseases, urinary complaints and toothache, astringent, treatment of tumors of the gland, urethral	

			discharges, chronic ulcers, abortifacient. Stem used for neurological problems. Heartwood controls blood sugar level. Flower used in fever, as astringent, bitter acrid, anti-inflammatory, anthelmintic, anodyne. Gum-Kino used as diarrhea, passive hemorrhages, leucorrhoea, dysentery.	
Setisal	<i>Dalbergia latifolia</i>	Fabaceae	Tannins from the bark are used to produce medicines for the treatment of diarrhoea, worms, indigestion, and leprosy. These tannins also produce An appetizer.	
Sirish	<i>Albizia lebbek</i>	Fabaceae	Astringent, also used by some cultures to treat boils, cough, to treat the eye, flu, gingivitis, lung problems, pectoral problems, is used as a tonic, and is used to treat abdominal tumors. The bark is used medicinally to treat inflammation.	
Sonali	<i>Cassia fistula</i>	Fabaceae	Specially used in jaundice, piles, rheumatism ulcers and also externally skin eruptions, ring worms and eczema. Its leaves and flowers are both purgative like the pulp. The root is tonic, febrifuge, astringent and strong purgative.	
Sishu	<i>Dalbergia sissoo</i>	Fabaceae		Used as firewood, timber, poles, posts, toolhandles, fodder, erosion control and as a windbreak. Oil is extracted from the seed and tannin

				from the bark.
Tetul	<i>Tamarindus indica</i>	Fabaceae	In traditional medicine, it is used in wound healing, abdominal pain, diarrhea, dysentery, parasitic infestation, fever, malaria and respiratory problems. It is also commonly used in tropical countries because of its laxative and aphrodisiac properties.	
Gamar	<i>Gmelina arborea</i>	Lamiaceae		The wood is used for pulp, particle board, plywood, matches, carpentry and packing. It is also used for construction at boards, carving and musical instruments. The leaves and fruits are used as a fodder, and also used for rearing silkworms.
Jarul	<i>Lagerstroemia speciosa</i>	Lythraceae	Traditionally used to lower blood sugar in the body. It is also recommended for kidney, bladder problems and hypertension.	
Sidha	<i>Lagerstroemia parviflora</i>	Lythraceae		Valuable tree species for its timber. The wood is very hard and durable. Usually it is used for general carpentry like house posts, beams, rafters, door, window frame, carts and agricultural implement. Elephant feed on

				the bark of this species.
Neem	<i>Azadirachta indica</i>	Maliaceae	Has an anti-inflammatory property, antifungal property, rich source of Vitamin E which help repair damaged skin cells, excellent exfoliant, useful in detoxification both internally and externally, has antimicrobial and antibacterial effects which plays a huge role in boosting immunity, used as insect and mosquito repellent, prevents gastrointestinal diseases, has antiseptic property which heals wounds, extensively used in shampoos and conditioners which help eliminate dandruff and strengthens the hair, reduces joint pain, etc.	
Pola	<i>Kydia calycina</i>	Malvaceae	Used traditionally as a remedy in different disease conditions like skin disease, hyperglycemia, antihyperlipidemic, analgesic, anti-inflammatory, anticancer,	

			<p>invigorating and freshening. The juice is restorative tonic and used in heat stroke. The seeds are used in asthma and as an astringent. Fumes from the burning leaves are inhaled for relief from hiccups and affections of the throat. The bark is astringent, it is used in diphtheria and rheumatism, and it is believed to possess a tonic action on mucus membrane. The gum is used in dressings for cracked feet and for scabies. It is also considered anti-syphilitic. The kernels are converted into flour after soaking in water and eliminating the astringent principles. Most parts of the tree are used medicinally and the bark also contains tannins, which are used for the purpose of dyeing.</p>	
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Rahara	<i>Soymida febrifuga</i>	Meliaceae	Bark used in the treatment of diarrhoea, dysentery and fever and also as a general tonic; decoction used in gargles, vaginal infections, rheumatism swellings and as enemata.	
Bahera	<i>Terminalia bellirica</i>	Moraceae	Used traditionally as antiulcer, antibacterial, antidiabetic, in the treatment of gonorrhea and skin diseases.	
Dumur	<i>Ficus hispida</i>	Moraceae	Traditionally, different parts of the plant have been used in the treatment of ulcers, psoriasis, anemia, piles jaundice, vitiligo, hemorrhage, diabetes, convulsion, hepatitis, dysentery, biliousness, and as lactagogue and purgative.	
Sheora	<i>Streblus asper</i>	Moraceae	Various parts of this plant are used in Ayurveda and other folk medicines for the treatment of different ailments such as filariasis, leprosy, toothache, diarrhea, dysentery and cancer.	
Kalo Jam	<i>Eugenia jambolana</i>	Myrtaceae	Widely used in folk medicine for diabetes. It is also used by mouth for gas (flatulence), swelling (inflammation) of the stomach (gastritis), constipation, diarrhea, and other conditions. Jambolan is sometimes used for sore throat, and applied directly to the skin for skin ulcers.	
Aamrul	<i>Oxalis corniculata</i>	Oxalidaceae	Used in the treatment of influenza, fever, urinary tract	

			infections, enteritis, diarrhoea, traumatic injuries, sprains and poisonous snake bites. An infusion can be used as a wash to rid children of hookworms. The plant is used as an antiscorbutic in the treatment of scurvy.	
Amla	<i>Phyllanthus emblica</i>	Phyllanthaceae	All parts of the plant are used for medicinal purposes, especially the fruit, which has been used in Ayurveda as a potent rasayana and in traditional medicine for the treatment of diarrhea, jaundice, and inflammation. Various plant parts show antidiabetic, hypolipidemic, antibacterial, antioxidant, antiulcerogenic, hepatoprotective, gastroprotective, and chemopreventive properties.	
Kaj	<i>Bridelia retusa</i>	Phyllanthaceae	The plant is pungent, bitter, heating, useful in lumbago, hemiplegia; bark is good for the removal of urinary concretions (Ayurveda). Root and bark are valuable astringents. The bark is used as a liniment with gingelly oil in rheumatism.	
Parasi	<i>Cleistanthus collinus</i>	Phyllanthaceae		The most commonly encountered plant poison in southern India. The leaves are used for poisoning humans (suicide or homicide) and animals (cattle and fish) and as an abortifacient, especially in rural south India.

Kadam	<i>Anthocephalus cadamba</i>	Rubiaceae	Used in the treatment of various ailments such as fever, uterine complaints, blood diseases, skin diseases, tumour, anaemia, eye inflammation and diarrhoea. Other reported uses include antihepatotoxic, antimalarial, analgesic, anti-inflammatory, antipyretic, diuretic and laxative.	
Larikaram	<i>Hymenodictyon excelsum</i>	Rubiaceae	Has been used in traditional medicine for a wide range of ailments related to digestive, endocrine, reproductive, and respiratory systems. Additionally, it is also used in gastrointestinal tract and urinary tract infection.	
Bel	<i>Aegle marmelos</i>	Rutaceae	Anti-inflammatory in nature; its extracts when applied on the exposed area, help to cure inflammation. The leaf juice with honey can prove useful for treating fever. It can be used to treat tuberculosis.	
Soru Ghash	<i>Sapindus mukorossi</i>	Sapindaceae	The seeds are used in Ayurvedic medicine to remove tan and freckles from the skin. It cleanses the skin of oily secretion and is even used as a cleanser for washing hair as it forms a rich, natural lather.	
Vutkusum	<i>Schleichera oleosa</i>	Sapindaceae	Bark is used for medicinal and preparation to cure fever.	Wood is used for fire wood. Seeds yield edible oil. Fruits edible also by Monkeys and by Spotted Deer. Elephants feed on the leaves. Honey bees forage on the flowers.
Kanta Buhel	<i>Sideroxylon armatum</i>	Sapotaceae		The wood is used to make house beams and carpenters' planes

Mohul	<i>Madhuca longifolia</i>	Sapotaceae	Used as a fermenting initiator in many Ayurvedic medicines. It is described in Ayurveda for treating skin diseases, nerve disorders, cough, burning sensation and diarrhea.	
Agoi	<i>Aquilaria malaccensis</i>	Thymelaeaceae	The incense is used against cancer in Western, Chinese, and Indian medicine. Agar wood is used to relieve spasms and to lower fever. In China, it is used as a sedative against abdominal complaints, asthma, colic and diarrhoea.	

ANNEXURE 2

List of Ethnobotanic Aspects of Flora:

LOCAL NAME	SCIENTIFIC NAME	FAMILY	USABLE/EDIBLE PART
Maan kachu	<i>Alocasia indica</i>	Araceae	Stem
Shalincha	<i>Alternanthera sessilis</i>	<u>Amaranthaceae</u>	Leaves
Kantanotey	<i>Amaranthus spinosus</i>	<u>Amaranthaceae</u>	Leaves, stem
Noteysak	<i>Amaranthus viridis</i>	<u>Amaranthaceae</u>	Leaves, seeds
Nona ata	<i>Annona reticulata</i>	Annonaceae	Fruits
Kamranga	<i>Averrhoa carambola</i>	Oxalidaceae	Fruits, flowers, leaves
Neem	<i>Azadirachta indica</i>	Meliaceae	Fruits, leaves, flowers, sap
Bramhisak	<i>Bacopa monnieri</i>	Plantaginaceae	Leaves, flowers
Kumkumsak	<i>Boerhavia diffusa</i>	Nyctaginaceae	Leaves, seeds
Karamcha	<i>Carissa carandas</i>	Apocynaceae	Fruits
Jhitkisak	<i>Cassia tora</i>	Fabaceae	Entire plant, leaves, seeds
Thankuni	<i>Centella asiatica</i>	Apiaceae	Leaves, stem
Bathua	<i>Chenopodium album</i>	Amaranthaceae	Leaves, young shoots
Telakucha	<i>Coccinia grandis</i>	Cucurbitaceae	Green fruits, tender leaves and shoots
Kachu	<i>Colocasia esculenta</i>	Araceae	Corms, young leaves
Kansira	<i>Commelina benghalensis</i>	Commelinaceae	Leaves
Amada	<i>Curcuma amada</i>	Zingiberaceae	Rhizomes eaten as whole
Chalta	<i>Dillenia indica</i>	Dilleniaceae	Fleshy sepals surrounding the fruit
Kham Alu	<i>Dioscorea alata</i>	Dioscoreaceae	Tuber
Kendu	<i>Diospyros melanoxylon</i>	Ebenaceae	Fruits
Keshut	<i>Eclipta rostrate</i>	Asteraceae	Tender leaves and young shoots
Amloki	<i>Emblica officinalis</i>	Phyllanthaceae	Mesocarp of the fruit
Hingchasak	<i>Enhydra fluctuans</i>	Asteraceae	Edible aquatic herb

Ash phal	<i>Euphoria longan</i>	Sapindaceae	Fruits
Dumur	<i>Ficus hispida</i>	Moraceae	Fruits
Gandhi buuti	<i>Glinus oppositifolius</i>	Molluginaceae	Leaves
Falsa	<i>Grewia asiatica</i>	Malvaceae	Fruits
Kulekhara	<i>Hygrophil apinosa</i>	Acanthaceae	Leaves and tender shoots
Kalmi Sak	<i>Ipomoea aquatica</i>	Convolvulaceae	Stem
Ranga Alu	<i>Ipomoea batatas</i>	Convolvulaceae	Underground root tuber
Dhudul	<i>Luffa cylindrica</i>	Cucurbitaceae	Fruits, young shoots, leaves, flower buds, and seeds
Mahua	<i>Madhuca latifolia</i>	Sapotaceae	Flowers
Aam	<i>Mangifera indica</i>	Anacardiaceae	Mesocarp of fruit
Susnisak	<i>Marsilea quadrifolia</i>	Marsileaceae	Young stems and leaves
Pudina	<i>Mentha viridis</i>	Lamiaceae	Leaves
Gimasak	<i>Mollugo spergula</i>	Molluginaceae	Leaves
Kari Patta	<i>Murraya koenigii</i>	Rutaceae	Leaves, roots and bark
Lalputiya	<i>Nasturtium officinale</i>	Cruciferae	Seeds
Seuli	<i>Nyctanthes arbortristis</i>	Oleaceae	Leaves
Sapla	<i>Nymphae rubra</i>	Nymphaeaceae	Dried rhizomes, tubers, unopened flower buds, young leaves
Amarul	<i>Oxalis corniculata</i>	Oxalidaceae	Leaves
Gadal	<i>Paederia foetida</i>	Rubiaceae	Leaves
Bon Tepari	<i>Physalis minima</i>	Solanaceae	Yellowish flowers and fruits
Nona sak	<i>Portulaca oleracea</i>	Portulacaceae	Stems, leaves and flower buds
Bedana	<i>Punica granatum</i>	Punicaceae	Aril, the edible portion of fruit, is a seed around the juicy pulp formed from ovules present in the ovary of the fertilized fruit

Bok phul	<i>Sesbania grandiflora</i>	Fabaceae	Flowers, young leaves and shoots, young pods
Kaakmachi	<i>Solanum nigrum</i>	Solanaceae	Ripe berries and cooked leaves
Piringsak	<i>Trigonella corniculata</i>	Fabaceae	Young leaves and stem tips
Khammam	<i>Typhonium trilobatum</i>	Araceae	Corms after boiling is edible, leaves
Okra phal	<i>Xanthium strumarium</i>	Asteraceae	seed oil is edible
Kundri	<i>Zehneria umbellata</i>	Cucurbitaceae	Fruits
Kul	<i>Ziziphus mauritiana</i>	Rhamnaceae	Ripefruits, seeds

ANNEXURE 3

Butterfly Check List (In-Situ)

CLASS	ORDER	FAMILY	COMMON NAME	SCIENTIFIC NAME	IWPA STATUS	IUCN STATUS
Insecta	Lepidoptera	Hesperiidae	Common Snow Flat	<i>Tagiades japaetus</i>	-	NE
			Indian Grizzled Skipper	<i>Spialia galba</i>	-	NE
			Cestnut Bob	<i>Lambrix salsala</i>	-	NE
			Indian Palm Bob	<i>Suastus gremius</i>	-	NE
			Common Redeye	<i>Matapa aria</i>	-	LC
			Common Straight Swift	<i>Parnara guttata</i>	-	NE
			Continental Swift	<i>Parnara ganga</i>	-	NE
			Beavan's Swift	<i>Borbo bevani</i>	-	NE
		Papilionidae	Rice Swift	<i>Borbo cinnara</i>	-	NE
			Obscure Branded Swift	<i>Pelopidus agna</i>	-	NE
			Common Jay	<i>Graphium doson</i>	-	LC
			Tailed Jay	<i>Graphium agamemnon</i>	-	LC
			Common Banded Peacock	<i>Papilio crino</i>	-	NE
			Common Mormon	<i>Papilio polytes</i>	-	LC
			Lime Butterfly	<i>Papilio demoleus</i>	-	NE
			Common Mime	<i>Papilio clytia</i>	-	NE
			Crimson Rose	<i>Pachliopta hector</i>	Sch I	LC
			Common Rose	<i>Atrophaneura aristolochiae</i>	-	LC
			Blue Mormon	<i>Pachliopta polymnestor</i>	-	NE
			Common Gull	<i>Cepora nerissa</i>	-	LC
			Common Jezebel	<i>Delias eucharis</i>	-	LC

Pieridae	Striped Albatross	<i>Appias olferna</i>	-	NE
	Psyche	<i>Leptosia nina</i>	-	LC
	Common/Indian Wanderer	<i>Pareronia hippia</i>	-	NE
	Common Emigrant	<i>Catopsilia pomona</i>	-	NE
	Mottled Emigrant	<i>Catopsilia pyranthe</i>	-	NE
	Small Grass Yellow	<i>Eurema brigitta</i>	-	LC
	Common Grass Yellow	<i>Eurema hecabe</i>	-	NE
	Three Spot Grass Yellow	<i>Eurema blanda</i>	-	NE
	Indian Sunbeam	<i>Curetis thetis</i>	-	NE
	Common Cerulean	<i>Jamides celeno</i>	-	LC
	Forget-me-not	<i>Catochrysops strabo</i>	-	NE
	Common Pierrot	<i>Castalius rosimon</i>	-	NE
	Rounded Pierrot	<i>Tarucus extricatus</i>	-	NE
	Striped Pierrot	<i>Tarucus nara</i>	-	NE
	Dark Grass Blue	<i>Zizeeria karsandra</i>	-	LC
Lycaenidae	Pale Grass Blue	<i>Pseudozizeeria maha</i>	-	NE
	Lesser Grass Blue	<i>Zizina otis</i>	-	NE
	Tiny Grass Blue	<i>Zizula hylax</i>	-	NE
	Purple Leaf Blue	<i>Amblypodia anita</i>	-	NE
	Quaker	<i>Neopithecops zalmora</i>	-	LC
	Gram Blue	<i>Euchrysops cnejus</i>	-	NE
	Lime Blue	<i>Chilades lajus</i>	-	NE
	Plains Cupid	<i>Luthrodes pandava</i>	-	NE
	Common Silverline	<i>Cigaritis vulcanus</i>	-	NE
	Common Shot Silverline	<i>Aphnaeus ictis</i>	-	NE
	Club Silverline	<i>Cigaritis syama</i>	-	NE
	Peablu	<i>Lampides boeticus</i>	Sch II	LC
	Apefly	<i>Spalgis epus</i>	-	NE

			Ciliate Blue	<i>Anthene emolus</i>	-	NE
			Pointed Ciliate Blue	<i>Anthene lycaenina</i>	Sch II	NE
			Glassy Tiger	<i>Parantica aglea</i>	-	NE
			Blue Tiger	<i>Tirumala limniace</i>	-	NE
			Striped Tiger	<i>Danaus genutia</i>	-	NE
			Common Tiger	<i>Danaus genutia</i>	-	LC
		Nymphalidae	Plain Tiger	<i>Danaus chrysippus</i>	-	LC
			King Crow	<i>Euploea klugii</i>	-	LC
			Common Crow	<i>Euploea core</i>	-	LC
			Common Evening Brown	<i>Melanitis leda</i>	-	LC
			Common Palmfly	<i>Elymnias hypermnestra</i>	-	NE
			Common Bushbrown	<i>Mycalesis perseus</i>	-	NE
			Dark Brand Bushbrown	<i>Mycalesis mineus</i>	-	NE
			Angled Castor	<i>Ariadne ariadne</i>	-	NE
			Common Castor	<i>Ariadne merione</i>	-	NE
			Common Leopard	<i>Phalanta phalantha</i>	-	NE
			Yellow Pansy	<i>Junonia hierta</i>	-	NE
			Blue Pansy	<i>Junonia orithya</i>	-	LC
			Lemon Pansy	<i>Junonia lemonias</i>	-	NE
			Peacock Pansy	<i>Junonia almana</i>	-	LC
			Grey Pansy	<i>Junonia atlites</i>	-	NE
			Chocolate Pansy	<i>Junonia iphita</i>	-	NE
			Danaid Eggfly	<i>Hypolimnas misippus</i>	-	LC
			Great Eggfly	<i>Hypolimnas bolina</i>	-	NE
			Common Sailor	<i>Neptis hylas</i>	-	NE
			Cestnut-streaked Sailor	<i>Neptis jumbah</i>	-	NE
			Commander	<i>Moduza procris</i>	-	NE
			Common Baron	<i>Euthalia aconthea</i>	-	NE

			Tawny Coster	<i>Acraea berpsicore</i>	-	NE
			Grey Count	<i>Tanaecia lepidea</i>	-	NE
			Bamboo Treebrown	<i>Lethe europa</i>	-	NE
			Common Four Ring	<i>Ypthima huebneri</i>	-	NE

ANNEXURE 4

Dragonfly & Damselfly Checklist (In Situ)

CLASS	ORDER	SUB-ORDER	FAMILY	COMMON NAME	SCIENTIFIC NAME	IWPA STATUS	IUCN STATUS
Insecta	Odonata	Anisoptera	Gomphidae	Common Clubtail	<i>Gomphus vulgatissimus</i>	-	LC
			Aeshnidae	Blue-tailed Green Darner	<i>Anax guttatus</i>	-	LC
			Libellulidae	Trumpet Tail	<i>Acisoma panorpoides</i>	-	LC
				Ditch Jewel	<i>Brachythemis contaminata</i>	-	LC
				Ruddy Marsh Skimmer	<i>Crocothemis servilia</i>	-	LC
				Ground Skimmer	<i>Diplacodes trivialis</i>	-	LC
				Fulvous Forest Skimmer	<i>Neurothemis fulvia</i>	-	LC
				Ruddy Meadow Skimmer/Paddy field Parasol	<i>Neurothemis intermedia</i>	-	LC
				Crimson-tailed Marsh Hawk	<i>Orthetrum pruinosum</i>	-	LC
				Green Marsh Hawk	<i>Orthetrum sabina</i>	-	LC
				Wandering Glider	<i>Pantala flavescens</i>	-	LC
				Yellow-tailed Ashy Skimmer	<i>Potamarcha congener</i>	-	LC
				Common Picture Wing	<i>Rhyothemis variegata</i>	-	LC
				Coral-tailed Cloud Wing	<i>Tholymis tillarga</i>	-	LC
				Red Marsh Trotter	<i>Tramea basilaris</i>	-	LC

ANNEXURE 5

Spider Checklist (In Situ)

CLASS	FAMILY	SPECIES
Arachnida	Araneidae	<i>Anepsion sp.</i>
		<i>Araneus mitificus</i>
		<i>Argiope catenulata</i>
		<i>Argiope pulchella</i>
		<i>Cyclosa hexatuberculata</i>
		<i>Cyclosa bifida</i>
		<i>Cyrtarachne ixoides</i>
		<i>Cyrtarachne sp.</i>
		<i>Cyrtophora cicatrosa</i>
		<i>Eriovixia excelsa</i>
		<i>Eriovixia laglaizei</i>
		<i>Gasteracantha hasselti</i>
		<i>Gasteracantha kuhli</i>
		<i>Gea sp.</i>
		<i>Larinia sp.</i>
		<i>Neoscona molemensis</i>
		<i>Neoscona mukere</i>
		<i>Neoscona subfusca</i>
		<i>Neoscona theisi</i>
		<i>Neoscona vigilans</i>
	Cheiracanthiidae	<i>Nephila pilipes</i>
		<i>Nephila kuhli</i>
		<i>Parawixia dehaani</i>
		<i>Poltys sp.</i>
		<i>Cheiracanthium sp.</i>

	Clubionidae	<i>Clubiona</i> sp.
	Corinnidae	<i>Castaneira</i> sp.
		<i>Cambalida</i> sp.
		<i>Corinnomma</i> sp.
	Ctenidae	<i>Ctenus</i> sp.
	Eresidae	<i>Stegodyphus</i> sp.
	Gnaphosidae	<i>Gnaphosa</i> sp.
		<i>Sosticus</i> sp.
		<i>Zelotes</i> sp.
	Hersiliidae	<i>Hersilia savignyi</i>
	Liocranidae	<i>Oedignatha</i> sp.
	Lycosidae	<i>Arctosa</i> sp.
		<i>Lycosa</i> sp. .
		<i>Hippasa</i> sp.
		<i>Pardosa</i> sp.
	Oxyopidae	<i>Hamadruas</i> sp.
		<i>Hamataliwa</i> sp.
		<i>Oxyopes sunandae</i>
		<i>Oxyopes shweta</i>
		<i>Peucetia viridans</i>
		<i>Artema</i> sp.
		<i>Crossopriza lyoni</i>
	Pholcidae	<i>Pholcus</i> sp.
		<i>Smeringopus</i> sp.
	Pisauridae	<i>Dendrolycosa</i> sp.
		<i>Asemonea. tenuipes</i>
		<i>Bianor</i> sp.
		<i>Carrhotus viduus</i>
		<i>Chrysilla volupe</i>
		<i>Cyrba</i> sp.

	Saltcidae	<i>Epeus sp</i>
		<i>Epocilla sp.</i>
		<i>Harmochirus sp.</i>
		<i>Hasarius adansoni</i>
		<i>Hyllus semicupreus</i>
		<i>Menemerus bivittatus</i>
		<i>Menemerus fulvus</i>
		<i>Myrmaplata platyleoides</i>
		<i>Myrmarachne melanocephala</i>
		<i>Phintella vittata</i>
		<i>Plexippus paykulli</i>
		<i>Plexippus petersi</i>
		<i>Portia sp.</i>
		<i>Rhene danieli</i>
		<i>Siler semiglaucus</i>
		<i>Stenaelurillus sp.</i>
		<i>Telamonia dimidiata</i>
		<i>Thiania bhanoensis</i>
		<i>Thyene imperialis</i>
	Scytodidae	<i>Scytodes pallida</i>
	Sparassidae	<i>Heteropoda venatoria</i>
		<i>Olios lamarcki</i>
		<i>Olios milleti</i>
	Tetragnathidae	<i>Guizygiella sp.</i>
		<i>Leucauge decorata</i>
		<i>Tetragnatha ceylonica</i>
		<i>Tetragnatha javana</i>
		<i>Tetragnatha sp.</i>
		<i>Tylorida sp.</i>
		<i>Argyroides flavescens</i>

	Theridiidae	<i>Argyrodes sp.</i>
		<i>Meopta sp.</i>
		<i>Parasteatoda sp.</i>
		<i>Thwaitesia sp.</i>
		<i>Rhomphaea sp.</i>
	Thomisidae	<i>Camaricus sp.</i>
		<i>Indoxysticus sp.</i>
		<i>Oxytate sp.</i>
		<i>Runcinia sp.</i>
		<i>Synema sp.</i>
		<i>Thomisus sp.</i>
		<i>Tmarus sp.</i>
	Uloboridae	<i>Uloborus* sp.</i>
		<i>Zosis sp.</i>

ANNEXURE 6

Amphibians and Reptiles Checklist (In Situ)

CLASS	ORDER	FAMILY	COMMON NAME	SCIENTIFIC NAME	IWPA STATUS	IUCN STATUS
Reptilia	Squamata	Colubridae	Butt Striped Keelback	<i>Amphiesma stolatum</i>	Sch IV	LC
			Common Vine Snake	<i>Ahaetulla nasuta</i>	Sch IV	LC
			Common Wolf Snake	<i>Lycodon aulicus</i>	Sch IV	LC
			Yellow Speckled Wolf Snake	<i>Lycodon flavomaculatus</i>	Sch IV	LC
			Common Kukri	<i>Oligodon arnensis</i>	Sch IV	NE
			Indian Rat Snake	<i>Ptyas mucosa</i>	Sch IV	LC
			Checkered Keelback	<i>Fowlea piscator</i>	Sch I	LC
			Common Bronze Back Tree Snake	<i>Dendrelaphis tristis</i>	Sch IV	NE
		Typhlopidae	Bramimy Worm Snake	<i>Indotyphlops braminus</i>	Sch I	LC
		Elapidae	Monocled Cobra	<i>Naja kaouthia</i>	Sch II	LC
			Spectacled Cobra	<i>Naja naja</i>	Sch II	LC
			Common Krait	<i>Bungarus caeruleus</i>	Sch IV	NE
		Viperidae	Russell's Viper	<i>Daboia russelii</i>	Sch II	NE
		Homalopsidae	Smooth Scaled Watersnake	<i>Enhydryis enhydryis</i>	-	LC
		Agamidae	Indian Garden Lizard	<i>Calotes versicolor</i>	-	NE
			Indian Rock Lizard	<i>Psammophilus blanfordianus</i>	-	LC
		Gekkonidae	Indian House Gecko	<i>Hemidactylus flaviviridis</i>	-	NA
			Spotted House Gecko	<i>Hemidactylus parvimaculatus</i>	-	NA
		Chamaeleonidae	Indian Chamaeleon	<i>Chamaeleon zeylanicus</i>	Sch II	LC
		Lacertidae	Jerdon Snake eye	<i>Ophisops jerdonii</i>	-	LC
		Scincidae	Common Keeled Skink	<i>Eutropis carinata</i>	-	LC
			Bronze Grass Skink	<i>Eutropis macularia</i>	-	NA

ANNEXURE 7

List of Avifauna

Class - Aves	IUCN status	Migratory Status	WPA status	WPA status.Updated	Inside the forest	Outside the forest
Galliformes : Phasianidae						
Gray Francolin	LC	RE	Schedule IV	Sch II	NO	Yes
Columbiformes : Columbidae						
Common pigeon	LC	RE	Schedule IV	Sch II	YES	YES
Eurasian collared dove	LC	RE	Schedule IV	Sch II	YES	YES
Spotted dove	LC	RE	Schedule IV	Sch II	YES	YES
Red collared dove	LC	RE	Schedule IV	Sch II	YES	YES
Caprimulgiformes : Caprimulgidae						
Large-tailed Nightjar	LC	RE	Schedule IV		YES	NO
Jordan's Nightjar	LC	RE	Schedule IV		YES	NO
Caprimulgiformes : Apodidae						
Asian Palm Swift	LC	RE	Schedule IV	Sch II	YES	YES
Cuculiformes : Cuculidae						
Greater coucal	LC	RE	Schedule IV	Sch II	YES	YES
Lesser coucal	LC	RE	Schedule IV	Sch II	YES	YES
Asian koel	LC	RE	Schedule IV	Sch II	YES	YES
Plaintive cuckoo	LC	RE	Schedule IV	Sch II	YES	YES
Common Hawk Cuckoo	LC	RE	Schedule IV	Sch II	YES	YES
Gruiformes : Rallidae						
White-breasted Waterhen	LC	RE	Schedule IV	Sch II	YES	YES
Pelecaniformes : Ciconiidae						
Lesser Adjutant	VU	RE	Schedule IV	Sch I	YES	YES

Asian openbill	LC	RE	Schedule IV	Sch II	YES	YES
Pelecaniformes : Ardeidae						
Black Bittern	LC	RE	Schedule IV	Sch II	YES	YES
Grey Heron	LC	RE	Schedule IV	Sch II	NO	YES
Purple Heron	LC	RE	Schedule IV	Sch II	NO	YES
Black-crown night heron	LC	RE	Schedule IV	Sch II	YES	YES
Indian pond heron	LC	RE	Schedule IV	Sch II	YES	YES
Cattle egret	LC	RE	Schedule IV	Sch II	YES	YES
Great egret	LC	RE	Schedule IV	Sch II	YES	YES
Intermediate egret	LC	RE	Schedule IV	Sch II	YES	YES
Little egret	LC	RE	Schedule IV	Sch II	YES	YES
Pelecaniformes : Treskiornithidae						
Red-naped ibis	LC	RE	Schedule IV	Sch II	NO	YES
Pelecaniformes : Phalacrocoracidae						
Little cormorant	LC	RE	Schedule IV	Sch II	YES	YES
Charadriiformes : Charadriidae						
Little ringed plover	LC	WV	Schedule IV	Sch II	NO	YES
Red-wattled lapwing	LC		Schedule IV	Sch II	YES	YES
Charadriiformes : Rostratulidae						
Greater Painted Snipe	LC	RE	Schedule IV	Sch II	NO	YES
Charadriiformes : Scolopacidae						
Tamnick's Stint	LC	WV	Schedule IV	Sch II		
Common sandpiper	LC	WV	Schedule IV	Sch II		
Green sandpiper	LC	WV	Schedule IV	Sch II		
Accipitriformes : Accipitridae						
Black-winged kite	LC	RE	Schedule IV	Sch II	YES	YES

Booted Eagle	LC	RE	Schedule IV	Sch I	YES	YES
White-eye buzzard	LC	RE	Schedule IV	Sch I	YES	YES
Shikra	LC	RE	Schedule IV	Sch I	YES	YES
Brahminy kite	LC	RE	Schedule IV	Sch I	YES	YES
Black kite	LC	RE	Schedule IV	Sch I	YES	YES
Oriental-honey Buzzard	LC	RE	Schedule IV	Sch II	YES	YES
Strigiformes : Tytonidae						
Common barn owl	LC	RE	Schedule IV	Sch I	NO	YES
Strigiformes : Strigidae						
Spotted owl	LC	RE	Schedule IV	Sch II	YES	YES
Collard scops owl	LC	RE	Schedule IV	Sch II	NO	YES
Bucerotiformes : Upupidae		RE				
Common hoopoe	LC	RE	Schedule IV	Sch II	YES	YES
Piciformes : Picidae		RE				
Black-rumped flameback	LC	RE	Schedule IV	Sch II	YES	YES
Streak-throated Flameback	LC	RE	Schedule IV	Sch II	NO	YES
Greater Flameback	LC	RE	Schedule IV	Sch II	YES	YES
Fulvous-breasted Woodpecker	LC	RE	Schedule IV	Sch II	NO	YES
Piciformes : Ramphastidae						
Blue-throated Barbet	LC	RE	Schedule IV	Sch II	YES	YES
Coppersmith Barbet	LC	RE	Schedule IV	Sch II	NO	YES
Coraciiformes : Meropidae						
Green Bee-eater	LC	RE	Schedule IV	Sch II	YES	YES
Coraciiformes : Coracidae						
Indian Roller	LC	RE	Schedule IV	Sch II	NO	YES
Coraciiformes : Alcedinidae						
Common Kingfisher	LC	RE	Schedule IV	Sch II	YES	YES
Pied Kingfisher	LC	RE	Schedule IV	Sch II	NO	YES
Stork-billed Kingfisher	LC	RE	Schedule IV	Sch II	NO	YES

White-throated Kingfisher	LC	RE	Schedule IV	Sch II	YES	YES
Falconiformes : Falconiidae						
Common Kestrel	LC	RE	Schedule IV	Sch I	NO	YES
Peregrine Falcon	LC	RE	Schedule IV	Sch I	NO	YES
Psittaciformes : Psittaculidae						
Plum-headed Parakeet	LC	RE	Schedule IV	Sch II	YES	YES
Rose-ringed Parakeet	LC	RE	Schedule IV	Sch II	YES	YES
Alexandrine Parakeet	NT	RE	Schedule IV	Sch II	NO	YES
Passariformes : Corvidae						
House Crow	LC	RE	Schedule IV	Sch II	NO	YES
Jungle crow	LC	RE	Schedule IV	Sch II	NO	YES
Rufous Treepie	LC	RE	Schedule IV	Sch II	YES	YES
Passariformes : Campephagidae		RE				
Small Minivet	LC	RE	Schedule IV	Sch II	YES	NO
Large Cuckooshrike	LC	RE	Schedule IV	Sch II	YES	YES
Black-headed Cuckooshrike	LC	RE	Schedule IV	Sch II	YES	YES
Passariformes : Chloropseidae						
Jordan's Leafbird	LC	RE	Schedule IV	Sch II	YES	NO
Golden-fronted Leafbird	LC	RE	Schedule IV	Sch II	YES	NO
Passeriformes : Vangidae		RE				
Common Woodshrike	LC	RE	Schedule IV	Sch II	YES	YES
Passariformes : Oriolidae		RE				
Black-hooded Oriole	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Artamidae		RE				
Ashy Woodswallow	LC	RE	Schedule IV	Sch II	YES	YES
Passariformes : Aegithinidae		RE				
Common Iora	LC	RE	Schedule IV	Sch II	YES	YES
Passariformes : Dicruridae		RE				

Black Drongo	LC	RE	Schedule IV	Sch II	YES	YES
Bronzed Drongo	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Lanidae		RE				
Brown Shrike	LC	WV	Schedule IV	Sch II	YES	YES
Long-tailed Shrike	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Monarchidae		RE				
Indian-Paradise Flycatcher	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Dicaeidae		RE				
Pale-billed Flowerpecker	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Necterniidae		RE				
Purple-rumped Sunbird	LC	RE	Schedule IV	Sch II	YES	YES
Purple Sunbird	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Ploceidae		RE				
Baya Weaver	LC	RE	Schedule IV	Sch II	NO	YES
Black-breasted Weaver	LC	RE	Schedule IV	Sch II	NO	YES
Passeriformes : Estrildidae		RE				
Scaly-breasted Munia	LC	RE	Schedule IV	Sch II	YES	YES
Tricolored Munia	LC	RE	Schedule IV	Sch II	YES	YES
Indian Silverbill	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Motacillidae		RE				
Olive-backed Pipit	LC	RE	Schedule IV	Sch II	YES	YES
Richard's Pipit	LC	RE	Schedule IV	Sch II	YES	YES
Paddyfield Pipit	LC	RE	Schedule IV	Sch II	YES	YES
Blyth's Pipit	LC	RE	Schedule IV	Sch II	YES	YES
Eastern Yellow wagtail	LC	RE	Schedule IV	Sch II	NO	YES
Citrine Wagtail	LC	RE	Schedule IV	Sch II	NO	YES
White Wagtail	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Paridae		RE				
Cinereous Tit	LC	RE	Schedule IV	Sch II	YES	YES

Passeriformes : Alaudidae		RE				
Bengal Bushlark	LC	RE	Schedule IV	Sch II	NO	YES
Oriental Skylark	LC	RE	Schedule IV	Sch II	NO	YES
Passeriformes : Cisticolidae						
Zitting Cisticola	LC	RE	Schedule IV	Sch II	YES	YES
Grey-breasted Prinia	LC	RE	Schedule IV	Sch II	YES	YES
Plain Prinia	LC	RE	Schedule IV	Sch II	YES	YES
Common Tailorbird	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Phylloscopidae						
Greenish Warbler	LC	WV	Schedule IV	Sch II	YES	YES
Passeriformes : Acrocephalidae						
Blyth's Reed Warbler	LC	WV	Schedule IV	Sch II	YES	YES
Clamorous Reed Warbler	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Hirudinidae		RE				
Barn Swallow	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Pycnodontidae		RE				
Red-whiskered Bulbul	LC	RE	Schedule IV	Sch II	YES	YES
Red-vented Bulbul	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Leiothrichidae						
Jungle Babbler	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Sturnidae						
Asian Pied Starling	LC	RE	Schedule IV	Sch II	YES	YES
Chestnut-tailed Starling	LC	RE	Schedule IV	Sch II	YES	YES
Common Myna	LC	RE	Schedule IV	Sch II	YES	YES
Brahminy Starling	LC	RE	Schedule IV	Sch II	NO	YES
Jungle Myna	LC	RE	Schedule IV	Sch II	YES	YES
Passeriformes : Muscicapidae						

Indian Robin	LC	RE	Schedule IV	Sch II	YES	YES
Oriental Magpie Robin	LC	RE	Schedule IV	Sch II	YES	YES
Taiga Flycatcher	LC	WV	Schedule IV	Sch II	YES	YES
Verditer Flycatcher	LC	SV	Schedule IV	Sch II	YES	YES

ANNEXURE 8

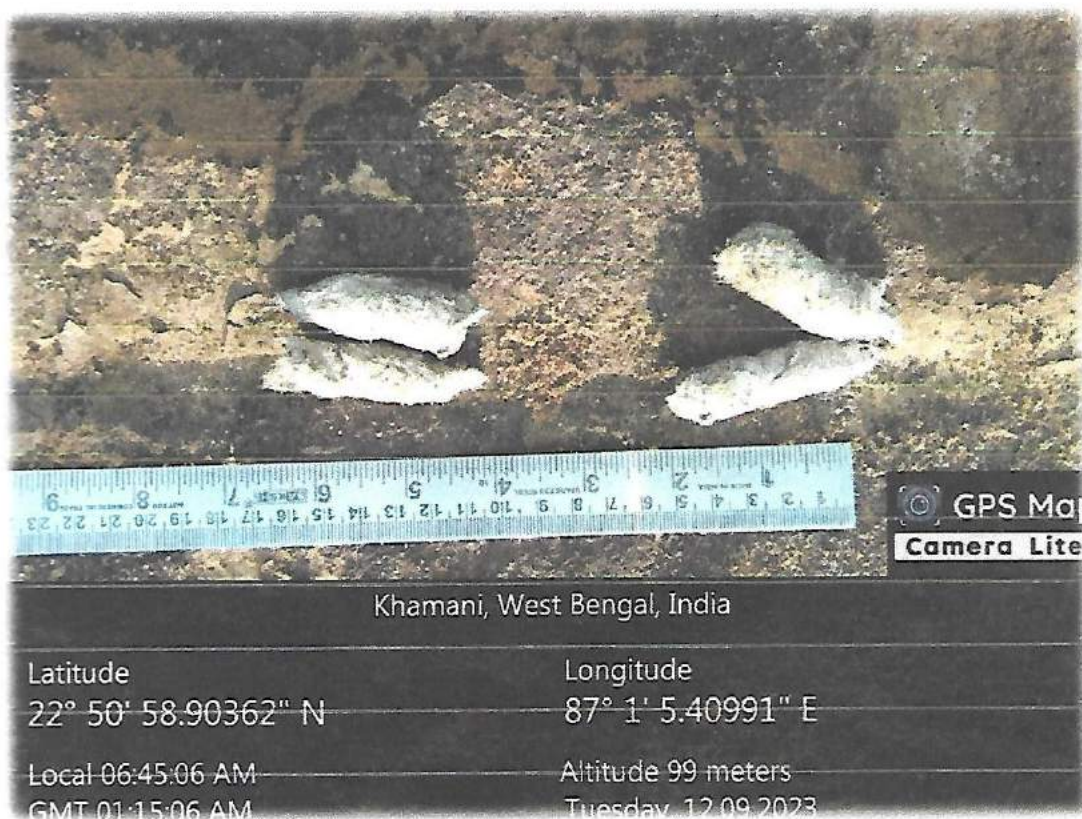
Mammal Checklist

Mammals		IUCN Status	WPA Status	WPA Status Updated
Order : Insectivora				
Crocidurinae				
	Asian House Shrew <i>Suncus murinus</i> (Linnaeus, 1766)	LC		
Order : Chiroptera				
Pteropodidae				
	Indian Flying fox <i>Pteropus giganteus</i> (Brunnich, 1782)	LC	Schedule II	Sch II
Order : Primates				
Cercopithecidae				
	Northern Plains Grey Langur <i>Semnopithecus entellus</i> (Dufresne, 1797)	LC	Schedule II	Sch II
Order : Carnivora				
Canidae				
	Golden jackal <i>Canis aureus</i> Linnaeus, 1758	LC	Schedule II	Sch I
	Bengal fox <i>Vulpes bengalensis</i> (Shaw, 1800)	LC	Schedule II	Sch I
Felidae				
	Jungle Cat <i>Felis chaus</i> Schreber, 1777	LC	Schedule II	Sch I
Viverridae				
	Asian Palm Civet <i>Paguma Paradoxurus hermaphroditus</i> (Pallas, 1777)	LC	Schedule II	Sch I

Herpestidae				
	Indian Grey Mongoose <i>Urva edwardsii</i> (E. Geoffroy Saint-Hilaire, 1818)	LC	Schedule II	Sch I
Order : Proboscidae				
Elephantidae				
	Asian Elephant <i>Elephas maximus</i> Linnaeus, 1758	EN	Schedule I	Sch I
Order : Artiodactyla				
Sulidae				
	Wild Boar <i>Sus scrofa</i> Linnaeus, 1758	LC	Schedule II	Sch II
Order : Rodentia				
Sciuridae				
	Indian Palm Squirrel <i>Funambulus tristriatus</i> (Linnaeus, 1766)	LC	Schedule II	Sch II
Hystricidae				
	Indian Crested Porcupine <i>Hystrix indica</i> Kerr, 1792	LC	Schedule IV	Sch I
Order : Lagomorpha				
Leporidae				
	Indian hare <i>Lepus nigricolis</i> F. Cuvier 1823	LC	Schedule IV	Sch II

ANNEXURE 9

Baseline survey of lesser mammal distribution in Bankura



Khamani, West Bengal, India

Latitude
22° 50' 58.90362" N

Longitude
87° 1' 5.40991" E

Local 06:45:06 AM
GMT 01:15:06 AM

Altitude 99 meters
Tuesday, 12.09.2023

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1.0 Background:

A meeting was called by the Chief Conservator of Forest (CCF) – Central Circle on 16th August 2023 at Machantala, Bankura, to discuss the methodology, resources required and timeline for the survey. Representatives from Nature Mates, SHER and WWF-India attended the meeting. Senior officials from Panchet, Bankura North and Bankura South



Figure 1: Director, Sundarbans Programme – WWF-India discussing the methodology at the meeting

Division, along with forest frontline staff, participated in the meeting. DFO – Panchet Division presented the recent findings and the heat map of lesser mammal congregations at the division level based on a preliminary survey conducted by forest frontline staff. During the meeting, it was decided that the status survey would be jointly designed by WWF-India, the other two NGOs, and the Panchet Division. Director, Sundarbans Programme, assured WWF-India's support to the Division with all necessary logistical and technical matters, including preparation of grid maps and grid files to be uploaded on the GPS devices of survey teams.

2.0 Study Area:

Bankura falls within the Burdwan Division of West Bengal. It is situated between 22° 38' and 23° 38' North latitude and between 86° 36' and 87° 46' East longitude. It has an area of around 6,882 sq. km. Out of the total area, approximately 1392 sq. km. is the forest area. On the North and North-East, the district is bounded by Bardhaman; on the South-East, it is bounded by Hooghly district; on the South by Paschim Medinipur district; and on the west by Purulia district (Fig. 2). Biogeographically, the district encompasses two provinces (Rodgers & Panwar, 1988). The western part of the district comes under the Deccan Peninsula: Chotta Nagpur province (6B), and the eastern part lies under the Gangetic Plain: Lower (7B). There are 93 beats under three forest Divisions (Bankura North, Bankura South and Panchet Division).

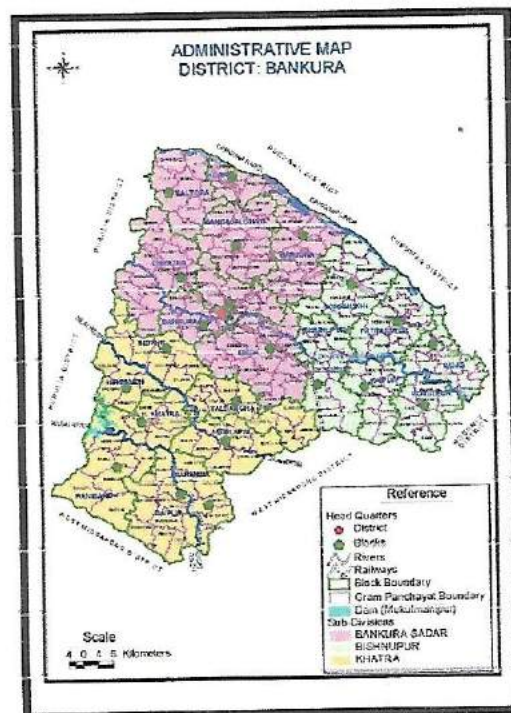


Figure 2: Administrative map of Bankura District

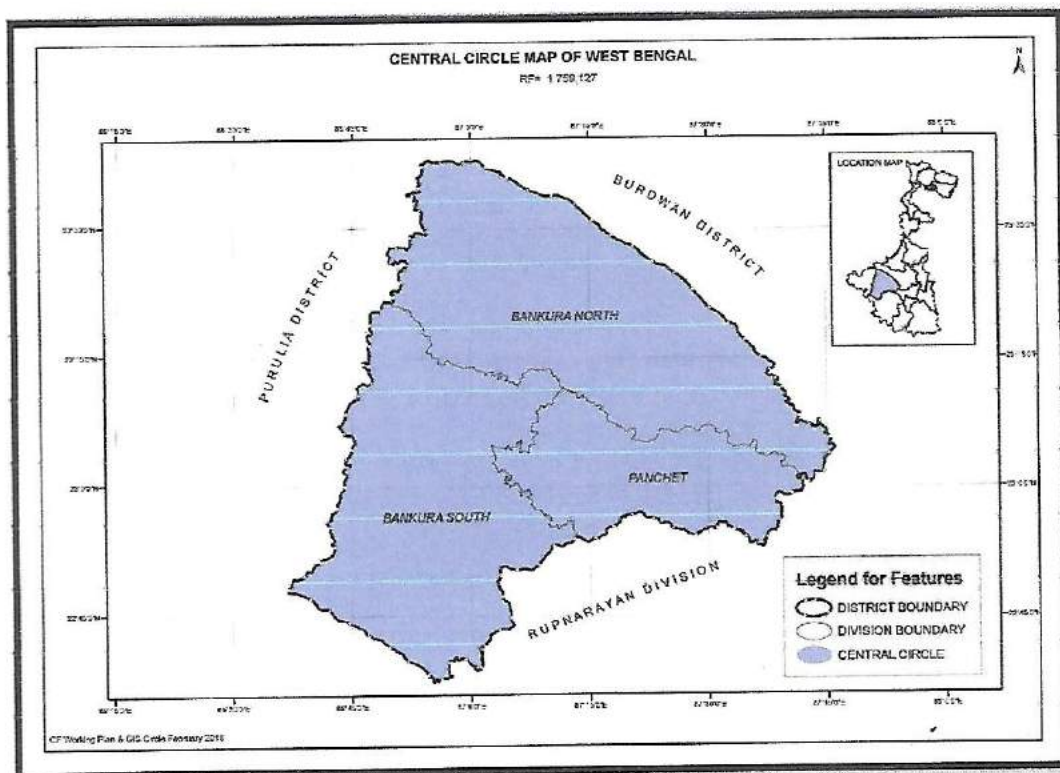


Figure 3: Map of the Central Circle

3.0 Methodology:

3.1 Sign encounter rate surveys:

Sign encounter rate surveys are prescribed/ widely used for status and baseline surveys. A less resource-intensive methodology of sign survey is usually used to record data on the presence, absence and intensity of the use of a beat by both herbivores and carnivores. All kinds of animal signs are recorded, such as footprints/ pugmarks/ hoofmarks, scrape, rake, scat/ dung/ pellets, direct sightings and vocalization.

Based on the guidelines mentioned by NTCA for the All-India Tiger Estimation Exercise (AITEE) and considering the target species and study area, the methodology for the sign encounter rate survey is modified. Instead of 5 KM, each survey's minimum distance was determined to be 3.5 KM, and a total of 10.5 KM distance has to be covered in each beat instead of 15 KM. Each of the encountered signs were geo-tagged using GPS.



Figure 4: Illustration of sign survey method

3.2 Species density distribution:

Encountered species signs were used for preparation of species density distribution across the Bankura district. A spatial auto-correlation (Moran's 1) among the encountered sign locations for each species and calculated kernel density using the Kernel Density Estimator (KDE) (Arévalo et al., 2017; Ayob et al., 2020) with a bandwidth of 500 m (Ramp et al., 2006). Estimated density was represented as a map with high (1) and low density (0) species distribution regions following the Jenks method based on the minimum and maximum variances of the density throughout the Central Circle (Jenks & Caspall, 1971).

3.3 Land cover of Bankura

A land use land cover thematic data was derived from ESA Sentinel-2 imagery at 10m resolution using Impact Observatory's deep learning AI land classification model at a service co-ordinate of Web Mercator Auxiliary Sphere WGS84 (EPSG:3857) (Karra et al., 2021). The generated thematic raster was masked with the administrative district boundary of Bankura. Results indicated that Bankura covered seven land classes (Table 1). The district has over 60% covered as cropland, followed by the forest area of around 21% (Table 2).

Table 1: Definition of each land class for the district of Bankura

Value	Name	Description
1	Water	Areas where water was predominantly present throughout the year; may not cover areas with sporadic or ephemeral water; contains little to no sparse vegetation, no rock outcrop nor built-up features like docks; examples: rivers, ponds, lakes, oceans, flooded salt plains.
2	Trees	Any significant clustering of tall (~15 feet or higher) dense vegetation, typically with a closed or dense canopy; examples: wooded vegetation, clusters of dense tall vegetation within savannas, and plantations.
3	Flooded vegetation	Areas of any type of vegetation with obvious intermixing of water throughout a majority of the year; seasonally flooded area that is a mix of grass/shrub/trees/bare ground; examples: emergent vegetation, rice paddies and other heavily irrigated and inundated agriculture.
4	Crops	Humans planted/plotted cereals and crops not at tree height; examples: corn, wheat, soy, and fallow plots of structured land.
5	Built Area	Human-made structures; major road and rail networks; large homogenous impervious surfaces including parking structures, office buildings and residential housing; examples: houses, dense villages/towns/cities, paved roads, asphalt.
6	Bare ground	Areas of rock or soil with very sparse to no vegetation for the entire year; examples: exposed rock or soil, dried lake beds, and mines.
7	Rangeland	Open areas covered in homogenous grasses with little to no taller vegetation; wild cereals and grasses with no obvious human plotting (i.e., not a plotted field); examples: natural meadows and fields with sparse to no tree cover, open savanna with few to no trees. A mix of small clusters of plants or single plants dispersed on a landscape that shows exposed soil or rock; scrub-filled clearings within dense forests that are clearly not taller than trees; examples: moderate to sparse cover of bushes, shrubs and tufts of grass, savannas with very sparse grasses, trees or other plants.

Table 2: Land classes and areas of Bankura district (As of 2021)

Sl. No.	Land Classes	Sq.KM	% Area
1	Water	196.04	2.85
2	Trees	1463.3	21.31
3	Flooded Vegetation	3.3	0.05
4	Crops	4188.6	60.99
5	Built Area	506.9	7.38
6	Bare Ground	45.6	0.66
7	Range lands	463.9	6.75
Total		6867.64	100.00

4.0 Training of forest frontline and technical staff:

A day-long capacity-building workshop was organized by WWF-India at their office premises on 6th August 2023 for the selected technical staff from the three forest divisions. Technical staffs were provided with a guiding document and soft copies of grid maps and files for GPS, which are to be uploaded to the GPS devices of the sign surveying teams.



Figure 5: Capacity building session for selected technical staff at WWF-India office premises ,

A training workshop was organized at the Bellatore Range office on the 9th September 2023 by the Central Circle. The workshop was attended by +100 forest frontline staff across three forest divisions. WWF-India took the lead and presented the theoretical part of the methodologies of sign encounter rate surveys and camera trap surveys. WWF-India also carried out an assessment of the existing knowledge base of the frontline staff who participated in the training using a multiple-choice questionnaire of 10 sets of questions. WWF-India also developed a three-pager guiding document for the frontline staff in the local language and distributed the same during the workshop.



Figure 6: CCF, Central circle addressing the audience during the training

The theoretical part of the training involves the following:

1. Wildlife sign encounter rate survey method and the datasheet to be used for the survey
2. Details of grid-based sampling approach
3. Camera trapping method
4. Basic identification of the targeted species and their pugmarks/ footprints/ hoofmarks and scats/pellets (provided by representatives of Nature Mates)

The second half of the day was used for field demonstration purposes. The session started with training on the use of camera traps, followed by demo sign encounter surveys and setting up camera traps in the field.



Figure 7: Capacity building session for forest frontline staff at Beliatore Range office, Bankura



Figure 8: Capacity building session for forest frontline staff at Beliatore Range office, Bankura

5.0 Results of Sign encounter rate surveys:

The forest frontline staff started conducting sign encounter surveys on 10th September 2023. The forest frontline staff started conducting sign encounter surveys on 10th September 2023 and continued till 12th September 2023. WWF-India and other NGO representatives participated with different surveying teams for the first day survey. Frontline staff spent 561.25 hours covering 1182.37 km in 91 forest beats for wildlife sign encounter surveys.

The survey encountered a total of 1637 signs of which 1578 signs from 20 species were detected for the mammal species (Table 3). Highest encountered signs were recorded for Bengal Fox (484), followed by Wild Boar (295), Golden Jackal (240), Black Naped Hare (126), Mongoose (89), Grey Wolf (74), Jungle Cat (54), Striped Hyena (42) and Spotted Deer (30). 82 of the encountered signs are unidentified. Identified signs indicate Striped Hyena and Grey Wolf as the only two species of large carnivores in the district. The rest of the encountered signs indicate a higher presence of meso-carnivores in the district of Bankura, with Wild Boar, Spotted Deer, Indian Hare and rodents as possible primary prey species. Among the felids, signs for only Jungle cat and Fishing cat were noticed. Among the canids, Bengal Fox, Golden Jackal and Grey Wolf were only recorded.



Figure 9: One of the teams conducting the sign encounter survey



Figure 10: Some of the wildlife signs encountered during the surveys

5.1 Signs encountered per land cover classes

Among the total encountered signs, more than 77% of the species signs were encountered in forest areas, followed by range land or open grasslands (11.3%), and crop lands (10.02%). Least number of species signs were encountered from the Bare/rocky areas (0.06%).

Table 4: Number & percentage of species encountered through sign survey in each land cover classes of Bankura during the current study.

Sl. No	Land classes	No of species signs encountered	% species signs encountered
1	Trees	1264	77.21
2	Range Land	185	11.30
3	Crops	164	10.02
4	Built Area	10	0.61
5	Water	13	0.79
6	Bare Ground	1	0.06
Total		1637	100

5.2 Species density distribution map based on encountered signs:

WWF-India prepared nine species density distribution maps based on the signs recorded during the survey. They are Bengal Fox, Black napped Hare, Golden Jackal, Grey Wolf, Jungle Cat, Spotted Deer, Striped Hyena, Wild Boar and Mongoose (Annexure: Figure 13-21).

6.0 Way forward:

6.1 Selective grid-based sampling using camera trapping:

Camera trap surveys are a well-established methodology for the abundance/density estimation of elusive carnivores. To ascertain the abundance and develop the baseline information of lesser mammals, 1X1 KM grids will be used. WWF-India developed the division-level grid maps of the study area and the grid files of the range level for each division so that those can be preloaded in the GPS devices of the survey team for easy navigation. Details of the grids are as follows:



Figure 12: 1 sq. km grid map of the study area

A total of 7792 square grids of 1x1 KM grid was laid covering the entire district of which 7306 grids were selected for the current study. Rest of the grids were discarded due to incomplete grid shapes at the boundaries. A total of 250-300 camera trap grids will be selected based on the results of the sign encounter rate surveys conducted by the forest frontline staff. The sampling session will be of 30 days, and a single-sided camera trap will be placed in each grid to maximise the effort.

6.2 Species Density Distribution map:

Camera trap data will be further used to update or create species density distribution maps and to understand the spatial distribution pattern of species and its relation to habitat and forest fragmentation.

7.0 References:

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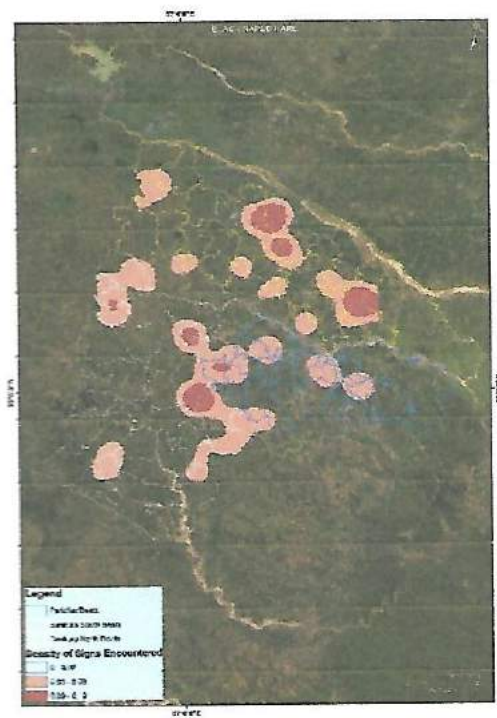


Figure 13: A density distribution map of Black-naped Hare at Bankura prepared using the signs encountered in the current survey.

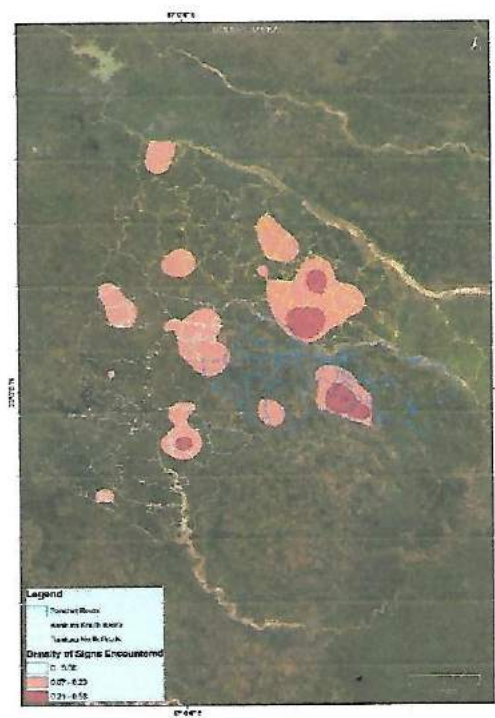


Figure 14: A density distribution map of Golden Jackal at Bankura prepared using the signs encountered in the current survey.

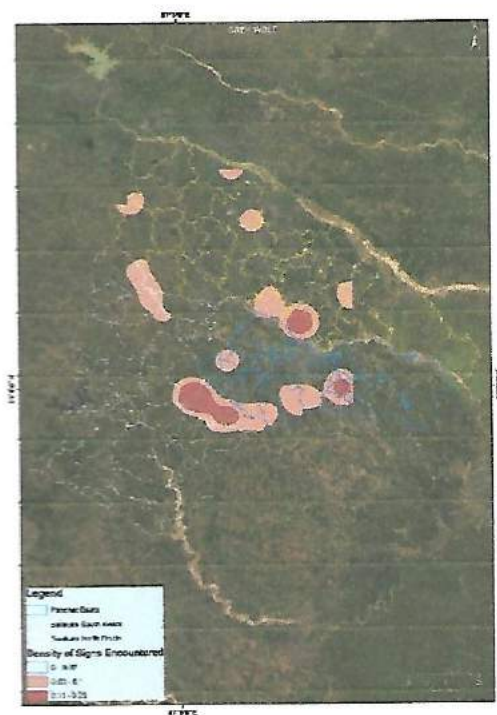


Figure 15: A density distribution map of Grey Wolf at Bankura prepared using the signs encountered in the current survey.

current survey.

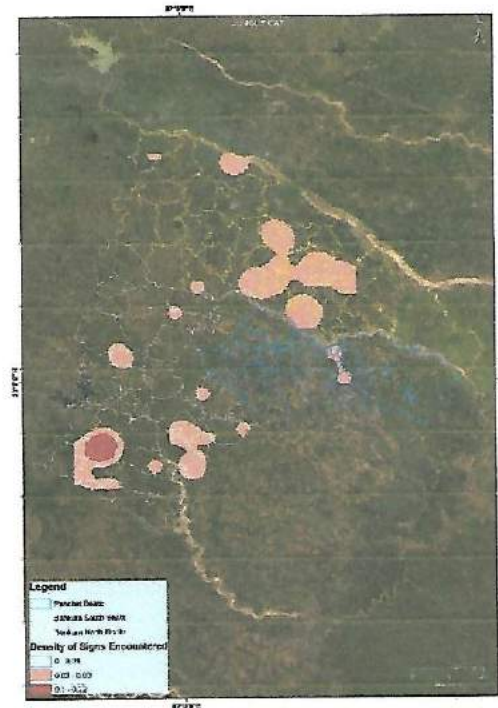


Figure 16: A density distribution map of Jungle Cat at Bankura prepared using the signs encountered in the current survey.

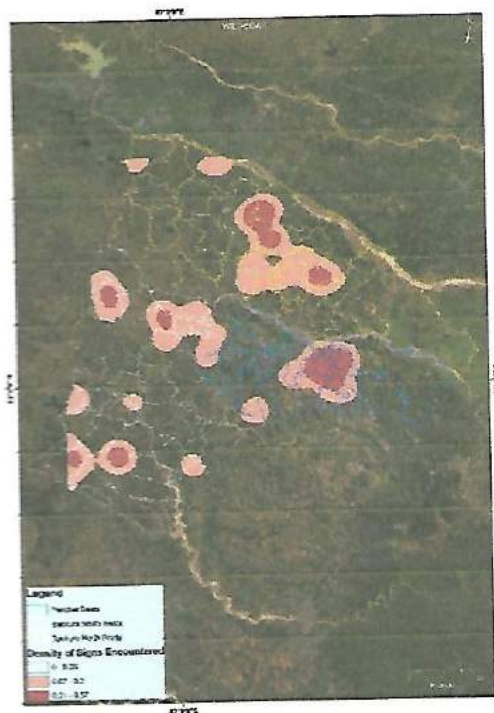


Figure 17: A density distribution map of Wild Boar at Bankura prepared using the signs encountered in the current survey.

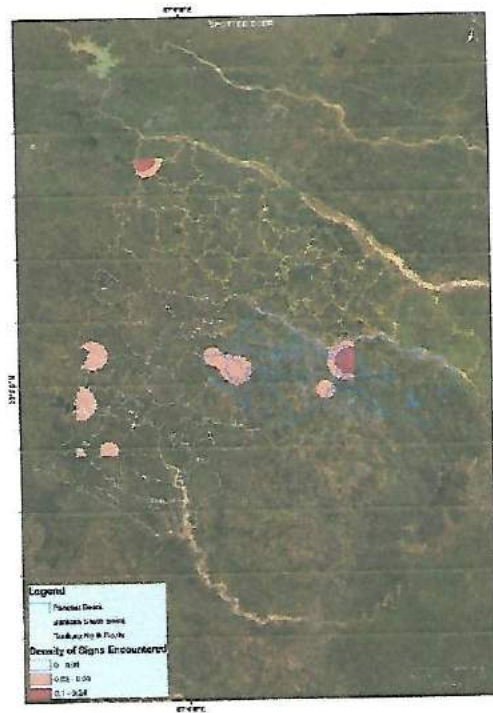


Figure 18: A density distribution map of Spotted Deer at Bankura prepared using the signs encountered in the current survey.

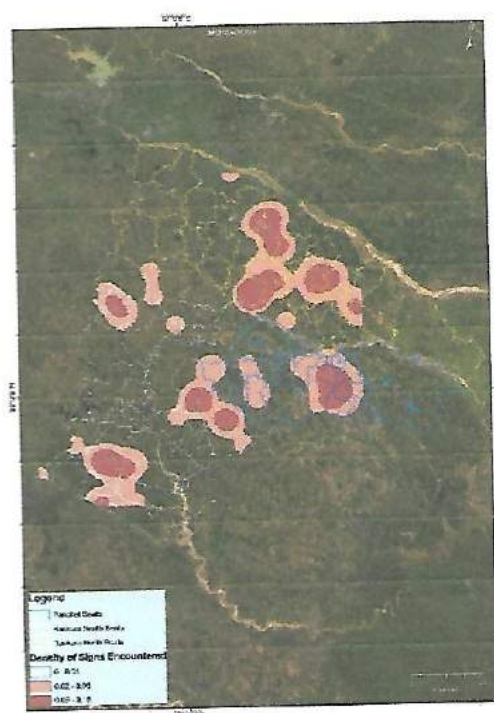


Figure 19: A density distribution map of Mongoose at Bankura prepared using the signs encountered in the current survey.

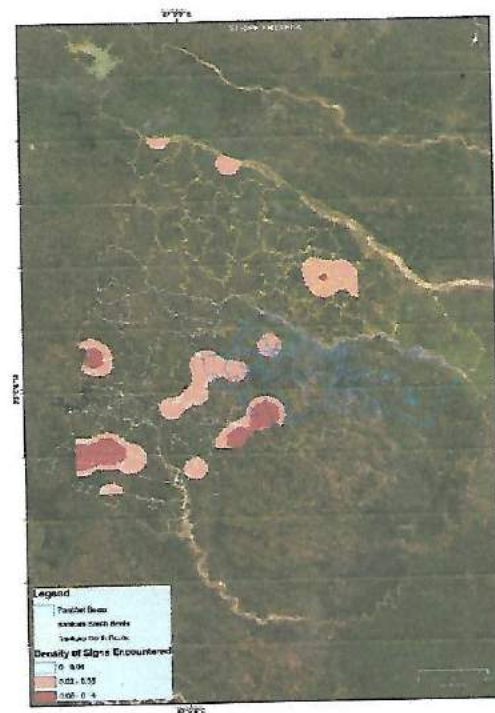


Figure 20: A density distribution map of Striped Hyena at Bankura prepared using the signs encountered in the current survey.

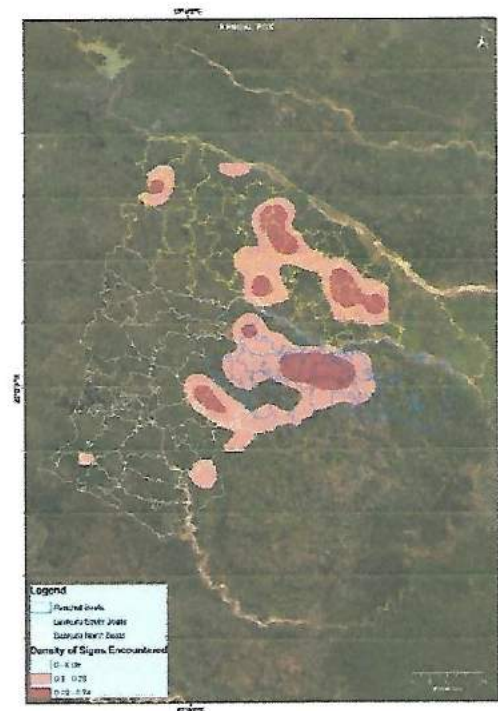
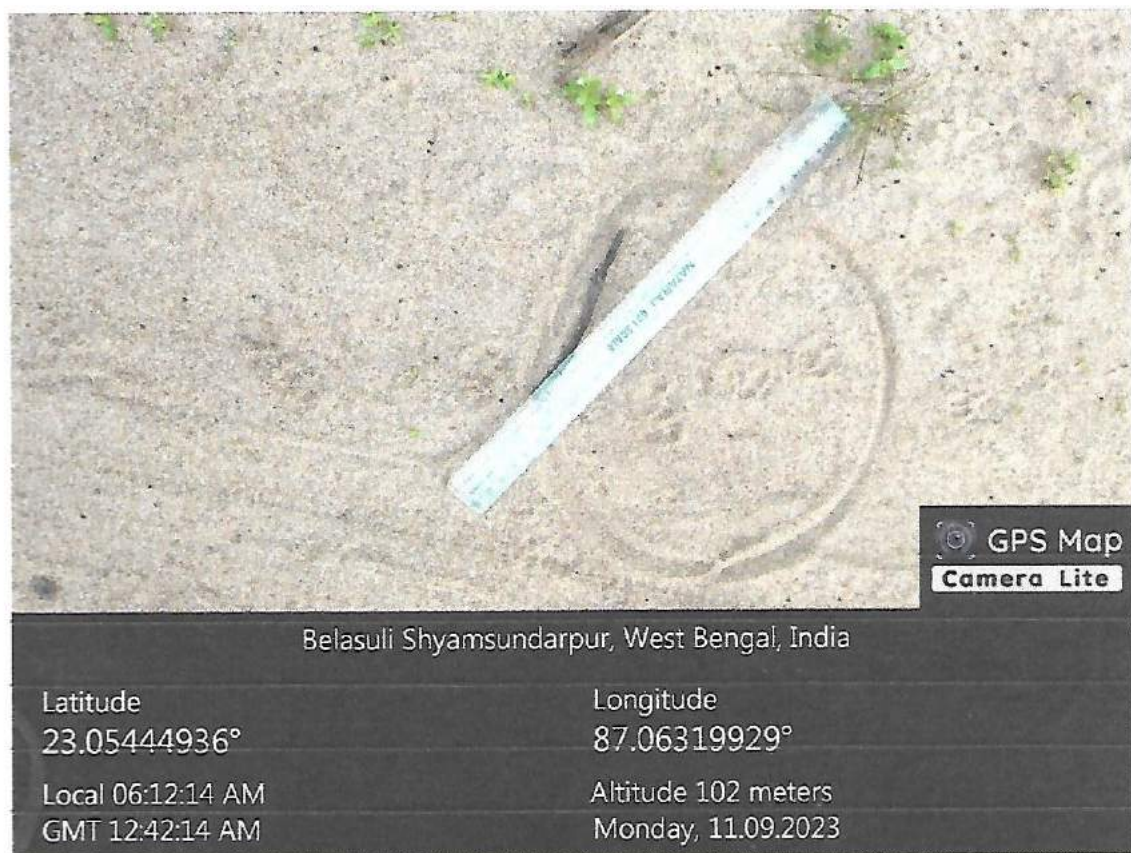


Figure 21: A density distribution map of Bengal Fox at Bankura prepared using the signs encountered in the current survey.



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Wildlife Conservation Plan for the Forest of Barjora North Coal Mine area of 338.74 Ha

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