

Ecology of Elephant (*Elephas maximus*) in South-West Bengal including population dynamics, migratory pattern, feeding habits and human-elephant conflict

Inception Report



Research Team

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Acknowledgements:

We thank Chief Project Director, West Bengal Forest and Biodiversity Conservation Project, and Principal Chief Conservator of Forests and Chief Wildlife Warden, West Bengal.

We thank Mr. Saurabh Choudhuri and Mr. K. L. Ghosh for kind cooperation and facilitating the initiation process of the project.

We thank Dr. S. Faizi, JAICA, for briefing the ground facts of the situation of the field, elephant movement and conflict.

We thank Mr. Gautham Chatterjee, WBFBCP, taking us to Midnapur and introducing to local forest officers.

Thanks are also due to Mr. Arnab Sengupta, Divisional Forest Officer, Rupnarayan – Midnapur, and Mrs. Purabi Mahato, Assistant Conservator of Forests sharing the information on local situation and helping us to develop the working strategy for the longterm study.

Kumara, Azeez and Arijit Pal

Ecology of Elephant (*Elephas maximus*) in South-West Bengal including population dynamics, migratory pattern, feeding habits and human-elephant conflict

Background:

Preparation of any conservation action plan for any protected area or region requires the most basic information about the given ecosystem that includes bio-diversity, ecological and conservation status of the species, distribution pattern and identification of critical areas for each priority species, evaluation of existing threats and solutions for resolving or reducing them. The success of the conservation management strategies can be assessed by analyzing the response to the steps taken for the targeted population. Therefore understanding of the population status and its dynamics is a basic requirement.

The elephants were noticed in South West Bengal only about half a century ago, in the forest patches of Medinipur, Purulia and Bankura, often on migration from what is now Jharkhand, but kept themselves away from human habitations. About two decades back, the elephants started exploring new areas and now they move through Burdwan, Birbhum and other nearby districts too. The absence of large forest patches and the lack of migratory corridors have forced the elephants to explore human habitations. Thus in spite of lower elephant population, there is large scale depredation in South West Bengal. The study will investigate the population dynamics, movement pattern and habitat utilization of elephants in South-West Bengal, and will explore ways to reduce the man-elephant conflicts during movement of elephants outside the forest patches, and will also recommend mitigation measures. A management plan for Elephants in South West Bengal, including the Mayurjharna Elephant Reserve will also be developed.

Objectives:

1. To study the elephant ecology in South-West Bengal (Paschim, Mednipur, Bankura, Purulia, Birbhum and Burdhwan districts), including the elephant demography, population trend, migratory pattern, resident population movement patterns, elephant corridors, habitat utilisation and related aspects.

2. To study the habitat of Mayurjharna Elephant Reserve in South-West Bengal and assess its carrying capacity and develop an Elephant Management Plan for the South-West Bengal including Mayurjharna Elephant Reserve.
3. To study and analyze the human-elephant conflict in South-West Bengal including preparation of conflict map and suggest mitigation measures to minimize human-elephant conflict in a participatory manner.

Detailed Methodology:

The entire study will be divided in to two categories i.e. movement pattern and conflict in a larger landscape level that is in entire South West Bengal (Paschim, Mednipur, Bankura, Purulia, Birbhum and Burdhan districts), where, the intensive study of population dynamics, herd characteristics, ecology and habitat use will be done in one intensive study area that is “Mayurjharana Elephant Reserve” (Fig. 1).

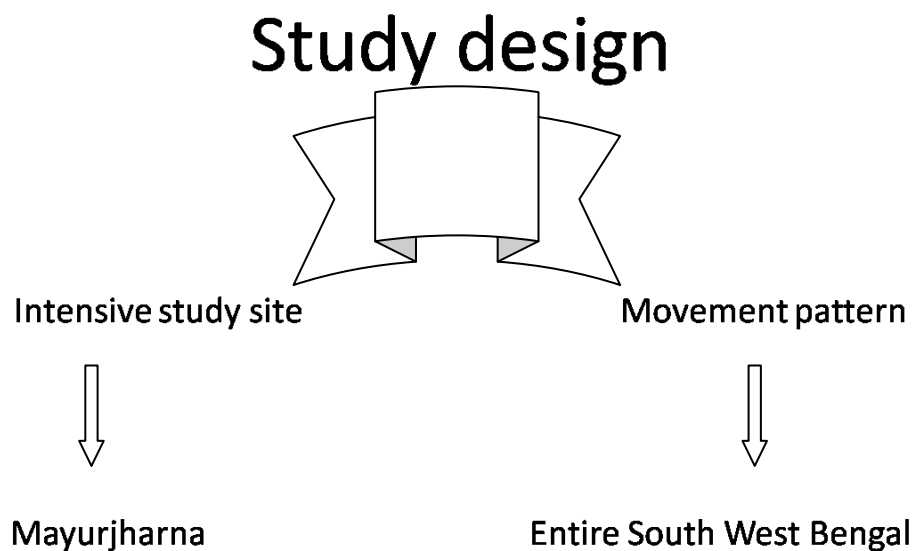


Figure 1. Major Study design for the elephant study in South West Bengal

Preparation of base maps for the study: If classified map is available with the department that will be procured, if not available the base map of the entire landscape will be prepared with existing files. The boundary of the available forest area including protected areas, reserve forests and department plantations will be marked.

I. Human-elephant conflict:

Whenever conflict happens, usually people register a complaint to forest department for compensation. Based on such applications, department document the first hand information and virtuality of the incidents. All such documents will be collected from the department, and the detailed analysis of the incident will be made. During the study period also details on all the conflict incidents will be recorded. The location of all such incidents will be mapped, and required analysis with landscape parameters will be made. In addition to this the data on individuals (herd or lone males) involved in the conflict will be recorded, photo documentation will be made, accordingly herd or lone males will be monitored for their movement, activity and foraging pattern. Compensation pattern, perception on crop damage, satisfaction and tolerance level will be evaluated. All these information will be superimposed on different layer of information on gridded GIS platform to understand the determinants from ecological, environmental and anthropogenic parameters. This will help in understanding the reason behind the conflict that will help in developing the measure to mitigate the conflict. If lone males are the reason for the conflicts and human kill, then the data will be segregated and separate analysis will be carried out and will be projected.

II. Occurrence or occupancy of elephant in a larger landscape level:

Based on existing scientific literature and data from forest department census over a period of time will be collected. In addition to this, visits will be made to all the forest patches and its surrounding areas, and the secondary information on presence of elephant will be collected from local people and forest department personnel. All possible known locations of the species will be mapped, and for this ~2 km buffer will be created. Using this occurrence map, further study design will be prepared to assess the species occupancy and abundance, and determining ecological-anthropogenic factors for the same.

The entire known range of the elephant will be gridded with 4 sq km using GIS platform. We consider 4 sq km area as a minimum sampling unit for the assessment of occurrence and abundance. The number of grids will be selected based on the total number of grids-area. If the number of grids are more in the number, then the alternative grids will be considered for sampling, otherwise all the grids will be sampled. The grids will be walked in such a way to represent the entire spatial area with all possible habitat variation of the grid. The ideal way of covering the grid is "S" shape with 4 km length that includes 8 spatial replicates (Fig.2).

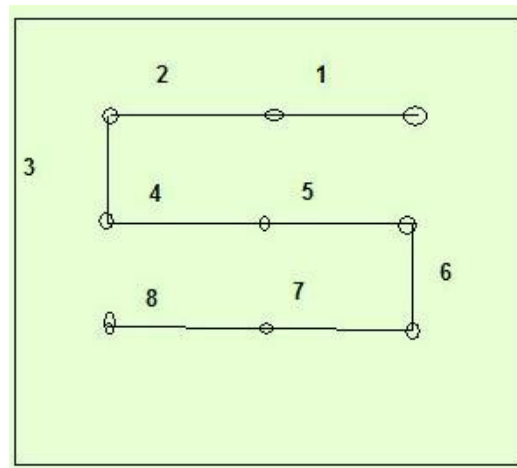


Figure 2. Ideal protocol to cover the entire grid for sampling

However, this may not be feasible in most of the hilly terrains, in such cases, the existing paths will be selected and a minimum distance of 2 km will be considered for sampling. Every 500 m of the line will be considered as spatial replicate (4 replicates) for the grid.

Sampling:

The shape file of the grid layer will be uploaded to the GPS to realize the grid and fix the walking path on ground. The starting point of the line will be entered and walked the sampling line keeping the GPS in track record mode. For every 500 m one waypoint will be marked until reaching the end point of sampling line. At the end point of the sampling line final way point will be marked.

During the walk, three meters on either side of the line will be scanned for the dung piles of elephant. All the detection of the dung piles will be recorded. In addition to this, every sighting of elephant will be recorded with geocoordinates and demography of the individuals sighted during the grid walk.

Variables: Qualitative habitat parameters, anthropogenic parameters will be recorded for every 100 m of sampling line. In addition to this, ecological and environmental parameters will be considered, and those parameters will be acquired from the global layers. The data will be analysed using PRESENCE software. This is one time sampling for the entire study period.

III. Habitat use:

Identify the conflict zone and source population area based on the preliminary assessment. Then select the 25 to 30 grids falling under these categories in each of the sites. Those grids will be sampled for every three months following the above said occupancy protocol. This provides the seasonal habitat use by elephants. We consider this approach to understand the seasonal habitat use by elephant. The data collection and analysis will be same as provided in the earlier section.

In addition to the above listed variables, major food species will be listed. Availability and abundance of those food species in each of the sampling grid will be recorded, and they will be considered as variables to build the model.

IV. Population estimation and carrying capacity:

Distance sampling:

In each of the protected areas, reserve forest patches and govt. plantations, depending on the size of the area, line transects will be laid, however, a minimum of five transects will be laid for each sampling site. Since the South-Western part of the districts are hilly terrain, depending on feasibility the location and length of transects will considered, however, the minimum length of the transects will be 0.5 km. All possible vegetation types and other

habitat variation in the site will be considered and accordingly the transect lines will be fixed to represent all those variations in the site (Fig.3).

Transects will be walked a minimum of five times or until the sufficient number of detections (40 detections) are achieved to estimate the number (Fig.3). Transects will be walked at dawn and dusk at the speed of 1 km/hr, when they are at fully active. For all the detections of elephants, distance between observers to animal will be recorded using range finder and angle of detection to transect line will be recorded using compass. Number of individuals sighted will be recorded. The data will be analysed using software DISTANCE. This is onetime sampling for the entire study period.

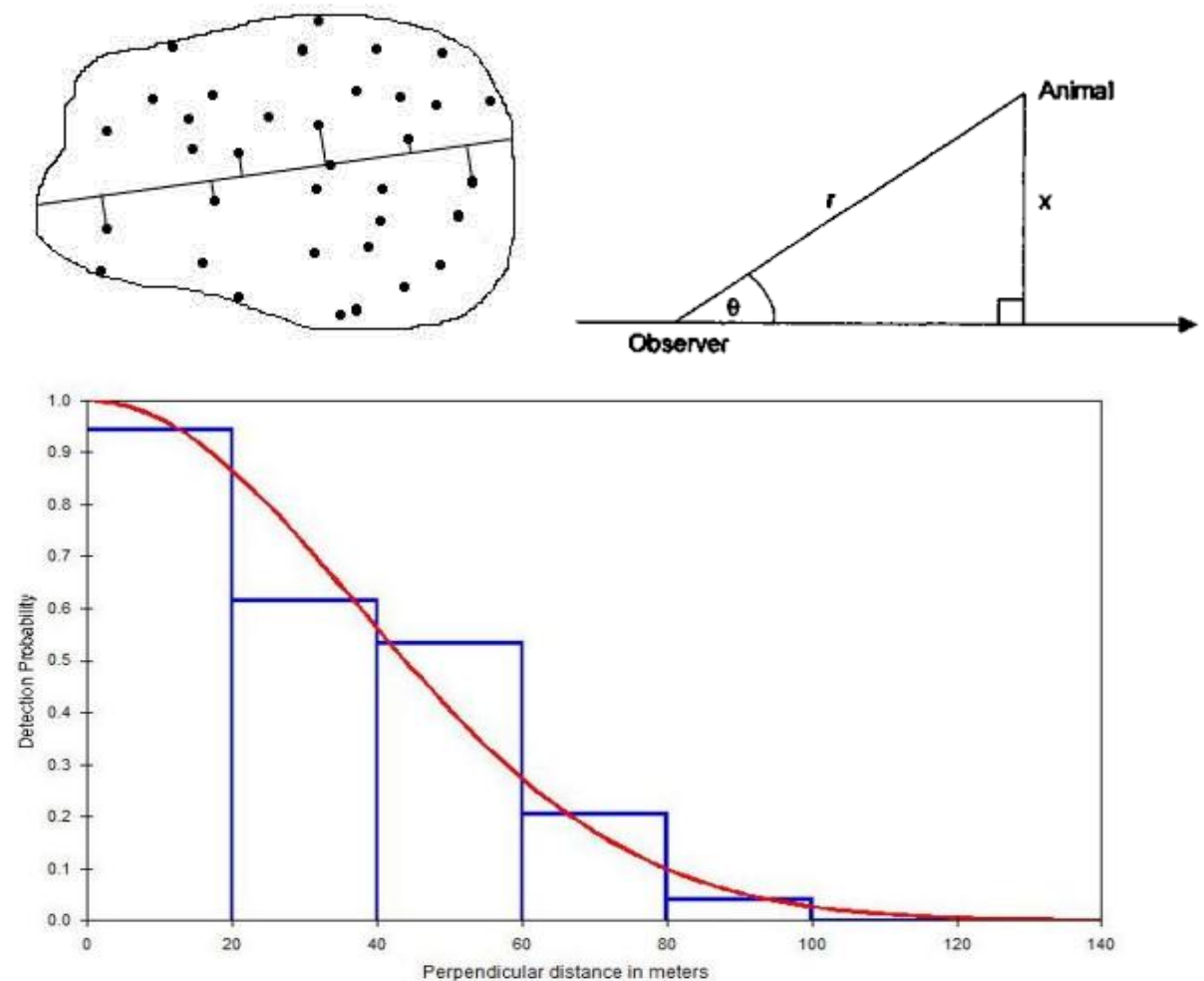


Figure 3 Schematic representation of transect method and detection distance to fit the model to estimate the density

To understand the variation in population density one of the site with high conflict zone and nearby site with source population will be selected. Only in the selected sites, transects will be walked every year following the same field protocol.

Dung count method:

Using the above said occupancy framework, in each of the grid cell, the number of dung on the trail or the sampling area will be counted, and the same will be plotted. The number of dung piles/ unit area will provide abundance of elephants on a large spatial area.

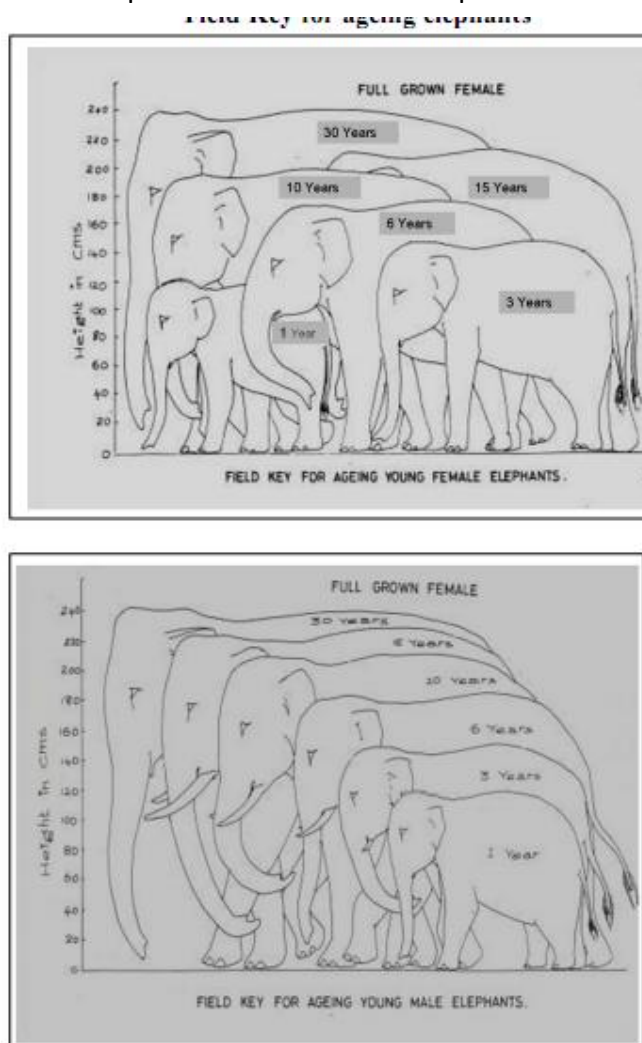


Figure 4. Key of age representative in elephants

V. Demography

Data on age and sex of all the individuals will be recorded by making random walks in all the sites in addition to above said efforts to study the demography. Age sex of the individuals will be done using the key (Fig. 4 and 5).

Across sites: Sampling will be made one time. Season wise and over a time period: In selected few major protected areas, and site with high conflict zone and nearby site with source population.



Figure 5. Identified age sex individuals in the elephant herd

VI. Ecology of elephant:

Two sites will be selected for the detailed study on elephant ecology, one site will be in the intact forest and other sites will be in intensive human-elephant conflict. If possible the identity of herd will be established based on their demography and marking or some unique marks on the body of some individuals. One herd in each area will be selected for this study. Every month, and at least for one complete year, focal herds will be monitored for their ecology using focal animal sampling technique or scan sampling (depending on the feasibility and access to follow the heard the specific technique will be adapted).

Scan sampling: All the individuals will be scanned for five minute for every 15 minutes. During this all visible individuals will be recorded with age-sex of the individual and activity, if they are feeding then the species and part of the species that they are feeding will be recorded. For every 30 minutes of observation, one GPS point will be taken to assess the day path length. Heard spread area will be assessed based on taking the two measurement of a distance between two farthest individuals on two directions. During this follow, if there is any inter-herd interaction that will be recorded as *ad-libitum* note.

Considering the ecology, habitat use and population characteristics, and pattern of human-elephant conflict, the management aspects will be addressed. If required, site specific management strategy will be prepared. With all these facts and figures the final management plan will be prepared.

VII. Population dynamics:

The distance sampling in the selected area will be repeated every year and also data on demography will be collected following the above mentioned method in respective sections. Over a period of time (during the study period), the data on demography on selected herds will help in calculate the life history parameters, that will give understanding of herd dynamics which will contribute in understanding the population dynamics.

VIII. Movement pattern:

We will develop a local people network, and few people will be identified, and they will be encouraged to inform sightings of elephants in their surroundings, and they will be considering as regular informer. Once the information is received from these people, research personnel will visit and monitor the herd and he will be able to collect all other required data. This will help in understand the movement of elephant out of forest at a landscape level.

Study site:

The study site includes entire elephant range in South West Bengal. However, the detailed study on ecology and habitat use by elephants will be conducted in Mayurjharna Elephant Reserve, and movement pattern and conflict will be studied in the entire landscape. The entire landscape of elephants largely span in Midnapur, Paschim, Bankura, Purulia and Bardhaman districts, and the Mayurjharna Elephant Reserve is one of the largest forest tracts in the entire landscape.



Figure 6. Map showing Mayurjharna Reserve Forest

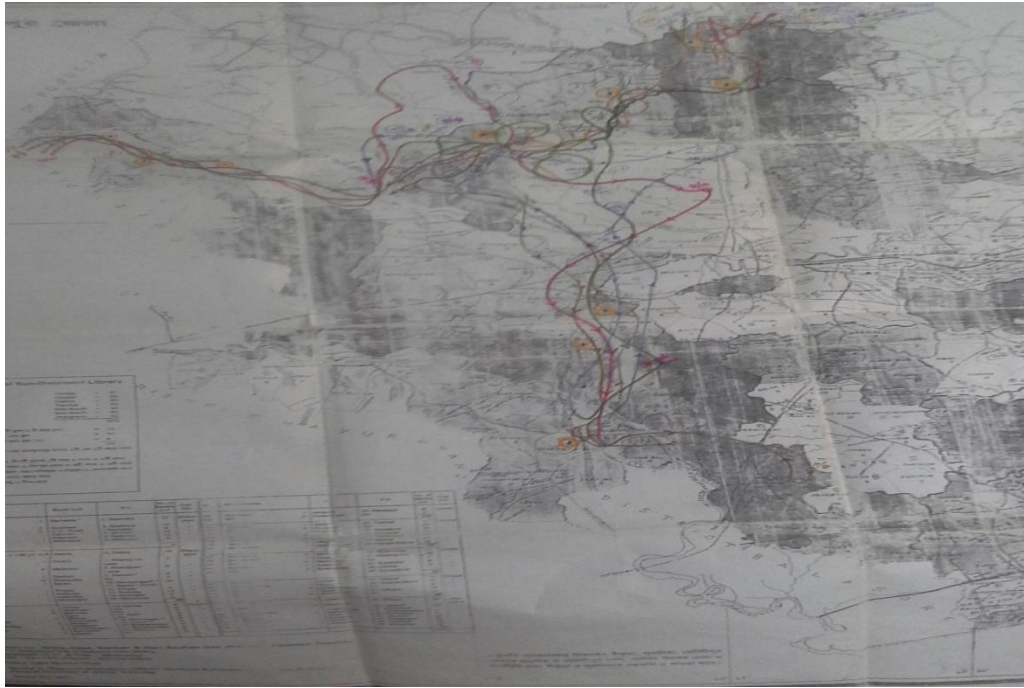


Figure 7. The southern part of South West Bengal showing movement pattern elephants

Time scale for main activities and their content

Activities	Months																	
	I Year						II Year						III Year					
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Recruitment of project personnel	■	■																
Procurement of equipments	■	■																
Human-elephant conflict (preliminary analysis of existing data with secondary information)	■	■	■															
Human-elephant conflict monitoring	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Develop a Local people network	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Monitor the elephant out of forest					■	■	■	■	■	■	■	■	■	■	■	■	■	■
Occurrence and abundance for entire landscape				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Seasonal habitat use in selected sites				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Population density for all the sites				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Population density for selected sites (to understand the					■	■											■	■

population dynamics)																		
Demography for all sites																		
Demography for selected sites																		
Ecology in the selected sites																		

Reconnaissance survey:

March 1st to 5th visited different parts of south West Bengal. Made a visit to Midnapur with the team from West Bengal Forest and Biodiversity Conservation Society (with Mr. Gautham Chatterjee, Mrs. Nupoor Prasad). I was introduced to Mr. Arnab Sengupta and Mrs. Purabi Mahato. I had a discussion on working strategy and available information in the forest department, and studied the existing maps and data that have been collected over a period of five years. I also visited locations of earlier conflicts in different parts of Bankura and Purulia and Bardhaman, and interacted with the local people on the conflict.

The preliminary information gathered gives the impression that largely elephants move in fragmented landscape, and the only large patch of the forest is Mayurjharna reserve.

Further, earlier elephants used to move in a large herd size but in the recent years they move in relatively smaller herds. Further, it appears that they have started to use new paths while moving between the locations. Baseline data on movement pattern and details of location of elephant while moving has been documented by the department.

Location selected for establishing the field station/s:

“Amlagore” is suitable location since it lies almost centre of the landscape, so that it is easier to cover both northern and southern part of the landscape. However, since the landscape of about 600 km needs to be covered, we may have to stay at different forest divisions during the study. Few sub stations considered to cover the entire landscape include Beliatore or Sonamukhi in Bankura district, and Mahalisari or Belpahadi in southern part.

Appointment of research personnel:

As per SACON rule, procedure to appoint research personnel for the project has been initiated. Field assistant will be appointed with the support of local forest officers.

Requisite to further carryout the study:

1. During our interaction with different forest officers, they expressed that they require official letter to facilitate the study.

2. Officers also expressed the same to share the information.
3. Since the study area is very sensitive, understanding with the department personnel and their cooperation is very essential for this study. Thus, I request a letter to all the department personnel of Paschim, Midnapur, Purulia, Bankura and Bardhaman forest divisions to facilitate the study.
4. The base map of entire landscape is requisite for the study to superimpose the findings. Thus, I request shape files of classified vegetation, all possible administrative boundaries and forest boundaries.
5. The existing information is a base for the study. I request for the information on human-elephant conflict data of at-least for the period of last five years.

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Profile of Research team:

Name and Designation	Photograph	Expertise and Role
<p>Honnavalli N. Kumara</p> <p>Senior Scientist</p>		<p>21 years of experience, 3 projects on elephants, published several papers on elephants in peer reviewed journals.</p> <p>Designing the study and executing the project. Overall responsibility of the project.</p>
<p>P. A. Azeez</p> <p>Senior Principal Scientist</p>		<p>35 years of experience, >40 projects, good statistician and modeller.</p> <p>Analysis of data and helping in writing the report.</p>
<p>Arijit Pal</p> <p>Research Fellow</p>		<p>Local person, 3 Years of field experience, good in field protocols.</p> <p>Interaction with local people, collecting social data, secondary data, and validating the data from the department.</p>
<p>Research Fellow</p>	<p>To be recruited</p>	<p>Data collection</p>
<p>Field Assistant</p>	<p>To be recruited</p>	<p>Assisting in data collection</p>