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TRUMPET

PROJECT ELEPHANT

MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE 2024

हाथी परियोजना भारत सरकार
PROJECT ELEPHANT GOVT. OF INDIA

भारतीय वन्यजीव संस्थान
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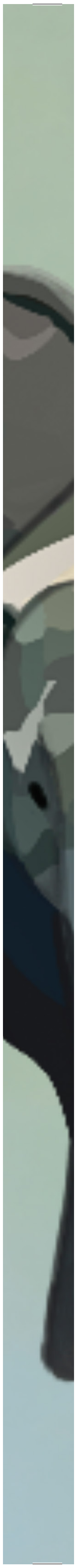

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MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE 2024

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From the Director's Desk

Ramesh Kumar Pandey
Inspector General of Forests (PT&E) & Director, Project Elephant

It brings me immense pleasure to announce that we are revealing the latest progress and accomplishments of Project Elephant from February-August, 2024 in this edition of Trumpet.

We have articles related to management of human elephant conflict, rescue & rehabilitation of wild elephants, environmental impact on elephant landscape, elephant upkeep, housing and other management issues, written by respective authors based on their invaluable field experience. We also have conservation news about the work done for the conservation and protection of Elephants and their habitats.

As we all know elephants are not only the keystone species but also an umbrella and flagship species. Considering this, it was envisaged to develop the Elephant Conservation Plan (ECP) for the management of the species in the large forest tracts / landscape by considering factor such as bio diversity of the topography, climate, hydrology etc. For this purpose, stakeholders' discussion, field visits, workshops were held and the ECP has been developed by necessitating landscape-level approach for implementation in the areas under different management also considers guidelines of the Tiger Conservation Plan (TCP); management plans for the Protected Areas (PA) etc. in the fringe areas governed by the Eco-sensitive Zone (ESZ) guidelines. The Framework for Elephant Conservation Plan is ready and may be released soon.

The Joint surveys of the critical stretches of the railway lines passing through the elephant habitats in Arunachal Pradesh, Assam, Jharkhand, Karnataka, Madhya Pradesh, Nagaland, Odisha, Tamil Nadu, West Bengal, Uttarakhand were conducted jointly by the officers/officials of Project Elephant, MoEF&CC, Wildlife Institute of India, Ministry of Railways and State Forest Departments. The joint team visited the critical stretches of railway tracks which were identified by the Forest Department and the site-specific mitigation measures, based on the location to mitigate train-elephant collisions were shared with the Ministry of Railways and the State Forest Departments for consideration and implementation.

As part of the project on creation of a repository of database of captive elephants in India, the collection of data and the DNA profiling of more than 554 captive elephants from different parts of the country have been completed.

The 'Project Elephant' took cognizance of the increasing need for a ready-reference manual to guide field personnel and constituted a technical committee comprising reputed veterinary professionals, experienced field managers, and biologists to draft the Recommended Operating Procedure. The draft document has been prepared which is a result of numerous structured deliberations by the committee. The committee members contributed to individual chapters, which have been collated and succinctly summarized as Recommended Operating Procedure: Capture and Translocation as a tool for managing human-elephant conflicts. The Recommended Operating Procedure is ready and may be released soon.

The process of field sampling in the North East States has been initiated and expected to be completed soon. The Ministry is regularly monitoring the progress of the exercise and all the required support is provided to the State Forest Departments of the North Eastern States and the Wildlife Institute of India to carry out the all India Synchronized Elephant Estimation.

The Ministry has finalized the report of the 'Management Effective Evaluation (MEE)' of the following 4 Elephant Reserves in India':

(i) Shivalik Elephant Reserve, Uttarakhand, Northern Region.

(ii) Kaziranga-Karbi Anglong Elephant Reserve, Assam, North-East Region.

(iii) Simplipal Elephant Reserve, Odisha, East Central Region.

(iv) Nilgiri Elephant Reserve, Tamil Nadu, Southern Region.

The report will be released during the World Elephant Day 2024.

Field visits were also conducted by the teams of Project Elephant, MoEF&CC and Wildlife Institute of India to assess the present situation of Human-Elephant conflict in the States of Kerala and Madhya Pradesh and to suggest appropriate mitigation measures.

The Ministry during the World Elephant Day 2022 had released an atlas as version-1 with basic maps depicting the land-use and land-cover in 31 Elephant Reserves. The forthcoming version-2 would have the land-use land-cover information using the same geospatial layers for all 33 existing Elephant Reserves. Maps have already been prepared. They are being collated together and the document may be released.

I'm confident that the habitats, landscapes, and corridors of elephants will be preserved and that future generations will live in peace thanks to the coordinated efforts of the Central Government, State Forest Departments, line departments, civil society, and others.

Community-centric HEC mitigation efforts in Assam & Meghalaya




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Asian elephants with a sizable population of over 5000 in Assam have been roaming around in the greater landscape of Northeast India since ancient times. No wonder, the animal, referred to as 'gentle giant' or 'Gajaraj' by the local populace, is part and parcel of folklore in the region's tribal society. People in Assam have been very respectful to the elephant whose existence in abundance is so important for the sustenance of the rich biodiversity in the area. However, the raging human-elephant conflict (HEC) triggered in Assam mainly because of the shirking of habitats and fragmentation of age-old movement routes of the giant animal that is always on the move looking for green pastures, has vastly degenerated the age-old harmonious coexistence between the elephant and human being in the state.

The intensity of the HEC in Assam can be gauged from the large number of human as well as elephant lives that have been lost because of the conflict in the last ten years. The HEC has cost over 1000 human lives and about 800 elephants in the state during 2014-23 (ten years). The ground situation demands a multi-stakeholder and multi-pronged strategy for mitigation of the HEC and aid in the conservation of elephants, the keystone species in biodiversity conservation. Elephant Research and Conservation Division (ERCD) of Aaranyak have adopted a community-focused multi-stakeholders HEC mitigation strategy to facilitate coexistence thereby trying to deal with the raging problem that has already taken a heavy toll on sizeable human settlements in Assam and Meghalaya besides posing threat to the life of elephant too.

We have been working in both states with the grassroots community in HEC-affected areas as well as in areas where the problem looks imminent because of various factors like shrinkage of forest cover, fragmentation of forest routes, and availability of fodder in human settlements. Of course, our efforts have been focused on complementing the measures undertaken by the Forest Departments of Assam and Meghalaya. Our mitigation strategy focuses on the economic, social, and overall well-being of the HEC-affected community but for whose cooperation no effort can deliver the desired results. Effective implementation of our mitigation strategy is expected to facilitate human-elephant coexistence.

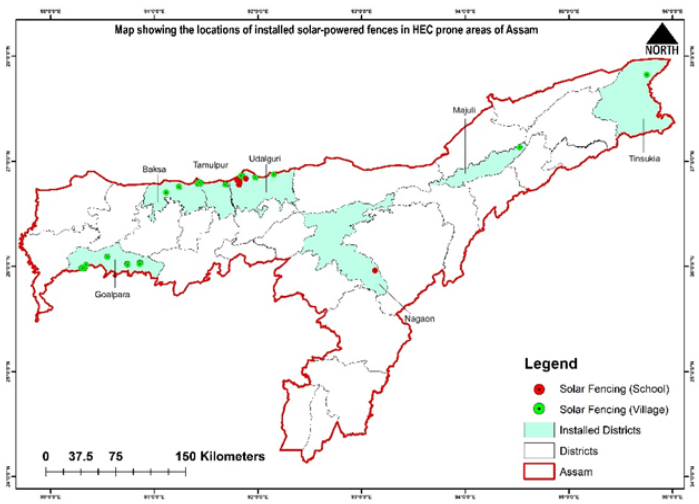
Installation of low-cost solar-powered and community-managed fences around HEC-affected human settlements leaving ample space for unhindered movement of wild elephants in the area is the focus of our short-term HEC mitigation strategy that has benefitted thousands of villagers in the high-incidence districts of Goalpara, Udalguri, Baksa, Kokrajhar, Kamrup, Golaghat, Majuli, Nagaon and Tinsukia in Assam and a part of West Garo Hills district of neighboring Meghalaya. We install community-based solar fences in two different ways. We install solar fences surrounding villages in areas where prevalent HEC is of high intensity that often leads to human deaths and damage of dwelling houses besides crop fields. Poor people in these areas can't afford to build another house in their lifetime if it is destroyed by elephants.

We also install seasonal solar fences around crop areas in emerging HEC-affected areas where wild elephants usually come to feed on the mature crops, but don't tend to cause damage to dwelling houses.

So far, we have installed 156.73 km of solar-powered fence during 2019-24 in Assam and a small part of the Garo Hills region in Meghalaya. These stretches of fence have been very effective in keeping wild elephants off the village property and crop areas leading to the protection of livelihood and restoration of normal social/cultural ways in villages and improvement of general health of villagers who no longer have to spend sleepless nights in the fear of wild elephants invading into their dwelling spaces at night. Education of children too has improved in these villages shielded from HEC by the low-cost solar fence.

Fences are usually activated after dusk to deter elephants from crop raiding or approaching human settlements.

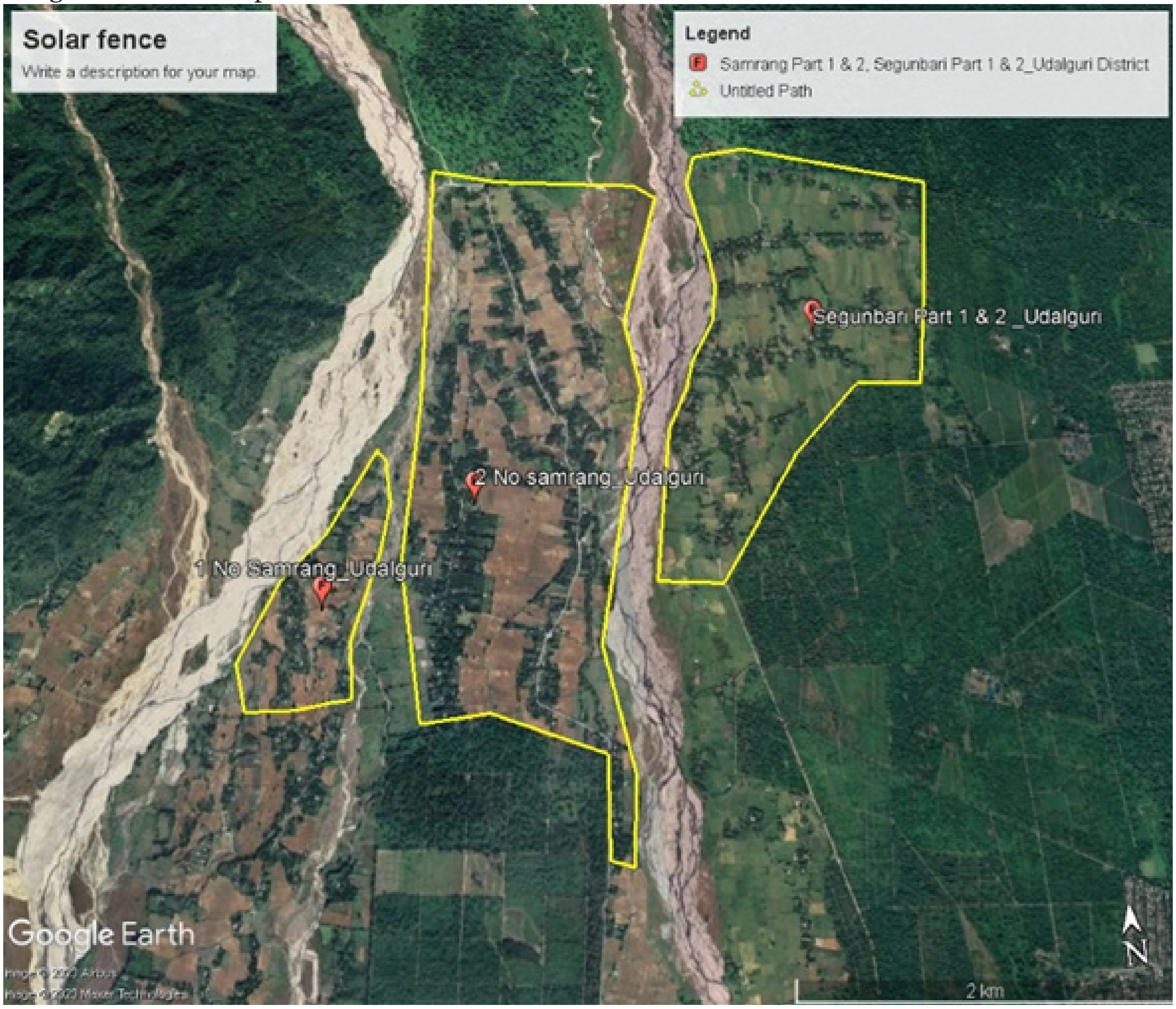
The community-based solar fences have been installed in Uttarkuchi, Lebra Shantipur-1, Lebra Shantipur-2, Nagrijuli, Bhuyanpara, Daodhara villages in Baksa district); Segunbari, Samrang-1, Samrang-2, Bhairabkunda, Sonajali L.P School, Kundarbil, Budlapara Tea Estate L.P School and Tenkibasti L.P School in Udalguri district; Dakurbhita, Nichinta, Kashibari, Bordol, Kochpara LP School, Pukhuripara-1, Pukhuripara-2, Lakhipur, Sesapani, Barigaon-1, Barigaon-2, Ganeshpara, Medhipara, Singimari-Bapupara, Tokorapara and Borjhuli in Goalpara district; Naam Kamakhya Scool in Silghat in Nagaon district; Jaborchuk Kathoni in Majuli district; Raimona and Takampur-Nabin Nagar in Kokrajhar district ; Gossaihat, Palashbari and Maliata in Kamrup district; Kaliani L.P School in Golaghat district; Padumphala and Sadiya in Tinsukia district; and Borogobal of West Garo Hills district of Meghalaya that shares boundary with Assam.



The successful installation of solar fences has positively impacted at least 50,000 people in the covered districts, either directly or indirectly. Moreover, the installation of solar fences around six Lower Primary schools so far in HEC-affected areas has facilitated undisrupted education for children. We have to mention here that without the constant support from the US Fish and Wildlife Service, British Asian Trust, Darwin Initiative, and SBI Foundation our community-oriented efforts wouldn't have been possible.

Aaranyak's team of experts first orient villagers in the target areas about the efficacy of solar fences in facilitating coexistence with wild elephants through sensitization workshops which are followed by technical training workshops for selected community members including women about the installation process, and safe operation of solar fences. In most of these villages, we havereceived overwhelming sustained cooperation from village-level solar fence management committees post-installation of fences. We have put in place a mechanism where the village solar fence management committees are constantly in touch with us for any need for the smooth operation of the fence. Significantly, in all these villages the community members have worked with our team manually during installation of fences.

Aaranyak has provided a large number of rechargeable torch lights to villagers and installed about 300 solar-powered street lights as mitigation tools to help monitor the movement of wild elephant herds by villagers themselves from a safe distance in night hours to avoid conflicts and thereby prevent loss of lives and property.



The Elephant Conservation Networks (ECN) and Rapid Response Units (RRUs) formed by Aaranyak with community volunteers have been working well for the mitigation of the conflict in HEC-affected areas in Assam.

The RRUs are mostly across five eastern Assam districts of Jorhat, Sivasagar, Majuli, Dibrugarh, and Tinsukia while ECNs are located in districts of Goalpara, Udalguri, and Baksa. The volunteers of the RRUs and ECNs are trained on basic ecology and behaviour of elephants, and they monitor the movement of elephants around villages and provide information villagers act as early warning units and manage HEC.

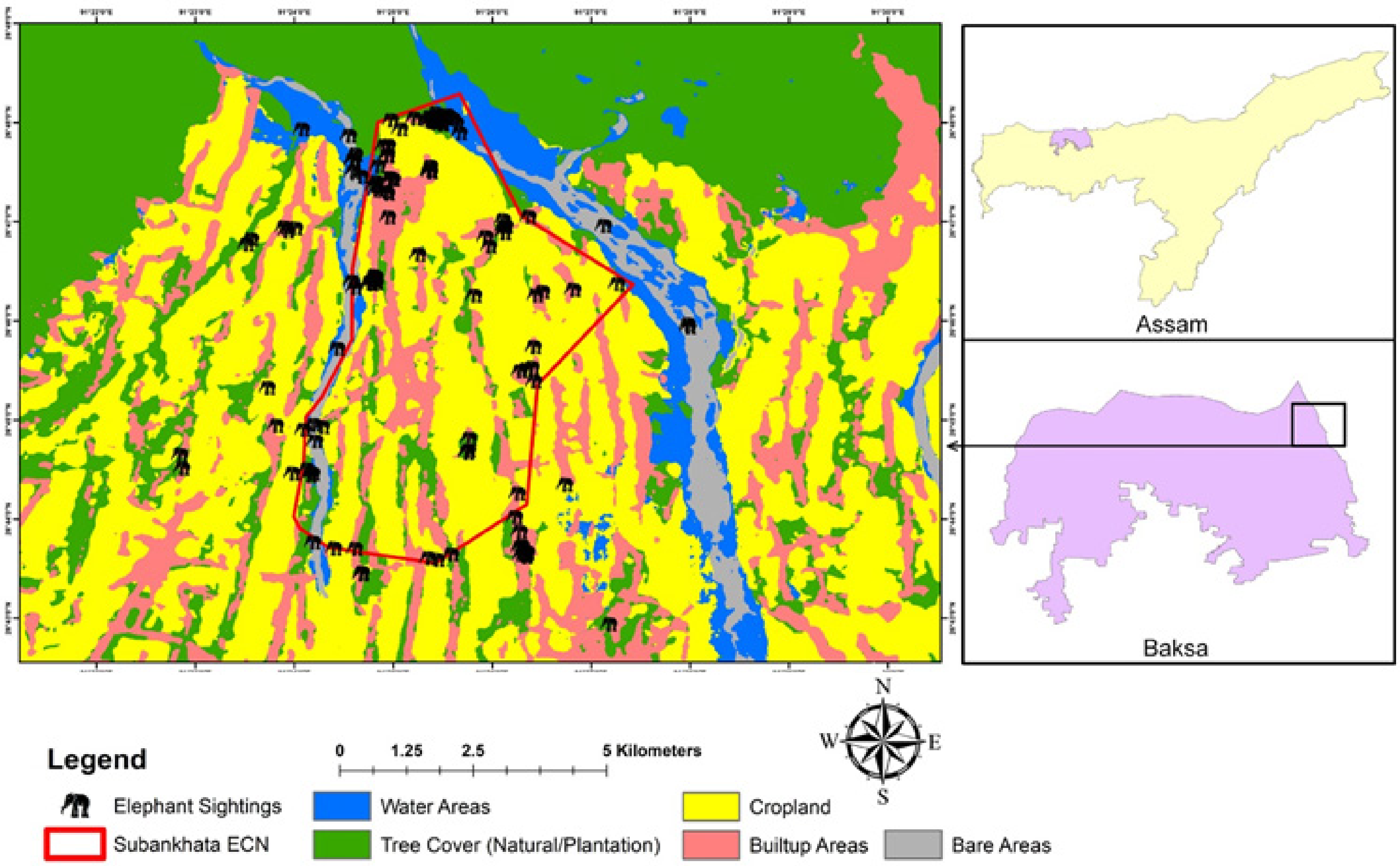
RRUs and ECNs comprising volunteers from HEC-affected villages act as eyes and ears in the sustained efforts for mitigation of the HEC so as to protect the lives of both human beings and elephants besides the livelihood of villagers as much as possible. Each of these RRUs/ECNs networked through WhatsApp groups, promptly relays messages about the presence of wild elephants in the vicinity of human settlements to minimize direct interactions between elephants and people. Aaranyak provides basic field gear like raincoats, caps, torchlights, and shoes to volunteers of RRUs and ECNs to help them carry out their work for the mitigation of HEC.

Alternative crops

As part of our community-centric strategy aimed at facilitating coexistence, we have providedto villagers the option for cultivating alternative crops, which are believed to be non-palatable to elephants, in HEC-affected areas in 'pilot project' mode. Accordingly, seeds/seedlings of sesame, mustard seed, turmeric, taro, chili and ginger have been provided to farmers in some of the HEC-affected areas in western Assam's Udalguri and Baksa districts during 2023-24.

In areas occurring in Eastern Assam we have provided training on the cultivation of winter varieties of oyster mushrooms to beneficiaries, in Sadiya of Tinsukia district and supported them with 44 kg of mushroom spawn. The mushroom 200/kg.

In some of HEC affected areas of Tinsukia, Sivasagar, Jorhat, Majuli districts villagers have been encouraged by the Aaranyak team cultivate mustard as an alternative crop. High-quality seeds were provided to farmers to help them reap better harvest. People are unable to cultivate paddy in these areas because of depredation by wild elephants. Eleven beneficiaries from HEC-affected areas in the West Garo Hills district of Meghalaya received 18 kg of oyster mushroom spawn along with training from the Aaranyak team so that they can supplement their income.



Aid to women for economic empowerment

Eleven training on weaving crafts were facilitated by Aaranyak in five Assam districts of Dibrugarh, Tinsukia, Majuli, Jorhat, Sivasagar, and Meghalaya's West Garo Hills (WGH) district. The training was provided to 231 women beneficiaries as well as 50 other community members. Each of the beneficiaries received 5 kgs of cotton yarn in Eastern Assam and 3.5 kgs in WGH (a total of 1118 kgs of yarn was provided) to kick-start their weaving initiative. The weaving-beneficiaries produced different kinds of merchandise such as "mekhela-chadors" (traditional two-piece clothes worn by women in Assam), "gamocha" (a cotton towel with high cultural value), and stoles.

Each merchandise was sold between INR 250 (gamosa) to INR 4500 (for Mekhela-chador).

First-aid administration training

In the last one year, 12 first aid training programmes have been conducted, focusing on women, where men and children, however, are often seen participating actively. These participant community members are from areas affected by HEC and where frequent human-elephant encounters are witnessed. We prioritise areas where there is very little or unavailability of medical and hospital facilities so that we can equip individuals with the basic training of aiding themselves during emergencies. This training is conducted as a part of Aaranyak's efforts to promote human-elephant coexistence and has been so far conducted in Baksa, Tamulpur, and Udalguri districts of Assam. Around 467 people participated in the 12 such training programmes.

Additionally, we have collaborated with the District Disaster Management Authority (DDMA) of Udalguri and Baksa districts to facilitate our training. The dedicated Aapda mitras, community volunteers from DDMA imparted the required skills for the training as resource persons.

Bio-fencing

Plantations of Assam lemon are created as bio-fence at Soraguri Chapori area in Sivasagar district of Assam, which worked effectively in repelling wild elephants from cropland. This project, which was undertaken in pilot mode, has proved effective in conflict mitigation, besides providing substantial income for lemon cultivators. The success of this pilot project has encouraged us to create similar plantations as bio-fence in some other HEC-affected areas in Assam including Majuli, Tinsukia, and Dibrugarh districts.

Habitat quality improvement efforts

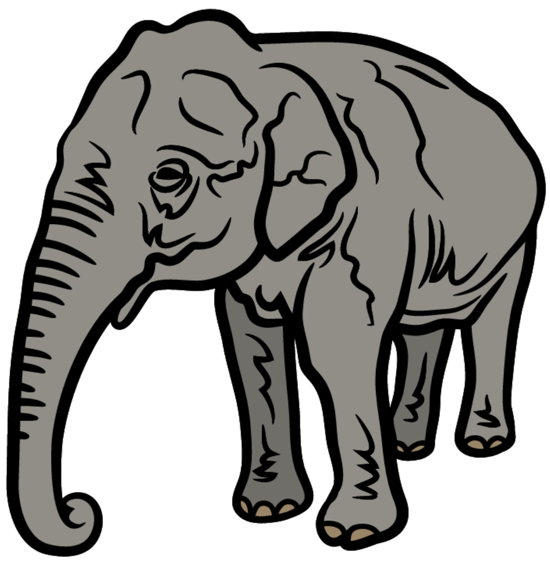
Besides community-centric strategy for mitigation and coexistence, Aaranyak has undertaken efforts for habitat quality improvement as part of long-term conservation of Asian elephants. We have identified a 100-hectare area, which is a mosaic of woodlands and grasslands in Udalguri district and are working towards replenishing it by planting 25000 saplings of native trees, managing grasslands, and regulating cattle grazing. For this, we are working cohesively with the Dhansiri Sikaridanga Joint Forest Management Committee (JFMC).

Convergence

In the wake of discernible effectiveness of measures undertaken by Aaranyak for mitigation of HEC and facilitating coexistence that has been experienced at the ground level, the Goalpara Forest Division of Assam Government has decided to collaborate with Aaranyak team to undertake similar measures in Goalpara district that is a high HEC incidence area.

As per the data available with Assam State Forest Department, Goalpara district recorded 14 human deaths and 5 elephant deaths in the year 2023 because of the raging HEC. The ongoing collaboration with Goalpara Forest Division is focused on the mitigation of HEC through the installation of solar-powered fence; distribution of torchlights to community members, elephant protection teams, and frontline forest staff; installation of solar street lights to enhance visibility at night in HEC-prone areas; capacity building training on installation, operation, and management of solar-powered fences; conducting community awareness programmes on HEC mitigation; promoting alternative crops that are less palatable to elephants.

The convergence of efforts with Assam Forest Department has rendered much credence to Aaranyak's sustained efforts for the mitigation of HEC and facilitating coexistence with wild elephants in the landscape. However, the convergence is not limited to only the Goalpara district. We have been working for the mitigation of HEC in close collaboration with civil and forest authorities in all the districts of Assam and Meghalaya where we have been working.



Understanding Asian Elephant Male associations in Rajaji National Park

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Cooperation provides benefits even if there is an initial individual cost. It can affect the resolution of disputes within social groups and help balance out innate differences in dominance potential between individuals in group-living species (Smith et al., 2023). However, owing to divergent strategies of male dispersal and female philopatry in polygynous species, the sexes are usually segregated (Greenwood, 1980; Keerthipriya et al., 2021a; Kie & Bowyer, 1999; Shannon et al., 2008). These sex-based differences may increase the propensity to form kin-based intragroup associations, making them more common in females than males (Smith et al., 2023). The intensity of intrasexual competition further diminishes the propensity of males to form cooperative associations, making these associations particularly rare among mammals (Clutton-Brock, 2009; Patzelt et al., 2014; Van Hooff & Van Schaik, 1994). Thus, setting the stage for conflict and not cooperation.

Even so, male associations have been reported across several species including African and Asian elephants. These associations are known to be important life history strategies for these polygynous mammals that live in fission-fusion societies with strong social bonds (Douglas-Hamilton, 1972; Fishlock & Lee, 2013; Moss & Poole, 1983; Sukumar, 2003). Though both being matriarchal societies, we now understand that there are differences in Asian and African elephant societies (De Silva et al., 2011; Nandini et al., 2018). Males dispersing from their natal groups and being largely solitary thereafter are common to both (De Silva et al., 2011; Nandini et al., 2018).

Male elephant associations and social structure are well-studied in African elephants (Loxodonta africana) (Lee et al., 2011; Moss & Poole, 1983). They alternate between living solitary lives in all-male groups or associating with mixed-sex herds with both males and females (Chiyo et al., 2011). The timing and process by which young male elephants separate from their family units are influenced by a combination of factors, including the dominance status of their mother, the presence of other male elephants to provide social interaction and their physical development (Lee et al., 2011). All-male groups in African elephants allow individuals to test their strengths, spar with their peers, and enable younger males to learn from older males (Chiyo et al., 2011, 2012; Keerthipriya et al., 2021a). Chiyo et al. (2011) showed that males associate in large groups of related individuals of similar age. However, these all-male groups have been associated with an increased propensity to raid crops, especially for elephants, both African and

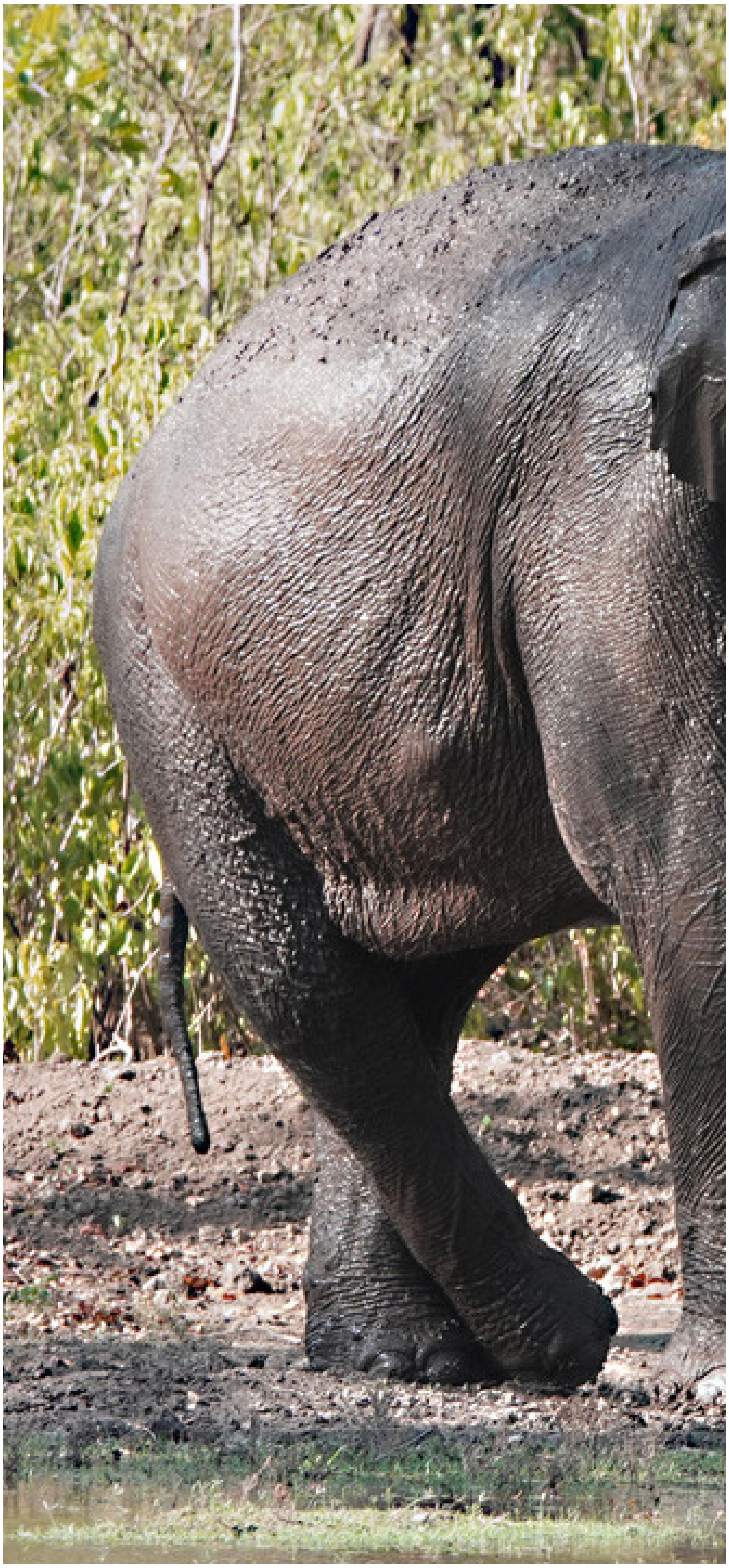
Asian (Chiyo et al., 2012; Srinivasaiah et al., 2019; Sukumar & Gadgil, 1988). Therefore, it can be understood that male alliances often form for protection, access to mates, and learning social behaviours - all of which can increase individual survival and reproductive success over time. The formation of such male alliances or coalitions can thus be explained by mutualism and reciprocity (Clutton-Brock, 2002).

All-male groups in Asian elephants have been noted earlier in India (Keerthipriya et al., 2021a; Srinivasaiah et al., 2012; Sukumar, 2003; Sukumar & Gadgil, 1988) but have only been recently reported to be a novel behavioural strategy in human-dominated landscapes (Srinivasaiah et al., 2019). Studies on all-male groups in Kabini have shown that Asian elephant males spent the least proportion of time in all-male groups (Keerthipriya et al., 2021a) as compared to African elephants, where the trend was reversed (Chiyo et al., 2011). Keerthipriya et al. (2021) also showed that older males preferred to associate more with older peers than younger males, pointing to the fact that older males associated with each other to test strengths. The tendency of individual elephants to selectively choose whether to associate in temporary or stable same-sex groups, mixed-sex groups or remain solitary may represent an important facet of their life history adaptations (Srinivasaiah et al., 2012). This could also be an artefact of the population size of males.


© Author

In Rajaji National Park and the adjoining ranges of the Haridwar Forest Division, all-male groups have been observed before but the aim of this study was to understand what factors affect how males associate with different group types- solitary, all-male groups and mixed sex herds. We ascertained that, factors such as age, physiological condition, body condition and habitat type may affect how males associate. In this study spanning 4 months, we closely observed males in all three association types and identified all adult males present in the study area. All-male groups as mentioned before are dynamic in nature and members of these groups keep changing both in terms of identity as well as size. The largest male group observed was of 11 individuals. It is also interesting to note that, a juvenile male was seen associating exclusively with all-male groups. Generally, is it observed in various other studies that younger males tend to associate more with herds than with all-male groups (Keerthipriya et al., 2021b; Srinivasaiah et al., 2019). As to why this particular individual was seen with male groups, there could be several reasons, the most probable of which is that the individual lost its mother and subsequently separated from the herd, after which he would have come in contact with an older male and introduced to other adult males in all-male groups. Male groups in Rajaji are usually seen in two points along the banks of the Ganga which serves as a rendezvous for males to cross over to the opposite bank to engage in crop-raiding. As found in the study by Srinivasaiah et al., all-male groups are indeed a behavioural response in anthropogenic landscapes and can be seen as a risk minimization strategy. The juvenile mentioned earlier has indeed had an early initiation in the world of crop raiding.

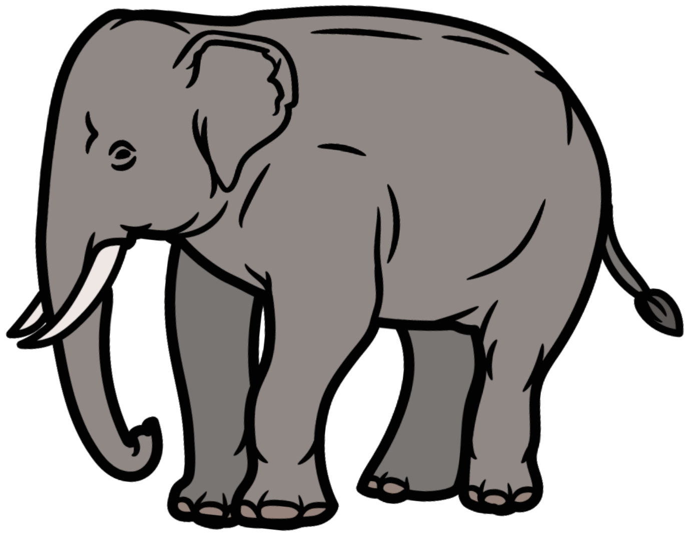
Our observations indicate that the individuals that do associate with all-male groups usually disperse after returning from crop raiding and are then seen in other small groups or as solitary during the day, coming together once again in the late evening hours to cross the river. Though in the early stages of analysis, the data does point to the fact that the cultural transmission of knowledge is the main purpose for individuals joining these groups. These groups usually comprise of young individuals between the ages of 15-30 and are usually accompanied



by at least one older male between the ages of 30-50. No aggressive behaviour was observed within all-male groups. Crop raiding is a means for males to improve their body condition so that they can effectively come into musth. Observations also show that once the older males come into musth and rove in search of females, younger individuals which are not yet capable of maintaining their musth and are usually suppressed by older males, do not associate as frequently with each other and the average group size reduces as well. This does categorically show that older individuals dictate group size of all-male groups and in their absence, there is a temporary dissociation.

Young individuals are rarely seen with male groups and are mostly seen with mixed herds. Adult male and on some occasions sub-adult males also join male groups. Risk minimization becomes important when in human-dominated landscapes and the habitat data for all-male groups sightings also paint the same picture with these groups being observed mostly in non-forest and open areas near built-up areas and roads.

This anthropogenic landscape-forest matrix provides a novel system to be further explored to understand the differences between the behavioural responses of different elephant populations to anthropogenic pressure. Understanding male associations and more importantly understanding individual idiosyncrasies could be pivotal in answering the problems of human-elephant conflict in the region and minimize risk to both humans and elephants.



Elephant Alert: An Early Warning System for Human-Elephant Conflict Avoidance

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Introduction

Negative interactions between humans and wild elephants is already a big conservation concern for policy makers, planners and development departments under various federal, state and local governments. In 2021, the Indian Parliament was informed that as many as 301 elephants and 1,401 humans lost their lives in the last three years due to such interactions. According to media reports, 115 elephants also died in 2018-19, 99 in 2019-20, and 87 in 2020-21. The number of humans who lost their lives through these interactions during the same period was 457, 585, and 359, respectively as per the data tabled in the Parliament. As per a latest peer reviewed paper, among the range countries, India is home to more than 60% of the extant wild elephant population, with 25,000–30,000 elephants spread over 1,63,000 sq. km of diverse landscapes.

The overlapping of requirements of forest fringe communities and this large foraging herbivore is a foremost cause of negative human-elephant interactions, which is commonly or erroneously described as "conflicts". Fragmented habitats, diminished landscape connectivity, water and food shortage, recurring forest fires, unpredictable weather phenomena, colonisation by invasive plant species, poor regeneration of bamboo and other native plants, easy availability of plentiful and palatable food choices (Plantain is widely reported as a major attractive crop) are alleged to be luring wild elephants frequently into the "humanosphere".

Published studies in Asia including India and also in Africa attests that elephant encounters are high during monsoon, in contradiction to the prevailing general belief that Human-Elephant Conflicts (HECs) are more in drier months! In many similar studies, seasonal encounters with the elephants showed a positive correlation with rainfall and crop cultivation cycle. In certain landscapes of south India, HECs also showed peaks during the fruiting seasons of jackfruit, paddy and coffee. Asian elephants, with their large body size and differential front-hind limb lengths prefer flat terrain forests and avoid steeper slopes. There is also data which substantiates the fact that slope has a negative correlation with HEC occurrences. In Kerala, wild elephants pose a major threat in many forest fringe areas. Several deterrents to minimize off negative interactions with elephants like the creation of various barriers such as elephant proof trenches, rail fences, solar fences, bee hives, construction of walls, driving straying wild elephants into the forests, cultivation of unpalatable crops in forest fringe farms, creation of water bodies, farming fodder resources, boundary perambulation etc are in place. With no single solution to date, management of HECs calls for multi-disciplinary or trans-disciplinary solutions that can scale down these confrontations, conflicts and casualties through evidence-based fast responses and decision-making.

Many research workers and groups have recommended employing early warning systems (for e.g. Bhagabati et al., 2024) against elephant intrusion to mitigate conflicts, and to avoid fatal encounters through the use of network technology such as television cable network, and mobile phone coupled with active participation of stakeholders suggested by Kumar and Ganesh (2012), automatic acoustic and visual detection methods (Zeppelzauer and Stoeger, 2015), the Wireless Integrated Sensor Network (WISN) based boundary intellect system that incorporates multiple sensors to detect elephants (Anni and Sangaiah, 2018), and Deep Learning tools like the Convolutional Neural Network (CNN) (Yuvaraj et al., 2022), to mention a few.

The intelligence of elephants abounds in our folklores, which is recognized in the present as well. Many workers based on their long-term studies have recorded variation in elephant behaviour at the individual level. Many animal behaviour experts are of the considered view that elephants can constantly learn, adapt, make decisions based on complex cognitive processes, and even teach each other. Hence, Mumby and Plotnik (2018) as well as Ball et al., (2022) has highlighted the importance of integrating behaviour, cognition, and ecology at the individual level to manage HECs.

Technology Concept

The concept of this invention relates to a system and method for detecting wild elephant intrusion and issuing early warning messages to prevent human-elephant conflicts. The system was designed to detect the presence of wild elephants in the vicinity of human settlements and send alerts to the concerned authorities and local communities.

Formulating the specification is an essential first step in any design process. When it comes to an early warning system for detecting wild elephants, it's also critical to make sure the system accurate, reliable, and effective in diverse environmental conditions, which will ultimately improve safety and reduce conflicts between people and elephants. It must be made sure that the system is reliable, accurate, and able to adapt in time. It must effectively detect elephant presence while minimizing false alarms to the control center. The system should reliably detect any motion within its range under various environmental conditions and terrains. The hardware and software must perform optimally in diverse weather and terrain conditions. The system should also be designed as a stand-alone unit with its own power generation system, capable of sustaining operations independently. The power supply must be efficient and sufficient to support continuous operation, particularly during nighttime. Furthermore, the communication system should be universal, capable of functioning in virtually any geographical location.

Our team goal was to develop a comprehensive solution to detect elephant intrusions, which requires addressing several key challenges identified during an in-depth analysis. The first problem is devising a method to detect the presence of an elephant when it enters the system's range. The second challenge is accurately distinguishing whether the detected animal is an elephant or another animal. The third critical issue was ensuring the early warning system could promptly send alerts upon detecting an elephant. To deliver timely and effective alerts, all system operations must also function in real time.

The Design of an Early Warning System

The design of such an early warning system to detect the intrusion of wild elephants involves integrating both hardware and software components to ensure accurate and real-time detection. The hardware components include motion sensors and cameras for detecting movement and capturing images, a microcontroller or processor for processing the data, and a communication module for sending alerts. In order to guarantee continuous operation, the system also needs power management components including solar panels and batteries. The software components consist of image recognition algorithms to distinguish elephants from other animals, data processing software to analyze sensor inputs, and communication protocols to send warnings to the control center. When combined, these hardware and software elements form a robust, standalone system that can function in a variety of conditions and terrains. The major components in the system architecture of the wild elephant detection and alert system are shown in Fig 1.

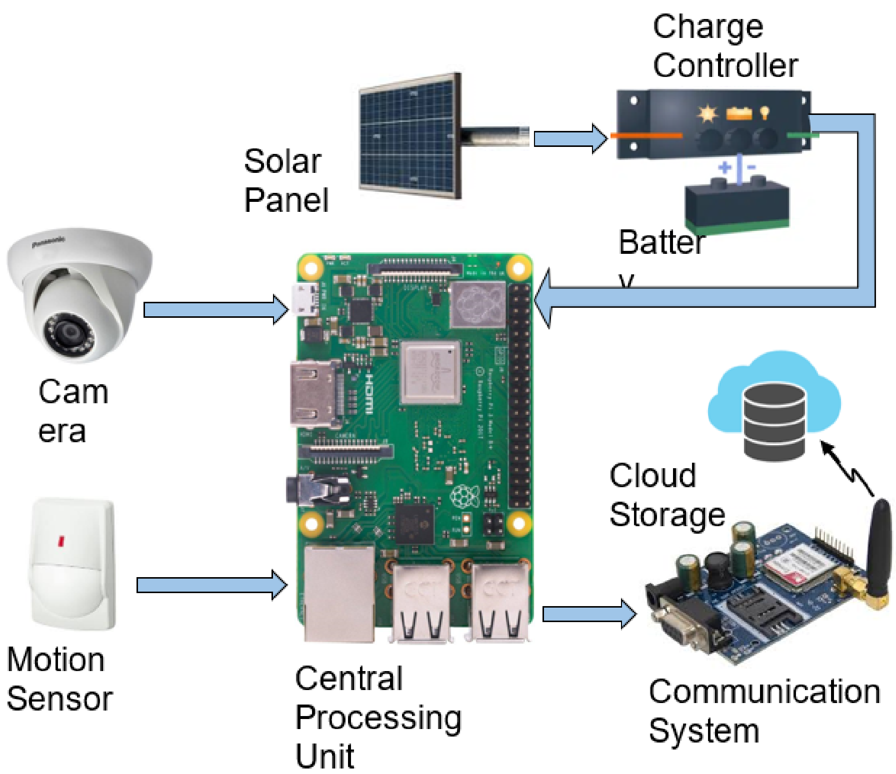

Fig 1. System Architecture of the Wild Elephant Detection and Alert System

The Hardware Design

Careful component selection is crucial when designing the hardware for an early warning system to identify intrusions by wild elephants. Components need to be chosen for their durability and ability to withstand harsh weather conditions, because the device will be placed in an outdoor environment. Sensors and cameras need to be robust and reliable, capable of operating effectively in varying temperatures and humidity levels. Additionally, the power supply, including solar panels and batteries must be resilient and efficient to ensure continuous operation. Rugged enclosures should be used to protect sensitive electronics from dust, moisture, and physical damage.

Motion sensor

Motion sensors are the primary components that trigger the device to respond to any detected movement. There are three main types of motion sensors that were considered for this application: The passive infrared (PIR) sensors, microwave sensors, and dual technology sensors that combine both PIR and microwave technologies. PIR sensors detect infrared radiation emitted by warm objects, such as elephants, while microwave sensors emit microwave pulses and measure the reflection off moving objects. Dual technology sensors offer enhanced accuracy by using both PIR and microwave detection, reducing false alarms and improving the system's reliability.

We started with using low-cost, basic PIR sensors that get activated upon detecting an object, while evaluating various sensors for the early warning system. Although these sensors performed well in closed environments, they had significant issues with false triggers in open spaces. To address this, we tested dual technology sensors that combine PIR and microwave detection, which greatly reduced false alarms; however, their detection range was limited to only 6 meters, making them unsuitable for our needs. Ultimately, we found that the Optex RX-40QZ/RX-40PT PIR sensor, which uses quad zone logic to accurately discriminate between unwanted motions and large objects, provided reliable false alarm protection and offered an extended range of 12 meters.

Camera

A camera that captures images of moving objects, when the PIR sensor is triggered, was the next essential hardware component. In order to accurately identify elephants using Artificial Intelligence (AI) algorithms, this camera must produce high-quality images both during the day and at night. Initially, we used a picamera for cost efficiency, which produced good daytime images but poor night-time images. Attempts to enhance night visibility with IR lighting were unsuccessful, as it compromised the system's compactness, power consumption, and increased space requirements. Consequently, we opted for an IP camera with integrated IR lighting, ensuring superior image quality around the clock. We selected the Panasonic 2MP Full HD Network IR Dome Camera PI-SFW202L, which captures images up to 1080P resolution and streams them to the processing unit via Ethernet using the ONVIF protocol. This camera features a 1/3" progressive scan CMOS sensor and supports H.264 and MJPEG dual-stream encoding, with a video recording capacity of 25/30fps at 2.0M (1920×1080) resolution.

The Central Processing Unit

The main component of the early warning system is the processing unit, which integrates the PIR sensor, camera, and communication system. Raspberry Pi 3 B+ serves as the control and processing hub, receiving input from the PIR sensor, capturing images from the IP camera upon detecting motion, and processing these images to classify whether they contain an elephant. The ARM-based processor in the Raspberry Pi 3 B+ is highly suitable for processing and analyzing inputs from the camera in the design of an early warning system. Its quad-core architecture and sufficient clock speed provide the necessary computational power to handle real-time image processing and AI-based classification tasks efficiently. The integrated GPU further enhances its capability to process high-resolution images, making it an ideal choice for capturing and analyzing data to detect elephant intrusions accurately. This ensures that the system can perform reliably and effectively in a real-time operational environment.

In addition to the main processor, an ATMEGA328P microcontroller was also used and the purpose was to connect voltage and current sensors, which collect data on battery charging current and voltage. This data helps analyze the health and charging/discharging properties of the battery, charged by a solar panel. The ATMEGA328P, with its inbuilt ADC, is ideal for converting the analog output of the current sensor to digital values, simplifying the circuit design. The collected data was then transmitted to the Raspberry Pi using the I2C protocol.

The Communication System

The commonly available communication network throughout most parts of the country is the cellular network, making it the chosen medium for this system. Since uploading images to the cloud for the real time storage requires high bandwidth, a 4G network was utilized for its speed and widespread availability. Testing was conducted with both the 2G-based SIM800 module and the SIM7600EI 4G module. While the SIM800 module is cost-effective and suitable for SMS and calls, it is inefficient for uploading images due to its slow speed. Conversely, the SIM7600EI offers faster and more secure network connectivity, essential for real-time image uploads. The 4G module was also compatible with both 2G and 4G networks, ensuring longevity and reliability. The SIM7600EI 4G/GSM/GPRS/GPS UART modem supports Multi-Band LTE-TDD/LTE-FDD/HSPA+/UMTS/EDGE/GPRS/GSM with LTE CAT1, enabling data transfer rates of up to 10Mbps for downlink and 5Mbps for uplink.

Solar Charging and Control Unit

The early warning system has to operate independently and relies on solar energy for power generation. The solar power system comprises a 12V, 75W solar panel, a solar charge controller, and a 30Ah battery. The solar panel's output voltage, varying from 0 to 24V based on sunlight, was regulated to stabilize around 12V by the charge controller. This regulated voltage charges the battery during day time, typically yielding 1A to 3A of current based on the daylight conditions. To prevent complete discharge of the battery in adverse conditions, a relay circuit with voltage sensors was used. The ATMEGA328P microcontroller monitors battery levels, cutting off power below 11V to protect against deep discharge and ensure reliable operation.

The Software Design

The software development for the elephant intrusion detection device required a robust approach with a focus on real-time responsiveness. It must guarantee prompt input response, for example, by triggering the IP camera to start taking pictures as soon as the PIR sensor detects motion. An additional challenge addressed in the software design was managing concurrent tasks; for instance, while one captured image undergoes classification processing, the system should seamlessly handle new motion detections and image captures without interference between processes. This ensures continuous operation and effective monitoring capabilities of the early warning system.

Background Detection

The OpenCV library is the main source of image processing techniques used in the early warning system's software design. It uses a background detection technique that looks for moving objects by comparing differences between successive photos captured in a second. This process includes applying gamma correction to enhance image clarity, normalizing the image to reduce shadows, calculating the absolute difference between images, converting the result to grayscale, and applying smoothing and thresholding techniques to obtain binary images. Morphological operations such as dilation and erosion are then used to refine the image by reducing noise, followed by identifying and evaluating various contours to ascertain the presence of moving objects effectively.

Image Classification

The software design of the early warning system includes an image classification process that identifies objects detected in motion. Using TensorFlow 1.4 with Python3, a CNN-based Inception-v3 2016 pretrained model with 47 layers is employed for deep learning. This model has been trained on a dataset of over 2000 images across four classes: elephant, no background, human subject, and buffalo, ensuring precise classification accuracy. On the central processing unit, each frame undergoes a classification process, involving two-phase convolutional and subsampling operations to extract features, followed by Gaussian classifier application to generate probabilistic distributions. Finally, the transfer learning-based Inception-v3 model was used for elephant detection and classification.

GSM Communication and Cloud Storage

The software design incorporates GSM-based communication for sending SMS messages to the control center, making calls, and uploading data to the cloud. Dropbox's free 2GB cloud storage service was utilized. The software sends SMS messages containing the classification output with probability data indicating how similar the image is to the elephant class. If the probability exceeds 0.8, the system enables GSM communication to send an SMS and make calls to the programmed numbers. Additionally, features were added in the software to upload the detected elephant's image with a timestamp to the cloud for further verification and record-keeping.

Conclusion

The early warning system designed for detecting wild elephant intrusion is a comprehensive solution integrating both hardware and software components. The hardware setup includes a PIR motion sensor, an IP camera, and a Raspberry Pi 3 B+ as the central processing unit (Fig 2). The system is powered by a solar energy system comprising a 12V 75W solar panel and a 30Ah battery, ensuring continuous operation in remote locations. The software design leverages a background detection algorithm and TensorFlow 1.4 for image classification, using a CNN-based Inception-v3 model trained on over 2000 images to accurately identify elephants. GSM-based communication facilitates real-time alerts, sending SMS messages, making calls, and uploading images with timestamps to Dropbox for verification. This robust and efficient design ensures timely detection and response to potential elephant intrusions, minimizing human-wildlife conflict (Fig 3, Fig 4 and Fig 5). The proposed system can be deployed in various locations where human-elephant conflicts are prevalent, helping to reduce the risk of economic losses and loss of human life.

Future Enhancements

Future enhancements for the early warning system could include integrating LoRa (Long Range) technology to improve communication range and reliability, especially in remote areas with limited cellular network coverage like remote forest fringe areas. Upgrading the image classification model with more extensive training data and optimizing the power management system for better efficiency during adverse weather conditions are also potential improvements. Expanding the system to include multiple sensors, such as thermal imaging or acoustic sensors, could further increase detection accuracy and robustness.

Testing and Deployment of Early Warning System

The early warning system was initially tested successfully in a lab environment. Subsequent field tests among domestic elephants also proved successful, demonstrating the system's effectiveness. The device was later deployed for testing in real-world conditions at the Pudur Gram Panchayath of Attappady Block in Palakkad district and at Kottapady, Perumbavoor in Ernakulam district, where it continued to perform effectively in detecting wild elephant intrusions (Fig 6).

Potential Applications

1. On the "elephant death trap" on the Walayar-Kanjikode railway stretch between Palakkad and Coimbatore: The forest/railway authorities can receive an early warning about the presence of wild elephants near or on the railway track. An alert can also simultaneously be relayed to the loco pilot of the train who can have an emergency response.

2. At all possible elephant crossings including Palakkad-Kozhikode National Highway, NH 212 which runs through three different wildlife sanctuaries - Wayanad National Park, Muthanga Wildlife Sanctuary and Bandipur National Park and elsewhere: Forest staff can get an early warning about the upcoming elephant presence.

3. In all forest fringe areas, alerts can be given about the presence and activity of wild elephants, so that the forest fringe communities can take evasive action and avoid an interaction, especially on rainy nights.

4. Animal-specific devices (like for wild boar, peacocks etc) based on the present concept can be further developed, tested and used.

Fig 2. The Early Warning System

Fig 3. Surveillance Area of the Early Warning SystemSystem

Fig 4: Wild Elephant Intrusion Detected by tl

Fig 5: Wild Elephant Intrusion Detected by the Device

Detected by the Device

Fig 6: Wild Elephants Detected by the Device on a

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Colonization of Elephants in Bandhavgarh Tiger Reserve

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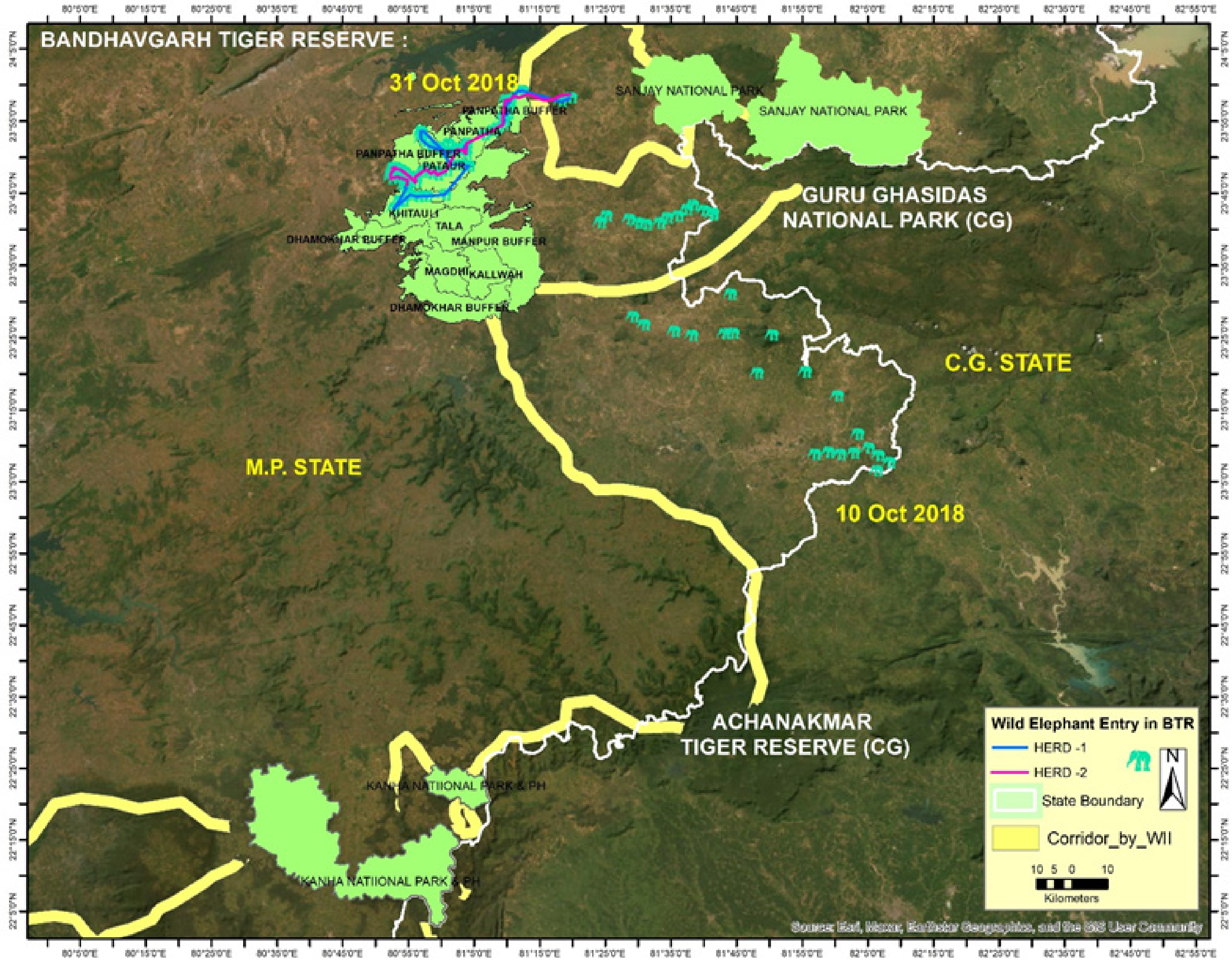
Introduction

Centuries ago, elephants roamed freely across Chhattisgarh and Madhya Pradesh, with historical records indicating their presence in areas such as Surguja and Korba. These regions were known for capturing elephants for the Mughal army. However, over time, the elephant population in these areas dwindled. According to Forsyth (1889), northern Chhattisgarh was home to elephants, but by the early twentieth century, they had become locally extinct (Krishnan, 1972).

In the 1980s and 1990s, a small population of elephants migrated from Jharkhand and Odisha into what was then Madhya Pradesh. This migration was primarily driven by habitat destruction in Jharkhand and Odisha due to illicit logging, encroachment, industrialization, and mining activities (Singh and Chowdhury, 1999; Singh, 2000). As a result, elephants were forced to undertake long-distance migrations, seeking refuge in smaller forest patches and eventually leading them into Chhattisgarh and occasionally into Madhya Pradesh (Menon et al., 2017). This migration sparked significant human-elephant conflict, claiming the lives of 164 people between 2009 and 2015. Recent reports have documented the movement of elephants into the eastern districts of Madhya Pradesh, such as Singrauli and Anuppur. In 2018, a herd of around 40 elephants migrated from Chhattisgarh to Madhya Pradesh, marking the first establishment of an elephant colony in the state. These elephants are now active in and around three national parks of Madhya Pradesh: Bandhavgarh, Sanjay and Kanha.

The Arrival and Colonization of Elephants in Bandhavgarh

On October 31, 2018, a herd of elephants made a significant journey into Bandhavgarh, entering through the Panpatha buffer range from the Shahdol forest division. The herd first appeared in the areas of Chatwa and Baraghati, as reported by the patrolling staff of the Panpatha buffer range. Initial tracking revealed that the elephants explored the Panpatha Core, Patour, and Khitauli forest ranges, as well as the Biruhali area of the Panpatha buffer, before temporarily leaving Bandhavgarh. This event marked a novel experience for the forest staff of Bandhavgarh.



Map 1: Showing the entry of wild elephants from adjacent forest division

On December 18, 2018, the same herd re-entered the reserve and has remained active within the Bandhavgarh Tiger Reserve ever since. The field director of Bandhavgarh immediately established a dedicated tracking team to monitor the elephants 24/7. The movement and number of individuals were estimated based on data received from the local patrolling staff and the tracking team. Each staff member was instructed to update the daily movements and sightings of the elephants through a wireless system.

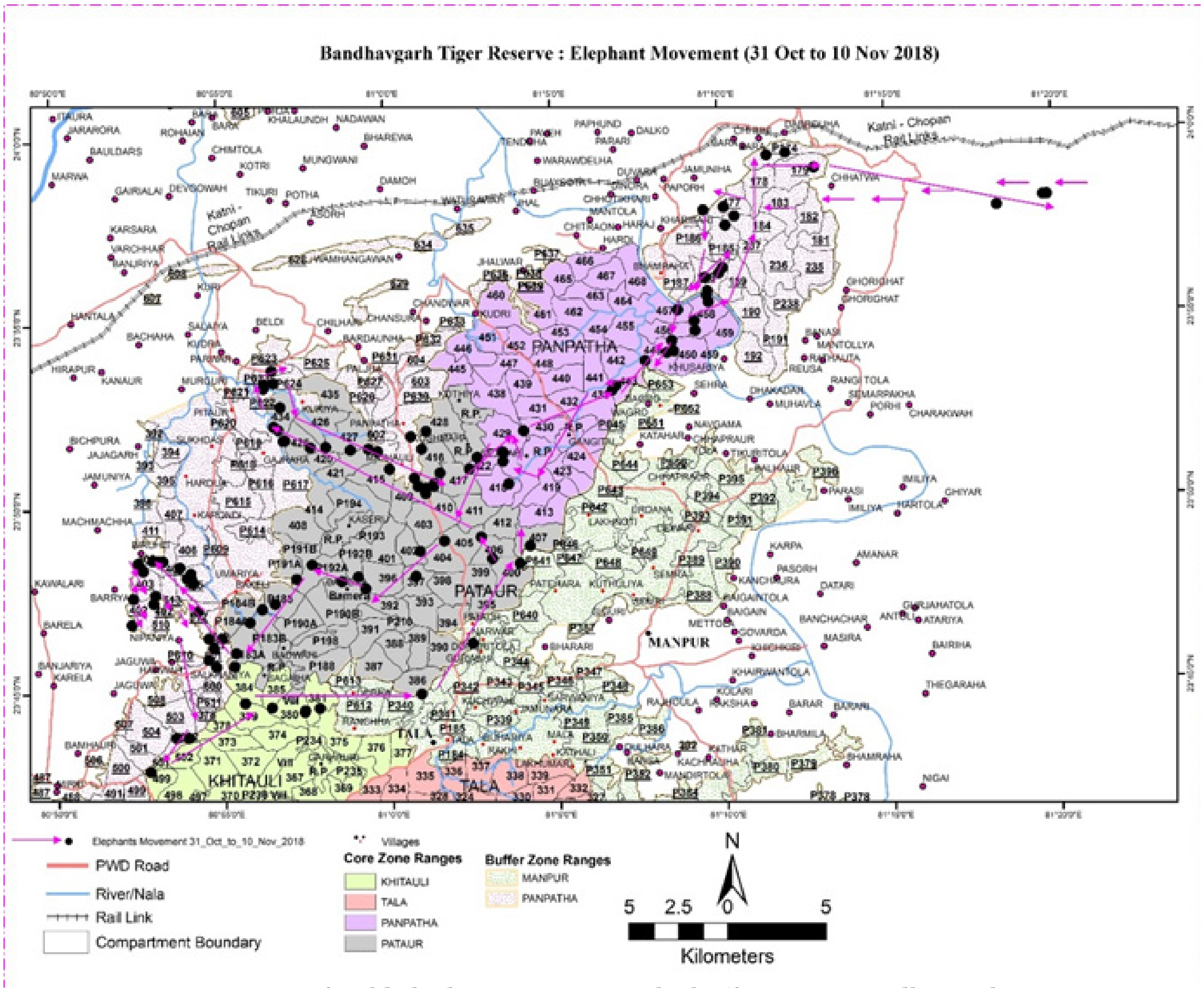
Initially, the herd comprised 27 elephants, which grew to 30 individuals. Later, a herd of 11 elephants joined the group in the Khitauli Range. By 2023, Bandhavgarh was home to around 48 to 50 elephants, divided into three groups, with frequent visits to areas of the Shahdol forest division, and Chhattisgarh. A drone shot captured in April 2023 in the Rajbehra area of the Tala range confirmed the presence of 43 individuals. Concurrently, records of lone bulls from the Patour and Panpatha core ranges supported a minimum population estimate of 45 to 50 elephants.

A drone shot of Wild Elephants in Rajbehra Grassland, Bandhavgarh TR (2023)

Monitoring Wild Elephants

In the beginning, the elephants displayed exploratory behavior, traversing all the ranges within the reserve. Given the nearby village populations and the harvesting season, this posed a significant management challenge. Crop raiding was reported from the Panpatha range, prompting the formation of a dedicated monitoring team to track the elephants' movements.

This team also functioned as a rapid response unit in conflict situations. Daily sighting data was collected and mapped to identify the elephants' routes (Map 2). Additionally, location data was gathered from the South and North Shahdol forest divisions to ensure comprehensive monitoring. The efforts to track and manage the elephant population in Bandhavgarh reflect a commitment to understanding and mitigating human-wildlife conflicts while ensuring the conservation and well-being of these magnificent creatures.



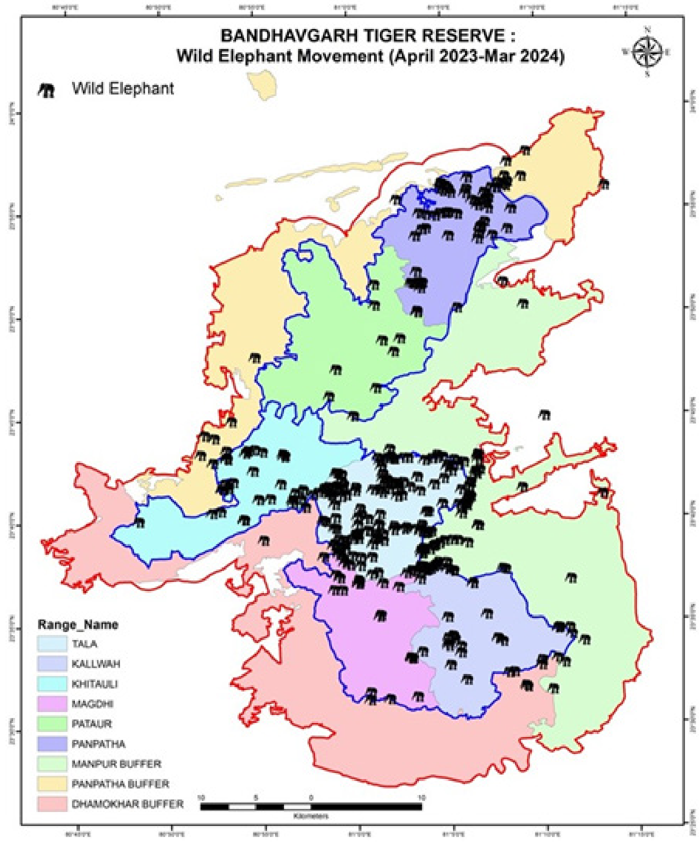
Map 2: Entry of Wild elephants into Panpatha buffer range, Bandhavgarh TR

A male Elephant is seen in Chhattisgarh (2019-21) (left) now established its territory in Bandhavgarh (2023) (right)(2018)

Present Status

At present, the elephant population in Bandhavgarh has grown significantly, with over 60 individuals, including more than five lone bulls. The elephants are exploring and utilizing almost the entire area of Bandhavgarh Tiger Reserve. Their movements show seasonal variations: during the monsoon, they predominantly use the Panpatha Wildlife Sanctuary and Panpatha buffer range; in winter, they are found in the Panpatha Wildlife Sanctuary and Bandhavgarh National Park; and in summer, they mostly utilize the Bandhavgarh National Park area.

The colonization of elephants in Bandhavgarh Tiger Reserve highlights the adaptability and resilience of these majestic creatures in the face of habitat destruction and human conflict. The ongoing conservation efforts in the region aim to protect and sustain the elephant population, ensuring their survival and the preservation of the delicate ecosystem they inhabit.

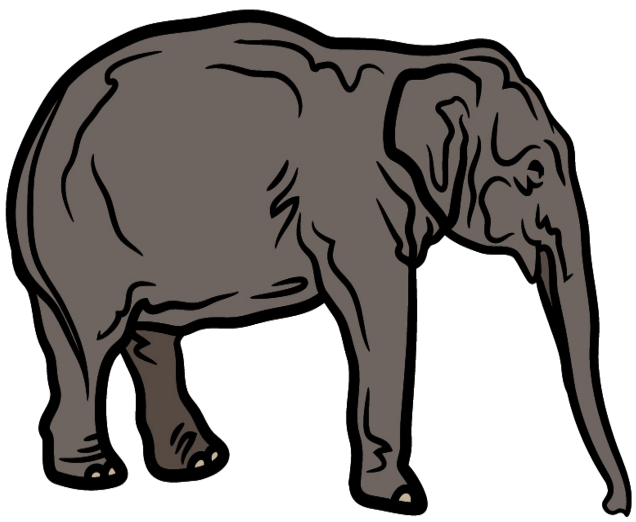


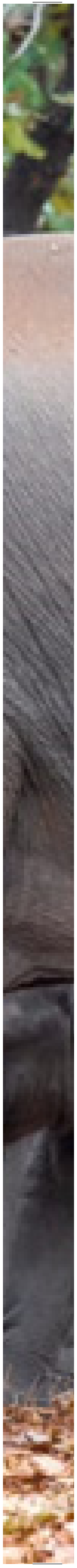
Conservation and Management Strategies

The management of Bandhavgarh Tiger Reserve has historically focused on tiger conservation. However, the arrival of elephants has necessitated the development of new conservation strategies to manage these gentle giants in a human-dominated landscape. Current priorities now include elephant monitoring, conflict mitigation, the establishment of rapid response teams, and habitat studies.

Efforts are underway to monitor elephant movements closely, mitigate conflicts with local communities, and study the habitat preferences and requirements of these elephants. The creation of rapid response teams is crucial to addressing human-elephant conflicts swiftly and effectively. These teams work to prevent property damage and human casualties while ensuring the safety of the elephants.

The colonization of elephants in Bandhavgarh Tiger Reserve highlights the adaptability and resilience of these majestic creatures in the face of habitat destruction and human conflict. The ongoing conservation efforts in the region aim to protect and sustain the elephant population, ensuring their survival and the preservation of the delicate ecosystem they inhabit.





Successful rescue and reconvening of a recumbent wild elephant calf at Biligiriranga Tiger Reserve, Karnataka

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Introduction

Late summer and early monsoon coincides with migration and dispersal of large herds of Asian Elephants across the Western Ghats of Karnataka, cutting across Kerala and even up to the Nilgiris of the Eastern Ghats in some cases. Karnataka itself boasts of a wild elephant population of close to 6000 identified individuals. Instances of mortality in calves due to separation, starvation, disease and predation are common during this time of the year. Although most casualties are discovered by forest beat staff at a state of decomposition and presented for post mortem, sometimes, individuals are found in a state of abandonment and debility wherein veterinary intervention is feasible. Providing the extent of disease does not extend to traumatic injuries such as long bone/ spinal fractures or severely debilitating diseases with high mortality as EEHV, calves with less serious forms of disease may be provided a chance at survival with correct diagnosis and timely intervention.

However, the ethics of intervention in cases where the calf is undergoing a morbidity or abandonment by its herd as a result of natural factors not facilitated by man-made or unnatural disturbances is debatable in a broader conservation worldview. In this particular case, intervention was deemed justified as the cow elephant had managed to locate its separated calf, although now recumbent and made several efforts to revive it when we were informed of the situation.

Planning the intervention

Approaching the recumbent calf was challenging as the adult female was aggressive and reluctant to allow anyone close to its calf, thereby increasing risk of approach on foot and limiting possibility of any examination by the veterinary team.

A team of three persons comprising of local guards who knew the terrain were stationed at an elevated hill from where the movements of the adult elephant and any other members of its herd if nearby could be monitored. It was decided to allow the mother to remain with the sick calf for another 24 hours and use this time for observation of both individuals. Three contingency plans were charted-

1) If the mother remained, we would attempt to drive the animal at a distance and try to keep her at bay while intervention was planned.

2) If the calf expired, a routine post mortem would be carried out.

3) If the mother had abandoned the calf on her own, intervention would be attempted at full swing and a decision to shift the animal to rescue center or otherwise would be taken later.

Post the observational period of 24 hours, it was found that the mother was half a kilometer away from the calf and a monitoring team stationed at an elevation and a drone team for better reconnaissance was pressed. One armed team on foot was stationed between the calf and mother to drive her if she charged at the intervention team. Once the area was considered safe for approach, the intervention team comprising of the Deputy Conservator of Forests, BRT, One Veterinary doctor from neighboring Bandipur Tiger reserve, the concerned Range Forest Officer and three field staff with necessary drugs and equipment commenced the operation.

Examination of the animal

The calf was a 2-3-year-old male with severe dehydration, anemia, debilitation and possible starvation. It was responsive and had normal vitals with low body temperature. No dung was found in the rectal cavity although significant Strongyle nematodes were found lining the rectal wall. Additionally, the calf was infested large bodied ticks in the inguinal region, anal opening, ears and lips. No physical injures such as large wounds or fractures were noted. All cranial and spinal reflexes were intact as well.

A blood test was carried out and it was observed that the calf was suffering from severe regenerative normocytic anemia, hypoprotenemia and elevated LDH values. A diagnosis of severe starvation with anaphylactic shock from tick infestation was made and treatment commenced thereafter.

Medical intervention

The animal was treated with large volumes of rectal and intravenous fluids comprising mostly of Normal Saline and warm water. The amount of fluid was calculated for 7% dehydration and maintenance volumes correcting for fluid loss from any diarrhea that may have been present. Injections of Ceftriaxone and Metronidazole were administered IV along with multivitamins. Dexamethasone was administered IV to relieve symptoms of shock. Large volumes of Hetastarch and amino acids were also administered to compensate for loss in protein.

During the course of treatment which lasted 8 -10 hours, the animal was fed sugarcane shoots and jaggery by hand which it took willingly after the first few hours of treatment. The calf passed copious amounts of urine and attempted to move its limbs at this point. Ticks and lice were manually removed with tweezers which amounted to several hundred in number. An Amitraz bath was given to kill any remaining ticks on the body and also as a preventive. Lastly injectable doramectin for the parasites and Injectable Tonophosphan for muscle strength were administered.

After close to 35-40 liters of fluid replacement and other remedial medications, towards evening, the mother had ventured close enough to the calf hampering safety of the staff. It was decided not to drive the mother and an attempt to allow the now responsive calf to rise on its feet was made. With gentle nudging and support, the calf gained sufficient strength to rise on its feet and ventured into the forest calling out to the mother. Although the mother and calf remained separated for close to 3 hours after, they finally united as documented on the drone camera being manned by the staff on ground. Two teams of trackers were deployed to monitor the calf for any debility in days to come as the veterinary opinion was that one round of therapy might not suffice for full recovery. However, the mother and calf continue to be monitored at the time of writing this report and are found to be doing well.

Discussion

Morbidities and mortalities in young unweaned elephant calves, especially in the period of transition from lactation to solid food are considerably high and contribute towards maintenance of a healthy population dynamic. However, a dilemma is presented when a live calf is presented especially outside the limits of the protected area such as in this presented case wherein risk of depredation by stray dogs, public mobs and media attention towards the situation require the authorities to intervene in the safest manner possible. Additionally, though the population of Asian elephants in the country is believed to exhibit an upward trend over the years, it is still very much classified as an Endangered species by the IUCN and falls under Schedule 1 of the WPA 1972. A willing effort, although fraught with risk to personnel, might be necessary in ensuring the conservation of this species in the Indian landscape.

In this case, after evaluation of the animal, arrangements were made to shift the animal to a recognized rescue center for continued treatment. However, the calf responded to timely therapy and instinctively approached the cow elephant on its own which refused to abandon its side as well. A calculated decision by the presiding DCF ensured successful reconvening and careful monitoring of the mother and calf was undertaken, which has proven to be incredibly beneficial and aided towards field level conservation of a species.

Post-partum management of Asiatic elephant (*Elephas maximus*): Case-based learning

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Introduction

The reproductive success in elephant may be determined by several factors including seasonal availability of food resources, population density, social factors, group sex ratio, ecological, psychological and physiological stress during early development, and subsequently confinement-related stress, capture-related trauma, and other stress combining these factors (Archie et al. 2006). In captivity, workload, adverse environmental conditions, frequent changes in group composition, training-related concerns and poor diet can limit reproductive success (Allen and Ullrey, 2004). In wild elephants, allomothering helps younger cows in calf care. While in captivity, after parturition, female elephants do not have the support of other female members of the herd, instead humans take up the task of provide care. The primiparous mother may not grow up learning how to care for younger elephant and may be inexperienced (Brown et al., 2004). Though there are cases where the mother is frightened by the pain and sight of an unfamiliar offspring, which may result in injuries to calves and even rejection.

Here is a similar case study, in which a primiparous elephant cow rejected her calf and injured it. The post-partum management of the cow and her calf is described below.

Case Details

A 14 year old female Asian elephant (*Elephas maximus*), gave birth to an 80kg female calf in the Panna tiger reserve, Madhya Pradesh. Immediately after parturition, the primiparous cow became agitated and aggressive towards the calf. Before the keepers were able to safely intervene and remove the calf, it was injured by the mother. Within 30 min, the cow calmed down, allowing the calf's reintroduction under close keeper supervision and control. Injury in its hind limbs hindered the calf's weight bearing ability. Further, there was a swelling on the left flank area with lack of sensation. No movement in external ears and tail could be observed and only trunk movement was there. Calf urinated and defecated after 4-5 hours of birth.

Veterinary Interventions

Initial treatment and management were started by the park veterinarian with intravenous fluid therapy (Dextrose and Isolyte-M) along with multivitamins. Additional technical support was sought from the School of Wildlife Forensic and Health, Jabalpur for detailed investigation and treatment. Radiographs of lateral abdominal region of calf were taken from different view within 12–15-hour post-partum. Radiographs revealed complete fracture at lumbo-sacral region of vertebral column.Accordingly, further medication was added to the initial treatment in the form of analgesics (Inj. Vetalgen 5 ml, i.m. and inj. Meloxicam 5 ml, i.m.), neurovitamins (Inj. Neuroquik 5 ml, deep i.m. and inj. Tribivet 5 ml, i.m.) for further 5 days. Physiotherapy with infra-red lamp and heating pad along with external massage with turpentine oil was done twice a day. Biological samples such as blood samples and faecal samples were also collected and processed for haemato-biochemistry and coprological examination. The laboratory results did not reveal any significant deviation of blood values. The cow was provided supplemental diet and medicaments to support lactation and to subside post-partum complications. After 36 hours, the calf responded to stimuli in the coccygeal region. Calf started to suckle milk duly facilitated by Mahout. Along with the veterinary treatment, the commercially available milk powder lactogen and calcium supplements were also provided to the calf. On 7th day onward, hydrotherapy was started with lukewarm water along with alum. A customized wooden cartwheel was prepared for the calf to provide external support. Calf tried to walk with the support of cart and got familiar with the mother. Despite intensive effort, which resulted in considerable improvement in its condition; the calf could survive for 25 days and eventually succumbed to the injuries.

Lesson learnt and Recommendations

Mother elephants, like many other animals, are generally protective towards their offspring. However, there can be situations where a cow elephant may reject her baby for various reasons.

Calves are more often rejected in captivity than in the wild, because the mother lacks the support that is part of elephant natural behavior (Murrayet al., 1996). The cow's postpartum difficulties like retained placenta, ventral oedema, and mucopurulent haemorrhagic vaginal discharge are common, but primiparous female may also suffer psychologically (Clubb et al., 2009). Some possible reasons include stress, lack of bonding, and genetic or developmental abnormalities by which a mother elephant might reject her baby. It is important to note that while rejection of calves by mother elephants can occur, it is not a common behavior and is usually a response to specific circumstances. Elephants, like other animals, have complex social behaviours and relationships that can influence their interactions with their young. All these circumstances could contribute to her infanticidal behaviour. In such situations, when a female elephant is primiparous then the management should focus on its emotional well-being too. Such female should be kept with a mature elephant and changing of group members should be avoided especially in the last phase of pregnancy. Such support from group members helps female elephant to build the confidence and presence of other mature female can provide support in developing maternal instincts to the new-born calf. Additionally, providing nutritional supplements in the last phase of pregnancy may provide strength to the female elephant to bear the discomfort and prevent post-partum complications. Elephants maintained in the Protected Areas are considered important tool for tiger monitoring, and they also play active role while performing veterinary interventions such as rescue and immobilization of wild animals. Therefore, in addition to physical fitness, the emotional well-being of park elephants should also be considered a part of primary health care management. Rejecting own calf is not common but careful management of captive elephants by providing psychological and nutritional support can prevent such possible unfortunate events especially in primiparous elephants.

Case photos

Application of wooden wheel cart and physiotherapy

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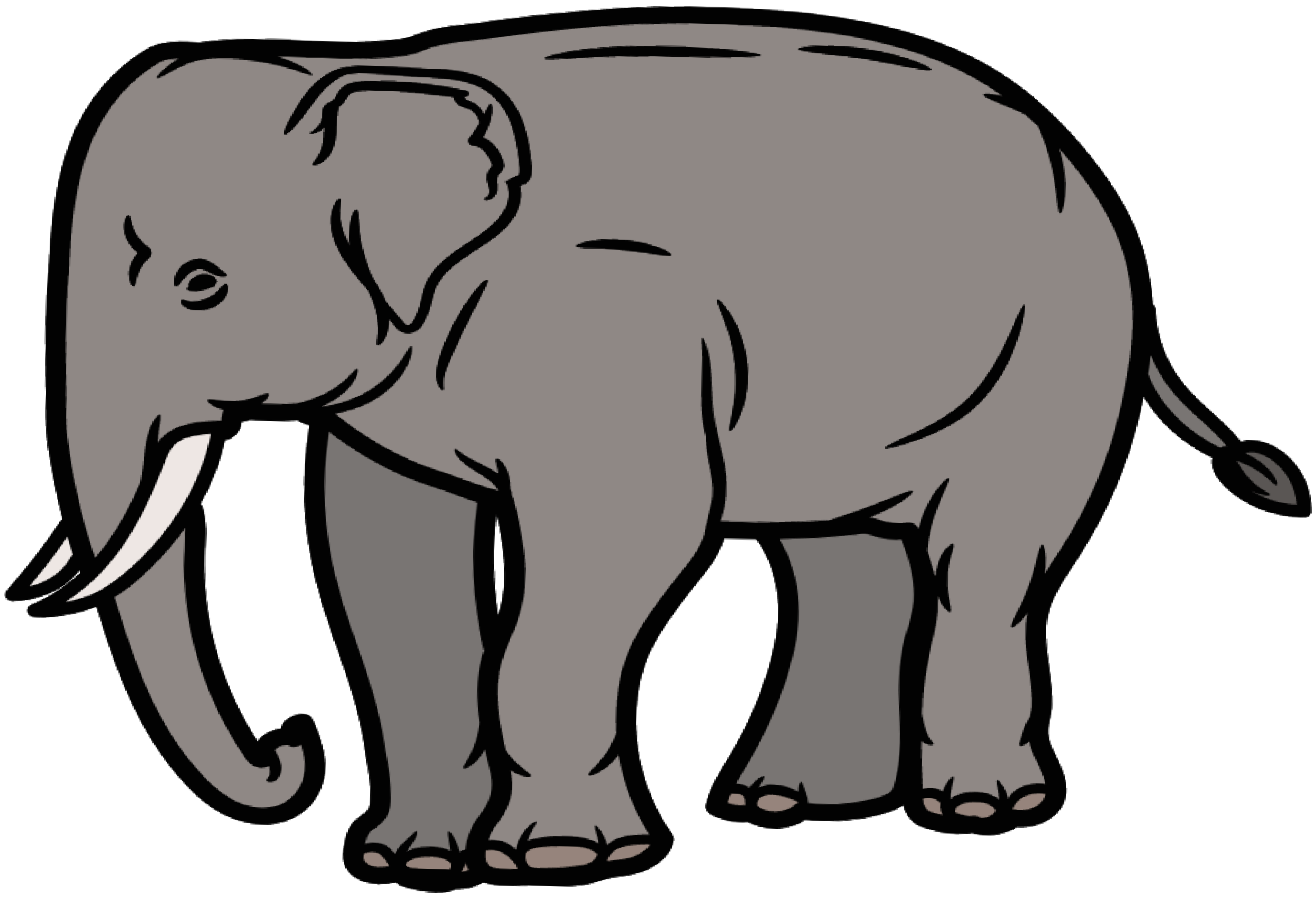

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Inspiring Local Heroes: Motivating Frontline Personnel Involved in Human-Elephant Conflict Management

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Introduction

Human-elephant conflict (HEC) poses a significant challenge in regions where human settlements overlap with elephant habitats. Mitigating these conflicts requires more than just technical solutions. It necessitates a transformation in community behavior and attitudes. Inspiration can play a crucial role in empowering local heroes—community members who can lead efforts to co-exist peacefully with elephants. This article explores how inspiration can change community behavior scientifically and outlines the role of inspiration in mitigating HEC.

Understanding Inspiration and Its Impact

Inspiration is a psychological state that stimulates individuals to pursue goals, adopt new behaviors, and overcome challenges. It is characterized by heightened emotions, increased motivation, and a sense of purpose. Inspiration can be a powerful catalyst for change, particularly in communities facing environmental challenges like HEC. When local heroes are inspired, they can influence others, fostering a collective effort toward mitigating conflicts and promoting coexistence with wildlife.

The Role of Inspiration in Changing Community Behavior

Emotional Engagement

Inspiration engages people emotionally, making them more receptive to new ideas and motivated to take action. Emotional engagement is crucial in HEC mitigation, as it helps communities move beyond fear and frustration toward a proactive approach. For instance, hearing success stories of communities that have successfully managed HEC can inspire others to believe that change is possible.

Social Learning and Modeling

Inspiration works through social learning, where individuals observe and emulate the behaviors of others. When local heroes demonstrate effective HEC mitigation practices, such as using deterrents or participating in community monitoring programs, they serve as role models. Their actions inspire others to adopt similar behaviors, creating a ripple effect that can lead to widespread behavioral change. Such an effect is critical to inculcate in managing human-elephant conflicts.

Sense of Agency and Empowerment

Inspiration fosters a sense of agency and empowerment. When community members see that their actions can make a difference, they are more likely to take initiative. This empowerment is critical in HEC mitigation, as it encourages individuals to participate in conservation efforts and collaborate with forest officials. For example, inspired community members might take lead in constructing barriers, report elephant sightings, or educating others about safe practices.

Collective Efficacy

Collective efficacy refers to a group's shared belief in its ability to achieve common goals. Inspiration can enhance collective efficacy by uniting community members around a shared vision of coexistence with elephants. When people are inspired to work together, they can pool resources, share knowledge, and support each other, making HEC mitigation efforts more effective and sustainable.

Long-term Commitment

Inspiration leads to long-term commitment by embedding conservation values within community's cultural fabric. Inspired communities are more likely to maintain HEC mitigation measures over time, even in the face of challenges. This sustained commitment is essential for ensuring the long-term success of HEC strategies.

Scientific Approaches to Inspiring Communities

Storytelling and Success Narratives

One of the most effective ways to inspire communities is through storytelling and sharing success narratives. Scientific research shows that narratives are a powerful tool for changing attitudes and behaviors. Stories of local heroes who have successfully mitigated HEC can be shared through community meetings, radio programs, social media, and educational materials. These narratives not only provide practical examples but also highlight the personal and communal benefits of coexistence with elephants.

Participatory Research and Citizen Science

Involving community members in participatory research and citizen science projects can be highly inspirational. When people contribute to scientific research, they gain a deeper understanding of the issues and feel more connected to the outcomes. For example, community members can be trained to monitor elephant movements, collect data on crop damage, and evaluate the effectiveness of mitigation measures. This involvement not only empowers individuals but also provides valuable data to improve HEC strategies.

Capacity Building and Education

Educational programs that build capacity and knowledge can inspire communities to take action. Workshops, training sessions, and educational campaigns can provide information on elephant behavior, safe agricultural practices, and non-lethal deterrents. By equipping people with the knowledge and skills they need to address HEC, these programs can inspire confidence and a sense of purpose.

Recognizing and Celebrating Local Heroes

Recognizing and celebrating local heroes who have made significant contributions to HEC mitigation can inspire others to follow their lead. Awards, public acknowledgments, and media coverage can highlight the achievements of these individuals, demonstrating the positive impact of their efforts. This recognition can motivate others to become involved and strive for similar success.

Community-Based Initiatives and Leadership Development

Supporting community-based initiatives and developing local leadership can foster inspiration and empowerment. Forest officers and conservation organizations can work with communities to identify leaders, provide leadership training, and support grassroots projects. These initiatives can include establishing community conservancies, developing eco-tourism ventures, or creating community-based monitoring programs. By empowering local leaders, these initiatives can inspire collective action and sustainable HEC mitigation.

Case Studies: Inspiration in Action

Namibia's Community Conservancies

In Namibia, community conservancies have successfully inspired local communities to participate in wildlife conservation. These conservancies are managed by local communities, who benefit from tourism and sustainable resource use. The success of these initiatives has inspired other communities to establish their own conservancies, leading to widespread adoption of conservation practices and reduced HEC.

Kenya's Amboseli Ecosystem Trust

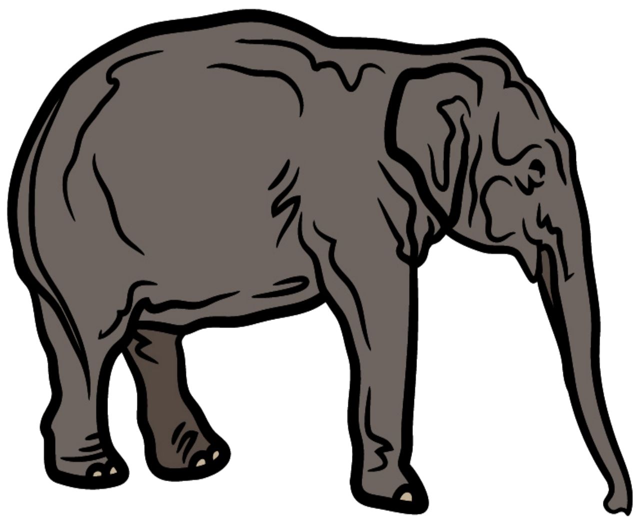
The Amboseli Ecosystem Trust in Kenya has engaged local Maasai communities in conservation efforts, inspiring them to take an active role in HEC mitigation. Through education programs, participatory research, and economic incentives, the Trust has fostered a sense of ownership and responsibility among community members. This inspiration has led to successful coexistence initiatives, such as the use of beehive fences to deter elephants and protect crops.

India's Eco-Development Committees

In India, With the help of skilled forest officers, Hathi Mitra Dals, Eco-Development Committees (EDCs) have been established in areas prone to human-elephant conflicts. These committees involve local communities in decision-making, conservation planning, and the implementation of mitigation measures. The success of EDCs in reducing conflicts and promoting conservation has inspired other communities to form similar committees, leading to a broader adoption of effective HEC strategies.

Conclusion

Inspiration is a powerful tool for empowering local heroes and transforming community behavior in the context of human-elephant conflict mitigation. By engaging people emotionally, fostering social learning, enhancing a sense of agency, and promoting collective efficacy, inspiration can drive meaningful and lasting change. Scientific approaches such as storytelling, participatory research, capacity building, and recognition of local heroes can effectively inspire communities to take action. Through these efforts, inspired communities can work collaboratively with forest officers to implement sustainable HEC mitigation strategies, ultimately leading to a harmonious coexistence with elephants. In nutshell, inspiration is a powerful catalyst in human learning, driving, engage deeply with focused subjects, and persist in their efforts to grow and innovate. It combines emotional, cognitive (creative thinking, curiosity and inquiry), and motivational elements to create a rich and fulfilling learning experience. As a forest officer with a longstanding experience of managing human-wildlife conflict situations in Madhya Pradesh and later in Chhattisgarh, I believe that inspiring people in the field would result in a positive approach towards wildlife management. I have observed HEC mitigation measures taken up in the field with inspiration and without inspiration and based on those observations, I am convinced that the inspirational inputs among trained members of Hathi Mitra dals in Chhattisgarh State can help in better managing the field situation.



Two Decades of Captive Elephant Welfare Initiatives: From Research to Reform

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Current Landscape of Captive Elephant Welfare

India has 2675 captive elephants as of a 2019, with 1678 (63%) owned privately (Pandey et al. 2022; Nigam et al. 2022; Ghosh, S. 2021). The Forest Department manages approximately 28% of these elephants, housed in zoos, rescue and rehabilitation centers, and elephant camps. Elephants owned privately live in the most compromised welfare conditions compared to those managed by the Forest Department. In recent years, the welfare of captive elephants has sparked intense debates, leading to differing views on their proper and improper uses (Bansiddhi et al. 2020). Concerns regarding the welfare of captive elephants are multifaceted and impactful, necessitating scientific evaluation to find practical solutions for their sustainability (Bansiddhi et al. 2019). In 2009, the Central Zoo Authority (CZA) of India banned the display of elephants in zoos nationwide due to concerns about their spatial and behavioral needs. However, this restriction was later lifted, and certain zoos that met the criteria for adequately housing elephants in captivity were authorized to retain them (Trumpet, 2022). Project Elephant, MOEF&CC (2020), the Wildlife Institute of India (Nigam et al. 2022), the Central Zoo Authority, and LACONES have all produced reports, articles, and guidelines highlighting welfare concerns and offering recommendations for improvement. In 2019, the Ministry established the Captive Elephant Health and Welfare Committee to address health and welfare issues of captive elephants and set up rescue and rehabilitation centers in key states. Additionally, an "Elephant Cell" was created within the Project Elephant Division to help prepare a Strategic Action Plan for mitigating Human-Elephant Conflict, conduct DNA profiling of captive elephants, and develop the National Elephant Action Plan.

Besides conducting capacity building workshops, the Project Elephant Division and Elephant Cell have created a forum for the exchange of information and education on elephants in both wild and captive settings. Since 2021, a quarterly magazine titled "Trumpet" has been published which acts as a valuable source of knowledge for veterinarians, forest officials, researchers, and policymakers. A special edition of Trumpet (2022) was released to mark the 30th anniversary of Project Elephant. This edition included a section focused on captive elephants, emphasizing the evolving management practices in India. Another special issue was dedicated to Caring for Elephants: Managing Health & Welfare in Captivity (Nigam et al. 2022). The articles in it covered a wide range of aspects including ecology and behavior, veterinary science, management and welfare, and conservation and genetics. Several esteemed NGOs in the country, including The Asian Nature Conservation Foundation (ANCF), Wildlife Trust of India (WTI), World Wide Fund for Nature (WWF) India, Wildlife Rescue and Rehabilitation Center (WRRC), and Wildlife SOS (WSOS), have highlighted the concerns and challenges faced by captive elephants in India and have played a significant role in raising awareness about these issues. According to Sections 40 and 43 of the Wildl Life Protection Act (1972), acquiring and transferring captive elephants required approval from the state's chief wildlife warden and prohibited commercial transactions. The union government proposed The Wildl Life (Protection) Amendment Bill, 2021, to legalize elephant transfer and transport. Subsequently, in March 2024, the Union environment ministry introduced the Captive Elephant (Transfer or Transport) Rules, 2024, permitting such actions for "religious or any other purpose" by a person with a valid certificate of ownership, subject to terms set by the Central Government.

Insights from a Six-Year Survey on Captive Elephants

An all-India survey (covering 1,200 captive elephants in 12 states of India) was conducted by Compassion Unlimited plus Action (CUPA) in technical collaboration with ANCF. This six-year survey yielded the most comprehensive reports on the status of captive elephants in India. The extensive survey encompassed elephants from various captive management systems including zoos (Varma et al. 2008a), circuses (Varma et al. 2008b), temples (Varma et al. 2009a), private owners (Varma et al. 2010a), travelling and begging elephants (Varma et al. 2010b), and forest camps (Varma et al. 2010c). Each of these reports offers recommendations for improving management practices to enhance the overall welfare of captive elephants respectively. An investigation report on the Population Status, Management, and Welfare Significance of Captive Elephants was also individually produced for 12 states: Andaman Islands, Andhra Pradesh, Assam, Bihar, Gujarat, Karnataka, Kerala, Maharashtra, Punjab, Rajasthan, Tamil Nadu, and West Bengal. Several notable publications emerged from this extensive survey, such as studies on the effects of temperature on captive Asian elephants in arid regions of north India (Varma et al. 2008c), development of a reliable and efficient model for elephant management and caretaker welfare (Varma et al. 2008d), application of GIS for the welfare and management of these elephants (Varma et al. 2009b), the selection of specific age and sex of Asian elephants in captivity as a reflection of cultural and economic identity (Varma et al. 2010d), investigations into incidents involving captive Asian elephants in Kerala causing mortality among mahouts (Varma et al. 2010e), and studies on the population status, trade, and welfare of captive elephants displayed at Sonepur mela (Varma and Kumar, 2010).

Exploring the two decades of research on captive elephants (2004-2024)

Numerous studies in India have aimed to understand and assess the health and welfare of captive elephants in various management systems. This review summarizes studies from the last two decades that assess the management and welfare of captive elephants, omitting those centered on veterinary science. Vanitha, V. (2007) explored various aspects related to the status and management of Captive Asian Elephants (*Elephas maximus*) at Tamil Nadu in Southern India for her Ph.D. Vanitha et al. (2008) conducted a study examining the food, feeding practices, and health conditions of captive Asian elephants (*Elephas maximus*) in Private, Temple, and Forest Department facilities across Tamil Nadu, Southern India. Their research revealed notable disparities in food provision across these settings. They recommended implementing improved food and feeding practices to promote the long-term welfare and conservation of captive elephants. Ramanathan and Mallapur (2008) conducted a study that assessed the health of 81 Asian elephants across 10 facilities in India through visual examination and a survey. Overall, the study highlights poorer health conditions among elephants at tourist camps compared to those in zoos and forest camps and recommended improvements. Vanitha and her team examined the socio-economic status of elephant keepers, shedding light on the human aspect of elephant management (Vanitha et al. 2009). The study emphasized the necessity for immediate measures to safeguard the tradition of mahoutery by enhancing the economic standing and welfare provisions for mahouts. Suggestions encompassed enhancements in wages, provision of risk allowances, implementation of insurance policies, and the provision of family accommodations, aligning with guidelines from the Project Elephant initiative under the Government of India.

Vanitha et al. (2010a) researched the demographic characteristics of captive elephants in Tamil Nadu across three management systems: private establishments, Hindu temples, and the forest department. Their findings suggest that the future survival of captive elephant populations in private and temple environments is uncertain due to the lack of breeding, rising mortality rates, and restrictions on elephant sales. Similarly, maintaining sustainability for the forest department population, characterized by a male bias and declining reproductive rates, poses considerable challenges. Vanitha et al. (2010b) examined the daily routines of captive elephants in Tamil Nadu and compared the daily activities across three systems (private, temple, and forest department) to assess alignment with natural behaviors observed in the wild. The study recommends reducing work hours for elephants in private facilities and increasing opportunities for exercise and bathing, while suggesting that temple elephants decrease periods of rest and ceremonial activities to enhance overall welfare.

Vanitha et al. (2010c) highlight challenges faced by mahouts in Tamil Nadu, including inadequate staffing and economic disparities across temple, private, and forest department systems. The findings underscore the importance of improving economic incentives and training to preserve traditional mahout skills and enhance safety in human-elephant interactions. These steps are crucial for sustaining the profession and promoting effective captive elephant management. Vanitha and Baskaran (2010) studied the effects of seasonal ambient temperature and roofing materials on captive elephants at six Hindu temples in Tamil Nadu. Observations showed that ear flapping frequency correlated positively with ambient temperature, peaking in summer and decreasing in winter. Elephants exhibited more ear flapping in housing with asbestos roofs compared to temple yards with granite roofs. Ear flapping was reduced in housing with coconut frond thatched roofs and remained moderate in houses with RCC roofs. Vanitha et al. (2011a) examined the social dynamics of captive Asian elephants in Southern India, revealing disparities in their management across private facilities, temples, and forest camps. They recommend grouping elephants in small social units to enhance welfare, particularly in temples and private facilities. The study underscores the need for experienced adult females to care for orphaned calves in zoos and advocates for educational programs to improve captive elephant management and welfare practices.

Vanitha et al. (2011b) examined how season, demographics, and management systems (temple, private, forest department) affected intestinal parasite prevalence in captive elephants in Tamil Nadu. The analysis found higher parasite rates in summer and among females, despite better veterinary care in forest department elephants, suggesting management practices play a crucial role. The study highlights the need for improved management to control parasitic infections. No publications on captive elephants in India were found for the years 2012 and 2013. The year 2014 saw research on reproductive status, stress, and traditional knowledge of captive Asian elephants. Kumar and colleagues conducted a non-invasive assessment of reproductive status and stress in captive Asian elephants in three South Indian zoos, contributing valuable data on their physiological health (Kumar et al. 2014). The research aimed to address the urgent need for focused breeding efforts to meet the growing demand for captive elephants and decrease dependence on wild populations. The study emphasized the potential of endocrine profiling of reproductive and stress hormones as a valuable tool for improving management and breeding strategies in captive elephant populations.

Srinivasaiah et al. (2014) underscored the critical importance of preserving and utilizing indigenous traditional knowledge for the benefit of Asian elephants in captivity. The study documented current practices among elephant keepers and highlighted concerns over declining birth rates within captive populations. Personality assessments of both elephants and their keepers revealed insights into the dynamics and interactions influencing welfare. Gurusamy et al. (2014) asked experts to rank welfare issues for captive elephants. The analysis of the responses found that priorities varied among groups but agreed on the importance of factors like ground conditions, group size, and healthcare. The study highlights the need for a comprehensive welfare index that considers diverse expert opinions to improve elephant care in zoos. An interesting study was conducted by Gurusamy et al. (2015), where the authors compared attitudes of people towards zoo elephants in Australia and India. Australians were more worried about how elephants were kept and were willing to pay more to visit zoos with elephants. In contrast, Indians valued elephants in zoos due to religious, cultural, and historical reasons and desired greater interaction with them. The study suggests that these diverse viewpoints should guide how zoo managers present elephants to the public. Research in 2016 focused on behavioral issues among captive Asian elephants.

Varadharajan et al. (2016) investigated stereotypies in captive elephants in Tamil Nadu, India, focusing on age, socialization, and daily routines. The study found that stereotypies were most common among elephants managed in temples, less common in private facilities, and least prevalent in Forest Department settings. These findings emphasize the need to enhance social interaction opportunities and enrich daily routines to enhance the welfare of captive elephants. Research in 2019 focused on the physiological stress and population status of Asian elephants. Menon and Tiwari (2019) presented data on the present population status of Asian elephants and identified major threats they encounter. The study also addresses issues surrounding the welfare and management of elephants held in captivity, advocating for advancements in training methods and the establishment of a unified registration system to combat the illicit trade involving captive elephants. Kumar et al. (2019) studied stress levels in captive Asian elephants using non-invasive methods like fecal glucocorticoid metabolite analysis. The study focused on body condition scores and different environments. The findings highlight the need for management practices to support the long-term survival of captive elephant populations, which have been declining.

Vijayakrishnan and Sinha (2019) provide a compelling narrative of how captive elephant traditions in Kerala have evolved over time, shifting from spiritual symbols to symbols of status and, more recently, media celebrities. The study highlights important issues like the weakening of the traditional bond between elephants and their caretakers, increased conflict incidents, and premature deaths due to commercial activities. The authors call for a detailed review of how captive elephants are managed to improve their welfare and support the harmonious coexistence of elephants and humans in Kerala. Phalke, S. (2019) explored the parameters for good captive elephant welfare through extensive systems of management for her Master's thesis. Her research centered on three key welfare parameters: social associations, activity budgets, and body condition scores (BCS), to assess the overall physical and psychological welfare of elephants using a natural-living approach.

Dhairykar et al. (2020) conducted a comparison of cortisol levels in Asian elephants across various tiger reserves (Kanha, Panna, and Bandhavgarh) in Madhya Pradesh. Their research, which included 30 elephants, showed no significant difference in cortisol levels between male and female elephants. However, an analysis based on age groups indicated that calves exhibited lower stress levels compared to adults and sub-adults. The Ministry of Environment, Forest and Climate Change (MOEF&CC 2020) issued a health assessment report on captive elephants in Jaipur, offering a thorough examination of their health status. The recommendations from this report highlight the pressing necessity for extensive enhancements in the management and care of captive elephants in Jaipur. Key priorities include addressing foot health issues, eye problems, inadequate living conditions, and the establishment of a dedicated veterinary facility. Ongoing training for mahouts and veterinarians is crucial, as is ensuring the psychological well-being of elephants through provisions for foraging, exercise, and social interaction.

Gurusamy and Phillips (2021) developed and validated the Captive Elephant Welfare Index (CEWI), which assesses elephant welfare based on critical husbandry attributes identified by experts. The study confirmed CEWI's validity through behavioral observations and cortisol measurements in Asian elephants across three zoos and three sanctuaries in southern India. In the future, CEWI should evolve with new scientific understanding of elephant behavior and social needs to stay useful and effective. As previously noted, articles on captive elephants appeared in the issues of Trumpet published in 2021 and 2022. For example, Swaroop, B. (2021) offered a historical perspective on Asian elephants, enhancing the understanding of their cultural and historical significance. Lakshminarayanan, N. (2022) discussed the implications of elephant ecology and behavior for the management of captive elephants. Nigam et al. (2022) addressed managing health and welfare in captivity, while Pandey et al. (2022) provided insights into the status and management of captive elephants in India. Vanitha and Baskaran (2022) gave an overview of the condition of captive elephants in Tamil Nadu and its implications on their sustainability. Similarly, the August 2023 issue featured an article on managing captive elephants during musth. The author addressed the challenges of musth management in captivity and proposed some precautionary measures. The article also highlighted the various phases of musth and their corresponding symptoms. In the latest issue of Trumpet (2024), two articles addressed captive elephants. One focused on their training, while the other explored housing and various enrichment practices. Knowledge sharing in veterinary sciences has been ongoing through various publications, which are beyond the scope of this article.

Conclusion

Significant progress has been made over the past two decades in improving the welfare of captive elephants in India. Efforts by various organizations, researchers, and the government have led to better understanding and management of these animals' health and needs. The wealth of research conducted has provided invaluable insights into their health, behavior, and management needs, laying the groundwork for ongoing improvements. Despite these advances, it's crucial to keep evaluating and updating policies and practices to match our growing knowledge. By working together and using new technologies, we can aim to create a more caring and sustainable environment for captive elephants, ensuring their well-being and preserving their important cultural and ecological roles.

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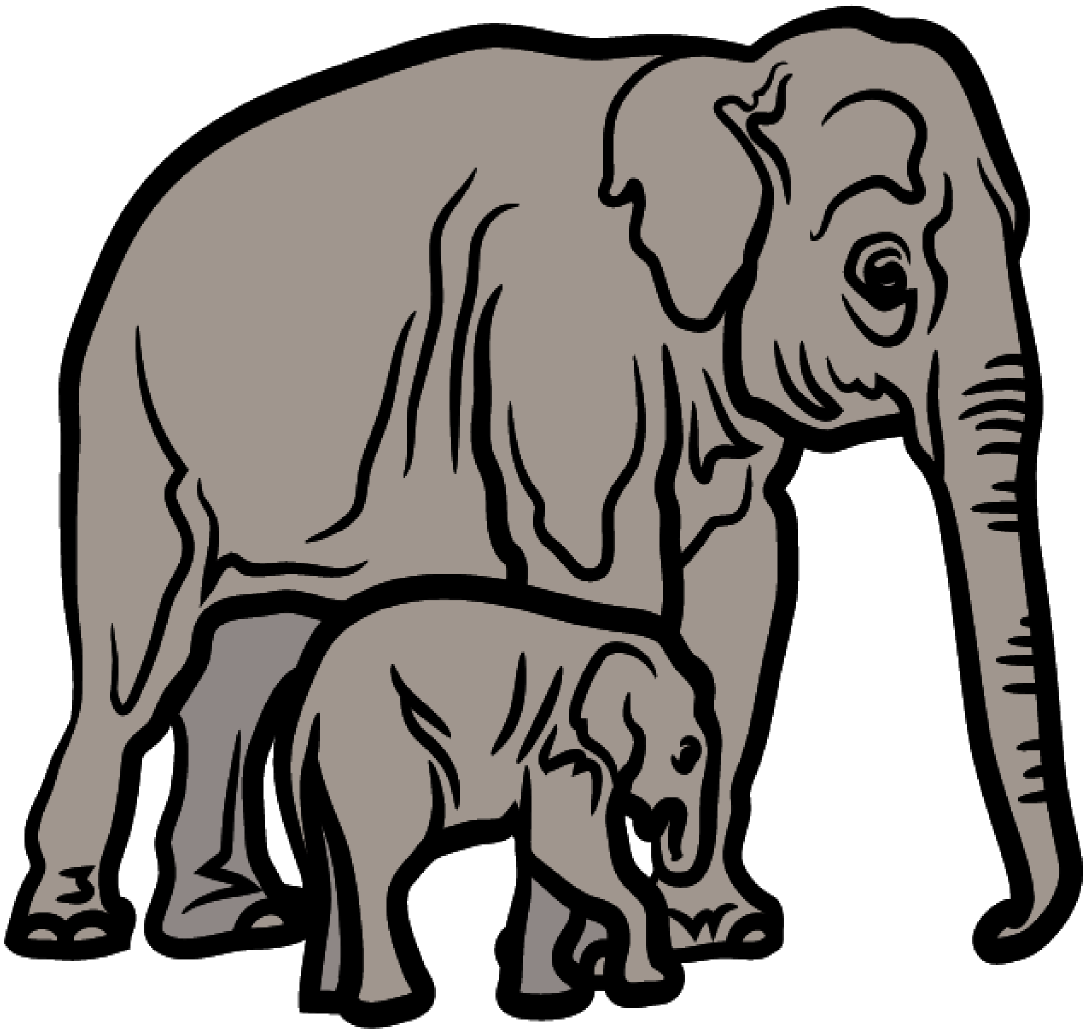

Positive Reinforcement of Elephants in Captivity

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Introduction

The earliest evidence of captive elephants likely comes from the Harappan civilization, which is around 4,500 years old. All captive elephants are believed to have been captured from the wild for captivity, both in ancient and modern civilizations (Fowler and Mikota, 2006). Elephants have had a long relationship with humans, serving as modes of transport, participating in wars, working in the wood logging industry, and being used in temples and for begging. However, elephants have never actually been domesticated, despite their long relationship with humans (Fowler and Mikota, 2006). Rather, they are forcefully dominated and controlled to a certain extent. As a result, there is often tension between the elephant and the mahout. Every year, many mahouts lose their lives to elephants in musth and during festival processions. Moreover, today, mahouts and their family members are concerned about their lives, social status, and salary, and they feel neglected by society (Varma S et al., 2010). Elephants have the largest brains among land animals and are well known for their immense cognitive skills (Connell and Caitlin, 2007). The potential danger associated with elephants has led to the training of these animals using protected contact methods. This training started in zoos in North America, Australia, and Europe, mainly for veterinary treatments such as presenting feet, nail trimming, opening mouths, and body checkups. There are mainly three types of training: i) free contact, ii) protected contact, and iii) no contact methods. Depending on the elephants, either free contact, protected contact, or both are adopted in the centers (Clubb, R. & Mason, G., 2002).

Aim and objective

The main aim and objective are to provide best medical care and management to these rescued elephants through positive reinforcement with minimal or no stress.

Methodology

To achieve this objective, these elephants need to be conditioned to voluntarily participate in their treatment, reducing any kind of risk to the mahouts and veterinarians. Operant conditioning involves modifying an animal's behaviou r, which can be controlled at some cost, such as with a favourite food. These behaviours are repeated and reinforced with rewards, which we call positive reinforcement. Zookeepers and managers across the world nowadays mostly rely on positive reinforcement training to work with captive animals. This helps build a strong bond with the animals and achieve goals like treatment and management without compromising their welfare (Fagen, A. et al., 2014). We started the positive conditioning training by building a bridge between the mahout and the elephant. A soft ball attached to a stick act as a bridge between the mahout and the elephant. A whistle blow followed by a treat (banana pieces, dates, groundnuts) is usually used to reward and repeat the behavior. Over time, many cues were taught to the elephant and are practiced every day (Table 1).

List of Cues	
Target head	Chest presentation
Forelimb right	Hip right
Forelimb left	Hip left
Hindlimb right	Tail presentation
Hindlimb left	Trunk presentation
Side body right	Teeth check
Side body left	Sit down
Right ear	Lay down right
Left ear	Lay down left
Eye presentation	Bend down

Table 1. List of Cues carried out at the center using positive reinforcement.

Result and Discussion

The Elephant Conservation and Care Centre was established in collaboration with the Uttar Pradesh Forest Department for the treatment and care of elephants. The elephants admitted to the centre are mostly traumatized, blind, lame, neglected, and crippled. These elephants are rescued from very stressful conditions. To provide better treatment without further stress, we implemented positive conditioning treatment. This approach enhances and brings a positive behavioural change in the elephants, making their approach to treatment food-driven. This behavioural change reduces the risk to mahouts and veterinarians. While working with elephants, depending on their response to different training options, we can also understand more about their cognitive abilities, how much they learn, and how much they remember (Fagen, A. et al., 2014). Most of the treatments carried out at the center are through positive reinforcement training. The training is done prior to treatment to make the elephant comfortable undergoing treatments (Figure 1-8). Positive reinforcement training should be adopted in all the captive elephant facilities for the treatment and management of the elephants whatsoever. This will eventually minimize the stress in elephants and animal welfare will not be compromised. The risk associated with the management of elephants in captivity will minimize with the introduction of positive reinforcement training.

Appendix

Figure 1 Target head

Figure 2 Forelimb

Figure 3 Forelimb left

Figure 4 Hind limb right

Figure 5 Lay down

Figure 6 Sit down

Figure 9 Ear presentation

Figure 8 Teeth check

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Conservation News

Elephant Conservation Plan:

Considering that elephant are not only the keystone species but also an umbrella and flagship species, it was envisaged to develop the Elephant Conservation Plan (ECP) for the management of the species in the large forest tracts / landscape by considering factor such as bio diversity of the topography, climate, hydrology etc.

The ECP, besides necessitating landscape-level approach for implementation in the areas under different management also considers guidelines of the Tiger Conservation Plan (TCP); management plans for the Protected Areas (PA); traditional forestry management as per Working Plan (WP) prescriptions guided by the National Working Plan Code; and Zonal Master Plan (ZMP) in the fringe areas governed by the Eco-sensitive Zone (ESZ) guidelines.

The Project Elephant tasked Elephant Cell, Wildlife Institute of India to develop the Elephant Conservation Plan in consultation with relevant stakeholders and experts. A core team was constituted by WII, comprising a diverse group of individuals including scientists, wildlife managers, wildlife policy specialists, and capacity development experts.

After several stakeholder consultations, workshops and field visits, the the draft ECP has been prepared. The final report of ECP would be released soon.

Recommended Operating Procedure: Capture and Translocation as a tool for managing human-elephant conflicts

The need for capture (chemical and physical restraint) and translocation of elephants from the wild could arise from a variety of circumstances. The 'Project Elephant' took cognizance of the increasing need for a ready-reference manual to guide field personnel and constituted a technical committee comprising reputed veterinary professionals, experienced field managers, and biologists to draft the Recommended Operating Procedure (RoP). The draft document has been prepared which is a result of numerous structured deliberations by the committee. The committee members contributed to individual chapters, which have been collated and succinctly summarized as RoP. The overarching purpose of this RoP is to lay down the procedures that will guide the field teams to:

i) Plan an elephant capture or translocation operation in the field and

ii) Minimize the risks associated with the operations through careful planning and execution.

The RoP would be relevant and useful in guiding decision-making and carrying out the operation. Since elephant capture operations are highly challenging and require careful consideration of many intricate technical aspects, it is important to have a ready reference document. Lately, increasing HEC in various landscapes has resulted in many elephant capture and translocation operations.

The RoP is applicable to all field situations involving elephants, capture using chemical or physical restraint, and the translocation of wild elephants, regardless of the administrative jurisdiction of the land. The document is being finalized and would be released soon.

Management Effectiveness Evaluation (MEE):

The 'Management Effective Evaluation (MEE)' of the following 4 Elephant Reserves in India' has been carried out by the 4 respective committees constituted by the Ministry:

i) Shivalik Elephant Reserve, Uttarakhand, Northern Region.

ii) Kaziranga-Karbi Anglong Elephant Reserve, Assam, North-East Region.

iii) Simplipal Elephant Reserve, Odisha, East

Central Region.

iv) Nilgiri Elephant Reserve, Tamil Nadu, Southern Region.

These 4 sites represented the four elephant holding regions of our country and have distinct landscapes and issues related to elephant conservation and management. The final report for the pilot MEE-ER is slated for release.

Repository of database of captive elephants in India

As part of the project on creation of a repository of database of captive elephants in India, the collection of data and the DNA profiling of more than 554 captive elephants from different parts of the country have been completed. The process has been competed in the States/ UTs of Delhi, Haryana, Chhattisgarh, Uttarakhand, Tripura, Rajasthan, Punjab and West Bengal. The sample collection has been partially completed in the States of Assam, Odisha, Andaman & Nicobar, Madhya Pradesh, Arunachal Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu, Bihar and Uttar Pradesh. The data collection and DNA sample collection is being initiated in other parts of the country as well.

All India Synchronized Elephant Estimation:

The Phase I and Phase II of the project have been completed. The process of field sampling in the North East States has been initiated and would be completed soon. The Ministry is regularly monitoring the progress of the exercise and all the required support is provided to the State Forest Departments of the North Eastern States and the Wildlife Institute of India to carry out the all India Synchronized Elephant Estimation.

Standardizing the protocol for elephant estimation:

The Project Elephant has tasked Wildlife Institute of India (WII) to evaluate and standardize the protocol for elephant estimation in the country and has sanctioned a project titled "Evaluation of efficacy of various population estimation methods for Elephants, to develop population monitoring protocol Project" Phase-I. WII has initiated a study on an isolated elephant Western Rajaji National Park, spread across an area of 558.05 sq.km, consisting of 7 ranges i.e., Ramgarh, Chillawali, Kansrao, Dholkhand, Beribara, Motichur and Haridwar.

Field data collection and basic data processing completed. Nine (09) different methods are being tested for elephant population monitoring and developing monitoring protocol. The data collection has been completed and the analysis is ongoing. The protocol would be soon.

Mapping Human Elephant Conflict hotspots:

Under the project titled "Understanding Elephant Conflict Issues for Suggesting Conflict Reduction Measures", the Wildlife Institute of India is analyzing the various aspects of the human-elephant conflict in the landscape through the following main objectives:

i) Development of village-level database

ii) Assess the present status of human – elephant conflict

iii) Assess villages' vulnerability to conflict

iv) Tracking forest loss and pattern of fragmentation in target states

v) Suggest measures for mitigating conflict

So far division-wise data on human-elephant conflict has been collected from the three states Assam, Jharkhand and Chhattisgarh. Exploratory data analysis and appropriate maps were prepared with the data. Drivers of conflict in these areas being analyzed from the data. Various conflict management strategies have been collated and the analyses being carried out.

Joint surveys of the critical stretches of the railway lines passing through the elephant habitats

The Ministry with an aim to elephant deaths due to train hits identified 110 numbers of sensitive railway stretches with support of Wildlife Institute of India, Dehradun and shared with the respective State Forest Departments and the Ministry of Railways. Joint surveys of the critical stretches of the railway lines passing through the elephant habitats
in Arunachal Pradesh, Assam, Jharkhand, Karnataka, Madhya Pradesh, Nagaland, Odisha, Tamil Nadu, West Bengal, Uttarakhand were conducted jointly by the officers/officials of Project Elephant, MoEF&CC, Wildlife Institute of India, Ministry of Railways and State Forest Departments. The joint team visited the critical stretches of railway tracks which were identified by the Forest Department and the site-specific mitigation measures, based on the location to mitigate train-elephant collisions were shared with the Ministry of Railways and the State Forest Departments for consideration and implementation.

An online railway portal has been developed by WII for monitoring the implementation of mitigation measures. The details of the survey conducted and reports finalized are available under the portal.

7th Meeting of the Central Project Elephant Monitoring Committee:

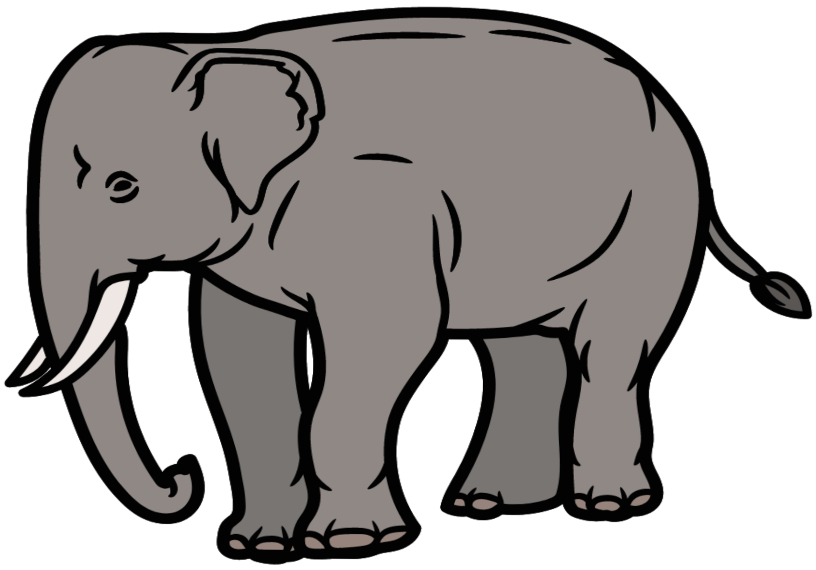
The 7th meeting of the Central Project Elephant Monitoring Committee was convened on 19th July, 2024 wherein matters such as All India Synchronized Elephant Estimation, Recommended Operating Procedure (R.O.P.) for utmost care of elephants in the procedure of capture & translocation during Human-Elephant Conflict situations, Eco-Friendly Measures to Mitigate Impacts of Linear Infrastructure on Wildlife with specific chapter related to Elephants, joint site-inspection of the sensitive railway stretches, framework for Elephant Conservation Plan, Management Effectiveness Evaluation for Elephant Reserves were deliberated.

4th Meeting of the Captive Elephant Healthcare and Welfare Committee:

The 4th meeting of the Captive Elephant Healthcare and Welfare Committee was convened on 26th July, 2024 wherein matters such DNA profiling of captive elephants in India, guidelines/SOPs for housing, feeding and other record keeping of captive elephants, revision of existing document about training of Mahouts, advisory on procedure for measurement & trimming of tusks and foot care of captive elephants and death of elephant due to Elephant Endotheliotropic Herpesvirus (EEHV) were deliberated.

Land-use land-cover version-2:

As part of developing management information system (MIS), PE collated basic information on all the Elephant Reserves of India and came up with a land use land cover classification (LULC) of the ERs during 2022.
In this version, using high resolution geospatial layers, LULC with emphasis on aspects like terrain, gradient, elevation and water courses have been pictorially presented for all the 33 ERs that presently exist. The document can serve as a ready reference to understand land cover of the ERs.



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Nature Protects if She is Protected

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