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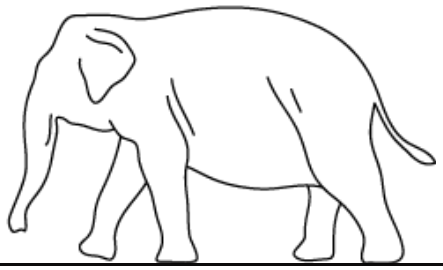

PROJECT ELEPHANT

MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE

2025

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CONTENTS

From the **Director's desk**

Ramesh Kumar Pandey

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

I am pleased to state that in this edition of the "Trumpet" newsletter, we are sharing the work done for the conservation and protection of elephants, along with the recent developments and achievements made by Project Elephant (PE) and the Elephant Cell, Wildlife Institute of India, during the period August–December 2024. In this edition, articles primarily focus on human-elephant conflict, conservation, and welfare, exploring themes like transboundary conservation, capacity building under Project Elephant, and innovative approaches such as AI. This also includes case studies on problem elephant management and the impacts of coal mining regions on elephant populations. The conservation news, the work done for the betterment of elephants and their habitats is highlighted. The last six months have been very active in PE as a number of meetings, and workshops were organized. The 20th Steering Committee Meeting of Project Elephant was held on 12 August 2024 at Raipur, Chhattisgarh, under the chairmanship of Shri Bhupender Yadav, Hon'ble Minister, MoEF&CC. The meeting deliberated upon further strengthening elephant corridors and the management of elephant reserves, and it emphasized efforts to deal with human-elephant conflicts in a responsive manner. A final report covering ten states, suggesting mitigation measures to prevent elephant-train collisions, was released during Meeting.

The 4th Meeting of the Captive Elephant Healthcare and Welfare Committee (CEHWC) was held on 7 August 2024, wherein deliberations on various aspects of captive elephant healthcare, welfare, and the capacity building of mahouts were undertaken.

During World Elephant Day 2024, the Ministry released a document on the Framework for Elephant Conservation Plan, intended to serve as a guiding document for managing Elephant Reserves. To further efforts in managing captive elephants, a Recommended Operating Procedure for capturing and translocating elephants in distress and conflict was also released during the event. A document titled Management Effectiveness Evaluation (MEE) of Elephant Reserves in India: Pilot Study & Revision of Criteria & Indicators was also released. As part of developing a Management Information System (MIS), PE has collated basic information on all Indian ERs and developed a Land Use Land Cover (LULC) classification of the reserves using high-resolution geospatial layers. To further detail the document, a second version of the LULC was released, which pictorially presents the LULC for 33 ERs, emphasizing terrain, gradient, elevation, and watercourses.

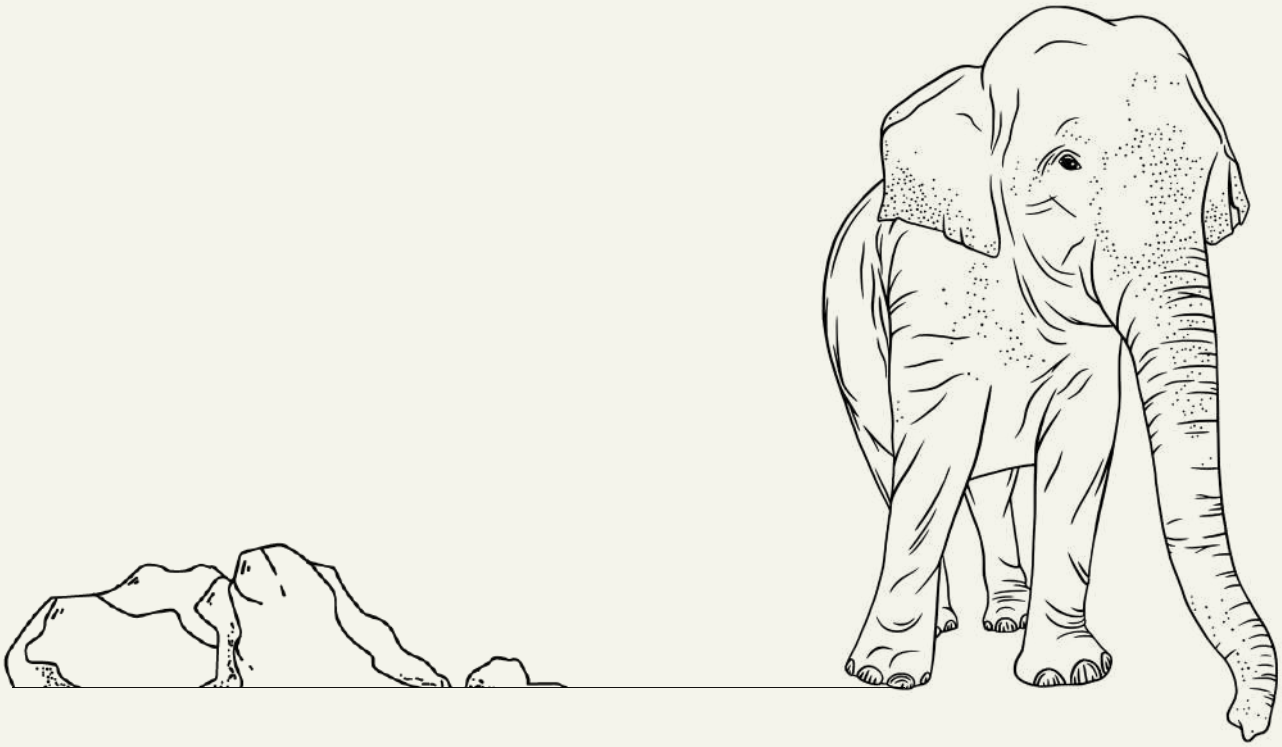
As part of the development of Guidelines for the Elephant Conservation Plan (ECP), two stakeholder consultation workshops were conducted. Based on feedback, the Guidelines for the Preparation of the Elephant Conservation Plan (ECP) for Elephant Reserves have been prepared. These guidelines now need to be adopted by the states for preparing Elephant Conservation Plans for their respective reserves. A project on "Planning Conservation in Elephant Reserves—Developing Elephant Conservation Model Plan" has been sanctioned by the Ministry for the Nilgiri Elephant Reserve.

As part of the project to create a repository database of captive elephants in India, data collection for more than 1,524 captive elephant biological samples from 21 states.

The process of Phase I sampling for the All India Synchronized Elephant Population Estimation 2022 is being completed in the North-Eastern states. The Ministry is regularly monitoring the progress of the census exercise, and all the required support is being 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 following events are on the calendar: a Regional Coordination Meeting on 11 January 2024 to discuss the Regional Action Plan for Comprehensive Understanding and Management of Human-Elephant Conflict in North Eastern India, and a Capacity Building Workshop on "Enhancing Elephant Welfare in Captivity" for Elephant Custodians and Handlers, scheduled to be held in Guwahati, Assam. A four days training program on "Approaches in Monitoring Elephant Populations and Managing Human-Elephant Conflicts" for the officials of the Himachal Pradesh Forest Department is also scheduled for January 2025 at WII.

I am confident that the habitats, landscapes, and corridors of elephants will be preserved, and that future generations will live in harmony with these magnificent creatures, thanks to the coordinated efforts of the Central Government, State Forest Departments, line departments, civil society, and other stakeholders.



Status and Management of Elephants in Coal Mine Landscape of Odisha

A Snippet of Study Conducted in Angul Division

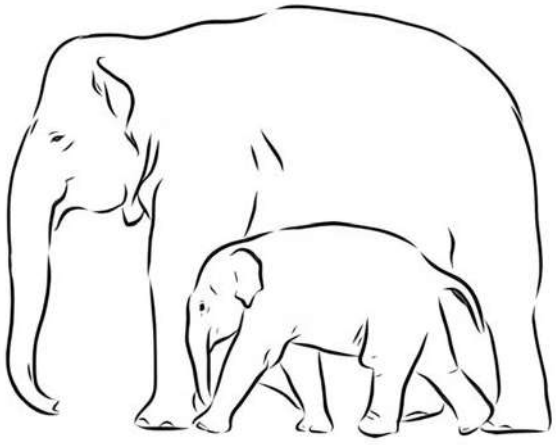
Karthy, S.[1]

Gopi, G.V.[1]*

Abstract

India's rapid economic development demands enormous energy consumption, which exerts pressure on the natural resources and its wildlife. The state of Odisha finds itself in the midst of the development and loss of habitat due to its abundant coal reserves, especially in the district of Angul. While it is a hub for coal mines, it is also a major foraging ground and corridor for migrating elephants from Sambalpur Elephant Reserve, Mahanadi Elephant Reserve and Satkosia Tiger Reserve. Using geospatial analysis, habitat suitability modelling, and conflict data from forest department it is predicted that the Angul division would lose about 390 km2 of forest if the proposed coal blocks come into operation. This loss of forest habitat, combined with the growing number of human deaths due to elephants in the Angul forest division would result in increase in conflict situation and devastating for the elephant population in Odisha.

Keywords: Angul district; Coal mines; Elephant Reserve; Habitat suitability modelling



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Introduction

India's elephant population constitute 60% of the total Asian elephant population, contained within <30% of contiguous forests and isolated patches of forests (Tripathy et al. 2021). The consequences of living in such close proximity to human habitat is, 400 human fatalities by elephants, 100 elephant deaths due to retaliation by people and close to 50,000 families affected due to crop depredation by elephants every year (MoEF&CC 2010).

The state of Odisha holds the highest number of Asian elephants (1,976 individuals) in the East-central region of India. This is 63% of the entire east-central population (3,128) and 6.5% of the total elephant population in India as per 2017 estimation (Trumpet 2020). The Human-Elephant Conflict is of utmost priority in terms of wildlife management in the state of Odisha. The state has elephant presence in 43 out of 50 forest divisions with a growth rate of 1.2% between 2015 and 2017. But certain forest divisions in Odisha experiences disproportionately high conflict compared to others, namely Angul, Dhenkanal, Keonjhar, Athmallik, Athgarh, Rourkela, Baripada, Karanjia and Sundergarh (Sukumar et al. 2018).

Among the aforementioned divisions, the Angul division provide habitat connectivity to the migrating elephants from Mahanadi Elephant Reserve (South) and Sambalpur Elephant Reserve (West). This division borders Satkosia Tiger Reserve, Mahanadi Elephant Reserve and fed by two major rivers, Mahanadi to the south and Brahmani to the north. As much as this division is important to elephants, it is also recognized for its coal wealth which accounts for 20% of India's coal stock. This has led to rapid developmental activities like thermal power plant, steel plant, road and railway networks, transmission lines and pipelines in Angul division (Site Specific Elephant Management Plan for Angul Forest Division, 2022). Most part of the division is expected to be leased to coalmine industries in the near future, which may turn out catastrophic for the elephants as well as the existing conflict scenario in the entire state of Odisha.

In this light, a study was conducted in the year 2023 in the Angul division towards understanding the status of elephants in coal mine landscape using mere geospatial methods.

Methods

Proposed coal mine boundary

The Angul region is proposed to become a massive coal block region in the future. This landscape has been compartmentalized to be leased by the government. These proposed coal block boundaries were provided by the Forest Department of Odisha.

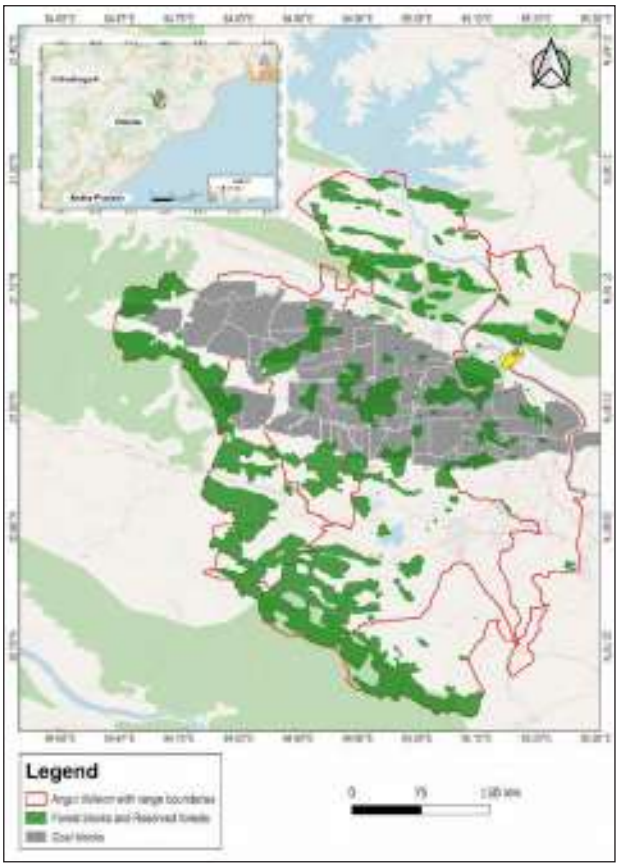


Fig 1. Angul Forest Division with Range boundaries, Forest blocks, and Coal blocks

Elephant occurrence data

Data regarding the forest division boundary, forest boundary, and elephant movement between 2018 and 2022 were obtained from the Divisional Forest Office of Angul. The elephant movement amounted to 4402 presence points after subjected to removal of repeated entries and spatial thinning process in R using Wallace package to remove occurrence data within 10 km diameter (Kass et al. 2018).

Forest cover

The Forest Cover and Reserved Forest boundaries were provided by the forest department.

Human-Elephant Conflict data

Data on human deaths due to elephant attacks and number of elephant deaths in human habitations between 2010 and 2022 were obtained from three forest divisions of Angul, Athmallik, and Deogarh respectively for comparing the trend.

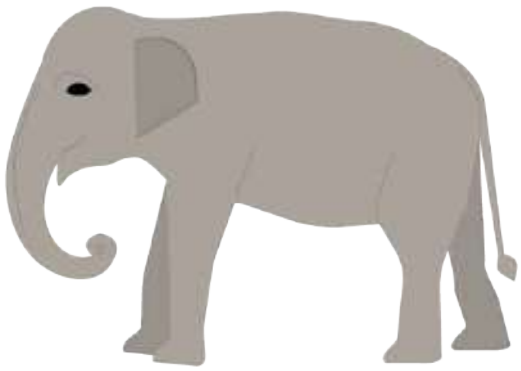
Geospatial approach – Maxent settings

The MaxEnt approach was applied to determine the suitable habitat for the elephants in the Angul division. We used 19 bioclim and elevation layers retrieved from worldclim 2.1 (Fick & Hijmans. 2017). Slope was derived from the elevation layer in QGIS (version 3.22.11). NDVI, Land Use Land Cover (LULC), Land Surface Temperature (LST), Burned area, Vegetation Condition Index, and Nightlight were processed and downloaded using Google Earth Engine. A collinearity between the selected environmental variables (layers) was examining pairwise correlation. This led to selection of 14 layers from 27 that had a correlation coefficient of <0.70 (Anand et al, 2021) (Table 1).

S. No.	Variables used
1	Bio 1 – Annual mean temperature
2	Bio 2 – Mean diurnal range
3	Bio 4 – Temperature seasonality
4	Bio 6 – Minimum temperature of the coldest month
5	Bio 12 – Annual precipitation
6	Bio 14 – Precipitation of driest month
7	Bio 17 – Precipitation of direst quarter
8	Slope
9	Normalised Difference Vegetative Index
10	Land Use and Land Cover
11	Land Surface Temperature
12	Burned area
13	Vegetation Condition Index
14	Nightlight

The settings we used for running the MaxEnt model is as follows: The maximum number of background points for pseudo-absence is 10,000; Random test percentage was set to 75% which calibrates model through random sampling and remaining 25% will be used to test the model performance; maximum iterations was set to 5000; The model was run for 15 times (replicates) using subsample replication to evaluate the accuracy of the model and the average output value was used to estimate the suitable spatial habitat (Liao et al, 2017) and threshold was selected to 'minimum training presence'. The jackknife test was enabled in Maxent to indicate the amount of gain from all the variables together and from individual variable (Anand et al, 2021).

The Area Under Receiver Operating Characteristic (ROC) Curve, in short AUC, shows the entire area under the entire two-dimensional area under the entire ROC curve. The AUC value is a straight forward representation of the predictive performance of the Maxent model, meaning the higher the AUC value, the better the model and valued from 0 to 1. A higher AUC value (0.5 or more) indicates that the distribution is less random (high specificity) and greater the correlation between environmental layers and model (Phillips and Elith. 2010).



Results

MaxEnt output

The MaxEnt results gave an AUC value of 0.86 which is considered to be better than random model (Fig 2). Out of the 14 variables scrutinized, the five major variables to affect the distribution of elephants are Precipitation of Wettest Quarter (Bio 16) - 61.3%, NDVI - 9.8%, Minimum Temperature of Coldest Month (Bio 6) - 5.8%, LULC – 4.5%, and Nightlight – 4.4%. The MaxEnt output shows that most of the habitat utilised by the elephants fall over the proposed coal block region as evident from the figure 3. There are already operational coal mines in the Angul division which again hinder the movement of the elephants. If all the inactive coal mines come into operation, it would lead to destruction of about 390 km2 of forest from the Angul division.

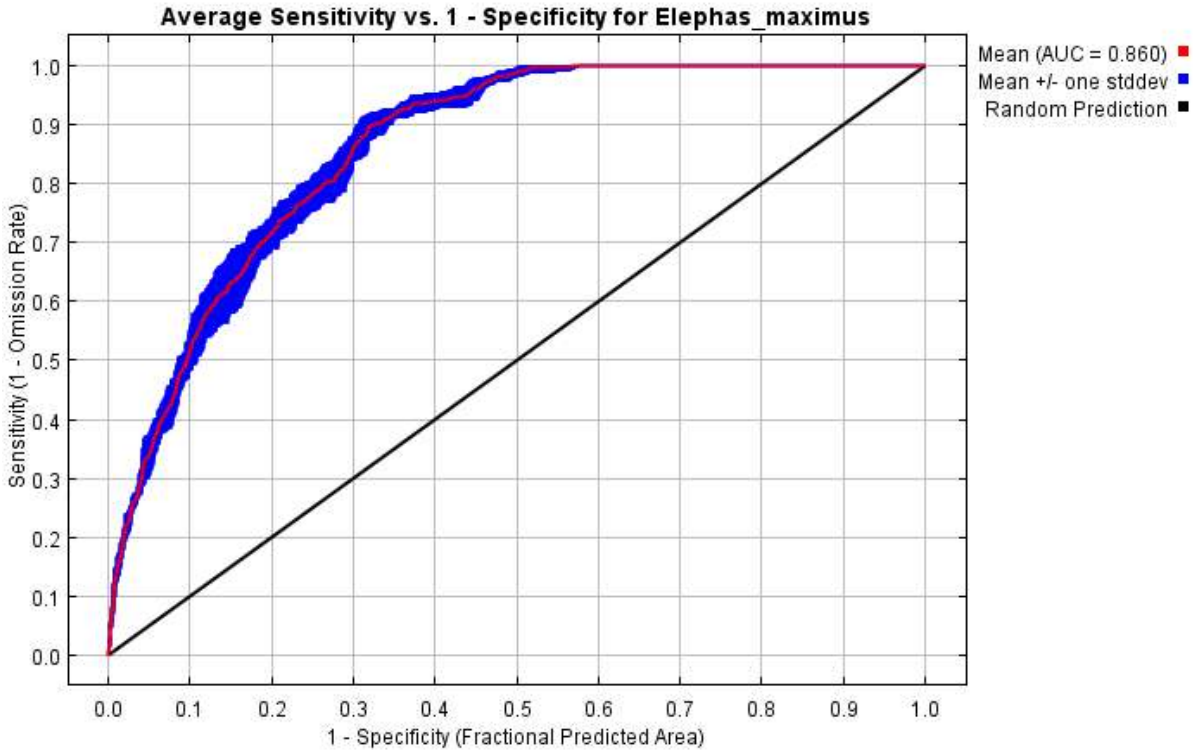


Fig 2. ROC curve for the model

Human-Elephant Conflict trend

The conflict data shows that the Angul Forest Division recorded the highest number of human deaths (89 persons) due to elephants with an average of seven persons killed every year. Athmallik division (22) and Deogarh division (23) had comparatively fewer human deaths due to elephants between 2010 and 2022 with a comparatively low average deaths of 1.69 and 1.77 person/year. There were no human deaths report in Deogarh for three years, thus revealing this division to have comparatively fewer human deaths due to conflict with elephants. The number of human deaths reached an all-time high between 2019 and 2021 in Angul division. Overall human mortality due to elephant attacks, is a more sensitive issue and will affect the elephant conservation in this landscape.

The number of elephant deaths recorded between 2010 and 2022 was 107 in three divisions. The annual elephant death rate shows that Angul division recorded the highest number of deaths (51 elephants), followed by Deogarh (33 elephants) and Athmallik (23 elephants) divisions. Only in the year 2016, Deogarh division recorded highest number of eight elephant deaths. The average death rate per year, estimated based on 13 years was more in Angul (3.29 elephants/year) and low in other two divisions. Annual death rate based on reported years showed little increase and similar trend is visualised in case of human death. Due to high fluctuation in elephant deaths across the years no increasing trend was observed (Fig 4).

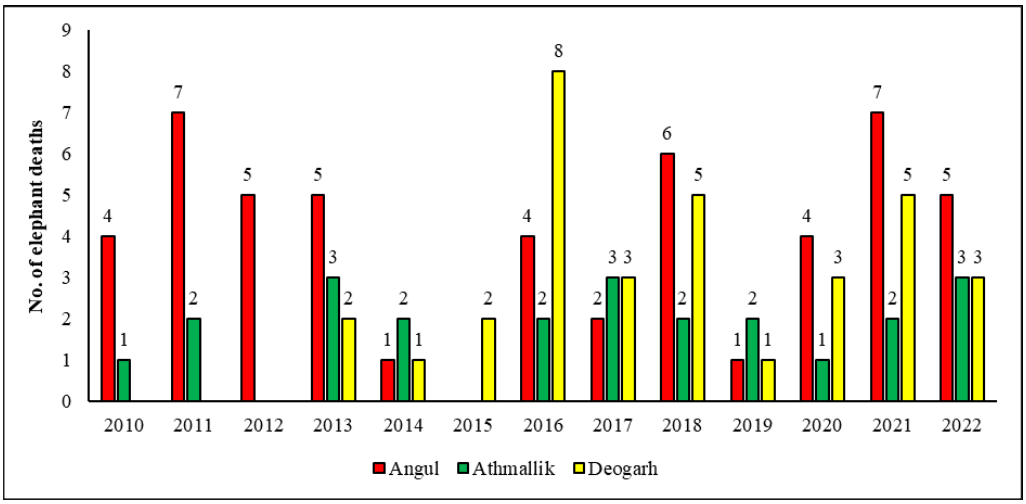


Fig 5. Elephant deaths in Angul and adjacent divisions

Every year nearly 17% of forest is lost to infrastructure led development in India (Madhok. 2023). Considering the current situation, about 80% of India's elephant range exist outside protected area (Kshettry et al. 2020). Between 1700 and 2015, India has lost 86.2% of its native elephant habitat and of the current range only 34.6% is considered suitable as of 2015. This is due to development driven destruction of forests for agriculture, resource extraction for commercial use and infrastructure development for economic growth (Savino. 2024). Among the aforementioned, mining was found to be the leading cause of habitat fragmentation in the states of Jharkhand, Chhattisgarh, Odisha and Southern West Bengal (Menon. 2017). At this rate of deforestation, it is expected to aggravate the already existing Human-Elephant Conflict situation in the Angul division. The study reiterates the importance of managing habitat outside protected areas and stringent Environmental Impact Assessment regulatory framework for conservation of India's wildlife.

Management

Some of the management interventions suggested for the Angul division are

1. Reconsideration of declaring the entire coal belt of Angul district for mining use.
2. Establishing habitat connectivity between Satkosia Tiger Reserve and Sambalpur, Deogarh divisions by forest restoration along the west border of Angul division.
3. Strengthening the Similipal-Satkosia Tiger Corridor as elephant utilise the same for migration.
4. Elephants prefer open grasslands and sparsely dense deciduous forest for food and shelter. The connectivity should include open grasslands wherever possible. Elephant food plants to be planted within the forest land.
5. Construction of overpass and underpass in the southern part of Angul division where a major highway (NH55) and railway line traverses, connecting the capital city of Bhubaneswar with Dhenkanal, Angul, Badakera, Boinda, Redhakhol, and Sambalpur. This road and railway line are constructed close to each other resulting in elephant deaths.
6. Sensitising locals, especially villages at the forest edge, about elephant behaviour (activity pattern in summer, monsoon, and winter season) and ways to avoid encounter.

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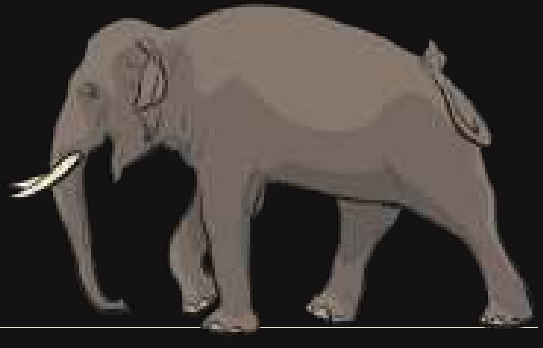

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Where Worlds Collide: Rethinking Human-Elephant Relationships in Udalguri, Assam

Richard Sangma

Project Associate-II,
Wildlife Institute of India

Human-wildlife conflict is the phenomenon whereby conflicting circumstances arise between humans and wildlife in the form of crop raiding, cattle depredation, predation on managed wild animal species, or loss of life (Woodroffe et al., 2005). Conflict between humans and wildlife often garners significant attention when it involves threatened species or impacts human welfare (Saberwal et al., 1994).

Two worlds collide daily in the heart of the North-Eastern States, Assam, India: that of the humans who have built their lives on the ground and that of wild elephants searching for survival in a changing environment. This intricate relationship, full of both wonder and conflict, has always been a subject of major interest in the field of conservation science, and Assam being an abode to the largest population of elephants holds potential grounds to understand these relationships. And thus formulates an important question: how people and animals might negotiate a shared environment in a world where human dominance is increasing? The number of Asian elephants, Elephas maximus, in the wild is continuously declining, primarily due to habitat loss and fragmentation resulting from growing human populations and related increased demand for resources (Sukumar, 1989; Leimgruber et al., 2003). In Assam, this has led to fast and extensive agricultural development, as well as the degradation of forests. This has caused a significant reduction in forest cover, an

increase in human elephant conflict, and a degradation of the region's traditional respect for elephants (Fernando et al., 2005). Elephants are a keystone species, and their movements shape ecosystems, from dispersing seeds to creating trails used by other animals (Sukumar, 2003). Yet, their natural habitats have been fragmented and lost, largely due to human activities such as deforestation, agriculture, and urbanization.

The Udalguri district in Assam offers a striking example of this trend. Historically, colonial land-use policies reshaped the region, replacing biodiverse forests with monoculture tea plantations and agricultural fields (Behal, 2014), which continued till date, leading to further forest degradation and habitat fragmentation (Sharma et al., 2012). Such changes not only displaced local human communities but also disrupted elephant populations, forcing them into closer and more frequent contact with people.

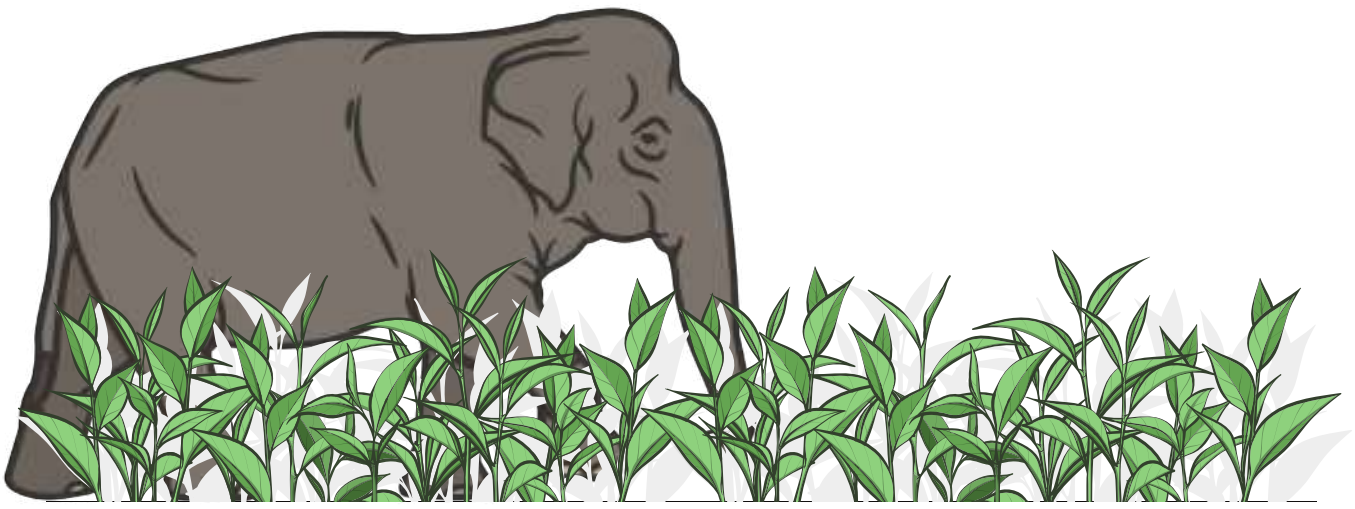
As forests receded, elephants adapted by moving through tea estates and agricultural settlements. However, these adaptations often result in what is termed "human-elephant conflict" (HEC). Crop raiding, property damage, and, tragically, electrocution are common outcomes of this interaction. During my fieldwork, I observed that high-voltage power lines running through some areas in Udalguri, often uninsulated, pose significant risks to elephants, making electrocution a leading cause of their unnatural deaths. Addressing this requires better infrastructure and enforcement, such as insulating power lines and establishing safe corridors for elephants.

Tea estates in Udalguri have become more than just sites of economic activity; they are now critical transit routes for elephants navigating fragmented landscapes. During my fieldwork, I observed that these plantations are often strategically located near rivers. Elephants frequently use these tea estates as corridors, moving along the edges of rivers to travel between forested areas. With many tea estates adjacent to riverbanks, offers elephants a dual advantage-access to water and connectivity between fragmented forest patches. However, they do more than just pass through these plantations. I noticed that elephants often linger in tea estates for extended periods, especially during crop-raiding events, probably because these areas serve as temporary shelters where elephants can rest, forage, or regroup before venturing into human-dominated areas. Thus, we can procure insightful information on their movement by simply studying these behaviours. Scientific studies can further clarify these connections, using tools like GIS mapping and telemetry to identify key corridors. Such insights can inform targeted conservation efforts, integrating both riverine ecosystems and tea estates into larger habitat restoration plans.

During colonial times, Adivasi communities were brought to Assam to work in tea plantations (Behal, 2014), intertwining the lives of these communities with elephants, and over generations, they have established their homes and livelihoods in these plantations, struggling with poverty, displacement, and limited access to resources (Banerji & Willoughby, 2019). Interestingly, these communities have learned to survive parallel to these gentle giants. As both have been forced into a "need economy," where survival depends on navigating shrinking resources and adapting to a fragmented environment (Sanyal, 2007). Just as community members work tirelessly in tea plantations or take up daily wage labor to sustain their families, elephants labor through the night, searching for food in agricultural fields and plantations. One striking observation from Udalguri is a complex interplay of conflict and coexistence: where some consider them a threat, others empathise with them, understanding that they, too, are victims of the changing landscape. This duality—of fear and respect—defines human-elephant relations in Udalguri. Moreover, this has also created a unique dynamic, not just of competition but also of mutual adaptation. Villagers have learned to interpret the signs of elephant presence, from distant calls to fresh dung on the path. And elephants, in turn, have learned to navigate human landscapes, avoiding busy roads during the day and moving under the cover of night, highlighting a level of intelligence and resilience in both species, contemporarily underscoring the burden of coexistence, for man bears the brunt of economic loss, while the animal faces the risk of injury or death in retaliation for its actions.

As observed from my field, this relationship between humans and elephants in Assam is challenging yet inspiring. These estates are more than plantations they are a source of livelihood for locals and critical transit routes for elephants, often serving as temporary shelters. Owing to the cultural virtues and traditional knowledge of the locals and mutual respect for the co-inhabitants, this bittersweet relationship between man and elephant has been prevalent since ages. However, it is imperative to understand this relation from a scientific point of view. More scientific interventions can help understand these interactions and develop effective solutions, consequently shaping a better future for both.

Coexistence isn't just about resolving conflicts it's about reimagining landscapes where both humans and elephants can thrive. By providing elephants with safe passage and access to resources, we can reduce the pressure on human settlements. At the same time, empowering local communities through education, healthcare, and sustainable livelihoods can help mitigate the economic impact of living alongside wildlife. With the blend of the wisdom of local communities along with scientific interventions, Assam can lead the way in fostering harmony between its people and the gentle giants that share their land.



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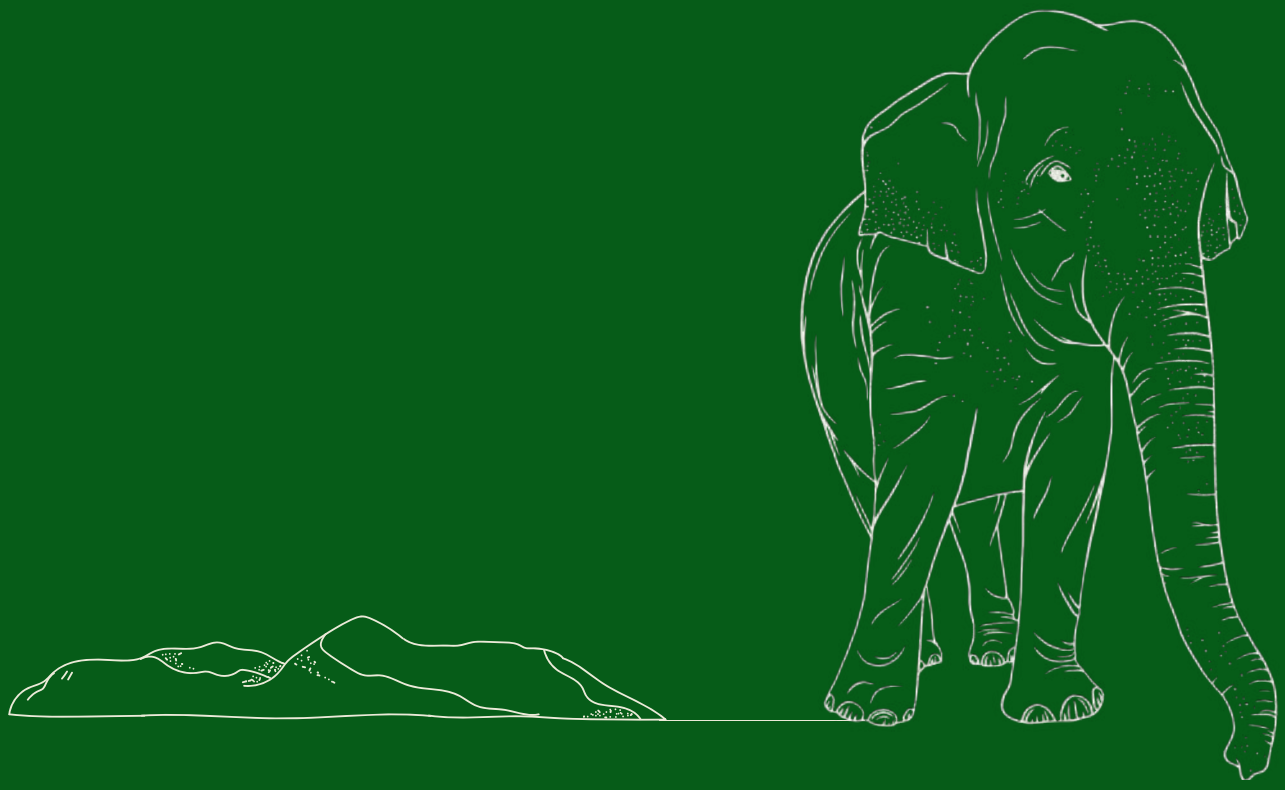

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Giants Across Border: A Transboundary Conservation Challenge

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Conservation beyond borders is best manifested in trans-boundary landscapes where mere political boundaries are unable to restrict the natural ecological processes such as the flowing of rivers and the migration of large-bodied animals. At the same time, trans-boundary utilization of natural resource by means of legal (international water sharing treaties) and illegal (trade in banned wildlife) mechanisms is also synonymous with trans-boundary landscapes. Ideally, trans-boundary cooperation should ensure better control of problems such as forest fires, poaching and human-animal conflict all of which can impact the sustainable use of natural resources by the local community living in the vicinity of such landscapes (Sandwith et al. 2001). Through this article, we tried to highlight the need to address human-animal conflict through active transboundary management initiative that may also help in long-term preservation of long ranging species in human-dominated landscapes of Asia. For example, in India each year, human-elephant conflict results in approximately 300 human deaths and damage to 10,000-15,000 houses and 8-10 million hectares of crops, while over 200 elephants die due to human-related activities which include poaching for ivory or meat, poisoning, cattle-borne diseases, electrocution and collision with trains (Bist 2002).

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Elephants are known as a 'keystone species' in an ecosystem as they have a large influence on the community through both direct and indirect ways (Nath et al. 2009; Power et al. 1996). The elephants are one of the widely studied animals across its range. The Asian elephant (Elephas maximus) has also been studied in all aspects during the last one century (Daniel 1980; Ishwaran 1984; Jackson 1985; Oliver 1978; Santiapillai & Suprahman, 1986; Storer 1981; Sukumar 1989, Choudhury 1999), and human-elephant conflict is recognized as one of the main threats for the survival of Asian elephants (Choudhury et al. 2008). The estimated population of Asiatic elephants in India at present ranges from 21,000-25,000 making it the highest in the world. Out of this one large population of 3800-5800 elephants ranges along the Himalayan foothills from northern West Bengal, eastward through Assam touching southern Bhutan and Arunachal Pradesh and Manas National Park (Sukumar & Santiapillai 1996; Lahkar et al. 2007). However, in the northeastern part of India during 1987-97 nearly 17,300 sq. km of forests (mostly elephant habitat) was lost (Forest Survey of India, 1999) of which at least 50% was elephant habitat. Although its overall range remains the same, but the expansion of human habitation, destruction of habitat for agriculture, and poaching have resulted in an overall sharp decline of the wild population, besides fragmenting the habitat (Choudhury 1999; Lahkar et al. 2007) and ultimately squeezing the animals into narrower areas of remaining habitats (Nath et al. 2009). In most cases, crops surround these remnants of habitats or agricultural fields that elephants like to feed upon. Thus, elephants frequently raid and destroy crop fields (Hails et al. 2006). Human–elephant conflict has become a severe socioeconomic and political issue today. Moreover, the number of people killed by elephant is raised to 400 per year (Baskaran et al. 2011), compared to approximately 200 in the 1980s (Rangarajan et al. 2010). In 2010, this number increased to over 400 (Baskaran et al. 2011). Subsequently, 67 people were killed by wild elephants in West Bengal alone in 2011 (Panja and Mistri, 2018). There has been an escalation of human-elephant conflict largely because of expansion of human population (Wilson et al. 2013), and forest fragmentation (Fernando & Pastorini 2011) which led to a significant decrease in forest cover, and growing intolerance towards wild animals and elephants (Fernando et al. 2005).

A study by Wang et al. (2006) examining farmers' attitudes toward livestock loss in Jigme Singye Wangchuck National Park, Bhutan, revealed that 68% of respondents supported eliminating problematic wildlife. Similarly, a comparable sentiment was observed among 68% of respondents in and around WCNP, who favored culling Asiatic black bears (Jamtsho, & Wangchuk 2016). Human-wildlife conflict at present continued to surface as one of the national issues and featured in regular deliberation in the Parliament of Bhutan (NCD 2008). At this juncture, addressing human-wildlife conflict has become a challenging task before the Ministry of Agriculture and Forests, particularly Department of Forests and Park Services (DoFPS). In the southern part of Bhutan, Asian elephant deplete crops while wild pig (Sus scrofa) is considered a nuisance to the farmers in the northern and eastern part of Bhutan. Mostly, elephants have contributed to the economic loss and social pressure on farmers in southern Bhutan (Jigme & Williams 2011; Nagdrel 2008). In Bhutan, since there are few settlements inside the protected areas, conflict mostly occur in the buffer zones (Jigme & Williams 2011). Sarpang District is one of the most affected districts in southern Bhutan. Similar trend has been also experienced in the neighbouring state of Assam (Nath et al. 2009 & 2015) in India. The population of wild elephants in Assam is gradually declining. The population of wild elephants was 5,524 in 1993. It came down to 5,312 in 1997, and further declined to 5,246 in 2002 (Talukdar 2006). Between 2003 and 2014, wild elephants in Assam were responsible for the deaths of 733 humans. Over the period from 2001 to 2014, 225 wild elephants lost their lives due to various causes, including poaching (32), poisoning (37), electrocution (107), and train collisions (49) (Saikia 2015). The Central and State Governments together spend rupees 10 to 15 corers every year on controlling elephant depredation and paying ex-gratia to affected people (Goswami 2015).

Currently, human-elephant conflict is one of the significant issues that confront the local communities of the Indo-Bhutan transboundary landscape. Located between (N 26.709530, E 89.849397 E; N 26.880076, E 92.102708) coordinates, the landscape is popularly known as Transboundary Manas Conservation Area (TraMCA) and is an amalgamation of more than six national designated Protected Areas (PAs) and corridors through which regular movement of elephants and other large mammals have been established. Despite the regular human-elephant conflict, there is a lack of scientific documentation of the human-elephant conflict scenario in TraMCA region. Furthermore, it is necessary to understand the spatial and temporal patterns of human-elephant interaction to initiate an effective conservation measure (Wilson et al. 2013). The challenge before the forest managers is to strike a balance between elephant conservation and safeguarding livelihood of local communities (RGoB 1995). Legally elephant has been included under schedule-I (assigning highest protection) of national legislation in India and Bhutan (e.g., Forest and Nature Conservation Act, 1995 of Bhutan and Wildlife (Protection) Act, 1972 of India). Hence, the introduction of conservation measures of elephant and safeguarding of livelihood required baseline information.

Analysis of Human elephant conflict in Bodoland Territorial Council (BTC), Assam, India

Long back in 1981, the Forest Department estimated about 1284 elephants in Chirang-Ripu Elephant Reserve (BTAD, 2008). Subsequently, during the late 1980s, this landscape experienced a severe socio-political crisis which completely devastated the infrastructure of the region and caused large-scale destruction of the wildlife and its habitat. This crisis has resulted in animal depredation in the adjoining fringe areas of the Tiger Reserve, the principal source of human-elephant conflict. However, studies carried out on human-elephant conflict restricted mostly on the adjoining villages of the southern boundary of Manas National Park. Nath et al. (2009) mentioned that during the period 1991 to 2006 there were 305 crop raiding cases, 172 household and property damage cases, and 31 human death and injury cases. However, Nelson et al. (2003) also mentioned that the conflict incidents reported previously collected from ex-gratia claims might render some sort of bias due to unsystematic data maintenance and other reasons (see Nath et al. 2009). Consequently, Das et al. (2011) reported that a total of 137 (120 crop raiding, 15 house damage, two physical injuries) conflict incidents during 2009-10. Both summer (March-August) and winter (June-November) season crops are affected due to raids and paddy raided the most among other crops. Majority people thought that forest department was responsible for crop loss whereas more people believed that constructing electric fence followed by guarding by forest department can be measures taken to protect crops/villages (Das et al. 2011). The study reveals that distance from the park boundary was the only independent variable that predicted crop-raiding incidents across different spatial scales. To compensate the annual crop loss, elephant –repellent alternative cash crops like lemon and chili were introduced to change the traditional cropping pattern. Furthermore, this also thought to be act as "bio fence" to check the elephant depredation movement. The mitigation measures used to ward off elephants include age-old traditional drive away techniques which include noise-making activities like shouting, drum beating, firecrackers, pelting stones, etc. But in recent times, the support provided by both local governments (BTC) & NGOs tremendously encouraged local people to the electric/solar fence surrounding villages.

The easternmost part of TRAMCA region Assam's Udalguri district administered by Bodoland Territorial Council (BTC) bordering Bhutan and Arunachal Pradesh has seen a steady rise in HEC over the past decade (see figure 3). In 2009 a total of 14 persons and 10 elephants died in the Dhansiri Forest Division, in and around the Bornadi, Neoli, and Khalingduar Forest complex. According to the Forest Department record between 2003-2009, a total of 23 elephant deaths recorded of which only four deaths were attributed to 'natural' causes and the rests were suspected as poisoning and electrocution and falls into trenches (Anonymous 2010). In 2010, the Dhanshiri Forest Division gave compensation for 249 cases of injuries, crop and property damage caused by wild elephants. BTC Government distributed compensation for US $ 8189.66 for a period between 2002-2009. Despite those 29 families who had lost their family members to elephant attack outside forest areas Ex-gratia payment of US $ 13890.44 was also released. While up to US $ 278.09 is paid for every injured individual and US $ 556.17was spent in case of human death. In case of damage to crops, farmers were paid between US $ 13.90 to 69.52 during the same period (Anonymous 2010). However, there was a gradual increase in conflict from 2012 to 2016. It was reported that 85 persons and 35 elephants died beside damage of property and crops (Anonymous 2017a).

Scenario of Human elephant conflict in Sarpang Forest Division (SFD) of southern Bhutan

A 2016 national elephant survey in Bhutan estimated approximately 678 elephants, primarily inhabiting the southern foothills bordering India's Assam and West Bengal states (NCD 2018). While these majestic giants are integral to the region's biodiversity, their presence increasingly comes at a cost to local communities. Human-elephant conflict (HEC) has emerged as a significant concern, causing economic strain and social stress, particularly for farmers in southern Bhutan.

Recent findings by Tshering et al. (2024) reveal the scale of the challenge in the Sarpang Forest Division, where over 40% of households reported experiencing HEC. Alarmingly, 30% of farmers leave their land fallow, fearing crop damage. Elephants primarily raid maize and paddy, which are the most widely cultivated crops, but cash crops like areca nut, oranges, ginger, and cardamom have also been targeted. The cultivated area for maize and paddy were large as compared to other crops resulting in the maximum incidence of crop raided by elephants. Positive association found between the extent of area as well as the majority of household of cultivation and number of incidents. Farmers in Sarpang have observed a steady rise in elephant incursions, a trend likely driven by forest degradation and fragmentation, which push elephants into human-dominated areas. Yet, a significant

number of conflict incidents remain unreported. Reasons include lack of awareness of reporting mechanisms, minimal loss, or religious beliefs rooted in Bhutanese culture, which encourage compassion toward wildlife. This underlines the need for greater awareness programs to ensure communities receive support. Local communities in Sarpang have predominantly relied on traditional mitigation measure including keeping night vigils, making fire, and beating drums. However, many farmers view electric fencing as the most effective solution. Unfortunately, only 0.65% of affected farmers in Sarpang could install electric fences due to financial constraints, leaving the majority unprotected.

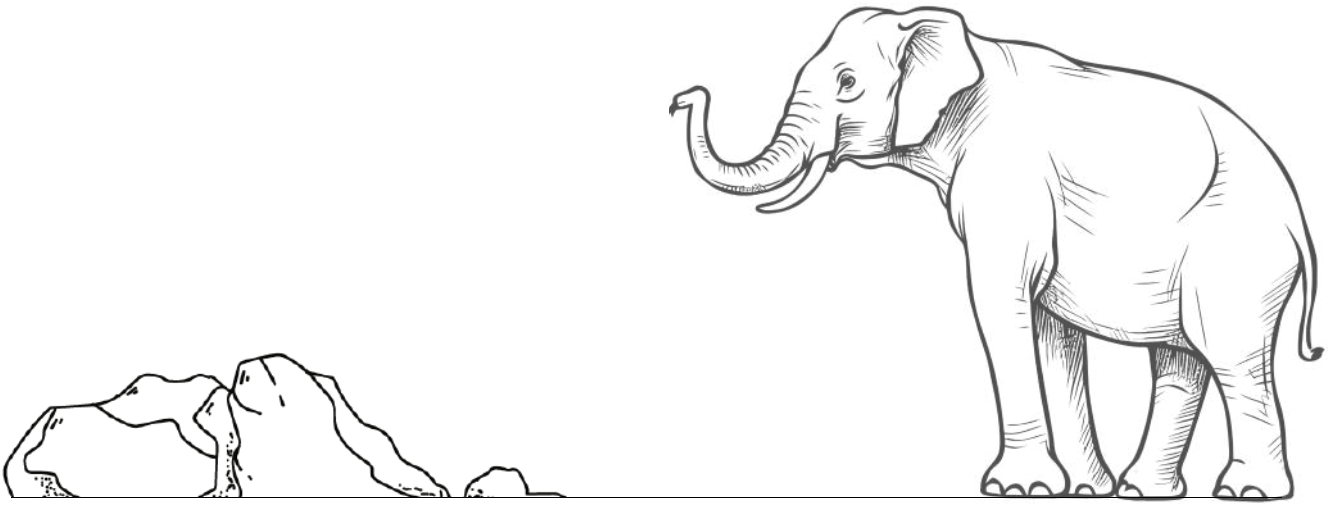
Need for transboundary management of long ranging elephants

In the context of Sarpang Forest Division (Bhutan) agriculture is the main source of income and crop loss to elephant creates huge adverse implication on the livelihood of the communities. Crop depredation by elephant in the communities adjacent to the international border with India is a serious concern. Bhutan does not have absolute control over stopping elephant conflict with human. This is mainly due to the affected communities situated at close proximity to elephant habitat across the border in India. So, the close coordination with the state forest department of Assam is essential. Introduction of mitigation measures to one community created problem to other communities. At this point of time, the mitigation measures should concentrate to the communities where crop raiding incidence is comparatively higher. Electric fencing has been proved effective mitigation measures, but farmers were not able to procure due to financial constraint. Hence, government's intervention is required here at least to support farmers procure fencing materials on cost sharing basis where the farmers are ready to accept. Currently, mitigation measures can be executed in maize and paddy field which incur main loss. The trend of conflict is dynamic across all communities. Apparently, it is necessary to understand drivers of conflict. It requires support from the scientific community and local people. Adequate scientific study is needed in terms of elephant migration pattern, habitat suitability, and to assess other drivers of conflict. Local people must be made aware of the importance of reporting incidence of conflict to the forest department in collaboration with gewog authorities to assist the department to plan and take appropriate measures. The reporting system needs to be simple and without having farmers to visit the office personally. A higher number of the report received by the gewog administration may be due to the presence of their elected representatives. Moreover, there is inadequate forest staff in the gewog where a single forest personal take charge of two gewogs as a result become unavailable when they visit office to report. Recently there has been demand from local communities for supply of solar or electric fencing as a mitigation measure. Locals have experienced the success of electric fencing against crop raiding by elephants in few villages. A study also showed that electric fencing was effective to safeguard large amount of crop damage and guarding time ultimately contributing to the reduction of conflict and alleviating poverty (Choda 2022). So far, the locals have been practicing traditional methods of mitigation measures. However, all the respondents preferred electric fence due to its effectiveness to keep away elephants from crop raiding. The effectiveness of electric fencing can apparently be deduced from the result of a study conducted in Sengye Gewog that farmers have started growing crops in the fallow land after electric fencing has established (Jigme & Williams 2011). The existing electric fencing has been undertaken with financial support from donors. Unfortunately, most of the villages could not afford to install electric fencing due to the financial constraint without funding from donors.

Furthermore, in the TraMCA area of Assam (India), a prolonged period of insurgency that resulted in illegal encroachment in most of the reserve forests under Chirang Ripu Elephant Reserve, large gaps. According to the data available with the forest department of BTC (Bodoland Territorial Council), a total of 39,750.86 ha. was under encroachment. About 2385.14 ha. under Kachugaon forest division, 4,262.7 ha. in Dhansiri division, 8,894.21 hectares in Chirang division, and 3,332.8 ha. in Porbotjhora division and 6337.6 ha. in Baksa forest division were under encroachment (Anonymous 2015). The Haltugaon division of Kokrajhar district has the highest encroachment of forestland with 14,538.41 hectares of land being encroached upon. The overall degradation of the elephant-habitat in the core and surrounding buffer may lead to the frequent conflict with the adjoining Sarpang district of Bhutan. Another report highlighted Dhansiri division in Udalguri district more details — 24,995 ha of lands belong to Wildlife Sanctuary, Reserve forests, proposed reserve forests (PRF), 8762 ha are at present been under encroachment (1365 ha. in Khalingduar RF; 2343 ha. in Rowta RF, 155 ha in Bhairabkunda RF, 400 ha in Bornadi WLS; 920 ha in Kundarbil PRF; 3520 ha. in Bhairabkunda PRF; 60 ha. in Newly PRF) (Anonymous 2017a). Recently, the Assam Government directed the Dhansiri Forest Division (Udalguri) to suggest measures well in advance for the mitigation of the man-elephant conflict in the district. Apart from that, tea gardens are one of the critical concerns for the elephants ranging in Indo-Bhutan boundary of Udalgiri district. However, very recently, two small tea gardens have earned the tag of being the world's first "Elephant-Friendly Certified

Tea". Primarily, to support elephant conservation by providing an opportunity for tea garden owners to gain premium prices for their tea. Also, make sure that the garden owners take the necessary steps to minimize conflict. Wildlife Friendly Enterprise Network (WFEN) and University of Montana, US has given this recognition for the tea gardens to raise funds for Asian elephant conservation (Anonymous 2017b). At the broader perspective certified tea gardens would meet the standards for the protection of elephant habitats and water resources, reducing human-elephant conflict, reducing barriers to elephant movement between habitat areas, exclusion of electrocution risks from fencing and power lines, elimination of drainage ditch hazards and elimination of the risk of poisoning of elephants. On the other hand, villages around Manas National Park have got more focus from both government and nongovernmental organizations. Electric fencing and community machan help the farmer to a certain extent to safeguard crop and property in around Manas National Park (pers. obs.). However, Desai & Riddle (2015) also pointed out that the lack of science-based approach to resolve HEC mitigation key reason for the failure in India. Additionally, HEC is being managed through inconsistent and uncoordinated approaches. Here in this Trans-boundary landscape Forest Department of both the countries along with the NGOs Aaranyak, Ashoka Trust for Research in Ecology and the Environment, World Wildlife Fund and Wildlife Trust of India could play a significant role in the mitigation of HEC at a certain level. However, the absence of a comprehensive guide on conflict mitigation addresses all the complexities of HEC. Currently, HEC mitigation efforts primarily focus on deterring elephants from raiding crops. Moreover, no elephant-inhabited landscapes have successfully mitigated human-elephant conflict (HEC) in a meaningful way. To address this issue, it is crucial to tackle longstanding challenges such as habitat loss, degradation, and fragmentation. Implementing effective land-use planning to redefine the boundaries between human-use areas and elephant habitats is essential.

The status of Elephants in TraMCA can be mentioned as demographically healthy from the population characteristics. The inter crossing of herds from Bhutan and other Reserves needs to be maintained well to ensure the chances of genetic flow at a larger landscape level. Except for few incidences of elephant death, there has not been any poaching incident recorded officially. However, increased conflict in the fringe areas is a cause for worry as it exposed the inadequacy of protection resources. In particular, a transboundary policy mechanism that explores the notion of adjusting relevant law and policy to the spatial scale of large migrating animals such as elephants needs to be devised. This view makes obvious biological sense at the forefront of current thinking regarding conservation and management, which includes sustainable use of cross-border species. At the same time, on ground implementation of conservation and management at the transboundary population level is a much more complex and challenging task (Selier et al. 2016). Many other species including elephants are transboundary, and most often overlapping the territories of several countries, which can lead to mismanagement of transboundary populations since there is a huge gap between the scales at which animal populations operate and the scale at which administrations of countries operate (Selier et al. 2016). The Government of India has a bilateral protocol with the Government of Bhutan on the conservation of tiger and other wildlife in this region. The National Tiger Conservation Authority (NTCA) and Government of Assam in association with Global Tiger Forum (GTF), an Intergovernmental-International body working for tiger conservation at the global level discussed several issues relating to conservation to tigers and other wildlife. Henceforth, a multi-pronged approach is therefore suggested to address the complex issue of transboundary governance.



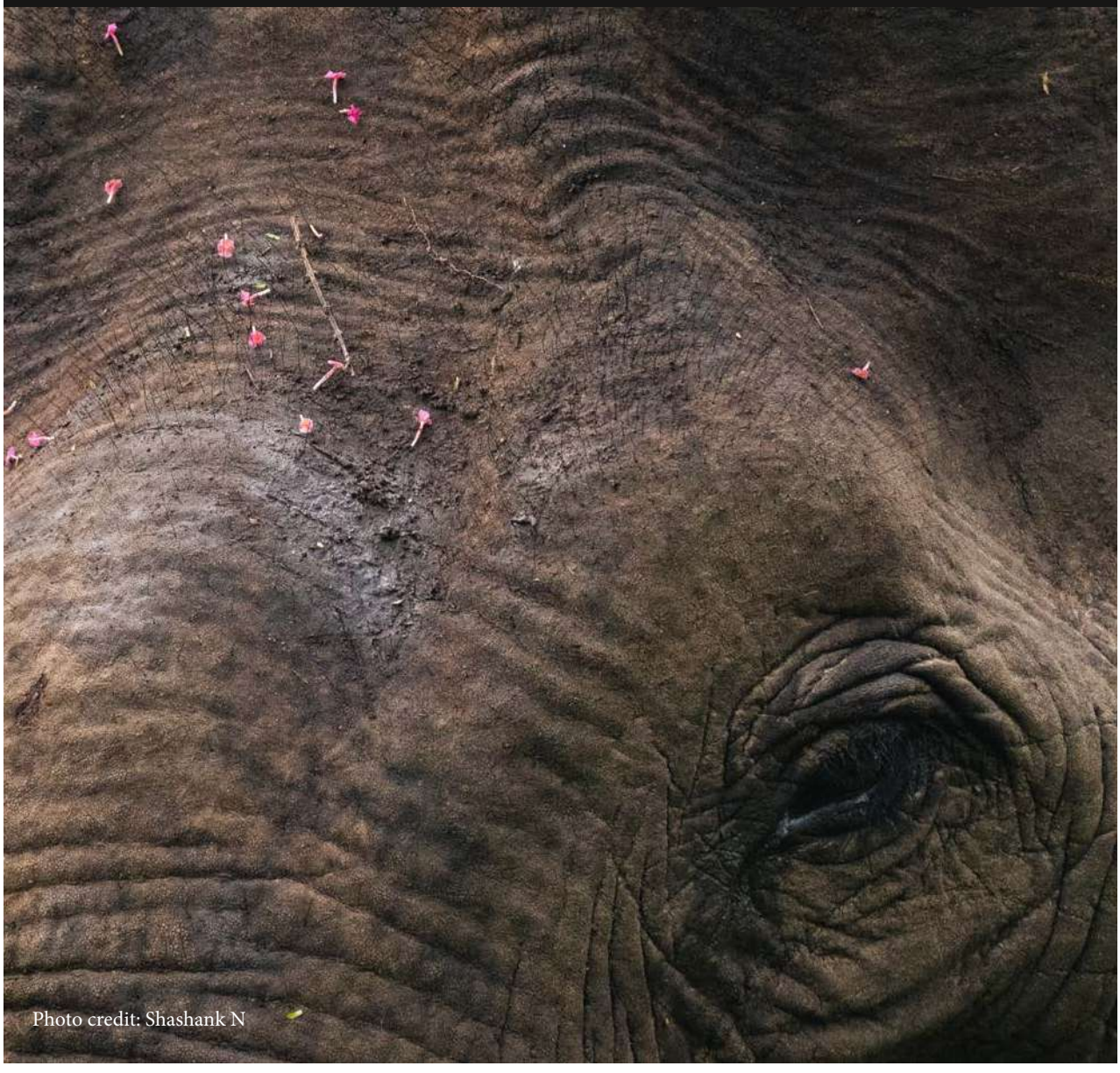
- Designing Institutional arrangements for transboundary elephant conservation- obtaining Political and Legal support– developing management plans, on ground plans for mitigation of conflict, alerts and penalties.

- Promoting Regional soft diplomacy– promoting multi-stakeholder groups such as TraMCA.

- Encouraging Community participation– exploring and implementing a variety of community and household-based protection measures including cooperative crop guarding and fencing (e.g., with solar-powered electric fences). Creating awareness and educating communities on the importance of elephant conservation should be initiated by officials from protected areas and other environmental and educational agencies.

- Capacity building and Law enforcement: The officials and local teams on both sides of the border can be jointly trained to enforce law and also maintain relevant databases. Illegal activities that result in elephant mortality can be prevented by such joint enforcement.

- Devising innovative Land use policies in the trans-boundary landscape: Eco-sensitive zonation has been proposed for Protected Areas within India. For transboundary landscapes, such zonation can be extended for maintaining the contiguity of such forested landscapes. It would then truly represent a conservation mechanism beyond borders.



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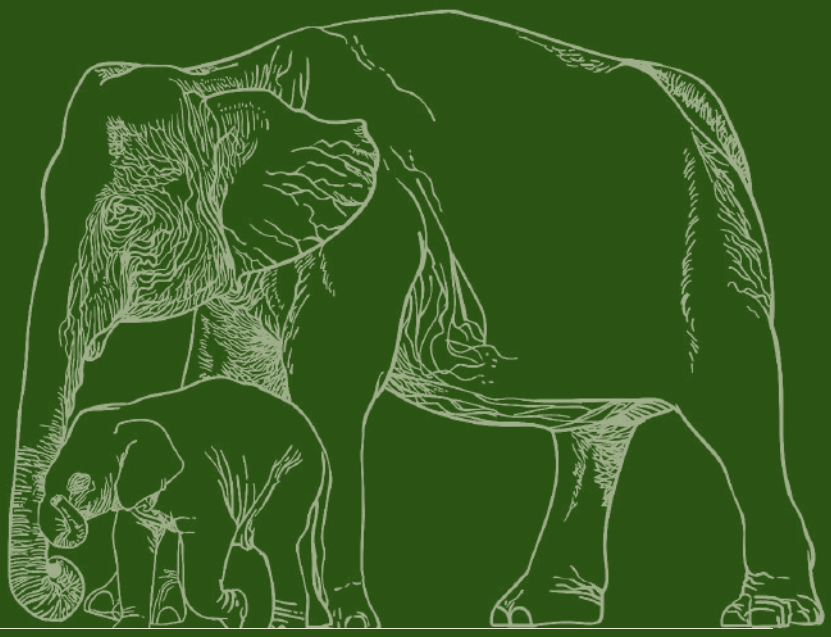

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Artificial Intelligence and its Use in Elephant Conservation

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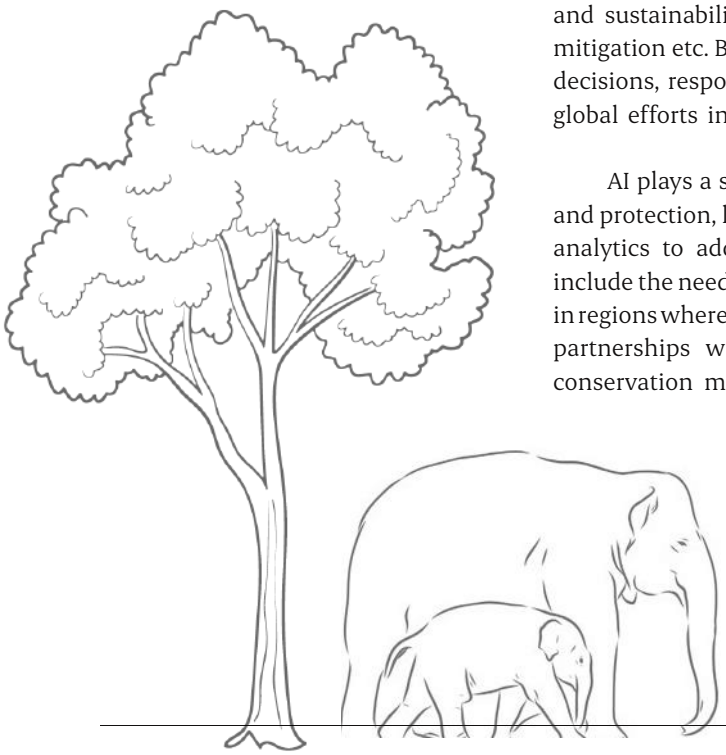
Introduction

Artificial Intelligence (AI) refers to the development of computer systems that can perform tasks typically requiring human intelligence. These tasks include learning from experience, recognizing patterns, solving complex problems, understanding language, and even generating creative content. AI operates through algorithms that allow machines to analyze data, make decisions, and adapt over time.

AI is continuously evolving, with advancements such as explainable AI (making AI's decision-making process transparent), collaborative AI (AI systems that work seamlessly with humans), and AI safety research. The ultimate goal for some is achieving Artificial General Intelligence (AGI), while others focus on ethical applications and ensuring that AI benefits humanity as a whole. The growth of AI promises transformative changes across almost every sector of society, driving innovations in how we live, work, and interact with the world.

AI is increasingly being applied in the forestry sector, transforming how forests are managed, monitored, and preserved. AI tools and technologies can analyze vast amounts of data, optimize forest management practices, and enhance sustainability efforts. Some key areas where AI is making an impact in forestry include: forest monitoring and data analysis; forest inventory and management; forest-fire prediction and management; pest and disease management; biodiversity conservation and protection; carbon footprint and sustainability; supply chain optimization in forestry; climate change mitigation etc. By leveraging AI, the forestry sector can make more informed decisions, respond proactively to environmental threats, and contribute to global efforts in climate change mitigation and biodiversity conservation.

AI plays a significant and rapidly growing role in wildlife conservation and protection, leveraging advanced algorithms, machine learning, and data analytics to address complex environmental challenges. The challenges include the need for high-quality data, technical expertise, and infrastructure in regions where conservation efforts are most needed. Continued innovation, partnerships with local communities, and integration with traditional conservation methods can enhance AI's impact in wildlife conservation.



Approaches and Techniques in AI

At its core, AI is about making machines smart by:

- Learning from data (e.g., training models with datasets).
- Drawing logical inferences (e.g., decision-making in dynamic environments).
- Interacting with the world (e.g., speech recognition, robotics).

AI systems are developed using a variety of approaches, ranging from basic algorithms to advanced methods like deep learning (Fig-1).

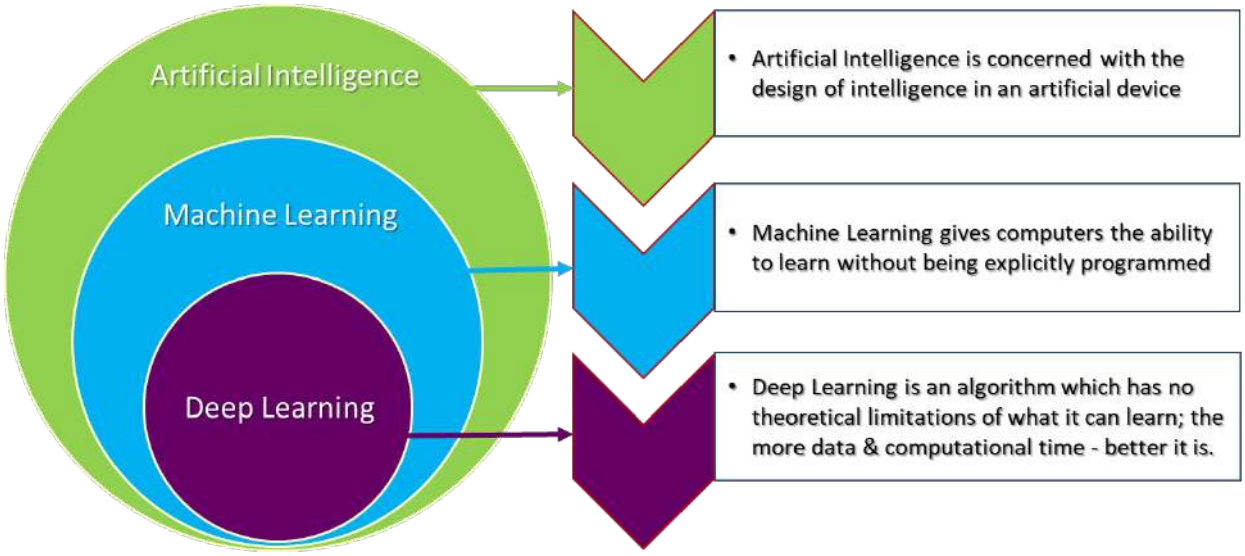


Fig-1: Conceptual approach in Artificial Intelligence

Machine learning

Machine learning (ML) is a subfield of AI that focuses on the development of algorithms and models that enable computers to learn and make predictions/decisions without being explicitly programmed. Key concepts & components include (Fig-2):

- Training data, Algorithms & Models
- Feature Extraction & Engineering
- Supervised & Unsupervised Learning
- Validation & Testing and
- Model Evaluation & Metrics

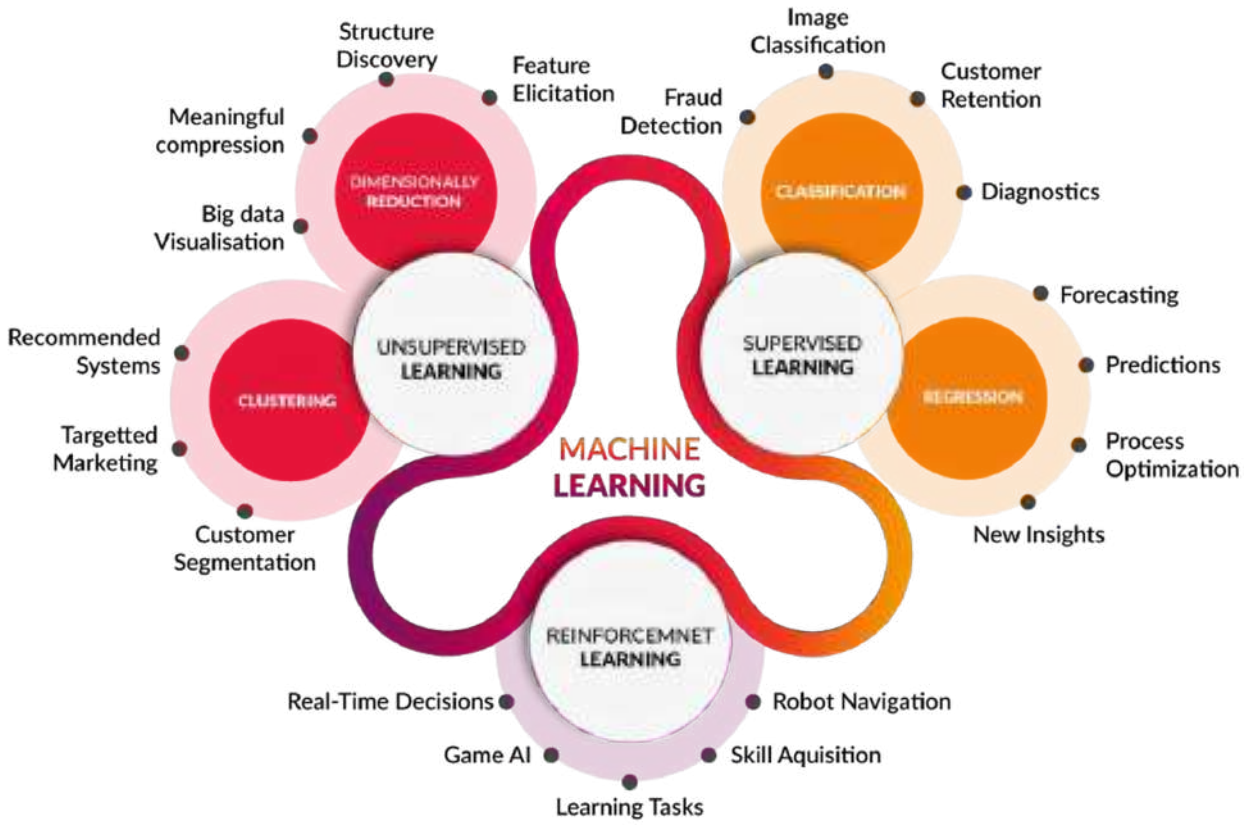


Fig-2: Wide range of applications in Machine Learning

An **artificial neural network** (ANN) is a computational model inspired by the structure and functioning of biological neural networks, such as the human brain & is a key component of deep learning, a subset of ML (Fig-3). An ANN consists of interconnected nodes, called artificial neurons or 'perceptron's', organized into 3 layers - Input, Hidden and Output Layers. The key characteristics and concepts associated with ANN include: Activation function, Feedforward, Backpropagation, Deep neural networks.

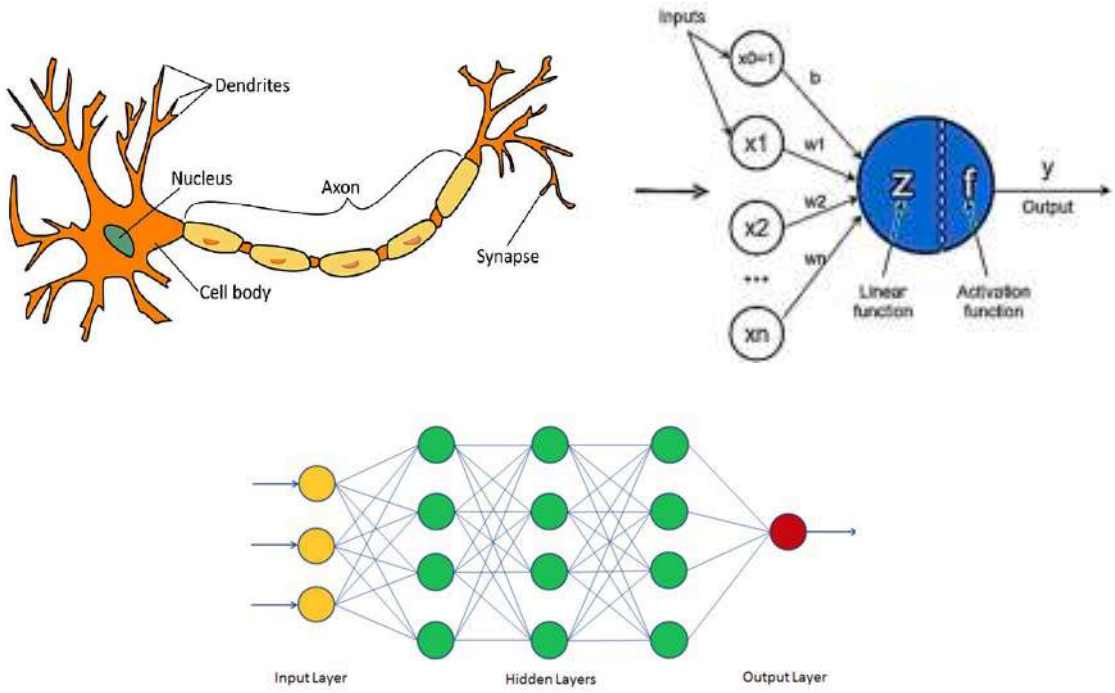


Fig-3: Principles of Artificial Neural Network (ANN)

The strengths and limitations in various approaches in AI envisages:

- Rule-Based Systems- Though simple, interpretable and fast but at the same time it is rigid and cannot handle complex data.
- Machine Learning- Learns patterns and adapts to the data but requires large datasets.
- Deep Learning- Excels in complex pattern recognition but is computationally intensive and needs big data.
- Reinforcement Learning- Handles dynamic environments but is time-consuming and is trial-and-error-based.
- Natural Language Processing- Interacts with human language but is limited in understanding context deeply.
- Expert Systems- Mimics domain experts but is limited to predefined knowledge base.

The major AI techniques applied in various conservation fields, including elephant conservation, can be categorized into several areas (Table-1).

Table-1: Various AI Techniques used in Elephant Conservation

Technique	Key Application in Conservation
Machine Learning	Population tracking, poaching prediction, habitat analysis
Artificial Neural Networks	Image/audio recognition, behavioural predictions
Computer Vision	Wildlife monitoring, habitat mapping
Natural Language Processing	Detecting wildlife trade, processing conservation literature
Reinforcement Learning	Optimizing patrols, simulating ecosystems
Predictive Analytics	Anticipating poaching or habitat changes
Data Mining	Discovering patterns in environmental and wildlife data
Generative Models	Habitat simulations, creating synthetic datasets
Swarm Intelligence	Modelling migrations, optimizing drone movements
Bayesian Networks	Risk assessment for extinction, predicting disease outbreaks
Fuzzy Logic	Managing uncertain environmental conditions
Agent-Based Modelling	Studying ecosystems and human-wildlife conflict
IoT Integration	Real-time surveillance and environmental monitoring

Application of AI in Elephant Conservation

The challenges include the need for high-quality data, technical expertise, and infrastructure in regions where conservation efforts are most needed. Continued innovation, partnerships with local communities, and integration with traditional conservation methods can enhance AI's impact in wildlife conservation.

i. Tracking and Monitoring Elephants

- GPS Collars: AI processes data from GPS collars worn by elephants, identifying migration patterns, feeding habits, and areas of conflict.
- Acoustic Monitoring: AI analyzes elephant vocalizations to monitor populations/ detect distress calls, which may indicate threats such as poaching or environmental stressors.
- Camera Trap Analysis: AI-powered image recognition tools analyze data from camera traps to identify specific/ target species, reducing the time and labor required for manual analysis.
- Drones with AI: Drones equipped with AI and thermal imaging can track animal populations, particularly in dense habitats where human observation is difficult.
- Population Estimation: AI-powered image recognition tools analyze aerial photos or drone footage to count elephants accurately and efficiently, replacing time-intensive manual methods.

ii. Combating Poaching and Illegal Trade

- Predictive Analytics: AI algorithms analyze historical poaching data, weather patterns, and human activity to predict where poaching might occur. This helps field staff optimize patrol routes.
- Automated Surveillance: AI-powered cameras and drones can detect and identify poachers in real-time using image recognition and thermal imaging.
- Wildlife Trafficking Detection: AI tools are used to monitor online marketplaces and social media for illegal trade, flagging suspicious activity for further investigation.

iii. Habitat Monitoring and Environmental Protection

- Land Use and Habitat Mapping: AI-powered satellite imagery analysis helps map habitats and detect changes, such as deforestation or urban expansion, that threaten wildlife including elephants and AI algorithms enables conservationists to identify critical habitats and prioritize them for protection.
- Climate Change Impact Analysis: AI tools assess the impact of climate change on elephant ecosystems, aiding long-term conservation planning and Machine learning models predict how climate change affects habitats and species, providing data for proactive conservation efforts.

iv. Human-Elephant Conflict Mitigation

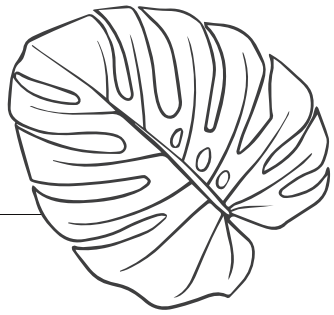
- Risk Reduction: AI can predict elephant movements and alert nearby communities, reducing the risk of conflict. For example, machine learning models analyze environmental factors like vegetation and water availability to forecast elephant paths.

v. Disease Detection and Health Monitoring

- Elephant Health Monitoring: AI can analyze data from trackers and biosensors to detect early signs of illness or stress in animals, enabling timely interventions.
- Pandemic Prevention: By monitoring zoonotic disease vectors in elephant populations, AI helps predict and prevent potential outbreaks that could spill over to humans.

vi. Citizen Science and Public Engagement

- Crowdsourced Data Analysis: AI enhances citizen science efforts by analyzing large datasets collected by volunteers, such as photos or sound recordings.
- Educational Tools: AI-powered apps help the public identify and learn about elephants, fostering greater awareness and engagement.



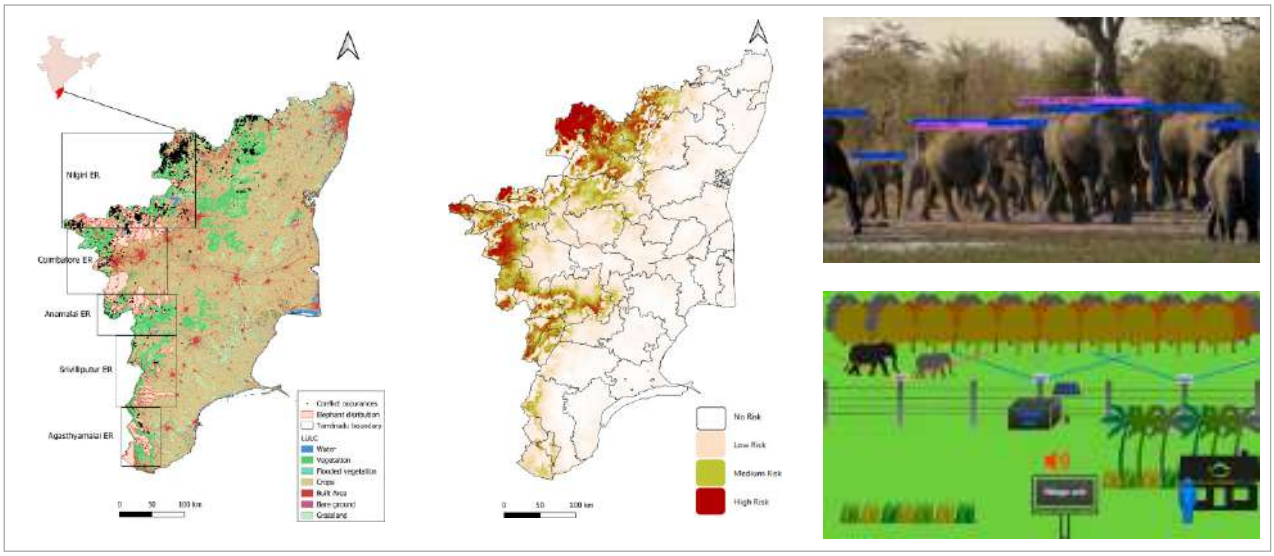


Fig-4: Use of AI in HEC mitigation and Advance Alert System

Challenges and Future Prospects

While AI holds significant potential, challenges include the need for high-quality data, technical expertise, and infrastructure in regions where conservation efforts are most needed. Continued innovation, partnerships with local communities, and integration with traditional conservation methods can enhance AI's

Photo credit: Sipu Kumar

Building The Institutional and Technical Capacities by Project Elephant (2020-2025)

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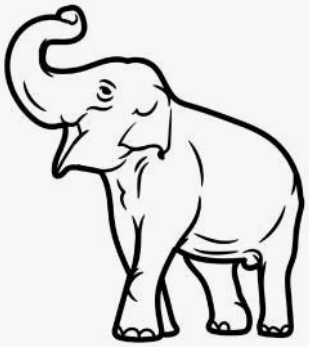
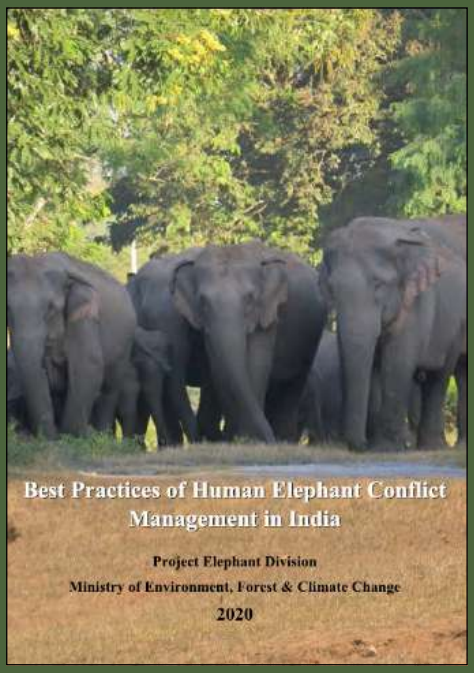


India holds the largest (60%) and one of the most stable populations of the endangered Asian Elephants. The Wildlife (Protection) Act, 1972 accords highest legal protection to elephants irrespective of whether the elephant is wild or captive. To further the cause of elephant management and conservation in India, Project Elephant is making steadfast efforts in enhancing the institutional and technical capacities of different facets of routine field management. In this regard, the Project Elephant and its associate Institutions have come up with many easy-to-use high-quality reference materials that are readily available to the field personnel. One of the Project Elephant's overarching aims is improving the technical know-how of field professionals is also being addressed. The publications encompass diverse areas of elephant conservation and management. These include strategies for mitigating human-elephant conflict, improving welfare and health in captivity, habitat and landscape management, conservation planning, and infrastructure mitigation. In this article we provide a brief of the various publications, guidelines and reports by PE division.

1. Human–Elephant Conflict (HEC) Management

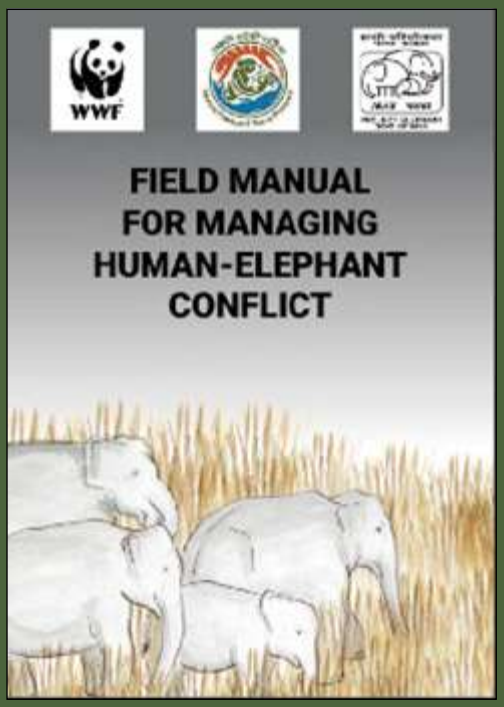
Best Practices of Human–Elephant Conflict Management in India (2020)

Friction between humans and elephants termed Human-Elephant Conflict (HEC) occurs mainly over space and is a major conservation concern across the country for governments, conservationists and people living close to the wild animals. Loss of natural habitat and fragmentation have been bringing wild elephants closer to human habitations, sparking these conflicts. Over 500 humans are killed in encounters with elephants annually, and crops and property worth millions are also damaged. Many elephants are also killed in retaliation due to conflict. To tackle such conflicts and avoid losses on both sides, it is important to strengthen the human-elephant coexistence through active management interventions by the State Forest Departments, involvement of various stakeholders and sensitization and generating awareness in local communities of forest fringe areas. A variety of management strategies and practices has been developed and customized are implemented at different scales by the State Forest Departments for preventing and mitigating human-elephant conflict. This pictorial guide summarises the various management interventions successfully adopted by the elephant range states and serves as a reference manual for adoption of the best possible site specific mitigation measures that can be adopted to reduce human-elephant conflict.



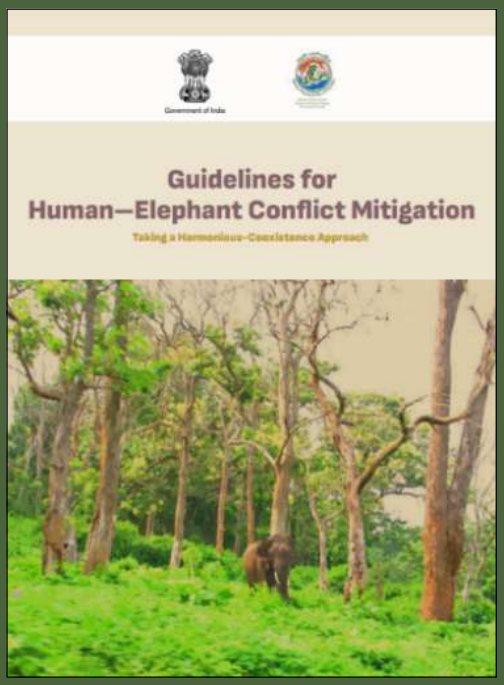
Human–Elephant Conflict Manual (2022)

Human–elephant conflict is a management challenge of high concern as it negatively affects elephant conservation and human welfare. There are several time-tested practical options available to address HEC. Often, the field personnel in the frontline are hampered by lack of information on tackling HEC. Recognizing this lacuna, the Project Elephant along with WWF-India and WII had come up with a pictorial, ready-to-use manual on HEC management. The content of the documents are illustrative and is designed for ready use in the field by all those who are in the forefront of managing elephants and their habitats. The English version of the manual was released by the Hon'ble Minister, EF&CC during the 16th Steering Committee held in Dehradun. Due to overwhelming demand for the manual, the manual has been released in Hindi, Assamese, Malayalam, Odiya, Kannada and Tamil. The manual would be translated into other regional languages too.



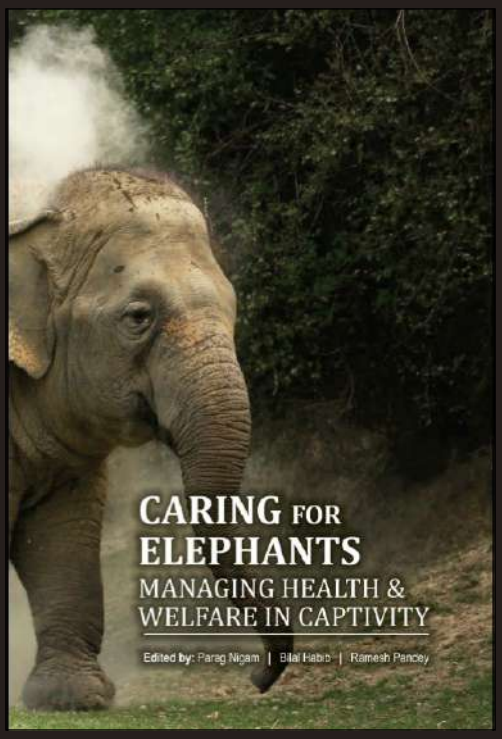
GIZ - MoEF&CC Guidelines on HEC Management (2023)

To effectively and responsively address the issue of Human Elephant Conflict, the Ministry of Environment, Forest and Climate Change (MoEF&CC) has facilitated the development of "Guidelines for Human-Elephant Conflict Mitigation in India" under the Indo-German cooperation project on "Human-Wildlife Conflict Mitigation in India (2017-2023), taking a participatory, integrated and inclusive approach. These guidelines aim to facilitate a common understanding among key stakeholders on what constitutes effective and efficient mitigation of the Human Elephant Conflict in India, leading to co-existence, to ensure standardisation in performing mitigation operations in the most effective and efficient manner, with minimum damage to humans and elephants.



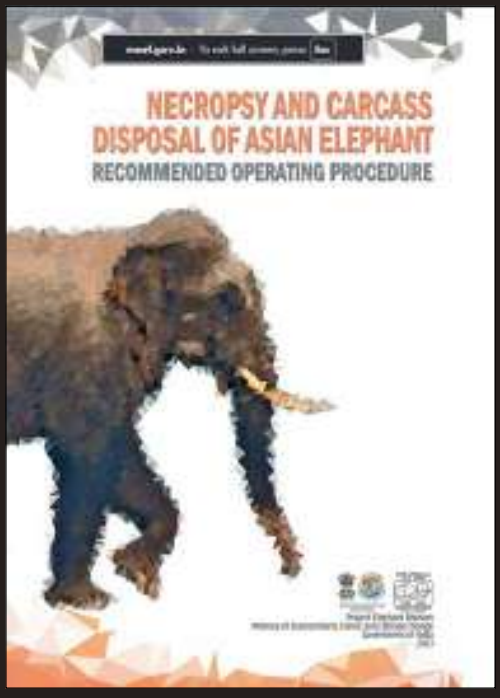
2. Elephant Welfare and Health

Caring for Elephants: Managing Health and Welfare in Captivity (2022)



Unlike free ranging wild elephants, captive elephants can be vulnerable to host of physical and psychological problems including abnormal behaviours if proper care and attention are not provided. Poor captive elephant management can result in chronic suffering and reduced lifespan of elephants. Inhumane treatment of elephants is also a moral and ethical concern, and therefore, improving welfare conditions of captive elephants assumes greater importance. Improving the welfare conditions of the captive elephants is one of the stated objectives of the Project Elephant, MoEF&CC, and Government of India. This book is an outcome of a workshop conducted by the Project Elephant and WII on aspects of captive elephant welfare during February 2022. The book contains chapters on various aspects of captive elephant management lucidly written and thus, highly relevant for field officers, veterinary professionals and elephant handlers. The individual chapters have been contributed by authors well-versed in their respective fields and edited by Dr. Parag Nigam & Dr. Bilal Habib, scientists from WII and Shri. Ramesh Kumar Pandey, IG (PE), MoEF&CC, Government of India.

Necropsy and Carcass Disposal of Asian Elephant (2023)



Elephants are long-lived and understanding the patterns of mortality would be crucial for informed management. Despite the importance, carrying out necropsy on elephants required high level of technical knowledge that is not readily available in all regions that elephants occur in India. The Project Elephant and the Elephant Cell at the Wildlife Institute of India have come up with this important "Recommended Operating Procedure" document on conducting elephant necropsy and safely disposing the carcasses targeting the field veterinarians and forest officials engaged in managing elephant populations. The aim of this manual is to improve the standards of conducting elephant necropsy and sample collection techniques so that critical scientific information related to elephant demography, emerging diseases of local and national importance, and habitat-specific variations in death rates can be obtained.

ROP – Capture and Translocation of Elephants in Distress and Conflicts (2024)

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 was released during the World Elephant Day 2024.

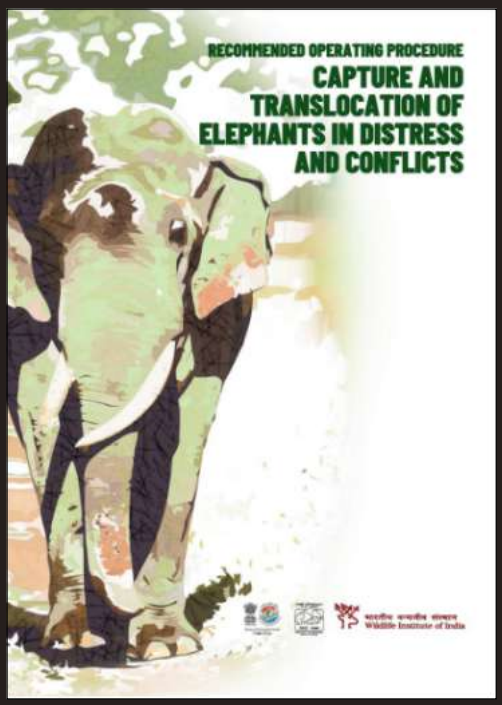


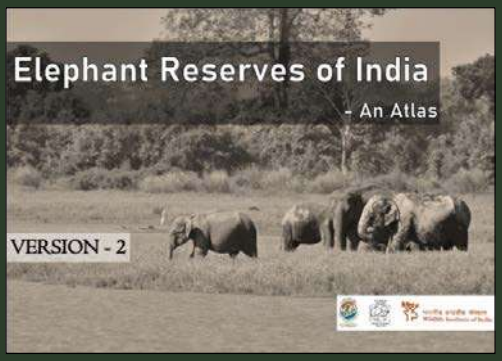
Photo credit: WWF-India

3. Elephant Habitat and Landscape Management

Elephant Reserves of India: An Atlas (Version 1 and 2)

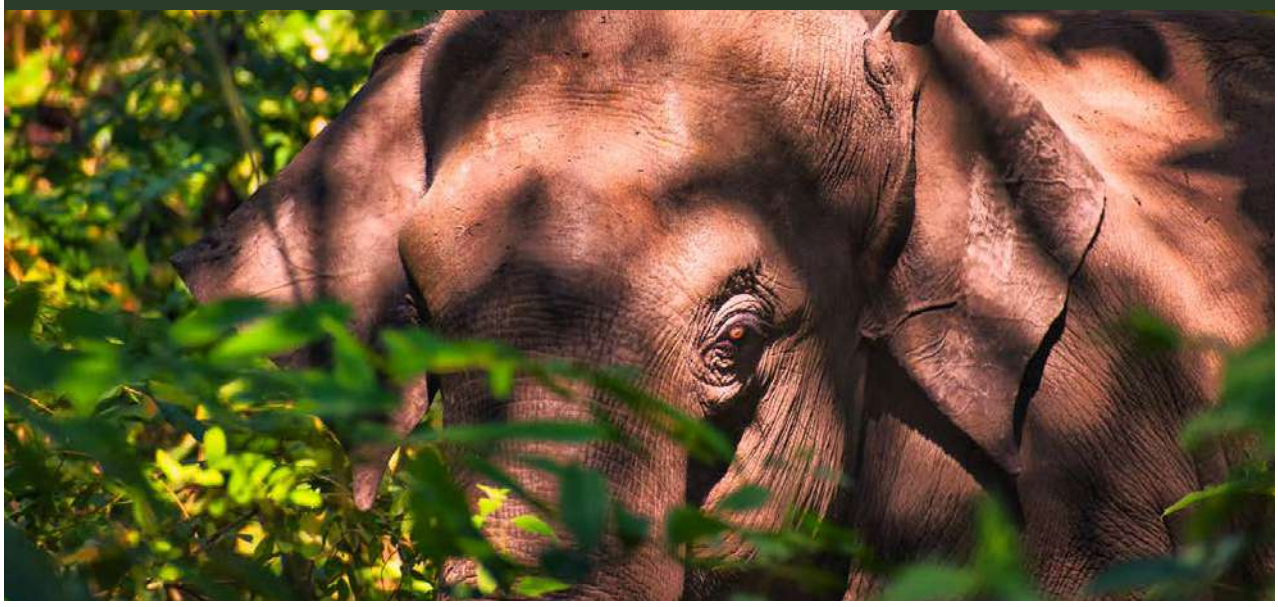
Under the ambit of Project Elephant, India has notified 31 elephant reserves across 14 states. More than 50% of elephants' distributional range in India falls within Elephant Reserves. Recognizing the need for a centralized database, the Atlas of Elephant Reserves of India was developed. The atlas provides basic spatial information on each of the 31 elephant reserves in India including boundary maps.

The updated Version-2, released in 2022, introduced additional features to provide a more detailed understanding of the 33 elephant reserves. These include:



i. the biogeographic region,
ii. the mean annual rainfall,
iii. the number of revenue villages within the reserve boundaries,
iv. the extent of various types of main roads passing through the reserves,
v. the coverage of irrigation canals and power lines,
vi. the extent of mining areas,
vii. forest administrative details, such as the Forest Ranges encompassing the reserve and the Protected Areas and Tiger Reserves within it, and
viii. the estimated elephant population in each reserve.

These enhancements make the atlas an essential tool for understanding and managing elephant reserves comprehensively.. The elephant corridors falling within the Elephant Reserve have also been indicated in the maps.

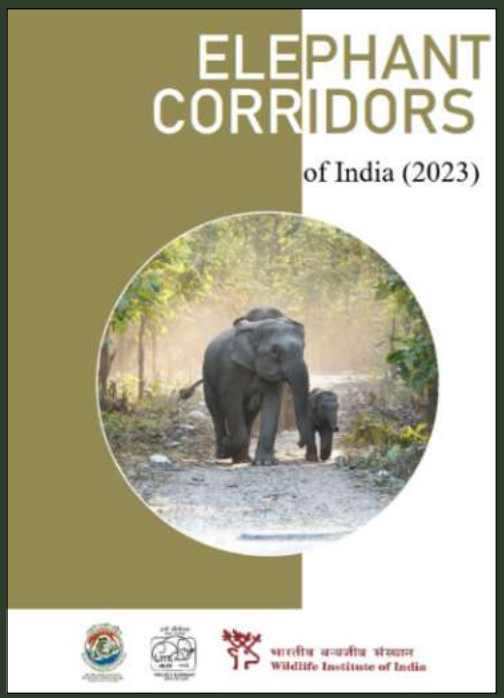


Elephant Reserves of India: Land-Use and Land-Cover Classification (Version 1 and 2)

Elephant ranges in India extend beyond Protected Areas, covering multiple-use forests and even non-forest regions. The **Land-Use and Land-Cover (LULC) Classification** provides a comprehensive analysis of the LULC across elephant reserves in India. It uses remotely-sensed geospatial layers to map and tabulate land-use patterns, enabling broad-scale trend comparisons across reserves.The enhanced Version-2, developed as part of Project Elephant's efforts to strengthen elephant reserve management, incorporates high-resolution geospatial data from 2022. It provides detailed LULC classifications for 33 elephant reserves, with additional emphasis on terrain features such as gradient, elevation, and watercourses. Presented in a pictorial format, this updated document serves as a ready reference for understanding the diverse land cover of elephant reserves, supporting both conservation efforts and the development of a management information system (MIS) for long-term sustainability.

Elephant Corridors of India (2023)

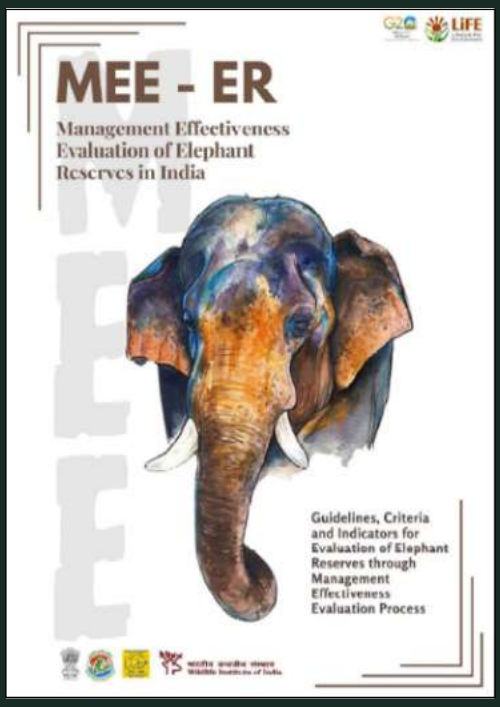
Securing corridors, which facilitate elephant movement across habitats remains an important elephant conservation strategy for the Project Elephant. In a country-wide exercise, the Project Elephant in coordination with the State Forest Departments ground-validated elephant corridors across the country in over a period of two years. The report comprises of details pertaining to 150 elephant corridors across India with corresponding maps. The report is intended to serve as an important reference manual for the elephant corridors of India. Given the strategic importance of maintaining habitat connectivity through a network of elephant corridors, it would be pertinent to start periodically monitoring the elephant corridors in line with the periodic population estimation of elephants. Such focused monitoring could not only be helpful in the timely securing of the corridors, but also aid in understanding elephant movement patterns, predicting human-elephant conflict so as to devise proactive conflict mitigation strategies.



4. Conservation Planning and Strategy

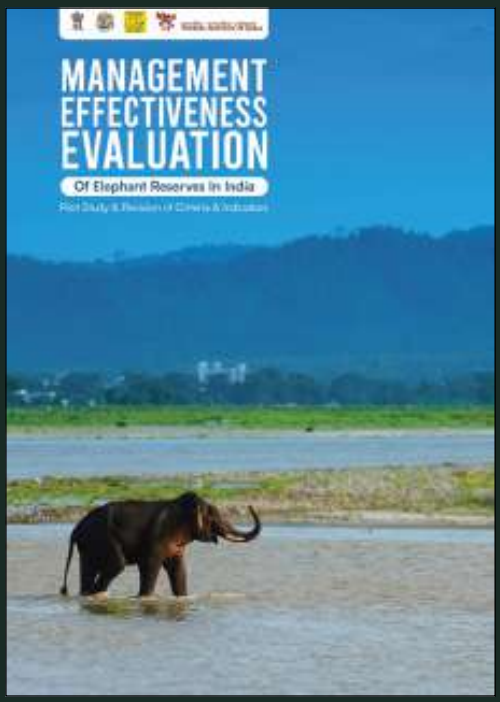
Management effectiveness evaluation of the Elephant Reserves in India (2023)

Elephant Reserves are the fundamental management units for the Project Elephant. As elephants are wide ranging animals, the concept of the Elephant Reserves emanates out of the landscape approach that may include forest areas, corridors that connect forest patches, and also villages affected by human–elephant conflict. To streamline management approaches and provide a platform for sharing best practices in managing elephant habitats, the document titled 'Management Effective Evaluation (MEE) of the Elephant Reserves in India' attempts to provide the conceptual, administrative and legal framework for objectively evaluating the elephant reserves.



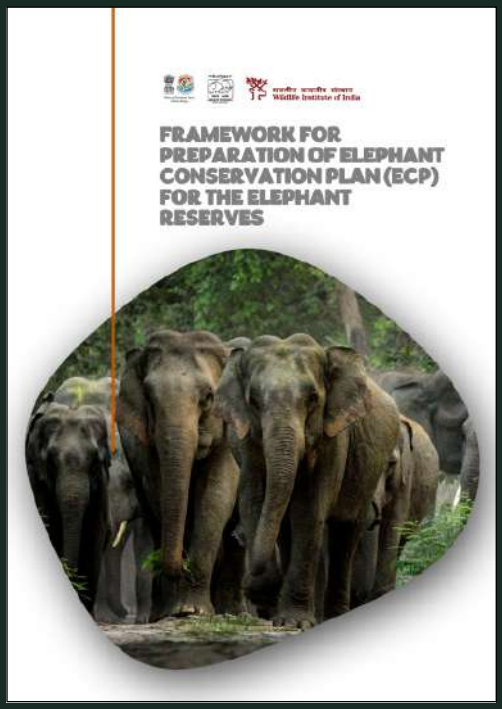
Management Effectiveness Evaluation of Elephant Reserves in India - Pilot Study & Revision of Criteria & Indicators (2024)

Project Elephant evaluated the management effectiveness of Elephant Reserves (ERs) to enhance landscape-level elephant management, integrate ERs with wildlife management, and standardize management requirements for elephant habitats and populations. The MEE-ER (Management Effectiveness Evaluation of Elephant Reserves) guidelines, criteria, and indicators were released in April 2023. A pilot MEE-ER, involving experienced foresters and scientists, was conducted in four ERs across India: Shivalik ER (northwest), Kaziranga-Karbi Anglong ER (northeast), Mayurbhanj ER (east-central), and Nilgiri ER (south). Based on the pilot's findings, the guidelines were reviewed, and the criteria and indicators were validated. This report details the pilot MEE-ER process and the revised criteria and indicators for evaluating ER management effectiveness. The ultimate goal is to ensure better management and conservation of elephant populations and their habitats.



Framework for Preparation of Elephant Conservation Plan (ECP) for the Elephant Reserves (2024)

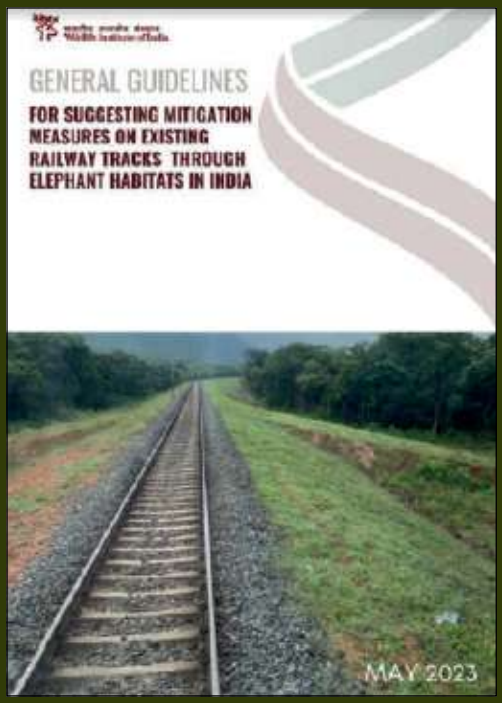
The Framework for Preparation of Elephant Conservation Plan (ECP) aims to provide a structured approach to elephant management, incorporating elephant ecology, socio-economic factors, and the latest scientific practices. Developed collaboratively by wildlife managers, conservationists, researchers, governmental and nongovernmental organizations, and local communities, the framework emphasizes a holistic perspective on the interconnectedness of elephants with their habitats and human communities. It seeks to create sustainable landscapes where elephants can thrive and move freely with minimal human conflict, ensuring the long-term conservation of elephant populations and their ecosystems. This framework is designed to be adaptable, allowing for adjustments based on new findings, changing conditions, and lessons learned from implementation. It recognizes the complex interplay of ecological, social, and economic factors in elephant conservation and seeks to address these holistically.



5. Infrastructure and Conflict Mitigation

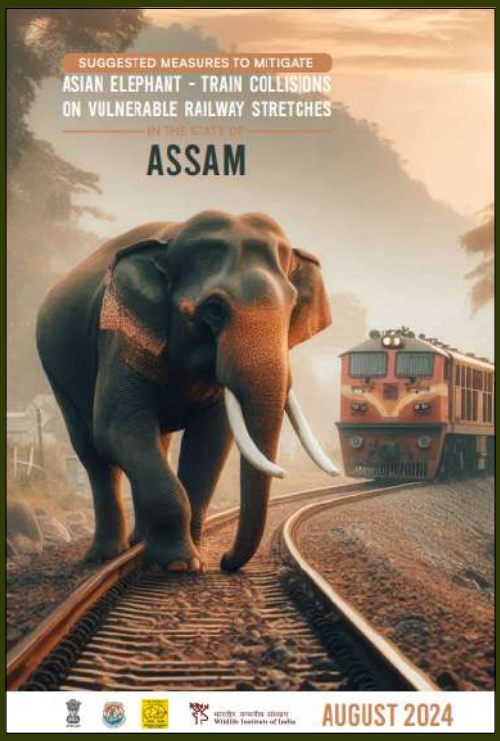
General Guidelines for Suggesting Mitigation Measures on Railway Tracks passing through Elephant Habitats in India (2023)

The General Guidelines for Suggesting Mitigation Measures on Railway Tracks passing through Elephant Habitats in India have been prepared and circulated to all the States/UTs for implementation in May, 2023. These guidelines would be a guiding document for the Railway and Forest Officials in designing and choosing between different structural mitigation measures in the identified critical elephant zones intersected by railway lines. The choice of mitigation measures can be based on landscape, topography, railway track height, and other logistics.



Joint surveys of the critical stretches of the railway lines passing through the elephant habitats (2024)

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 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. Currently Joint survey reports for "Suggested Measures to Mitigate Asian Elephant -Train Collision on Vulnerable Railway Stretches" for the State Arunachal Pradesh, Assam, Jharkhand, Karnataka, Madhya Pradesh, Nagaland, Odisha, Tamil Nadu, Uttarakhand and West Bengal has been finalized. Additionally, an online railway portal has been established by WII to facilitate the monitoring and assessment of these mitigation strategies. The portal provides access to detailed survey findings and finalized reports, enabling on-going evaluation and refinement of collision prevention measures.



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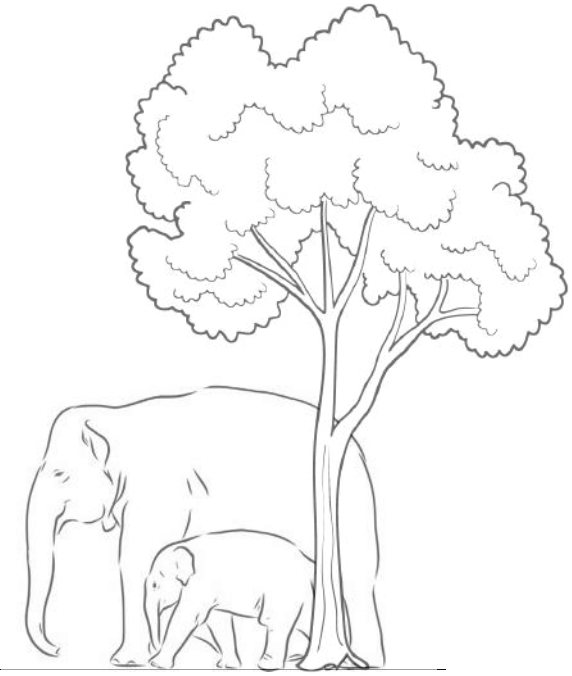

Photo credit: Richard Sangma

Ensuring the Well-Being of Elephants at Vantara's Radhe Krishna Temple Elephant Welfare Trust:

A Comprehensive Approach to Ethical Care

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Abstract

The Vantara's Radhe Krishna Temple Elephant Welfare Trust (RKTEWT), Jamnagar, is dedicated to the comprehensive captive care of elephants in India, addressing both their physical and psychological well-being. This paper presents an overview of the welfare practices implemented at RKTEWT, which encompass advanced husbandry techniques, medical care, and enrichment programs tailored to meet the specific needs of each elephant. This approach is grounded in scientific research and traditional knowledge, aiming to provide a holistic environment that promotes natural behaviours and social structures. Key components of the welfare strategy of captive elephants at RKTEWT include meticulous health monitoring, innovative nutritional plans, and specialized care for elephants in musth. Additionally, RKTEWT emphasizes the importance of continuous training and development of mahouts, fostering a deep understanding and respect for elephant behaviour and welfare. By integrating modern veterinary practices with cultural traditions, RKTEWT has established a model for elephant care that can be replicated in other conservation efforts. Through this comprehensive welfare program, RKTEWT aims to contribute to the global initiatives in conserving this endangered species and enhancing their quality of life.

Keywords: Elephant, Captivity, Welfare, Musth, Mahouts.

Introduction: Understanding the Context of Captive Elephant Welfare

In Asia, particularly in South Asia, captive elephants have been associated with humans for millennia, symbolizing wisdom, strength, and reverence. Captive Asian elephants in South Asia are used for many purposes in Asia, including logging, cultural and ceremonial purposes, public exhibitions, tourism, and transportation (Menon and Tiwari, 2019). Recent estimates put the current number of captive Asian elephants in range countries at 14,000 to 16,000, of which 3,400 to 3,700 are in India (AsERSM, 2022). In recent years, there has been a global shift towards a more ethical and humane treatment of animals that recognizes their intrinsic value. This shift has been driven by advances in scientific understanding, changing public perceptions, and a growing awareness of the importance of animal welfare. Many countries, including India, have husbandry guidelines for keeping and caring for elephants in captivity that take animal welfare into account. The welfare of elephants in captivity is assessed based on their physiological functions (e.g., health, reproduction, stress) and behavioural characteristics. However, recent studies in India have shown that the welfare of most captive elephants was poor (Varma et al., 2011). Health assessments in captive elephants to evaluate welfare include measures of body condition, foot health, and reproductive cycle activity (Lewis et al., 2010; Brown et al., 2016; Miller et al., 2016; Morfeld et al., 2016). Studies assessing the health of elephants in captivity have found that many elephants have significant health problems, ranging from body and skin conditions to foot health, eye problems, edema, and wounds (Ramanathan and Mallapur, 2008). Due to poor nutrition and husbandry practices, many elephants in captivity suffer from obesity or arthritis (Sirikaew et al., 2019). Elephants in captivity should be kept in conditions that allow them to express their natural behaviours. Stereotypic behaviours (repetitive patterns of behaviour) are the most common welfare-related behaviours in captive elephants and have been linked to chaining, lack of space, and social isolation (Greco et al., 2016; Varadharajan et al., 2016). Musth in adult male elephants is characterised by high testosterone levels and increased aggression, making them difficult to control in captivity. Poor management practices often result in elephants being starved to force them out of musth, negatively impacting their welfare and living conditions. Short tethering, social isolation, and a lack of fresh food and clean water lead to increased frustration and aggression (Brown et al., 2020).

Expressions such as play behaviour, alertness and responsiveness, relaxed boot movements, tail wagging, vocalisations and rhythmic ear flapping are associated with positive well-being in captive elephants (Lee and Moss, 2014). Studies have shown that good welfare of captive elephants is associated with a diverse and enriched captive environment, exercise opportunities, diverse feeding, housing in compatible social groups, natural substrates, and good relationships between elephants and caretakers (Brown et al., 2016; Morfeld et al., 2016; Holdgate et al., 2016). Considering best welfare practices, elephants in captivity require socialization (by humans and conspecifics), appropriate nutrition and feeding practices, freedom of movement, mental stimulation, and good veterinary care (Brown et al., 2020). The diet of Asian elephants in the wild includes a wide range of food plants with different nutrient compositions (Vanitha et al., 2008). In captivity, they are often not fed as they would be in the wild. Due to the restricted diet, many elephants in captivity suffer from nutritional deficiencies and metabolic diseases. Nutritional management with proper supplementation of minerals and vitamins protects the animals not only from metabolic disorders but also from infectious diseases (Dhairykar and Singh, 2020).

Training elephants in captivity usually involves harsh methods that are mainly associated with negative reinforcement. With positive reinforcement instead of negative reinforcement, elephants can learn commands faster. Elephants kept with positive reinforcement may be less anxious or fearful during training, contributing to a more cooperative relationship between staff and animal (Kane et al., 2005). The welfare of captive elephants is directly linked to the welfare of their mahouts, as a positive human-animal relationship is crucial for animal welfare (Carlstead et al., 2019). The mahouts' expertise accumulated over many generations is of great importance when dealing with elephants in captivity. Frequent changes of mahouts and mahouts with little experience in this profession can increase the stress of the animals and the risk of injury. In addition, studies have found that traditional family ties to the profession are declining, and many mahouts today have little experience in handling captive elephants (Mumby, 2019). The tradition of mahout ship is on the wane in India (Lair, 1997; Hart and Sundar, 2000; Varma et al., 2010; Radhakrishnan et al., 2011). There is a need to teach mahouts humane methods of training elephants that focus on the idea of positive reinforcement.

Elephants kept in captivity in India can be broadly divided into the following categories: Zoo elephants, which are housed in zoos; Temple elephants, which are owned by temples and used for religious activities; Forest Department elephants, which are kept in elephant camps run and managed by state forest departments and used for patrolling, human-wildlife conflict resolution, conservation and wildlife research activities; privately owned elephants owned by individuals, companies or organisations and used for various purposes such as religious activities or entertainment rides; and rescued elephants housed in rescue facilities across India, including elephants rescued from captivity or the wild and cared for and rehabilitated in captivity. As far as the welfare of captive elephants is concerned, the intensity and number of problems faced by these elephants depend on which of these categories the elephants are kept in. Elephants in some categories are unfortunately in a worse condition than others. Considering the welfare of captive elephants in India, Project Elephant has issued 'Guidelines for the Care and Management of Captive Elephants (2008)' under the aegis of the Ministry of Environment, Forest, and Climate Change (MoEFCC). Similar guidelines from various states and statutory bodies followed, including the Kerala Captive Elephants (Management and Maintenance) Rules, 2003; the Tamil Nadu Captive Elephant (Management and Maintenance) Rules, 2011; the Gujarat Captive Elephant (Management and Maintenance) Rules, 2024, the Central Zoo Authority Recommended Guidelines for "Elephants Upkeep in Zoos" 2013; and more recently, the Captive Elephant (Transfer or Transport) Rules, 2024. To a certain extent, elephant camps and zoos run by state forest departments and central governments in India adhere to these rules and regulations. A study on the overall welfare of privately owned elephants found deviations of 50% or more from the prescribed norms (Varma, 2010).

Physical health and healthcare

Many captive elephants, especially the working elephants, suffer from a spectrum of chronic health conditions. The most common ones are unhealing wounds and abscesses, foot injuries, eye and vision problems, and joint problems. In many cases, an experienced veterinarian is not available to routinely examine and treat these conditions, which results in worsening of these conditions and discomfort of the elephant.

New and inexperienced mahouts (elephant handlers) many times tend to overuse negative reinforcements using the equipment that may cause injury and wounds to the elephant where the equipment has been applied. Most common sites are behind the ears and on the legs, where the elephants frequently get poked with the sharp objects. Use of spiked hobbles on the legs is another common reason for the wound on the legs. This is very common in the case of male elephants when they come in musth. At most places, bulls in musth are restrained by 3 to 4 legs with heavy chains for the entire musth period, which can be as long as 3 to 4 months. During this period, it is very difficult to approach the elephant for cleaning or even feeding and watering. However, this causes infections in the foot pads due to constant exposure to unhygienic substrate. If there are already existing foot pad or toenail injuries, they tend to get worse during this period as regular medical attention and dressing is not possible due to the aggressive behaviour of the male. If the elephant is restrained for such a long period on a hard surface like a concrete floor, that also takes a toll on the weight-bearing joints of the legs. Lack of exercise during musth adds to this joint problem. In many cases, due to constant pulling by the elephant, the heavy chains put on the legs get embedded into skin, or even underlying tissues, causing severe painful wounds on the legs (Img. 1).

Joint problems are very common in elephants that are kept on the hard surfaces most of the time and do not have the freedom to move around, thus not getting the necessary exercise for the joints. Also, the elephants used for the activities that required walking on hard surfaces like stone paths or tar roads for long durations and long distances are more prone to developing joint inflammations (Img. 2). Nutrition also plays a very important role in avoiding and controlling the arthritic conditions. Captive elephants, due to

Image 1. Infectious tethering wounds on the hind legs

lack of optimum exercise, are more prone to obesity and thus joint problems. Improper diet and nutrition result in the imbalance in the essential nutrients that are required for the maintenance of bones and joints.

Many elephants are restrained on the hard floor and are made to sit or lie down frequently for different works. Such elephants, over the years, develop chronic inflammation with swellings on the pressure points, such as the elbows, hip area, or the temporal area of the head. These swellings might not be painful for some time, but if the constant hard floor impact and irritation continue, they may develop into inflammatory edema or abscess. In that case, it becomes painful and uncomfortable for the elephant to sit or lie down. If such swelling is on one side of the body, the elephant starts preferring or putting more weight on the other side while sitting or lying down, which eventually causes a similar condition on the other side as well.

Image 2. Severe swelling of hind foot of an elephant

All elephants with joint problems absolutely require access to a water body. It works as hydrotherapy by taking the weight off from the inflamed joints due to buoyancy and providing the necessary rest to the joints. All such elephants must be given daily access to water bodies for a few hours, where they can relax their painful joints. Many elephants with arthritis are unable to lie down to rest due to joint pain and due to the fear of not being able to get up again. Such elephants sleep only in a standing position for months or even years. This gradually worsens the joint inflammation. These elephants should be provided with a support structure for them to lean against while sleeping. Even if this is provided, there is no alternative for the hydrotherapy. In captive situations, these requirements of arthritic elephants are not met in many cases.

Zoonotic diseases are another important concern in captive elephants. Most importantly, transmission of Tuberculosis (TB) from people to elephants. Captive elephants, due to their frequent contact with humans, especially mahouts, are more prone to "reverse zoonosis" of TB from people to them (Lainé 2018). These infected elephants, in turn, may transmit the disease to other people. In most captive situations, this aspect of the healthcare and husbandry management remains neglected. The elephants are not tested or screened for TB. As the infection may be present in the elephant in a latent form, there is always a chance that it may flare up when the immunity levels go down due to any reason. The disease may cause weakness and eventually death in elephants.

Prophylactic healthcare is severely lacking for many elephants in captivity. This might be due to difficulty in regular and necessary access to experienced veterinarians. Prophylactic measures like deworming and vaccinations are not properly followed. Even if it is done sporadically, proper medical records are not generally maintained. This makes it difficult for the veterinarians to know the health history and carry out proper holistic treatment when required.

Psychological health

Many captive elephants, especially working elephants, suffer from a spectrum of chronic health conditions. Among the most common are non-healing wounds and abscesses, foot injuries, eye and vision problems, and joint problems. In many cases, no experienced veterinarian is available to routinely examine and treat these conditions, resulting in the exacerbation of these diseases and the malaise of the elephants.

New and inexperienced mahouts (elephant handlers) often tend to overdo negative reinforcement with the equipment, which can result in injury and wounds to the elephant where the equipment has been used. The most common places are behind the ears and on the legs, where the elephants are often pricked with the sharp objects. The use of spiked hobbles on the legs is another common cause of leg wounds. This is particularly common in male elephants when they are in moult. In most places, bulls are shackled with heavy chains on 3 to 4 legs throughout the musth period, which can last 3 to 4 months. During this time, it is very difficult to approach the elephant to clean it or even feed and water it. However, this leads to infections in the footpads as they are constantly exposed to unhygienic substrate. If there are already injuries on the footpads or toenails, they worsen during this time as regular medical care and bandaging are not possible due to the male's aggressive behaviour. If the elephant is kept on a hard surface such as a concrete floor for such a long period of time, this also puts strain on the joints of the legs, which bear the weight. The lack of movement during musth exacerbates this joint problem. In many cases, the heavy chains attached to the legs penetrate the skin or even the underlying tissue due to the constant pulling of the elephant, causing severe, painful wounds on the legs (Img. 1).

Joint problems are very common in elephants that are kept on hard surfaces most of the time and cannot move freely, so the joints are not sufficiently exercised. In addition, elephants used for activities that require them to walk for long periods of time and over long distances on hard surfaces such as stone paths or tarred roads are more prone to joint inflammation (Img. 2). Diet also plays an important role in the prevention and control of arthritic diseases. Elephants in captivity are more prone to obesity and thus joint problems due to the lack of optimal exercise. A poor diet leads to an imbalance in the essential nutrients needed to maintain bones and joints.

Many elephants are confined to the hard ground and have to sit or lie down frequently for various tasks. Over the years, such elephants develop chronic inflammation with swelling in pressure points such as the elbows, the hip area, or the temple area of the head. These swellings may not be painful for a while, but if the constant hard ground impact and irritation persist, they may develop into inflammatory edema or abscess. In this case, it becomes painful and uncomfortable for the elephant to sit or lie down. If such swelling occurs on one side of the body, the elephant will begin to favour or put more weight on the other side when sitting or lying down, eventually leading to a similar condition on the other side as well.

All elephants with joint problems absolutely need access to a body of water. It acts as hydrotherapy by relieving the inflamed joints through buoyancy and giving the joints the rest they need. All of these elephants need to be given access to a body of water for a few hours every day where they can relax their aching joints. Many elephants with arthritis are unable to lie down to rest because of the joint pain and fear of not being able to get up. Such elephants sleep standing up for months or even years. This gradually worsens the joint inflammation. These elephants should be provided with a support structure to lean on while sleeping. Even if this is the case, there is no alternative for hydrotherapy. In captivity, these requirements are not met by arthritic elephants in many cases.

Zoonotic diseases are another important problem in captive elephants. Most important is the transmission of tuberculosis (TB) from humans to elephants. Captive elephants are more susceptible to "reverse zoonosis" of TB from humans to them due to their frequent contact with humans, especially mahouts (Lainé 2018). These infected elephants can in turn transmit the disease to other humans. In most cases, this aspect of captive health and husbandry management is neglected. The elephants are neither tested nor screened for tuberculosis. Since the infection may be latent in the elephant, there is always a possibility of an outbreak if immunity wanes for any reason. The disease can lead to weakness and eventually death in elephants. Many elephants in captivity lack prophylactic health care. This may be because it is difficult to get regular access to experienced veterinarians. Prophylactic measures such as deworming and vaccinations are not carried out properly. Even when they are carried out sporadically, proper medical records are generally not kept. This makes it difficult for veterinarians to know the health history and provide appropriate holistic treatment when needed.

Radhe Krishna Temple Elephant Welfare Trust (RKTEWT): Redefining Captive Elephant Welfare

The Radhe Krishna Temple Elephant Welfare Trust (RKTEWT) attaches great importance to the welfare of elephants in captivity. In line with modern ethical standards, the RKTEWT is committed to improving the care of elephants through contemporary practices. The manuscript "Ensuring the Welfare of Elephants at Radhe Krishna Temple Elephant Welfare Trust: A Comprehensive Approach to Ethical Care" describes the Trust's commitment to high standards of care. It details the efforts to incorporate contemporary principles of animal welfare into daily routines and operations. The article takes a comprehensive look at aspects of physical health and health management as well as the mental health of the captive elephants at RKTEWT. A transformative journey has been undertaken to modernize practices to ensure alignment with current ethical standards and best practices in animal welfare. Continuous learning and adaptation are at the heart of this commitment. Protocols are regularly reviewed and updated based on the latest research and feedback from experts. By sharing knowledge and experiences, RKTEWT aims to encourage the adoption of similar practices and contribute to improved conservation of captive elephants in India and elsewhere. This manuscript serves both as a record of current practices and as a dynamic document reflecting continuous learning and growth. It is intended as a valuable resource for organizations, researchers, and individuals working for the welfare of these remarkable animals.

Transformative approaches to physical health and proactive healthcare

In the RKTEWT, elephants are admitted from a variety of backgrounds and with many of the health problems mentioned above. A flow chart explains the process of how the elephants arrive at the RKTEWT (Fig. 8). In order to provide the elephants with the best possible medical care and welfare, the facility has created a specialised infrastructure that can best meet their needs. The RKTEWT has the largest elephant hospital in the world with advanced equipment and technology, including a hydraulic height-adjustable operating table, an endoscopy unit, a laser lithotripsy unit, special anaesthesia equipment for the elephants, and other regular equipment such as portable X-ray and ultrasound machines. The hospital is equipped to perform intensive surgery on an emergency basis. The team has already successfully performed life-saving surgeries at the hospital, including a tumour removal from the urinary tract and the removal of a urinary bladder stone with laser lithotripsy. Cataract surgery has also been successfully performed at the hospital.

RKTEWT has 40 hydrotherapy pools spread across many areas of the facility to provide relief to elephants with arthritis, joint pain, and foot problems. This includes a temperature-controlled Jacuzzi pool equipped with high-pressure jets that create hydrostatic pressure. This pressure serves as a therapeutic massage for the muscles, joints, and the entire body and promotes blood circulation. Hydrotherapy plays a crucial role in relieving chronic muscle discomfort in elephants suffering from the challenges of arthritic conditions. Water resistance is invaluable for strengthening muscles and cardiovascular exercise, as it can effectively reduce edema and swelling. It is particularly beneficial for elephants in captivity who are often plagued by arthritis and foot problems. All elephants in the facility are given loose earth or sand mounds to sleep on. This gives them the support they need to stand up and serves as enrichment, as the elephants love to rub against these mounds.

The captive environment, characterized by poor nutrition and little space, puts elephants at risk of arthritis, which is exacerbated by movement on uneven surfaces that are unsuitable for their sensitive feet. In addition, these animals often suffer from painful sores and abscesses on their feet. The buoyancy of the water in these hydrotherapy sessions offers them respite by easing the burden on their feet and promoting relaxation in the large pool. Many of the elephants cared for by RKTEWT have been rescued from difficult circumstances. Some were privately owned and exploited as beggars; others spent their lives in captivity and confinement as temple elephants or were forced to perform in circuses. Such elephants in captivity are often forced to move in environments that are unsuitable for their anatomy, leading to premature onset of arthritis. In addition, the lack of proper foot care leads to overgrown toenails and cracked cuticles. As a result, standing and walking become torture for these majestic creatures. Hours of walking on scorching, tarred roads have taken their toll on the sensitive soles of their feet. This special treatment not only provides relief for the elephants but also serves as a model for the management of elephants in captivity worldwide.

For elephants, maintaining good health begins with healthy feet. The undersides of elephants' feet are made of a cushioning material that serves as a natural support system, much like a sturdy shoe. In captive elephants, foot health is the biggest problem and the most important disease they face. Factors such as inactivity, suboptimal postural practices, and prolonged contact with

unnaturally hard surfaces such as pavement, compacted dirt, and concrete can lead to thin, uneven, and bruised foot pads as well as cracked nails. This can lead to irreversible damage to the nail bed, ultimately resulting in lameness. These diseases are common in captive elephants and sometimes lead to severe and irreversible health problems that require removal of the infected toe bone. Therefore, comprehensive foot care is an essential part of any captive elephant's health care programme.

RKTEWT prioritises regular care of elephants' feet as an integral part of husbandry practices. Foot care for captive elephants at RKTEWT commences with granting them self-directed access to appropriate and uncontaminated substrates such as grass, natural soils, and diverse vegetation. These natural surfaces promote the natural wear and conditioning of feet, cuticles, and nails as elephants engage in their typical foraging activities. Daily inspections of elephants' feet are a routine practice, carried out while the elephants are lying on their sides. Additionally, staff always monitor elephant movement and behaviour to detect signs of lameness, which can indicate foot pain or injury. During these foot care inspections, elephants are thoroughly examined for injuries and common foot disorders. To support overall health and prevent infection, lameness, and osteomyelitis (a bone disease), all elephants receive pedicures on a monthly basis. This process involves trimming foot pads and nails to eliminate necrotic tissue that may pose a threat to the animals. Overgrown nails are also removed to prevent them from cracking, splitting, and becoming infected. Mahouts are trained to use specialized sterile tools to work with the foot pads carefully. These tools include a large knife for removing pads and trimming nails, a small blade for addressing infected areas, and a rasp for fine-tuning the nails.

In addition to maintaining the grooves of the elephants' foot pads, the care team takes care of clipping their nails using a large rasp to keep them in optimal health. All these activities are made possible through a positive reinforcement training programme, which enables the elephants to willingly participate in their own care. Consistent cleaning and trimming of the feet of elephants ensures their continued health and prevents potential issues that might arise in the absence of regular foot care.

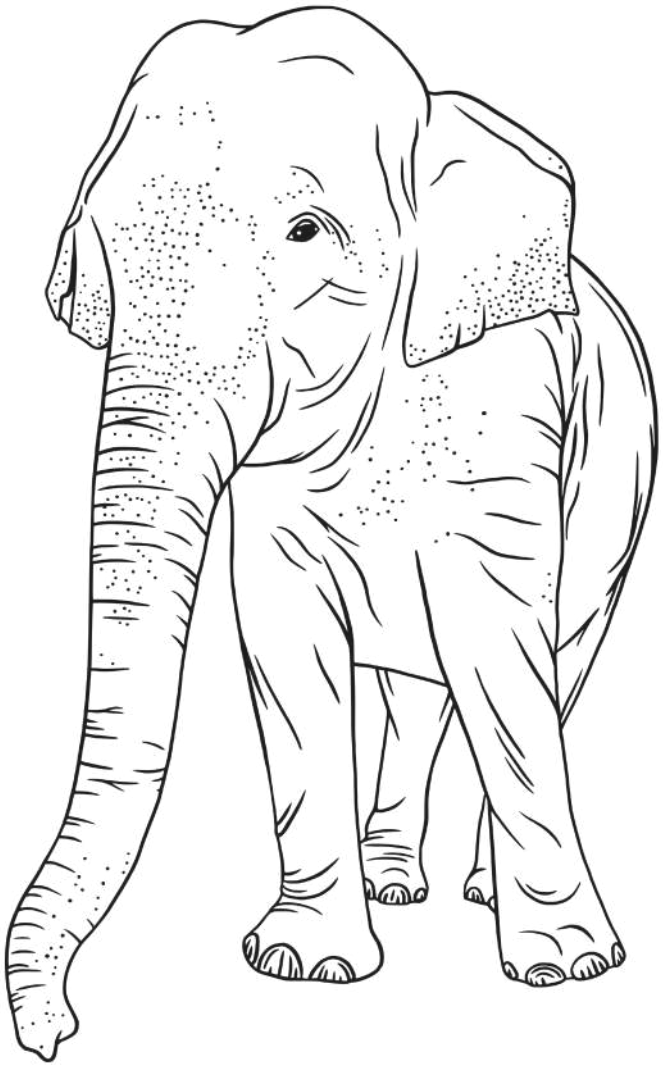


Photo credit: Shashank N

Revolutionizing nutritional management for optimal health

Caring for the nutritional needs of captive elephants is a paramount aspect of ensuring their well-being in captivity. Different elephants have varying nutritional requirements, depending on their general health and individual needs. With a population of over 200 captive elephants, the task of consistently providing them with nourishment is quite demanding. To meet this challenge, RKTEWT boasts a world-class elephant kitchen equipped with state-of-the-art facilities. Much like a top-tier restaurant, the elephant kitchen's day commences before sunrise, as trucks deliver a variety of essential items, including hay, sugarcane, fresh fruits, vegetables, and vital nutritional supplements. Within the expansive kitchen, spanning several thousand square feet, skilled chefs meticulously craft special diets and enrichment items tailored to each elephant's specific dietary guidelines, as directed by nutritionists.

The nutrition programme at RKTEWT comprises a nutrition laboratory and a centralized diet kitchen, working in harmony to ensure the adequacy and safety of the elephants' diets. The nutrition laboratory continuously monitors and assesses the diets for various nutrients, thereby ensuring the optimal health of elephants. Diets are meticulously designed and formulated based on the health history of each individual, taking into account their unique digestive anatomy and physiology. Within the nutrition laboratory, a dedicated team of nutritionists produces daily elephant diets, making it a leader in elephant nutrition research on a global scale. Equipped with cutting-edge analytical instruments, the lab measures specific nutrients, including water content, protein, fat, fatty acids, and dietary fibre. Regular monitoring of the nutritional quality of the elephants' diets allows us to make necessary adjustments based on analytical findings.

Feeding elephants at RKTEWT is a year-round commitment, and dedicated diet kitchen staff are responsible for procuring and managing all the ingredients required for the animals' diets. This includes a wide range of feed ingredients such as alfalfa hay, fodder, vegetables, fruits, dietary supplements, and more, all of which are carefully measured and prepared daily to cater to each animal's specific dietary needs. Improvements in the nutritional status of elephants have a direct impact on their overall health and longevity. Additionally, advances in nutrition research provide us with valuable tools to effectively manage their well-being and enhance their chances of survival. Maintaining cleanliness is of utmost importance throughout the process, with all fruits and vegetables undergoing thorough washing. For elderly elephants or those with dental issues or health concerns, specially prepared food tailored to their nutritional requirements is provided. Feeding time is a critical juncture when caregivers and the veterinary team discuss the elephants' response to medications and the need to continue prescribed courses of treatment.

The team at RKTEWT actively encourages and works on the socialisation of the elephants depending on their ages and compatibility. The facility has managed to socialise the elephants into stable herds as big as 12 elephants. As mentioned above, this socialisation has a big impact on improving the psychological welfare of the elephants, as they get the opportunity to be in a social environment and structure as close as possible to the wild. This reduces the stereotypies and allows the elephants to exhibit natural behaviour.

Humane and safe management of Musth

Musth, pronounced as "must," represents an annual hormonal cycle naturally occurring in adult male bull elephants. This cycle can persist for a few days or extend for several months. During musth, male elephants undergo significant physical and behavioural changes, characterized by a surge in testosterone levels, heightened aggression, the secretion of temporin, a hormone-rich substance, from glands on either side of their heads, and a continuous dribble of urine down their hind legs. Given that a bull Asian elephant can weigh over 6,000 kilograms, these behavioural changes can pose considerable dangers not only to themselves but also to other bulls and even female elephants. Caution and minimal interaction are advised when dealing with bull elephants in musth, only engaging when necessary.

In captivity, managing bull elephants during musth presents unique challenges for both the elephants and their caretakers. Typically, docile elephants have been known to become uncontrollably aggressive, posing risks to caretakers, facilities, and other elephants. Traditional methods involve tethering these elephants to trees and reducing their food intake in the hope of expediting the end of musth. However, these techniques can lead to severe leg wounds from the ropes used for restraint, exacerbate aggression, and create significant hazards for their keepers or mahouts. Tragically, human fatalities resulting from encounters with musth elephants are not uncommon, perpetuating lasting psychological harm for these gentle giants. Unfortunately, the treatment of musth bulls in India has remained largely unchanged for centuries.

RKTEWT has redefined the approach to managing elephants in musth captivity. After conducting a comprehensive study and considering existing methods and welfare standards, RKTEWT designed a robust, secure, and humane approach to managing musth bulls. This method not only ensures the safety of the bulls but also guarantees the well-being of their mahouts. RKTEWT has established a dedicated area exclusively for managing bull elephants in musth, specially designed musth-proof enclosures, where the male elephants are housed during musth. Within this facility, adult male elephants in musth are housed in large holding paddocks, entirely free from chains or ropes. The design of these enclosures and the husbandry protocols followed with musth elephants allows the facility to take care of the males in musth without restraining them. This is also possible due to the highly experienced team of international elephant trainers at RKTEWT. They work with the mahouts, vets, and biologists to curate individual training protocols for elephants as per their medical needs. These enclosures are purposefully designed to address the care and medical needs of the animals. This innovative approach offers an alternative management strategy that prioritizes the safety of both the bull elephants and their mahouts. The spatial separation of the two parties is always maintained until the musth cycle concludes, eliminating the need for direct human contact as the sole means of control. The enclosure design aims to provide the bull elephants with a sense of security and control over their environment, in contrast to being physically tethered. Furthermore, the use of ankuses, chains, or ropes to restrain the elephants is minimized, with management relying on conditioning the animals to follow a routine before and during the musth period. The primary focus of this approach is to afford elephants opportunities to express a full range of natural behavioural responses.

Importantly, there is currently no such facility in India with a similar approach. The experience gained at RKTEWT in managing musth elephants have the potential to transform the way these animals are cared for by providing a robust, safe, and compassionate management tool. The design of the paddocks holds promise for reducing injuries to elephants and ensuring the safety of both the animals and their mahouts.

As an organisation dedicated to advancing the welfare of captive animals in India, RKTEWT is committed to leading the way in promoting this humane management practice as an alternative tool for managing bulls in musth. This approach allows elephants to transition out of musth without the use of chains or other forms of cruelty, employing positive reinforcement and a large enclosure. The routine training and careful handling ensure that elephants recover from musth with minimal harm to themselves and complete protection for their caretakers. This approach to managing bulls in musth is marked by care, the latest research, medical expertise, and teamwork, all geared towards ensuring the safety of both the elephants and dedicated staff.

Strengthening the mahout-elephant bond

RKTEWT recognises the importance of training and developing mahouts to ensure the well-being of the elephants under their care. Traditionally in India, the art of elephant handling and care was passed down from father to son. Unfortunately, in many places, the role of the mahout has become a lowly occupation, often taken up by those unable to find other work and lacking real knowledge of elephant care. There is a renewed effort to reestablish respect for the role of the mahout and to enhance their knowledge and skills. One of the main goals of RKTEWT is to build long-lasting relationships with mahouts and make them aware of the crucial role they play in protecting a vanishing resource: an endangered species that has been part of human history for centuries. It is essential that mahouts receive continuous training in the care and management of elephants, rather than accepting a low level of expertise as satisfactory. Training of mahouts at RKTEWT is inculcated by a team of well-trained elephant managers, staff managers, and qualified teachers who are prerequisites for building a strong team of skilled mahouts who value and take pride in their work. Only knowledgeable mahouts and managers can ensure the well-being of the elephants in their care and help secure the future of the species. Mahouts from RKTEWT regularly attend mahout workshops to gain insights and training to further this mission. Care staff at RKTEWT undergo extensive training on elephant behaviour, husbandry, and all aspects necessary to properly care for elephants as a species while also addressing the specific and individual needs of each elephant in their care.

Enhancing psychological welfare through innovative enrichment

The well-being of each elephant is a top priority at RKTEWT. This includes providing optimal care for the health, social, and psychological well-being of each elephant. A dedicated team, including senior veterinarians, nutritionists, biologist, elephant care managers, and caregivers, works in close coordination to provide the best care possible for the elephants. Together, they continually evaluate health and well-being, ensuring a "Wholesome Elephant Care" approach to meet the elephants' individual needs. Currently, both African and Asian elephants are permanent residents at RKTEWT, living in various habitat areas within expansive facilities. With opportunities to roam, socialize, and browse throughout the day, the elephants move at their own preferred pace with companions of their choosing, which helps maintain their physical health and psychological well-being.

New elephants arriving at RKTEWT, are housed separately and not introduced to other elephants until their health status is fully assessed and an individualized care plan has been developed by the care staff.

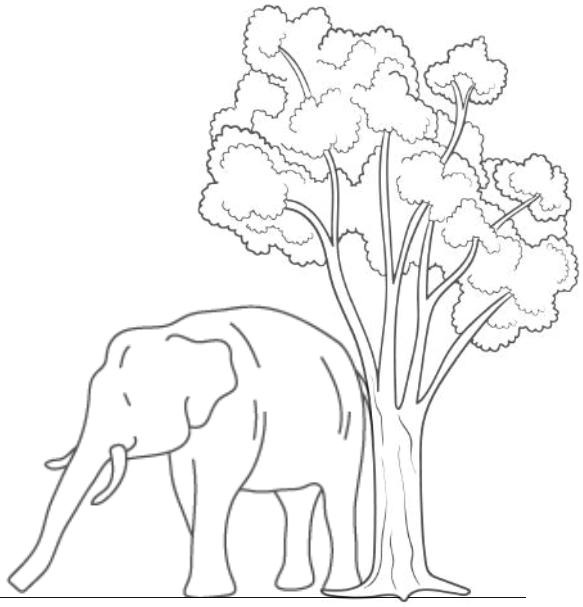
To meet the daily needs of elephants in captivity, they are provided:

- Expansive, diverse habitats and opportunities for choice and control of their environment.
- A varied diet including browse, hay, fruits, vegetables, grains, and fresh produce.
- Supplements to address deficiencies and health issues common to aging elephants.
- Ongoing husbandry care and medical treatment, including foot care, dental care, weight monitoring, routine annual testing, radiographic monitoring of chronic illnesses such as osteoarthritis, laser therapy, and pain medication.

RKTEWT has established a separate facility with dedicated enclosures for the management, care, and enrichment of elephants with known health ailments. This facility has a separate entrance and dedicated staff to ensure the highest standards of care.

Radhe Krishna Temple Elephant Welfare Trust takes inspiration from the natural feeding behaviour and nutrition of wild elephants to guide feeding practices for those in captivity. RKTEWT tries to replicate these natural feeding opportunities as closely as possible. Given that wild elephants can spend 14 to 18 hours a day feeding, elephants at RKTEWT are allowed to feed during their idle time. Most elephants in captivity have excessive amounts of high-sugar diets. Such foods deviate from the elephant's natural diet of high-roughage and low-calorie grasses. High caloric intake can lead to excessive weight gain, contributing to conditions such as arthritis and foot problems. Additionally, foods not naturally available to elephants in the wild often lack essential minerals, vitamins, and nutrients necessary for their health. One of the important goals of RKTEWT is to provide a well-balanced diet that meets all their nutritional needs.

Daily care for elephants at RKTEWT includes providing clean drinking water, a proper diet, opportunities for social interactions, regular training sessions, and maintaining healthy skin and feet. Elephants are intelligent and social animals. In the wild, older elephants teach and discipline calves to understand their role within the family unit. In captivity, mahouts foster and nurture social relationships among the elephants to ensure safe interactions. Regular training sessions offer mental and physical stimulation and build trust between the mahout and the elephant, facilitating medical care with minimal stress to the animal. Daily baths are crucial for skin care and allow for the inspection of the elephant's skin and feet for any abrasions or cuts that may require medical attention.



Conclusion and Way Forward

In conclusion, the Radhe Krishna Temple Elephant Welfare Trust (RKTEWT) exemplifies a forward-thinking and compassionate approach to the care of captive elephants. Through its commitment to modern ethical standards, RKTEWT has developed an extensive and holistic welfare programme that addresses the physical, psychological, and social needs of these majestic animals. The Trust's innovative practices, including advanced medical care, specialized nutrition, and humane management of musth bulls, set new benchmarks for elephant care in captivity. By fostering a nurturing environment that mirrors the natural behaviours of elephants, RKTEWT not only enhances the well-being of its residents but also serves as a model for improving captive elephant welfare globally. This comprehensive and dynamic approach ensures that RKTEWT remains at the forefront of elephant conservation efforts and welfare, inspiring others to adopt similar practices and contribute to the protection and dignity of these endangered creatures.

Looking ahead, RKTEWT envisions several key initiatives to further its impact:

1. **Research and Innovation:** Establishing a dedicated research wing to explore emerging health and behavioural challenges, with a focus on zoonotic diseases, reproductive health, and the psychological well-being of captive elephants. Leveraging AI and machine learning technologies to monitor health and behaviour in real time.

2. **Capacity Building:** Developing advanced training modules for mahouts, veterinarians, and conservation professionals to ensure the highest standards of care. Expanding knowledge-sharing platforms through workshops, conferences, and online courses.

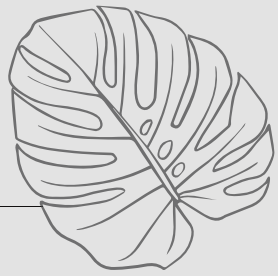
3. **Global Partnerships:** Strengthening collaborations with leading conservation organizations, zoological institutions, and research institutions worldwide. Sharing RKTEWT's successful models and practices to inspire global standards in elephant welfare.

4. **Community Engagement:** Enhancing outreach programmes to involve local communities in elephant conservation efforts. Promoting eco-tourism and awareness campaigns that highlight the importance of humane treatment and biodiversity preservation.

5. **Infrastructure Expansion:** Creating new facilities to accommodate more elephants in need and developing specialized units for elderly and disabled elephants. Incorporating sustainable and eco-friendly practices in facility design and operations.

6. **Policy advocacy:** Advocating for stronger legal frameworks to protect captive elephants in India. Collaborating with policymakers to implement guidelines that prioritize animal welfare and ethical treatment.

By implementing these initiatives, RKTEWT aims to solidify its role as a global leader in elephant welfare, conservation, and advocacy. The Trust's commitment to continuous improvement and innovation ensures that it remains a beacon of hope for the preservation and dignified treatment of these majestic creatures. Through these efforts, RKTEWT not only safeguards the lives of the elephants under its care but also contributes to the global movement towards ethical and sustainable wildlife conservation.



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Figures

Fig 1: Enrichment toys intended to mimic elephants' natural behaviour of using their trunks and feet.

Fig 2: Puzzle feeders make elephants use their natural skills and diligence when gathering and eating food.

Fig 3: Suspended hay nets are useful ways to keep elephants engaged.

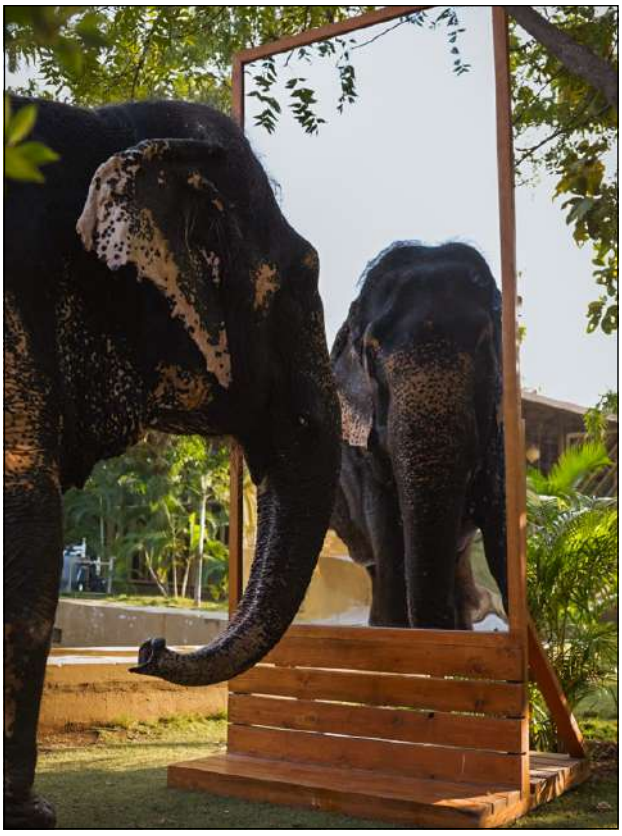

Fig 4: The mirror test: Elephants can recognize themselves in a mirror.

Fig 5: Elephants live in complex social systems with families. In captivity, the presence of other elephants is one of the most effective forms of social enrichment possible.

Fig 6: Mahouts are the most important factor of the elephant's wellness in captivity as they dedicate their lives to these majestic beings.

Fig 7: In captivity, elephants typically sleep up to six hours.

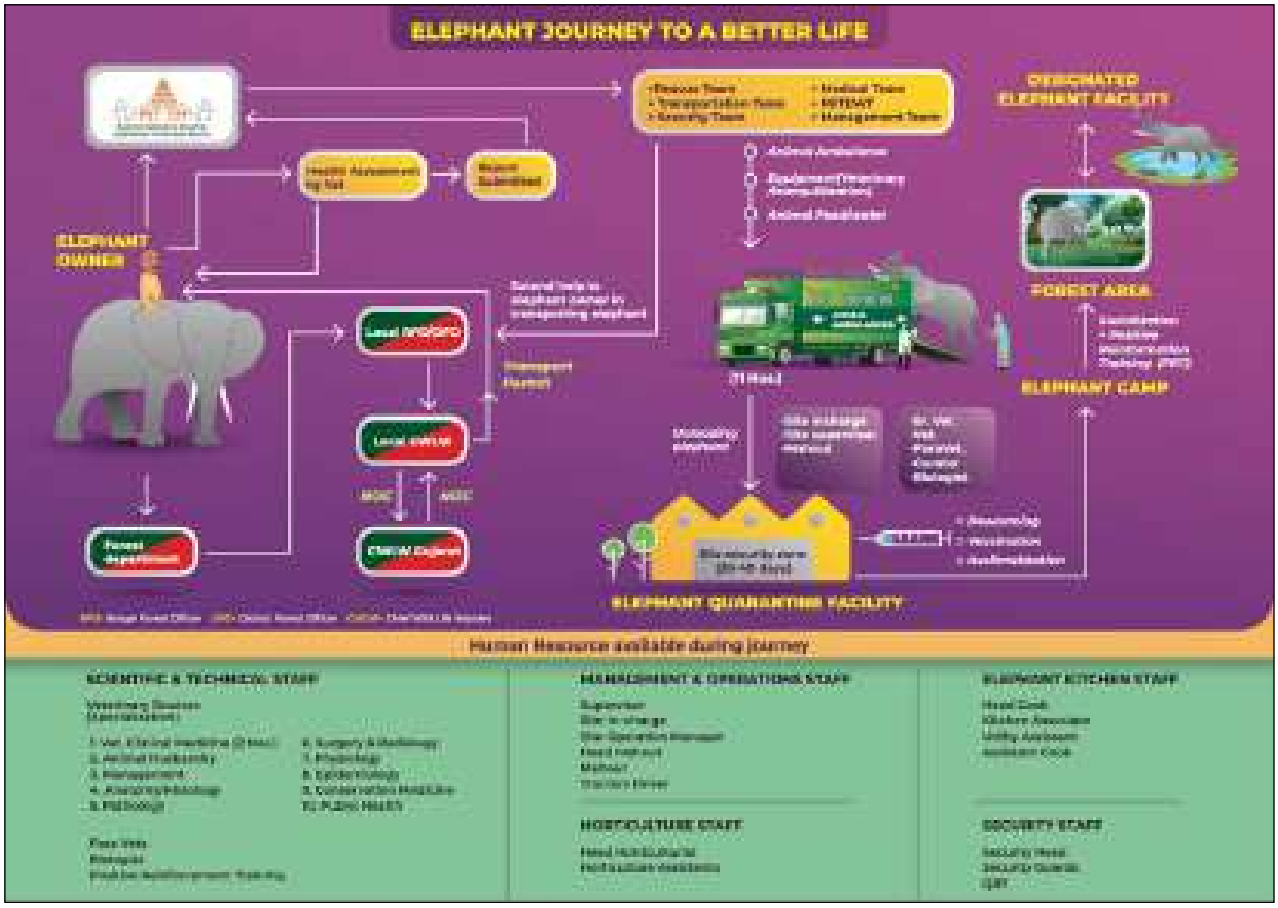

Fig 8: Flow chart explaining the process on Elephant Journey.

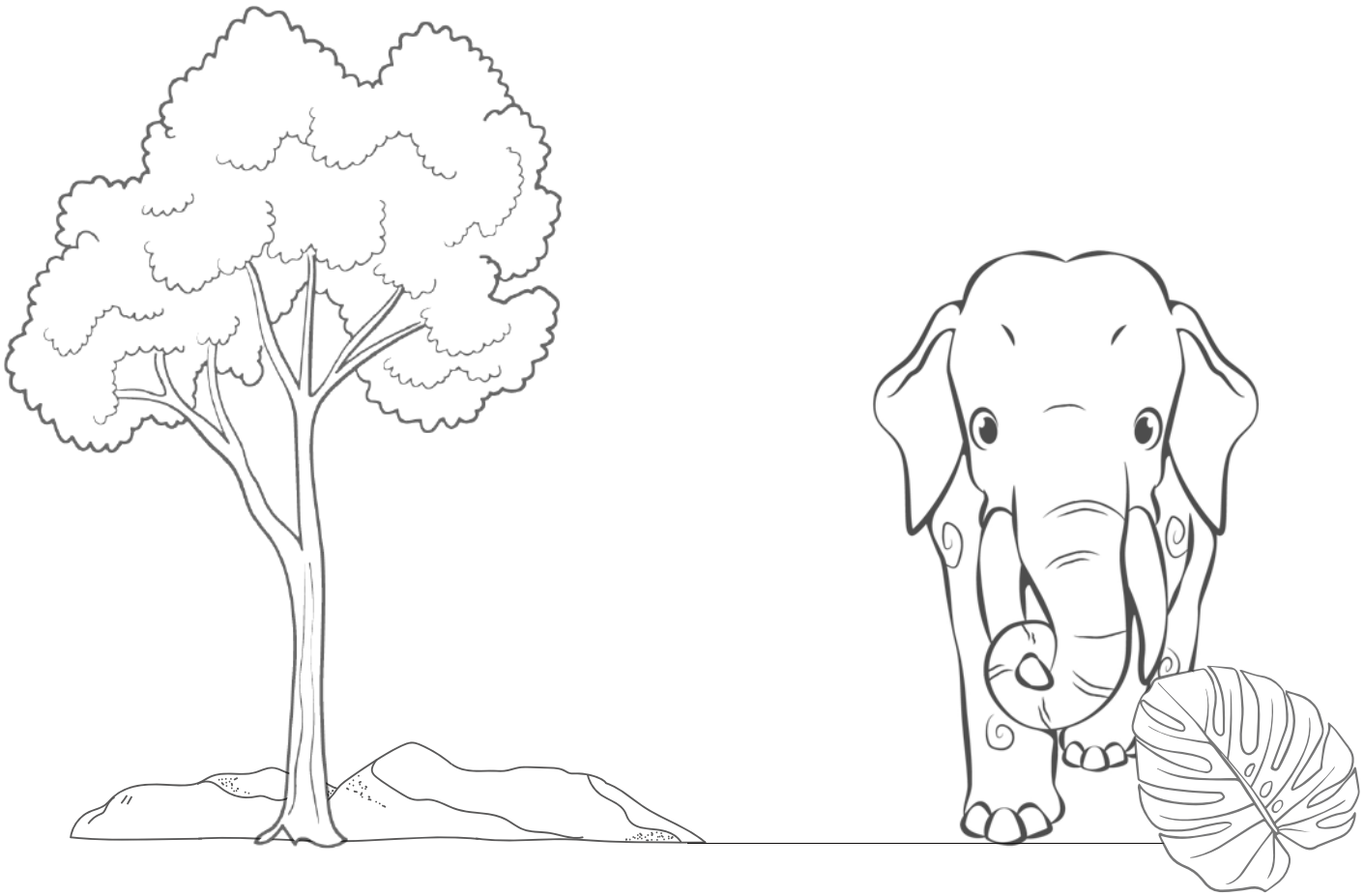

Photo credit: WWF-India

Field Note: Translocation of A Problem Wild Tusker in Tripura, July 2015

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Introduction

Tripura, with 74% forest cover, faces escalating human-elephant conflicts due to habitat fragmentation. A sub-adult male tusker, aged around seven years, was a recurrent problem in the districts of West, Sepahijala, and Gomati. Regular crop raiding and proximity to human settlements created fear among locals and strained Forest Department resources.

Problem Analysis

The tusker exhibited altered behavior, repeatedly returning to human habitations despite prior attempts to drive it back into forests. Its actions, though not directly aggressive, posed a significant risk of property damage and potential human harm.

Management Decision

In June 2015, Chief Wildlife Warden Dr. A.K. Gupta decided on a scientific resolution: capturing and relocating the tusker to Sepahijala Zoo. The operation involved coordination with West Bengal Forest Department and expert guidance.

Operation Details

1. Preparation: Materials, two captive elephants, and experienced personnel were mobilized. Veterinary support was arranged, and a detailed operational plan was developed.

2. Capture: On June 13, 2015, after tracking the tusker in dense bamboo brakes, it was darted with a sedative mixture. It was restrained securely and monitored overnight.

3. Translocation (Phase 1): The tusker, sedated and guided by captive elephants, was marched 14 km to Tepania Park amidst challenges such as terrain and adverse weather.

4. Translocation (Phase 2): A makeshift ramp facilitated loading the elephant onto a truck. It was transported 20 km to Sepahijala Zoo, arriving on June 16, 2015, where it was settled into captivity under veterinary supervision.

Outcome

The tusker, named 'Kishore,' was trained for departmental activities. Its relocation marked Tripura's first scientific effort in human-elephant conflict management. In 2023, Kishore participated in GPS collar operations, aiding further conservation initiatives.

Photo credit: Shashank N

Living with Elephants: Understanding Culture and Personality is Vital for Coexistence

Tarsh Thekaekara[1]

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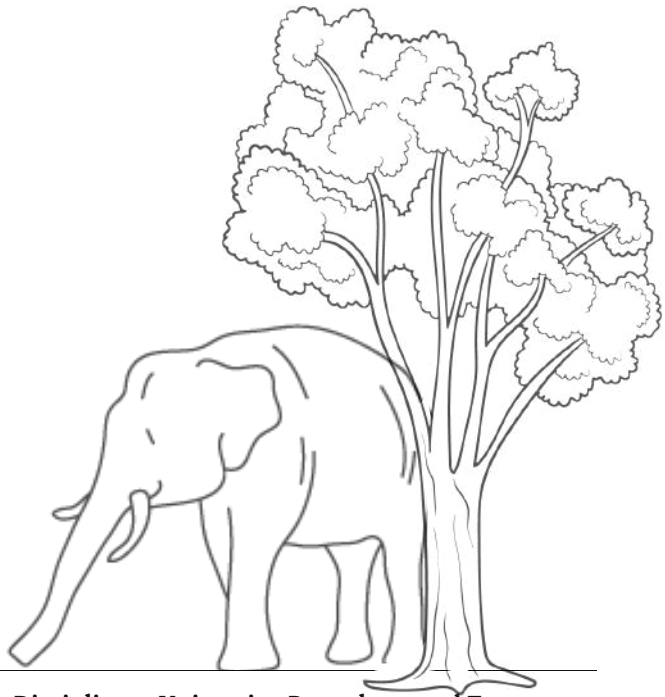
Mihika Sen[3]



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Elephants are highly intelligent and socially complex beings. For millennia, they have held a special place in human cultures, regarded as symbols of power and wisdom. Most significantly, they are worshiped across Asia, in India as Ganesha, the elephant-headed deity in the Hindu pantheon, to Kangiten in Japan. However, in landscapes where humans and Asian elephants coexist, their relationship is shaped by a multifaceted interplay of ecological, ethological, cultural, and social dynamics.

India is a global conservation enigma. The number of people has doubled in the last 40 years or so, but paradoxically, the population of elephants and tigers (and also lions, rhinos and other animals in limited ranges) has also perhaps doubled during this time. This remarkable coexistence can largely be attributed to the enduring tolerance of local communities. Elephants in India overlap with humans across a massive 80% of their range, and also cause substantial harm, claiming nearly 500 lives every year and causing extensive damage to croplands and property.

How do we better understand and conserve this tolerance to allow for continued coexistence? This is vital in the Nilgiri region in Southern India, which is the core of the largest population of Asian elephants globally. It connects up the Eastern and Western Ghats, with a wide range of habitats from dry thorn forests, to montane shola grasslands, to deciduous and semi-evergreen forests all in close proximity - with the range of one herd of elephants. The Gudalur Division, south of the Mudumalai Tiger Reserve, surrounded by more intact forests on all sides, is home to about 2.5 lakh people and 160 elephants. While it is well known for "conflict", it has also ended up being a remarkable case to understand the possibilities of coexistence, where we find that culture and personality among both the local people and the elephants has a key role to play!

Conflict vs Coexistence

Rather than assuming these are opposing states, conflict is perhaps better understood as a sub-theme of coexistence. Wherever people and elephants coexist, there will be some elements of conflict, but not all interactions are conflicting!

Despite the damage they cause, elephants continue to inspire a sense of wonder and awe for many people across India. Enjoying the sight of elephants is not limited to affluent tourists who pay to visit forest areas. Despite all the damage that local people face, people everywhere are fascinated by elephants – local people gather in large numbers to see elephants, or workers all stop plucking tea (a significant opportunity cost), and gather to watch and around to talk and discuss the lives of the elephants. While excessive crowds around elephants can sometimes pose a significant problem, it is essential to recognize that this fascination stems from a positive sentiment. This plays a crucial role in maintaining tolerance toward these animals, and **these positive human-interactions should be recognised and applauded.**

The public perception of human-elephant interactions as "conflict" is often higher than the actual incidents. Wayanad/Kerala and Southern states of India are in the news for high conflict, but in terms of numbers of people killed it is far greater in Northern and Eastern States. **Managing the public perception of conflict is therefore vital.**

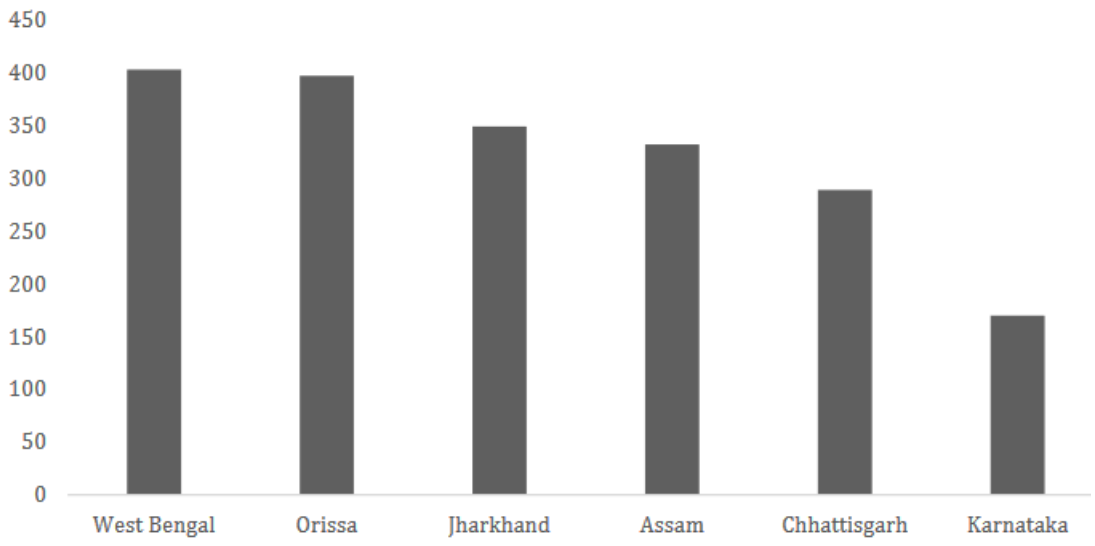


Figure 1: Mortality figures from 2014-15 to 2019-20

Cultural knowledge of individual elephants as "Other-than-human persons"

Digging deep into the human-elephant relationship, we find many Indigenous communities who live with elephants on a daily basis know that they are individuals and have personalities, and consider them as "other-than-human persons", and this animistic worldview is vital for coexistence. Indigenous ethics rooted in mutual respect and reciprocity, that value elephants on par with humans – if we behave well with elephants, they in turn will behave well with us.

The Kattunayakan community's relationship with elephants has been well studied, where they refer to some elephants as "devaru" (different from the more widespread idea of an Elephant-God, more recognising them as individuals). One Kattunayakan village in the Gudalur region is particularly well-known for having very low conflict with elephants, as explained by a resident:

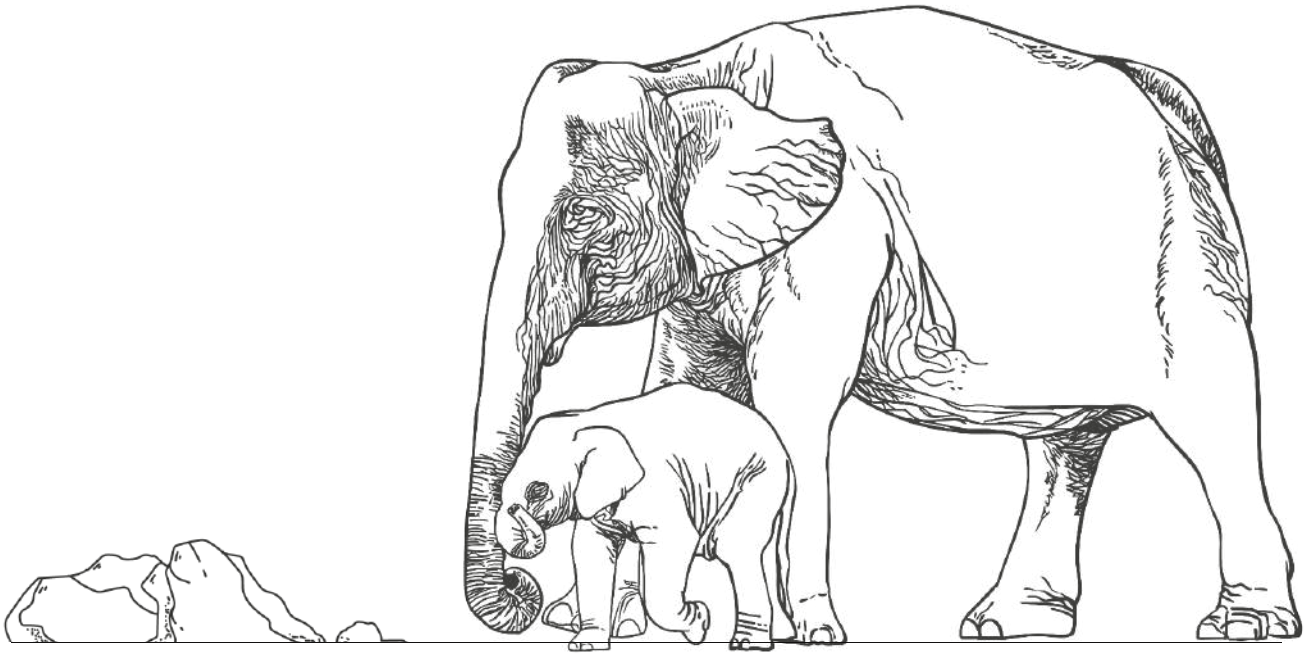
"We have no problem with these elephants. We know them, and they know us. Every year we do pooja for Aane devaru and ask them not to disturb our village. They listen to us. They don't come and trouble us here even though there are lots of jack fruit trees, but all the other people in this whole area have lot of problems with elephants" (Therpakolly, October, 2011)[2]

Anthropologists have studied these links with nature for decades, and Kattunayakan people's links with elephants have been well documented, which give a good sense of the "other-than-human personhood" of elephants.

"One October night in 2003, elephants entered KK [[the village]]; they trampled one of the huts, walked through the wetland paddies, and started to eat banana plants. While doing so, they also emitted loud bellows that were heard all over the village. One man went to about eight meters from where the elephants were standing, a distance that, should the need have arisen, would still have enabled him to run away. From there he approached the elephants boldly. In a typical blaming tone he said:

'Seri [in this sense "ok], if you want to eat, you silently eat and go. We have children here!' The elephants, then, stopped bellowing, and a few minutes later went away, out of the village." (2008:63)

"When a Nayaka finds himself in front of an elephant, he prefers to stand still and, as calmly as possible, to address the elephant in a persuasive tone of voice (characterized both by the tone and by the substance): "I am not coming to disturb you, or to do any harm to you."



Conservation or coexistence efforts can benefit from this "other-than-human" worldview of elephants. People across India worship elephants, but when an elephant repeatedly causes significant harm and people feel powerless to respond negatively against a God. The person's attitudes towards elephants can suddenly flip to intense negative feelings, potentially leading to even extreme actions such as poisoning them surreptitiously. But in the "other-than-human" perspective, they see it as an individual elephant problem, and not the entire species. This understanding of elephants as individuals is vital to allow for more peaceful coexistence, and is also echoed by modern science. Crop raiding behaviour is not based on the availability of fodder and water, level of human disturbance, or biological factors like age and sex, but based on some other personality traits or cognitive processes by "idiosyncratic individuals" (Srinivasaiah et al 2012).

People living alongside elephants often mention "talking" to elephants and the importance of being able to communicate with elephants. Assuming elephants can understand human languages may be far-fetched, but understanding this interaction from an elephant's perspective is important. Elephants are used to people shouting and being aggressive towards them. They understand they are trying to chase them away, potentially some food source, and then they resist and try to keep feeding. But when people talk to them in a different tone of voice, even if they cannot understand what is being communicated, they may choose to move away since they cannot understand what is happening in the interaction. This was experienced by the first author directly in 2016, around a garbage dump where elephants used to feed.

"The municipal truck arrived, but OVT8 was at the dump, feeding on what looked like a load of spoilt vegetables. They honked, shouted and made a lot of noise, but he refused to move. They tried to drive the truck close to him, but still he ignored them. They dumped it on the other side and left.

I was at a safe distance at an elevated position in the tea, and thought I'd try to talk to the elephant, asking it to leave the garbage dump. It stopped feeding, stood still and put its ears out, alert. I continued talking in a calm tone. It then turned towards me and mock charged up to the edge of the dump, but I was well out of its visible range, and continued talking. It went back to feeding, but was a bit uneasy and kept turning back now and then. After about 6 minutes it stopped and moved out of the garbage dump on the other side."

Scientists have noted that African elephants are able to "determine ethnicity, gender, and age from acoustic cues in human voices" (McComb et al 2024). Even if the elephants cannot understand human language, they are probably able to understand tone and intentionality, and map that onto previous experiences with different communities. So, there may be a scientific basis for "talking" to elephants as a way to reduce negative interactions.

This deep relation and knowledge of elephants must not of course be confused with social media stars, tourists, or drunk people trying to talk to wild elephants – there are videos of people getting killed doing the rounds of social media when they try to do this.

Variation between communities

While the deep connection with elephants is very relevant, it is important to note that this is not true for all local people, and there is huge variation in how local people perceive elephants. For immigrant communities who practice agriculture in the Nilgiris for example, they see themselves as victims of the elephants. They do not have title for their land, and do not get compensation for elephant damage:

"You have to help us somehow. We live in constant fear. Elephants never used to be here before, but in the last few years they are always here. They come at night and break down houses. We can't go out to the toilet in the morning without fearing for our lives. We can't come back to our houses from the bus stand if it gets later than six in the evening. More and more people are getting killed every year. Either the government should give us land somewhere else or they should chase all these elephants back to Mudumalai"- (O'Valley region, October 2013)

Understanding this diversity in how humans perceive and interact with elephants is vital for fostering coexistence. In the Nilgiris, it was found that different ethnic communities have very different understandings of even the most fundamental question of "What is an elephant?" - what Anthropologists call "ontology". We have discussed the framing of elephants as Gods and other-than-human persons. For most conservationists and urban people, elephants are thought of as victims in need of conservation and help, while other people consider them "wild and unpredictable animals", without much of the cultural attachment outlined earlier. All of this is summarized in Table 2 taken from Thekaekara et al., 2021.

There are various groups of indigenous people who originally inhabited the region, some of whom were settled agriculturalists, while others were traditional hunter-gatherers. After that, there were waves if migration into the landscape, starting with early planters in late 1800s and early 1900s, then Malayalis from Central and North Kerala while Gudalur was being shunted between the Malabar and Madras presidencies just before and after Indian independence, and finally the Sri Lankan Tamils from the 1970s onwards, fleeing from persecution. And finally, an important stakeholder in the region is the forest department staff, conservationists and others seen to be supporting wildlife conservation. All of these stakeholder groups are very different from each other, the details of which are summarized below.

Table 1: Summary of all the communities living in the region

Community	Indigenous	Tribal	Subsistence Mode/ Occupation	Legal Land Owners	Interaction with Elephants	Approx. Population
Kattunayakan	Yes	Yes	Traditionally Hunter-Gatherer (HG) and now occupied in wage labour, but still most forest dependent of all the tribes.	No	High	Less than 1%
Bettakurumba	Yes	Yes	Traditionally HG, now also occupied in wage labour, with a number of them working for the forest department, particularly as mahouts.	No	High	1%
Paniya	Yes	Yes	Traditionally HG, but now mostly occupied in wage labour	No	Moderate	6%
Mullukurumba	Yes	Yes	Settled agriculturalists (SA), with a significant number of them currently employed in Government jobs.	Yes	Low	Less than 1%
Chettys	Yes	No	SA, now also involved in small local businesses	Yes	Moderate	10%
Malayalis	No, arrived 1940s onwards	No	Agriculturalists, though mostly growing cash crops, with the educated younger generation moving to urban centres.	No	Low	17%
Srilankan Repatriates	No, 1980s onwards	No	Wage labourers and small-scale cash crop farmers	No	Moderate	35%
Early Planters	No, 1900s onwards	No	Tea/Coffee plantation owners and workers, again with younger generation mostly in other parts of the country/world.	Yes	High	30%
Forest Department/ Conservationists	No	No	Government/other employment and temporary/outside residence in the Nilgiris.	N/a	High	n/a

Table 2: Different communities' varied beliefs about elephants

Community	Other-than-human persons	Gods	Victims	Wild animals
Kattunayakans	■			
Bettakurumbas	■			
Paniyas	■			
Mullukurumbas		■		
Chettys		■		
Early planters		■	■	■
Sri Lankan Tamils		■		■
Malayalis				■
Wildlife people			■	■

Other key cultural variables linked to tolerance, and whether human-elephant coexistence is possible in a landscape, is the mode of subsistence or agricultural crops, as well as a shared history of living together. Traditional hunter-gatherer communities even to date do not engage in significant agriculture, and so have no reason to come into conflict with elephants and can inherently coexist better. Plantation crops (tea and coffee) are not browsed by elephants and have been called "conservation compatible landscapes" (Kshettry et al 2020). Indefinitely paying compensation to local communities for damaged food crops is neither beneficial to the elephants or the people in the long term, and coexistence may not be feasible.

These variables have been summarised from the Gudalur region in the Nilgiris, but may also be relevant at more national scales.

Table 3: Different communities' varying agricultural practices

Community	No Agriculture	Inedible Crops	Edible Crops
Kattunayakans	■	■	
Bettakurumbas	■	■	
Paniyas	■		
Mullukurumbas		■	■
Chettys			■
Early planters	■	■	
Sri Lankan Tamils	■		
Malayalis			■
Wildlife people	■		

Table 4: Different communities' varying history of living with elephants

Community	Indigenous	c. 100 years	c. 50 years or less
Kattunayakans			
Bettakurumbas			
Paniyas			
Mullukurumbas			
Chettys			
Early planters			
Sri Lankan Tamils			
Malayalis			
Wildlife people			

While the Nilgiris are perhaps more complex and varied than most other regions in India, understanding these differences among different communities sharing space with elephants may have a very important bearing on human-elephant interactions across India.

Scientifically understanding elephants as individuals

While Indigenous communities know elephants as individuals, in some areas many other local communities have similar experiences.

Bharathan, a large Makhna, was a local celebrity in Thorapally, a small town along the Mysore-Ooty highway near the Mudumalai Tiger Reserve (MTR) in Tamil Nadu. The highway closed at 9 pm every night, which was when Bharathan typically emerged. One night, as people sat outside a brightly lit local restaurant, Bharathan suddenly appeared from behind the parking lot, towering over the neatly lined cars and calmly weaving his way through them. While the instinct for those familiar with wild elephants might be to run, the locals remained unconcerned. Bharathan was a regular visitor and seemed to be on friendly terms with the people of Thorapally, possibly the only wild elephant in Mudumalai to be named by locals.

Bharathan walked past the people, not more than 15 meters from them, crossed the highway, and headed to a garbage dump where he ate a mound of used banana leaf plates that had been especially piled up for him. A small crowd of tourists gathered, taking photos with their camera phones, but Bharathan ignored them.

Figure 2: Bharathan, a local celebrity elephant at Thorapally, just outside the Mudumalai Tiger Reserve

The situation took a dangerous turn when a young tourist, tired of waiting for Bharathan to turn around, quickly ran across the road and tugged the elephant's tail. Many people have died from much less intimate encounters with elephants, but Bharathan was unconcerned. He lazily swung his hind leg out, narrowly missing the foolhardy tourist, moved to the other side of the pile so he could keep an eye on the troublesome crowd while eating. The locals reassured the observers that Bharathan was used to such antics and would not react aggressively.

Stories about Bharathan's intelligence and measured interactions with people abounded. One popular tale described how he had outsmarted a jackfruit seller - waiting for hours till the man left for a loo break, to then quickly take his place and feast on his fruit! Unlike other wild elephants, Bharathan's interactions with people were thoughtful and deliberate, not unpredictable and instinctive. The locals did not mind having him around, viewing him as a part of their community.

Bharathan is not entirely unique. The internet is littered with images and videos of such habituated elephants, with very un-elephant-like behaviour. There is Ganesh Ram at the edges of Guwahati, Padayappa in Munnar, Ram Lal in South Bengal, and perhaps many more. While biology struggles with challenges around "anthropomorphising" and the question of elephants having individual personalities, for people who interact with elephants this is a given - these elephants do indeed have individual personalities. The challenge is to systematically understand this individuality, and then incorporate it into policy and management practices, to improve the outcome for both humans and elephants in sharing space.

The Gudalur Elephant Monitoring Project

Understanding this individuality and behavioural categories across elephants has been undertaken systematically in the Gudalur region of the Nilgiris. The programme started to some extent from the Valparai SMS-based early warning system by Dr. Ananda Kumar at the Nature Conservation Foundation. The same system was automated, but in the Nilgiris, it was found that a large number of people would congregate to see the elephant when they got an alert, rather than move away. It was having the opposite of the intended effect. But it was a very useful way of collecting information about elephant presence, and this grew into www.jumboradar.org - a comprehensive tool to profile individual elephant behaviour.

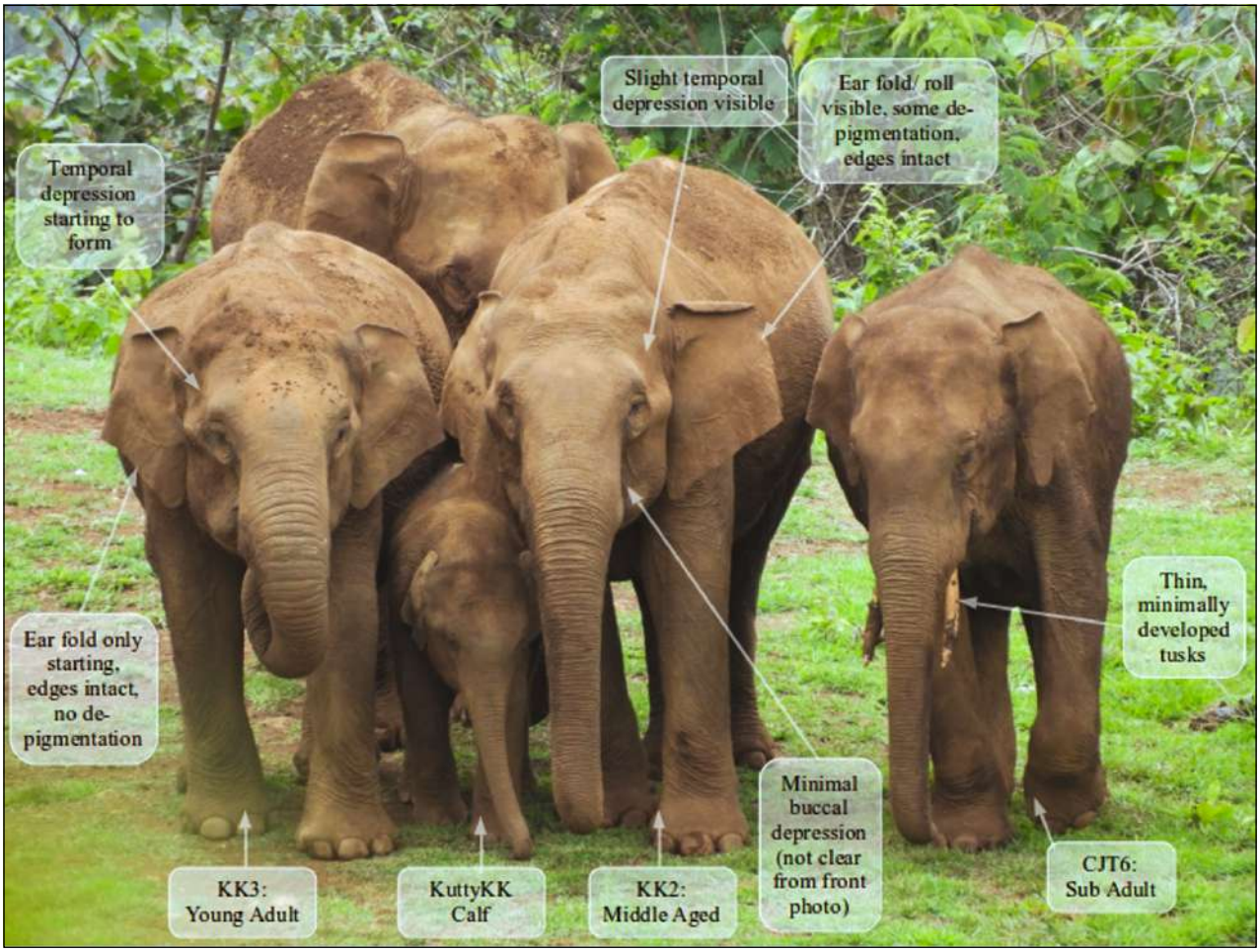
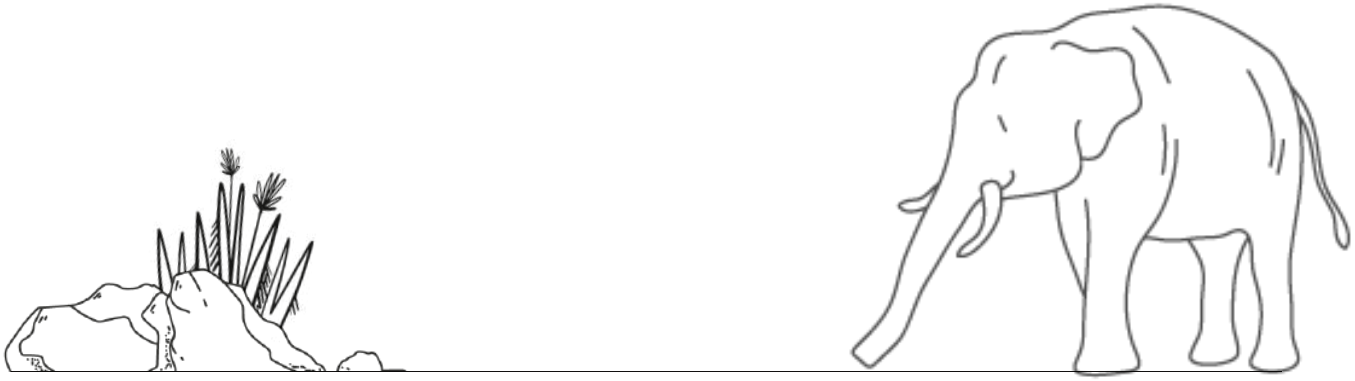


Figure 3: Graphic showing key feature to identify and age elephants



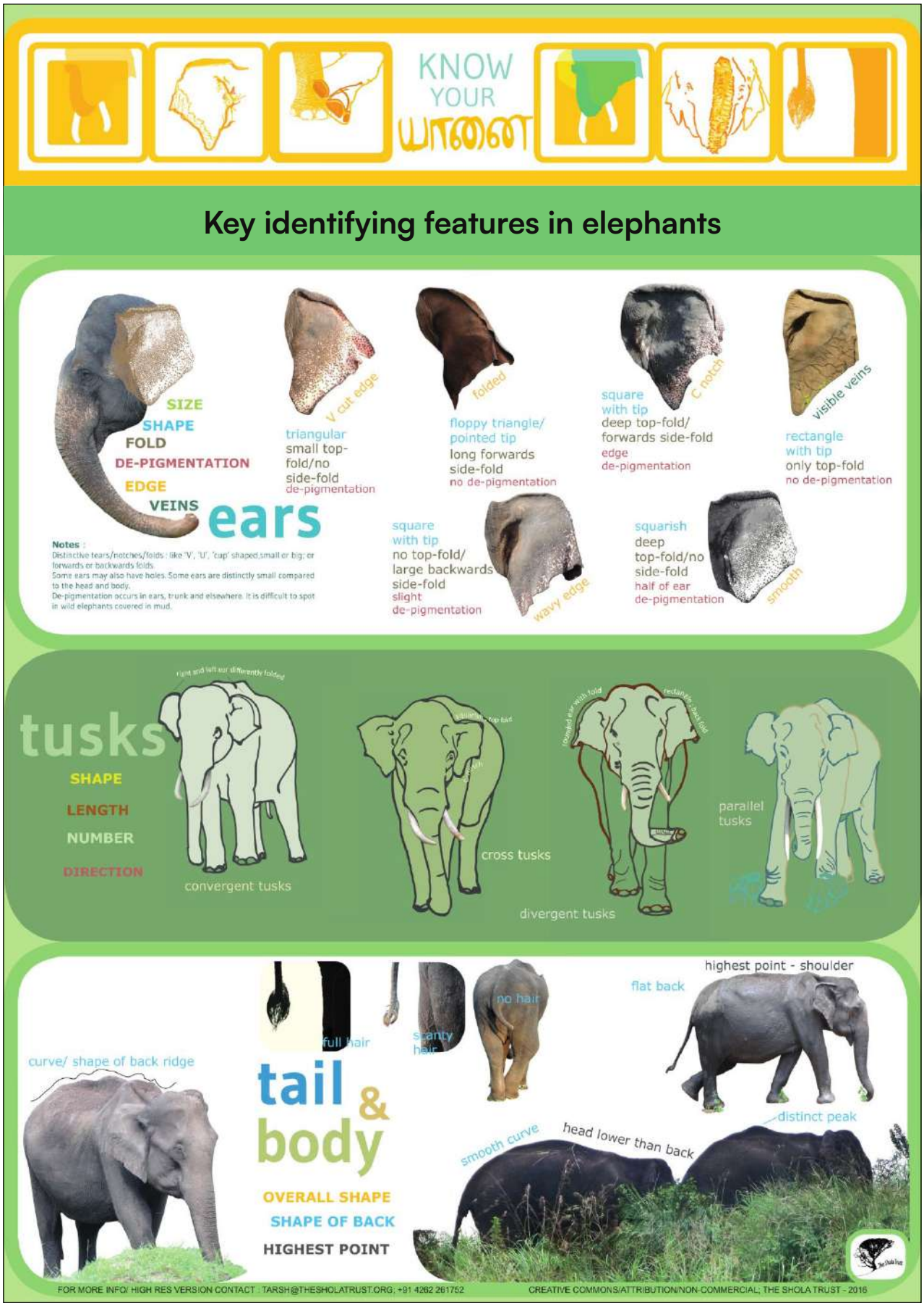


Figure 4: Poster shared widely to identify individual elephants

A small team of people well versed with identifying individual elephants first worked closely with field staff of the forest department to extensively photograph all the elephants regularly interacting with people in a landscape, over a 3-month period. Profiles of all the elephants were then made, ensuring photographs from all sides, which were then shared with field staff. Multiple workshops with field staff were conducted, to get all of them to identify all the elephants, beyond the few individuals they were already familiar with. All these photos were then uploaded into the website.

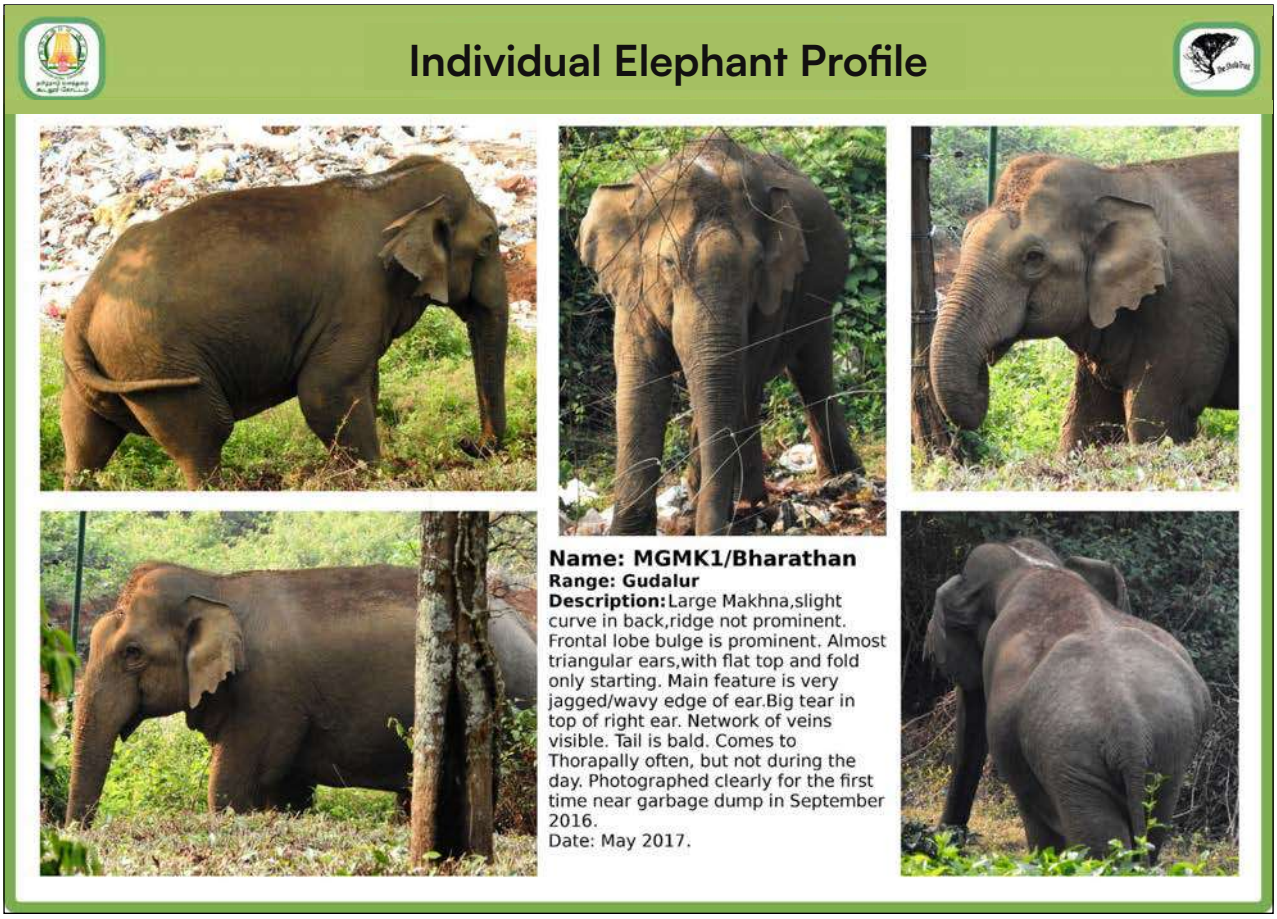


Figure 5: Profile photos and text for individual elephants

A mobile phone app was then shared with all the field staff, who had to upload photographs of elephants whenever they saw them. Along with the metadata of the phone (date, time location), some other simple data was also collected - how the elephant reacted to people, how the people reacted to the elephants, how close to habitation the elephant was etc. One trained biologist at the division level would identify the individual elephant and assign them with an alphanumeric ID (based on the range first sighted and also whether it was a tusker, Makhna or female/herd.

Based on this very simple data collection by field staff on an ongoing basis, four very interesting behavioural categories of elephants emerged.

1. First were transient elephants that were seen very rarely in the - less than 5 times a year, which constitute about 46% of the population.

2. Second were “resident but shy” elephants that came into the divisions regularly, but did not come close to habitation or interact with people, which constitute another 40% of the population.

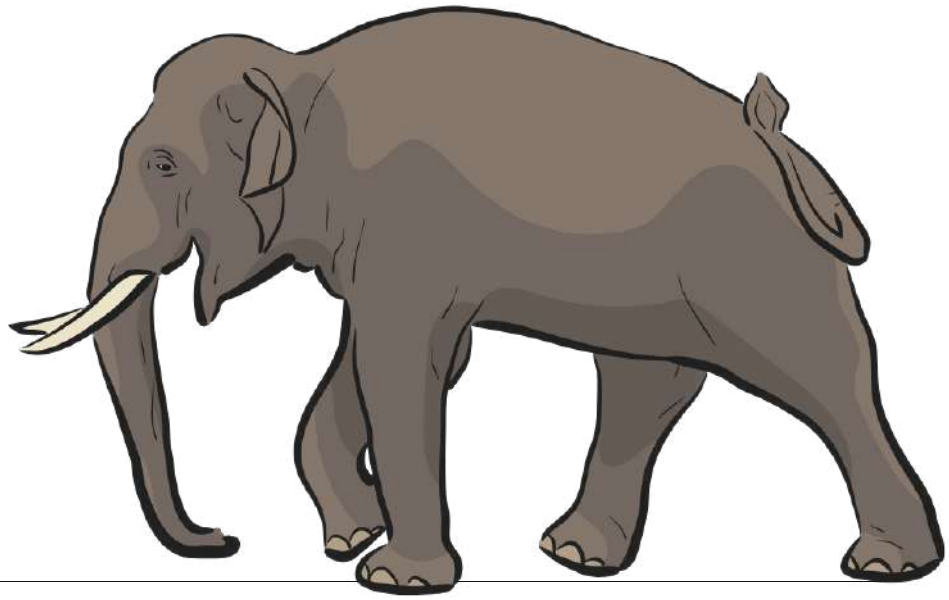
3. Third were elephants that came near habitation often, but were not comfortable around people and exhibited the physiological “fight or flight” response, which was around 6% of the population.

4. And finally, were the “highly habituated’ older males like Bharathan and others, which were the remaining 8%.

Type 1 Translent elephants (46%)	Type 2 Seen often, but away from habitation (40%)	Type 3 "Fight or Flight" (6%)	Type 4 Highly Habituated (8%)
BK1(2) CMK3 CT2 CT7 CT9 CT10 CT11 CT13 CT15 CT16 CT17 CT18 CT19 MGMKI MGTI MGT2 MGT3 MTRH(12) OV4(2) OVCH(7) OVMKI OVMK2 OVTI OVT4 OVT5 OVT7 PMKI PTI PT2 PT3 PT4 PT5 PT6 PT7 PT8 PT9 PT10 PT11 PT12	GDKH (10) KMH (11) OVH (12) OVT6 PNRH (16)	CMK2 CT3 CT4 CT8 CTI CT12 OVT8	CBTI CMKI KKH (6) OVMK3 OVT3

Figure 6: Classification of personality types

The most important element of this classification is that only the third category of elephants were causing damage to people, which was 6% of the elephants, or about 7 young males. The vast majority were not a problem. Instead of chasing all elephants, the local policy was changed to only chase away these few individuals, while all other elephants were only monitored. This significantly reduced the workload on the field staff, and altogether improved the human-elephant relationship as all the elephants were not always being chased and under stress.



Conclusion

In summary, coexistence will always involve some level of conflict, though not all elephant-human interactions are conflict. The challenge is to reduce the negative interactions to a minimum, to conserve tolerance. We have outlined three underlying drivers of peoples' tolerance to elephants and the ability to share space more peacefully – (1) Elephant ontologies and the very conceptualisation of what is an elephant, where identifying elephants as individuals is useful for coexistence. (2) The mode of subsistence and kind of crops people choose to grow. And (3) the shared history of living together. Understanding these is important in knowing whether coexistence is feasible or not, and to minimise negative interactions.

For elephants, there is significant variation in behaviour, and we have developed a simple tool that can be used by field staff to better understand this variation. Not all elephants are a problem - conflict is usually caused by only a few individuals, and the behaviour of each of these individuals can be monitored relatively easily over time.
But to go back to the basic question that is relevant to managers - how can we conserve local people's tolerance to improve coexistence outcomes? We must perhaps start with the definition of coexistence, the most apt perhaps being based of Pooley et al. 2021 from the www.coexistenceconsortium.com website:

> "A sustainable though dynamic state, where humans and wildlife co-adapt to sharing landscapes. While some negative impacts on both people and wildlife are perhaps unavoidable, laws, policies and conservation interventions should attempt to minimise these. To ensure wildlife populations persist, but in socially and ethically legitimate ways, acceptable to local communities, where the risks are kept within tolerable levels, which are determined based on the local context"

Human-elephant coexistence must also involve keeping elephants out of some areas. We all agree cities are no ideal habitats for elephants, and if they enter places like Mysore they are immediately captured and translocated. Coexistence in areas with large areas of food crops may not also be feasible as the damage cannot be kept "within tolerable levels". More efficient compensation scheme will lead to costs spiralling outwards, while also acting as a perverse subsidy, with farmers protecting their crops less and less. Elephants themselves will get more habituated to people and crops and teach more elephants to crop raid.

A zonation scheme could be useful, first suggested by the Karnataka High Court Task Force in 2012 - of conservation (intact forests), coexistence and exclusion zones (urban areas and food crops), with coexistence being the most contentious. Local communities (who are often poor and disempowered) sometimes have coexistence forced upon them, and suffer significant losses. Reducing the damage these people face is vital to allow for continued tolerance. Currently we only have reactive measures in place (compensation for damage), but if we better define these zones and then more proactively support the local people in coexistence zones rather than investing extensive resources and energy into areas where coexistence is not feasible it will make a significant difference. Some possible scheme could be:

- Ongoing institutional engagement between panchayats (and other local bodies) and the forest department, to improve the perception of "conflict", educate communities about elephant behaviour in areas with no shared history, and have more community support.
- Subsidies for non-palatable crops (citrus fruits, herbs, plantation crops etc.) to minimise the losses, while also providing market linkages and possibly premium prices for such produce.
- Promoting alternative, non-agricultural livelihoods, including possibly genuinely low impact homestay tourism.
- Providing subsidies for better infrastructure for human safety, including better street lights, toilets so people don't have to venture out in the dark, protection for habituation etc.

- Potentially also removing a few individual elephants if they are causing very large amounts of damage, while ensuring robust data on individual behaviour is available.

All of these are perhaps only guiding principles, and the key takeaway is that most coexistence solutions have to be **site-specific and customized to the local requirement.** Understanding the diversity in both the humans and the elephants in terms of culture and personality can be a key guiding principle for improving the outcomes for both elephants and humans living in shared spaces.

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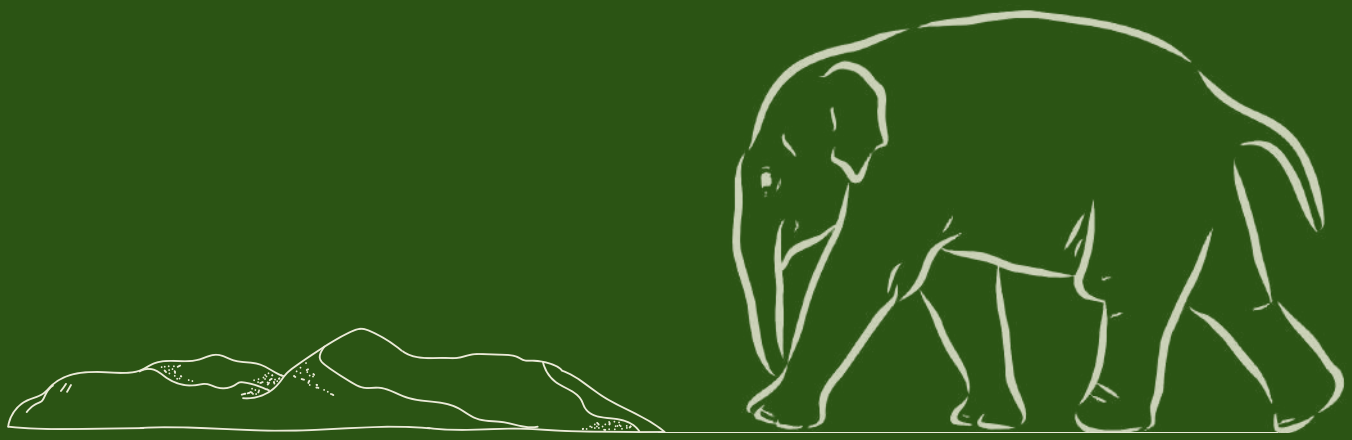

Photo credit: Stock Image,

Managing Human-Wildlife Conflicts at Valparai using Early Warning Systems.

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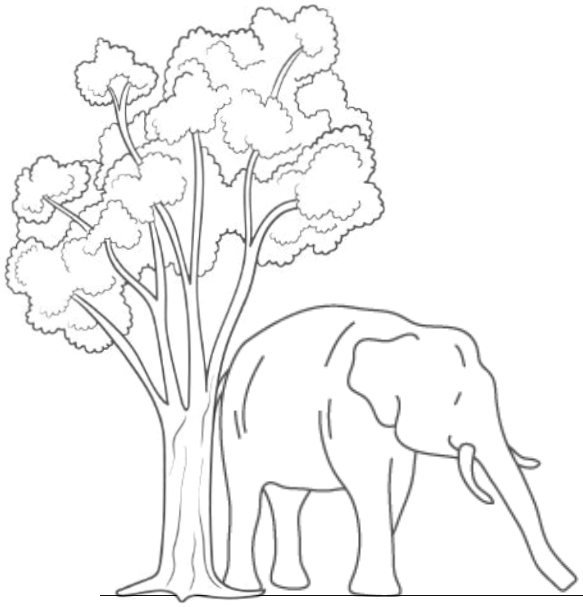
Valparai and the Conflict

Valparai, located at 3,474 feet above mean sea level on the Anaimalai Hill range of the Anaimalai Tiger Reserve in the Western Ghats, is a unique landscape teeming with a wide range of flora and fauna. Blessed with numerous water bodies, waterfalls, rivers, and dams, this region is also home to human and tribal settlements with sprawling tea and coffee plantations. However, the delicate balance between humans and wildlife in Valparai is often interrupted by the encounters of carnivores and powerful animals, particularly elephants. These majestic creatures, essential to the ecosystem, frequently wander into human habitats, leading to dangerous and sometimes deadly encounters. Over the past decade, many people have encountered fatal incidents by elephants in the region. The challenge lies in managing these conflicts without compromising the safety of either humans or wildlife.



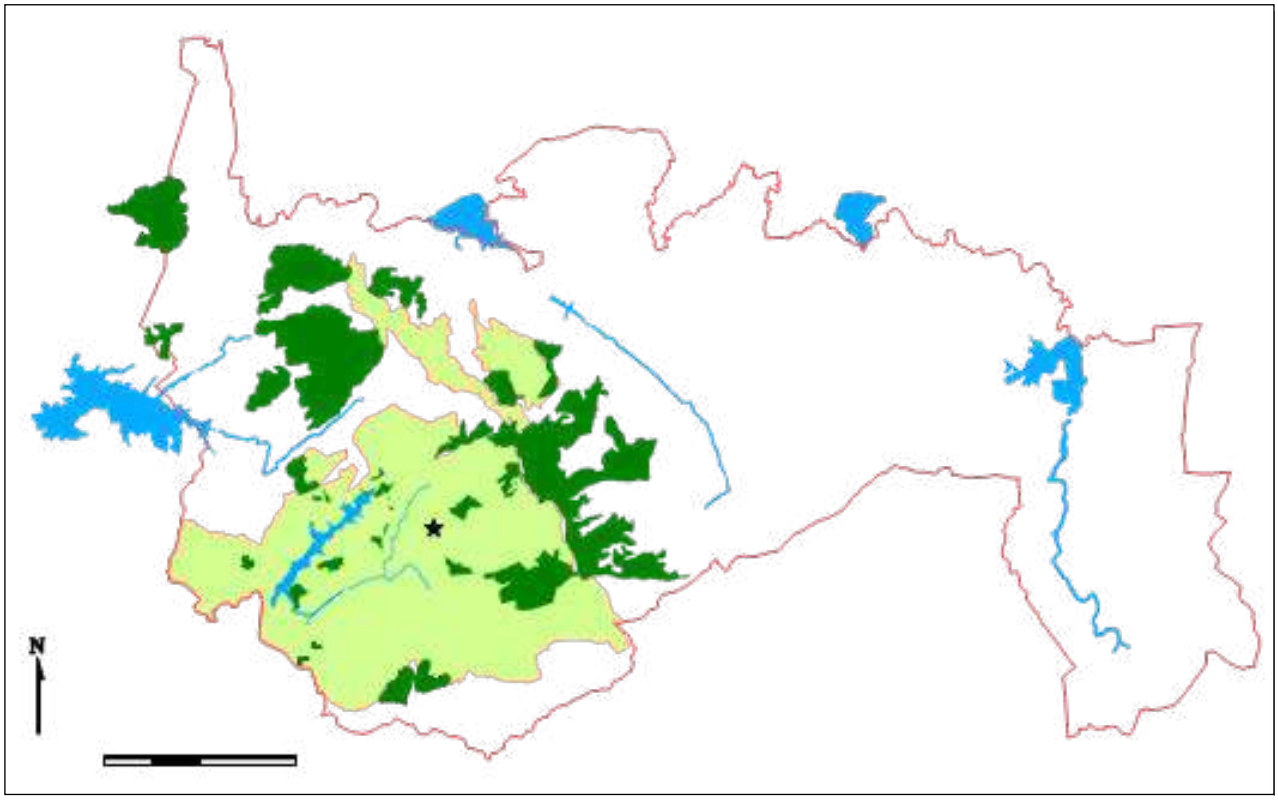
Tea Plantations in Valparai

[1]He was the Field Director at Anaimalai Tiger Reserve (2012 - 2014) during implementation of the ValparaiModel.

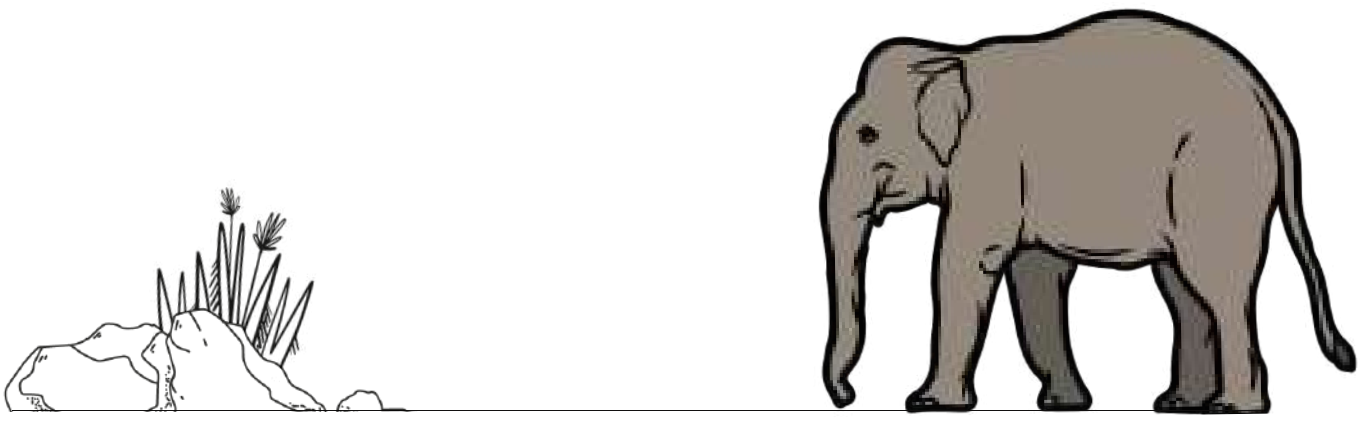
The Forest Department's Role

The Forest Department plays a crucial role in keeping the Valparai Plateau conflict-free. Their work is constant, requiring vigilance and a multi-faceted approach to mitigate human-wildlife conflicts. The department's primary objective is to safeguard both people and wildlife. They work relentlessly to monitor elephant movements and other wildlife patterns, which often strayed in human settlements in search of food and water.

With the fragmented landscapes due to plantations and human settlements, elephant movements have become unpredictable. These animals migrate between forest fragments and often wander into tea and coffee estates, attracted by the smell of stored grains, salts and fruits such as jack fruit, banana etc. The influx of elephant populations from Kerala can be observed in-between September and March, with numbers peaking during January and February. During that period, nearly 100 elephants in different size of groups are moving along the plantation areas, including tea, coffee, and cardamom estates, abandoned fields, human settlements and forest fragments. This inevitable interaction between humans and elephants heightens the risk of conflict, particularly during Sabarimala festival season when the group of elephants migrate to the Valparai landscape.



Fragmented forests in Valparai

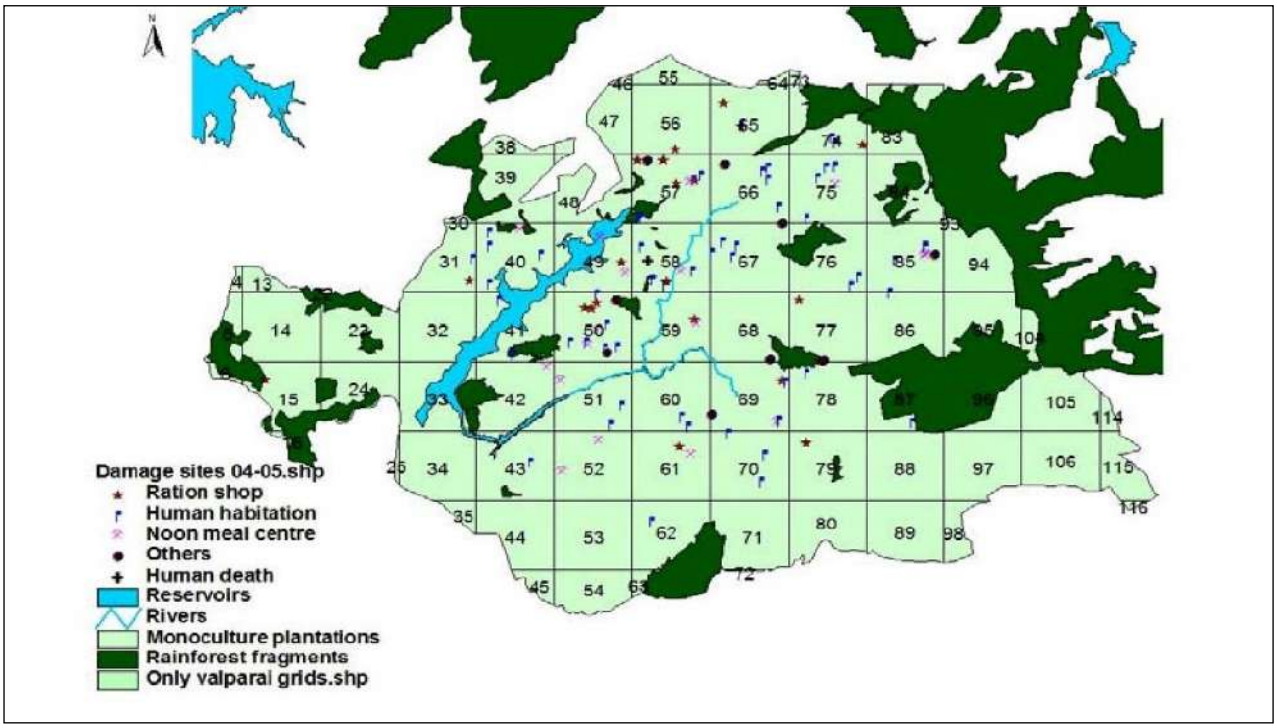


Coordinated Conflict Mitigation

The Forest Department's efforts are bolstered by well-coordinated responses involving local communities, NGOs, line departments and Plantation Estate management.

The genesis of the consorted effort by forest department started during August to October 2012. Then field director, after observing unrest and strikes related to fatal encounters with elephants, initiated comprehensive discussions with the forest officials, line departments, NGOs, stakeholders, including plantation workers and management. Regular consultations and workshops fostered awareness among public community, tea and coffee workers, leading to a more tolerant and responsive population.

By analysing past and present data, identifying conflict zones, and understanding migration patterns, he developed a multi-layered approach to address these issues.



Distribution of conflict incidents in Valparai plateau

Strategic Patrolling

First, the forest department prioritized the patrolling of problematic elephant corridors and conflict zones. Special emphasis was given on areas where elephants are known to be frequent. The department has also divided the region into three vulnerability zones: high, medium, and low-risk areas. By focusing efforts on the most vulnerable zones, the risk of conflict was mitigated effectively. Further, regular on-foot patrolling by APW in the landscape produced good results.

Remote Monitoring Systems

To tackle this issue effectively, the Forest Department has implemented early warning systems in different identified conflict zones, and also installed an innovative remote monitoring system in the vulnerable regions. Sophisticated cameras have been set up in conflict-prone zones, such as Amaravati Range, to monitor wildlife movement in real-time. These cameras can be remotely rotated and tilted, offering a comprehensive view of the terrain. By tracking elephant movements, the system alerts the forest officials, allowing them to take appropriate actions in swift manner.

Fully equipped Anti-Depredation Center

Anti-Depredation Center

An Anti-Depredation Center has been established to streamline operations and respond more effectively in mitigating the conflicts. This center, which started in 2012-13, was equipped to tackle any situation, be it an elephant or leopard or bear conflict. The best possible equipment and Personal Protective Equipment (PPEs) were made available to the squad to avert any chance of attack by wild animals while addressing the issue in the field. Additionally, more vehicles were stationed at strategic locations to have quicker response.

Initially, to streamline and monitor the implementation of system, the anti-depredation squad was trained by an experienced ex-army cum forest officer in managing the animal conflicts. Facilitated with dedicated helpline, the center allowed the public to inform the sightings to the Anti-Depredation Squad (ADS). The squad responded swiftly to elephant sightings, guiding them back to the forest using lights and sirens. The usage of crackers, chilli powder and loud sounds were avoided since it used to irritate and aggravate the elephants.

This center served a dual purpose, not only responded to the animal sightings and conflicts but also alerted the public and plantation workers about the presence of wildlife in their vicinity. The calls received and response time of the squad at each instance was recorded and monitored from the center, thereby resulted in maintaining a quick, systematic and transparent operation. Further, the introduction of BSNL toll-free number by forest department boosted the confidence of public.

Furthermore, Intensive monitoring by the Anti-Poaching Watchers (APWs) and support from NGOs and other stakeholders have significantly improved conflict management. This model also emphasized the importance of engaging other line departments to ensure a holistic resolution to conflicts.

Early Warning Systems

Some of the innovative methods adopted to alert the public about the elephant movement include:

SMS-Based Alerts: SMS based alert system was developed by the National Conservation Foundation (NCF), an NGO to alert the public. Thousands of people have joined in this initiative and receive timely SMS texts in their mobile phones about elephant movement in their vicinity.

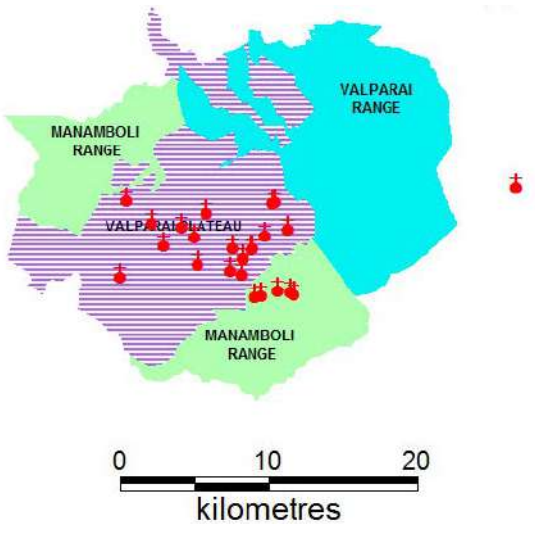
Red Light Alert System: This visual alert system warns the public about the elephant movements in their vicinity, ensuring that they stay cautious.

Voice Call System and Automated Sirens: Understanding the shortcomings of red-light alert system during the poor visibility due to mist, Voice call alert systems were developed by the forest department to warn the residents, plantation workers and stakeholders, allowing them to take precautions and avert fatal incidents. Further, the voice alert systems were also installed in the buses to alert the public who are travelling through the elephant corridors.

Laser Linear Cutoff Devices: Installed in the most vulnerable elephant movement areas near the labour line and other human habitations, these devices provide precise alerts, enabling swift mitigation measures.

Camera Traps: A camera-based monitoring and trapping system was introduced by the Field Director to effectively mitigate the man – leopard conflicts in the Valparai. This assured the identity of the problematic animals before capturing them.

Such technological interventions have proven to be game-changers in reducing human-wildlife conflicts.



Location of early warning systems in Valparai plateau(ATR)

Voice call Alert System

Reducing Conflict through Education and Awareness

While technology and manpower play crucial roles, education and awareness are equally vital. The Forest Department has been working to educate the local population on coexisting with elephants. People living in conflict-prone areas are advised to secure food at safe place and avoid actions that might attract elephants. Regular workshops were conducted to teach locals about elephant behavior and safe practices to minimize interactions.

A Hopeful Future

The coordinated efforts of forest department in Valparai have significantly reduced human-wildlife conflicts. Before 2012, the region witnessed many fatalities in humans as well as elephants, alongside numerous injuries within a 200 square-kilometer area. However, the initiatives like early warning system, SMS alert system, voice call systems, automated sirens etc., and swift actions of ADS and APWs, have drastically reduced the fatalities and injuries from elephant attacks, and incidents involving leopards have also declined.

The Valparai model, recognized and appreciated at various forums for its effectiveness, led to the establishment of rapid response teams across Tamil Nadu. This integrated approach, combining technology, community and NGO involvement, and inter-departmental coordination, serves as a blueprint for managing human-wildlife conflicts in other regions.

In future, with technology evolving and touching new horizons, there is a need for continuous learning and adaptation on field by the forest department to maintain a harmonious environment between the humankind and the wildlife.

Conclusion

The Valparai Plateau presents a unique case study in balancing the needs of both humans and wildlife. With elephants and other wild animals increasingly coming into contact with human settlements, the Forest Department's role has never been more critical.

The key lessons learned from this case study include the effectiveness of intensive on-foot patrolling in high vulnerability zones combined with prompt early warning systems, ensuring continual improvement of response time in managing the wildlife conflicts, addressing conflicts at the genesis and grass root level, and tailoring conflict management strategies to the specific characteristics of the landscapes. These insights offer valuable frameworks for addressing similar challenges in other landscapes by taking suitable measures as per the site conditions.
The work in Valparai demonstrates that, with right strategies, technologies and systems, the Forest Department has shown that peaceful coexistence between humans and wildlife is achievable, offering hope for the future of the region's biodiversity and the welfare of its people.

Photo credit: Shashank N

Management Effectiveness Evaluation (MEE) of Elephant Reserves in India: A Pilot Evaluation

Ramesh Kumar Pandey[1]

Bilal Habib[2]

1. Introduction

Elephants have played a crucial role in the rise of Asian civilizations; hence, the species is considered iconic in the continent. In India, which harbours the largest fraction of the population in the wild, the elephant range occupies nearly 5% of the country's landmass. While elephants enjoy the highest legal protection in India, to stem the threats and foster long-term conservation of the species, the Project Elephant was launched in 1992. Landscape units commensurate with elephants' large range needs were notified as Elephant Reserves (ERs). Presently, 33 ERs have been notified in 14 States, covering an area of 80,778.7 km2. The concept of ER is designed to manage landscapes for the conservation and protection of elephants. However, there had been a need to granulate the aspects of management and their assessments.

During the last few years, Project Elephant has taken numerous steps to reinforce the management implementation in ERs. Project Elephant had prepared essential documents and reports such as (i) The Elephant Reserves of India – Atlas Version I and II (ii) Report on Elephant Reserves of India - Land Use and Land Cover Classification, (iii) Elephant Corridors of India 2023 and (iv) Framework for preparation of Elephant Conservation Plan (ECP) for the Elephant Reserves. The Project Elephant initiated the task of evaluating the management effectiveness of the ERs to institutionalize activities pertinent to landscape-level elephant management, mainstreaming ERs with wildlife management and to standardize elephant-specific management requirements for better management of elephant habitats and populations. In this regard, the MEE-ER (Management Effectiveness Evaluation of Elephant Reserves in India) providing required guidelines, criteria and indicators was released in April 2023.

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[2]Scientist F , WII Dehradun
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The guidelines, criteria and indicators for MEE-ER were tested (on a pilot basis) in four ERs from the four elephant-bearing regions of India. The ERs include the Shivalik ER in Uttarakhand (northwest region), Kaziranga-Karbi Anglong ER in Assam (north-east region), Mayurbhanj ER in Odisha (east-central region) and the Nilgiri ER (southern region) by involving a team of seasoned foresters and scientists. Based on the lessons learnt during the pilot MEE-ER, the guidelines were thoroughly reviewed, criteria and indicators were evaluated, and the adequacy of the overall MEE process was validated. The present paper summarises the Management Effectiveness Evaluation (MEE) of Elephant Reserves (ERs) and highlights the revised criteria and indicators developed for evaluating the management effectiveness of these reserves.

2. Objectives of MEE

The MEE aims to evaluate the management performance of ERs, focusing on:

- **Conservation Effectiveness:** Assessing the status of habitats and elephant populations.
- **Adaptive Strategies:** Identifying gaps in current practices and proposing targeted interventions.
- **Stakeholder Integration:** Promoting collaboration between local communities, governmental agencies, and conservation groups.
- **Conflict Mitigation:** Developing frameworks to address human-elephant conflicts (HEC).

3. Framework Overview

The 2024 MEE framework is built upon six fundamental elements: Context, Planning, Input, Process, Output, and Outcomes, assessed through 44 criteria. Each criterion is rated on a 10-point Likert scale. While these elements remain consistent with the 2023 manual, significant modifications have been made to criteria and evaluation processes to enhance effectiveness and address previously identified gaps. The evaluation combines three primary approaches to ensure a comprehensive assessment. First, self-assessments are conducted by reserve officials, allowing local managers to reflect on their practices and challenges. Second, field visits are undertaken by expert teams to validate self-assessments and gather first hand observations. Third, an analysis of existing management plans and performance indicators provides a data-driven perspective on the effectiveness of reserves.

In the pilot study, four elephant reserves were selected to represent India's ecological and regional diversity. The Shivalik Elephant Reserve in Uttarakhand represented the Northwest region, while the Kaziranga-Karbi Anglong Elephant Reserve in Assam was chosen for the Northeast. The Mayurbhanj Elephant Reserve in Odisha represented the East-Central region, and the Nilgiri Elephant Reserve in Tamil Nadu was selected for the Southern region. These sites were chosen to reflect diverse management challenges and ecological contexts, ensuring that the findings would have broad applicability. These enhancements ensure a more robust and holistic evaluation of management effectiveness across the Elephant Reserves.4.

4. Evaluation Approach

The revised evaluation of Elephant Reserves now incorporates both area and elephant density to address biases in ranking based solely on population size. The previous method, which used weighted averages based on elephant numbers per Forest Division, risked undervaluing areas with suitable habitat but low or zero elephant presence. The new approach ensures that even divisions with no elephants contribute to the final weightage through their area, while also compensating for smaller but high-density areas. This refinement improves the relative ranking of units within Elephant Reserves, as demonstrated by adjustments in Mudumalai TR and Sathy TR scores. For example, in Table 1 Mudumalai TR and Sathy TR have comparable populations, but Mudumalai gets a better score (0.272) for having more elephants in a smaller area as compared to Sathy TR (0.228). The weighatages for these tiger reserves as per the previous approach are 0.267 and 0.559 for Mudumalai TR and Sathy TR, respectively.

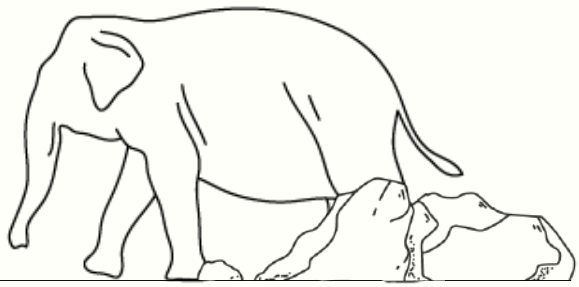

Table 1: Calculation of Weightage for the different territorial units (Revised Approach)

Divisions	Area	ER Habitat	ER Population	Density (Number/ Area)	Relative Weightage (Habitat) (Unit Area/ Total Area)	Relative Weightage (Density) (Unit Density/ Total Density)	Total Weightage (Average of Habitat and Density)
Mudumalai TR	688.59	588.82	790	1.342	0.126	0.417	0.272
Nilgiris	527.57	311.48	21	0.067	0.067	0.021	0.044
Gudalur	468.18	116.63	80	0.686	0.025	0.213	0.119
Sathy TR	1455.31	1455.31	668	0.459	0.313	0.143	0.228
Erode	821.47	784.57	158	0.201	0.168	0.063	0.116
Dharmapuri	1600.00	400.00	144	0.360	0.086	0.112	0.099
Hosur	1492.00	1000.00	105	0.105	0.215	0.033	0.124
Total	7053.12	4656.81	1966	3.22	1.000	1.000	1.000

The weighted average rating/score for each criterion was obtained by multiplying the proposed rating/score according to that criterion of the (respective) territorial unit by the calculated weightage and then arriving at the weighted average as given in the following formula:

Weighted Average for each Criteria

[(MPR*0.272)+(NPR*0.044)+(GPR*0.119)+(SPR*0.228)+
(EPR*0.116)+(DPR*0.099)+(HPR*0.124)]
(Where: PR means proposed rating for Madumalai TR.... and HPR for Hossur FD)

Example for Criteria 1.1
Weighted Average: [(10*0.272) +(5*0.044) +(2.5*0.119) +(10*0.228) + (5*0.116) +(7.5*0.099) +(7.5*0.124)] = 7.77

5. Key Findings

The Management Effectiveness Evaluation (MEE) pilot study for India's elephant reserves assessed four distinct reserves: Shivalik ER (Uttarakhand), Kaziranga-Karbi Anglong ER (Assam), Mayurbhanj ER (Odisha), and Nilgiri ER (Tamil Nadu). These reserves, which were selected from different regions, were evaluated based on six elements: context, planning, inputs, processes, outputs, and outcomes. The assessment aimed to identify strengths, weaknesses, and actionable areas to improve elephant conservation. Among the reserves, Nilgiri ER achieved the highest rating of 81.82% ("Very Good"), followed closely by Shivalik ER with 78.40%. Mayurbhanj ER scored 73.39% ("Good"), while Kaziranga-Karbi Anglong ER, though scoring the lowest at 65.91%, still received a "Good" rating. The Nilgiri Elephant Reserve (ER) ranked highest in the Management Effectiveness Evaluation (MEE) due to its strong planning, effective human-elephant conflict management, and innovative conservation strategies. It excelled in integrating ecological networks, maintaining well-managed corridors, and updating management plans systematically. The reserve demonstrated exceptional resource utilization, supported by adequate personnel, funding, and advanced technologies. Stakeholder involvement and community-based initiatives further strengthened its management alongside scientifically planned habitat restoration and biodiversity conservation efforts. High scores in planning, processes, and outcomes, along with robust emergency preparedness, positioned Nilgiri ER as a benchmark for effective elephant reserve management. Conversely, challenges such as delayed plan updates, inconsistent resource availability, and insufficient inter-sectoral coordination hindered progress in other reserves.

6. Recommendations

The recommendations focus on enhancing conservation efforts across the reserves. First, developing comprehensive Elephant Conservation Plans (ECPs) is essential to address each reserve's unique challenges and opportunities. Additionally, regular capacity-building programs should be implemented for field staff focusing on advanced conservation techniques and conflict management to improve on-the-ground effectiveness. To mitigate Human-Elephant Conflict (HEC), mechanisms for timely compensation, crop insurance, and deployment of rapid response teams should be strengthened. Monitoring and Evaluation (MEE) processes need to be institutionalised to ensure consistent progress tracking and necessary strategy updates. Finally, fostering greater collaboration with local communities and NGOs will ensure that conservation efforts align with socioeconomic goals, promoting sustainability and community engagement.

Photo credit: Shashank N

Conclusion

The MEE framework is a critical tool for enhancing the management of India's Elephant Reserves (ERs). The systematic evaluation of strengths, weaknesses, and actionable points facilitates adaptive strategies to address emerging conservation challenges. The pilot study highlights the importance of a standardised ranking system for objectively assessing and comparing ER performance. This approach not only identifies areas requiring improvement, but also promotes the replication of best practices across reserves, fostering more effective management strategies. The findings and recommendations of this pilot study underscore the need for comprehensive planning, resource adequacy, and stakeholder collaboration to achieve conservation goals. By focusing on elements such as human-elephant conflict mitigation, habitat restoration, and integration into wider ecological networks, the MEE framework establishes a foundation for continuous improvement. Scaling this framework across all ERs will ensure the long-term survival of India's iconic elephants and their habitats while establishing a benchmark for best practices in wildlife conservation management.

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2. PE-MoEFCC-WII (2023). Management Effective Evaluation of Elephant Reserves in India: Guidelines, Criteria and Indicators for Evaluation of Elephant Reserves through Management Effectiveness Evaluation Process, Project Elephant Division, Ministry of Environment, Forest and Climate Change, Government of India and Wildlife Institute of India. Pp. 77

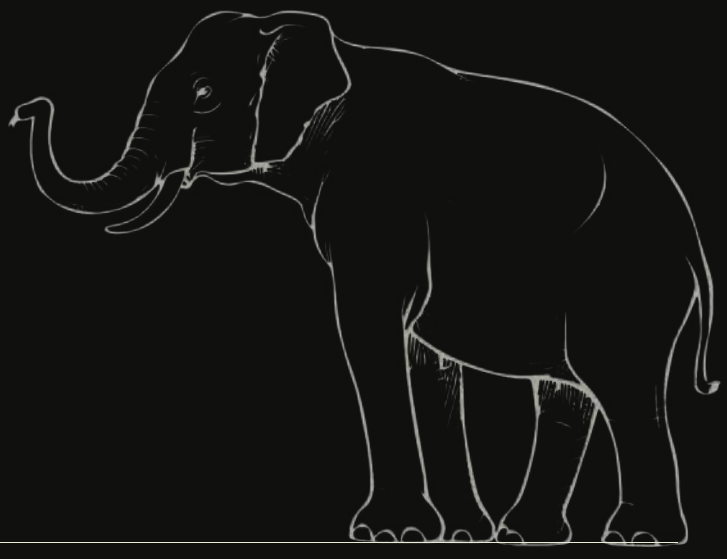


Photo credit: Abhimanyu Madhusudanan

Conservation News

World Elephant Day 2024

Every year 12th August is celebrated as the World Elephant Day. It is dedicated to the preservation and protection of the world's elephant's aims to create awareness on elephant conservation, and to share knowledge and positive solutions for the better protection and management of wild and captive elephants. In India, elephants are regarded as the National Heritage animals and are deeply ingrained in our culture. World elephant day across the globe is a day to reaffirm humankind's collective pledge in conserving one of the most iconic species in the planet. This year, the Ministry of Environment Forest & Climate Change (MoEF&CC) and the Government of Chhattisgarh co-hosted the World Elephant Day event at Raipur. Chhattisgarh is biologically and culturally rich, and also has a sizeable population of elephants. From the perspective of mitigating conflicts between people and elephants, Chhattisgarh assumes a high priority. The World Elephant Day event brought together diverse stakeholders like the foresters, policymakers, civil society, and wildlife experts to share ideas that not only foster elephant conservation, but also addresses the pressing issue of human-elephant conflicts. A mass awareness program was undertaken across the country wherein, approx. 10 lakh school children from around 5000 schools participated.

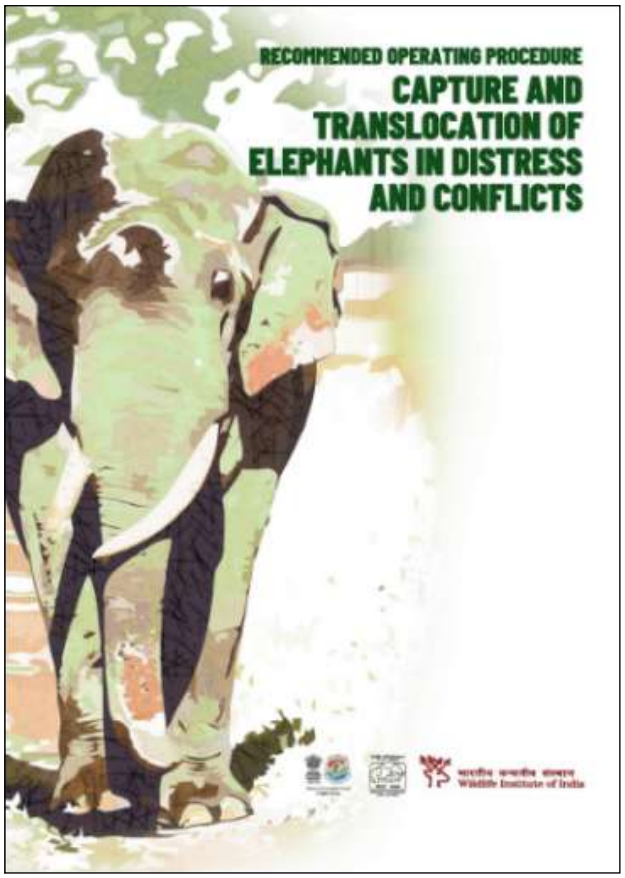
The World Elephant Day was inaugurated by Hon'ble Minister, MoEF&CC, Shri. Bhupendra Yadav in the presence of Shri Vishnu Deo Sai, Hon'ble Chief Minister, Government of Chhattisgarh and Shri. Kedar Kashyap, Hon'ble Minister, Forest and Climate Change, Government of Chhattisgarh and Shri Brijmohan Agrawal, Hon'ble Member of Parilament, Raipur. Senior officials from the MoEF&CC Shri. Jitendra Kumar, Director General of Forest & Special Secretary and Shri. Ramesh Pandey, Director Project Elephant along with officers from MoEF&CC and Senior officials from Chhattisgarh Forest Department including Shri V Sreenivasa Rao, Principal Chief Conservator of Forest & Head of Forest Force and Shri. Sudhir Agarwal, Chief Wildlife Warden, Ministry of Railway, Ministry of Power and State Forest Department were present during the event.

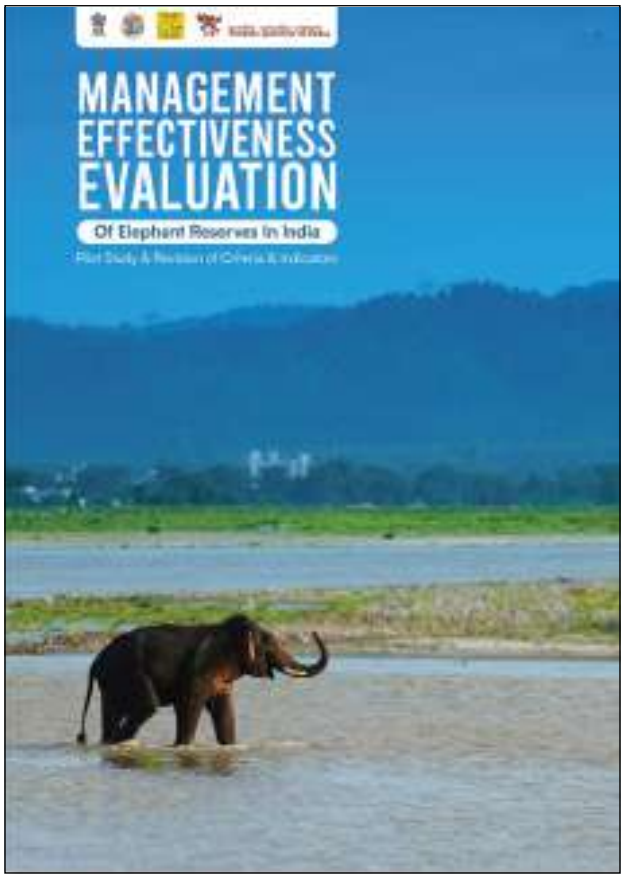
During the event, Hon'ble Minister, MoEF&CC released following documents:

I. Framework for Elephant Conservation Plan, which is indented to serve as a guiding document for managing Elephant Reserves was released.

II. To further the effort in managing captive elephants Recommended Operating Procedure for capture and translocation of elephants in distress and conflicts also released during the event.

III. The Ministry conducted the management effectiveness evaluation (MEE) for Four (4) Elephant Reserves as pilot basis. The pilot exercise was carried out in four Elephant Reserves in four different regions i.e. Shivalik ER in Uttarakhand (northwest region), Kaziranga-Karbi Anglong ER in Assam (North-east region), Mayurbhanj ER in Odisha (east-central region) and the Nilgiri ER (southern region) of India provided crucial lessons. As per report released Nilgiri Elephant Reserve score the best rating out of four (4) sites followed by Shivalik ER. Based on these learning, the criteria and scoring system for conducting MEE for the ERs have been revised and a document on **Management Effectiveness Evaluation (MEE) of Elephant Reserves in India: Pilot Study & Revision of Criteria & Indicators was released.**





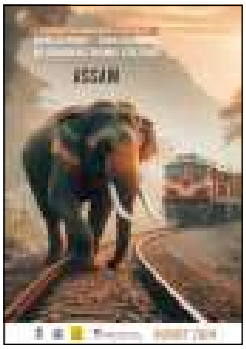
Gaj Gaurav Award

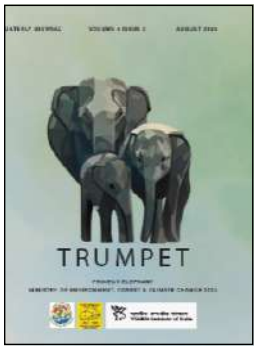
The Ministry conferred the Gaj Gaurav awards to the awardees for their exemplary contributions in the field of elephant conservation and management. During the event, the prestigious Gaj Gaurav awards were conferred to (1) Late Shri Bubul Gogoi, (Posthumous) Mahout, Assam (2) Shri Dinabandhu Barman, Head Mahout & Team, West Bengal (3) Shri Anaya Kumar Samal, Para Forest Worker, Odisha and (4) Smt. Sanghamitra Mahanta, Forest Guard, Odisha for his exemplary services.

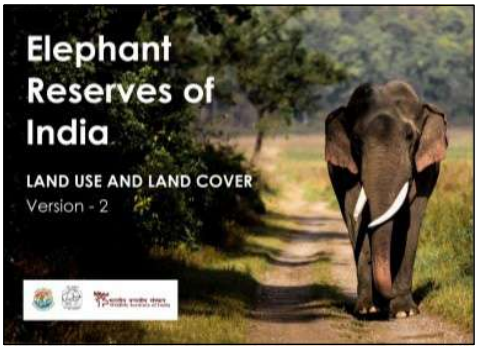
Steering Committee -Project Elephant

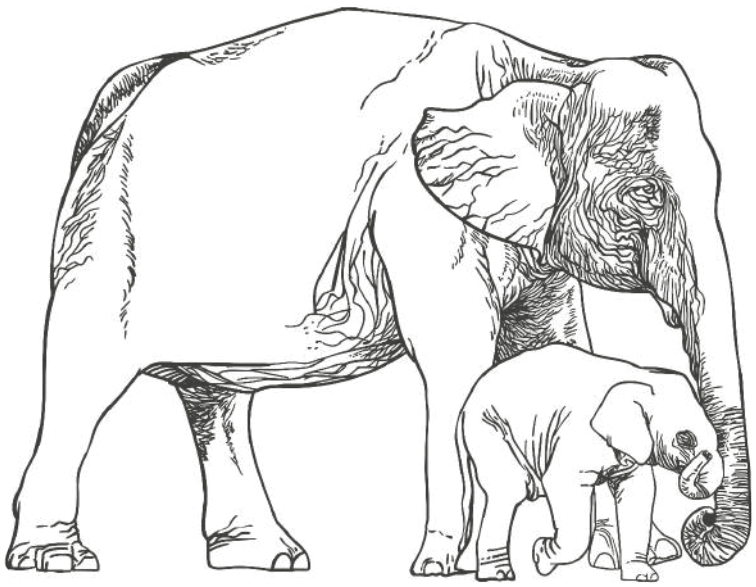
The 20th Steering Committee Meeting of the Project Elephant under the Chairmanship of Shri Bhupendra Yadav, Hon'ble MoEF&CC, was held during which the current issues facing elephant conservation and management were deliberated at length. During the meeting, the Hon'ble Minister released following documents:

- Final report of 10 States (Arunachal Pradesh, Assam, Jharkhand, Karnataka, Madhya Pradesh, Nagaland, Odisha, Tamil Nadu, Uttarakhand and west Bengal) suggesting mitigation measures to prevent elephant train collision.
- Trumpet Newsletter by Project Elephant
- Human Elephant Conflict: Field manual in Odiya, Kannada & Tamil.
- Land Use & Land cover of Elephant Reserves in India-Version II.









Meeting to Granulate the components of Regional Action Plan (RAP)

During the 16th Steering Committee meeting of the Project Elephant held on 29/04/2022 at the Forest Research Institute, Dehradun under the chairmanship of Hon'ble Minister, MoEF&CC, Government of India, the Tamil Nadu Forest Department highlighted the issue of escalating human-elephant conflicts in the state, which necessitates preparing a comprehensive action plan that elucidates on aspects of effectively managing such conflicts. Subsequently, the Tamil Nadu Forest Department submitted a concept note to the Project Elephant elaborating on the main thrust areas the states can collectively work in the southern region through a structured "Regional Action Plan" intended to serve as a guiding document to standardize management interventions across the states. Accordingly, during the 20th Steering Committee meeting held at Raipur, Chhattisgarh it was decided to conduct the Regional workshop at Coimbatore during September 2024. Accordingly, the workshop was held on 5th September 2024 at Coimbatore. During the meeting it was decided that, a core team cum drafting committee will be constituted by the Project Elephant which would comprise officials from Project Elephant and the officials from State Forest Department. The core team will deliberate on the action pan and come up with a comprehensive template that may be shared with the States.

Capacity building workshop on "Enhancing Elephant Welfare in Captivity" for elephant custodians and handlers

The RAP meeting was followed by a capacity building workshop **"Enhancing Elephant Welfare in Captivity (Southern Region)"** at Coimbatore, Tamil Nadu on 5th -6th September, 2024. This workshop was aimed to enable the elephant custodians and mahouts in the Southern region (encompassing Tamil Nadu, Kerala, Karnataka and Andhra Pradesh) of the country in ensuring the welfare and health of captive elephants maintained by government, temple authorities and private agencies by bringing together experienced mahouts, veterinarians, biologists and managers to improve the knowledge and skill levels of the practicing elephant handlers and custodians.

Capacity Building Workshops

Capacity building of stakeholders is essential for effective elephant conservation efforts. Elephants are keystone species that play a crucial role in maintaining the biodiversity and ecological balance of their habitats. However, they face numerous threats, including habitat loss, poaching, human-elephant conflict, and climate change. To address these challenges and ensure the long-term survival of elephants, it is imperative to build the capacity of various stakeholders involved in conservation.

Infrastructure development, such as roads, railways, and urban expansion, often leads to habitat fragmentation, isolating elephant populations and disrupting their migratory routes. Capacity building can help agencies design infrastructure projects that minimize these negative impacts through wildlife corridors and proper spatial planning. It is vital to ensure that development projects can coexist harmoniously with elephant conservation efforts. By equipping these agencies with the knowledge and tools necessary to minimize environmental impacts and promote sustainable development, we can work towards a future where infrastructure and elephants can thrive together.
Considering this, the Project Elephant, MoEF&CC with support of Elephant Cell, WII have organized the following capacity building workshops:

I. A capacity building workshop on "Minimizing the Impact of the Railway on Elephants and Other Wildlife" for the officials of Indian Railways was conducted on 20-23th November, 2024 at Wildlife Institute of India, Dehradun.

II. A capacity building workshop on "Exploring Solutions for Minimizing Electrocution Risks and Promoting Wildlife Safety Across Power Infrastructure in India" for the officers/officials of the Ministry of Power, State Power transmission agencies, Central Electricity Authority (CEA), State Forest Departments was organized from 20–23rd November, 2024 at Wildlife Institute of India, Dehradun.

Elephant Conservation Plan (ECP)

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.

To formulate the plan, stakeholder consultation was done to discuss the "Framework for the preparation of Elephant Conservation Plan (ECP) for the Elephant Reserves". Field visits were also undertaken to Nilgiri Elephant Reserve from 26th-30th September 2023 and Shivalik Elephant Reserve from 8th -12th October 2023, for the purposes of Management Effectiveness Evaluation (MEE) as well as understanding the various issues related to the Elephant Conservation Plan. Accordingly, a Framework for Elephant Conservation Plan, which is indented to serve as a guiding document for managing Elephant Reserves was released during the World Elephant Day 2024.

Further, a project on 'Planning Conservation in Elephant Reserves-Developing Elephant Conservation Model Plan' for the Nilgiri Elephant Reserve has been sanctioned by the Ministry on 23.10.2024.

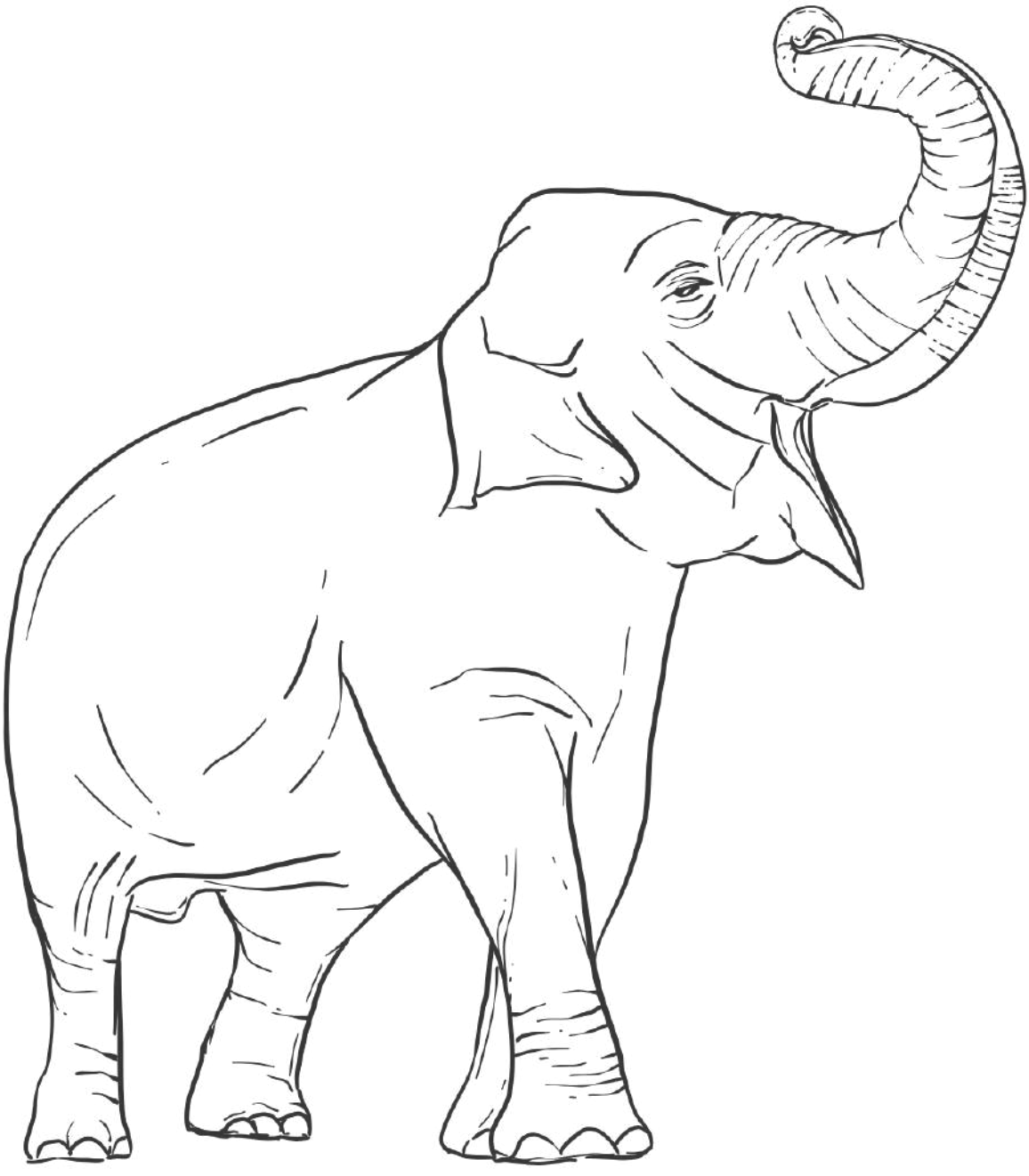
DNA profiling of captive elephants

The Project Elephant, MoEF&CC decided to develop a comprehensive database (including DNA) for all the captive elephants regardless of their ownership in India to curb illegal wildlife practices and manage their population in a scientific manner. The objective of the programme is to account/ identify every single captive elephant in the country and bring it all in a central database which would have individual-level genetic data along with pictures of these captive elephants, making it extremely useful to stop any illegal activities involving these animals. As of November 2024, 1,524 biological samples (~52% of the captive elephant population) from 21 states have been received at WII. State-wise data highlights completed and pending sampling efforts.

Photo credit: Somreet Bhattacharya

All India Synchronized Elephant Estimation

For the first time ever, the all India Synchronized Elephant estimation is being conducted through more scientific and robust methodologies. 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.



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