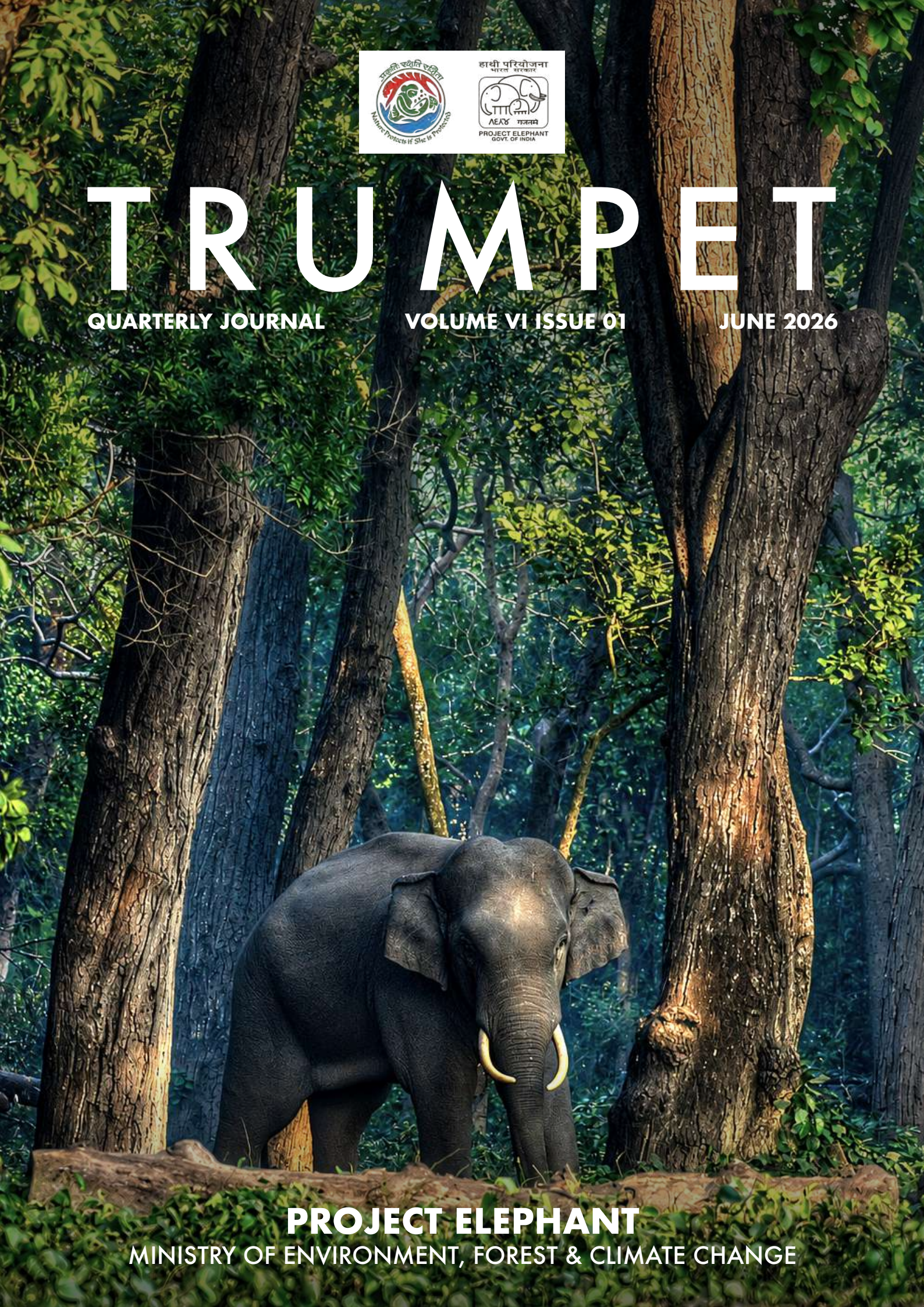


TRUMPET

QUARTERLY JOURNAL VOLUME VI ISSUE 01 JUNE 2026

PROJECT ELEPHANT

MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE

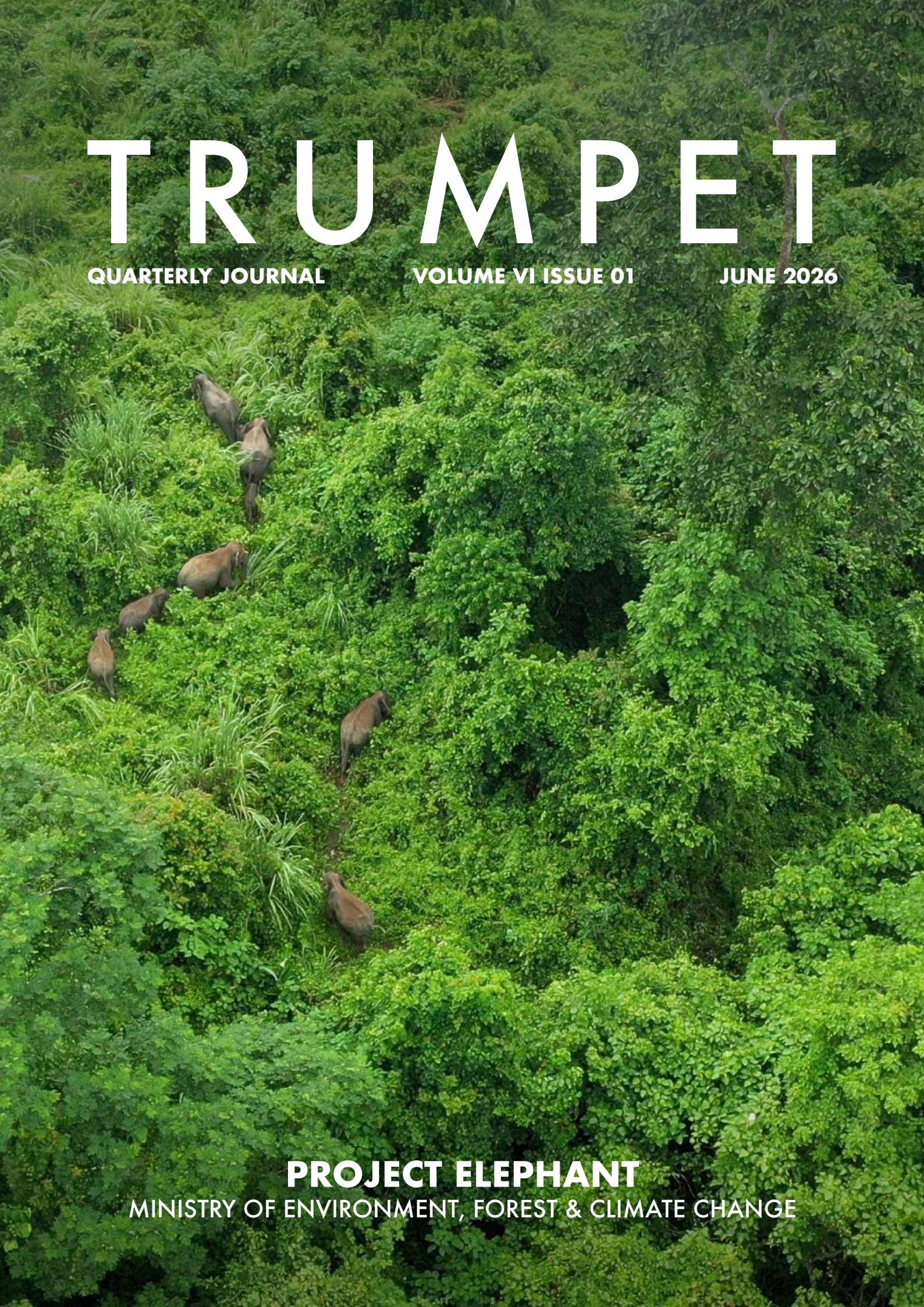
Suggested Citation
Trumpet Vol. VI. Issue 1 (2026). A quarterly newsletter of the Project Elephant, MoEF&CC, Government of India

Design support by WWF

Front cover: © Surendra Kumar

This page: © Imnawapang Jamir

Back cover: © Sangram Singh Katiyar



TRUMPET

QUARTERLY JOURNAL VOLUME VI ISSUE 01 JUNE 2026

PROJECT ELEPHANT

MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE

Contents

From the *Director's Desk*

I am delighted to announce that this edition of the "Trumpet" newsletter highlights our efforts in elephant conservation and protection, as well as the latest progress and achievements by Project Elephant (PE) and the Elephant Cell at the Wildlife Institute of India from December 2025 to June 2026.

Recent conservation initiatives have focused on the advancement of elephant welfare and habitat preservation. Over the past four months, multiple field visits and meetings have been conducted, including the 22nd Steering Committee Meeting held on 21st December 2025 at the Sundarbans Tiger Reserve. Notable advancements have been made in formulating the regional action plan, with the drafting subcommittee for the Southern Region finalising its draft and the Northeastern Region's subcommittee completing six phases of fieldwork, bringing its draft plan close to completion. Additionally, workshops titled ***Empowering Communities: Strategies for Human-Elephant Coexistence and Support for Conflict-affected Victims***, ***Capacity Building Workshop on Policy Implementation for Minimizing Elephant Mortalities on Railway Tracks*** and I***nception workshop on Management Effectiveness Evaluation of Elephant Reserves*** were successfully organised during this period. A major milestone during this period was the initiation of MEE for all the Elephant Reserves.

With the continued collaboration among the central government, state forest departments, associated agencies, civil society, and other stakeholders, it is anticipated that elephant habitats, landscapes, and corridors will be effectively preserved, thereby ensuring sustainable coexistence with these species for future generations.

Dr Vaibhav C Mathur

Director, Project Elephant

© Sanjay Kumar

01 Community-Driven Early Warning Systems For Human–Elephant Conflict Mitigation In Dhenkanal Forest Division, Odisha, India


Haree Krishna[1,4]


Sumit Kumar Kar[3]


Ramaswami Krishnan[4]


Sanjeeb Kumar Behera[4]


Pratyush P Mohapatra[1]


Lalit Kumar Patra[2]


Ranjit Pattnaik[4]


Ramesh Kumar Pandey[5]

[1] *Zoological Survey of India, Indian Museum Campus, Kolkata, West Bengal, 700016, India*
[2] *Office of Divisional Forest Officer, Dhenkanal, Odisha, 759001, India*
[3] *Office of the Deputy Director, Similipal South Wildlife Division, Bhanjapur, Baripada, Odisha, 757002, India*
[4] *SNEHA NGO, No.680/1, Rayanakere post, Kotehundi Mysore, Karnataka, 570008, India*
[5] *Ministry of Environment, Forest and Climate Change, New Delhi, 110003, India*
Correspondence: pratyush.m@zsi.gov.in

INTRODUCTION

Fragmented forest terrains, expanding human settlements, and linear infrastructure form the most conflict-prone landscapes for intensifying Human–Wildlife Conflict (HWC). Among these conflicts, Human–Elephant Conflict (HEC) stands out with an elevated figure—causing threat to human fatalities, house damage, livestock loss, and crop depredation —while retaliatory actions threaten endangered elephant populations (Fernando et al., 2005; Hoare, 2015).

Odisha has 72% of the east India's elephant population which is 7% of the whole Asian elephant population. The state also harbours 12% of total tusker elephants of Indian which makes the area an important reservoir of gene pool with tusk as the key trait (Padhi & Singh, 2010). Odisha State is known for high conflict events, especially Human Elephant Conflict. From 2009 to 2026, Odisha recorded the highest number of human fatalities due to elephant-related incidents in India, with 1,495 deaths, contributing to more than 7,868 fatalities nationwide (Pandey et al., 2026).

Early warning System (EWS) had its roots since ages as the conflict existed along with civilization, particularly in areas experiencing continuous human-wildlife interactions. The form of the system got evolved based on technical advancements and it's raging its pace based on novel approaches and insights. Use of diverse detection systems advanced drastically

with smart technologies especially with the advent of Artificial Intelligence (AI) which is accelerating conflict mitigation and ecological monitoring (Basher, 2006; Wall et al., 2014; Shaffer et al., 2019). Early awareness regarding elephant presence is one of the most crucial steps to reduce the conflict and though the concept of Early Warning System (EWS) upholds and promotes coexistence and sustainability with the use of technology and connectivity. An effective EWS constitutes structured mechanism designs to detect, monitor, and communicate potential treats before they escalate to a conflict lead loss of life, and resources. The system has a crucial role in minimising direct encounters between human and wildlife, by increasing preparedness and response time (UNDRR, 2015). Integration of smart surveillance technologies has gained attention as an effective solution for early warning and conflict mitigation (Fernando et al., 2008).

Most elephant prone villages are located in forested and isolated landscapes having weak communication networks, infrastructure, and socio-economic limitations; questioning community acceptance, equipment failure, reliability, long-term sustainability, and swift information dissemination, which are the most crucial parts of an EWS and its success (Shaffer et al., 2019). Lack of integrating local ecological knowledge and community participation for system design and integration is also the crucial constrain for sustainable EWS. Studies has shown several top-down warning systems often fail when local communities are less engaged in dissipation, connectivity, and decision-making (Barua et al., 2013; Dickman, 2010). Most EWS combines the monitoring efforts via visual, acoustic or telemetry and club with simple alert channels like SMS, sirens, alert lights or messaging apps (Zulhafizie & Seman, 2019). Researchers use technology-oriented approaches with IoT and AI-based detection systems providing real-time elephant presence and the deterrent mechanisms connected with the same such as acoustic and lights (Kongyim & Kaitwanidvilai, 2026). Convolutional Neural Networks (CNNs) and object detection models like YOLO and Faster R-CNN shows high accuracy in identifying elephants from camera feeds under varying environmental conditions. These intelligent systems offer automated detection, reducing the need for constant human observation (Radhakrishnan et al., 2021). Conversational AI has expanded animal observation and public safety

Figure 1. Elephant movement near human habitation during night.

communication (Adamopoulou & Moussiades, 2020).Intelligent surveillance systems integrating edge computing with cloud computing have enhanced animal monitoring applications (Shi et al., 2016). In India, numerous research initiatives have investigated technology-based elephant warning systems in places like Odisha, Karnataka, Assam, and Tamil Nadu, where human–elephant conflict is significantly common (Kumar et al., 2022).

Recent advances in wildlife conservation have highlighted the importance of technology-based EWS in mitigating HEC. A community-based study in Kodagu, Karnataka, by Sanath et al. (2026) demonstrated the use of satellite telemetry and mass communication systems to improve human–elephant coexistence. The study also noted that conventional measures such as translocation, barriers, and firecrackers often provide only temporary relief due to habituation and ecological limitations. The study also highlighted the ecological value of telemetry-assisted surveillance, generating over 104,000 elephant location records providing insights into movement patterns, habitat use, and behavioural adaptation in human-dominated landscapes. The findings revealed that some elephant herds permanently occupied plantation-dominated areas, emphasising the importance of integrating movement ecology into conflict mitigation planning (Muliya et al., 2026).

Building a strong and stable communication infrastructure is the pillar of EWS and when it is combined with the participation and support from the affected will generate long term effective system. Dhenkanal landscape has made multitude of efforts to build such strong connectivity and the pros and cons of the same will be discussing in this literature.

The study area is Dhenkanal Forest Division of Odisha State lies between 20°17′48″ N to 21°31′37″ N latitude and 84°40′08″ E to 85°15′44″ E longitude covering an area of approximately 2,909.54 km², the altitude ranges between 100-900m MSL having medium elevation hills. Landscape is a mosaic of forested hills, river valleys, agricultural plains, and also holds a habitat for mines and industries at a fare pace. The terrain is predominantly characterised by low to medium elevation hilly zones interspersed with broad valleys. Seasonal streams from hill slopes drain into major rivers like Brahmini, Mahanadi and portions of Baitarani sub-basins. The landscape supports tropical moist and dry deciduous forests, open scrub and degraded forest patches. As per the records of the Forest Division 294 human fatalities happened in Dhenkanal Division during April 2015 to April 2026.

The climate of the study area is tropical monsoonal, with three distinct seasons-summer (March-June), monsoon (July-September), and winter (October-February). The region receives most of its rainfall during the southwest monsoon, with an annual average of 1,200-1,500 mm. Maximum summer temperatures often exceed 40 °C, and winter minimum temperatures may drop to 10-12 °C in forested interiors, strongly influencing vegetation phenology and water availability (Government of Odisha, 2022; Odisha State Climate Profile, 2020).

HEC is more pronounced in this landscape as per the Forest Department statistics more than 170 human death happened in the landscape since 2020. Increased invasion of migratory elephants is also considered as one of the sound reasons for the increase in conflict (Mishra & Nayak, 2014).

Figure 2. Infographic of the basic working of an Elephant EWS.

Early Warning Systems for Elephants

The basic function of EWS includes the detection of elephant presence, and dissemination of the information to affected residents and travellers using the landscape during elephant intrusion. Early awareness of the elephant presence by this means reduces conflict.

Diverse EWS differing in working and iterations have been deployed in the Division by the Forest Department themselves, along with other NGOs and villagers, to study and reduce conflict in the landscape. The effectiveness of these systems is being thoroughly studied by the Department and researchers currently working in the landscape.

Community-Driven Early Warning Systems (EWS)

Poor communication connectivity in rural landscapes remains one of the major constraints in the establishment and effective functioning of EWS. Limited mobile network coverage, fluctuating signal strength, and infrastructural limitations often hinder timely dissemination of alerts and coordination among stakeholders. To overcome this challenge, rigorous field-based trial and error assessments were conducted using multiple SIM service providers to identify the most reliable and operational network suitable for the landscape. The selection of an effective network provider was essential to ensure uninterrupted communication and rapid transmission of warning signals during elephant movement events. Meeting and discussions were conducted for admins and active participants of EWS WhatsApp groups regarding the message dissipation and awareness. This created more ordered clarity in running the groups and active members were encouraged by felicitation which will drive them to move with structured and sustained workflow of the groups. The landscape is having WhatsApp groups with more than 4,000 participants including villagers, forest staff, researchers and other stakeholders working in the landscape. Messages are monitored throughout the day by the Department staffs and the EWS hooters are activated accordingly after verifying the information. Along with *Gajasathis* (elephant friend) and village volunteers the genuineness of the message is cross checked and after which the EWS process is moved forward. The major strength and key informers are the villagers who are facing the conflict and plays a crucial catalytic role in EWS execution.

Site Selection and Placement of EWS

Conflict hotspots were mapped by stakeholders, and villages and areas at high risk were chosen for deploying EWS. For EWS involving hardwires and expensive components like hooters and LED boards—along with the conflict heatmap—perspectives of the villagers and undertaking

Figure 3. A prime-adult tusker blocking a village road, while forest staff and villagers stop traffic — reducing the conflict.

personnel were analysed to reduce and avoid property loss. Spots with visibility and sound-travel constraints were avoided. For this—rather than the conflict data alone—opinions from ground staff, villagers, and researchers were used.

Detection of Elephant Presence

Advancements in AI—and techniques like CNN-, YOLO-, and Faster R-CNN–based elephant detection systems—fail to give their best in habitats with dense vegetation, undulating terrain, poor lighting, and adverse weather conditions that reduce image quality and detection accuracy. Frequent power failures and unreliable network connectivity in remote forest fringes hinder real-time monitoring. This is where people-driven EWS fills the gap, and fine-tuning and empowerment of villagers with solid connection to the Forest Department is important and effective.

Presence of elephants is confirmed when villagers have a direct sighting of elephants or their spoor in human habitations. Messages are conveyed directly over the phone to the Forest Department or to the community WhatsApp groups. App-based EWS has a different mode of operation in which the sighting is added by the viewer, and the confirmation is done by selected villagers who are expert in reading elephant spoor and have been given focused training to operate the App more efficiently. On approval, the hooter hoots—giving alert across the area of focus.

Community-Based Information Sharing Through Whatsapp-Enabled EWS

Use of smartphones has considerably increased in rural areas with advancements in technology, increasing the feasibility of mobile-based communications (MoSPI, 2025). This fact was exploited to disseminate EWS messages to the common person in real-time.

Village-wise and Section-wise WhatsApp groups were created by adding villagers and daily updates on elephant presence were shared by the group members in the group based on elephant sighting which they came across during their daily activities. The messages sent will be verified by the villagers, department staffs or other experts and conveyed for further actions. Apart from hooting for the villager's information the group admin will send a concluding voice message in the evening informing elephant presence throughout the Section. Villagers who used to go for work during the day and those who work for night shifts were mostly benefited through this message dissipation. Forest department staffs are also part of the groups and they will also get insight and swift information regarding elephant presence, which will pay for further actions and precautions. Admins are called upon for expert level meeting with the Forest Department for ensuring genuine use of the group and to gain public insight on elephant issues.

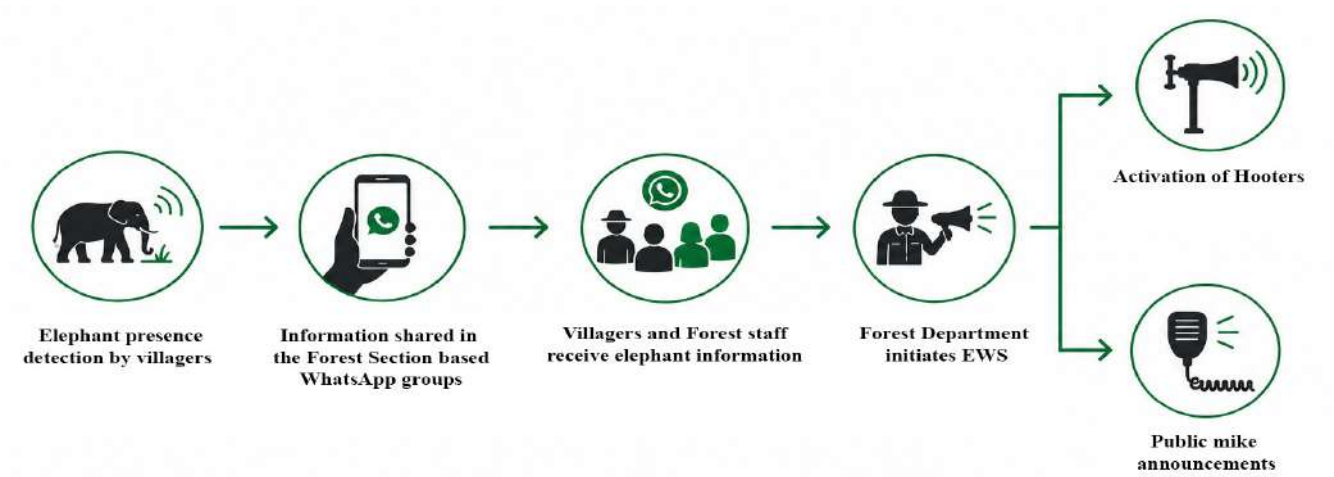


Figure 4. Infographic showing WhatsApp-based warning messages and following actions by the Forest Department.

GSM-based hooter

Hooter is used as a rapid alert mechanism designed to warn villagers regarding elephant presence. When elephants are detected by forest staff or field squads, the information is immediately communicated to the control personnel, who initiate the warning system through a mobile network. A dedicated SIM card installed inside the hooter unit receives the incoming call or signal through the GSM network, automatically activating the hooter to hoot for 3 minutes along with a Strobe light. The loud alarm sound serves as an immediate warning to nearby residents, enabling them to avoid movement toward conflict-prone areas and take necessary precautionary measures. Once elephant movement subsides, the system returns to its normal operational condition. This communication-based mechanism provides a simple, cost-effective, and community-oriented approach for reducing sudden human-elephant encounters. Hooters are placed at centre point of the villages on the highest possible structures, which enables the hooter to cover a minimum of one kilometre air distance. Division is equipped with 150 GSM based hooter with three iterations; first one consists of a solar panel, charge controller, streetlight head and a GSM unit attached to a 20 feet pole (Fig 3a), along with hooting the hooter acts as a streetlight, whereas the second one (Fig 3b) is a portable form which can be attached to any structure having maximum height for effective sound range. The third design (Fig 3c) is a hooter containing a LED board along with the hooting unit, GSM unit and a solar panel. Dissipated messages from the WhatsApp groups, and information from the locals are channelled to the Forest Department and a missed call to the concerned SIM inside the hooter will trigger the hooter along with a LED running message regarding elephant presence and warning. Each hooter costs around thirty thousand to one-lakh rupees based on the model, and the maintenance of the same done by department staffs, villagers and other stakeholders providing the system. The effectiveness and efficiency of the hooters require further long-term evaluation, as most units have been installed only within the past year. Therefore, additional monitoring time is necessary to adequately assess their operational reliability, and behavioural impact on elephants, and overall role in mitigating human-elephant conflict.

Figure 5. Community-centred role in EWS: A. Detection of elephants in urban landscapes; B. Information and warnings spread to other villagers and forest staff; C. Activation of EWS sirens and mass-messaging; D. Assisting field staff for safe evacuation and crowd management; E. Informed actions to safeguard lives and livelihood; F. Supporting mitigation strategies of the Department; G. Contributing to habitat protection and corridor conservation; H. Participating in training and awareness programs.

Figure 6. GSM and App based hooters used in Dhenkanal Forest Division; 3a) GSM hooter with streetlight, 3b) Portable GSM hooter, 3c) GSM hooter with LED panel, 3d) App based hooter.

App-Based EWS, GSM Hooters & Mass-Messaging

App based intervention which include multitude of systems make the EWS more pronounced. The hooters are connected to the App server through which hooters set across the landscape can be controlled via manual hooting and sighting based hooting. Here the users are villagers, Forest Department, NGOs and Research Scholars working in the landscape. App is maintained and run by Research team and Forest Officials; whereas some selected villagers are trained along with the ground staffs of different stakeholders to maintain the hooting and information passed in the App. Any person registered in the App can upload the sighting data by filling simple questionnaire and the approval will be done by the trained villagers and stakeholders. Soon after approval the siren in the concerned village will hoot and villagers who has been registered in the App portal will receive warning calls and messages regarding elephant presence near their village. This will help to overcome the limitations in lack of smart phones among villagers. Till date approximately 1,000 villagers have been registered in the App for receiving elephant alert calls and messages. Total of 15 hooters have been deployed in Dhenkanal Division. Till date more than 100 EWS hooting have been done with direct sighting of elephant presence.

Along with the elephant presence information, other conflict factors like presence of waterbodies, crop fields, crop storage and electrocution threats can also be entered by the user, which can be used to get more insights on elephant mitigation. Users can also post their vies and finding regarding elephants which will also be monitored and refined by the expert panel. The Dhenkanal Division witnessed more than

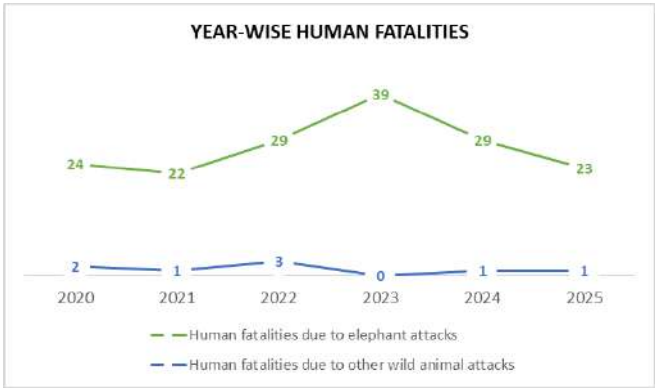


Figure 8. Year-wise human fatalities due to attack by elephants and other wild animals during 2020–2025 in Dhenkanal Division.

Figure 7. EWS Application interface.

174 human fatalities caused by wild animal attacks between 2020 and 2025. Among these, elephants were responsible for the highest number of deaths, accounting for 166 fatalities, which constituted 95.4% of the total human deaths recorded.

Geographic coordinates (latitude and longitude) of recorded conflict-related human fatalities were collected from field records, and forest department reports. The location coordinates of installed hooters were collected using handheld GPS devices and existing departmental spatial records. The spatial analysis was performed using Geographic Information System (GIS) software. All coordinate datasets were projected into a common coordinate reference system suitable for regional-scale spatial analysis. Administrative layer boundary shapefiles of the Dhenkanal Forest Division, Range boundaries, Odisha State and India were added and symbolised to create the base map.

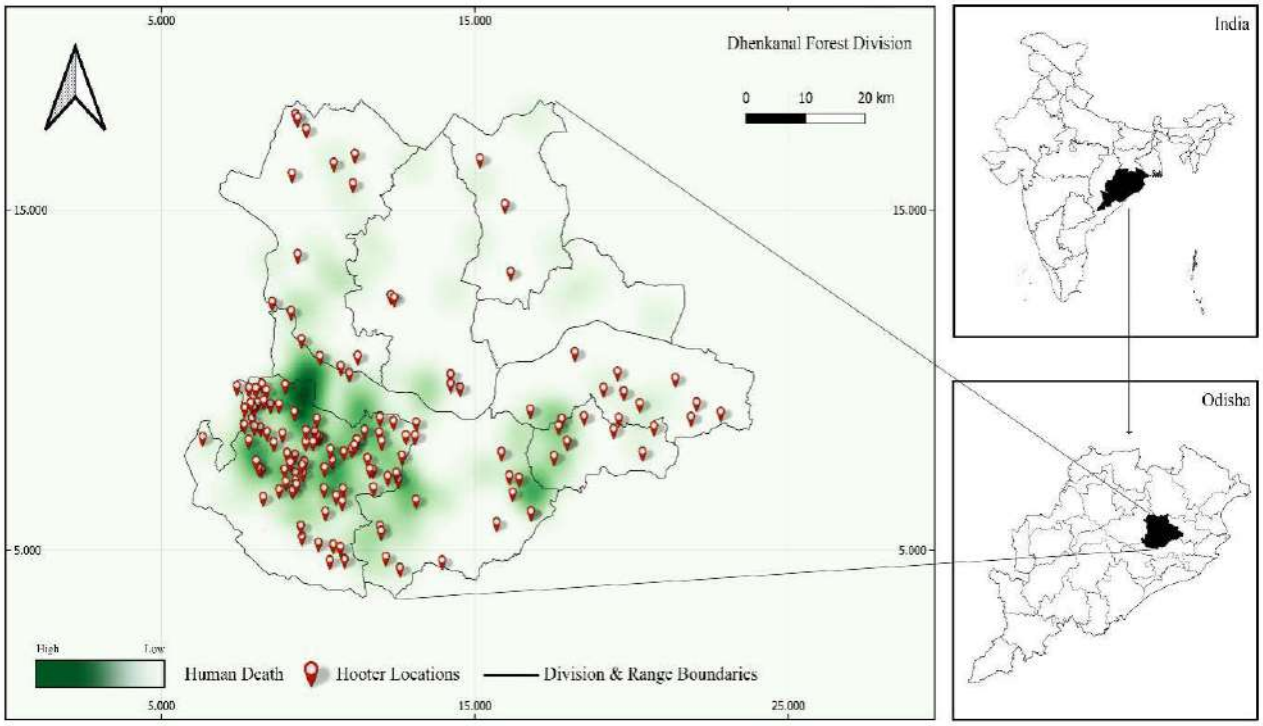


Figure 9. Heat map of human death with hooter locations in Dhenkanal Division.

The human death locations and hooter locations were imported as separate point layers, in which the human death points were used for density estimation. Hooter locations were represented using red point symbols to distinguish mitigation infrastructure from incident locations. A heatmap (Kernel Density Estimation) was generated using the human death point dataset to identify spatial concentrations of mortality incidents. This approach helps in identifying spatial hotspots of human fatalities within the forest division. The hooter location layer was superimposed on the human death heatmap to examine the spatial relationship between the conflict hotspots, and the placement of EWS hooters. The overlay allowed assessment of whether hooters were installed: within high-risk areas, near moderate-risk zones, or outside major conflict clusters.

The heatmap analysis reveals that human death incidents are not uniformly distributed across the Dhenkanal Forest Division, instead they exhibit strong spatial clustering, particularly in the south-western and central parts of the Division. These areas represent high-intensity conflict hotspots, indicated by darker green density surfaces. Several moderate-density clusters are also visible in the eastern and northern regions, although these are comparatively less concentrated. Based on the analysis the EWS hooters are preferentially implemented in areas experiencing frequent conflict with wild elephants. The heatmap-based approach provides a clear visualization of conflict-prone regions and can support various stakeholders in improving mitigation planning, optimising hooter placement, prioritising surveillance, and reducing future human fatalities.

Recent Interventions in the Landscape

GPS Collaring of Problematic Elephants

AWT (African Wildlife Tracking) radio-collars are being used to track and monitor problematic elephants in the landscape. The collar combines iridium-based satellite communication technology with UHF (Ultra-High Frequency) transmission, enabling real-time monitoring in landscapes lacking GSM network coverage.AI towers for wildlife detection.

AI Towers for Wildlife Detection

e-Eye® is an Artificial Intelligence (AI) and Machine Learning (ML) based monitoring system with high resolution thermal Pan-Tilt-Zoom (PTZ) camera. This system was mounted on a custom-built 45 m solar powered tower for continuous monitoring in conflict-prone landscapes. The visuals are integrated into AI

Figure 10. GPS Collared tusker named "Kanha" moving through an open grassland near human habitations.

and ML for detecting and identifying elephants in real-time. Once the system detects the elephant, it starts analysing the movement patterns and transmit alert messages to the field staffs. The solar-powered autonomous design allows uninterrupted operation in remote forest-edge areas with limited electrical infrastructure. Towers are placed in maximum altitude areas with open landscape for distant detection avoiding vegetation barriers. The system is fledging to its full form in which active EWS handholding community will be happening.

Early Warning Systems (EWS) is one of the effective and sustainable approach for mitigating HEC by enabling timely detection, communication, and response to elephant movement in fragmented and rural landscapes. The integration of community participation, local ecological knowledge, mobile communication networks, along with high-end infrastructures can significantly enhance preparedness and reduces sudden human-elephant encounters. In rural landscapes where technologies are limited, interventions handholding simple and accessible technologies along with active community involvement can make a positive elevation in reducing HEC.

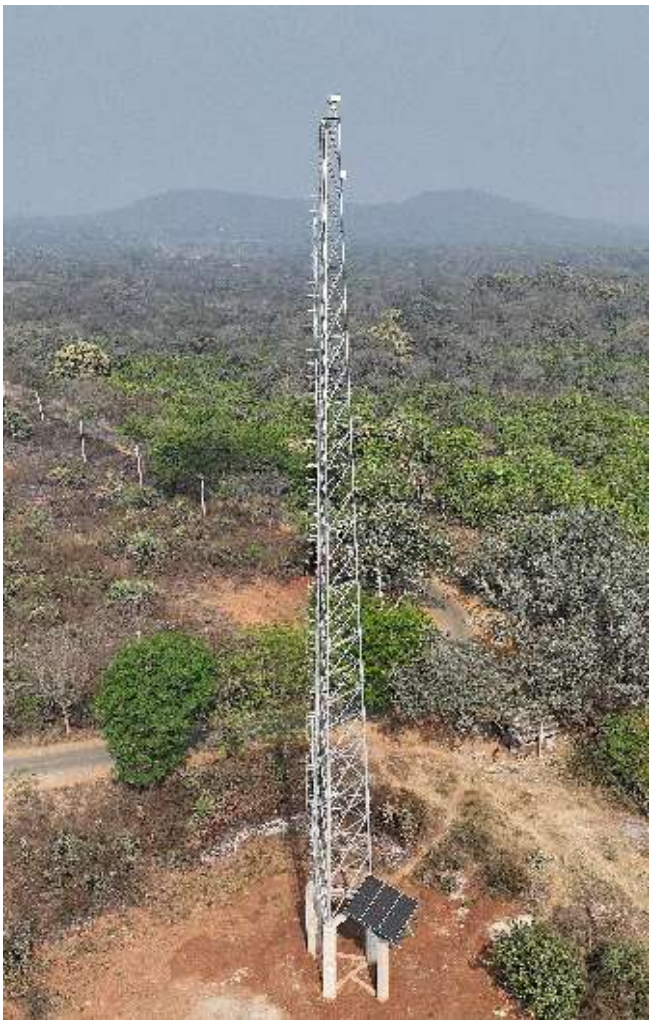


Figure 11. AI tower in Hindol Range of Dhenkanal Division.

References

1. Adamopoulou E., & Moussiades L. (2020). “Chatbots: History, technology, and applications.” Machine Learning with Applications, 2, 100006.
2. Barua, M., Bhagwat, S. A., & Jadhav, S. (2013). The hidden dimensions of human–wildlife conflict: Health impacts, opportunity and transaction costs. Biological Conservation, 157, 309–316.
3. Basher, R. (2006). Global early warning systems for natural hazards: Systematic and people-centred. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 364(1845), 2167–2182.
4. Dickman, A. J. (2010). Complexities of conflict: The importance of considering social factors for effectively resolving human–wildlife conflict. Animal Conservation, 13(5), 458–466.
5. Fernando, P., Wikramanayake, E., Weerakoon, D., Jayasinghe, L. K. A., Gunawardene, M., & Janaka, H. K. (2005). Perceptions and patterns of human–elephant conflict in old and new settlements in Sri Lanka: Insights for mitigation and management. Biodiversity & Conservation, 14(10), 2465–2481.
6. Fernando P., Wikramanayake, E., Weerakoon, D., Jayasinghe, L. K. A., Gunawardene, M., & Janaka, H. K. (2008). Review of human–elephant conflict mitigation measures practiced in South Asia. WWF and IUCN.
7. Government of Odisha. (2022). Climate of Odisha (Odisha Climate Change Profile 2022). Agriculture and Farmers’ Empowerment Department, Government of Odisha. Retrieved from https://agrisnetodisha.ori.nic.in/CCP_Book_2022.pdf.
8. Hoare, R. (2015). Lessons from 20 years of human–elephant conflict mitigation in Africa. Human Dimensions of Wildlife, 20(4), 289–295.
9. Kongyim, N., & Kaitwanidvilai, S. (2026). Smart Surveillance with Conversational Alerts for Wild Elephant Early Warning. Remote Sensing Applications: Society and Environment, 101924.
10. Kumar S., et al. (2022). “Smart monitoring and alert systems for human–elephant conflict management in India.” Journal of Wildlife and Biodiversity, 6(3), 45–58.
11. Ministry of Statistics and Programme Implementation (MoSPI). (2025). Comprehensive Modular Survey: Telecom, 2025. Government of India.
12. Mishra, S. R., & Nayak, A. K. (2014). Human-Elephant conflict by Inter-State migratory elephants (Elephas maximus) in Baripada & Balsore, Odisha, India. International Journal of Fauna and Biological Studies, 1(6), 19-22.
13. Muliya, S. K., Kolipakam, V., Pandey, R. K., Sharma, S., Pushkar, K., Kuttappa, T. C., Manjunath, C. C., Bindhani, U. T., Kawlni, L., Tiwari, V. R., & Qureshi, Q. (2026). Satellite-telemetry and mass communication based early warning system for human-elephant coexistence in Southern India’s agroforestry landscapes. Frontiers in Conservation Science, 6, 1640741. https://doi.org/10.3389/fcosc.2025.1640741.
14. Odisha State Climate Profile. (2020). Climate overview: Odisha (pp. 5–12). Retrieved from https://www.scribd.com/document/749082727/4-Climate-of-Odisha.
15. Pandey, R. K., Mittal, D., George, A. M., Sirola, G., Nigam, P., Nath, A., & Habib, B. (2026). Reframing human–elephant conflict in India through context-dependent coexistence strategies. Frontiers in Conservation Science, 7, 1762380.
16. Radhakrishnan R., et al. (2021). “Elephant detection and tracking using deep learning techniques for smart surveillance systems.” International Journal of Advanced Computer Science and Applications, 12(6), 455–462.
17. Shaffer, L. J., Khadka, K. K., Van Den Hoek, J., & Naithani, K. J. (2019). Human-elephant conflict: A review of current management strategies and future directions. Frontiers in Ecology and Evolution, 6, 235.
18. Shi W., Cao, J., Zhang, Q., Li, Y., & Xu, L. (2016). “Edge computing: Vision and challenges.” IEEE Internet of Things Journal, 3(5), 637–646.
19. UNDRR. (2015). Sendai framework for disaster risk reduction 2015–2030. United Nations Office for Disaster Risk Reduction.
20. Wall, J., Wittemyer, G., Klinkenberg, B., & Douglas-Hamilton, I. (2014). Novel opportunities for wildlife conservation and research with real-time monitoring. Ecological Applications, 24(4), 593–601.
21. Zulhafizie, M., & Seman, F. C. (2019). An Early Warning Elephant Intrusion Integrated with IoT. Evolution of Information, Communication and Computing System, 1(1), 21-29.

© Ramesh Kumar Pandey

02 When The Trumpet Meets Rubber — And Why Bamboo Must Hear Better

Tejas Mariswamy

Divisional Forest Officer

Goalpara Division (T)

The elephant's trumpet remains one of the most reliable communication systems in the subcontinent. It requires neither spectrum allocation nor formatting compliance, and it circulates without reminders or follow-up notes. When it sounds, it expects acknowledgement—and historically, landscapes obliged.

Forests carried it. Valleys amplified it. Communities interpreted it. The arrangement was simple: the trumpet spoke, and the terrain responded.

Then came optimisation—a noble and well-documented chapter.

© Prashasti Pandey

Across the Northeast, landscapes are being energetically repositioned as productive assets, and rubber has emerged as a preferred instrument of this transformation. Targets measured in lakh hectares, supported by coordinated institutional effort, demonstrate impressive administrative coherence. Saplings arrive, training modules function, incentives align, and hectares accumulate with commendable efficiency.

Among the enthusiastic facilitators of this expansion is ATMA—the Automotive Tyre Manufacturers' Association—whose commitment of resources has ensured that plantation growth proceeds with admirable traction. ATMA's involvement has helped the rubber agenda move forward smoothly, cushioning uncertainties and absorbing resistance with engineering precision.

The irony, however, writes itself.

For while ATMA strengthens the rubber beneath our wheels, the same momentum appears remarkably effective at thinning the atma—the living spirit—beneath the elephant's feet. Corridors soften into plantations, memory collides with productivity, and the trumpet encounters terrain designed not to carry signals but to mute them.

Rubber performs exactly as designed: it absorbs shock, dampens vibration, and neutralises sound. These are virtues in transport engineering. In ecological landscapes, they produce a quieter conversation—sometimes so quiet that one participant is presumed to have stopped speaking.

The elephant, unfortunately, continues speaking.

This produces our familiar administrative theatre: conflict mapping, mitigation workshops, technical advisories, and solemn acknowledgement that coexistence requires innovation. Meanwhile, the landscape—newly insulated—ensures that ecological messages travel only short distances before disappearing politely into absorption.

To be clear, neither rubber cultivation nor institutional support for livelihoods deserves caricature. Economic opportunity and regional development are legitimate objectives. The satire rests only in the surprise expressed when ecological continuity declines in terrains intentionally redesigned for uniform output. Expecting ecosystems to remain conversational under such conditions is akin to carpeting an entire conference hall and then wondering why applause sounds restrained.

If coexistence is to move beyond management toward restoration, a shift in material imagination may be required. This is where bamboo ceases to be metaphor and becomes proposition.

Unlike monoculture replacement, bamboo cultivation participates in ecological function. It stabilises soil, integrates with biodiversity, supports hydrological balance, and sustains habitat complexity while simultaneously generating income, enterprise, and industry. It belongs to local economies without alienating local ecologies. It resonates rather than insulates. It connects rather than interrupts.

In policy terms, bamboo does not merely complement livelihood objectives—it aligns them with ecological sustainability. It represents a pathway where productivity does not necessitate acoustic isolation from wildlife movement, and where development strengthens rather than substitutes landscape memory.

Rubber helped mobility. Bamboo may help coexistence.

If the trumpet is to be heard again—not as intrusion, not as emergency signal, but as ordinary background language of shared terrain—then coexistence may require replacing insulation with integration. Not symbolically, but programmatically.

And until such transitions occur, the trumpet will persist—sounding with patient consistency—waiting for landscapes that choose resonance over absorption, and listening over insulation.

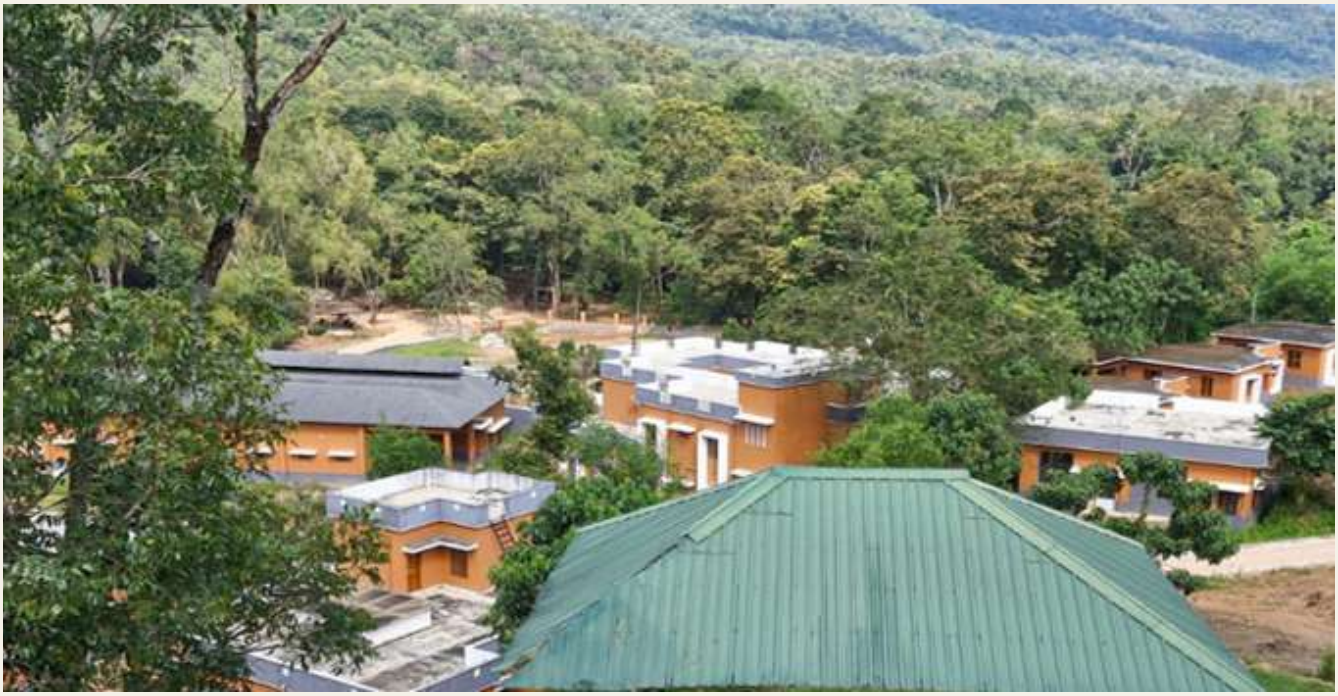
03 Elephant Rehabilitation Centre, Kottoor

Vinod S V
Wildlife Warden
Thiruvananthapuram

The Elephant Rehabilitation Centre (ERC) at Kottoor serves as a vital sanctuary for one of nature's most majestic species. Established in 2008, the centre operates across 56 hectares of forest land on the fringes of the reserve forest within the Agasthyavanam Biological Park Range. What began with just three elephants has expanded significantly, now housing 15 Asian elephants ranging from 5 to 84 years old. These residents include orphaned wild calves, rescued captive elephants, and individuals transferred from other forest department camps.

The vision of ERC is to provide required amenities to house, treat, and nurture captive, sick, injured, orphaned, and rescued elephants—including calves and aged captive elephants as well as those from conflict areas—in a near-natural environment with facility for free roaming and foraging. The centre also acts as a place for public awareness, training mahouts and other stakeholders in captive elephant management, research, and education.

Today, the ERC has grown to occupy a prime position in the minds of nature lovers. Many veterinary trainees, Range Forest Officer trainees, wildlife biology students, and enthusiasts of nature and forests visit the ERC individually as well as in groups. Apart from the scenic beauty of the adjacent forests and the Neyyar dam reservoirs, visitors are exposed to elements of the daily routine of elephants — such as elephant bathing and community feeding — from a stipulated distance, as the elephants roam freely. The centre also has a reputation for nursing abandoned elephant calves to maturity. Most of the calves received at ERC were successfully brought up through adequate care.



All the elephants in ERC are maintained in enclosures measuring from 1 acre to 2.47 acres, with roofed tethering sheds within each enclosure. The enclosures are provided with natural flooring with shade and are surrounded by elephant protection trenches. The elephants in the centre are looked after by a team of mahouts, forest administrators, and professionals.

Daily Routine

The ERC follows a daily routine for its rescued inhabitants to keep them healthy and active. A day in ERC starts at 8 in the morning when the mahouts take the elephants out for their morning walk. The elephants are made to walk within the area of the centre and are led to the reservoir area for the morning bath. During this time the elephants are properly bathed by the mahouts using a brush, and while doing so, gives them a massage. By 10 am, they are fed with mineral and protein-rich rice balls with pulses, grains, sugar, salt, Jaggery and essential mineral mix. After the morning feeding, they are taken to the enclosure where they are left to feed and stroll in the near-natural environment. In the afternoon, they are again led to the Neyyar reservoir for the second bath of the day. They are allowed to cool off in the reservoir area under the supervision of mahouts. The elephants are again fed with the same enriched rice ball mix and are led to their shelter by 4 pm.

Feeding

All elephants are stall-fed with fodder and concentrates, and are provided with restricted grazing or browsing opportunities in the forest. The elephants are fed with cooked rice or wheat, horse gram, ragi, turmeric powder, salt, mineral mixture, and jaggery made into spheres. The quantity and quality of the feed are determined by the Veterinary team in the facility. A community feeding area is present in the centre, where the feed mix is prepared for all the elephants of the centre.

Animal Collection Plan

At present, the animal collection is as per the orders issued by PCCF and CWW, Kerala, under the following circumstances:

- Captive elephants subjected to cruelty and seized under orders of Courts or competent officers
- Injured/diseased elephants
- Orphan elephant calves
- Free-ranging elephants captured from conflict areas
- Any other captive and wild elephant requiring rescue and rehabilitation

Elephant Enclosures

TThe most critical components in the design and implementation of the ERC are the elephant enclosures. The ERC is expected to cater to a population of 50 elephants in the fullness of time. The thought process behind the design of enclosures is in tune with the Central Zoo Authority regulations as well as by adopting the best practices from around the world. All-out efforts have been taken to design enclosures that help the elephants mimic their natural environment as far as possible. In addition, the global best practices that help positive reinforcement of elephant behaviour, designs that increase browsing time, etc., have been generously incorporated in each enclosure.

Within the ERC, the elephant enclosures are located in those places where the terrain is favourable, accessible by road, and where mahout and medical attention are readily available. Presently, ERC has 14 enclosures of varying area and terrain.

Stepping into the finer aspects of the design of the enclosure, the boundaries of the enclosure have been proposed to be a combination of the best of current techniques that are being used across the world. There are various techniques that are used in the design of enclosures for elephants. The first technique is the trenching method which in common parlance is called a Ha-ha trench (Depth <1.75m and width >3m). These trenches shall have a turfed recline from the enclosure side and a sharp vertical face towards the outer side. This design allows uninterrupted view of those designated viewing enclosures for visiting elephant enthusiasts while ensuring safety and security. These trenches also allow the elephant to clamber out in case they happen to descent into the trench. Another technique that is currently in use is the steel cable fencing method where steel cables are passed through metal channels and beams to cordon off the enclosure. A third and commonly used method is that of solar fencing. Another alternative that is available for enclosure fencing is the broad-gauge rail fencing which has been implemented considerable success.

The boundaries of a few enclosures are designed to have a combination of broad- gauge rail fencing on the inner side and solar fencing on the outer side. Broad-gauge rail fencing are implemented using broad-gauge rail for the vertical members and metre-gauge rail for the horizontal members.

In those enclosures where rail fencing is not being implemented, the enclosures are constructed using steel cable fencing. Horizontal steel cables passes through steel columns. They are anchored to the earth at their ends and the steel columns are buttressed from the outside.

The solar fencing, however, covers the periphery continuously in all areas where broad-gauge rail

fencing or steel cable fencing is present. The solar fencing (Pulsating 8000v @3.5 Joules with failsafe alarm system) is kept as an additional safety measure.

Other options were also considered in comparison with the present techniques for fencing of enclosures. However, the present combination was chosen in view of safety, strength, cost, reliability, aesthetics, and success history of implementation. The enclosures themselves are gated (with gate height >3m) and protected so as to allow controlled access by means of foot as well as by vehicle into the enclosure. Vehicular access into the enclosure is of supreme importance to enable regular and easy supply of food for the elephants.

The design aspects within the enclosure were also properly looked at on various levels. Elephants need to have a covered resting place within the enclosure where they can relax while the mahout and other caregivers can attend to the needs of the elephants. For this purpose, the enclosure has a roofed holding area. The size of the holding area is 9m x 6m for each elephant as per the guidelines prescribed in Kerala Captive Elephant (Management and Maintenance) Rules, 2012. In view of the height of the elephants and the heights which can be accessed by an elephant using its trunk, the roof of the holding area is kept at a height greater than 7m. The holding area has underground electrical connections and underground piped water supply. It also has water troughs for making drinking water available to the elephants. The holding area is designed to facilitate drainage and easy removal of dung. There is also a provision for tethering the elephant in the holding area itself.

Captive elephants are brought up in different conditions and exhibit a wide spectrum of unpredictable behaviour when untethered in a new area. Therefore, the tethering practices need to be modified to suit the individual needs and circumstances of each elephant.

At present, though there are facilities for keeping the elephants free from chains, all the elephants except the calves are kept chained in separate enclosures for the major part of the day. The elephants in musth are chained throughout their musth period.

Veterinary Care

For providing care and treatment to the resident elephants, the ERC has a Veterinary hospital with developing state-of-the-art lab facilities. The hospital is a two-storey building with a procedure room, medicine storage, and office facilities on the ground floor and lab facilities on the floor above. The Veterinary team is headed by the Assistant Forest Veterinary Officer (AFVO), Trivandrum, whose Office is also located within the hospital building, and hence provides service to animal rescue operations in the landscape in addition to catering to the veterinary needs of the centre.

The team regularly monitors every resident animal for any medical needs and is ready to administer the required treatment. If the required veterinary treatment is minimal, it is carried out in the enclosures themselves by the veterinary team as far as possible. The feed and its quality are also carefully monitored by the veterinary team headed by the AFVO Trivandrum for meeting the dietary requirements of the animals.

The centre also has facilities for quarantining recruits before incorporating them into the daily routine. This area is located away from the hospital and enclosures of resident elephants to prevent disease outbreaks and to allow the animals to ease into the new environment. In addition, the centre also has an Isolation shed for treating elephants with communicable diseases.

The centre is yet to see its full potential as many facilities in the ERC are in their development stage. An elephant museum is under the final stages of construction and in the near future it is expected to be one of the major attractions of the centre, providing interpretation on the life and habits of these magnificent creatures. At its fullness, the ERC is expected to have around 24 enclosures, which will be able to care for a significant number of elephants and provide ample opportunity for nature enthusiasts, researchers, and students alike to know these gentle giants up close.

04 Emerging Trends in Foraging Behaviour and Movement and Spread Dynamics of Elephants in Southwest Bengal

Dr Singaram Kulandaivel

Chief Conservator of Forests

Government of West Bengal

INTRODUCTION

The story of elephants in Southwest Bengal is no longer a simple narrative of seasonal migration and occasional crop raids. It is a profound account of adaptation unfolding in real time. Once regarded primarily as transient visitors from the Dalma landscape, elephants today are reshaping the ecological and social contours of Jhargram, Kharagpur, Bankura, and Purulia. The article titled *Emerging Trends in Foraging Behaviour and Movement and Spread Dynamics in Southwest Bengal* seeks to examine this transformation not as a crisis alone, but as a complex ecological response to a rapidly changing terrain. What appears on the surface as rising depredation is, in reality, a deeper behavioural shift driven by survival, memory, intelligence, and necessity.

Elephants are among the most cognitively advanced terrestrial mammals, capable of long-term spatial memory, emotional bonding, and learned behavioural modification (MoEFCC, 2017). In stable landscapes, their movements follow predictable seasonal rhythms, guided by ancestral corridors and resource availability. However, Southwest Bengal is

no longer a stable landscape. Expanding agriculture, fragmented Sal forests, highways, rail lines, irrigation canals, mining belts, and dense human settlements have transformed once-fairly smooth corridor into a mosaic of forest patches interspersed with high-calorie croplands. In this altered environment, elephants have not retreated; they have recalibrated. Large cohesive herds are increasingly fragmenting into smaller splinter groups, enabling faster movement, reduced detectability, and greater foraging efficiency. Crop fields—particularly Paddy, Potato, Vegetable, Sugarcane etc.—have become nutritional hotspots, encouraging prolonged stays and expanded ranging behaviour.

The steady rise in "elephant days" across divisions such as Kharagpur and the sudden expansion into Purulia signal that Southwest Bengal is evolving from a corridor into a semi-residential elephant landscape. These changes are not random disruptions but strategic adjustments shaped by ecological pressure. Understanding this silent behavioural language is essential. The future of coexistence will depend not on forceful displacement, but on informed planning, community resilience, and a compassionate recognition that these giants are adapting—just as humans must—to share a shrinking, contested space.

I. When Ancient Minds Confront a Fragmented Landscape

There was a time when the movement of elephants across Southwest Bengal followed a rhythm as old as the Sal forests themselves. Their passage was seasonal, predictable, and almost ceremonial. Villagers would say, *"They will come after the harvest moon, and they will leave before summer burns the land."* That rhythm has now been disrupted.

Today, the elephant landscape of Jhargram, Kharagpur, Bankura, Purulia, and adjoining divisions no longer behaves like a corridor alone. It behaves like a living, shifting habitat under negotiation. Elephants—among the most intelligent and socially complex mammals on Earth—are responding not with retreat, but with recalibration. What we are witnessing is not merely crop depredation. It is a silent behavioural revolution.

As one frontline forest officer remarked during a night operation in Kharagpur Division, *"We are not managing the same elephants anymore. They are learning faster than our strategies."* This statement captures the essence of the paradigm shift.

During the year 2010 the herd number was more than 30 individual at this landscape.

Total number of elephant days during this particular period (as on 31/12/2025):

Year	Jhargram	Medinipur	Kharagpur	Rupnarayan	Bankura N.	Panchet	Purulia	Total
2018–19	5,729	11,895	11,562	4,125	3,329	118	0	36,758
2019–20	10,495	11,170	12,453	5,496	3,843	164	0	43,621
2020–21	9,394	9,140	14,129	4,586	7,013	144	0	44,406
2021–22	11,651	8,194	17,802	2,291	8,801	217	3,805	52,761
2022–23	9,856	10,334	14,212	3,043	9,870	365	4,968	52,648
2023–24	16,499	8,513	21,268	2,374	10,451	686	6,176	65,967
2024–25	14,578	13,304	20,719	2,835	7,750	476	9,486	69,148
2025–26	10,245	11,811	16,473	2,337	7,510	275	3,597	52,248 (part)

II. Rising Elephant Days: The Ecological Pulse of a Changing Terrain

The data on "Elephant Days" tells a compelling story. From 36,758 elephant days recorded in 2018–19, the figure rose dramatically to 69,148 by 2024–25. The daily average increased from 91 elephants per day in 2018–19 to around 110 per day by 2021–22. These are not just statistics. They are biological signals.

Kharagpur Division has emerged as a central anchor, recording peaks above 21,000 elephant days in 2023–24. Purulia, once peripheral, suddenly witnessed a dramatic expansion—from least presence to nearly 9,486 elephant days by 2024–25. Bankura North shows a gradual and steady rise, reflecting semi-residential occupation rather than temporary passage.

This transformation indicates a profound ecological truth (Sukumar, R., 2003). In Southwest Bengal is no longer merely a transit landscape from Dalma. It is becoming a functional habitat. *"When elephant days double,"* observed a divisional Forest Officer, *"it means the land is feeding them—somehow, somewhere."* and increasingly, that "somewhere" is agricultural terrain.

III. Fragmentation of Herds: The Splinter Strategy

One of the most striking behavioural shifts is the fragmentation of large herds into multiple splinter groups. In earlier decades (during 2010) about 128 individual elephants and a consolidated herd of 25 to 60 or more individuals moved as larger groups in the landscape. Today, populations numbering close to 240 across the region disperse into numerous small, agile units. This fragmentation is not chaos. It is strategy (Hoare, R. 2015).

Smaller groups reduce detection, slip through fragmented forest edges, exploit crops more efficiently, and evade coordinated driving operations (Baskaran, N., et al., 2011). During Hullah operations, when teams attempt to push elephants toward safer forest zones, these groups deliberately split into divergent directions, overwhelming manpower and creating operational paralysis.

A veteran Hullah team member described it poignantly: *"Earlier, we chased one herd. Now we chase shadows."* This "Splinter Effect" has multiplied the points of human–elephant interception across a wider geography, intensifying conflict frequency while diffusing predictability.

IV. High-Speed Escape and Tactical Disappearance

Field observations across Jhargram and Bankura reveal another adaptation—rapid high-speed escape followed by sudden disappearance. After being driven from crop fields, elephants run with astonishing velocity, then abruptly fragment into smaller clusters and vanish into scrub, orchards, riverine belts, or even within village mosaics. This is not panic alone. It reflects learned evasion.

In recent years, elephants have increasingly been observed foraging in agricultural and horticultural crops even in close proximity to humans. Such bold behaviour, once rare or virtually unseen in the region, now reflects a significant shift in their risk perception

and adaptive strategy. The diminished avoidance of human presence signals a profound change in behavioural patterns, intensifying the complexity and severity of human–elephant interactions.

Repeated exposure to human intervention has shaped behavioural memory. Elephants now anticipate patterns of driving, exploit terrain complexity, and dissolve visibility to neutralise pressure. *"They are reading us,"* remarked one range officer after losing visual contact with a herd near Rupnarayan. *"And they know the terrain better than we do."*

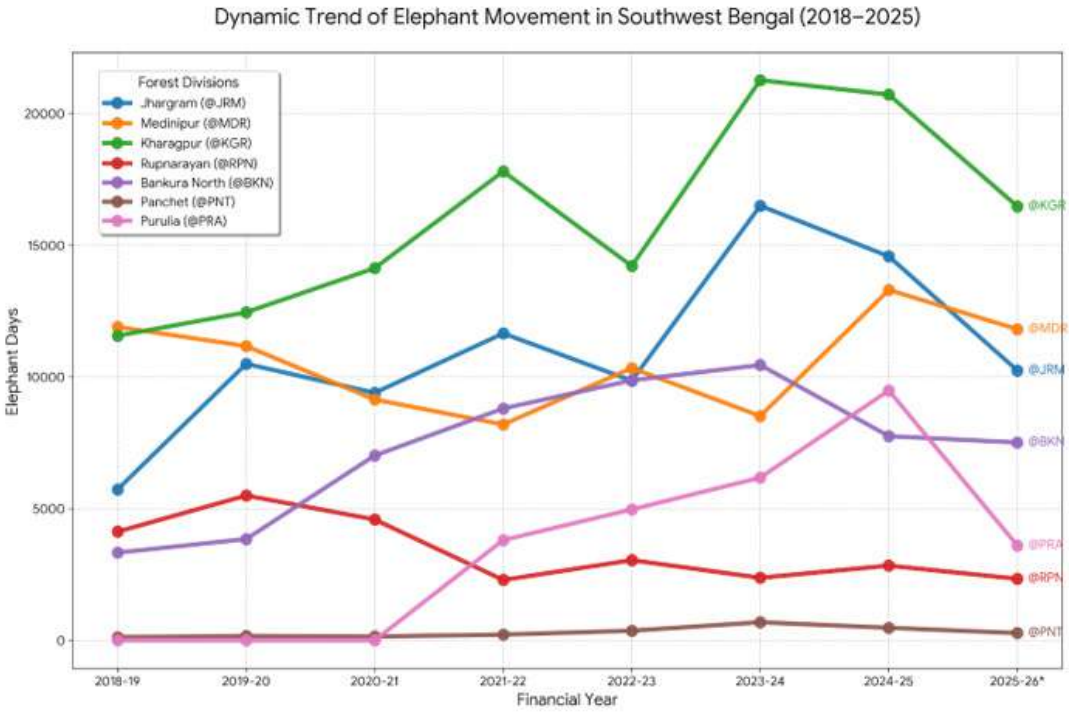
V. Expanding Diet: The Ecology of Necessity

Traditionally dependent on forest fodder, elephants in Southwest Bengal now display remarkable dietary plasticity. Paddy, maize, sugarcane, banana, pumpkin, potato, and even horticultural species have become regular components of their foraging repertoire.

An adult elephant requires 150–250 kilograms of fodder daily. When forest productivity declines or becomes fragmented, agricultural fields transform into nutritional islands. Irrigated crops provide concentrated calories with minimal effort. Crop-raiding, therefore, is not wilful destruction. It is adaptive efficiency.

In irrigated pockets of Paschim Medinipur, elephants remain for extended periods, exploiting year-round cropping cycles. The collapse of seasonal predictability has forced administration into permanent emergency mode.

"The forest no longer feeds them fully," a local farmer from Bankura reflected, *"so they come where food stands ready."*



VI. Abandoning Traditional Routes: A Crisis of Corridors

Elephants are legendary for spatial memory. Matriarchs remember waterholes and migration paths across decades. Yet in Southwest Bengal, traditional routes are being abandoned. Mining belts, highways, railway lines, irrigation canals, industrial clusters, and expanding settlements have fractured ancestral corridors (Menon, V., et al., 2017). When generational trails are blocked, elephants are compelled to improvise. The result is the emergence of new conflict zones—villages historically unfamiliar with elephant presence now face sudden encounters. Purulia's sharp rise in elephant days reflects this westward exploratory push.

"They are searching for space," observed a senior conservationist, *"and we have left them very little."*

VII. Intentional Distraction and Cognitive Sophistication

Increasingly, elephants appear to deploy distraction tactics. One visible group engages attention while others quietly forage elsewhere (Fernando, P., et al., 2008). During night raids, multiple entry points are used simultaneously, confusing response teams. Such behaviour underscores high cognitive ability and situational awareness. Elephants are not reacting blindly—they are processing patterns. This sophistication challenges conventional mitigation methods designed for predictable herd dynamics.

VIII. Human Casualties: When Defense Becomes Devastation

From 2004–05 to 2021–22, 573 human lives were lost and 734 individuals injured due to human–elephant conflict in South Bengal. Over 51,085 hectares of crops were damaged and more than 25,000 huts affected. Compensation disbursed about Rs. 8,124 lakh during this period. Behind each statistic lies tragedy.

The Kanyaduba incident of August 2022 remains etched in memory: a mother elephant, a tusker, and a calf moving along a dark village path. Startled by human presence, the mother acted defensively. Within seconds, a life was lost. This was not predation. It was protection. *"In that darkness,"* recalled a villager, *"neither side saw the other in time."* Such incidents reveal a harsh truth: most fatal encounters arise from surprise, fear, and proximity—not aggression.

Outcome of Human–Elephant Conflict in South Bengal (2004–05 to 2024–25)

Year	Persons Killed	Persons Injured	Crop Damage (Ha.)	Hut Damage (No.)	Total Damage Paid (Rs. lakh)
2004–05	27	57	1,898.0	1,774	16.39
2005–06	25	40	1,926.1	1,530	77.60
2006–07	20	66	1,956.9	1,555	34.13
2007–08	18	42	1,778.8	1,770	88.21
2008–09	22	33	1,348.4	1,465	143.80
2009–10	24	32	1,335.5	730	148.12
2010–11	40	62	3,488.4	1,359	244.31
2011–12	22	43	2,721.0	1,616	193.69
2012–13	16	23	3,513.5	1,131	269.45
2013–14	36	52	3,934.6	929	294.55
2014–15	39	47	5,128.1	2,055	408.78
2015–16	70	57	3,450.6	1,197	325.71
2016–17	38	19	4,000.3	1,907	752.26
2017–18	23	30	3,482.4	1,469	822.61
2018–19	33	36	2,752.0	1,519	527.98
2019–20	45	41	3,024.2	1,284	652.44
2020–21	46	26	2,924.3	941	557.60
2021–22	29	28	2,422.1	1,115	492.51
2022–23	53	31	2,458.0	1,329	857.06
2023–24	38	52	3,938.6	1,559	704.10
2024–25	28	65	2,260.3	1,205	512.50
Total	**692**	**882**	**59,742.0**	**29,439**	**8,123.80**

IX. Economic and Psychological Toll

Beyond casualties, the psychological burden is immense. Night-long crop guarding, sleep deprivation, and constant anxiety erode rural peace. Compensation claims have risen manifold. Operational expenditure strains administrative capacity. Field managers face exhaustion as simultaneous splinter groups stretch manpower thin (Government of India ,1992).

One officer confessed quietly, *"It feels like holding water in a sieve."* The crisis is not merely ecological; it is social and emotional.

X. Technical Constraints: The Forest-less Dilemma

Relocating elephants from HEC-prone areas to dense forests has become nearly impossible. Contiguous forest cover is insufficient. Fragmented patches cannot absorb large populations (Srinivasaiah, N., et al.,2012). Driving operations often push elephants from one village boundary to another, merely shifting the problem of conflict rather than resolving it. Without landscape-level restoration, tactical operations remain temporary relief measures (Chanda, S. (2012).

XI. Community Interface: Daily Livelihood in the Shadow of Giants

Forest-fringe communities intersect with elephants daily while collecting NTFPs, firewood, Sal leaves, or mahua flowers and while protecting their field crop, etc.. Early morning or late evening routines—attending natural calls, returning from markets—carry unpredictable risk. Crop-raiding peaks between 6 p.m. and 4 a.m. Elephants exploit darkness with strategic precision (Kulandaivel, S.,2010).

"The night belongs to the elephant now," says a farmer from Jhargram, *"and we borrow it cautiously."* Such shared terrain demands new behavioural etiquette from both species.

XII. The Splinter Effect and Governance Stress

The shift from consolidated herds to dispersed micro-groups has overwhelmed management systems. Instead of tracking one predictable herd, authorities now monitor multiple moving fronts across divisions. Manpower deficits, increased need for Hullah teams, logistical exhaustion, and growing compensation burdens compound the strain. Yet within this challenge lies opportunity—the need for adaptive governance.

XIII. Toward Intelligence-driven Management

The future demands recalibration. Strengthening corridors between West Bengal, Jharkhand, and Odisha is essential. Landscape-level planning must integrate agriculture, irrigation, power infrastructure, and forest restoration (Ghosh, S., & Basu, P. (2019). Early-warning systems using SMS alerts, GPS tracking, and rapid response squads engaged become insufficient to address the complicated HEC mitigation/management (Kulandaivel, S.,2025). The urgent and systematic adoption of all available technologies is essential for effective human–elephant conflict mitigation. Compensation disbursement protocols require modernisation to match rising claims swiftly and transparently.

Community participation like JFMCs in the Southwest Bengal Terrain—crop zoning, bio-fencing, chili deterrents, and beehive barriers—must complement institutional strategies (Bist, S. S.,1992). "*Coexistence,"* as one senior forest officer stated, *"is not about pushing elephants away. It is about designing space intelligently."*

A lone elephant engaged in foraging at paddy field adjacent to Joypur Forest, Bankura District.

XIV. Listening to the Behavioural Language of Elephants

The behavioural changes observed in Southwest Bengal are not acts of defiance. They are adaptive messages. Fragmentation of herds, dietary expansion, nocturnal foraging, route improvisation, tactical splitting—each is a sentence in the behavioural language of survival (Santiapillai, C., & Jackson, P. , 1990).

Elephants are not merely reacting to human pressure; they are negotiating survival within a shrinking mosaic. If elephant days have nearly doubled, it is because the land still offers sustenance—but at a cost (Williams, A. C., et al., 2001).

CONCLUSION

From Conflict to Conscious Coexistence

Human–elephant conflict in Southwest Bengal is neither accidental nor inevitable. It is the product of intersecting ecological necessity and demographic expansion.

The data from 2018–2025 signals a historic turning point. Southwest Bengal has evolved from a transient corridor into a semi-permanent elephant landscape. Management strategies designed for the past must evolve accordingly.

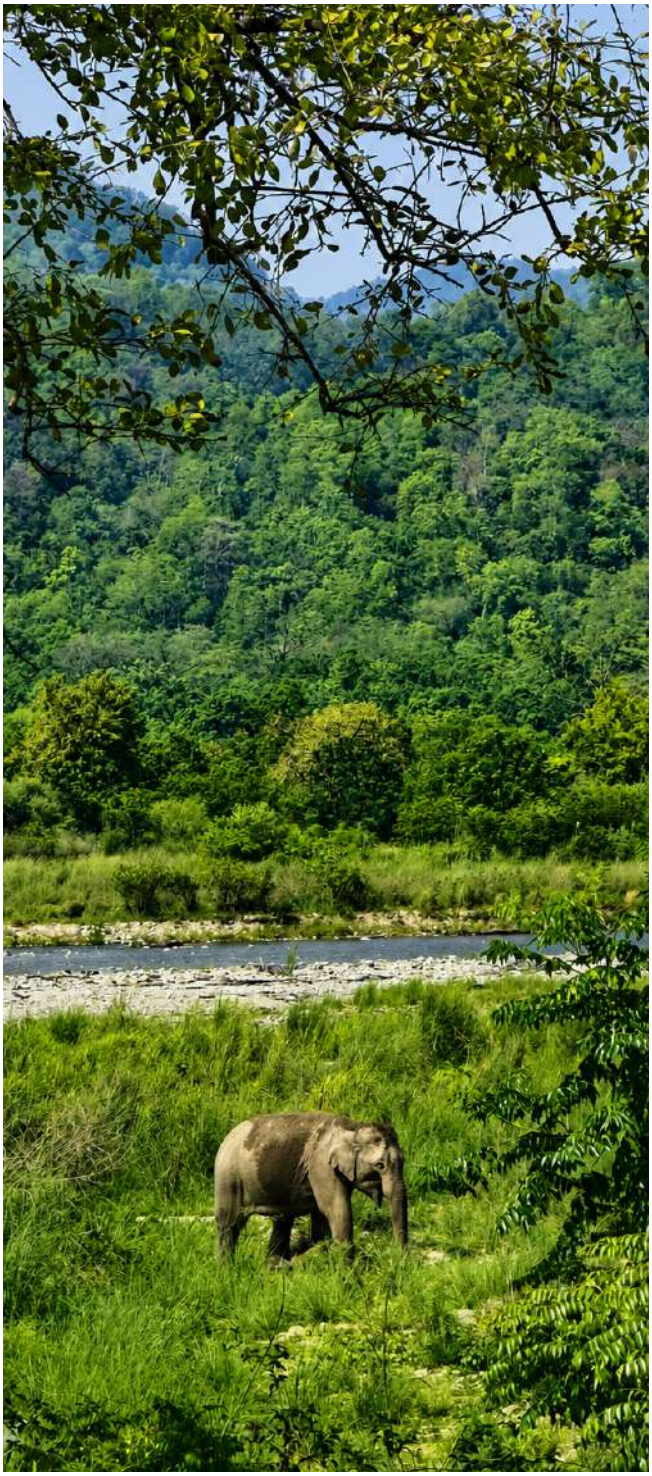
The measure of success will not be the absence of elephants from fields. It will be the presence of safety, dignity, and ecological balance for both communities and wildlife.

As one elderly villager in Bankura expressed with quiet wisdom: *"They were here before us. We must learn how to live together—not because it is easy, but because it is necessary."*

A small elephant foraging group at a forest water body near Garbeta- Paschim Medinipur

References

1. Baskaran, N., et al. (2011). "Feeding Ecology of Asian Elephants in Fragmented Landscapes." *Journal of Tropical Ecology*. This study demonstrates how elephants broaden dietary preferences under resource stress.
2. Bist, S. S. (1992). *Community-Based Elephant Management Strategies in South Bengal*. Forest Department Reports, Government of India. An early administrative account emphasizing community participation in elephant management, laying groundwork for later participatory mitigation models in West Bengal.
3. Chanda, S. (2012). "Role of Tribal Communities in Biodiversity Conservation in Southwest Bengal." *Journal of Forest Ecology*, 17(3), 45–53. This article highlights indigenous stewardship practices and the contribution of tribal communities in conserving forest biodiversity within elephant landscapes.
4. Fernando, P., et al. (2008). "Review of Human–Elephant Conflict Mitigation Measures Practiced in South Asia." WWF–World Wide Fund for Nature. A regional synthesis of mitigation strategies including early warning systems, chilli deterrents, bio-fencing, and compensation frameworks, advocating landscape-level planning.
5. Ghosh, S., & Basu, P. (2019). "Changing Patterns of Human–Elephant Conflict in Eastern India." *Current Science*. Documents rising interception frequency and shifting spatial use patterns, supporting behavioural adaptation observations in Southwest Bengal.
6. Government of India (1992; revised periodically). *Project Elephant Guidelines and Operational Framework*. Ministry of Environment, Forest and Climate Change (MoEFCC). The principal national framework guiding elephant conservation, emphasizing corridor protection, habitat restoration, and inter-state coordination.
7. Hoare, R. (2015). "Lessons from Human–Elephant Conflict Studies." *Pachyderm*. Discusses stress-induced aggression, habituation, and limitations of reactive deterrence strategies, offering comparative insights applicable to India.
8. Kulandaivel, S. (2010). A paradigm shift in the Elephant depredation in South Bengal, Online publication in the Forest Department, Government West Bengal Website during the year,2010. Documents early coexistence experiences and administrative responses in emerging elephant-use zones.
9. Kulandaivel, S. (2025). Beneath the footsteps of Elephants: Conflict and Coexistence in Bengals's Forests. Published Article in the "Trumpet" Volume V Issue 01, August, 2025by Project Elephant –Ministry of Environment, Forest & Climate Change .
10. Menon, V., et al. (2017). *Right of Passage: Elephant Corridors of India*. Wildlife Trust of India. A comprehensive national mapping of elephant corridors identifying fragmentation and infrastructure barriers affecting movement ecology.
11. MoEFCC (2017). *Guidelines for Human–Elephant Conflict Mitigation*. Government of India. Provides standardized operational protocols for rapid response, compensation systems, and mitigation planning.
12. Santiapillai, C., & Jackson, P. (1990). "The Asian Elephant: An Action Plan for its Conservation." IUCN/SSC Asian Elephant Specialist Group. An early international conservation blueprint recognizing habitat loss and corridor degradation as primary drivers of conflict.
13. Srinivasaiah, N., et al. (2012). "Habitat Fragmentation and Elephant Movement Patterns." *Biological Conservation*. Uses telemetry and modelling to link corridor fragmentation with altered movement dynamics and increased human interface.
14. Sukumar, R. (2003). *The Living Elephants: Evolutionary Ecology, Behavior, and Conservation*. Oxford University Press. Explores cognitive complexity, behavioural innovation, and adaptive responses to anthropogenic pressure, providing theoretical grounding for corridor shifts and route redefinition.
15. Williams, A. C., et al. (2001). "Elephant–Human Conflict in Asia: A Review." *International Journal of Biodiversity Science*. Offers comparative analysis of crop-raiding behaviour and habituation patterns, introducing the concept of adaptive crop foraging relevant to South Bengal.



© Ramesh Kumar Pandey

05 Hanging Solar Fence and Community Stewardship: Lessons from Human–Elephant Conflict Mitigation in Assam's Manas Landscape

Hiranmoy Chetia[1]

Rathin Barman[1]

[1] *Wildlife Trust of India, Noida Sector-8, Uttar Pradesh*

1. Context: Human–Elephant Conflict in Assam's Manas Landscape

India supports nearly 60% of the global Asian elephant population, estimated at approximately 22,446 individuals (Qureshi et al. 2025). While this represents a major conservation success, it also brings persistent challenges at the human–wildlife interface. Across the country, human–elephant conflict (HEC) results in an estimated 500 human fatalities and around 100 elephant deaths annually, largely driven by crop raiding, property damage, and retaliatory actions such as poisoning and illegal electrocution (Panda et al. 2020).

Assam remains one of the most conflict-prone states in India, reporting the second-highest number of elephant deaths due to electrocution and poisoning and the third-highest number of human casualties due to HEC (Mohan 2024). The First Addition to Manas National Park (FAMNP) in Chirang district exemplifies this challenge. This landscape forms a critical interface between protected forest and densely cultivated agricultural land and has long been identified as a priority area for conflict mitigation (Environment, Forest & Climate Change Department, Government of Assam 2016).

Field monitoring conducted over more than a decade in the FAMNP landscape recorded repeated incidents of crop loss, house damage, and both human and elephant mortality, particularly along the southern boundary of the park. In several instances, conflict escalated into retaliatory actions, including illegal electrocution and poisoning of elephants, highlighting the urgent need for effective and socially acceptable mitigation measures (MoEF&CC 2019).

Earlier mitigation efforts in the landscape, including chilli fencing, beehive fences, powerful lights, and noise-based deterrents, yielded limited and short-lived results. Consultations conducted across 60 fringe villages, including those with prior interventions, revealed a strong community preference for solar-powered fencing as a more reliable and practical solution. This consensus informed the initiation of a community-led hanging solar fence programme by the Wildlife Trust of India in 2018, with support from Chester Zoo.

The intervention began with a 1km pilot stretch in 2019 and expanded steadily to cover 17km of hanging solar fence and an additional 7km of single- and double-line fencing by early 2024. The fencing network now spans 42 villages, directly protecting approximately 8,000 households across nearly 46km² along the southern boundary of FAMNP, while indirectly supporting elephant conservation across the greater Manas landscape.

2. Why Hanging Solar Fences?

Solar-powered electric fencing has long been promoted as an effective tool for mitigating human–elephant conflict. However, conventional ground-based fences often fail in high-rainfall landscapes like Assam due to vegetation growth, waterlogging, and frequent grounding, leading to voltage drops and fence breaches. These failures not only reduce effectiveness but also erode community trust in the intervention.

The hanging solar fence was designed as a response to these limitations. By suspending live wires from insulators mounted on wooden, concrete, or iron posts, the fence remains elevated above ground, minimising contact with vegetation and moisture, especially during the monsoon season. The design allows flexible adjustment of wire height to match local terrain undulations, making it difficult for elephants to crawl under or step over.

Each fence unit is powered by solar panels connected to charge controllers, deep-cycle batteries, and high-voltage energisers that deliver a non-lethal but effective shock. Non-insulated wires are hung using droppers and porcelain or polymer insulators to maintain consistent spacing and voltage. Routine voltage monitoring, carried out twice daily by trained community members, ensures early detection of faults and rapid repairs.

This combination of technical robustness and ease of local maintenance makes the hanging solar fence particularly suited to community-managed landscapes. In the Manas fringe, it has proven capable of functioning reliably even during heavy rains, floods, and high winds—conditions under which traditional fencing systems frequently fail.




Photo plate 1: Baba Bandhus and local community at work

3. Community Institutions that Made the Fence Work

The effectiveness of the hanging solar fence in the Manas fringe landscape is closely tied to the strength of community ownership and local institutions built around it. From the outset, the intervention moved beyond a purely infrastructure-based approach and focused on empowering communities to manage, maintain, and respond to conflict situations independently.

3.1. Solar Fence Management Committees (SFMCs)

To ensure long-term sustainability, Solar Fence Management Committees (SFMCs) were established across the protected stretches. These committees are composed of local volunteers responsible for defined sections of the fence. At present, 14 SFMCs are operational, nine managing hanging solar fence segments and five overseeing single-line fencing.

Each SFMC mobilises resources through community contributions and uses these funds to engage a dedicated fence technician. The technician is responsible for daily voltage checks, routine inspections, and timely repairs. This decentralised system has significantly reduced response time to faults and minimised prolonged fence downtime, which is often a major weakness in externally managed fencing projects.

Encouragingly, several SFMCs have begun building corpus funds to support long-term maintenance. Contributions are raised through modest household donations, in-kind support such as betel nuts, and locally organised fundraising events. These initiatives have strengthened financial self-reliance and reduced dependence on external agencies.

3.2. Primary Response Teams *(Baba Bandhus)*

Complementing the fence system is a network of 45 trained volunteers, locally known as *Baba Bandhus.* These volunteers act as a rapid response unit when elephants breach or attempt to bypass the fence.

Operating as a second line of defense, *Baba Bandhus* respond to alerts from fence technicians or villagers, monitor elephant movement, and safely guide animals back toward forested areas. Between 2021

Figure 1: An elephant by the side of the fence, unable to bypass

and 2024, these teams successfully intervened in approximately 80% of recorded breach incidents, preventing escalation and reducing the risk of injury to both people and elephants.

Their presence has been particularly critical during periods of elephant adaptation, when individuals attempted novel breaching strategies. By combining vigilance, local knowledge, and coordination with forest staff, the response teams have played a vital role in maintaining community confidence in the intervention.

3.3. Building Local Capacity and Trust

Regular training programmes were conducted for SFMC members, fence technicians, and response teams, covering fence maintenance, voltage management, safety protocols, and elephant behaviour. In parallel, frontline forest staff were supported through targeted capacity-building on HEC management and community coordination.

Together, these efforts have fostered a shared sense of responsibility between communities, conservation practitioners, and the forest department. Notably, no human or elephant fatalities have been recorded within the fenced areas since the intervention began, underscoring the value of people-driven conservation systems.

within the fenced areas since the intervention began, underscoring the value of people-driven conservation systems.

4. Effectiveness of Hanging Solar Fences in Conflict Deterrence

The effectiveness of the hanging solar fence system in the FAMNP landscape is evident from a combination of incident records, fence expansion data, and field observations between 2021 and 2024. Together, these indicators show a gradual but measurable reduction in conflict intensity, even as elephants adapted to the intervention.

4.1. Trends in Crop and Property Damage

In 2021, areas later covered by hanging solar fences recorded 39 crop damage cases and 8 house damage cases. Following fence installation and expansion,

Photo plate 2. Elephant breaching strategies: branch placement, charging behaviour, crawling underneath and wind-damaged fence sections.

crop damage declined by 26% in 2022, falling to 29 cases. However, in 2023, crop damage increased sharply to 53 cases, reflecting a phase of behavioural adaptation by elephants, including fence bypassing and breaching attempts.

In response, fence maintenance protocols were strengthened, weak points reinforced, and community vigilance enhanced. These adaptive measures led to a 40% reduction in crop damage in 2024, with incidents declining to 32 cases.

House damage followed a different trajectory. From 8 cases in 2021, incidents rose to 25 cases in 2022, largely due to elephants entering villages through unfenced gaps. Targeted interventions, including fence extensions, improved night surveillance, and faster response by Baba Bandhus, resulted in a 28% reduction in 2023 and a further 33% decline in 2024, bringing house damage down to 12 cases.

Importantly, no human injuries or fatalities were reported in fence-protected areas throughout the 2021–2024 period.

4.2. Effectiveness Per Kilometer of Fence

During the same period, the hanging solar fence expanded from 7km in 2021 to 15km by 2024, with an average annual increase of 2.5km. When conflict incidents are analysed relative to fence length, a clear improvement emerges.

Overall property damage per kilometer of fence declined markedly, with crop damage reducing from 5.6 cases/km in 2021 to approximately 2 cases/km in 2024, and house damage decreasing from 1 case/km to 0.8 cases/km over the same period.

This reduction indicates that, despite occasional breaches, the fence has become progressively more effective as maintenance quality, response mechanisms, and community experience improved.

5. Challenges and Elephant Adaptation

The deterrent performance of the hanging solar fence must be viewed in light of several persistent challenges.

Seven elephants in the landscape have been identified as habitual crop raiders, with four individuals frequently approaching the fence. These elephants display advanced problem-solving behaviour, including throwing branches onto live wires, crawling under loosened sections, or charging through the fence when voltage drops. Such learning behaviour underscores the need for continuous adaptation rather than static solutions.

Natural factors also pose challenges. Strong winds regularly uproot trees that damage fence sections, while financial constraints can delay repairs if community funds are insufficient. To address these issues, the project adopted an adaptive management approach informed by camera trap data, direct observations, and local reporting. Breach-prone zones were reinforced, undergrowth cleared regularly, and voltage levels monitored twice daily.

Despite these pressures, rapid response by SFMC members and Baba Bandhus has ensured that fence functionality is quickly restored. The experience highlights that institutional strength and vigilance are as critical as fence design.

6. Comparison with Conventional Solar Fencing

Traditional single- and double-line solar fences in the region often suffer from grounding due to vegetation growth, waterlogging, and soil moisture, leading to frequent voltage drops, particularly during the monsoon. These failures reduce deterrence and increase the likelihood of dangerous elephant–human encounters.

In contrast, the suspended design of the hanging solar fence minimises ground contact and short-circuiting. Field observations indicate that the fence maintained consistent voltage and functionality even during heavy rainfall, flash floods, and prolonged monsoon conditions. This reliability has been central to sustaining community confidence and preventing retaliatory actions such as illegal electrocution.

7. Landscape-level Outcomes: Land Use and Land Cover Change

Beyond immediate reductions in conflict, the hanging solar fence intervention has contributed to broader landscape-level changes along the southern

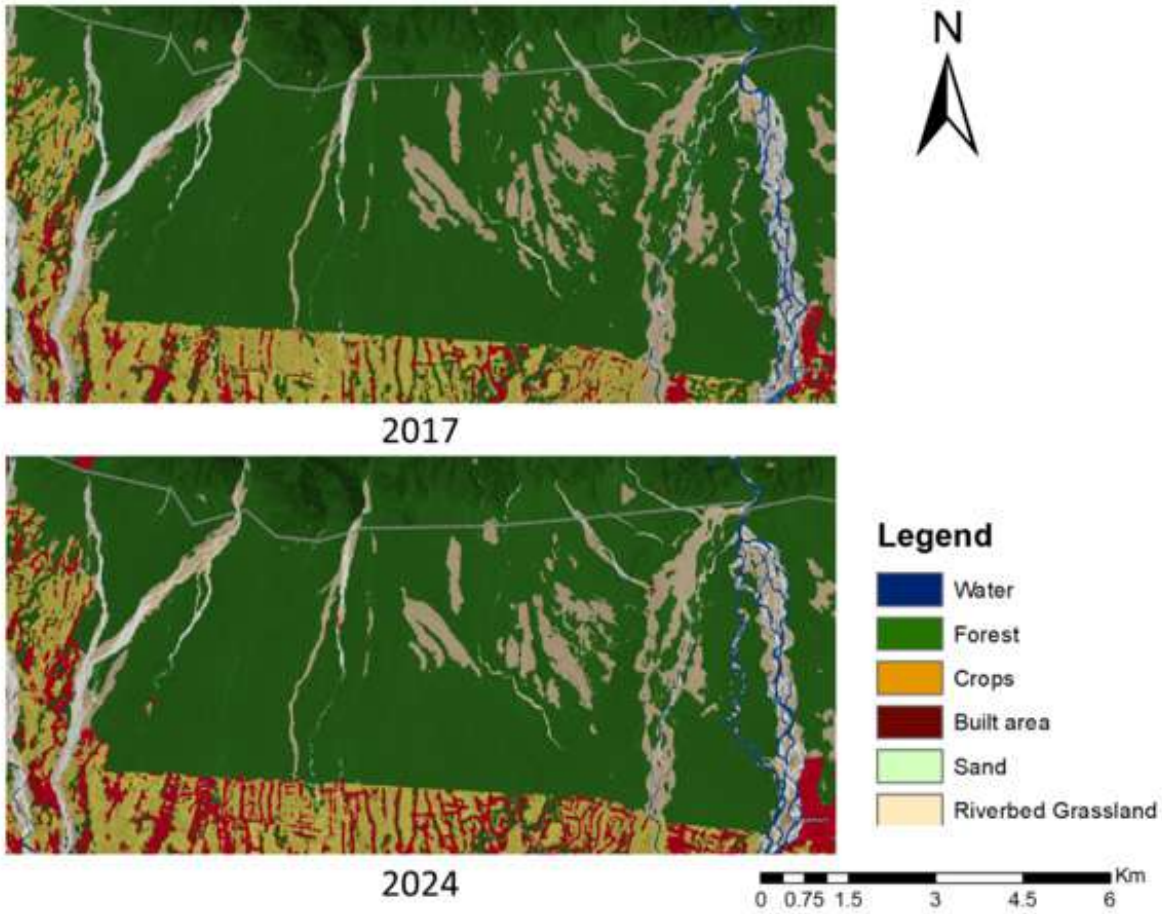


Figure 2. Comparison of LULC in the FAMNP landscape (2017–2024) (ESRI Living Atlas)

boundary of the First Addition to Manas National Park. An analysis of land use and land cover (LULC) change between 2017 and 2024, using remote sensing data from the ESRI Living Atlas, provides insight into how reduced conflict has influenced human land-use behaviour.

Forest cover across the landscape remained largely stable at approximately 75% during this period, indicating limited degradation within core forest areas. Riverbed grasslands showed a modest increase from 12% to 13%, likely reflecting improved hydrological dynamics and reduced disturbance along riparian zones. Built-up areas expanded from 1% to 3%, suggesting gradual growth in rural infrastructure and settlement consolidation.

One of the most notable changes was a reduction in the sand class from 5% to 2%, pointing toward greater landscape stability and reduced erosion or deposition in riverbeds. Cropland coverage remained constant at 5%, but spatial analysis revealed a key qualitative shift: the reoccupation of agricultural fields that had previously been abandoned due to repeated elephant incursions.

Field interactions confirmed that many fringe farmers had earlier stopped cultivating land near the forest edge because of high risk. Following the installation of hanging solar fences and the establishment of community-led protection mechanisms, confidence returned, and cultivation resumed in these once-vulnerable areas. This shift highlights an important secondary benefit of conflict mitigation, the restoration of livelihoods and food security without further forest encroachment.

Taken together, these patterns suggest that the hanging solar fence has played a dual role: physically limiting elephant entry into human-use areas while indirectly reshaping land-use decisions by reducing perceived risk. Such outcomes underline the importance of integrating conflict mitigation with broader landscape management objectives.

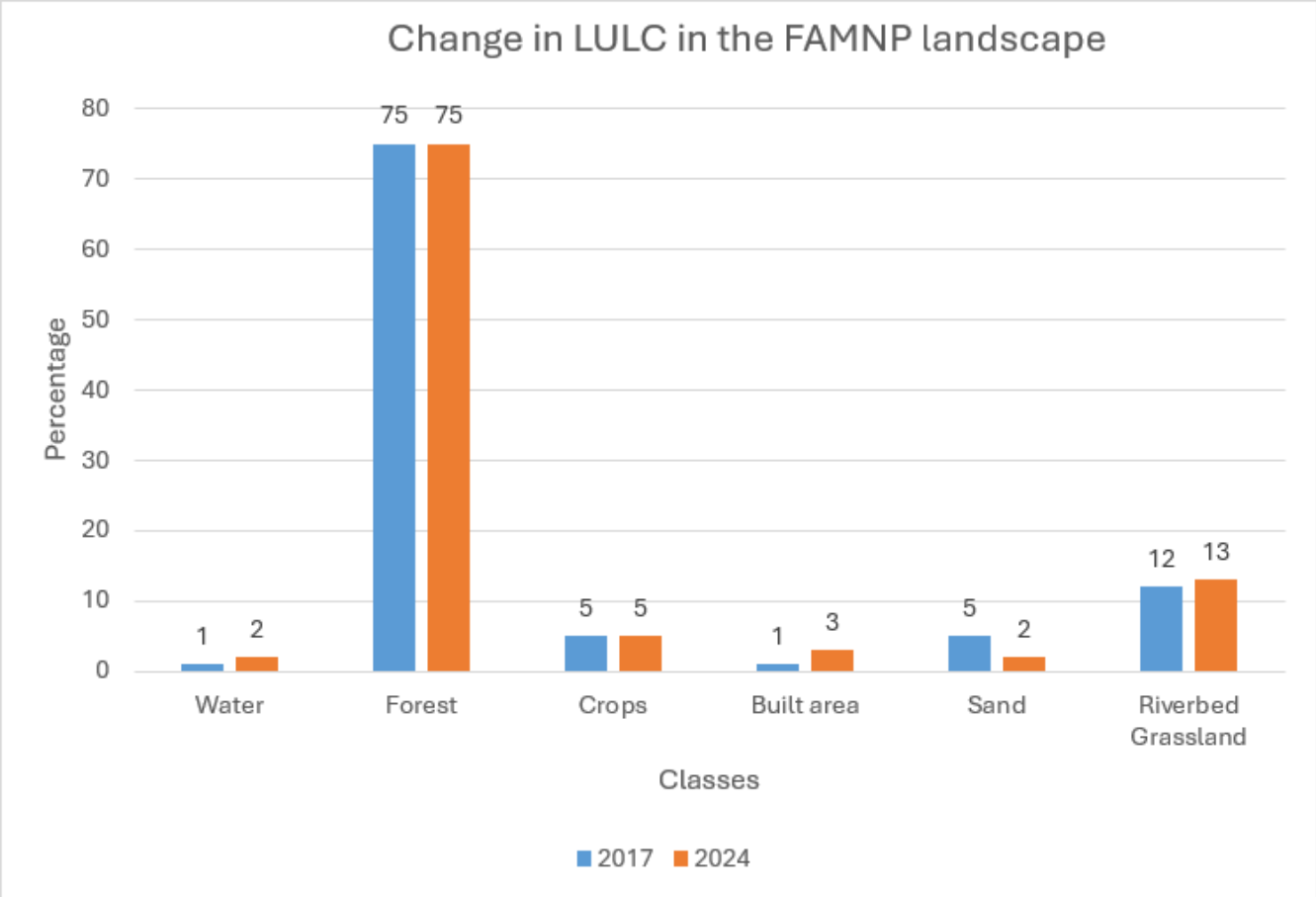


Figure 3. Change in LULC In the FAMNP landscape from 2017-2024 (ESRI Living Atlas)

8. Conclusion

The hanging solar fence initiative implemented by the Wildlife Trust of India in the First Addition to Manas National Park demonstrates how technically sound design, when combined with strong community institutions, can substantially reduce human–elephant conflict. Over time, the intervention has lowered crop and property damage, eliminated human and elephant fatalities within protected stretches, and restored confidence among fringe communities.

Equally important are the broader outcomes. Stable forest cover, resumed agricultural use along the forest edge, and reduced retaliatory actions indicate that the fence has contributed to a more balanced and resilient landscape. As pressures on elephant habitats continue to intensify across India, this model offers a scalable, adaptable, and community-centered approach to coexistence one that places people not at the periphery of conservation, but at its core.

Equally important are the broader outcomes. Stable forest cover, resumed agricultural use along the forest edge, and reduced retaliatory actions indicate that the fence has contributed to a more balanced and resilient landscape. As pressures on elephant habitats continue to intensify across India, this model offers a scalable, adaptable, and community-centered approach to coexistence — one that places people not at the periphery of conservation, but at its core.

References

1. Environment, Forest & Climate Change Department, Government of Assam (2016). 1st addition to Manas National Park
2. https://environmentandforest.assam.gov.in/sites/default/files/swf_utility_folder/departments/envforest_lipl_in_oid_3/menu/document/1st_addition_to_manas_np-1.pdf
3. Ministry of Environment, Forest and Climate Change (2019). Guidelines for Management of Human-Elephant Conflicts. Ministry of Environment, Forest and Climate Change, Government of India.
4. Mohan, V. (2024). India reported 2,829 human casualties due to elephant attacks in last five years, lost 528 elephants during that period. The Times of India. https://timesofindia.indiatimes.com/india/india-reported-2829-human-casualties-due-to-elephant-attacks-in-last-five-years-lost-528-elephants-during-that-period/articleshow/112114356.cms
5. Panda, P. P., Noyal, T., & Dasgupta, S. (2020). Best practices of human–elephant conflict management in India. Elephant Cell, Wildlife Institute of India.
6. Qureshi, Q., Kolipakam, V., Kumar, U., Jhala, Y. V., Pandey, R. K., Habib, B., Bhardwaj, G. S., Yadav, S. P., & Tiwari, V. R. (2025). Status of elephants in India: DNA-based synchronous all-India population estimation of elephants (SAIEE), 2021–2025. Wildlife Institute of India. (ISBN 81-85496-85-4).

© Prashasti Pandey

06 Zero Human Death Cases for the First Time in 2 Decades due to Human-Elephant conflicts in Bankura North Division in Forest Department of West Bengal

Sheik Fareed J
Divisional Forest Officer
West Bengal

(Worked in Medinipur, Malda, Kurseong, Jhargram, Darjeeling and Bankura North divisions in last 9 years and handled the human-elephant and human-leopard conflicts extensively)

INTRODUCTION:

The human-elephant conflicts are of serious concern in the state of West Bengal that results in huge number of Human deaths every year. Though the state has only around 707 elephants out of 22,446 elephants in India, it accounts for around 75-100 human deaths every year out of 450-600 human deaths in the entire country. This longstanding issue of having just around 3% of elephants but contributing to 15% of human death cases in the country, the state of West Bengal deserves unique and special approaches suitable to the landscape apart from the traditional approaches. The Bankura North Division is one amongst such severely affected Forest divisions in the state with the recorded Forest lands of 546 sq.km. in Central circle of Forest department in a highly fragmented South-west Bengal landscape. This landscape has elephant corridors connecting the adjacent states of Odisha and Jharkhand. The division is located in the at the terminal end of the elephant corridors in this landscape, beyond which many towns are located. It has recorded the highest number of 28 human death cases with 8 retaliatory killing of elephants due to human-elephant conflicts in 2015-16 and both were brought down to zero in 2025-26. This achievement of zero human death cases for the first time in 2 decades was made with the consistent guidance of senior officers, such as Shri. Sandeep Sundriyal, IFS. PCCF&HOFF, West Bengal, Shri. Rajesh Kumar, IFS, PCCF, Wildlife and CWLW, West Bengal and Shri. Basavaraj Holeyechi, IFS, CCF, Central circle along with the hard work of all frontline officers and staffs in the field over the years. This article will discuss few of the important steps taken by this division over the years to achieve that success.


National

NATIONAL ASSEMBLY ELECTION RESULTS 2026 IPL 2026 WORLD SPORTS ENTERTAINMENT LIFESTYLE

ETV Bharat / State

Zero Elephant Attack Deaths In Bankura After Two Decades, Forest Department Hails Breakthrough

According to Forest Department data, a total of 108 deaths due to elephant attacks have been recorded in the Bankura North Division since 2007.

Zero Elephant Attack Deaths In Bankura After Two Decades, Forest Department Hails Breakthrough (ETV Bharat)

By ETV Bharat English Team
Published : April 2, 2026 at 11:02 PM IST

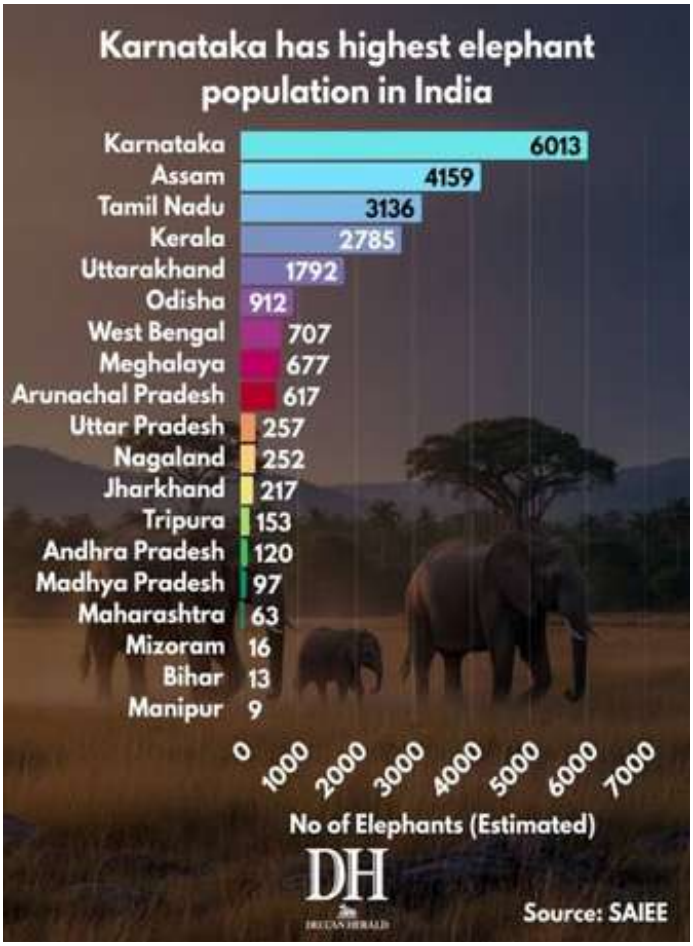
2 Min Read

By Sahajan Purkait

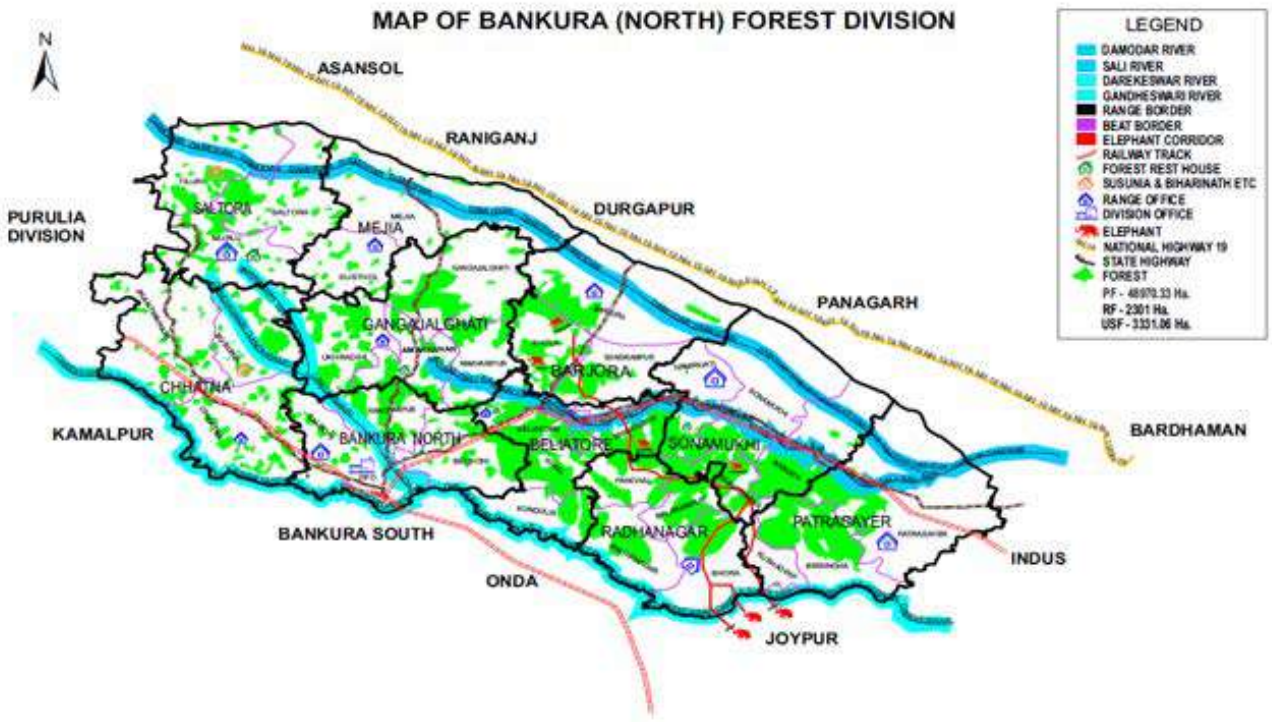
Human death cases details in last 2 decades in Bankura North division:

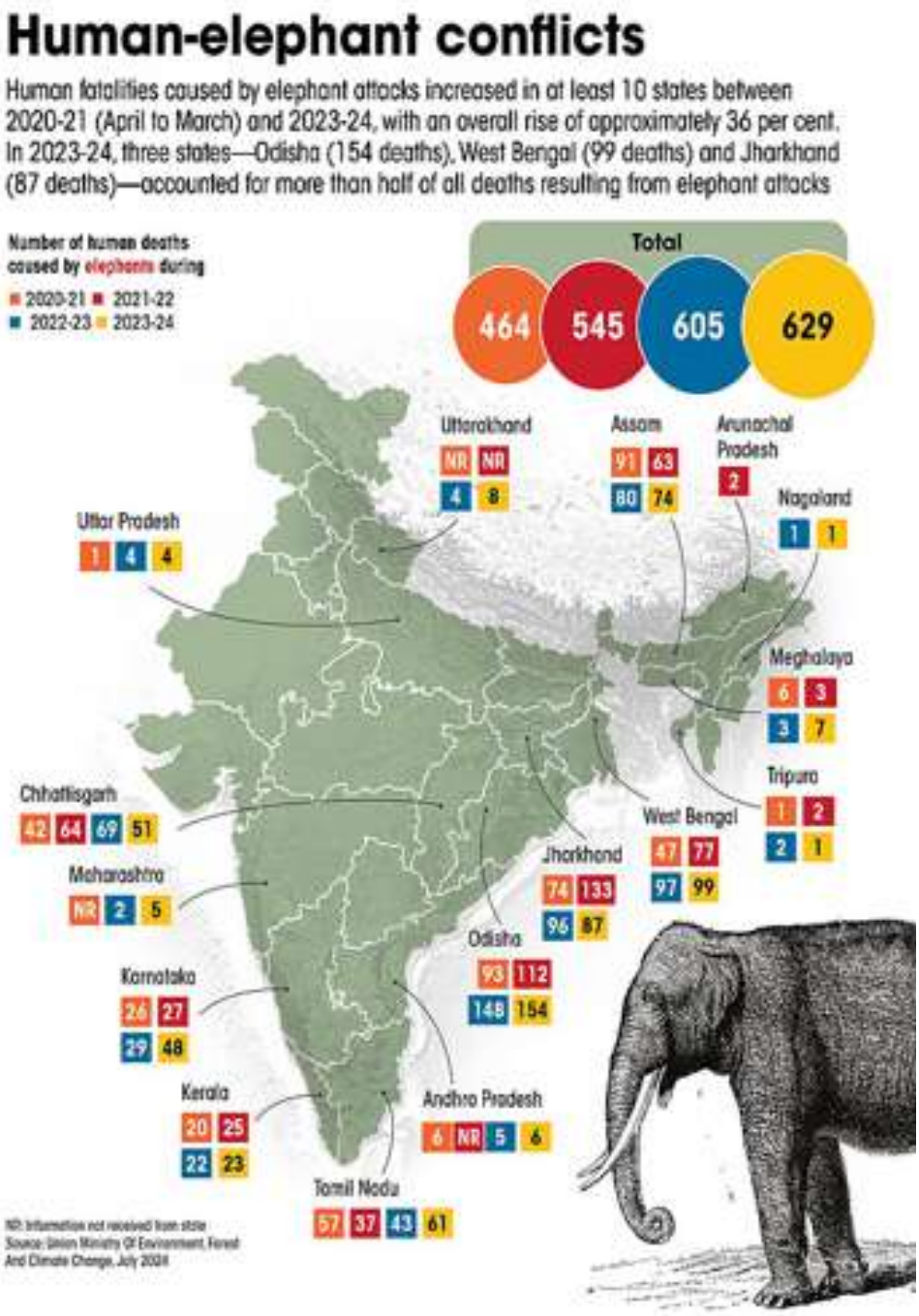
Courtesy: eTV Bharat Bangla

Total number of elephants in India statewise:



Courtesy: SAIEE and Deccan Herald



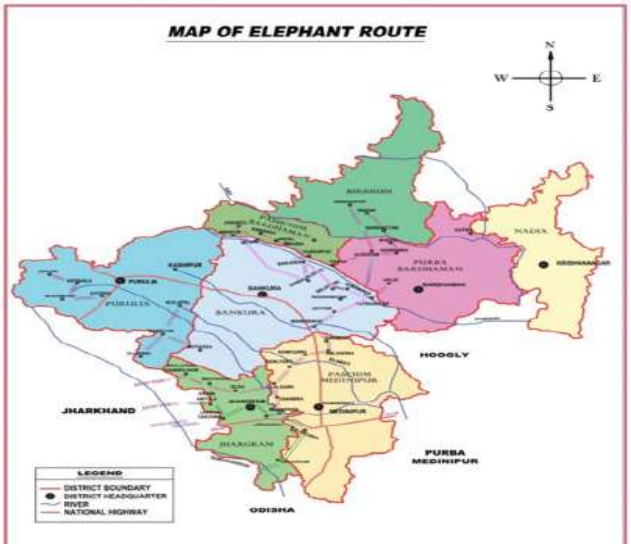


Courtesy: MOEFCC,GOI

The various strategies employed in the division are hereby detailed as follows:

Elephant Days:

The introduction and application of the concept of elephant days as a central tool of management has given a new perspective of management in the landscape. Elephant days are the addition of number of elephants in a particular period of time. For instance, 10 number of elephants for each day for 30 days amounts to 300 numbers of elephant days. These numbers are compiled Mouza wise, Forest Range wise, Forest Division wise, circle wise and landscape wise on a daily basis and shared with all concerned officers within the Forest department and the actual pressure points are monitored from all levels from Forest department state Headquarters to division level. The movement of elephants are planned and guided from high pressure areas to low pressure areas based on the situation on the particular day in the whole landscape. The financial and human resources can also be planned and deployed considering the elephant days. The compiled report as on 31.03.2025 is given for the reference purpose.

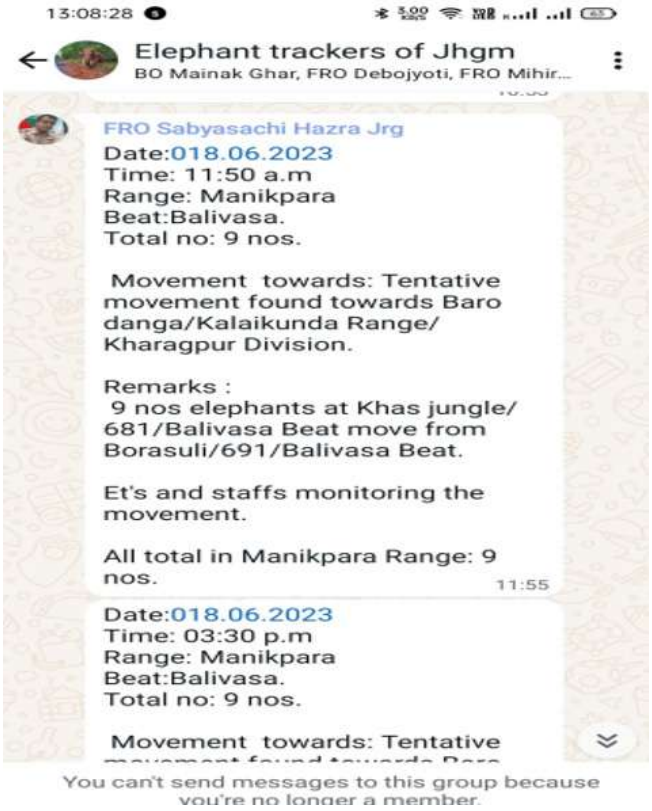


Manual Tracking of Elephants on Real Time Basis 24x7:

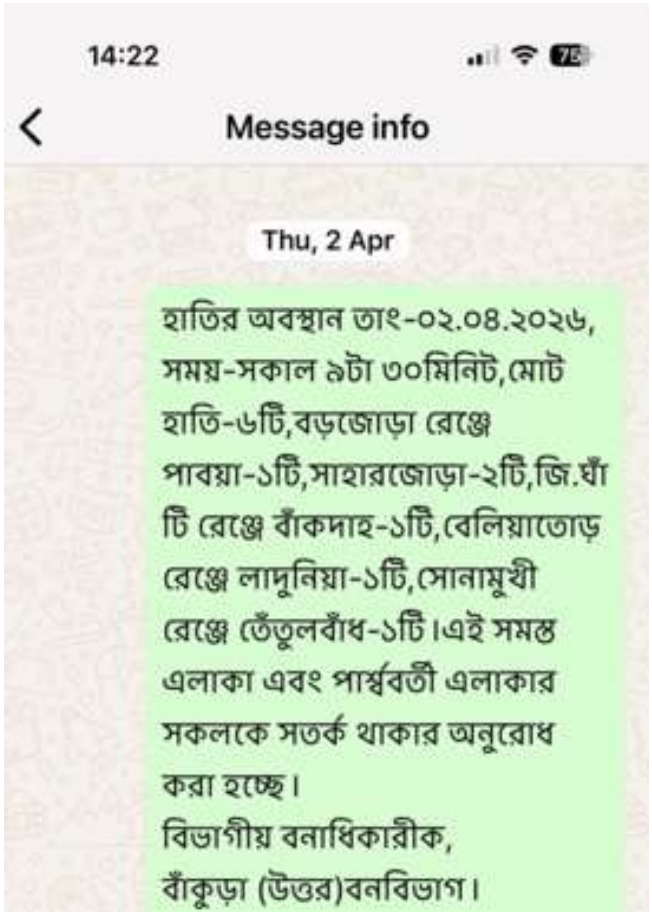
The elephants stay in 2 categories as loners (mostly adult male Makhnas and Tuskers) and matriarchal herds (mostly with females, calves and sub adult males). The herds often get split and reorganised among themselves considering various factors such as food and water availability and cover (dense forest to stay during the day time). The continuous tracking of herds with near accurate numbers are possible in this landscape dominated by Sal, Akashmoni (*Acacia auriculiformis*) and Eucalyptus. The herds mostly follow the existing corridors for movement and digress into non forest lands only for food and water. The manual tracking loners is found difficult often due to their erratic movement particularly during night and raining times. The tracking is done by forest staffs in field with markers such as sighting, foot prints and scent of elephants by engaging the trained casual daily labourers. They use search lights and their traditional knowledge of movement in that particular place. The coordination amongst various forest ranges is monitored at the Division level WhatsApp group on a real time basis for 24x7 by both Divisional Forest Officer and Assistant Divisional Forest Officer and instructions are given to the field staffs regularly and continuously. Each movement of all elephants are very closely monitored and tracked with 90% accuracy. The tracking aids in passing on the information well in advance to the local people about the movement of elephants. A just reference of tracking is given below for the better understanding of manual tracking.

Daily Elephant Movement Report.

Date	Circle	Division	Range	No. of Migratory Elephants	No. of Residential Elephant	Total No. of Elephants	Elephant days starting from 01.04.2024 to till date.
31/03/2025	Western Circle	Jhargram	Jhargram	0	3	3	14725
			Manikpara	29	0	29	
			Lodhasuli	0	5	5	
			Jambani	8	0	8	
			Gidhani	0	1	1	
		Total :-		37	9	46	
		Kharagpur	Chandabila	15	0	15	19402
			Kessorekha	0	3	3	
			Nayagram	0	8	8	
			Kalaikunda	25	6	31	
		Total :-		40	17	57	
		Rupnarayan	Goaltor	0	1	1	2839
			Hoomgarh	0	2	2	
		Total :-		0	3	3	
		Medinipur	Chandra	0	4	4	13304
			Pirakata	0	3	3	
			Nayabasat	0	2	2	
			Arabari	0	1	1	
			Godapiasal	0	2	2	
			Lalgarh	0	3	3	
		Total :-		0	15	15	
	Western Circle Total:-			77	44	121	50270
	Central Circle	Bankura North	Barjora	62	1	63	7790
			Beliator	0	1	1	
			Bankura North		2	2	
		Total :-		62	1	66	
	Central Circle Total:-			62	1	66	8258
	South west Circle	Purulia	Matha	4	0	4	8556
			Baghmundi	12	2	14	
			Jhalda	0	3	3	
			Kotshila	0	3	3	
		Total :-		16	8	24	
	South West Circle Total:-			16	8	24	9047
	South East	South East Circle Total:-				0	
South Bengal Grand Total :-				155	53	211	67575



The information of presence of elephants is shared as bulk SMS in local language daily before 8 a.m. to the local public, public representatives and police so that all can plan for their movements on their particular day.



Moreover the advance technologies and equipments are going to be put in place very soon such as thermal drone, Early Warning System (EWS), AI cameras and thermal monoculars. These technologies along with control room will improve and increase the efficiency of manual tracking.

Hullah Parties:

Hullah parties are the unique term used for casual daily labourers engaged in the guiding of elephants in the South Bengal landscape. They are trained and guided by the forest officers. They will hold the fire sticks (*mashaals*) to guide the elephants in this highly fragmented landscape so that the elephants do not venture into non forest lands and human habitations. Utmost care is taken to ensure that the elephants are not harmed in the process.

Diversionary Feeding Inside the Forest Areas:

During the peak season of paddy crop cultivation and *Puja* festival period (September to November: *Durga Puja* and *Kali Puja*), the human movements are maximum in both night and during early morning times around the forest areas when the elephant movements coincide with the movement of public. Hence some 45-60 elephants are contained in a beautiful natural landscape of 2000 ha. in Barjora Forest Range in a power fenced forest area that contains good natural fodder and many waterbodies for a limited period of 3 months. The area has 25km of double layered power fencing with 150 casual daily labourers engaged on a daily basis to protect, monitor and repair the breaching of fence by elephants. As the elephants here are already habituated to frequent crop raiding in the nearby non forest lands in this fragmented landscape, the damaged crops that do not reach the market but not infected and also the banana stems are given as fodder to the elephants. They were mostly collected from local people in order to restrain the elephants within the same fenced area. The long term objective is to develop many microhabitats with fodder plantations (mix of tree fodders interspersed with grass fodders) and water bodies in many such natural habitats across the landscape and to keep the elephants less disturbed during the peak seasons of human movements.

Power Fencing as a Tool:

This division has 104km of power fencing in order to prevent the movement of elephants into non-forest lands. These fences act as guiding force to the elephants.

Tranquilisation, Capture and Translocation of Elephants:

The division has 2 tranquilising guns (dart gun-dist inject) with essential drugs such as Xylazine, Ketamine and reversal drug along with all accessories. The staffs are regularly trained to do the tranquilisation operations. Elephants are captured using hydra/ crane, excavator (JCB) and trucks without resorting to Kunki/Kumki elephants.

Solar Street Lights:

Installation of many solar street lights is a continuous process being done across the landscape to facilitate the identification of elephants during dark times and to avoid the accidents with public.

Coordination with Stakeholders and Awareness Generation:

There are lot of stakeholders in the Human elephant conflicts such as Public representatives, Joint Forest Management Committees, District administration, other departments like police, fire and power and forest frontline staffs. Frequent consultation and awareness meetings are done with all stakeholders.

Apart from the above meetings, interstate meetings, intercircle and interdivisional coordination meetings, regular briefing of media are routinely done in order to ensure the regulated movement of elephants.

Conclusion:

With all the above measures with limited human and financial resources, the zero death case was achieved despite keeping more number of elephants for a comparatively longer period than previous years in Bankura North Division. The success can be replicated anywhere with proper planning, investment and efforts to mitigate the human-elephant conflicts.

Hon'ble MP, Bankura Parliamentary constituency along with Hon'ble MLAs on 16.01.2026 at Bankura.

Antielectrocution cell meeting on 11.11.2025 at Bankura involving all stakeholders to prevent the electrocution of elephants.

Tranquilisation workshop at Beliatore range on 27.11.2025.

Tranquilisation and translocation of a sub adult elephant in Joypur range of Panchet division in Bankura district on 04.03.2026.

Block level meeting chaired by BDO and attended by Police, Forest Range Officers and Gram Panchayat Presidents regarding planning for movement of elephants.

Meeting with local farmers to sensitize them regarding expected movement of elephants and safe harvesting of standing crops.

07 Experimental Buffer Cropping by Hathi Bondhu to Mitigate Human–Elephant Conflict in Assam

Dulu Bora
Assam, Project Elephant Steering Committee Member

Diju Valley Reserve Forest in Nagaon district of Assam serves as a critical seasonal congregation site for elephants during September–October, where herds gather for social interaction before dispersing into surrounding agricultural landscapes. In eastern India, Human–Elephant Conflict (HEC) is largely driven by the attraction of elephants to ripening paddy, a high-calorie and palatable crop. As elephants move from forested habitats into farmlands, conflicts arise, often resulting in crop loss, property damage, and casualties on both sides. Recognising this predictable ecological pattern, the Hathi Bondhu organisation conceptualised an experimental buffer cropping approach to intercept elephant movement and reduce direct competition between humans and elephants.

The intervention began in 2018 near Rong Hang village in Nagaon district, where ~200 bighas (70 acres) of paddy were cultivated specifically for elephants, along with ~500 bighas (166 acres) of Napier grass, a fast-growing, high-biomass species. Elephants arriving from the Bagser Reserve Forest near Kaziranga utilised these feeding zones. The design followed a controlled and sequential feeding strategy, wherein elephants first consumed Napier grass for about a month and subsequently fed on paddy for 20–25 days. With active participation from local communities, feeding was restricted to designated plots (10–15 bighas at a time), and barriers were used to regulate their movement, preventing entry into nearby farmer fields.

A similar intervention was implemented in 2019 in Golaghat district, where rice was cultivated specifically for elephants over approximately 80 acres adjacent to Nambor Reserve Forest. Elephants fed on the paddy for about 20–25 days and then returned to the reserve forest without entering nearby agricultural fields. As a result, human–elephant conflict in the area was effectively eliminated, enabling nearly 200 villages to harvest their crops without disturbance and fostering a positive shift in community attitudes toward elephants.

Improving the immediate food security of wild elephants by planting native and suitable fodder species and developing supportive habitats is a key component of the initiative. Some of the major plant species identified for enhancing fodder availability are as follows:

1. Napier grass (*Pennisetum purpureum)* also known as Uganda grass or elephant grass is a high-biomass, fast-growing species that can be cultivated across tropical regions. It can be harvested multiple times annually and produces substantial biomass. Hathi Bondhu (HB) has planted approximately 2 lakh Napier grass plants to support elephant foraging.

2. Broom grass (***Jharu*** grass) is a perennial, high-value non-timber forest product (NTFP) that grows well in degraded, steep, and marginal lands. It is naturally found in the Karbi Hills and other parts of Assam, making it suitable for ecological restoration and fodder support.

3. Tora or Galangal (*Alpinia officinarum*) is a tropical species from Southeast Asia belonging to the ginger family (Zingiberaceae) and contributes to diversifying available forage resources.

4. Rice (*Oryza sativa*), an annual crop widely cultivated in Assam, is used as a short-term, strategic food source to address peak conflict periods during harvesting seasons. Targeted cultivation of paddy in designated areas helps divert elephants away from farmers' fields, thereby reducing human–elephant conflict.

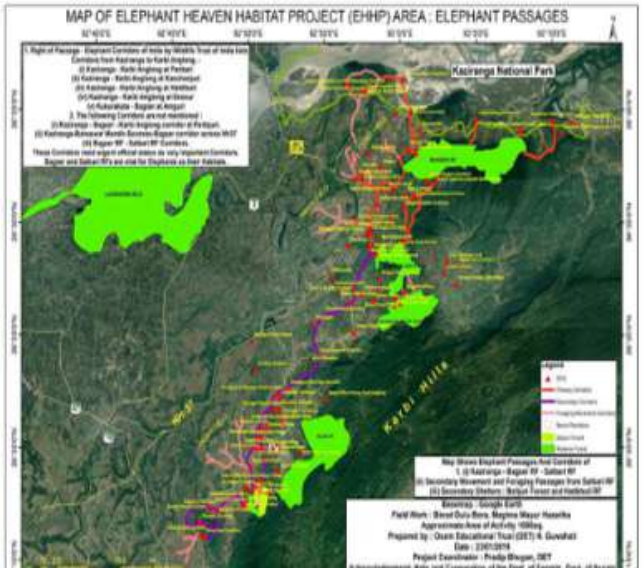
5. Kako bamboo (*Dendrocalamus hamiltonii*) is a fast-growing, large tropical bamboo species that can reach up to 30 metres in height. It plays an important ecological role and provides long-term forage and structural habitat support.

6. Jackfruit (*Artocarpus heterophyllus*) is a long-lived, perennial tropical tree native to India, known for producing large, nutrient-rich fruits favored by elephants. Its seasonal fruiting and longevity make it a reliable and sustainable food source in elephant habitats.

Overall, this approach focuses on combining short-term food provisioning (paddy, Napier grass) with long-term habitat enrichment (bamboo, jackfruit, broom grass) to ensure sustained food availability and reduced dependence on agricultural crops, thereby mitigating human–elephant conflict.

Eviction of Forest Areas

Nagaon district in Assam comprises twelve Reserve Forests and one Wildlife Sanctuary, forming an important part of the Kaziranga–Karbi Anglong Elephant Reserve. Many of these forests are relatively small and have experienced substantial human encroachment over time. Recent government initiatives to remove encroachments have resulted in the recovery of approximately 1,900 hectares of forest land, with efforts ongoing. This restoration is ecologically significant; if protected from further disturbance, these areas are likely to regenerate into structurally and functionally diverse forests within four to five years, thereby improving habitat quality and reducing pressure on elephants to move into human-dominated landscapes.




Before Plantation
After Plantation

In addition to habitat restoration, mitigation of landscape-level risks is necessary. Open earthen wells along the foothills of the Karbi Hills pose a persistent threat to wildlife, particularly elephant calves and other fauna. Installing concrete rings or protective barriers around these wells is a practical and effective measure to prevent accidental falls and associated mortality.

Release of Compensation

Timely and efficient disbursement of compensation to farmers affected by elephant depredation is a critical socio-economic intervention for reducing Human–Elephant Conflict (HEC). Although compensation mechanisms exist for crop loss and property damage, delays often extending up to a year—undermine their effectiveness and erode community trust. Ensuring that compensation is delivered within a defined timeframe (e.g., within one month) can substantially alleviate financial stress on affected households.

Prompt compensation not only provides immediate economic relief but also reinforces a sense of institutional support, which is essential for fostering tolerance toward elephants. Strengthening compensation delivery systems, therefore, plays a key role in maintaining positive community attitudes and supporting long-term conservation objectives.

Hatibondhu's paddy cultivation for wild elephants

Hathi Bondhu converted a bareen hill into elephant habitat by planting different grass and trees.

Elephants were allowed to graze on cultivated paddies in designated sections

08 Kamalapur Elephant Camp: From Timber to Tranquility

P. Vishnu Vardhan Reddy
SDFO Aheri, Sironcha Division
Gadchiroli, Maharashtra

The Evolution of Kamlapur Elephant Camp

The forests of Gadchiroli , historically have been more than just a source of high-quality timber; they are a living archive of India's relationship with the wild. For generations, these dry deciduous tracts in India's tropics have provided the nation's "wood security,". But that security was built on the backs of an extraordinary partnership. Long before the roar of machinery echoed through the forests the heavy lifting was done by a silent, powerful workforce, The tamed wild elephants. In the early days of independence, these magnificent animals were the true backbone of the industry, working in tandem with human handlers to fell and drag massive logs through the dense forests.

To host these vital work force an elephant camp was established in Kamlapur in 1960s. As Mechanised labor eventually replaced the need for animal toil, and evolving conservation laws shifted our focus from what the forest could produce to what it needed us to protect. This shift left Kamlapur elephant camp at a poignant crossroads. Instead of fading into history or disbanding the herd, the camp underwent a beautiful transformation.

It evolved from a site of industry into a sanctuary of dignity—a dedicated retirement home where the giants who once built our infrastructure could finally find rest. Today, the camp isn't just a place where elephants live; it is a place where they are finally allowed to just be. Today, it serves as a multi-generational home for nine elephants, ranging from a playful two-year-old calf to a venerable matriarch estimated at 110 years old. This demographic—comprising 2 males, 5 females, and 2 sub-adults—represents a complete social spectrum of elephant life.

Clinical and Cultural Care: The Pulse of the Camp

Over the years the camp has evolved to gain expertise in elephant management by maintaining a balance between the India's rich traditional knowledge and modern-day veterinary care. The "Chopping" Ritual: A hallmark of traditional care is the winter application of "Chopping"—a medicinal paste of *hirda*, *beheda*, ginger, and jaggery. This Ayurvedic treatment protects the elephants' footpads and joints from the dry forest floor, proving that ancient wisdom remains a cornerstone of health. Similarly, dikamali oil, a concoction of garlic, neem oil, camphor and dikamali resin is applied to elephants nails to protect their nails and legs to ensure foot care.

This cultural care is being complemented by clinical vigilance by following rigorous scientific regime. The camp conduct regular screenings for Elephant Endotheliotropic Herpesvirus (EEHV), Tuberculosis, and Foot-and-Mouth Disease (FMD) along with periodical blood tests. The staff also oversees complex biological phases, from the 22-month gestation period of pregnancy care to the careful management of musth in bulls. They also monitor the herd's lineage for inbreeding, ensuring the long-term genetic health of the sanctuary.

Managing a herd of this magnitude requires a specialised workforce. The camp is helmed by 5 mahouts, 4 charakatars, 9 protection staff, and a dedicated veterinary doctor. Their work transcends simple feeding; it is a rigorous exercise in clinical monitoring and behavioral studies.

Further, Kamlapur does not exist in a vacuum. It thrives on cross-learnings from other camps across India like Teppakadu (Tamil Nadu) and Dubare (Karnataka). This exchange represents a profound transfer of both scientific and cultural management practices. While a mahout from Gadchiroli in Maharastra adopts a technique for "dikamali oil"—the periodic application of medicinal oil, learned from a peer in the Tamil Nadu, it transcends language and regional barriers reflecting the spirit of Ek Bharat Shreshtha Bharat in action: a national brotherhood of handlers united by a singular devotion to India's wildlife.

These activities and initiatives reflect positively on the health of elephants, making them thrive in stress free and happy environment, welcoming regular offsprings.

Convergence and Collaboration

The success of Kamlapur is a testament to the power of Convergence. Initially a sole Forest Department initiative later it is joined in its efforts by number of stakeholders making it a model of collaboration and

cooperation. Local population, despite reeling under the threat of left wing extremism for years have never flinched in their support for this camp. Their voice has been an important pillar for the past survival and present thriving of the camp. The voice of the people is supported by political and administrative will of the government providing strong political support that has ensured that Kamlapur remains a protected sanctuary, resisting attempts to commercialise the herd. In recent years private firms have shown the spirit of conservation by contributing via corporate social responsibility, providing support by updating camp's care and medical infrastructure.

The Kamlapur Elephant Camp has quietly blossomed into a sanctuary for mindful travel over the years, unlike commercial parks that focus on spectacle. The camp is offering something far more meaningful: the chance to witness the intimate, daily bond between the elephants and their mahouts. For visitors, the camp is an eye-opening experience. By focusing on visitor education and experience the camp sensitises the public to the social nature of elephants. Visitors learn about the matriarchal herd nature of females and the intricate social bonds that make these creatures so human-like in their emotions.

This elephant camp is more than a retirement home; it is a sanctuary for mindful travel where the ancient bond between man and elephant is preserved through science, sweat, and a shared national identity.

09 Encephalomyocarditis Virus and Elephant Conservation: Surveillance Matters

Anandhu Vijayan[1] Karikalan Mathesh Gaurav K Sharma

[1]*ICAR- Indian Veterinary Research Institute, Izatnagar, Bareilly-243122*

The Asian elephant (*Elephas maximus*), recognised as India's national heritage animal, plays a crucial ecological role as a keystone species. By dispersing seeds, modifying vegetation, and creating trails that facilitate movement of other wildlife, elephants help maintain the structure and function of forest ecosystems. In India, Asian elephants are primarily distributed across the Western Ghats, North-East India, Central Indian forests, and the Shivalik Gangetic plains. They are also deeply embedded in the country's cultural traditions, religious practices, and local economies. According to the most recent All-India Synchronous Elephant Estimation (2021-2025), the population of wild Asian elephants in India is estimated to be around 22,446, based on the country's first DNA-based census. India currently supports more than 60% of the global Asian elephant population, highlighting the country's critical role in the conservation of this iconic species. Despite their ecological importance, Asian elephants face numerous threats. The species is classified as Endangered on the IUCN Red List and is listed under Appendix I of CITES, providing the highest level of international protection against trade. However, habitat loss and fragmentation, human elephant conflict, linear infrastructure such as roads and railways, poaching, and emerging infectious diseases continue to threaten their survival. Climate change and the disruption of traditional migration corridors further intensify stress on elephant populations, potentially affecting their health, reproduction, and long-term survival.

In recent years, infectious diseases have emerged as an additional concern for elephant conservation. Viral diseases, in particular, can spread rapidly and cause significant mortality, especially among calves. Increased human-wildlife interactions and habitat fragmentation may further elevate the risk of disease transmission. For instance, Elephant Endotheliotropic Herpesvirus (EEHV) has caused severe outbreaks among young elephants. Another emerging viral threat is Encephalomyocarditis (EMCV), a rodent-borne disease capable of causing sudden cardiac and neurological complications. Encephalomyocarditis Virus (EMCV) is a non-enveloped, single-stranded RNA virus belonging to the genus *Cardiovirus* in the family *Picornaviridae*. The virus infects a wide range of hosts, including humans and several animal species. EMCV was first identified in 1945 in a captive male gibbon in Florida that died due to myocarditis and pulmonary oedema. Rodents serve as the primary natural reservoirs of the virus, and transmission typically occurs through the faeco-oral route via contaminated food or water. Among domestic animals, pigs are considered the most important hosts, where infection can lead to high mortality in piglets as well as reproductive problems

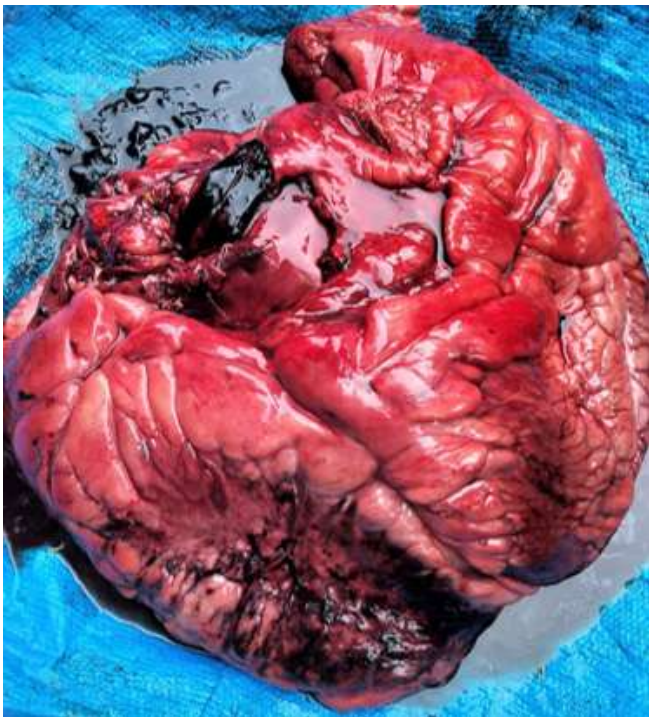
such as abortions and stillbirths. In wildlife, EMCV has been reported in elephants and several non-human primates, including rhesus macaques, baboons, and lemurs. The virus can cause myocarditis and encephalitis in various mammals, potentially resulting in neurological disorders, reproductive complications, and in some cases metabolic disturbances such as diabetes. Although EMCV is considered zoonotic, human infections with clinical symptoms remain rare.

Several fatal outbreaks have been documented in African elephants, including four deaths in zoos in Florida (1976-77), a 19-year-old female elephant at Western Plains Zoo in Australia (1987), over 50 deaths of free-ranging elephants in Kruger National Park, South Africa (1993-94), and a captive elephant in southern France (2013). The recent first documented fatality in a captive African elephant at the National Zoological Park, New Delhi, in 2025 by ICAR-Indian Veterinary Research Institute, Izatnagar, Bareilly highlights potential gaps in disease surveillance and underscores the importance of adopting a One Health approach. Although Encephalomyocarditis Virus (EMCV) infection is more frequently reported in African elephants, the possibility of infection in Asian elephants cannot be disregarded. To date, there has been only one report of an Asian elephant infected with the virus, which presented with non-specific signs of enteritis. It may therefore be inferred that certain underlying processes could have predisposed the animal to both enteritis and subsequent EMCV infection.

Following infection, EMCV enters the host through the intestinal Peyer's patches and replicates within macrophages before spreading through the lymphatic system. The virus shows strong affinity for cardiac tissue and commonly causes acute myocarditis, which may progress to congestive heart failure. Gross lesions typically include cardiomegaly, pale necrotic foci in the myocardium, abdominal or pericardial effusions, and pulmonary or cerebral oedema. Clinically, affected animals may exhibit apathy, tremors, and sudden collapse, and in some cases, death may occur without obvious preceding symptoms. Diagnosis of EMCV relies primarily on laboratory detection methods such as virus isolation, electron microscopy, ELISA, genome sequencing, immunohistochemistry, and RT-PCR. Among these, RT-PCR is considered the most sensitive technique, particularly when dealing with small or suboptimal samples. Heart, brain, or splenic tissues are commonly used for virus detection. Since specific treatment options are limited, preventive management remains the most effective control strategy. Measures such as rodent control, safe storage of feed, and strict sanitation of animal enclosures are essential to reduce the risk of virus transmission.

Major Challenges in EMCV Management

1. Rapid disease progression with few or no early clinical signs
2. Difficulty in early detection and timely diagnosis during outbreaks
3. Limited routine surveillance in susceptible animal populations
4. Continuous circulation of the virus through rodent reservoirs
5. Contamination of feed and environment by infected rodents
6. Limited availability of rapid diagnostic facilities in field conditions
7. Absence of an effective commercial vaccine
8. Lack of specific antiviral treatment for infected animals



Haemorrhages and necrotic areas in the heart of African elephant

Effective management of EMCV requires strengthening surveillance systems, early diagnosis, and strict biosecurity practices in both captive and wild animal populations. Regular health monitoring of susceptible species and rapid laboratory confirmation using molecular techniques such as RT-PCR can help detect infections at an early stage and reduce the risk of outbreaks. Integrated rodent control programs and safe storage of feed are also critical in preventing virus transmission. Equally important is improving awareness among veterinarians, wildlife managers, and animal caretakers to ensure timely reporting and coordinated response to suspected cases. Surveillance in Asian elephant populations, both captive and wild, is particularly important to better understand the circulation of EMCV and assess potential spillover risks. Strengthening diagnostic infrastructure, encouraging collaborative

Sample collection from Asian elephant

research, and advancing vaccine development will be crucial steps in improving EMCV prevention and safeguarding the long-term conservation of Asian elephants.

Currently, the research work was initiated at the Centre for Wildlife Conservation Management and Disease Surveillance, ICAR–Indian Veterinary Research Institute (ICAR-IVRI), with the objective of conducting a pan-India surveillance of Encephalomyocarditis Virus (EMCV) in Asian elephants and identifying potential intermediate and other associated hosts involved in its transmission dynamics. Effective surveillance systems are essential to detect EMCV circulation early and prevent large-scale mortality events. Surveillance should also include monitoring of potential reservoir hosts, particularly rodent populations around elephant enclosures or feeding areas. Wildlife health monitoring programs should integrate routine health assessments, diagnostic testing, and environmental monitoring. More robust and user-friendly indigenous kits are also required for wide scale surveillance.

The management of EMCV aligns with the broader concept of One Health, which recognises the interconnectedness of human, animal, and environmental health. Although EMCV rarely infects humans, its ability to affect diverse species underscores the importance of integrated surveillance across wildlife, livestock, and environmental interfaces. Collaboration between wildlife veterinarians, virologists, conservation biologists, and public health authorities can enhance early detection and response.

© Prashasti Pandey

10 Are Elephant Reserves Working Effectively on Ground? India initiates the Management Effectiveness Evaluation (MEE) process to find out

Anoop Raj Singh[1]
Project Scientist-I
Wildlife Institute of India, Dehradun

Nikhil Singh Kahera[1]
Project Associate-II
Wildlife Institute of India, Dehradun

Sourabh Pundir[1]
Project Associate-II
Wildlife Institute of India, Dehradun

Anukul Nath[1]
Scientist-C
Wildlife Institute of India, Dehradun

Dr Aju Mathew George[2]
Scientist-C
PT&E, MoEF&CC

Dr Vaibhav C Mathur[2]
IGF
(PT&E), MoEF&CC

Dr Parag Nigam[1]
Scientist-G
Wildlife Institute of India, Dehradun

Ramesh Kumar Pandey[2]
ADG (WL)
MoEF&CC

Affiliation:
[1]Elephant Cell, Wildlife Institute of India, Dehradun 248001
[2]Project Tiger & Elephant Division (PT&E), Ministry of Environment, Forest & Climate Change (MoEF&CC), New Delhi-110003

The Background

The idea of elephant conservation in India has evolved over centuries, shaped by a deep cultural reverence for the species and a long history of protection. Ancient rulers are known to have set aside dedicated tracts of land for elephants, echoing what we today recognise as Protected Areas. This sense of stewardship continued into the colonial period with early legal measures (such as the Madras Wild Elephant Protection Act, 1873), and later found stronger expression after independence through national legislations (Wildlife Protection Act, 1972; and Forest Conservation Act, 1980) that placed elephants under the highest level of protection and sought to safeguard their habitats. Yet, even as these frameworks took shape, new challenges emerged including ivory poaching, habitats began to fragment, and encounters between people and elephants grew more frequent, gradually revealing the limits of protection confined within fixed boundaries.

It was in this backdrop that Project Elephant was launched in 1992, marking a shift in how elephant conservation was imagined and practiced in India. Moving beyond the idea of isolated PAs, it embraced a broader, landscape-based vision recognising the wide-ranging nature of elephants. From this vision emerged the concept of Elephant Reserves (ERs), not as rigid enclosures, but as living landscapes

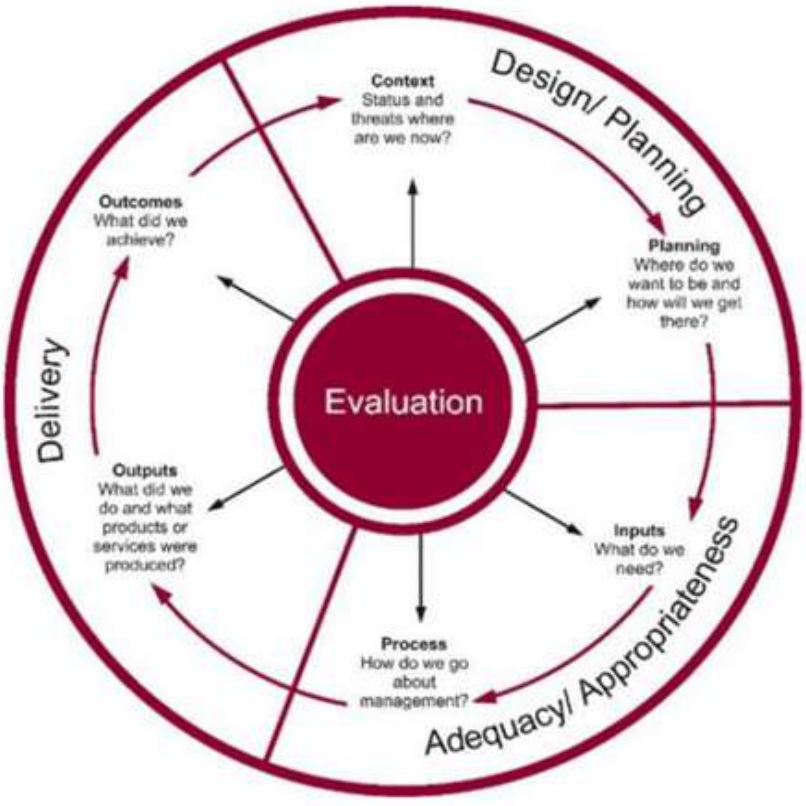
that extend across forests, fields, and human settlements. Over time, state governments were encouraged to identify such areas, resulting in the notification of multiple ERs across different regions of the country. This reflects an understanding that conserving elephants is as much about protecting habitats as it is about nurturing coexistence between people and wildlife. However, even as this vision expanded across landscapes, ERs largely remained an administrative construct without formal legal backing, a concern that has only recently begun to receive attention through proposed amendments to the WPA, 1972.

As this journey progressed, the 2010 Elephant Task Force Assessment Report drew attention towards fact that much of the ER areas lies beyond formally PAs, where increase in developmental activities is inevitable pointing need for coordinated action across sectors. In many ways, ERs stand as a promise; of connectivity, of coexistence, and of a more inclusive approach to conservation. Yet, like all promises, their true meaning lies in how they are realised on the ground. The declaration of ERs marks an important beginning but understanding how effectively they serve their purpose calls for careful evaluation, so that these landscapes continue to sustain both elephants and the people who share them.

Learnings from the Other MEE Exercise

1.What is MEE Framework?

Historically, protected areas were often subjected to periodic audits that focused largely on how funds were spent, with limited attention to whether conservation goals were being achieved. Recognising this gap, India introduced the Management Effectiveness Evaluation (MEE) framework in 2006, through the Ministry of Environment, Forest and Climate Change (MoEFCC), beginning with Tiger Reserves (TRs). The idea was simple but important: conservation success cannot be measured by expenditure alone. It must also be judged by how well protected landscapes safeguard wildlife, habitats, ecological processes, and the benefits they provide to people. At its heart, the MEE framework is a practical, evidence-based tool to examines whether a protected area is being governed, managed, and supported effectively to deliver real conservation outcomes.



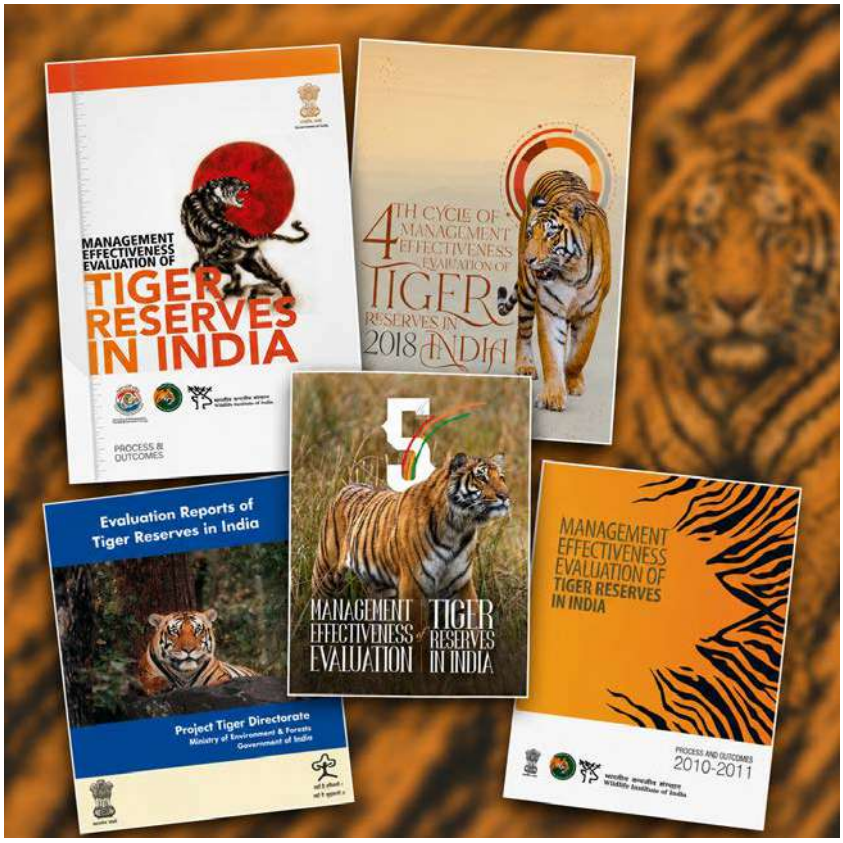
IUCN WCPA MEE Framework

Inspired from the globally recognised IUCN–World Commission on Protected Areas (WCPA) framework, MEE assesses protected landscape based on six interlinked elements: context, planning, input, process, output, and outcomes. In simple terms, it turns the multifaceted aspect of conservation management into measurable indicators that can be compared across sites and tracked over time. Importantly, the framework is not meant to fault managers or assign blame. Its real purpose is to generates insights showing where management is working well, where gaps remain, and where targeted action can make the greatest difference. When repeated periodically, MEE helps track progress across cycles, supports adaptive management, and reveals whether a reserve is

improving, stagnating, or facing new pressures. Over time, these repeated assessments create something invaluable: a continuous, evidence-based record of how conservation is truly unfolding on the ground.

2.How is it helping TR, PAs, and Zoos?

India was among the earliest countries to adopt MEE for its most important conservation landscapes, and the results have been highly encouraging. The assessment of TRs began in 2006, and by 2022 five consecutive evaluation cycles had been completed across 51 reserves. Over time, the process generated far more than rankings or scorecards: it provided clear evidence of institutional improvement. By the fifth cycle, no TR in the country remained in the "poor" management category, reflecting steady progress supported by accountability, regular review, and timely course correction. India's tiger recovery story, once challenged by poaching, habitat loss, and shrinking populations, is now widely recognised as a global conservation success. The MEE framework has played an important role in that journey by helping managers identify weaknesses, strengthen protection systems, and improve long-term planning.



The same approach was later extended to India's wider network of Protected Areas, including National Parks and Wildlife Sanctuaries, bringing structured assessment to diverse ecosystems and governance settings. In 2022, the Central Zoo Authority also introduced MEE for Indian zoos, recognising that ex-situ conservation too must be judged by outcomes, animal welfare, education, and management standards. Across these experiences, one lesson stands out that MEE works not because it focuses on shortcomings alone, but because it empowers them with evidence, comparative learning, and a practical roadmap for better conservation. Increasingly, it is seen not as an administrative exercise, but as a valuable management tool.

Pilot Testing of MEE in Elephant Reserves

1. Designing and Piloting the MEE Framework for ERs

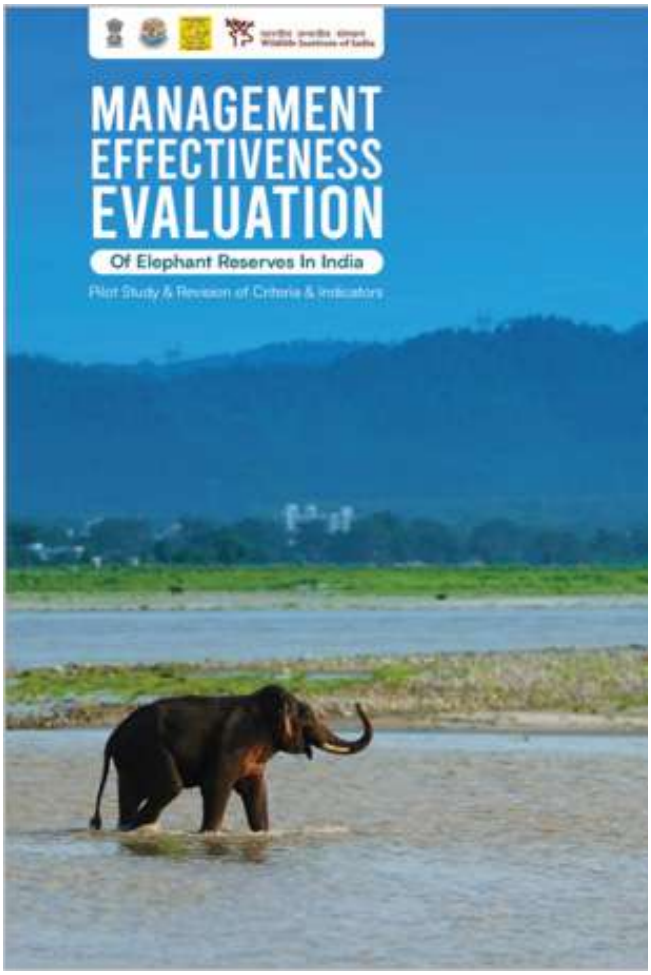
To advance this effort, a dedicated framework of guidelines, criteria and indicators for the MEE of ERs was developed and released in April 2023 following deliberations during the 16th Project Elephant Steering Committee meeting. For this purpose, an eight-member drafting committee was constituted in consultation with the Elephant Cell, Wildlife Institute of India (WII). The ER exclusive MEE framework was subsequently pilot-tested across four selected ERs representing four elephant-bearing regions of India i.e., Shivalik ER in the North, Kaziranga–Karbi Anglong ER in the North-East, Mayurbhanj ER in the East-Central region, and Nilgiri ER in the South. Teams of experienced and senior forest officers travelled across these ER landscapes, applied the framework, assessed performance across 45 indicators, and identified where the tool worked robustly and where further refinement was needed.

2.Refining the Framework Through Field Experience

The pilot assessments offered valuable and candid lessons, helping sharpen the framework for real-world application in ERs. One important finding was that simply averaging scores across multiple forest divisions within a reserve could hide major ecological differences. A division supporting large elephant populations or containing vital habitat corridors, for example, should carry greater importance than one located at the periphery of the landscape.

The pilot studies also highlighted that ERs did not yet have dedicated Elephant Conservation Plans (ECP), making it difficult to assess planning-related criteria in a meaningful way. In response, the MEE framework was improved through a weighted scoring approach that considered both elephant population size and habitat area, ensuring that ecologically significant divisions contributed proportionately to the final reserve score.

Based on these on-ground insights, the criteria and indicators were comprehensively reviewed and recalibrated. The criterion was revised, while the scoring system was refined, and the overall framework became more practical, robust, and better suited to the realities of elephant landscapes. Nilgiri Elephant Reserve, which served as the most detailed pilot case study, recorded an overall score of about 80%, earning a "Good" rating and thereby validating the framework's usefulness while also highlighting areas for future improvement.



The Pan-India Initiative to Evaluate Elephant Reserves (MEE-ER Project)

With the framework piloted, validated, and refined, the stage was set for a far more ambitious undertaking: the evaluation of all 33 ERs spread across 14 states of the country. For implementation of this ambitious national exercise, the MoEF&CC has entrusted the WII, Dehradun, through its Elephant Cell, for project coordination and execution. Senior retired Heads of Forest Force (HoFF), former Principal Chief Conservator of Forests (PCCFs), experienced field managers, scientists, subject experts, and WII faculty members have been brought together as Regional Team Members, organised into eight regional groups to evaluate ERs across the country. The design is intentional, combining decades of field experience with scientific rigour and institutional credibility to ensure that the assessments are both practical and robust.

To formally launch the field phase, a workshop titled *Inception workshop on Management Effectiveness Evaluation of Elephant Reserves* was organised on 23 March 2026 at the WII, Dehradun. The programme was aimed at orienting teams on the evaluation framework, assessment criteria, field protocols, timelines, reporting formats, and operational procedures for the nationwide evaluation exercise.

Shri Ramesh K. Pandey, Additional Director General of Forests (Wildlife), MoEF&CC, during his inaugural address emphasised that elephant conservation would require coordinated management across large, shared landscapes and the evaluation would provide a strong foundation for future planning, accountability, and long-term sustainability of Elephant Reserves.

Dr G. S. Bhardwaj, Director, WII highlighted that MEE has already been implemented in PAs and TRs and expressed confidence that extending this approach to ERs would significantly strengthen adaptive management and conservation outcomes.

Dr Parag Nigam, Project Investigator and Nodal Officer, Elephant Cell, WII, stressed that the initiative represents an important convergence of science, field experience, and policy support. He added that the exercise would help identify strengths, bridge management gaps, and support more resilient elephant landscapes across India.

The workshop concluded with detailed regional consultations, during which teams reviewed logistical requirements, travel plans, reserve-specific priorities, and timelines for field assessments. With this preparatory phase completed, the Regional Teams are now set to begin visits to their designated ERs across the country, where on-ground evaluations will translate the framework into actionable insights for management improvement.

Expectation from the National Exercise and Future Actions

The first cycle of MEE for ERs is expected to create a standardised, evidence-based picture of management across all 33 reserves. It can generate comparable insights on governance, planning, resource adequacy, human–elephant conflict mitigation, corridors, community engagement, and conservation outcomes. This baseline can identify strong practices for wider replication while highlighting reserves requiring greater support. Until now, such understanding has largely come from scattered studies and local experiences rather than a unified national review.

Beyond scoring, the exercise is expected to deliver reserve-specific recommendations on strengths, gaps, and priority actions. These findings can support field managers, state forest departments, the Elephant cell-WII, and the PT&E division, MoEF&CC in better planning, decision-making, policy support, resource allocation, Elephant Conservation Plans (ECPs), and infrastructure planning in elephant habitats. Most importantly, the exercise can help strengthen a culture of periodic review, adaptive management, and evidence-based conservation across elephant-range states. These outcomes can also lay the foundation for future cycles of evaluation. In the long term, MEE for ERs should evolve into a recurring process to track progress, recognise improvements, and identify emerging gaps over time. As seen in Tiger Reserves, periodic evaluations can drive institutional learning, accountability, and better management outcomes. By institutionalising periodic review and adaptive management, India has taken an important step toward securing connected habitats, reducing threats, and ensuring a safer future for elephants and people sharing common landscapes.

> The lessons, methods, and field processes emerging from this first national exercise are expected to significantly strengthen future cycles of MEE for Elephant Reserves. Importantly, the exercise may also catalyse the preparation of dedicated management instruments such as reserve-specific Elephant Conservation Plans (ECPs), moving beyond the present dependence on Tiger Conservation Plans or Protected Area Working Plans, which may not fully address the landscape-scale ecological, connectivity, and management needs of elephants

Conservation News

22nd Steering Committee of Project Elephant

The meeting convened on 21 December 2025 at the Sundarbans Tiger Reserve, West Bengal, and was chaired by the Union Minister for Environment, Forest and Climate Change, Shri Bhupender Yadav.

The Steering Committee reviewed updates on the All-India Synchronized Elephant Estimation, a pivotal exercise essential for evidence-based planning and decision-making. Progress under the Model Elephant Conservation Plan for the Nilgiri Elephant Reserve and ongoing efforts related to DNA profiling of captive elephants were also discussed, with particular attention given to strengthening scientific management and welfare standards.

A thorough review of the status of human–elephant conflict nationwide was conducted. Further deliberations included an assessment of elephant population estimation methods, advancements in integrated conservation and management strategies for the Ripu–Chirang Elephant Reserve, and future action plans. These initiatives encompass the implementation of Management Effectiveness Evaluations for all Elephant Reserves supported by CAMPA funding, along with a proposed study focusing on elephant corridors, habitat utilisation, and conflict hotspots in the Bandhavgarh region.

The Steering Committee reaffirmed the Government of India's commitment to science-based conservation, inter-state collaboration, technological innovation, and community-centric approaches to promote a sustainable future for both elephants and local communities within elephant landscapes.

The following documents were released during the meeting:

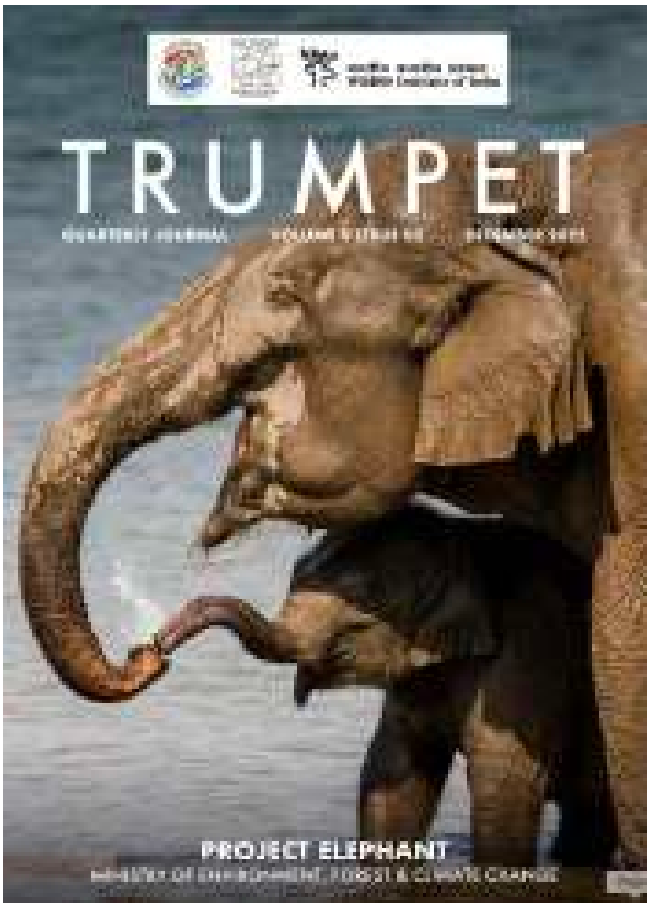
1. Best Practices in Captive Elephant Management for Elephant Handlers
2. December 2025 issue of the TRUMPET Quarterly Journal.

Best Practices in Captive Elephant Management

Captive elephants play important roles in ceremonies, forest management, tourism, and education. Their care depends on providing scientifically informed and compassionate treatment that meets their physical and social needs. Project Elephant, with experts and mahouts, created the guide *Elephant Care and Management: A Guide for Elephant Handlers* to offer practical best practices on husbandry, health, ethical training, and behavior.

TRUMPET Vol 5 Issue 2

This special issue centers on the theme "Elephant population estimation and use of Technology". A majority of the articles focus on the application of emerging technologies-such as spatial tools, monitoring systems, and data-driven approaches for improving population estimation and enabling proactive management of human–elephant conflict. Case studies from regions such as Coimbatore, Kaziranga, and Nagaland illustrate region-specific strategies, while broader reviews provide comparative insights into estimation methods across Asian and African elephants.



Update to Regional Action Plan

During this period the draft of Regional Action Plan for Southern India has been finalised and circulated to all the Southern India Elephant Range states for their feedback. Further the VI phases of the field visits by the sub-committee for the North-eastern Range states have been conducted and now the committee will finalise the draft.

Update on Workshops

On February 9th, 2026, a one-day workshop called "Empowering Communities: Strategies for Human-Elephant Coexistence and Support for Conflict-Affected Victims" was held at Ratnamouli Palace in Guwahati, Assam. The event tackled the rising issues of human-elephant conflict and aimed to build stronger community-driven solutions for mitigation and support to victims. Its main goal was to equip communities and frontline workers with tools to better handle human-elephant interactions,


EMPOWERING
COMMUNITIES:

encourage coexistence through scientific and participatory means, and improve institutional systems for timely aid and compensation to families affected by conflict. Twenty-eight participants from seven elephant-range states Assam, Arunachal Pradesh, Meghalaya, Nagaland, Tripura, Chhattisgarh, and Odisha were joined by experts from government agencies such as the forest department, research institutions, and conservation organisations. Discussions emphasised the urgent need for joint efforts, especially regarding habitat fragmentation, frequent encounters in areas dominated by humans, and improved policies for compensation and conflict mitigation.

Workshop on "Policy Implementation for Minimising Elephant Mortalities on Railway Tracks" was organised for officials of the Indian Railways and State Forest Departments. The workshop held on 10th–11th March 2026 at the Wildlife Institute of India, Dehradun. The workshop aimed to strengthen inter-agency coordination and enhance field-level capacity for translating policy decisions and technical recommendations into effective on-ground implementation.

"Inception workshop on Management Effectiveness Evaluation of Elephant Reserves" was organised on was organised on 23 March 2026 at the Wildlife Institute of India, Dehradun. The programme was aimed at orienting teams on the evaluation framework, assessment criteria, field protocols, timelines, reporting formats, and operational procedures for the nationwide evaluation exercise. Eight teams from four different elephant landscapes attended this workshop.

PROJECT ELEPHANT

Ministry of Environment, Forest and Climate Change,
Indira Paryavaran Bhawan,
Jorbagh Road, New Delhi – 110 003

In coordination with

भारतीय वन्यजीव संस्थान
Wildlife Institute of India