

MANAGING HUMAN-ELEPHANT CONFLICT IN ARUNACHAL PRADESH: A STRATEGY AND ACTION PLAN

Report by

Department of Environment, Forest and Climate Change,
Government of Arunachal Pradesh

And

World Wide Fund for Nature-India
(WWF-India)

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A Strategy and Action Plan, WWF-India and Arunachal
Pradesh Forest Department, 2026

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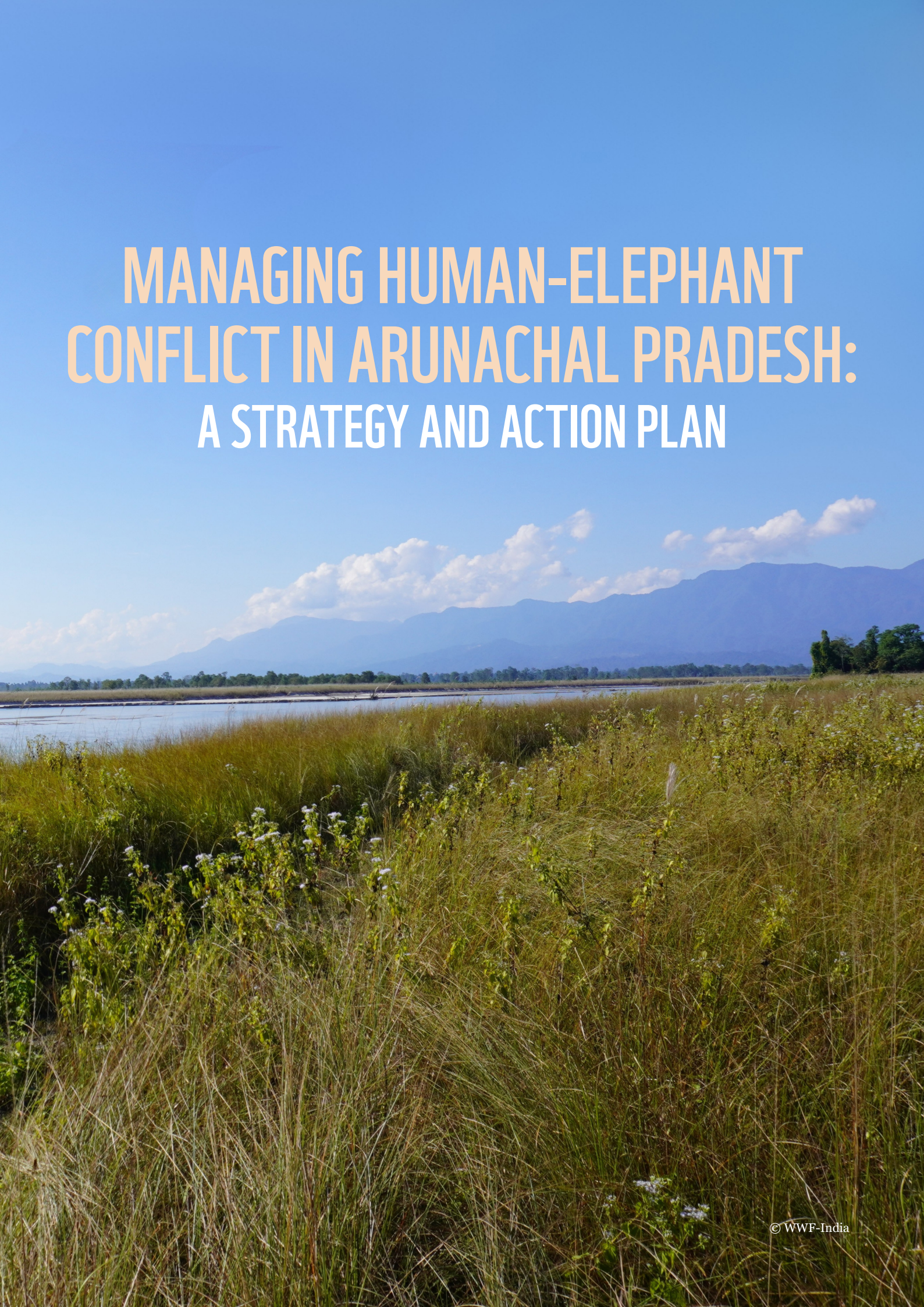
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MANAGING HUMAN-ELEPHANT CONFLICT IN ARUNACHAL PRADESH: A STRATEGY AND ACTION PLAN





CHIEF MINISTER ARUNACHAL PRADESH

FOREWORD

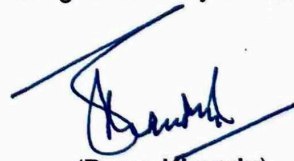
Arunachal Pradesh is a land where nature and culture walk hand in hand. Among its most majestic residents is the elephant - an enduring symbol of strength, wisdom, and heritage. With nearly 1,600 elephants roaming our forests, these gentle giants have carved their own timeless journey across the Himalayan foothills, even scaling the highest elevations recorded in India. For centuries, they have been part of our stories, our landscapes, and our identity.

But today, this bond faces new challenges. Expanding settlements, changing land-use, and rapid infrastructure growth have brought people and elephants into closer contact than ever before - sometimes with tragic consequences. Human-Elephant Conflict now threatens not only the survival of this magnificent species but also the lives and livelihoods of our people.

Recognizing the urgency, the Government of Arunachal Pradesh, in partnership with WWF-India, has crafted the *State Action Plan on Human-Elephant Conflict*. Rooted in science and grounded in the realities of our state, the plan seeks balance - honouring both human aspirations and the ecological needs of elephants. Through sustainable management, community participation, and long-term conservation, it envisions a future of coexistence.

This document is more than a plan - it is a promise. A promise to protect our natural heritage, to secure our communities, and to work together in harmony with nature. I extend my heartfelt appreciation to the Forest Department, WWF-India, and every stakeholder whose dedication has made this initiative possible.

May this Action Plan become our guiding light - uniting communities, government, and conservation partners to reduce conflict, protect our elephants, and reaffirm Arunachal Pradesh's eternal commitment to living in harmony with nature.



(Pema Khandu)



Wangki Lowang



MINISTER

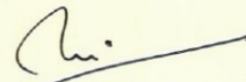
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MESSAGE

Human-elephant conflict is one of the pressing challenges we face in Arunachal Pradesh today. While elephants are a symbol of our State's rich natural heritage, their increasing interaction with human settlements has led to adversity for many. Protecting lives, livelihoods, and crops, while also conserving wild elephants, is a responsibility we must address with urgency and compassion.

This **State Action Plan on Human-Elephant Conflict**, prepared by the Forest Department in partnership with WWF-India, is a step in that direction. It lays out practical measures to prevent conflict, strengthen rapid response, and promote coexistence between people and elephants. The plan reflects the voices and concerns of our people and underlines the importance of community involvement in finding lasting solutions.

I, reaffirm our government's commitment to stand with the people of Arunachal Pradesh while protecting our forests and wildlife. I am confident that this Action Plan will guide us in reducing conflict, ensuring safety and security for our citizens, and aid in conservation of our national heritage animal.



(Wangki Lowang)



Wanglin Lowangdong

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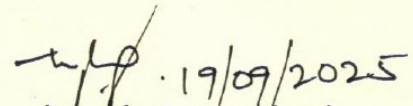
Message

Elephants are our national heritage animal and carry significant ecological, economic, and social values. Approximately 1,600 elephants inhabit the state of Arunachal Pradesh, primarily in the Himalayan foothill regions. Incidences of negative human-elephant interactions have increasingly come to limelight in the recent years. Such interactions threaten the long-term survival of elephant populations and place considerable socio-economic pressures on local communities.

The State Action Plan on Human–Elephant Conflict has been developed as a science-based framework to address this pressing challenge. Developed from ground-based situations, it provides multi-dimensional approaches, including habitat management, landscape connectivity, corridor protection, early warning systems, and rapid response protocols. It also emphasizes participatory governance, recognizing that coexistence can only be achieved when communities are empowered as partners in conservation.

Importantly, this document situates HEC management within a broader sustainability framework that seeks to balance developmental aspirations with biodiversity conservation. By integrating ecology, modern technology, and traditional knowledge, it provides a pragmatic roadmap for reducing conflict, safeguarding livelihoods, and ensuring the persistence of elephants across their range in Arunachal Pradesh.

I commend the Forest Department, WWF-India, and all collaborating stakeholders for their commitment and vision in preparing this important document. I believe this Action Plan will not only strengthen elephant conservation but also reinforce Arunachal Pradesh's commitment to promoting a harmonious balance between people, wildlife, and landscapes.


(Wanglin Lowangdong)

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Message

The State of Arunachal Pradesh is uniquely positioned as a biodiversity-rich landscape, where the Asian elephant holds both ecological, cultural and aesthetic importance. Incidences of human-elephant conflict highlights the need for an integrated approach where diverse stakeholders contribute towards mitigating its impacts, where not only the keystone species is endangered but it also has significant social and economic impacts on communities.

In recognition of these challenges, the Government of Arunachal Pradesh, through its Forest Department and in partnership with WWF-India, has prepared this **State Action Plan on Human-Elephant Conflict**. The document brings together scientific understanding and management strategies through community engagement and adoption of modern technology. It outlines a comprehensive framework for mitigation, including habitat management, early warning systems, community-based approaches, capacity building of frontline staff, and inter-departmental coordination.

This Action Plan reflects the state's commitment to both conservation and citizen welfare. By adopting a multi-stakeholder approach, it seeks to balance ecological integrity with human security and also ensure that the development and conservation go hand in hand.

I extend my appreciation to the Forest Department, WWF-India, and all stakeholders whose contributions have made this document possible. I am confident that the Action Plan will serve as an important guiding framework for effective, coordinated, and sustainable management of Human-Elephant Conflict in Arunachal Pradesh.

(Manish Kumar Gupta)

P. Subramanyam, IFS
PCCF & HoFF
Govt. of Arunachal Pradesh

MESSAGE

Arunachal Pradesh, with its vast and diverse landscapes, forms an integral part of the elephant distribution range in Northeast India. These forests not only support viable elephant populations but also sustain ecological processes and provide essential ecosystem services to local communities. However, the increasing incidence of human-elephant conflict poses significant challenges to both conservation and human well-being.

Managing this conflict requires a balanced approach that aligns conservation priorities with developmental needs. With increasing modernization, the interactions between humans and wildlife have been increasing. For coexistence in a fast-changing world, it is important to integrate modern mechanisms with the traditional concept of coexistence.

The State Action Plan on Human-Elephant Conflict has been formulated as a strategic response to this challenge. Adopting a multi-pronged strategy where multiple stakeholders join hands, it focuses on revitalizing habitats for elephants, deploying early warning and monitoring systems, and enhancing the capacity of frontline staff. Equally important is the emphasis on community participation, recognising local support and involvement as central to achieving sustainable coexistence.

This Action Plan provides clear guidance for implementation at the landscape and forest division levels, with defined priorities and timelines. It reflects our commitment to proactive conflict management and long-term conservation of elephants and their habitats for shared coexistence.

I am assured that effective implementation of this plan will contribute significantly to reducing human elephant conflict and will contribute to secure future for both people and elephants in Arunachal Pradesh.


P. Subramanyam.



MESSAGE



Arunachal Pradesh represents the north-easternmost boundary of the Asian elephant's range in India. The State is also significant for hosting the species at the highest recorded altitude in the country—up to 3,200 meters above sea level—in the Eaglenest Wildlife Sanctuary. However, the majority of elephant populations are found in the foothills and low-lying plains of the State, the very landscape currently undergoing rapid change. Notably, elephants range between the forests of Arunachal Pradesh and Assam, but extensive forest loss in Assam over the past two decades, along with shifting land-use patterns in the Arunachal plains, have put their habitats under serious threat.

Elephant habitats in Arunachal Pradesh provide critical ecosystem services as these forests and grasslands are a source of many streams and rivers. These forests are also of immense cultural importance for the many tribes and ethnic communities inhabiting the region. Conserving these precious elephant habitats ensures the survival of our National Heritage Animal and the diverse ecosystems that these areas support. Elephant conservation efforts also need to focus on the range of interactions that local communities have with the species to pre-emptively mitigate and manage adverse outcomes, such as crop losses, human casualties, and elephant deaths.

WWF-India is honoured to collaborate with the Department of Environment, Forest, and Climate Change, Government of Arunachal Pradesh in formulating the State's first comprehensive Action Plan for Managing Human-Elephant Conflict. This plan has been developed using primary data collected from across the State, combined with insights drawn from other elephant landscapes in India. This Action Plan provides a crucial framework for developing forest division-level and landscape-level strategies aimed at effective conflict management and the long-term conservation of elephants and their habitats in Arunachal Pradesh.

A handwritten signature in black ink that reads 'Ravi Singh'.

Ravi Singh
SG and CEO, WWF-India

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PREFACE

The Asian elephant is a keystone species of Arunachal Pradesh vital in its role as an “ecosystem engineer” maintaining the structural health and biodiversity of the forests. The varied key ecological roles played by this species is essential to maintain one of the most biodiverse states in India, with nearly 79% area under forest cover and having a network of two national parks and sixteen wildlife sanctuaries, which includes three tiger reserves and two elephant reserves. In addition to these, there are eleven Community Reserves and several Community Conservation Areas (CCAs) across the state, providing safe havens for species ranging from the smallest endemic species to the long-ranging elephants.

The state supports a significant population of elephants distributed along its Himalayan foothills from West

Kameng district in the west to Longding district in the east forming an important stretch of the Northeast India elephant landscape which holds the second largest elephant population of India. In such a scenario, human-animal interaction is unavoidable. Continued conservation efforts, including corridor identification and scientific monitoring, inter-state coordination and assessments have strengthened our understanding of elephant ecology and conservation.

The Department of Environment, Forest and Climate Change has been taking up multiple measures, including compensation mechanisms, monitoring of elephant movements, use of barriers to prevent elephants from entering human habitation and preventive interventions to reduce conflict. However, of late, the increasing interactions between people and elephants,



driven by the changing land use and expanding urban infrastructure and agricultural expansion have intensified Human-Elephant Conflict (HEC).

Addressing this challenge requires a balanced approach that safeguards both human livelihoods and wildlife and as such, in partnership with WWF-India, the State Action Plan on Human-Elephant Conflict has been drawn to provide a scientific, evidence based and practical framework for managing conflict across Arunachal Pradesh. Drawing on field data, stakeholder consultations, and district-level insights, it outlines strategic interventions tailored to varying patterns of elephant presence and conflict intensity.

This document outlines Strategies and Action Plan to address human-elephant conflict with district-specific

action plans, tailored interventions for different conflict scenarios, categorized by various types of elephant presence and the intensity of conflict. Additionally, the document specifies the timelines and establishes prioritisation framework for effective implementation and will serve as a comprehensive guide to mitigate conflict, conserve elephants, and promote long-term coexistence. I extend my sincere appreciation to the officers of the Forest Department, WWF-India and the stakeholders whose dedication has made this initiative possible.



Samuel Changkija, IFS
PCCF & Chief Wildlife Warden,
Government of Arunachal Pradesh





ACKNOWLEDGEMENTS

We extend our heartfelt gratitude to Shri Ngilyang Tam (IFS-Retd.), former PCCF (Wildlife & Biodiversity) & CWLW and CEO, State CAMPA, for his vision, guidance, and unwavering support. His significant contribution has been central to shaping this Strategy and Action Plan for managing human-elephant conflict in Arunachal Pradesh.

We sincerely acknowledge the guidance and support of senior leadership of the Arunachal Pradesh Forest Department:

Chief Conservator of Forests, Western Arunachal Circle, Banderdewa
Chief Conservator of Forests, Central Arunachal Circle, Pasighat
Chief Conservator of Forests, Eastern Arunachal Circle, Tezu
Chief Conservator of Forests, Southern Arunachal Circle, Deomali

We are grateful to the unwavering support from the field in shaping this report. We are indebted to the Conservator of Forests and Field Director, Namdapha NP & TR and the Divisional Forest Officers of Bomdila Forest Division, Eaglenest Wild Life Sanctuary, Itanagar Wild Life Sanctuary, Shergaon Forest Division, Khellong Forest Division, Banderdewa Forest Division, Sagalee Forest Division, Seppa Forest Division, Tale Wild Life Sanctuary, Changlang Forest Division, Nampong Forest Division, Khonsa Forest Division, Deomali Forest Division, D. Ering Wild Life Sanctuary, Pasighat Forest Division, Likabali Forest Division, Namsai Forest Division, Dibang Forest Division, Lohit Forest Division, Pakke Wild Life Sanctuary & Tiger Reserve, Kamlang Wild Life Sanctuary & Tiger Reserve, Kanubari Forest Division, Mehao Wild Life Sanctuary, Daporijo Forest Division, Aalo Forest Division.

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Ravi Singh, Secretary General and Chief Executive Officer
Sejal Worah, Programme Director
Dipankar Ghose, Senior Director, Biodiversity Conservation
Yash Sethia, Director, Wildlife and Habitats

Finally, we gratefully acknowledge the United States Fish and Wildlife Service (USFWS) for their initial funding support, which provided the foundation for this important initiative and WWF-US for strategic guidance.

LIST OF ABBREVIATIONS

AI: Artificial Intelligence	M-StrIPES: Monitoring System for Tigers - Intensive Protection and Ecological Status
ANR: Aided Natural Regeneration	NDRF: National Disaster Response Force
BRO: Border Road Organisation	NGO: Non-Governmental Organisation
CAMPA: Compensatory Afforestation Fund Management and Planning Authority	NGS: Next-Generation Sequencing
CCF: Chief Conservator of Forests	NH: National Highway
CEO: Chief Executive Officer	NHAI: National Highway Authority of India
CF: Conservator of Forests	NHIDCL: National Highway Infrastructure Development Corporation Limited
CM: Chief Minister	NHPC: National Hydro Power Corporation
CWLW: Chief Wildlife Warden	NP: National Park
CZA: Central Zoo Authority	NTCA: National Tiger Conservation Authority
DCF: Deputy Conservator of Forests	PA: Protected Area
DFO: Divisional Forest Officer	PCCF: Principal Chief Conservator of Forests
DLCC: District Level Coordination Committee	PE: Project Elephant
DNA: Deoxyribonucleic Acid	PIB: Press Information Bureau
DPR: Detail Project Report	RCC: Reinforced Cement Concrete
Dy CWLW: Deputy Chief Wildlife Warden	RF: Reserved Forest
EPT: Elephant Proof Trench	RFO: Range Forest Officer
ER: Elephant Reserve	RRT: Rapid Response Team
ESRI: Environmental Systems Research Institute	SBWL: State Board for Wildlife
FD: Forest Division	SDRF: State Disaster Response Force
GAS: Ghora Aabhe Society	SG: Secretary General
GPS: Global Positioning System	SLCC: State Level Coordination Committee
GRK: Gumin Rego Kilaju	SNP: Single Nucleotide Polymorphism
GSM: Global System for Mobile communications	SOP: Standard Operating Procedure
HEC: Human-Elephant Conflict	TOR: Terms of Reference
HQ: Headquarters	TR: Tiger Reserve
HWC: Human-Wildlife Conflict	USFWS: United States Fish and Wildlife Service
HWC-NAP: Human-Wildlife Conflict - National Action Plan	VHF: Very High Frequency
INR: Indian Rupee	VRT: Village Response Team
IUCN: International Union for Conservation of Nature	WII: Wildlife Institute of India
IWT: Illegal Wildlife Trade	WLPA: Wildlife Protection Act
LULC: Land-use land-cover change	WLS: Wildlife Sanctuary
MoEF&CC: Ministry of Environment, Forest and Climate Change	WWF-India: World Wide Fund for Nature – India

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EXECUTIVE SUMMARY

Among the three extant elephant species, the Asian elephant (*Elephas maximus*) is the most threatened when compared to the African Savanna elephant (*Loxodonta Africana*) and the African forest elephant (*Loxodonta cyclotis*). With less than ~50,000 individuals left in the wild, India hosts approximately 60% of the wild Asian elephants today with an estimated population of 27,000-29,000 individuals. The species faces risk of extinction unless urgent efforts are put in place. For the conservation of the species at large, every sub-population deserves special focus, especially the lesser known populations. Arunachal Pradesh hosts one such population of elephants numbering around 1,600 individuals that range in the foothills and low-lying areas of Arunachal Pradesh and Assam.

Rapidly changing land-use and expanding infrastructure has impacted the persistence of the species in Arunachal Pradesh. However, there is immense conservation potential given high forest cover in the State and remnant habitats within and beyond Protected Areas. The long-term conservation of the species in Arunachal Pradesh would hinge on effective management of adverse interactions between people and elephants and by efficient land-use planning that considers elephant habitats and connectivity. In view of escalating adverse interactions between people and elephants in the State and with an aim of securing the future of the species, the Government of Arunachal Pradesh and WWF-India have prepared a Strategy and Action Plan to manage human-elephant conflict through a holistic and inclusive approach.

This plan provides an overview of elephant distribution in the State using primary and secondary data. The coarse-scale distribution is also compared to previous

studies on elephant distribution in the State based on the Synchronised Elephant Population Estimation (2017). The report underscores the current pan-India trends of human-elephant conflicts, focussing on elephant-attributed human casualties and non-natural elephant mortalities to put the current situation in Arunachal Pradesh in the context of country-wide trends. Secondary information on human casualties, crop damage, property damage, and elephant mortality is then presented at the State-level and Forest Division-level to highlight hotspot Forest Divisions requiring urgent interventions. The report subsequently provides a strategic framework for managing human-elephant conflict by identifying desired outcomes, followed by an Action Plan of activities to be carried out to achieve desired outcomes.

This document can be used by officials of the Arunachal Pradesh Forest Department and other key stakeholders in the following ways:

1. Identify conflict hotspot divisions to prepare more granular and context specific action plans based on a suite of interventions provided in this document.
2. For each hotspot division, identify the interventions that may be applicable based on a situational analysis and prioritisation criteria provided in this document.
3. Create a budget for conflict management in a particular division based on the Action Plan provided in this document.
4. Identify research /knowledge gaps that can be addressed to effectively manage human-elephant conflicts.





1. INTRODUCTION

India is one of the 17 megadiverse countries in the world, supporting approximately 8% of the global biodiversity within 2.5% of the global land surface (Venkataraman, 2012). Approximately 25% of the country's land area is covered by forests. The country has several unique ecoregions, including the high Himalaya, the Deccan plateau, the Eastern and Western Ghats and various coastal and river flood plains (FSI, 2023). The country also encompasses a complex mosaic of natural landscapes, forests and ecosystems within which people share unique cultural bonds with nature and wildlife.

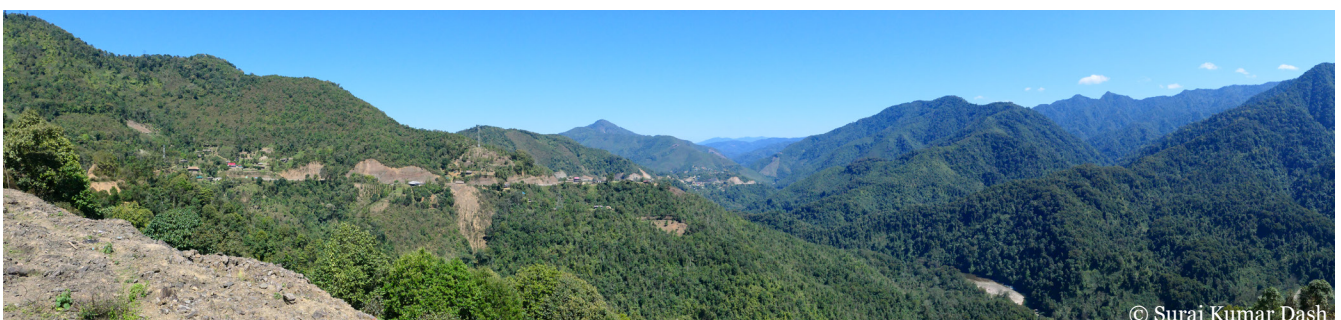
Central to many forest ecosystems in India are the megaherbivores, large-bodied animals that perform vital functions in shaping forests and ecosystems (Sekar & Sukumar, 2015). Asian elephant is the largest terrestrial mammal in Asia, found across a mosaic of land use such as forests, grasslands, plantations, and agriculture landscapes from the Himalayan foothills to peninsular and North-east India (MoEF & CC, 2017). Due to its significant role in the ecosystem and the myriad ways in which people associate with and revere the elephant, the species was declared the National Heritage Animal of India (PIB, 2010; Sukumar, 2016). In recent decades, elephant populations in India have faced increasing pressure, particularly from rapid land-use change and escalating human-elephant conflicts. Over the past century, these and other threats, including poaching, have also impacted elephants across their distributional range in 13 Asian countries (Shaffer et al., 2019). The species is currently listed as endangered by the International Union for Conservation of Nature (IUCN), emphasizing that its long-term survival is contingent on conservation investment and initiatives.

As ecosystem engineers, elephants play a key role in seed dispersal of various plants and thereby shape the vegetation composition of a forest (Sukumar, 2003; van de Water et al., 2022). With their large body size, they help open pathways for other small animals in the forest understorey. Their dung acts as manure for

forest vegetation, supporting natural regeneration. They are also known to make water available for other small creatures during the dry season by digging into the soil (Sukumar, 2003; van de Water et al., 2022).

Elephants in India are found in four distinct geographies with at least six sub-populations identified (Khan et al., 2023). In North-eastern India, elephants are found in northern West Bengal, Assam, Arunachal Pradesh, Meghalaya, Tripura, Mizoram, Nagaland and occur occasionally in Manipur (Table 2). In northern India, elephants are found in Bihar, Uttar Pradesh, and Uttarakhand, with recent reports from Haryana and Himachal Pradesh. The central Indian elephant population spans across southern West Bengal, Jharkhand, Odisha, Chhattisgarh, Madhya Pradesh, and Maharashtra. The South Indian population has three distinct clusters spanning Karnataka, Andhra Pradesh, Tamil Nadu, and Kerala with recent presence in southern Maharashtra and Goa. Three clusters in southern India are divided by the Palakkad Gap and Shencottah Gap along the Western Ghats.

The elephant presence in India is spread over an area of approximately 1,11,000 km², comprising protected areas, forests, grassland, monoculture, agriculture, agriculture-plantations, and human settlements. Within these habitats, India supports about 60% of the global Asian elephant population with an estimated population of ~30,000 individuals (<https://moef.gov.in/project-elephant-pe> accessed on March 2025) (Table 1). There are 35 designated Elephant Reserves (ER) cumulatively spanning an area of about 65,000 km². Protected Areas comprise 30% of the extent of Elephant Reserves, whereas the remaining areas are within Reserved Forests (RF) (40%) and non-forest lands (30%) (PE-WII-MoEF&CC, 2024). To facilitate smooth elephant movement across their core and fragmented habitats, 150 elephant corridors from across 15 elephant range States of India have been recognised by the Government of India.



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Table 1: Region-wise elephant population estimates/counts

S. no	Geographical region	Population
1	North Eastern India	10,139
2	East Central India	3,128
3	North Western	2,085
4	Southern India	14,612

Table 2: Elephant population in North Eastern India

S. no	State	Population
1	West Bengal (Northern Districts)	488*
2	Assam	5,825+
3	Arunachal Pradesh	1,614*
4	Meghalaya	1,754*
5	Nagaland	446*
6	Mizoram	7*
7	Tripura	102*

NB:

+ Elephant Population Estimation in Assam, (2024). Assam Forest Department.

* Synchronized Elephant Population Estimation India, (2017). Project Elephant Division Ministry of Environment, Forest and Climate Change Government of India.

1.1 Status of Human-Elephant Conflict (HEC) in India

The widespread distribution of Asian elephants in India leads to significant levels of adverse interactions between people and elephants (Rangarajan et al., 2010; Shaffer et al., 2019). There is significant variation among States in terms of the number of human casualties attributed to elephants with Odisha, Jharkhand, West Bengal, Assam, and Chhattisgarh accounting for more than 70% of such incidents in India annually (Figure 1). Each year, more than 600 people succumb to accidental encounters with elephants; the number of injuries is expected to be even higher (Figure 2). Elephants also bear the costs of these adverse interactions, as more

than 100 elephants die due to anthropogenic causes each year in India on an average. Among the various causes of non-natural elephant mortality, electrocution appears to be the predominant cause in India (Figure 3). Assam and Odisha is reported to witness the highest incidents of such elephant mortality among all the elephant range States (Figure 4-5). Furthermore, high quantum of crop losses and property damage impose additional direct and indirect costs on local communities (Anoop et al., 2023; Kshetry et al., 2021; Rangarajan et al., 2010; Shaffer et al., 2019).



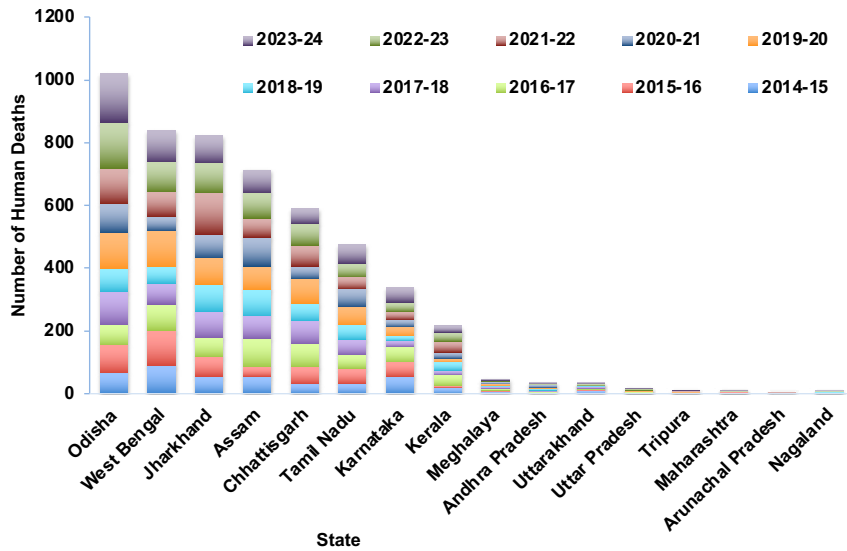


Figure 1: State-wise elephant-attributed human deaths reported between 2014 and 2024 compiled from Press Information Bureau (PIB) statements.

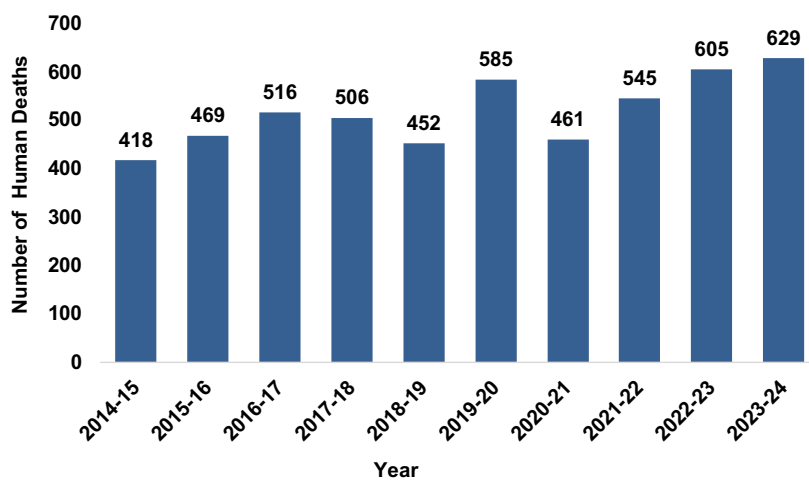


Figure 2: Elephant-attributed human deaths in India reported between 2014 and 2024

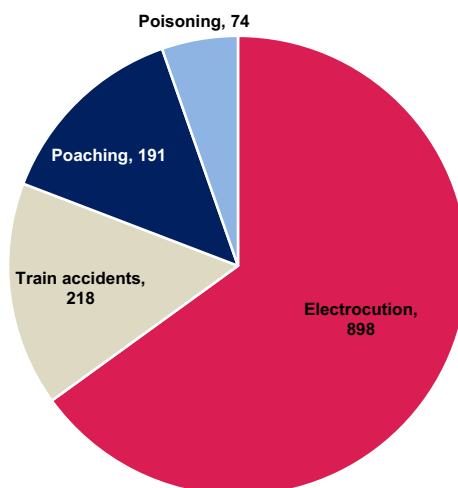


Figure 3: Non-natural elephant deaths in India reported between 2009 and 2023

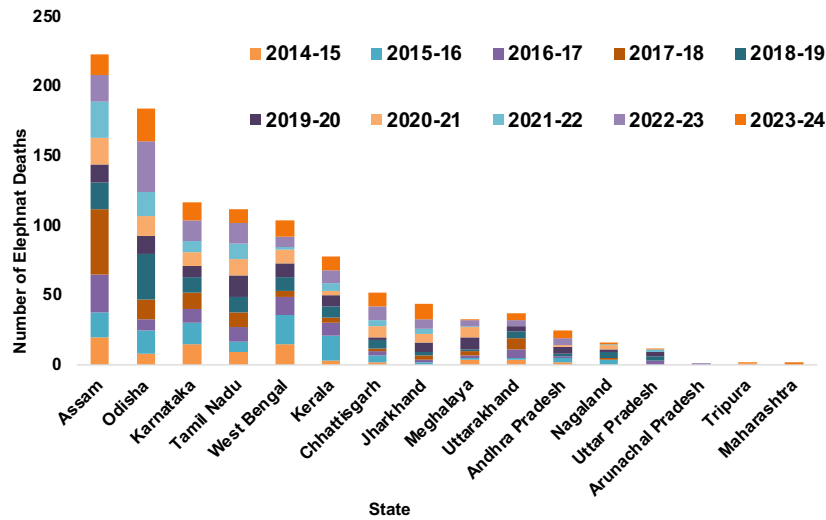


Figure 4: Reported State-wise figures of annual non-natural elephant mortalities between 2014 and 2024

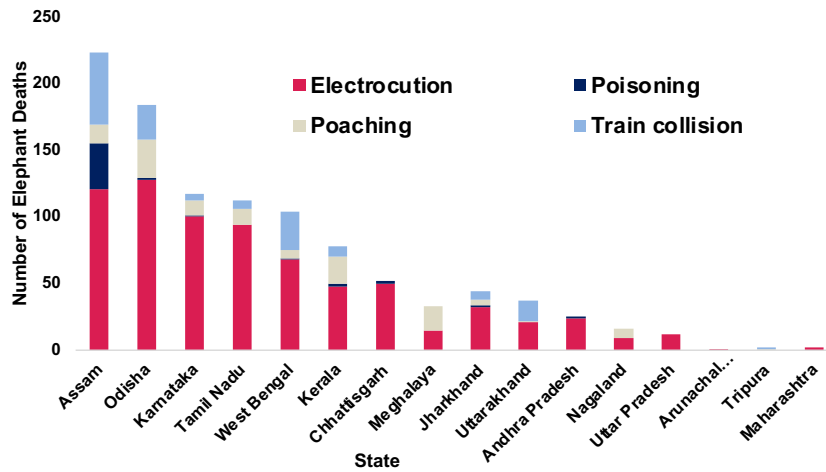


Figure 5: Reported elephant deaths due to non-natural causes between 2013 and 2023

1.2 Status and Distribution of Elephants in Arunachal Pradesh

Information on the distribution of a species in any geography forms the foundation for devising conservation measures to ensure that the scale of interventions match the scale of distribution of the species. In this section, the geographic distribution of elephants across Arunachal Pradesh has been mapped using a combination of primary and secondary data sources. The current distribution is then compared to the distribution of elephants in Arunachal Pradesh in 2017 to understand if there has been and shrinkage or expansion of elephant distribution in the State (Varma et al., 2019). To assess the current distribution of elephants in Arunachal Pradesh, confirmed locations of

elephant presence were recorded from three sources: **a.** Confirmed locations of elephant presence (based on dung piles) across Arunachal Pradesh as provided by Arunachal Pradesh Forest Department, the data was collected between December 2024 and January 2025, **b.** Location of cases of crop damage, property damage, and human casualty based on secondary records of Arunachal Pradesh Forest Department that occurred between 2007 and 2024, and **c.** Data on elephant presence from camera traps deployed by WWF-India in Khellong Forest Division spanning an area of 172 km² between 2023 and 2024 in the western Arunachal foothills. The methodology used for assessing

distribution for this action plan has been closely aligned with the methodology used in the 2019 study which also used a combination of elephant presence locations and locations of elephant presence in villages based on secondary records (Varma et al., 2019). The only additional information used is from the camera traps deployed in Khellong Forest Division.

The records of elephant presence across elephant range in Arunachal Pradesh was systematically collected by the Arunachal Pradesh Forest Department using a 5 km X 5 km grid size through primary surveys. All coordinates of confirmed elephant presence were used for understanding variation in elephant signs across Forest Divisions and to map elephant distribution across the State. Locations of all elephant-attributed damage and elephant casualties were also used to infer presence and distribution. All secondary records were georeferenced and digitised using Survey of India maps, and Google Earth interface. The location of camera traps in Khellong Forest Division where elephants were sighted were also used as confirmed elephant presence and used in the distribution mapping. A minimum concave polygon was drawn joining the outermost points of confirmed elephant presence using the above three data sources to draw the boundaries of the current elephant distribution in Arunachal Pradesh. For the purpose of this action plan, coarse-scale District-level and Forest Division-level analysis has been carried out.

The elephant population of Arunachal Pradesh, as per the 2017 assessment, is 1,614 individuals distributed across an area of approximately 7,000 km² (Project

Elephant, 2017; Varma et al., 2019). The elephants predominantly occupy forested areas comprising subtropical broadleaf forest and moist deciduous forests, in addition to barren and agricultural areas, which they may be using to traverse or for foraging. Elephant distribution lies majorly in forested habitats (88%), and least in barren areas (6%) and agricultural areas (4%) (Varma et al., 2019). Elephants are recorded to move between Bhutan, Arunachal Pradesh, and Assam (Varma et al., 2019). Four population clusters were identified based on elephant distribution as per the 2017 assessment: Khellong Forest Division (FD) to Banderdewa Forest Division, Banderdewa FD to Yingkiang FD, Pasighat FD to Lohit FD, and Anjaw FD to Kanubari FD (Figure 7).

However, in the present study, and based on the records of elephant signs as provided by the Arunachal Pradesh Forest Department, the current elephant range is found to be greater than the estimated range in 2017. While elephants were found to be distributed over 7,001 km² according to Varma et al 2019, the current study estimates the distribution to be 12,446 km², which represents a 78% increase. Furthermore, as per Varma et al. 2017 elephants in Arunachal Pradesh were found to occur in four distinct population clusters (Table 3). The current mapping of elephant distribution identifies habitat contiguity between Pasighat-Lohit cluster and the Anjaw-Kanubari cluster, evidenced by elephant presence between these two clusters as shown in Figure 6. The evidence of increasing distributional range of Asian elephants in Arunachal Pradesh could signify changes in the interface between people and elephants.

Table 3: Elephant population clusters in Arunachal Pradesh as per the 2024 elephant survey data

Cluster no.	Forest divisions	Elephant distribution area (sq km)	Length (km)	Forest divisions	Districts
1	Khellong-Banderdewa	1947	100	Khellong, Shergaon, Seppa, Bomdila, Pakke TR	West Kameng, East Kameng, Pakke Kessang
2	Banderdewa-Pasighat	4653	190	Banderdewa, Sagalee, Itanagar WLS, Hapoli, Daporijo, Aalo, Likabali	Papum Pare, Lower Subansiri, Kamle, Upper Subansiri, Lower Siang, Lepa Rada
3	Pasighat-Kanubari	5365	250	Pasighat, D'Ering WLS, Lower Dibang, Lohit, Namsai, Anjaw, Namdapha TR& NP, Nampong, Changlang, Deomali, Kanubari	East Siang, Lower Dibang Valley, Lohit, Namsai, Anjaw, Changlang, Tirap, Longding

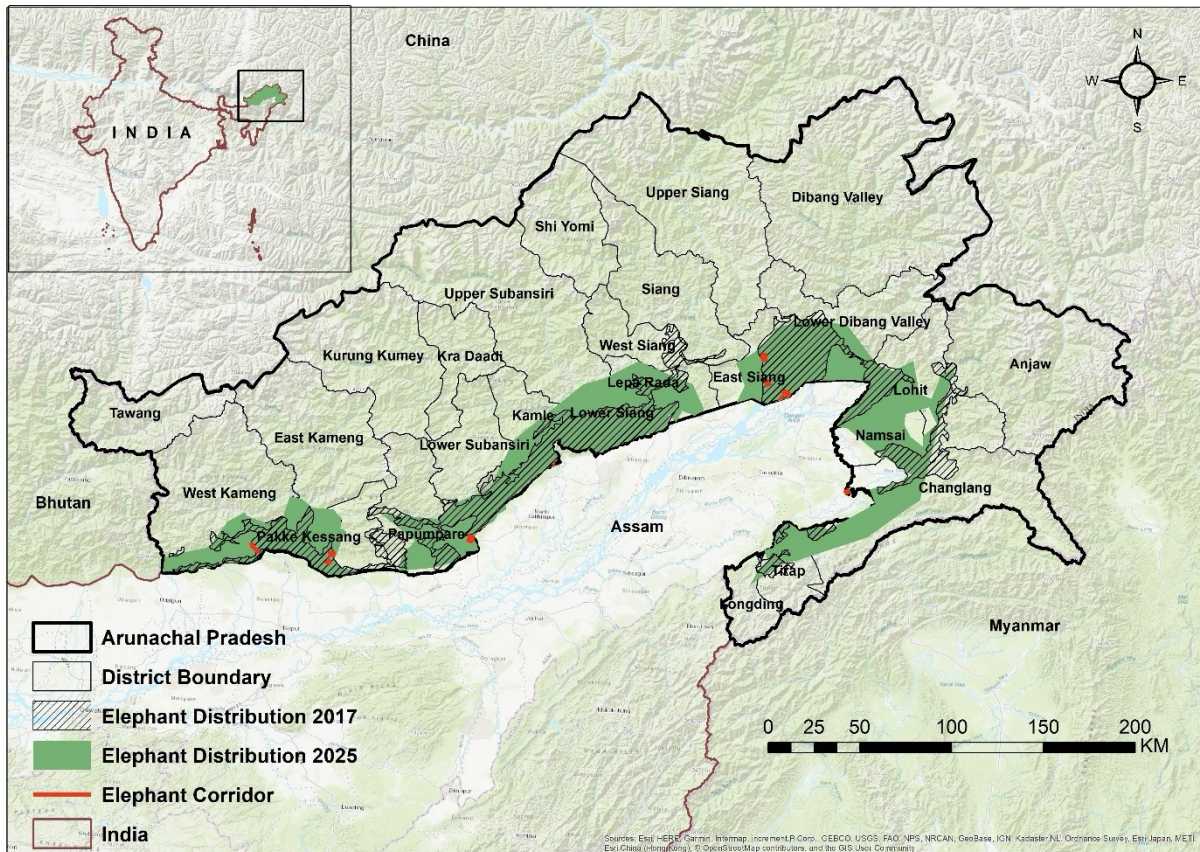


Figure 6: Map comparing the extents of elephant distribution in 2017 and 2025

Elephants are distributed across 17 districts, between elevations of 150 to 3,266 m. The indirect evidence of elephant presence collected by the Arunachal Pradesh Forest Department indicates that the elephant range in the State extends beyond the Protected Areas. Further, in 2024, elephants were also observed beyond the earlier distribution records of 2017 (Figure 6). Elephants were observed in the high-altitude regions in Eaglenest Wildlife Sanctuary in the Shergaon Forest Division in West Kameng district and in the temperate Himalayan forests up to elevations of 2000 m in Sagalee, Aalo, and Daporijo Forest Divisions in Papum Pare, Lepa Rada, and Kamle districts, respectively (Figure 7).

The maximum count of elephant signs was recorded from the Pakke Tiger Reserve in Pakke Kessang district, Banderdewa Forest Division in Papum Pare district, Pasighat and D'Ering area in East Siang district, Deomali Forest Division in Tirap district and from Nampong Forest Division in Changlang district (Figure 7).

The highest elevation record of elephants in Arunachal Pradesh was at an altitude 3,266 m (± 10 m), observed in Eaglenest Wildlife Sanctuary in West Kameng district. Other areas include the Rillo range of Pakke Tiger Reserve in Pakke Kessang district at around

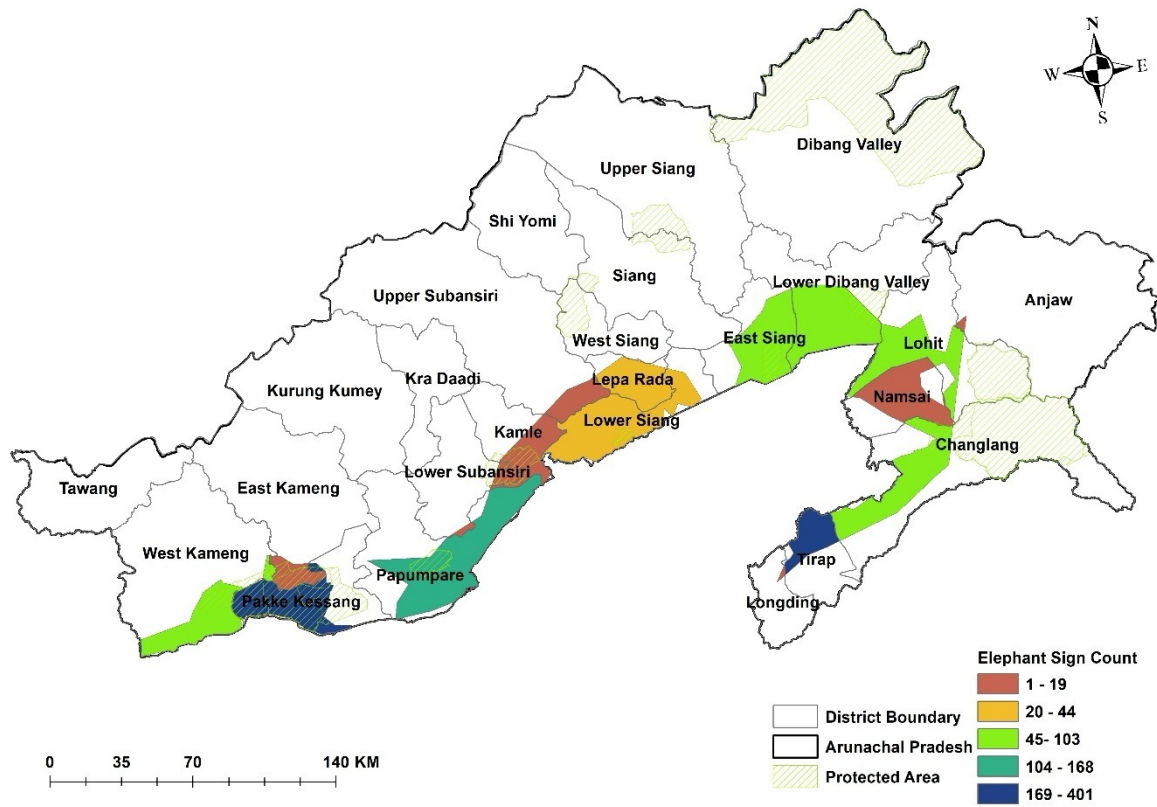


Figure 7: Spatial variation in counts of elephant signs as per data provided by Arunachal Pradesh Forest Department

1,500m, and the Basar range of Aalo Forest Division in Lepa Rada district, around 1,500 m. Elephants are largely recorded from the low lying areas in Pasighat, D’Ering, Pakke, Deomali, Namsai, and Banderdewa Forest Divisions in East Siang, Pakke Kessang, Tirap, Namsai and Papum Pare districts, respectively (Figure 8).

Considering the elephant presence with respect to forest types, elephant presence was mainly observed in the tropical moist deciduous forests in the foothill region. In the middle Himalayan region, the presence was found in tropical semi-evergreen, evergreen, and subtropical broadleaved hill forests at altitudes ranging

from 200 to 2,000 m. Further, in the high altitude region above 2,500 m, elephant presence was found in the montane wet temperate forests and Himalayan moist temperate forests.

It was observed that the river valleys play a crucial role in elephant movement in Arunachal Pradesh. Given the State’s undulating topography, infrastructure and other anthropogenic footprint in the plain areas, the river valleys, particularly the riverine habitats, provide paths that elephants can negotiate in an otherwise steep, mountaineous terrain, Elephant presence was recorded in the river valleys of Kameng, Pakke, Dikrong, Ranganadi, Lohit, Namdapha, etc (Figure 9).



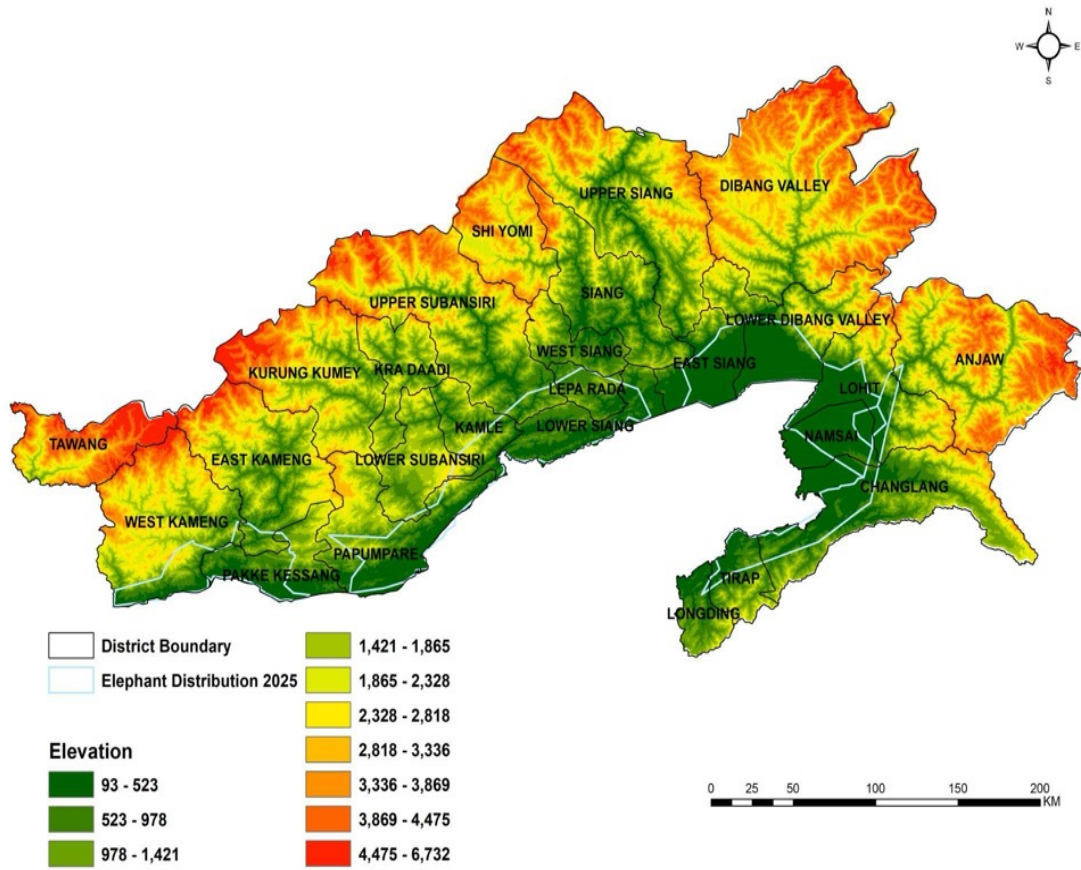


Figure 8: Elephant distribution with respect to elevation in Arunachal Pradesh

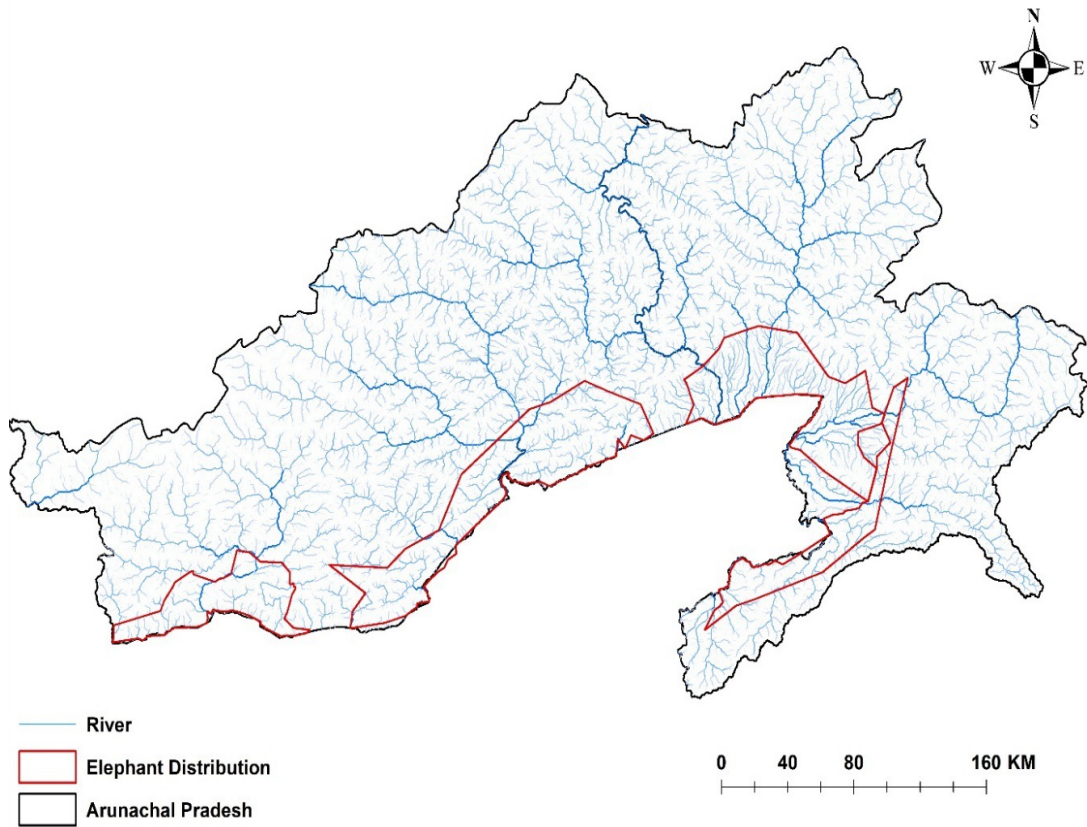


Figure 9: Elephant distribution in Arunachal Pradesh with reference to hydrology



2. CONSERVATION CHALLENGES

2.1 Status of Human-Elephant Conflict in Arunachal Pradesh

Records of the Arunachal Pradesh Forest Department indicate that 1,503 incidents of human-elephant conflicts (HEC) were reported between 2007 and 2024 of which the majority were crop damage incidents (91.08% n=1369) followed by house damage (5.26% n=79) and property damage (1.66% n=25) (Figure

10). Two percent (2%) of those incidents were human deaths and injuries, each contributing 1% (n=15) of the total HEC cases. Between 2007 and 2024, an average of 76.9 (± 18.4) HEC incidents were reported annually (Figure 11). Approximately 85% of those incidents were reported in the last 10 years between 2014 and 2024.

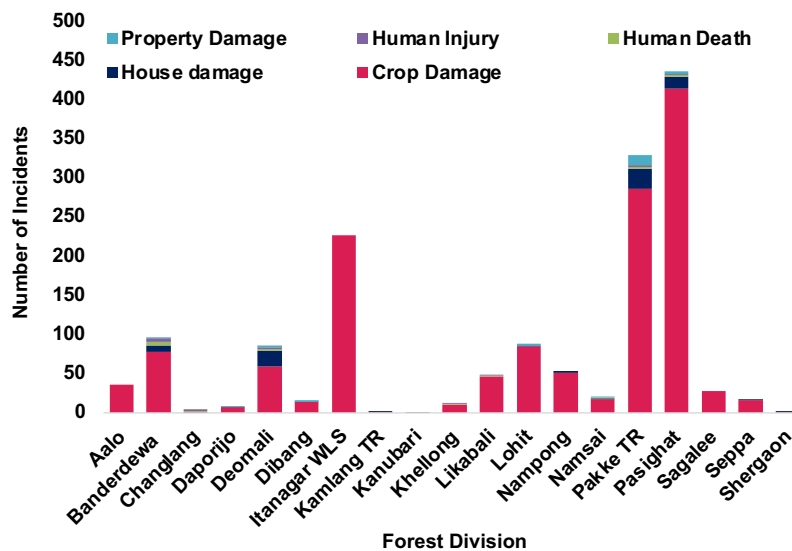


Figure 10: Forest Division-wise counts of incidents of damages attributed to elephants in Arunachal Pradesh

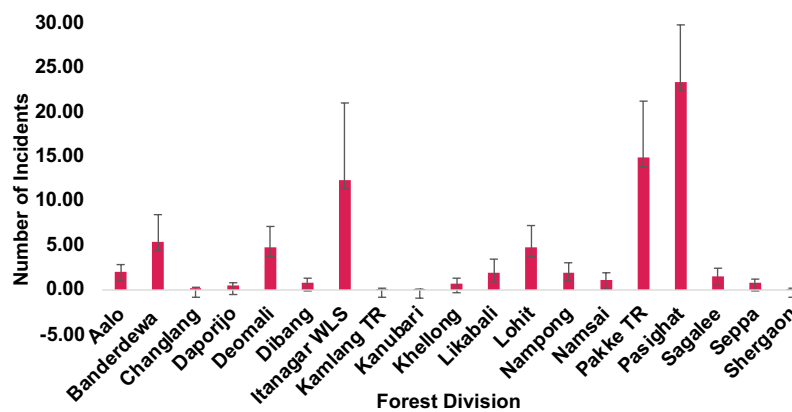


Figure 11: Annual average numbers (\pm Standard Error) of HEC incidents (crop damage, property damage and human casualties) reported from Forest Divisions of Arunachal Pradesh between 2007 and 2024

2.2 Hotspots of Human-Elephant Conflict in Arunachal Pradesh

Pakke Kessang, Papum Pare, East Siang, Lohit, Changlang, and Tirap are the districts observed to be the hotspots of HEC, representing approximately 75% of the total reported HEC incidents in Arunachal

Pradesh. Considering the different HEC types, such as crop damage, property damage, and human casualties, the hotspots remained consistent across conflict types (Figure 12-17).

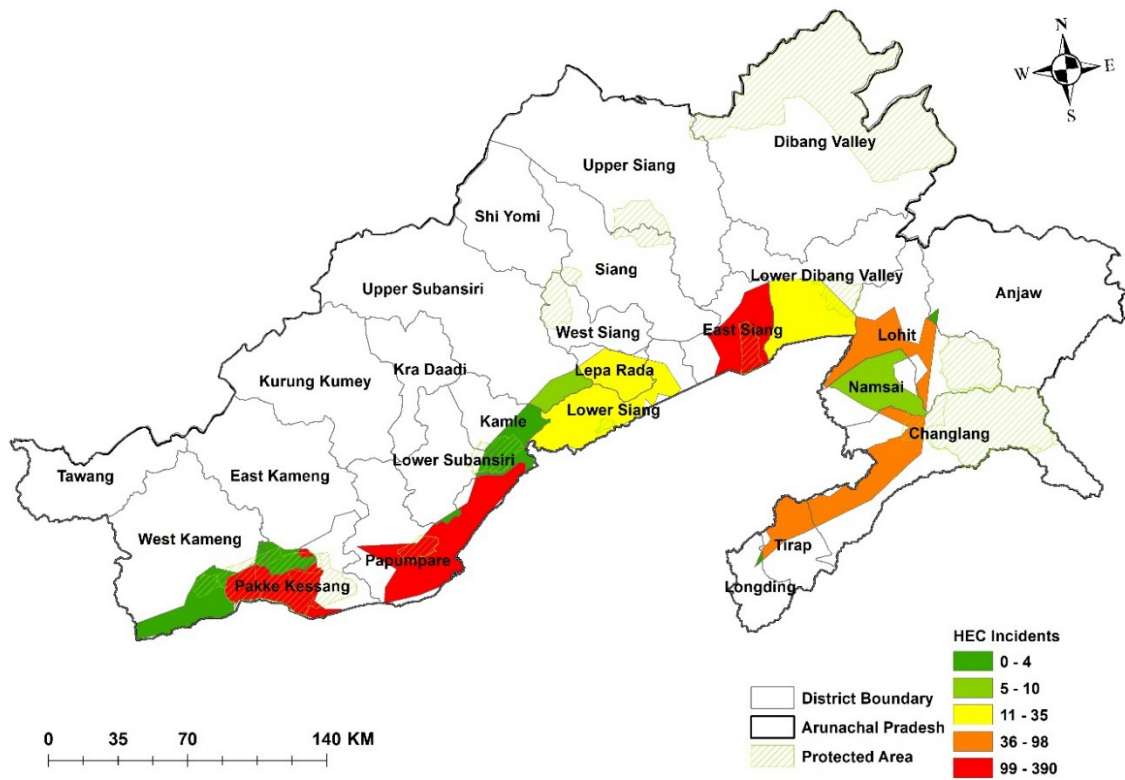


Figure 12: Map depicting spatial variation in reported elephant-attributed damages (crop damage, property damage, and human casualties) across elephant bearing districts of Arunachal Pradesh. Only elephant distribution areas within each district is depicted.



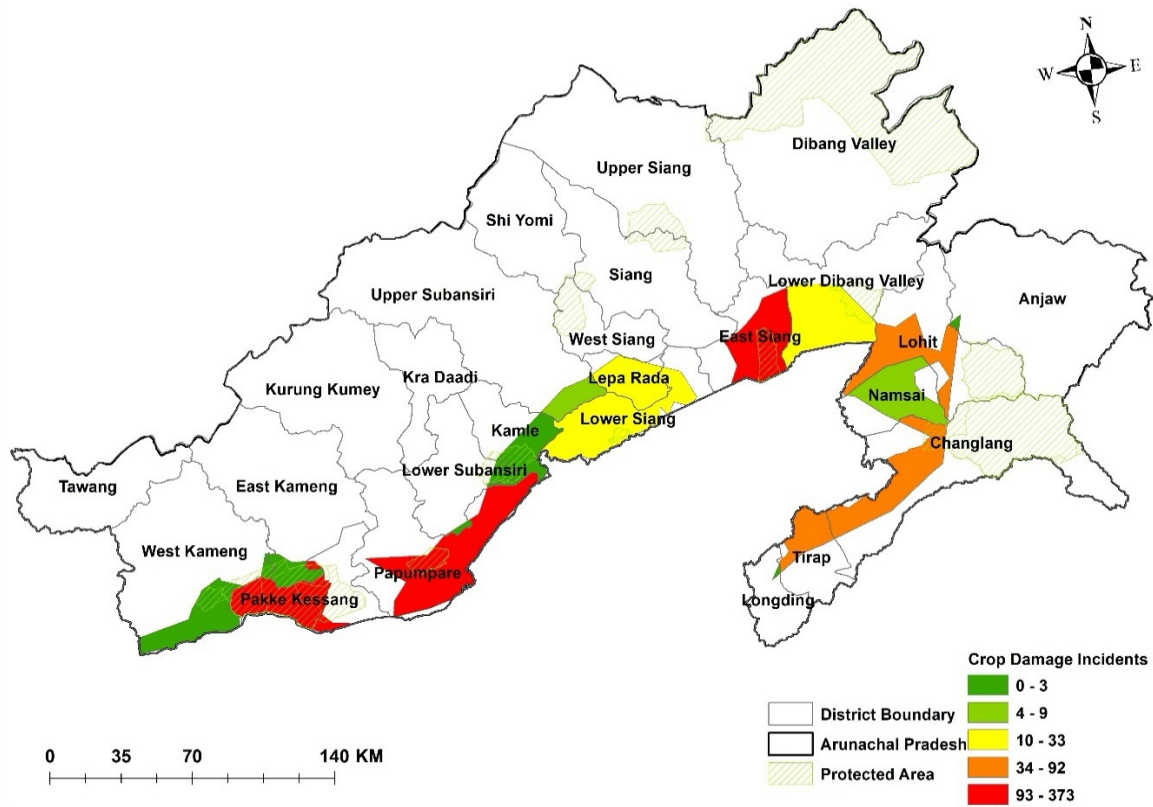


Figure 13: Spatial variation in reported crop damage incidents due to elephants within elephant distribution area across the Districts of Arunachal Pradesh

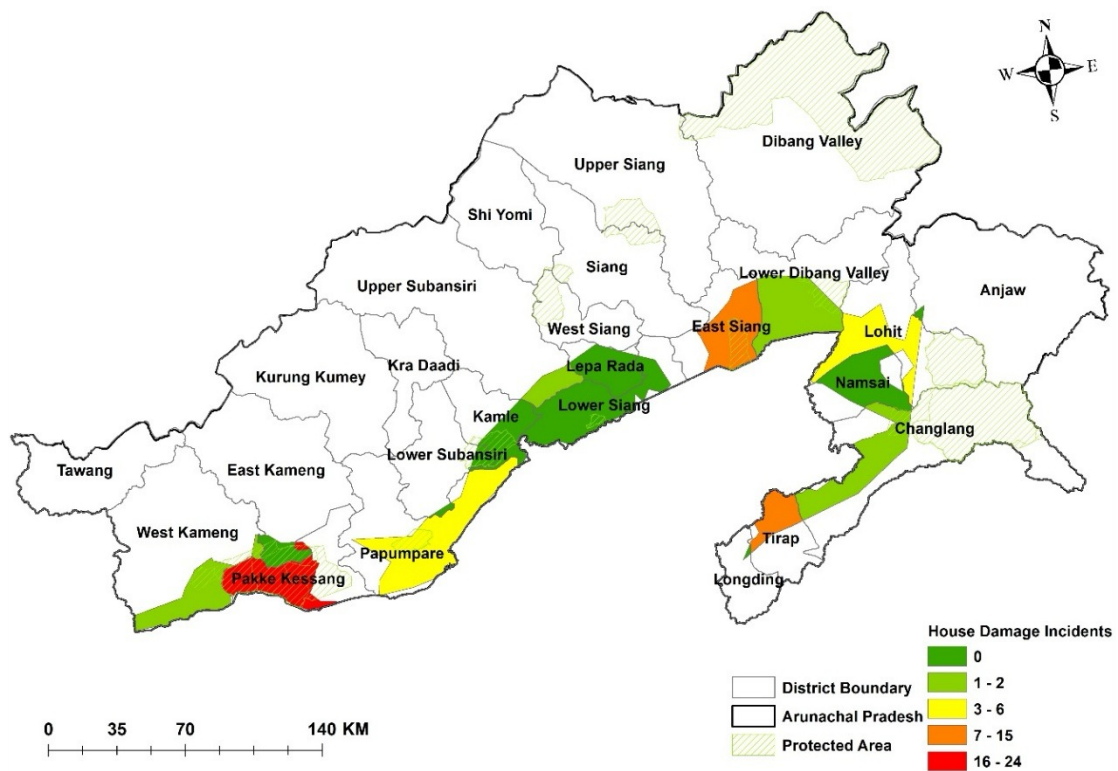


Figure 14: Spatial variation in reported house damage incidents by elephants within elephant distribution area across the Districts of Arunachal Pradesh between 2007 and 2024

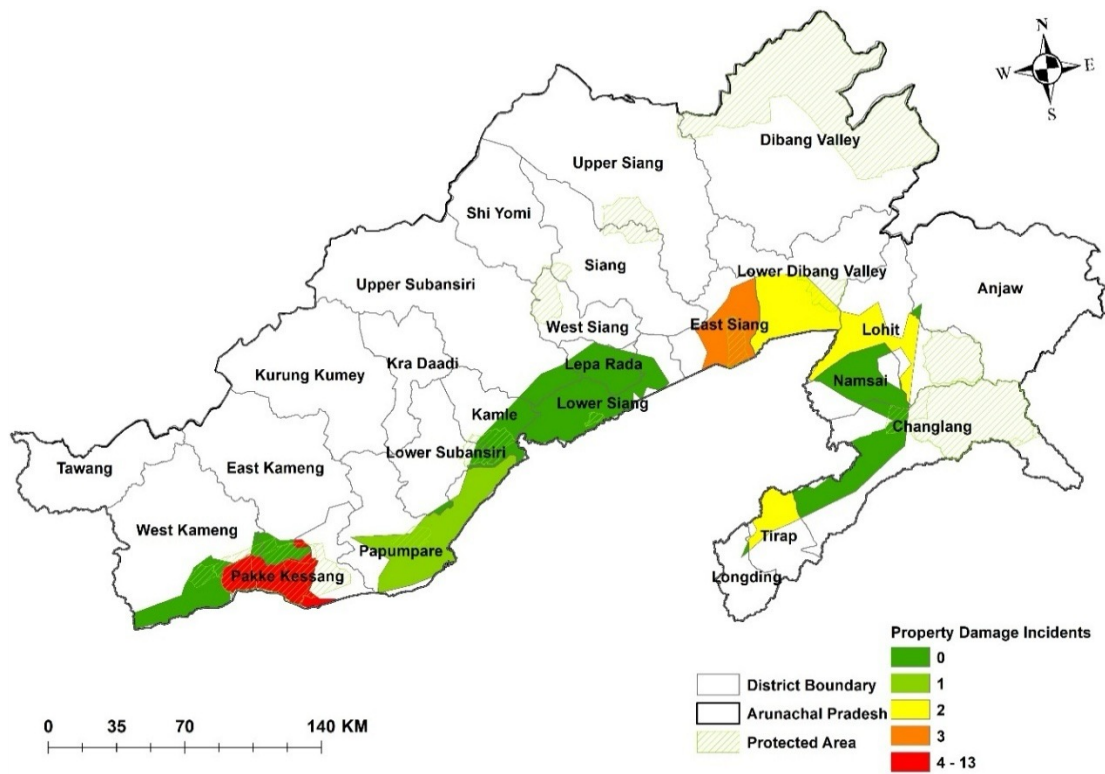


Figure 15: Spatial variation in reported property damage incidents by elephants within elephant distribution area across the Districts of Arunachal Pradesh between 2007 and 2024

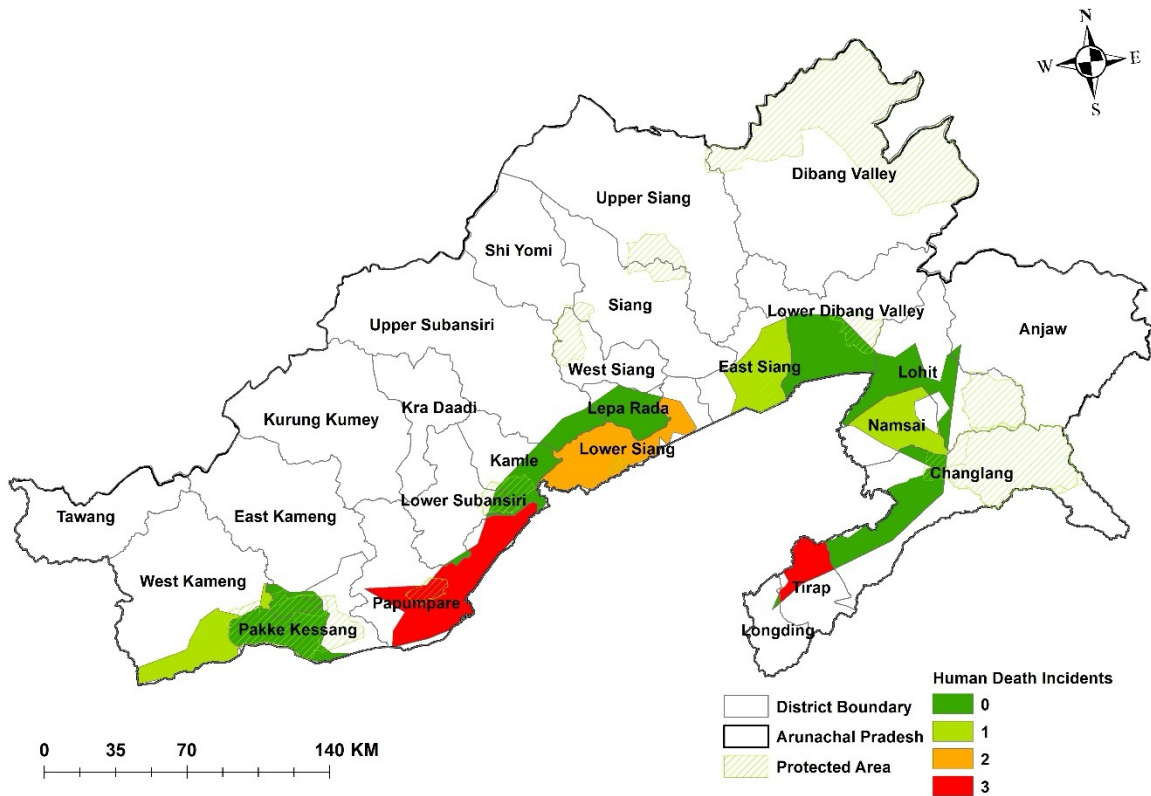


Figure 16: District-wise count of human death incidents attributed to wild and captive elephants within elephant distribution area of Arunachal Pradesh between 2007 and 2024

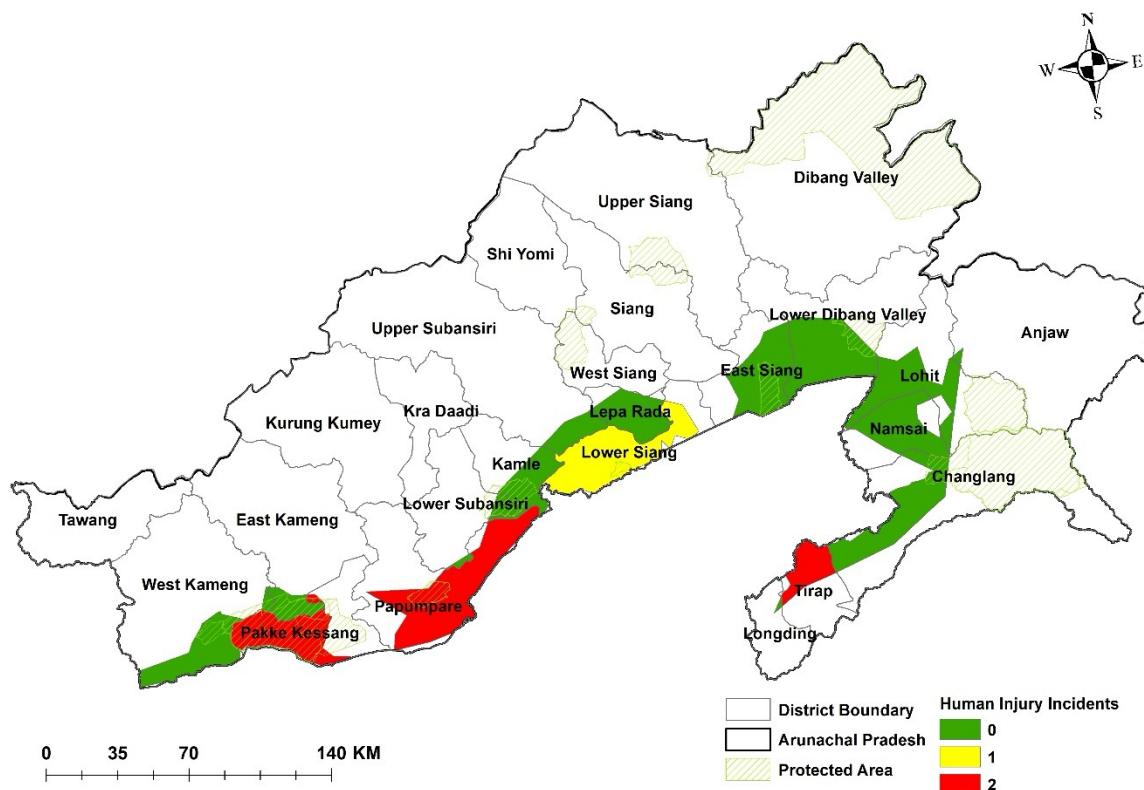


Figure 17: District-wise count of human injury incidents attributed to elephants within elephant distribution area of Arunachal Pradesh between 2007 and 2024

2.3 Priority Forest Divisions for HEC Management

The districts of Pakke Kessang, Papum Pare, East Siang, Lohit, Changlang and Tirap have been identified as hotspots for human-elephant conflict in Arunachal Pradesh based on the reports collected by the Forest Department. The Forest Divisions within these districts requiring management interventions include Banderdewa, Changlang, Deomali, Itanagar Wildlife Sanctuary, Lohit, Nampong, Pakke TR, Pasighat, and Sagalee (Figure 18 - 19). These divisions together report more than 75% of the total HEC cases in Arunachal Pradesh. Analysis of the seasonal pattern of HEC revealed that most HEC incidents occurred in the rainy and winter seasons which overlapped with the cropping season (Figure 20). This pattern is consistent with previous studies as crops attract elephants due to the lure of easy nutritional gain (Sukumar, 1991). Most cases reported for compensation pertain to crop damage in *jhum* cultivations and paddy fields. The monthly trend of reported crop damage cases corresponds with cropping patterns, particularly in the months of June to September (monsoon) and October to December (post-monsoon) (Figure 20). Monsoon is when millets are grown in *jhum*, and upland rice is planted. The post monsoon peak in crop damage corresponds to

the harvest season as the crops ripen. Incidences of damage to betel nut palms, banana, and other crops are also documented from *jhum* sites and orchards. While the reported cases accessed did not classify the type of cultivation, interactions with people and the forest department staff indicated that *jhum* cultivations are equally, if not more, susceptible to crop damage by elephants in hill tracts.



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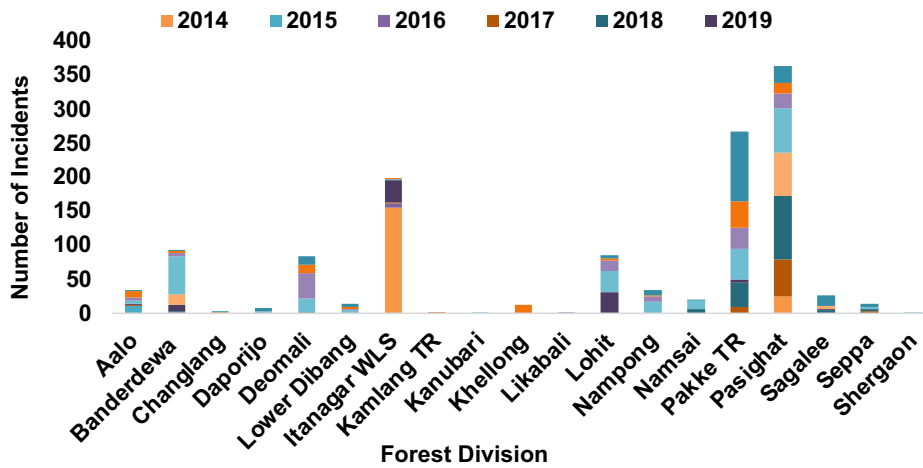


Figure 18: Spatial variation in human-elephant conflict levels across Forest Divisions of Arunachal Pradesh

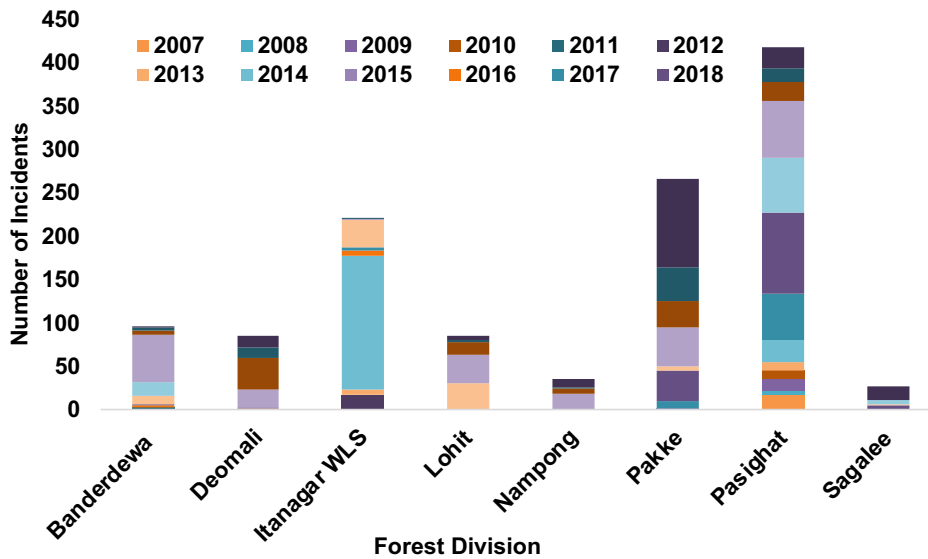


Figure 19: Annual variation in HEC levels in the hotspot Forest Divisions of Arunachal Pradesh

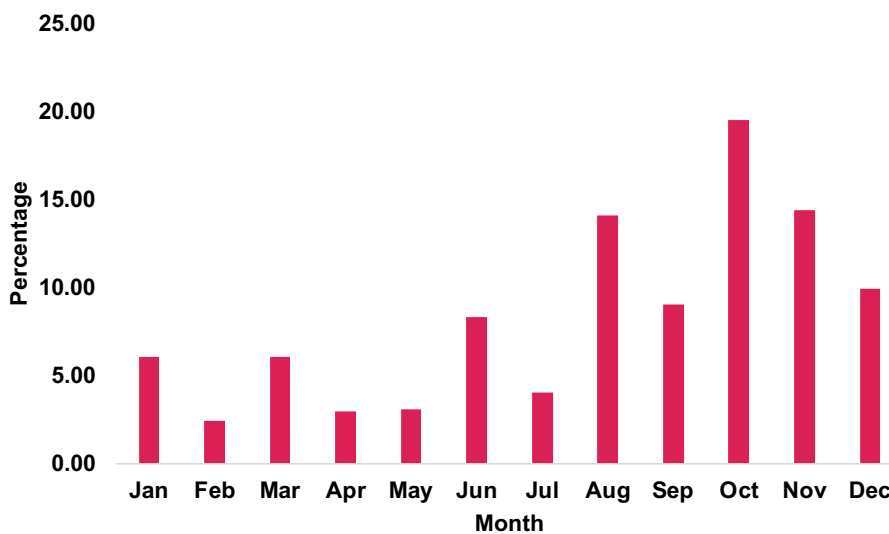


Figure 20: Month-wise trends in human-elephant conflict represented as a percentage of HEC cases per month, pooled across all years

2.4 Elephant Deaths in Arunachal Pradesh

Between 2018 and 2024, a total of 17 elephant deaths were reported, including five unnatural deaths, all of which were attributed to electrocution. The highest number of elephant deaths occurred in Pakke Tiger Reserve, with five cases reported. Following that, the Banderdewa Forest Division reported three elephant deaths, while D'Ering Wildlife Sanctuary documented

two deaths. One elephant death was reported each in the Sagalee, Deomali, Namsai, and Dibang Forest Divisions during this period. One elephant death was reported in 2024 due to train accident near the Assam and Arunachal Pradesh Border in the Banderdewa Forest Division.

2.5 Compensation Paid by Arunachal Pradesh Forest Department for Elephant-Attributed Damages

Between 2019 and 2024, Arunachal Pradesh Forest Department paid out INR 70.035 lakh as compensation for 515 cases of crop damage, eight human deaths,

six injuries and 48 cases of property damage. Annual average compensation payment was estimated at INR 14.007 lakh for elephant-related damages (Table 4).

Table 4: Table summarising compensation paid by various Forest Divisions in Arunachal Pradesh for elephant-attributed damages 2019-2024

Forest division	District	Year	Crop damage	Human death	Human injury	Property damage	Compensation paid in Lakh (INR)
Namong	Changlang	2023-24	25	0	0	0	1.25
Banderdewa, Sagalee, Itanagar WLS	Papumpare	2023-24	8	1			5.125
Deomali	Tirap	2023-24	26			9	2.1
Lohit	Lohit	2023-24	2			1	0.15
Along	West Siang	2023-24	7				0.7
Pasighat	East Siang	2023-24	1	1		5	4.35
Khellong	West Kameng	2023-24	9			1	1
Banderdewa, Sagalee, Itanagar WLS	Papumpare	2022-23	71			4	2.49
Khellong	West Kameng	2022-23	1			3	0.11
Along	West Siang	2022-23	1				0.05

Forest division	District	Year	Crop damage	Human death	Human injury	Property damage	Compensation paid in Lakh (INR)
Pasighat	East Siang	2022-23	41			2	1.61
Nampong & Changlang	Changlang	2022-23	39	1		2	5.32
Deomali	Tirap	2022-23	26	1	1	2	6.97
Lohit	Lohit	2022-23	41				1.57
Namsai	Namsai	2022-23	6				0.12
Dibang	Lower Dibang	2022-23	4			1	0.4
Banderdewa, Sagalee, Itanagar WLS	Papumpare	2021-22		2			9
Khellong	West Kameng	2021-22		1			4
Kanubari	Longding	2021-22			1		2.5
Banderdewa, Sagalee, Itanagar WLS	Papumpare	2020-21	45			3	4.7
Hapoli	Lower Subansiri	2020-21		1			0
Deomali	Tirap	2020-21	32				3.2
Dibang	Lower Dibang	2020-21	1				0.1
Lohit	Lohit	2020-21	29			2	2.84
Banderdewa, Sagalee, Itanagar WLS	Papumpare	2019-20	12		1		2.67
Pasighat	East Siang	2019-20	51				2.55
Deomali	Tirap	2019-20				1	0.06
Dibang	Lower Dibang	2019-20					
Namsai	Namsai	2019-20	6		2		2.07
Khonsa	Longding	2019-20			1		1
Pakke TR	Pakke Kesang	2019-20	31			12	2.03



3. HOTSPOT SPECIFIC DETAILS OF HUMAN-ELEPHANT CONFLICTS

3.1 Pakke Kessang

In Pakke Kessang district, the majority of the HEC incidents were confined to the foothill region of Seijosa (Figure 21). As per the census report 2011, Seijosa block has a total human population of 5,519 with 1,078 number of households. People here primarily depend on agriculture, including *jhum* cultivation, for their livelihood. In addition, they engage in tourism and horticulture. They also depend on the forest for collecting forest produce, hunting and fishing.

Paddy is the area's major crop, followed by millets, vegetables, betelnut, and banana. Crop damages are mainly reported during the monsoon, post-monsoon and winter months (Figure 23). House damage and property damage cases are also reported from this

area frequently as the area is adjoining the Pakke Tiger Reserve which is the core habitat of elephants. Crop raiding incidents are reported in the nearby villages in the Seijosa. Between 2007 and 2024, an average of 33.43 (± 6.86) cases of crop damage and 1.72 (± 0.83) house and property damage cases were reported every year (Figure 22). In the case of human casualties, two human injury cases were reported during the same period.

Driving elephants from crop fields and settlements are the most common methods practiced by the villagers and the forest department to prevent damages. People use firecrackers, drum, tin, and loudspeaker to make noise to drive elephants.

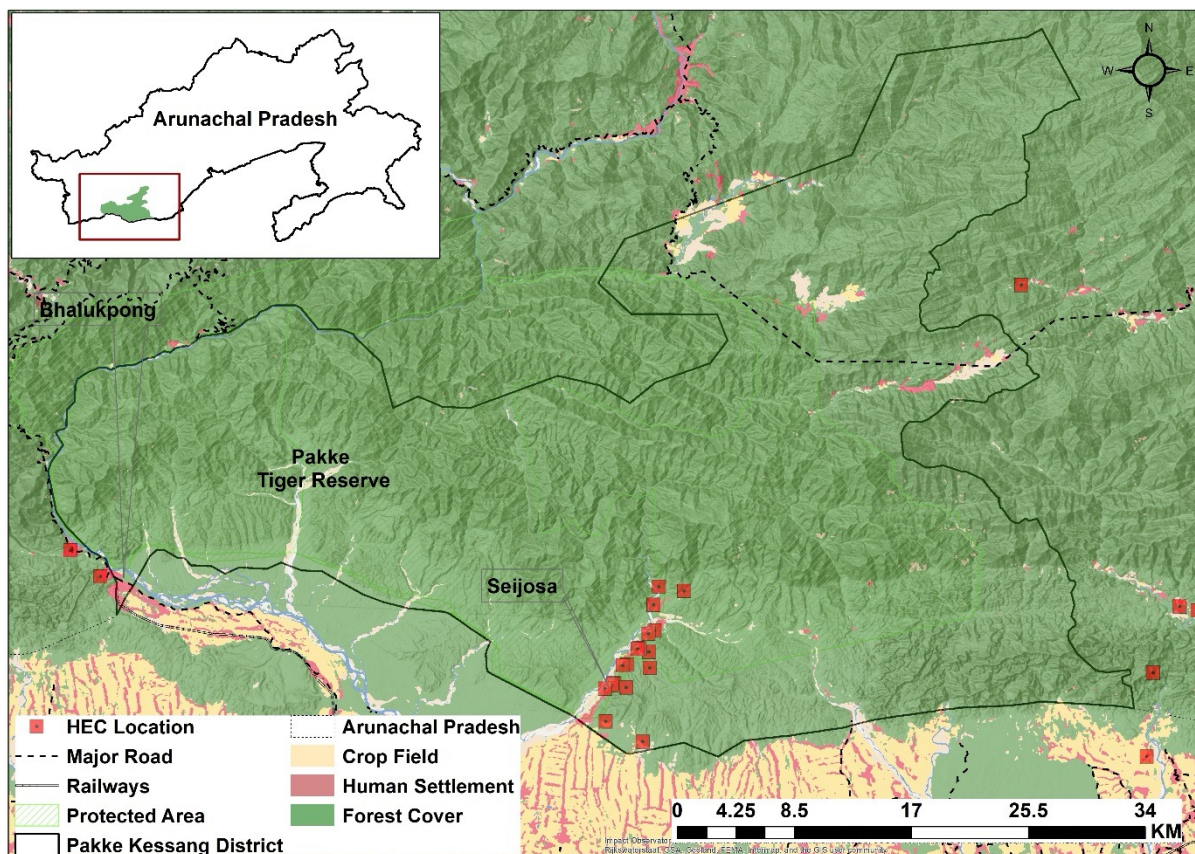


Figure 21: Map depicting locations of elephant-attributed damages in Pakke Kessang district between 2007 and 2014

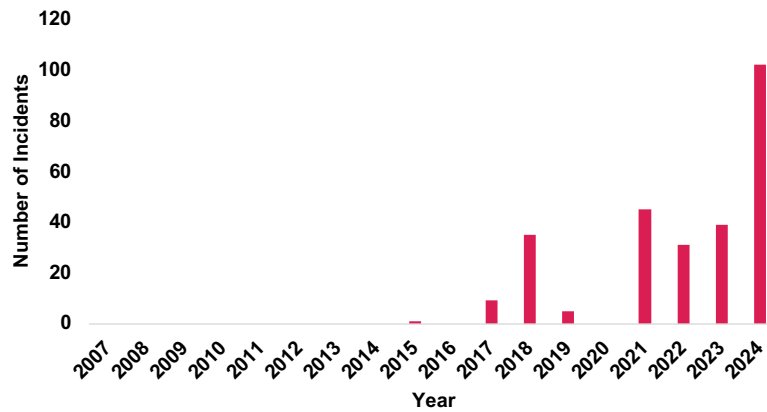


Figure 22: Year-wise count of elephant-attributed damages in Pakke Kessang district between 2007 and 2024

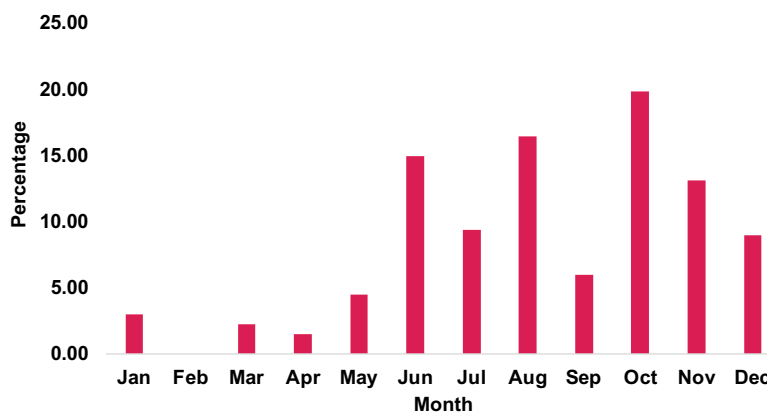


Figure 23: Month-wise proportion of HEC incidents in Pakke Kessang district in Arunachal Pradesh

3.2 Papum Pare

In Papum Pare district, two Forest Divisions, i.e. Banderdewa and Sagalee and the Itanagar Wildlife Sanctuary area, experience relatively high levels of damage due to elephants. Human density of Papum Pare district as per the 2011 census report is 51.03 persons per km² with a total population of 1,76,573 in a total 3,462 km² area. More than 50% of the population depends on agriculture for their livelihood. Paddy, maize and millets are the primary crops grown in this area. *Jhum* cultivation is commonly practised, especially in the forests in and around Sagalee and Banderdewa Forest Divisions. Apart from agriculture, business, livestock rearing, fish farming, horticulture, and mining are major occupations. The Nyishi community is the major ethnic tribe of the region. People here depend on the forest for the collection of forest produce, hunting, and fishing.

Damages due to elephants are confined to the low lying areas from the foothill region up to 2,000 m elevation (Figure 24), where elephants comprising small herds (5-6) and solitary bulls are observed in crop fields. An average of 17.16 (\pm 8.55) cases of crop damage, 0.56 (\pm 0.32) cases of house and property damage every year and a total of eight human casualties were reported between 2007 and 2024 (Figure 25). The HEC related damages are widespread across the division and occurred mostly during cropping season between June to January (Figure 26). The area has a high forest cover, and the dominant forest type is semi evergreen forest. HEC mitigation strategy primarily involves driving elephants using firecrackers, drums, and tin. An elephant death due to a train collision has also been reported from this area in the Doimukh Forest Range.

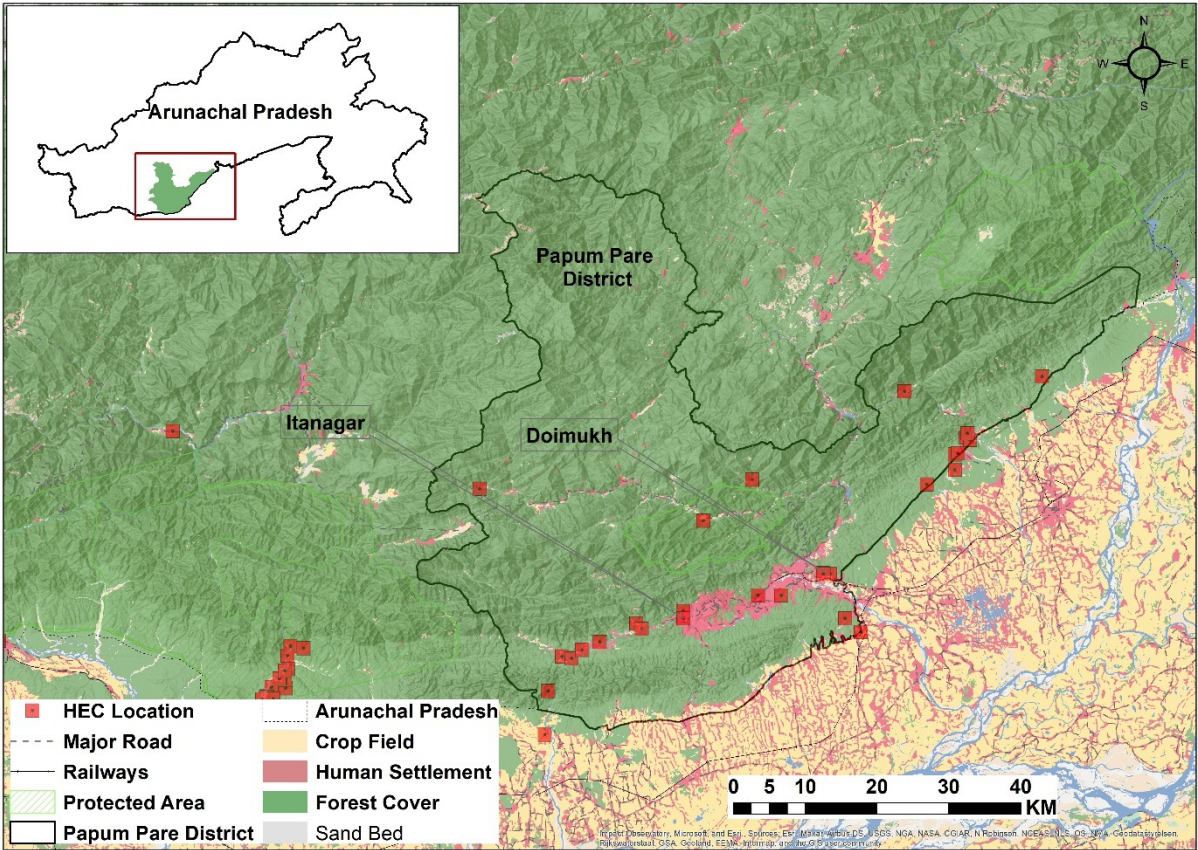


Figure 24: Map depicting locations of elephant-attributed damages in Papum Pare district between 2007 and 2014

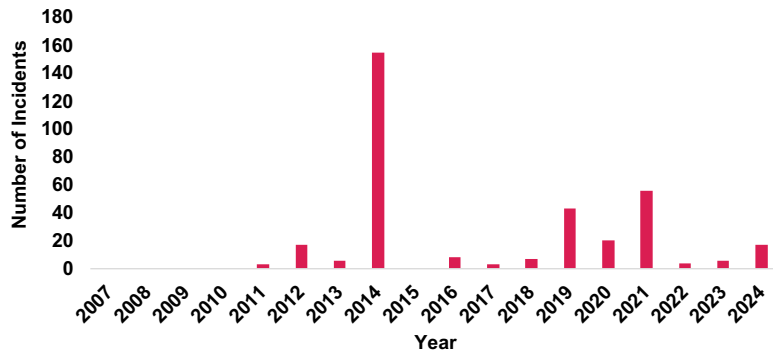


Figure 25: Year-wise count of elephant-attributed damages in Papum Pare district between 2007 and 2024

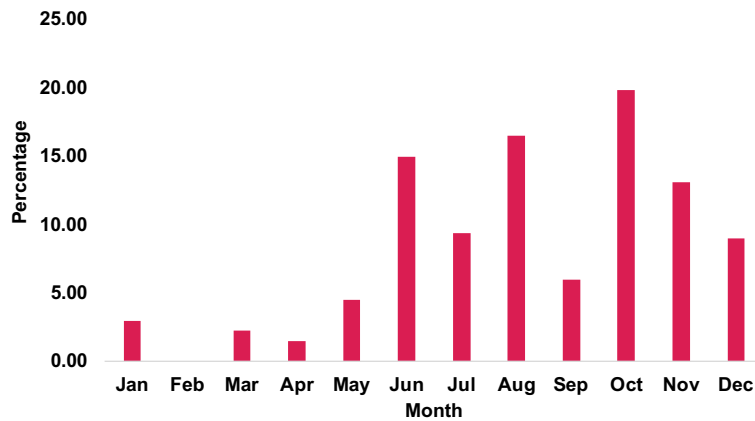


Figure 26: Month-wise proportion of HEC incidents in Papum Pare district in Arunachal Pradesh

3.3 East Siang

HEC in East Siang District is confined to Pasighat Forest Division (Figure 27), as D'Ering Memorial Wildlife Sanctuary has no human settlements in its jurisdiction. Mebo, Railling, Motum, Rani, and Berung are the villages located in the foothill regions of this district, experiencing recurring incidents. HEC in this area is primarily crop loss by elephants, which occurs between September and April (Figure 29). Between 2007 and 2014, an average of 30.54 (± 6.54) crop damage incidents, and 1.06 (± 0.35) house and property damage cases were reported every year and three human casualties reported (Figure 28).

The human population of this district is 81,882 as per the 2011 census. The Galo and Mishing communities are the dominant tribes in the district. Paddy is the major crop grown along with maize, millets, and vegetables. This area is also known for orange cultivation as a horticulture crop. Agriculture is the major source of livelihood. Besides, people depend on the forests for forest produce, hunting, and fishing. Private cultivators have recently adopted oil palm plantations. The residents also practice *jhum* cultivation, and plant oil palm in the forest areas.

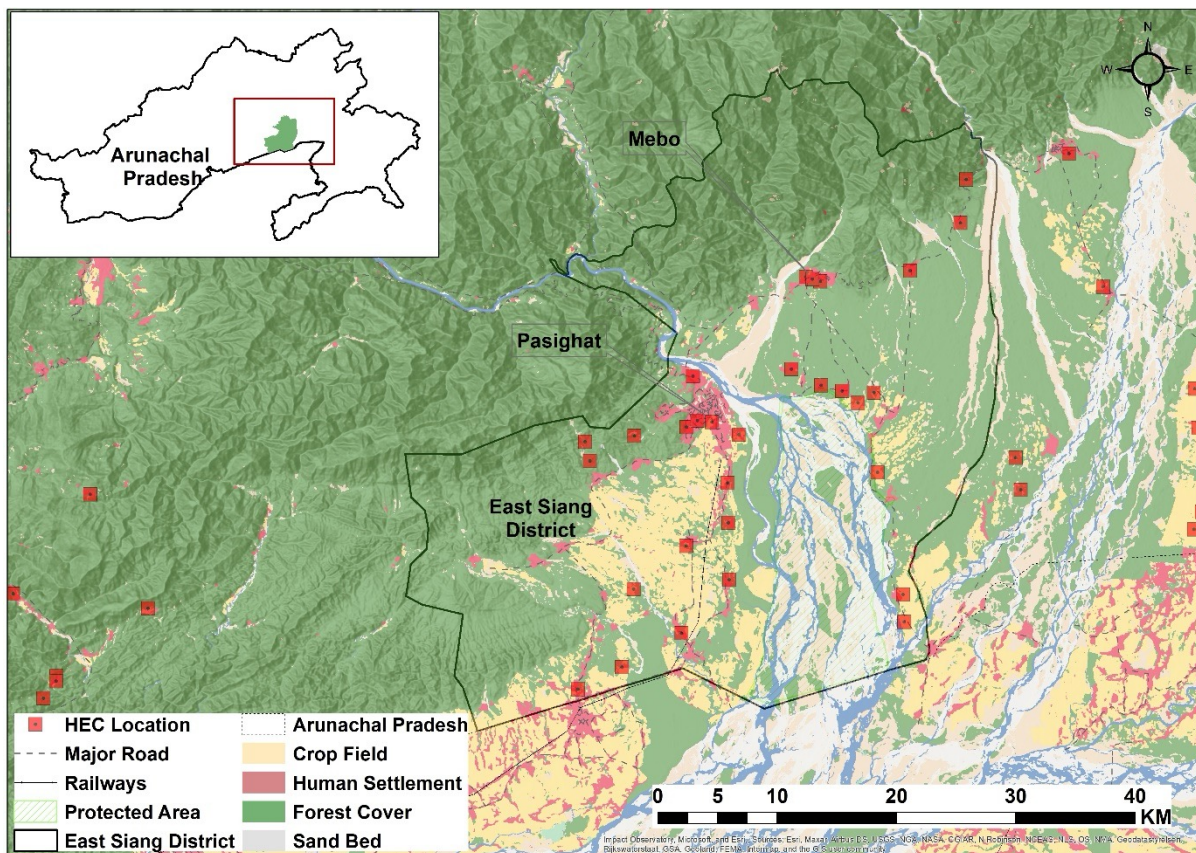


Figure 27: Map depicting locations of elephant-attributed damages in East Siang district between 2007 and 2014



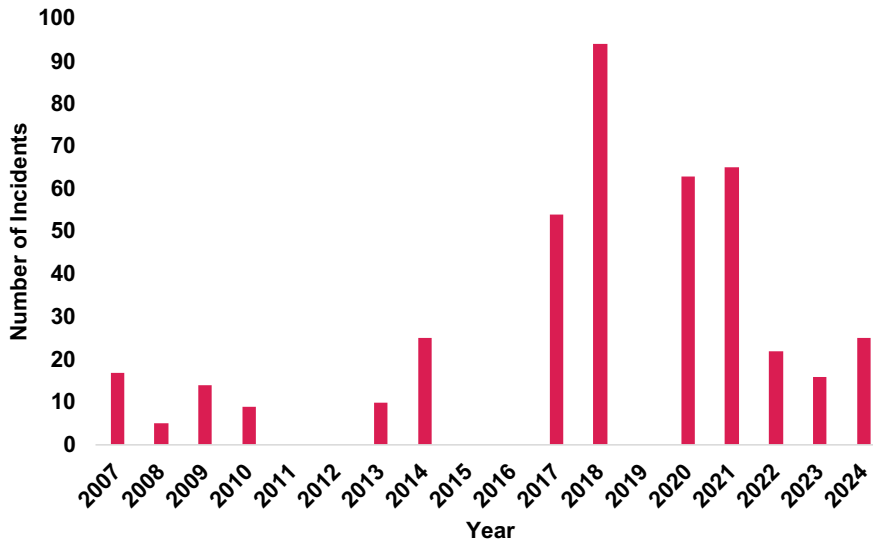


Figure 28: Year-wise count of elephant-attributed damages in East Siang district between 2007 and 2024

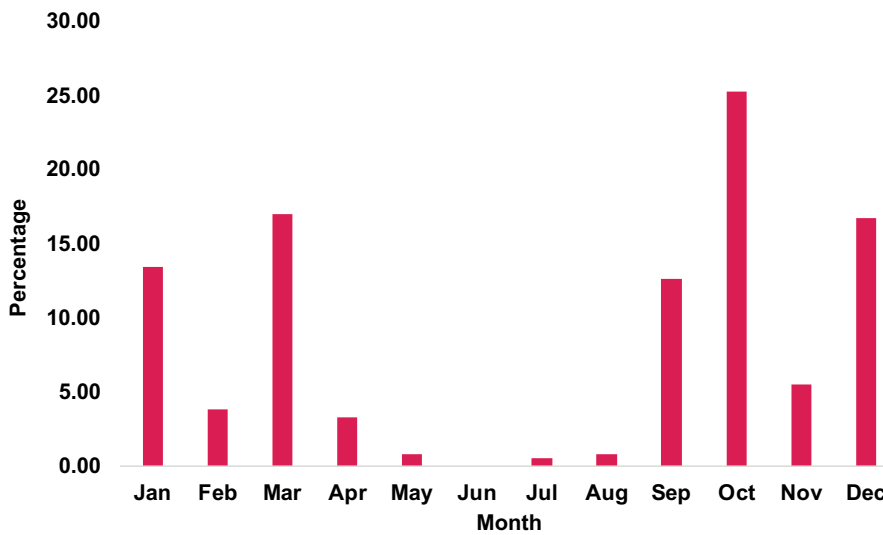


Figure 29: Month-wise proportion of HEC incidents in East Siang district in Arunachal Pradesh

3.4 Lohit

HEC in the Lohit district mostly pertains to crop damage restricted to certain areas in the foothills region (Figure 30), where elephants range in the districts (areas between 150 and 500 m in elevation). Bhekuliang, Paya, and Sunupura are the villages that experience recurrent losses due to elephants. According to local residents, damage due to elephants is a recent issue in this district and is gradually increasing. Based on the decadal reports of elephant-caused damages, damages were observed after 2018, with most of the incidents observed during the monsoon months of August to October (Figure 31 - 32). Between 2018 and 2024, an average of 16.60 (± 5.23) crop damage cases and 0.43 (± 0.20) cases of house and property damages were reported yearly. The forest type is mainly tropical moist

deciduous and semi evergreen. Lohit is the major river in this landscape, joined by many small and medium streams and rivers, making its river islands a productive elephant habitat.

Lohit district has a population of 1,45,726 as per the 2011 census and a density of 27.96 persons per km². Mishmi, Adi and Tai-Khampti communities are the indigenous tribes of the district. Agriculture is the predominant source of livelihood, with paddy, maize, and millet being major crops grown along with seasonal vegetables and oranges as horticulture crops. People also grow tea in the foothill regions. *Jhum* cultivation is commonly practised, and people have recently started cultivating oil palm.

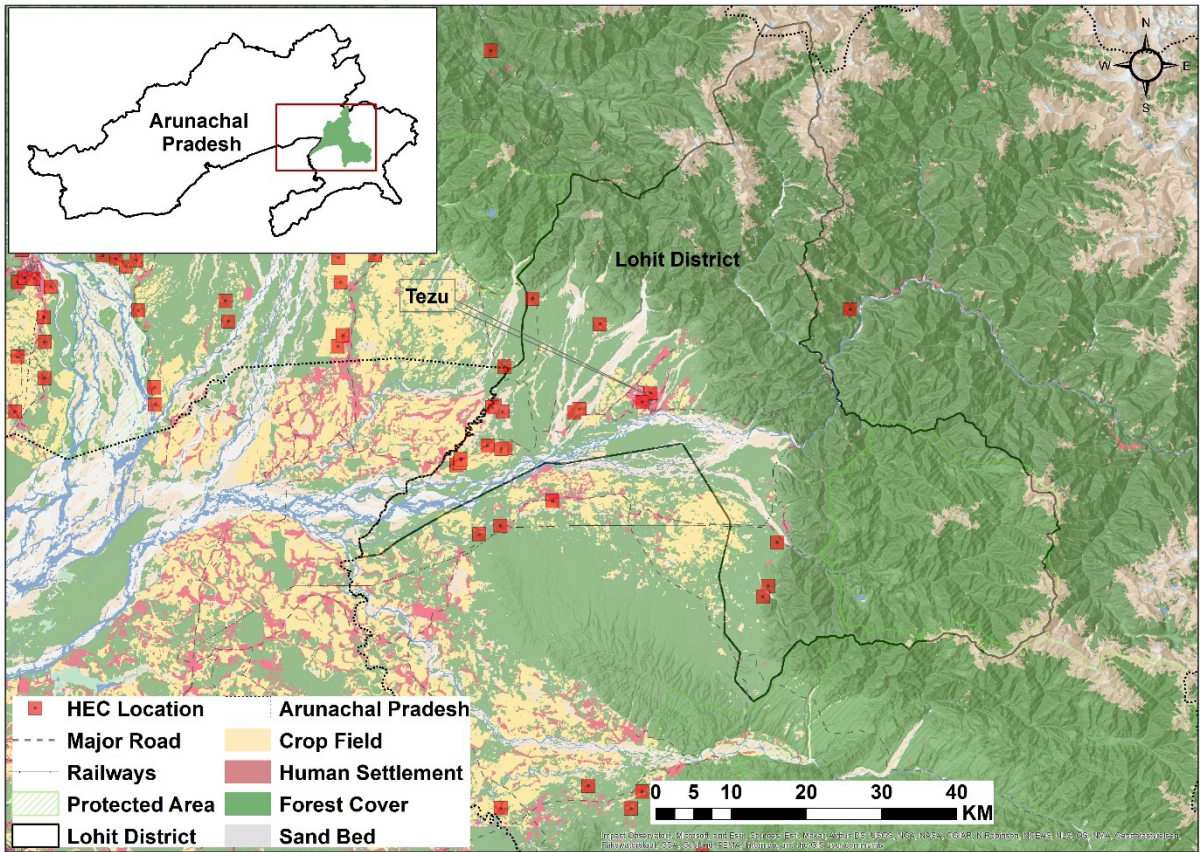


Figure 30: Map depicting locations of elephant-attributed damages in Lohit district between 2007 and 2014

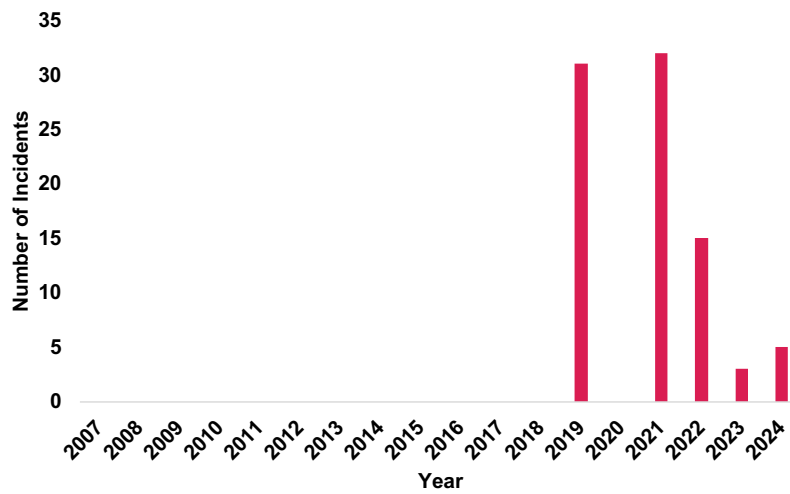


Figure 31: Year-wise count of elephant-attributed damages in Lohit district between 2007 and 2024

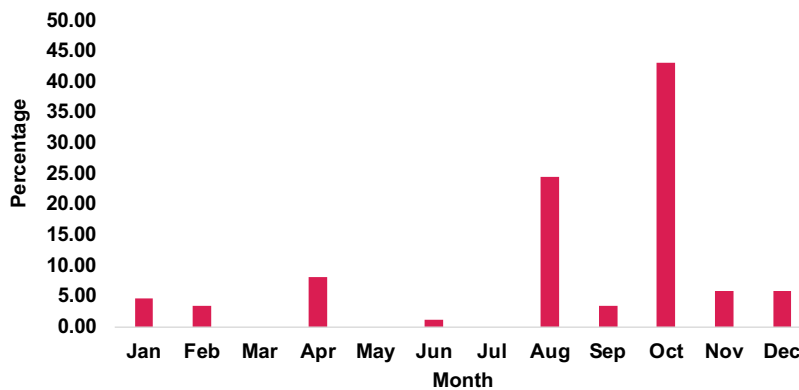


Figure 32: Month-wise proportion of HEC incidents in Lohit district in Arunachal Pradesh

3.5 Changlang

The Changlang district has two Forest Divisions, Changlang and Nampong. Both divisions have reported HEC in the last few years. Like Lohit, HEC is a new issue for these divisions, with cases being reported only since 2021 (Figure 34). Longshang, Namphuk, Old Longtoi, Old Champu are the villages reporting the highest HEC incidents in the district. Among the forest ranges, Namphai is the forest range located close to the Assam border near the Namphai Reserve Forest which experiences the highest magnitude of HEC in the district (Figure 33). Between 2021 and 2024, an average of 8.50 (± 3.12) crop damage cases were reported yearly. Besides this, two cases of house damage and two human casualties, including one death, were reported during the same period. In Changlang, crop damage occurs in the rainy and the winter months between elevations of

150 to 800 m and is the predominant manifestation of elephant-caused damages (Figure 35). Elephant habitat in this district is primarily close to the Assam border in the foothills and up to an altitude of 1,000 m. The forest type is dominated by semi-evergreen and evergreen forest. Namdapha is the major river in this landscape.

Changlang district has a human population of 1,48,226 in an area of 4,662 km². Tangsa, Singpho, Tutsa, and Nocte are the major tribes of the district. Similar to other districts, agriculture is the mainstay of the local economy. People grow paddy, maize, vegetables, millet, chilli, ginger, mustard, local pulses, sugarcane, orange, banana, papaya, guava and litchi. *Jhum* cultivation is commonly practised.

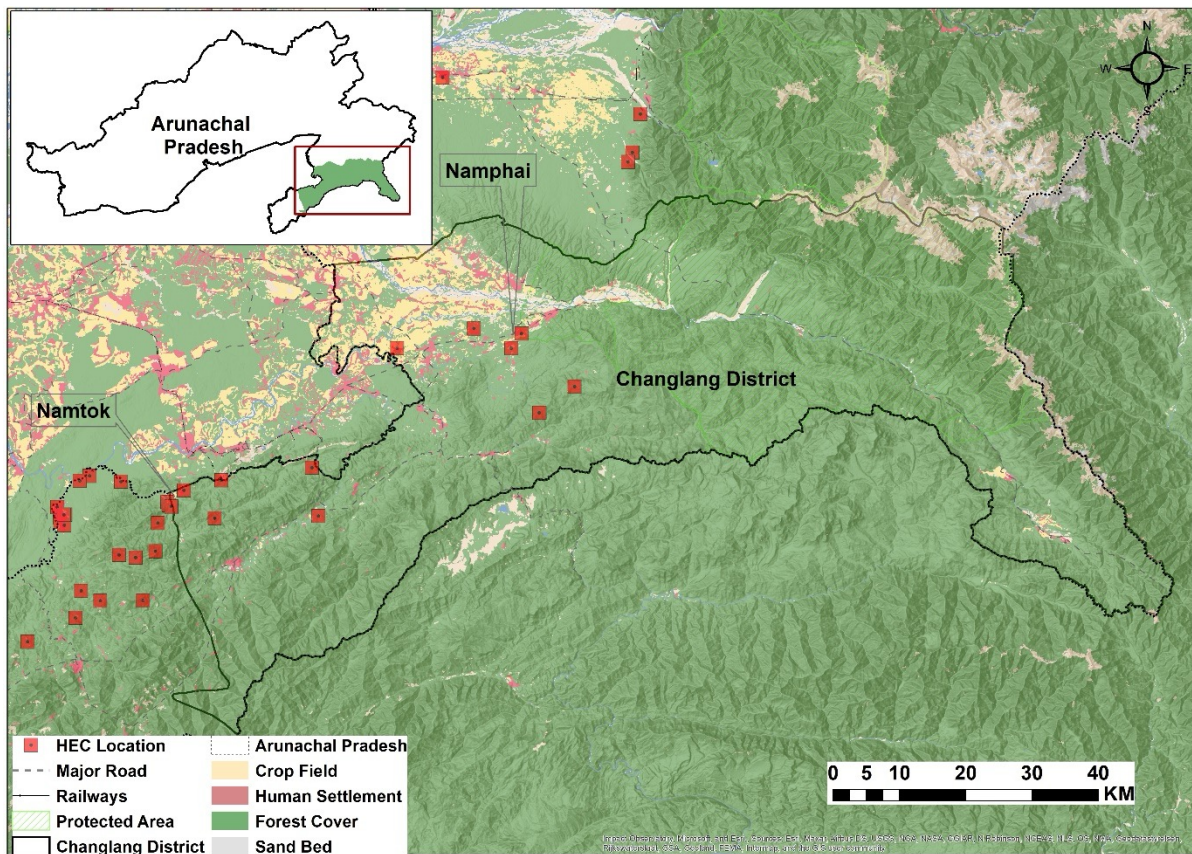


Figure 33: Map depicting locations of elephant-attributed damages in Changlang district between 2007 and 2014



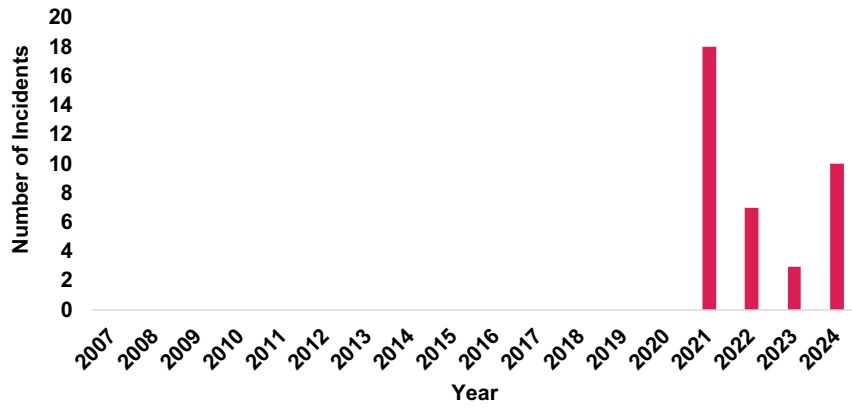


Figure 34: Year-wise count of elephant-attributed damages in Changlang district between 2007 and 2024

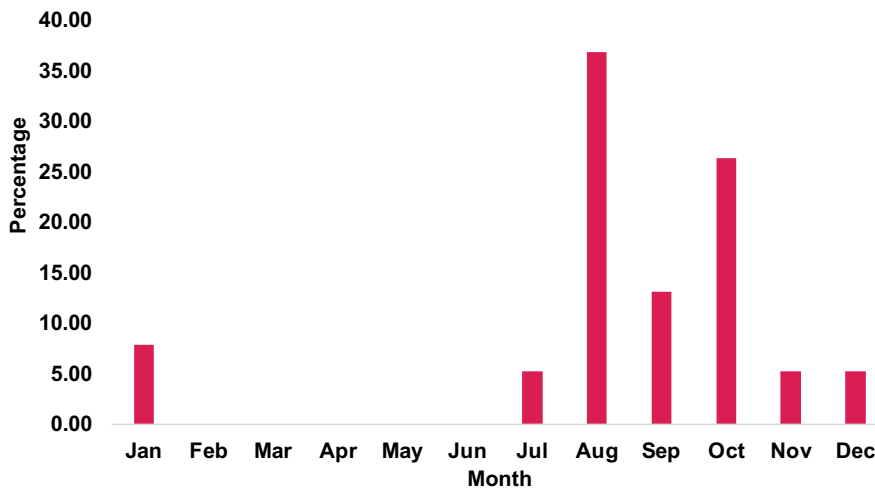


Figure 35: Month-wise proportion of HEC incidents in Changlang district in Arunachal Pradesh

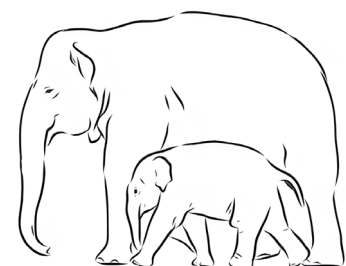
3.6 Tirap

The Tirap district comprises the Deomali Forest Division. HEC in this division mostly occurs during the monsoon and winter seasons (Figure 38). Although HEC is widespread and occurs between elevations 150 m and 1,000 m, the majority of the incidents are confined to the Deomali town (Figure 36). Analysing the HEC trend of the past few years, it is evident that HEC is a recent phenomenon that is gradually increasing. Between 2021 and 2024, the annual average crop damage incidents were 14.75 (± 3.12). Considering the house and property damages, the annual average incidents were 5.00 (± 1.47) and a total 5 casualties including both human injuries and deaths, were reported between 2013 and 2024 (Figure 37).

As per the 2011 census, Tirap district has a population of 1,11,975 in a total geographic area of 2,362 km². Nocte, Wancho and Tutsa are the dominant tribes of this district. Agriculture is the primary source of livelihood, and people grow paddy, maize, and millet

along with seasonal vegetables and fruits such as oranges, pineapples, and bananas.

Elephant habitat in this district is primarily close to the Assam border in the foothills up to 1,000 m altitude. The Dehing Patkai National Park, located in Assam, is the major elephant habitat adjacent to Deomali town, with elephants known to visit the area during the paddy season between June and January. The forest type is dominated by evergreen and semi-evergreen forest. Tirap, Namchik and Nampbok (Buri Dihing) are the major rivers in this landscape.



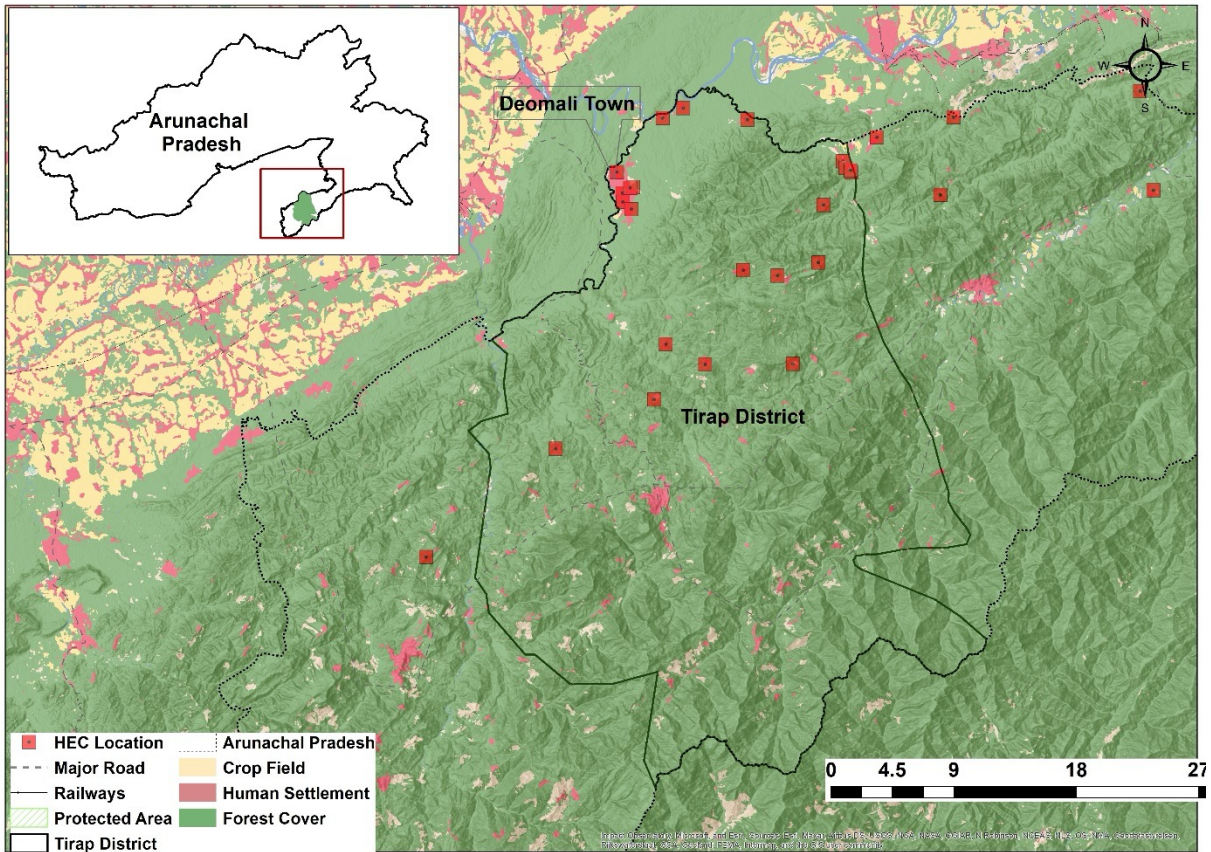


Figure 36: Map depicting locations of elephant-attributed damages in Tirap district between 2007 and 2014

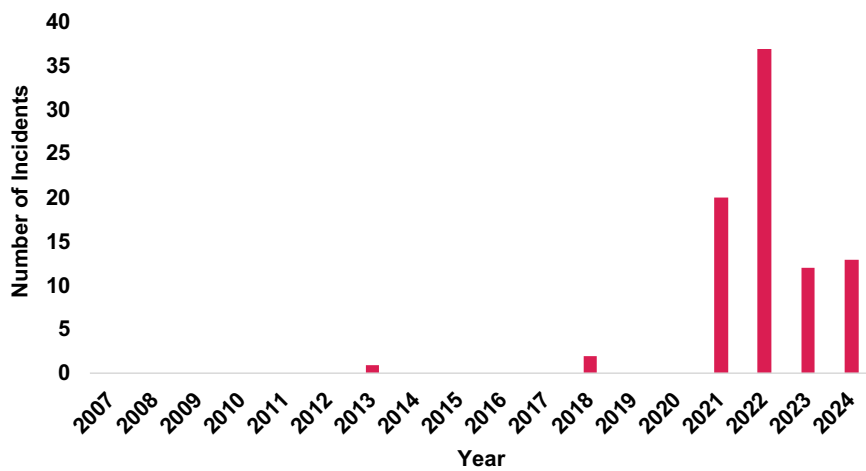


Figure 37: Year-wise count of elephant-attributed damages in Tirap district between 2007 and 2024

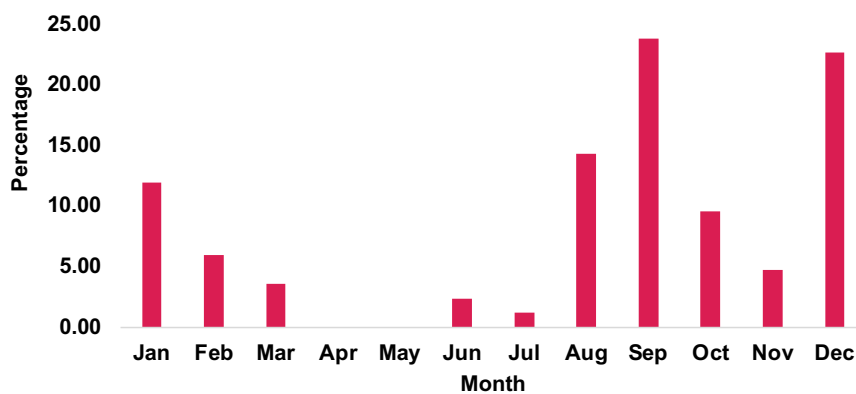


Figure 38: Month-wise proportion of HEC incidents in Tirap district in Arunachal Pradesh



4. PRIMARY DRIVERS OF HUMAN-ELEPHANT CONFLICT

4.1 Land Use Land Cover Change of the Human-Elephant Conflict Hotspot Districts

As observed in other elephant landscapes, land-use land-cover change (LULC) is one of the primary drivers of HEC. In Arunachal Pradesh, we analysed the LULC between 2018 and 2023 using the Sentinel Data from the ESRI portal. We considered only the HEC hotspot districts of Arunachal Pradesh to understand the LULC change in the last five years.

Agricultural land was observed to be reduced in all the six districts, which could have been converted to plantations (Table 5). Similarly, water bodies were also observed to be reduced in the last five years in all the districts. In Changlang, East Siang, Lohit, and Tirap,

the forest area increased, whereas in Pakke Kessang and Papum Pare, the forest cover decreased significantly (Table 5). Shrubland, one of the major land use types, was found to have increased in Changlang, Lohit and Pakke Kessang districts and decreased in East Siang, Lohit and Tirap districts. Built-up areas were found to have increased in all the six districts, of which Tirap showed an 81.37% increase in the last five years. Pakke Kessang and Papum Pare showed an increase in human settlements by 69.4% and 64.1%, respectively. Similarly, Changlang, Lohit and East Siang also witnessed an increase in human settlements between 2018 and 2023 (Table 5).

Table 5: Change in land use land cover in HEC hotspot districts of Arunachal Pradesh between 2018 and 2023

District	LULC class	Area (Km ²)		Difference (Km ²)	Percentage change
		2018	2023		
Changlang	Water	28.95	27.06	-1.90	-6.56
	Forest	4349.01	4355.32	6.31	0.15
	Agriculture	217.48	188.90	-28.58	-13.14
	Settlements	51.96	77.57	25.60	49.27
	Barren	37.21	16.51	-20.70	-55.62
	Shrub land	229.12	248.69	19.57	8.54
East Siang	Water	73.40	67.56	-5.83	-7.95
	Forest	1118.60	1118.79	0.19	0.02
	Agriculture	204.29	182.29	-22.01	-10.77
	Settlements	38.84	50.57	11.73	30.20
	Barren	59.69	104.82	45.13	75.61
	Shrub land	185.76	156.85	-28.90	-15.56
Lohit	Water	49.49	45.22	-4.26	-8.61
	Forest	2453.14	2472.96	19.82	0.81
	Agriculture	61.03	54.27	-6.76	-11.07
	Settlements	22.18	30.37	8.19	36.90
	Barren	120.26	77.46	-42.80	-35.59
	Shrub land	310.25	336.67	26.42	8.52

District	LULC class	Area (Km ²)		Difference (Km ²)	Percentage change
		2018	2023		
Pakke Kessang	Water	6.92	6.18	-0.74	-10.66
	Forest	1853.24	1848.83	-4.41	-0.24
	Agriculture	9.92	5.36	-4.56	-45.98
	Settlements	5.26	8.91	3.65	69.40
	Barren	7.29	3.92	-3.37	-46.20
	Shrub Land	25.83	35.26	9.43	36.51
Papumpare	Water	10.85	9.78	-1.06	-9.81
	Forest	3207.40	3179.44	-27.96	-0.87
	Agriculture	38.98	30.87	-8.11	-20.81
	Settlements	69.40	113.92	44.51	64.14
	Barren	3.14	1.24	-1.90	-60.37
	Shrub land	44.84	39.49	-5.34	-11.92
Tirap	Water	1.86	1.72	-0.15	-7.85
	Forest	1124.20	1125.51	1.31	0.12
	Agriculture	0.61	0.31	-0.31	-49.98
	Settlements	10.60	19.22	8.62	81.37
	Barren	0.09	0.01	-0.08	-87.68
	Shrub land	37.61	28.21	-9.40	-25.00

Source: <https://livingatlas.arcgis.com/landcover/>

4.2 Agriculture Profile of Human-Elephant Conflict Hotspot Districts

The agricultural profile of the six human-elephant conflict hotspot districts in Arunachal Pradesh shows notable variation in crop diversity and the extent of cultivation. Changlang has the largest agricultural area at 43,907 hectares, with a wide variety of crops including wet and upland rice, millet, maize, tubers, vegetables, spices, fruits, and plantation crops like betel nut and tea. East Siang, with 22,813 hectares, and Papumpare, with 18,992 hectares, also have significant areas under cultivation, with a variety of crop grown.

Lohit and Tirap support moderately large agricultural landscapes, with 11,409 hectares and 11,028 hectares, respectively, while Pakke Kessang has the smallest area of farmland at just 992 hectares.

Overall, rice cultivation predominant across the districts, complemented by millets, maize, horticultural and plantation crops (Table 6). This reflects both subsistence farming and cash crop cultivation, which increase the interaction with elephant habitats.



Table 6: District population and crop types of the HEC hotspots of Arunachal Pradesh

District	Human population	Agriculture area (ha)	Major crops grown
Changlang	148226	43907.48	Rice, wet rice, upland rice, millet, maize, yam, arum, tapioca, sweet potato, chilli, ginger, garlic, potato, pumpkin, gourd, brinjal, betel vine, oilseed, spices, orange, banana, pineapple, betel nut, tea.
East Siang	99214	22812.77	
Lohit	145726	11408.74	
Pakke Kessang	15358	992.41	
Papumpare	176573	18992.16	
Tirap	111975	11027.53	

Source: Human Census Data 2011 (<https://www.census2011.co.in/>), Arunachal Pradesh Agriculture Contingency Plan, 2019 (<https://agricoopgov.org/en/AgricultureContingencyPlan/ARUNACHAL%20PRADESH.html>)

4.3 Impermeable Infrastructure Development

DULUNG-SUBANSIRI CORRIDOR

The Dulung-Subansiri Corridor connects elephant populations of Panir Reserve Forest (Banderdewa Forest Division, Arunachal Pradesh) and Dulung Reserve Forest with Subansiri Reserve Forest (Lakhimpur Forest Division, Assam) across the Subansiri River, and facilitates elephant movement between these areas (Figure 39). This corridor is disturbed due to the establishment of the NHPC hydro project on the Subansiri River. The ancillary development, such as project township and roads, has also changed the land use in the corridor region. In addition, sand mining along the river has further hindered elephant movement through this corridor in recent times.

EXPANSION OF NATIONAL HIGHWAY 13

The expansion project of NH 13 from Nechipu to Hoj, passing through Seppa, Khodaso, and Sagalee, was completed in 2023. This project transformed the one way road into a two lane highway with paved shoulders. Additionally, two infrastructure projects, the Ranga River and Pare River hydro power projects, were recently developed. This newly built infrastructure may have disrupted the movement of elephants in the area. According to local forest officials, a group of 25 to 30 elephants has become isolated in a small patch of forest on the left bank of the Pare River, on the northern side of NH 13, within the Sagalee Range of Sagalee Forest Division (Figure 40). These elephants frequently come into conflict with nearby villages, including Ompuli, Khyunglo, Dapo, and the 47 and 52 km Camps. Furthermore, movement restriction and isolation also have implications for long term viability of the elephant sub- population here.



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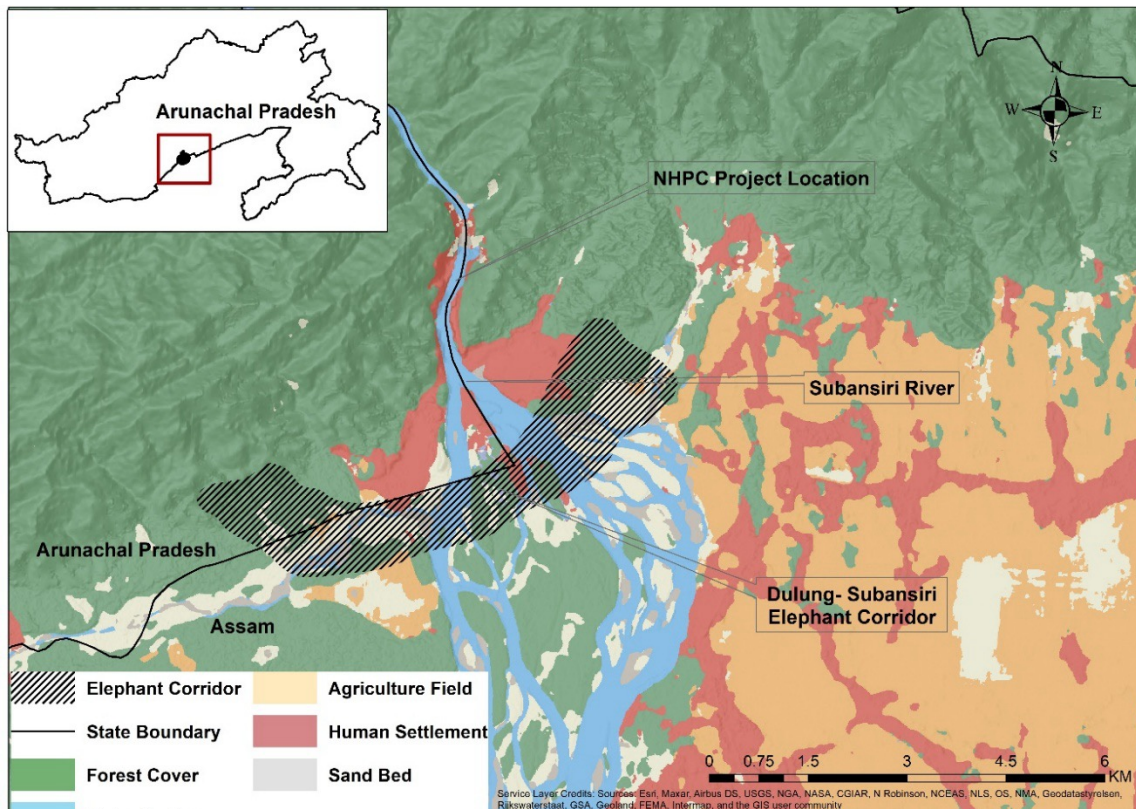


Figure 39: Map showing location of Dulung-Subansiri elephant corridor

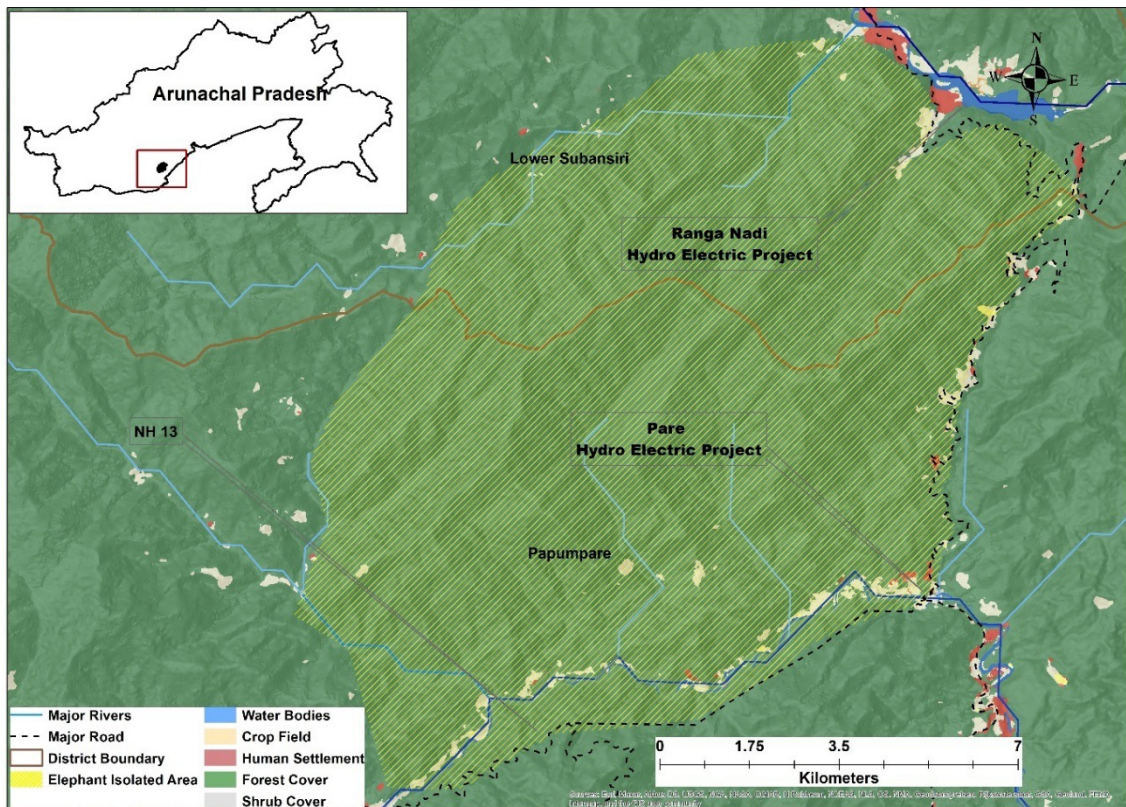


Figure 40: Map depicting range restriction of elephant herd based on information provided by Arunachal Pradesh Forest Department

4.4 Incidental Field Observations

ELEPHANT PRESENCE IN HIGH ELEVATION OF 3,266 M (± 10 M)

In Arunachal Pradesh, elephant distribution was earlier observed primarily in the foothill region and occasionally moving up to an altitude of 2,000 meters. Damages due to elephants in Arunachal Pradesh also followed the distribution pattern of elephants, wherein it primarily occurred in the foothill region with a

few exceptions above 1,000 and 1,500 m altitude. In Eaglenest Wildlife Sanctuary of Shergaon Forest Division, elephant presence has been reported above 3,000 m (Figure 41). During the study, elephant signs were reported at an elevation of 3,266 m (Figure 42). Further north of Eaglenest, elephant presence and HEC were reported from the Tenga valley of the Shergaon forest range. A herd of 5-6 elephants and solitary elephants were often reported in crop raiding incidents in the Tenga valley area.

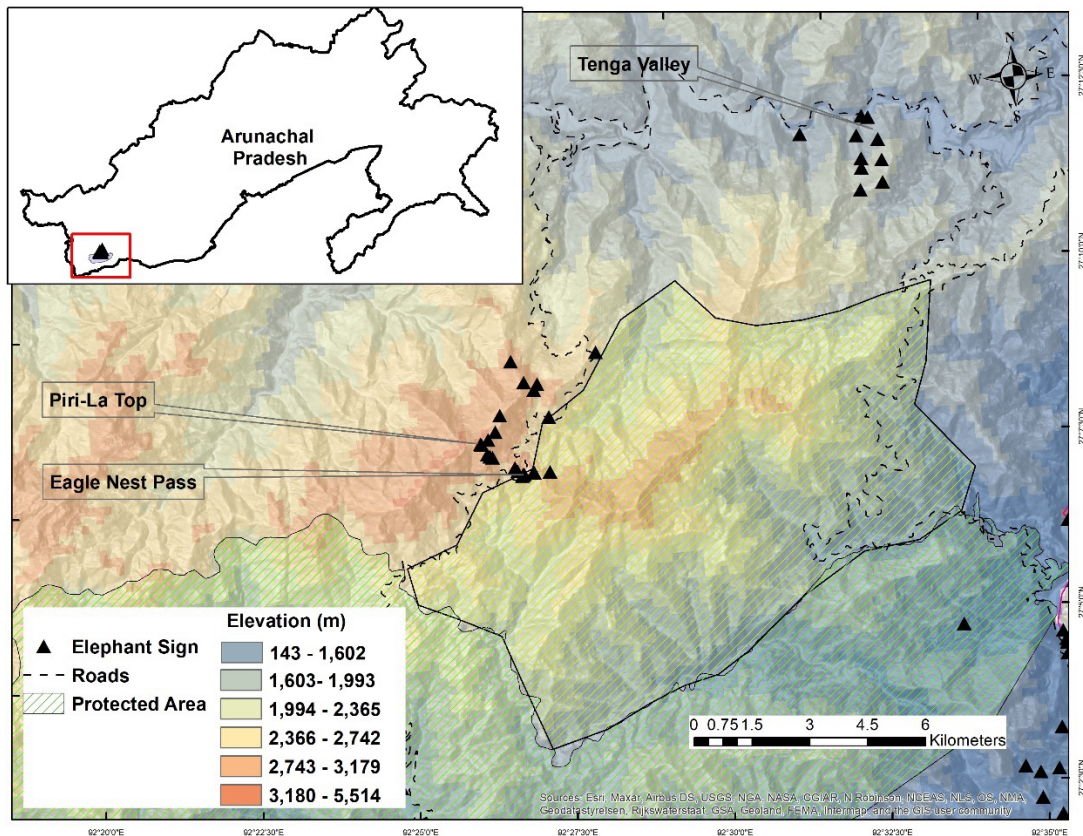


Figure 41: Map showing elephant signs recorded in high elevation areas of Arunachal Pradesh



Figure 42: Elephant habitat in Eaglenest Wildlife Sanctuary above 3,000 m a.s.l.



5. CONFLICT MANAGEMENT STRATEGY FOR ARUNACHAL PRADESH

A Human-Elephant Conflict management strategy is presented in this section based on the problems identified in the previous sections of this document. Elephant distribution in Arunachal Pradesh is concentrated along the remnant low-lying forests adjoining elephant distribution areas in Assam. These areas have forest types and terrain that are conducive for elephant presence. However, these productive habitats are also ideal for cultivation and human settlements. Hence, there is increasing pressure on these areas, necessitating an urgent plan to reconcile human development and infrastructure needs with that of habitat conservation since these habitats also provide vital ecosystem services. Elephant is an ideal flagship to conserve these habitats as the species ranges over vast areas and planning for landscape level conservation at the scale of elephant habitats can ensure that the ecological integrity of these landscapes are maintained. While managing adverse interactions between people and elephants will be of paramount importance, addressing the drivers and pressures will also be critical. The following sections define the high-level outcomes that would need to be achieved to enable coexistence.

The strategy hinges on two approaches, the first is to minimise risks and costs to people and elephants in priority Forest Divisions, the second is to address the drivers and pressures by securing elephant habitats, corridors and protecting the populations.

Based on the trends of reported elephant-attributed damages, six divisions have been identified as high priority and a prioritisation framework for the activities has also been provided based on consultation with Divisional Forest Officers of all elephant-bearing forest divisions. The six high priority divisions include Pakke Kessang, Papum Pare, East Siang, Lohit, Changlang, and Tirap (Table 7).

STRATEGIC OUTCOMES FOR MANAGING HUMAN-ELEPHANT CONFLICT IN ARUNACHAL PRADESH

As per the current context and situation of elephant presence in Arunachal Pradesh, it is evident that elephants range well beyond the protected areas. Hence, considerable overlap between elephants and local communities is expected, which may lead to a host of interactions, ranging from positive to adverse, with adverse interactions manifesting as crop loss, economic loss, human casualties and elephant deaths. A consensus-building workshop was organised in October 2024 with representatives from Arunachal Pradesh Forest Department, local community representatives and representatives from line departments from across the elephant range in the State. The primary challenges faced by the stakeholders in managing human-elephant interactions were discussed and a vision plan was created for elephant conservation in the State.



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Table 7: Comparative summary of the hotspots of human-elephant conflict in Arunachal Pradesh

Division	Major challenges	Average annual crop damage incidents	Average annual human casualties	Extent of issue
Pakke Kessang	Crop damage	33.5	0.01	Eastern border Seijosa. Occasional cases on the western border.
Papum Pare	Crop damage and human casualties	17	0.47	Spread along the foothills and Assam border.
East Siang	Crop damage	30.54	0.18	Spread across the district.
Lohit	Crop damage	15.6	NR	Hotspot in the western edge of Kamlang and along the riverine grasslands/islands.
Changlang	Crop damage	8.50	0.18	Western fringe of Namdhpha.
Tirap	Crop damage, property damage, and human casualty	15	0.45	Clustered around Deomali town, but also spread in the northern areas of the division.

Based on inputs from officials of the Arunachal Pradesh Forest Department, local community members, and other key stakeholders, the consensus vision is for elephant populations to coexist with people and thrive in secure and connected habitats. Hence, the initiative's aim has been framed as ensuring safer shared spaces between people and elephants in Arunachal Pradesh. Safer shared spaces indicate the outcome where any land use type where people and elephants co-occur is made compatible for the cohabitation of the two by minimising losses to both sides. The first strategic outcome involves reducing crop and other economic losses, and reducing the risk of human casualties from elephants (Figure 43). The second outcome includes the protection of elephant populations, their critical habitats, and critical corridors (Figure 43). Enriched

habitats, safe populations, and secured corridors will lead to reduced pressures and drivers, while the outcomes around human casualties and crop losses will address the immediate concerns faced by the communities.

Under each strategic outcome, programme objectives have been identified to achieve the desired outcomes. Subsequently, each objective will include several activities and sub-activities to fulfill each objective. A brief overview and mechanism of each activity and sub-activity has been provided to serve as a template for the development of division-level or landscape-level plans for elephant conservation and conflict management (Figure 44 & 54).

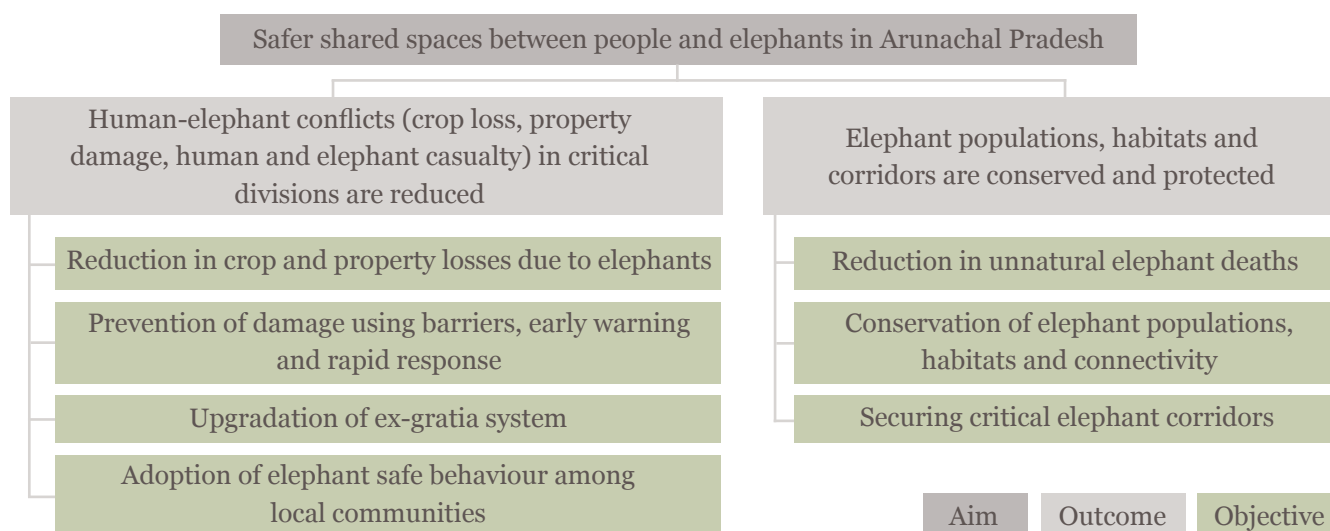


Figure 43: Schematic representation of human-elephant conflict management strategy for Arunachal Pradesh

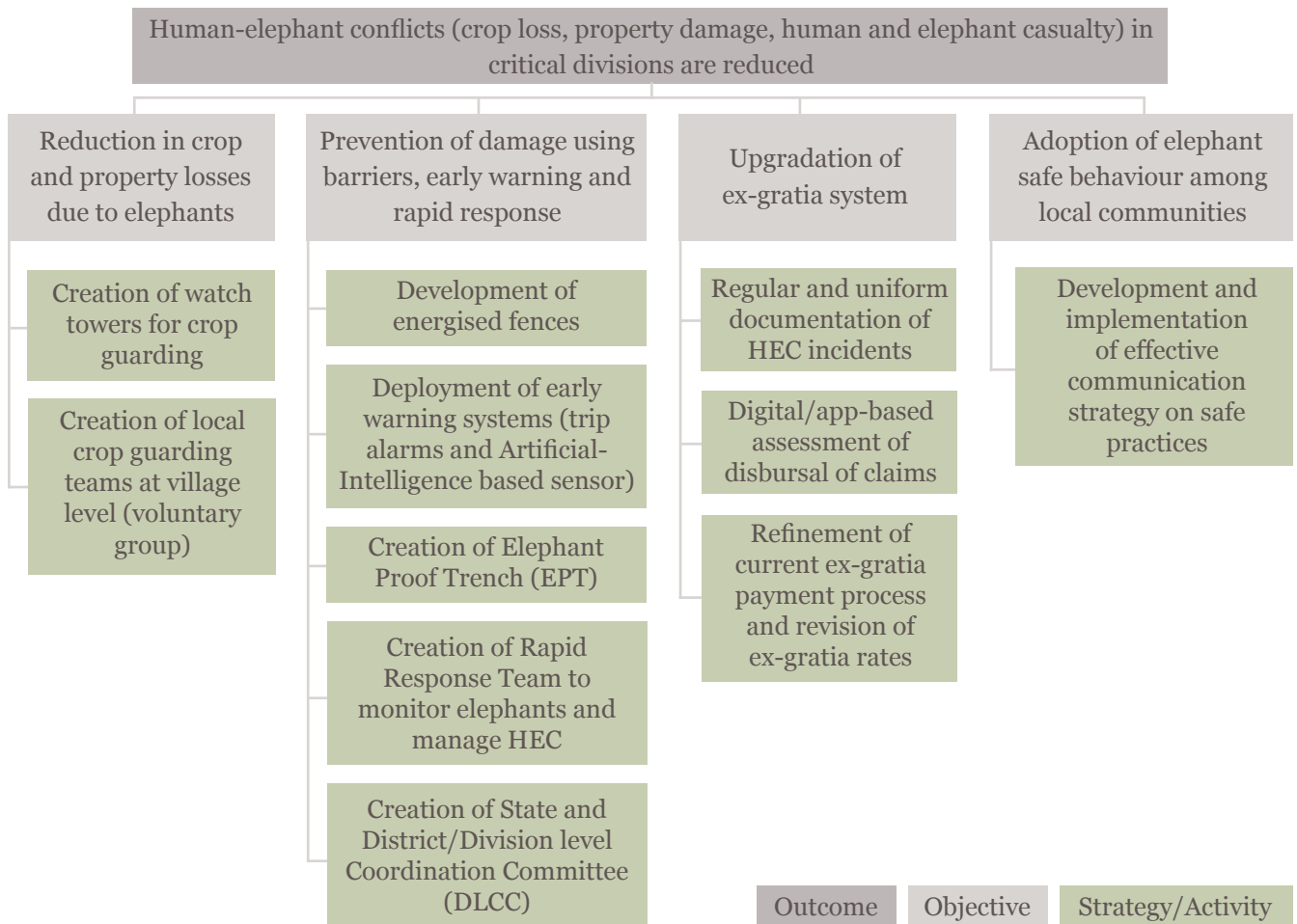


Figure 44: Schematic representation of strategic outcome 'A', including objectives and activities to reduce human life loss, crop losses and other economic losses



5.1 Strategic Outcome A: Human-Elephant Conflict (crop loss, property damage, human and elephant casualties) Management in Critical Divisions

The outcome of reduced crop losses and property damage can be achieved through three primary objectives: the first will be through measures that local communities themselves proactively take, the second will be where the State works with the communities to implement specific measures, and the third will be around the revision and streamlining of government ex-gratia processes (Figure 44).

OBJECTIVE A.1: REDUCTION IN CROP AND PROPERTY LOSSES DUE TO ELEPHANTS

Local communities, when adequately equipped for managing the impacts of elephants, may be able to prevent crop losses due to elephants. Across parts of India, community based crop guarding acts as an effective deterrent to crop damage by elephants (Srinivasaiah et al., 2012). Locally made watch towers provide a safe refuge and vantage points for local community members to guard their crops from elephants. Low cost trip alarms may be used in conjunction with these watch towers to provide early warning of elephant presence near crop fields. The suggested activities to enable community based crop protection have been outlined below:

ACTIVITY A.1.1: CREATION OF WATCH TOWERS FOR CROP GUARDING

Use of watch towers for guarding are effective in crop protection from elephants and provide the crop guarders with a clear vantage point to observe elephants from a safe distance. These watch towers may be erected on large trees that elephants cannot easily dislodge (Figure 46). A small platform may be erected at a height of above 20 ft and wooden or bamboo ladders constructed to access these machans/platforms. These local watch towers can

be covered with thatch or tarpaulin to protect the crop protection groups from harsh weather. The crop protection teams can further be equipped with search lights and sirens to ward off elephants from the crop fields. Alternatively, concrete watch towers with advance facilities, including solar panels, water taps, VHF towers and rest rooms, may be created at the interface of crop lands and forests where a hard edge exists between the two (Figure 45). The Forest Department, NGOs or District Administration can provide support for such watch towers. The average cost of temporary watch towers is approximately INR 30,000 to INR 50,000 whereas the average cost of permanent watch towers is approximately INR 15,00,000 to INR 25,00,000.

ACTIVITY A.1.2: CREATION OF LOCAL CROP GUARDING TEAMS

Local agriculture-based communities bear the brunt of crop damage by elephants, especially the farms that are at the periphery of the forests (Anoop et al., 2023; Kshetry et al., 2021; Naha et al., 2019). To prevent the entry of elephants into crop fields, local voluntary groups may be created to guard crop fields and prevent crowd buildup during any elephant related emergency. These teams may be trained and equipped by the Forest Department or NGOs with domain expertise. The equipment can include high power rechargeable searchlights, sirens, megaphones, rain coats, boots, safety jackets etc (Figure 47). These teams may also be trained in filing compensation claims, sharing Do's and Don'ts with local community members, and conducting other local outreach on human-elephant conflict management. Furthermore, these teams may also be involved in installing and maintaining energised fences in their locality to prevent elephant entry into settlements and crop fields while ensuring that elephant corridors between habitats are not blocked. Each team should ideally comprise 5-10

persons, depending on the coverage area, these teams must be established at the village level as a Primary Response Team (PRT). These teams may be named as Village Response Team (VRT), Gaja Mitra Dal (GMD), etc. In this case of establishing such teams at the Division- level, the headquarter

needs to guide the Divisions by developing Standard Operating Procedure (SOP) for such teams while incorporating safeguards to ensure that these teams do not jeopardise human and elephant lives in any manner.



Figure 45: Concrete watch tower for the purpose of guarding crops from elephants and other herbivores



Figure 46: A locally made watch tower on a tree to guard and protect the crop from elephants



Figure 47: Voluntary Response Teams watching out for elephant presence in Assam, India

OBJECTIVE A.2: DAMAGE PREVENTION USING BARRIERS, EARLY WARNING AND RAPID RESPONSE

Strategic use of barriers can minimise the interface between people and elephants, especially in vulnerable locations such as forest fringes, settlements, and crop fields. Barriers can be of different types based on the cost of installation and maintenance. Low cost barriers include single-wire energised fences supported with locally available bamboo poles. NGOs with expertise in installing and maintaining such fences may be involved in training local communities. If ownership and maintenance is taken care of by the local communities, such fences can effectively restrict elephant movement in vulnerable areas (Kamdar, 2020).

Elephant Proof Trenches (EPT) are also effective barriers, but their efficacy depends on soil type, as areas with mud/loose soil may not be suitable for these structures. High cost barriers such as rubble walls, railway fences, and steel rope barriers can be effective where a hard edge exists. The relative merits and demerits of all these types of fences have been detailed in the Field Manual for Managing Human-Elephant

Conflict jointly published by Project Elephant of the Union Ministry of Environment, Forests, and Climate Change and WWF-India (WWF-India et al., 2022).

The placement of barriers should be carefully considered since fences or trenches, when not carefully placed, could lead to spillover effects where the problem is shifted to new locations or could block elephant movement routes. When there is a hard edge between elephant habitats and human spaces with no elephant habitat beyond, hard barriers like fences and trenches could be effective. When elephant movement needs to be ensured across a mosaic landscape, enclosure fences that protect vulnerable areas such as crop fields and human settlements should be explored. Fences should be implemented by design at a landscape-scale, so that spillover and connectivity blockages are considered.

‘Early Warning’ refers to a suite of interventions to provide early information on elephant presence to local community members and the forest department to prevent any emergency. ‘Rapid Response’ refers to mechanisms to respond swiftly to any elephant related emergency by local voluntary teams and Forest Department Rapid Response Teams. The suggested mechanisms for these processes are outlined below:

ACTIVITY A.2.1: DEVELOPMENT OF ENERGISED FENCES

Energised fences have varying levels of efficacy in keeping wild elephants out of vulnerable areas (Hoare, 2012; Sangay, 2014). In Assam, energised fences have been successful when the local community takes ownership of these fences (Kamdar, 2020). Hence, it is proposed that seasonal or annual low cost energised fences be deployed in areas where elephant damage to crops and settlements is high. The fences can be installed using locally available material, such as bamboo poles or wooden poles, and galvanised wire can be used as the conducting material. Each fence needs solar panels, a battery, and an energiser to supply power to the fence. The details of fence construction and maintenance are available online as a manual for training of forest department staff and local communities (<https://www.wvfindia.org/?21522/The-Ele-fence-Manual> accessed on May 2025).

Local community members may be involved in establishing Barrier Maintenance Committees. The installation cost can be shared between the Arunachal Pradesh Forest Department and local communities, and the maintenance can be taken care of by the communities. The average cost of installing a low cost fence with bamboo poles (Figure 48 & 49) in 2 km is approximately INR 1,00,000 and the cost of a three strand solar fence with RCC pillar is approximately INR 4,50,000 (Working plan Sonitpur forest Division, 2019-2020 to 2028-2029). In more vulnerable areas, high cost fences such as steel rope fence and railway barricade fence may be opted. Railtrack and steel rope fences are strong, durable barriers that keep elephants out and need little upkeep. However, these fences can be very costly for many HEC situations. A rail track fence (Figure 50) costs about INR 1.5 crore per kilometre, while a steel rope fence (Figure 51) costs around INR 45 lakhs per

kilometre. These barriers work well in tough areas like rocky or marshy landscapes, where electric fences are hard to build and maintain, especially in places with heavy rain. They also clearly mark large forest boundaries without roads in the way, and are useful in high conflict areas where elephants can break through low-cost fences.

Rail track fence specifications:

Rail track fences are made out of meter gauge rails that are cut into 3 meter and 6 meter lengths. The 3 meter lengths are used as vertical posts and the 6 meter lengths are placed horizontally. Vertical posts are made from concrete and set in 1.5 meter deep holes, placing posts 6 meters apart. The 6 meter rails are placed horizontally to the vertical posts at two heights: one line at 0.7 meters above the ground and another at 1.5 meters. Holes are drilled in the flat parts of the horizontal and vertical rail bars with a gas welding drill. Four inch bolts and rivets are used to secure the bars together. To discourage elephants from crossing, a single nonlethal electrified wire along the fence between the horizontal posts may be installed.

Steel rope fence specifications:

Precast reinforced concrete posts about 4 meters tall and measuring 0.3 meters by 0.3 meters are used for this purpose, installed vertically at 10 meter intervals. Two types of posts are normally used: corner posts and intermediate posts. Corner posts have an extra support arm angled down for added stability. Each post is set 1.5 meters underground, leaving at least 2.3 meters above ground. Four or five strands of steel ropes (14 mm in diameter, with a 6 x 19 strand steel core and a break force of 12.8 tonnes) are attached horizontally. Sturdy wooden posts, with diameters between 0.15 and 0.2 meters, need to be placed halfway between concrete posts to prevent the steel rope strands from bending too much (Figure 51).

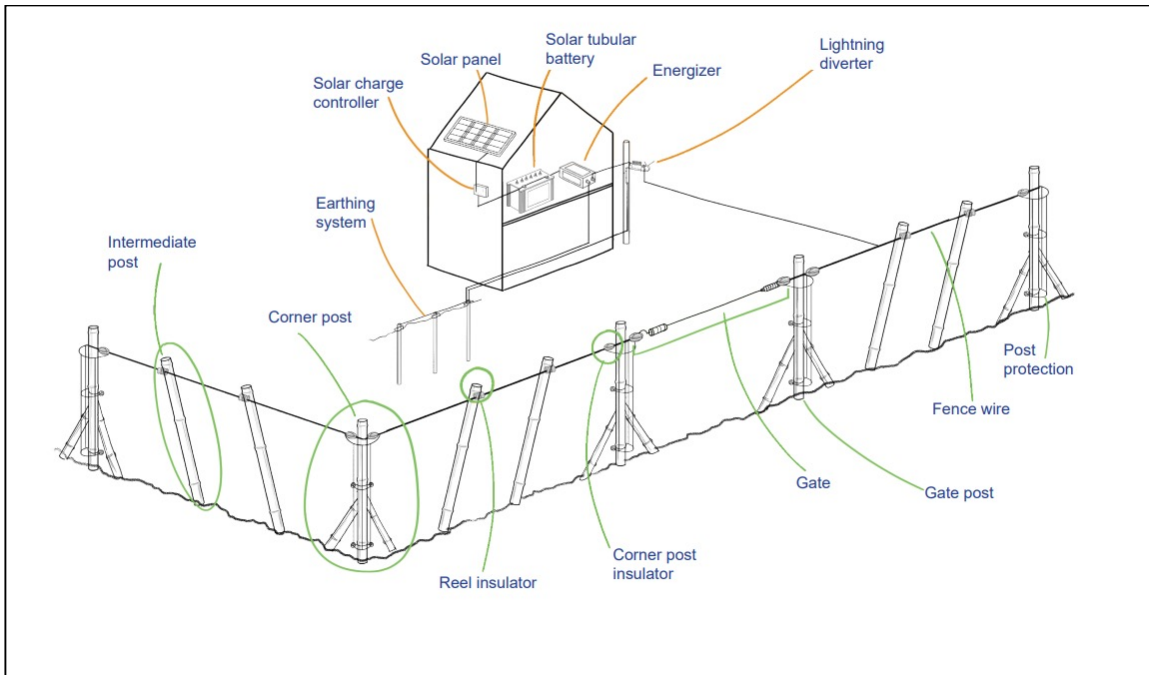


Figure 48: Drawing of single-strand solar fence to keep elephants away



Figure 49: Photograph of low-cost single-strand solar fence to prevent crop raiding



Figure 50: Picture of a rail barricade fence installed in Karnataka, India, Photo Credit: THG Pvt. Ltd.



Figure 51: Steel rope fence in Tamil Nadu, Photo Credit: MoEF & CC

ACTIVITY A.2.2: TRIP ALARMS AND ARTIFICIAL INTELLIGENCE BASED SENSORS FOR EARLY WARNING:

Low cost trip alarms around crop fields can provide early warning about elephant presence to farmers and crop protection teams. These fences comprise regular strands of wire placed perpendicular to the paths elephants use to enter human settlements. The wires are connected to a trip alarm which emits a loud siren when tripped by elephants. The wires can be installed at a height of 6 ft to prevent false positive tripping by livestock and/or other species.

Trail cameras with built-in functionality of identifying species are increasingly being used to provide early warning of elephant presence near settlements (Rastogi et al., 2024). These cameras have Artificial Intelligence based image classification capacity and can identify the

species in real time. These cameras can be set to send alerts via GSM network when the species of interest (elephants in this case) is detected (Figure 52). These cameras can be set along known routes elephants use to enter settlements.

ACTIVITY A.2.3: CREATION OF ELEPHANT PROOF TRENCH (EPT):

Elephant-proof trenches are one of the traditional methods used to prevent damage caused by elephants in villages (Figure 53). To create these trenches, a small channel like structure is dug around private properties to deter elephants from intruding. While the success rate of EPT has not been extensively analysed, they appear to be popular in certain regions, such as south west Bengal and the southern Indian States, particularly in areas with hard rock soil (Saklani et al., 2018; Ramkumar et al., 2014; Das et al., 2022). However, it is recommended that the trenches are monitored



Figure 52: Setup of AI Trail Guard Camera showing identified picture of elephant (top right) and humans (bottom right)



Figure 53: Picture of an Elephant Proof Trench in South India: Image credit: THG publishing Pvt. Ltd.

regularly to ensure their continued effectiveness in keeping elephants away from human properties. The recommended dimensions of the EPT at the time of construction are 2.5 to 3 m (top width) x 1 to 2 m (bottom width) x 1.5 to 2 m (height) (Manigandan et al., 2022).

ACTIVITY A.2.4: CREATION OF RAPID RESPONSE TEAM (RRT):

Rapid Response Teams are instituted at the range or division level in high conflict areas. The teams are constituted by Forest Department and includes forest department staff and temporary/casual staff. The teams need to be equipped and trained to deal with a variety of elephant related emergencies. The detailed operation procedures have been outlined in the Field Manual in Managing Human-Wildlife Conflict (WWF-India et al., 2022). The composition and roles of these teams have been outlined below:

Composition:

- RFO or the Forest Range In-Charge (responsible for decision-making on the need for capture, and final reporting)
- Local veterinary expert (on call)

- Staff with knowledge of landscape
- Staff responsible for engaging with the local panchayat and communities
- Staff responsible for engaging with local media
- Staff responsible for managing and maintaining the equipment and vehicles
- Staff responsible for documentation

Role:

- To supervise, in close coordination with the local crop guarding team (Activity 1.2), the barriers and other mitigation measures set up to prevent human-wildlife conflict (HWC) and inform the appropriate authority about their maintenance.
- To regularly patrol and monitor the location where any human has been injured (the area must be scanned/monitored by a camera trap to investigate whether any other animal is moving in the area).
- To conduct an enquiry into each case of human death/ injury caused by an encounter with a wild animal.

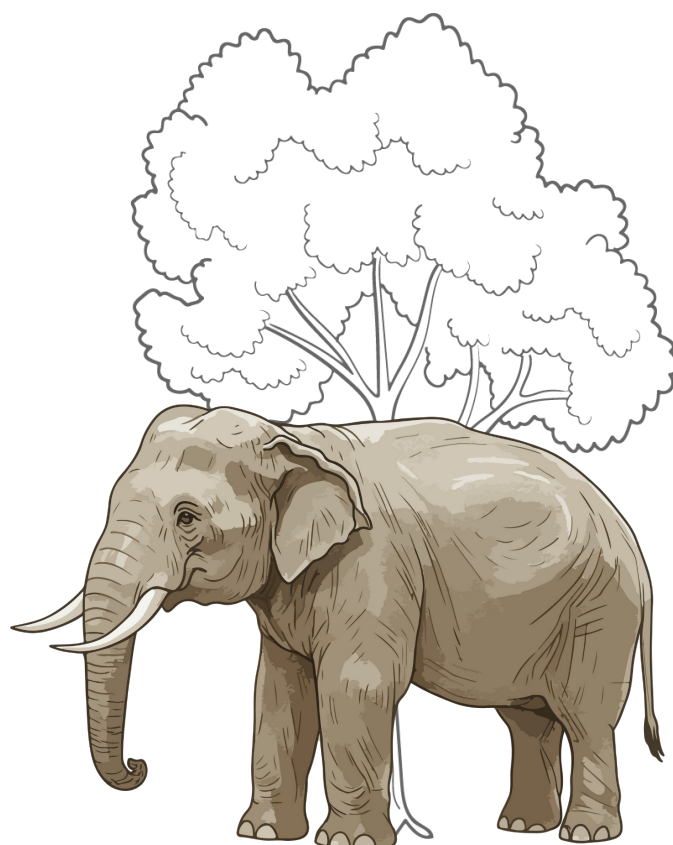
- Monitor movement of wild elephants close to human settlements and crop fields.
- To identify wild animals indulging habitually in encounters with humans/ crops and submit proposals to the DFO for action under S.11(1) of the WPLA-1972.
- To monitor any symptoms of zoonotic and other emerging diseases and alert the HWC mitigation Hub/ control room.
- To take up communication and awareness measures for the local communities.
- To provide training in conflict management techniques to Community Primary Response Teams or Village Response Teams.
- To manage minor operations of HWC (e.g., chasing and driving of wild animals as per the WPLA-1972, snake handling, etc.) or to manage the situation until the arrival of the Division RRT, in case a capture is required.
- While the Range RRT does not itself conduct rescue and capture operations, it informs and alerts the HWC Mitigation Hub (Elephant Cell) of the need for a Division Level team deployment if any capture or rescue is required.
- To provide first aid to persons injured by wild animals, and help them receive timely medical care.
- To help the authorised chemical immobilisation expert in tracking and locating the conflict animals proclaimed by the Chief Wildlife Warden CWW/ Authorised Officer under Section 11(1) of WPLA-1972.
- To help farmers affected by crop damage get compensation/or ex-gratia relief from the competent authority at the earliest (this would involve close coordination with the Revenue Department for efficient claims and disbursements).
- To conduct a damage assessment of crops.
- To manage the crowd of onlookers during and after an incident.

- To engage with local media.
- To meticulously document the operations, report, and upload the data into the Hub using the mobile app (wherever applicable).
- To maintain the vehicles and other rescue equipment in top condition.

Rescue of elephants in an emergency case

In emergency situations, it may be necessary to rescue elephants. For example, an elephant could become trapped in a well or depression, get caught in a snare, or suffer critical injuries during human-elephant conflict. Additionally, young calves may become separated from their herds. In such cases, the Rapid Response Team (RRT) will play a crucial role in rescuing and rehabilitating the elephants.

To provide treatment for injured elephants, an advanced rescue centre equipped with the necessary medical facilities may be established under the supervision of the Central Zoo Authority (CZA) and in collaboration with relevant organisations. To ensure a smooth process, detailed guidelines and protocols would have to be developed by headquarters in consultation with the CZA. Preparing a DPR by the CZA before starting the project is recommended.



ACTIVITY A.2.5: CREATION OF STATE AND DISTRICT/DIVISION LEVEL COORDINATION COMMITTEE (DLCC):

District Level Coordination Committees (DLCC) are composed of members from various departments operating at the district level. In addition to the Forest Department, typically, these members include the District Magistrate/District Collector, police representatives, fire services, the Animal Husbandry Department, the Health Department, the State Disaster Response Force (SDRF), the National Disaster Response Force (NDRF), the Agriculture and Fisheries Department, the Indian Coast Guard, Marine Police, paramilitary forces, as well as local community members, particularly panchayat leaders and village community PRTs.

At the State level, the committee comprises representatives from key departments, with the Chief Secretary serving as the chair and the Chief Wildlife Warden (CWLW) as the member secretary. These committees are established to facilitate discussions and make informed decisions regarding the management of HEC. The formation of DLCCs is recommended in the National Human-Wildlife Conflict Mitigation Strategy and Action Plan of India. Both State Level Coordination Committees (SLCC) and DLCCs can enhance inter-agency coordination necessary for addressing HEC, and they may develop specific operational mechanisms tailored to the unique needs of HEC mitigation in their respective areas.

Creation of the Elephant Task Force

An Elephant Task Force may be established to oversee and advise on elephant management activities in the State. This task force serves as an apex body, comprising top government officials from both the State and the Centre, including the Chief Wildlife Warden, scientists from educational and research institutions, NGOs, members from High Court of the State concerned, members from Project Elephant Division MoEF & CC, retired forest officers of the State having experience in elephant management work, etc.

The Terms of Reference (TOR) for the Task Force is outlined below:

- Implementing measures to strengthen elephant conservation in Arunachal Pradesh.
- Monitoring elephant management actions in the State.
- Developing guidelines to incorporate state-of-the-art technology in elephant conservation and management.
- Creating an action plan to mitigate human-elephant conflict.
- Providing advice on elephant radio-collaring.
- Offering guidance on elephant rescue and rehabilitation efforts.
- Advice to declare a critical area as an elephant conservation unit.
- Monitoring elephant corridors and advising on their protection through notifications under the Wildlife (Protection) Act of 1972 or the Environment Protection Act of 1986.
- Advising on interventions needed during the planning of any developmental projects.

The Task Force would meet twice a year and have provisions for urgent meetings whenever necessary.

OBJECTIVE A.3: UPGRADATION OF EX-GRATIA SYSTEM

Crop loss emerged as the primary hurdle to coexistence between people and elephants in Arunachal Pradesh. The actual quantum will be higher than the reported loss as crop damages often go unreported due to a variety of reasons ranging from high transaction cost to lack of information on compensation schemes (Kshetry et al., 2021). It may be safe to assume that for Arunachal Pradesh, the reported losses as per the records of the Forest Department represent a fraction of the crop losses due to elephants. Ex-gratia payments for crop losses and human casualties are crucial in partially offsetting losses to local communities (Karanth et al., 2018). There is a need to identify the primary hurdles for efficient claim process and settlement in the current ex-gratia/compensation process for the State.

This review will aid in exploring ways to streamline the overall process. Many States such as Karnataka, Odisha, and Chhattisgarh have moved towards a digital interface for claims and payments. Similar approaches may be adopted in Arunachal Pradesh. The overall aim of this activity will be to review the overall process of claims, the time taken to process, and to identify any hurdles in the process.

ACTIVITY A.3.1: REGULAR AND UNIFORM DOCUMENTATION OF HEC INCIDENTS:

To ensure a smooth and effective compensation process, the first step is to document HEC incidents thoroughly. Once these incidents are properly recorded, it will be easier to make informed management decisions. The adoption of digital technology can facilitate the collection of real time data by field level forest staff. This data can then be shared immediately with the relevant officials to enable prompt action. The forest department could consider utilising drone technology and app based documentation for HEC incidents. This would allow for accurate evaluations of the damage caused by elephants and enable real-time sharing of information with the headquarters of the forest department, helping in the provision of ex-gratia payments.

ACTIVITY A.3.2: DIGITAL/APP BASED ASSESSMENT OF DISBURSAL OF CLAIMS:

The process of claiming ex-gratia/compensation is often difficult, given the remote location of the crop fields. Hence, a digital claim and disbursement process can help alleviate the losses faced by the local communities in a timely manner. It is suggested that the Arunachal Pradesh Forest Department develop a novel Mobile Application-based process for digital filing of compensation claims and disbursement. Exposure visits for senior Forest Department Officials may be planned for other States such as Odisha, Chhattisgarh, and Karnataka to obtain a detailed understanding of the process.

ACTIVITY A.3.3: REFINEMENT OF THE CURRENT EX-GRATIA PAYMENT PROCESS AND REVISION OF EX-GRATIA RATES:

Based on the review of the State's current ex-gratia/compensation process, the State may consider revising the compensation amounts for various crop types to alleviate the losses faced by local communities due to damages by elephants. Swift and fair compensation and proactive crop protection measures may help foster sustained coexistence between people and elephants in the State.

Under this objective of upgradation of ex-gratia system, both the headquarters and the divisions have unique roles. While the creation of a digital database to facilitate real time data sharing (between divisions and HQ), management actions, the review of current ex-gratia system, and modifications should be executed by the headquarter, the divisions have to ensure proper utilisation of these mediums to collect the information promptly.

OBJECTIVE A.4: ADOPTION OF ELEPHANT-SAFE BEHAVIOUR AMONG LOCAL COMMUNITIES

To promote safe and positive behaviour of the local public towards elephants, it is crucial to raise awareness about the benefits of wildlife and outline the basic dos and don'ts for when these animals venture into human habitats. In this context, the National Human-Wildlife Conflict Mitigation Strategy and Action Plan of India (HWC-NAP) emphasises the media's role as a key stakeholder in effectively communicating the message of human-wildlife conflict mitigation to the public. It recommends fostering constructive dialogue between forest department personnel and media professionals, agreeing on guidelines, and identifying key points for engaging the media as partners in HWC mitigation.

Under this objective, the strategic activities are outlined in the following page.

ACTIVITY A.4.1: COMMUNICATION PLAN FOR HUMAN-ELEPHANT CONFLICT (HEC) MANAGEMENT:

A communication cell can be established at the headquarters level in Itanagar to achieve this objective. A senior officer, such as at the rank of the Chief Conservator of Forests (CCF), will be in charge of this communication cell. This individual will be responsible for communicating any matters of HWC with the media.

The communication cell will include several technical members or possibly collaborate with technical partners to develop content that raises public awareness, create multimedia materials for regional display, and prepare a basic set of do's

and don'ts regarding HEC. Additionally, the cell may partner with NGOs and wildlife filmmakers to create wildlife documentaries to raise public awareness on HEC.

Promoting human-elephant coexistence requires fostering a positive attitude among people towards elephants, as well as community support for conservation efforts. To help the public view elephants positively, it is essential to communicate the positive values associated with them. Periodic awareness programmes in areas prone to elephant conflict can significantly influence public perception and encourage a shift in attitudes towards elephants. At the division level, communication efforts will focus on conducting regular awareness programmes about HEC, emphasising the positive values of elephants, and best practices for mitigating HEC.

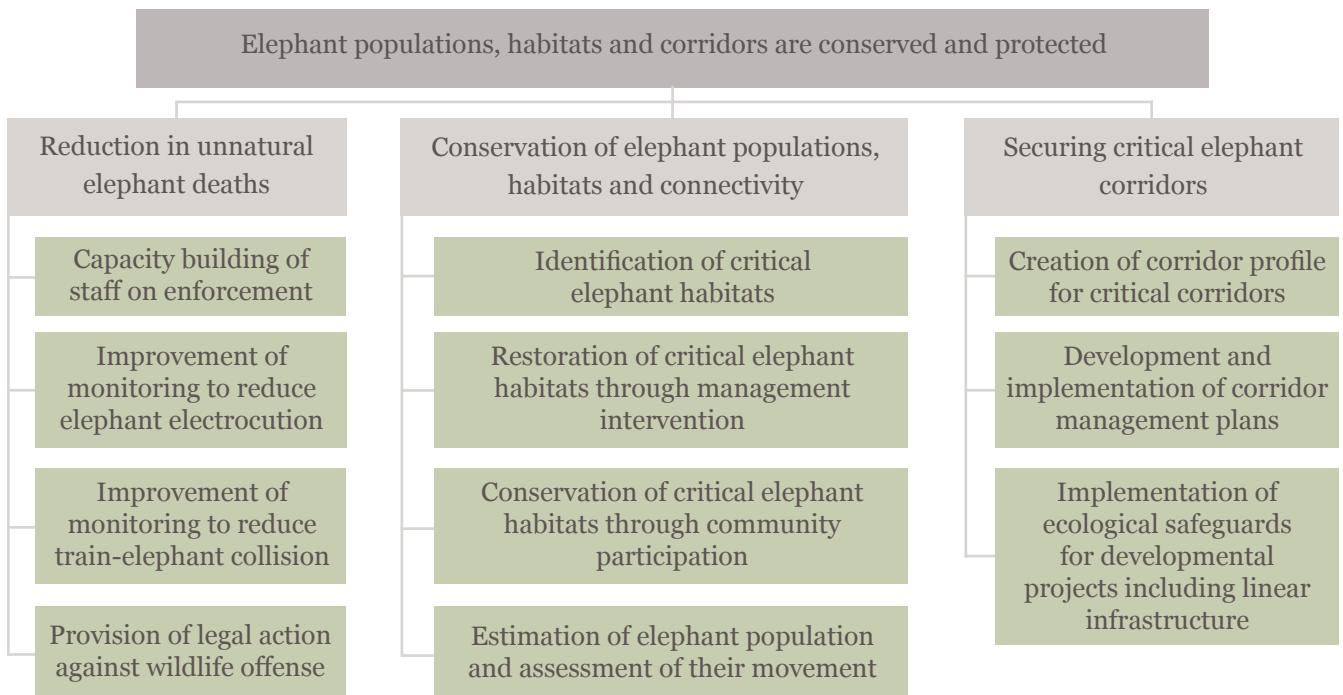


Figure 54: Schematic representation of strategic outcome 'B', including objectives and activities to secure elephants and their habitats



5.2 Strategic Outcome B: Protection of Elephant Populations, Habitats and Corridors

Although official records are scarce, elephants in Arunachal Pradesh are reported to face threats such as poaching, hunting, and illegal capture. In addition, elephant habitats in Arunachal Pradesh are also gradually shrinking due to the implementation of infrastructure projects and the expansion of human settlements and farmlands. Therefore, it is essential to protect the elephants and their habitats and corridors for long term elephant conservation in Arunachal Pradesh and for effective mitigation of human-elephant conflicts. The Strategic Outcome B pertains to addressing the unnatural deaths of elephants and to securing the elephant habitats and corridors.

OBJECTIVE 1: TO REDUCE UNNATURAL ELEPHANT DEATHS IN ARUNACHAL PRADESH

Between 2018 and 2024, five unnatural deaths of elephants were reported in the State. All the unnatural deaths of elephants were attributed to electrocution. Additionally, one more elephant was killed by train accident in October 2024 in the Durpang-Doimukh elephant corridor near the Assam-Arunachal border. Apart from these, vigilance and proactive management is also needed to curb the threat of poaching and hunting of elephants in Arunachal Pradesh, even though such cases have not been reported over the past six 6 years. To prevent/ reduce unnatural elephant deaths, this document proposes a few activities that may be adopted and followed for elephant conservation.

ACTIVITY B.1.1: CAPACITY BUILDING OF STAFF ON ENFORCEMENT:

In most PAs and Forest Divisions of Arunachal Pradesh, current staff strength is lower than sanctioned numbers of staff. Additionally, several beats within many forest ranges, particularly those in territorial Forest Divisions, are severely

understaffed and under-resourced thereby limiting their operations and efficient functioning. To ensure effective enforcement of law and order, it is essential to increase the staff strength to at least 60% and restore management operations at the beat level. Concurrently, enhancing the capacity of the staff through workshops and exposure visits focused on Illegal Wildlife Trade (IWT) prevention, detection, and response are also priority actions.

To fill capacity gaps, local residents could also be engaged towards strengthening protection and management of elephant habitats. Local individuals who possess sound knowledge and a genuine interest in elephants should be recruited by Range Forest Officers (RFOs), in the capacity of daily-wage beat watchers, or similar. These personnel are to be trained in accordance with the Wildlife (Protection) Amendment Act as amended in 2022, under the supervision of the respective RFOs.

The staff assigned to the beat level will be responsible for conducting regular patrols within the forest area to monitor for irregular and illegal activities. They will receive training on how to use digital devices, including camera traps, GPS, and smartphones, to operate software while patrolling. In Arunachal Pradesh, the implementation of M-STrIPES has so far been limited to tiger reserves. This approach may also be extended to other critical elephant habitats, with support and assistance from the personnel in the tiger reserves. Furthermore, local communities may be involved for more participatory approaches to monitor these forests through advanced technologies.



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ACTIVITY B.1.2: IMPROVING MONITORING TO REDUCE ELEPHANT ELECTROCUTION:

To prevent elephant deaths due to electrocution, it is recommended that frontline forest staff conduct regular monitoring in their areas, particularly during the monsoon season when wire sagging can increase significantly. Additionally, it is advisable to hold regular consultation meetings with the electricity department to identify potential threats early and take prompt action to prevent electrocution of elephants.

ACTIVITY B.1.3: IMPROVING MONITORING TO REDUCE TRAIN-ELEPHANT COLLISIONS:

To prevent elephant deaths related to train collisions, frontline forest staff, especially those in the Banderdewa and Doimukh Ranges, should regularly monitor elephant movements near railway tracks. They should inform the railway department to implement precautionary measures to avert accidents. Regular consultation meetings with the railway department are also essential to discuss initiatives such as reducing train speeds in critical areas and maintaining continuous communication with forest departments to detect potential threats early and respond promptly to prevent collisions.

ACTIVITY B.1.4: LEGAL ACTION AGAINST WILDLIFE OFFENCES:

To curb illegal activities such as hunting and poaching, it is recommended to engage a legal consultant at the headquarter level. The consultant will support the Forest Department with filing of cases related to wildlife crime. This consultant will also be responsible for designing, organising, and conducting periodic training and legal orientation for frontline forest staff on handling wildlife crime cases and understanding the related processes.

OBJECTIVE B.2: CONSERVATION OF ELEPHANT POPULATIONS, HABITATS AND CONNECTIVITY

This objective focuses on a comprehensive and holistic approach to the overall conservation of elephants in Arunachal Pradesh. To protect elephants and their habitats, it is essential to conserve critical elephant areas. These habitats are ecologically significant because they allow elephants to feed, breed, and find shelter. Critical elephant habitats can include protected areas with minimal disturbances, reserve forests rich in fodder species, grasslands, or riverine ecosystems.

ACTIVITY B.2.1: IDENTIFICATION OF CRITICAL HABITATS:

In Arunachal Pradesh, elephants are distributed over an area of approximately 12,000 km². However, only a small portion—about 1%—of this area is designated as protected area. The Pakke Tiger Reserve and the D'Ering Wildlife Sanctuary are currently recognised as critical habitats for elephants. To better understand elephant status and conservation needs beyond these PAs, it is essential to identify other critical elephant habitats through scientific studies. One effective approach is to monitor elephant distribution using occupancy surveys. These surveys provide rapid assessments of the species' distribution and habitat use. The areas where elephants are found can be divided into 5 km x 5 km grids, and researchers can survey for elephant presence within these grids by conducting regular visits. This activity will help pinpoint priority areas that require management interventions to support elephant conservation.

The habitats can also be evaluated through the lens of availability of food and water for elephants. Therefore, it is also essential to carry out a study on the forage selection of elephants and map the habitats with respect to the vegetation composition and health and the availability of water, which is one of the most important parameters for the elephants.



ACTIVITY B.2.2: RESTORATION OF CRITICAL ELEPHANT HABITATS THROUGH MANAGEMENT INITIATIVES:

After identifying critical elephant habitats, the next step is restoring degraded areas through human intervention. This involves actions such as Aided Natural Regeneration (ANR), managing invasive species, and implementing soil moisture conservation techniques within these habitats. In the ANR scheme, it is essential to ensure that only indigenous species are planted, avoiding invasive ones.

ACTIVITY B.2.2: CONSERVATION OF CRITICAL ELEPHANT HABITATS THROUGH COMMUNITY PARTICIPATION:

Elephants in Arunachal Pradesh are primarily found outside of Protected Areas (PAs), making the conservation of elephants outside these zones crucial. In Arunachal Pradesh, community reserves could play an essential role in conserving biodiversity. For instance, the Bugun Community Reserve, which surrounds the Eaglenest Wildlife Sanctuary, has been instrumental in preserving biodiversity, particularly the Critically Threatened bird Bugun Liocichla. Different communities have their unique beliefs and relationships with nature, and driven by these belief systems, they typically prefer to avoid any disturbances in the community conserved areas. Therefore, declaring community reserves could be an ideal strategy for conserving elephant habitats in the State.

ACTIVITY B.2.3: ESTIMATION OF ELEPHANT POPULATION AND ASSESSMENT OF THEIR MOVEMENT:

Monitoring the elephant population and their movement is essential for effective conservation planning in Arunachal Pradesh. Currently, there is no comprehensive State-level elephant

monitoring system that can accurately assess and predict elephant distribution, movement, and demographics, on lines of the All India Tiger Estimation (AITE). This lack of information hinders the development of long term conservation action plans for the species. Therefore, it is crucial to implement robust protocols for monitoring elephant populations and movements using modern techniques.

To monitor the elephant population, molecular methods such as individual-based DNA profiling can be adopted, which holds promise in estimating elephant numbers (Khan et al., 2023). DNA from dung swabs, a non-invasive method, may be used to identify individual elephants, and then a mark-recapture framework similar to the method used to estimate tiger numbers may be adopted. Ideally, such assessments need to be carried out for the entire population in one go, in coordination with adjoining States. However, if such coordination is not possible, the exercise must be carried out for the entire State in the same sampling period to avoid violating assumptions of demographic closure during the sampling period. The sub activities under population estimation through molecular methods will involve close collaboration with any reputed institution with a demonstrated history of working with Asian elephant DNA. DNA swab collection kits will need to be procured from the laboratory, and all staff must be trained in dung collection protocols. The field work can be completed in 2-3 days for the entire State. The samples then need to be transported to the laboratory for analysis. Once the DNA sequences are obtained from the laboratory, spatial capture-recapture analyses may be conducted at the State-level Elephant Cell. Latest methods using Single Nucleotide Polymorphism (SNP) Panel markers and Next-Generation Sequencing (NGS) can drastically reduce the cost of analysis (Khan et al., 2023). Alternatively, for relatively small populations, photographic capture-recapture methods may be modified through mark-resign methods to estimate population size (Goswami et al., 2019). This approach is similar to the methodology for tigers with slight modifications. The sampling for this exercise can also be done over a short period of 2-3 days and is based on high quality images of elephants where both flanks are clearly visible, along with tusk (for males) and tail patterns. Experts can then sort the images

and identify individuals for subsequent analysis. Monitoring of elephant populations over time is of critical importance to understand demographic trends and to assess the efficacy of any management action, and/or identify conservation challenges.

Similarly, GPS telemetry can be used to monitor the movement of elephants. To carry out this activity, the selection of elephants is important. Usually, single bulls or the leader of a particular herd is selected for the collaring activity. This will require a decision on the number of animals to be radio-collared in a Forest Division. If there are multiple solitary bulls ranging in or near human settlements, then these bulls will need to be collared individually. Alternatively, if herds are moving through human settlements or between State borders, then collaring one or two adult females in the herd can help to monitor the movement of the entire herd. GPS telemetry will include procurement of collars, each collar along with its set of VHF receiver and antenna. Once collars have been procured, a collaring team needs to be constituted comprising of biologists, veterinarians, field level forest officers and the Divisional Forest Officer/ Deputy Field Director. This team will identify the animals to be collared, install the collars, and will monitor the collared animals for one month post-collaring. Post the intensive monitoring period, the GPS-based location signal can be shared with field Rapid Response Teams (RRTs) for any pre-emptive conflict management. The data from the collared animals can be analysed at the Elephant Cell by trained ecologists.

Alternatively, mobile technology may be leveraged for continuous monitoring of elephant populations and their movement across the State. Individual identification profiles of wild elephants may be created and sighting records of the identified individuals may be updated through mobile applications by ground staff during regular patrolling. The location history of profiled individuals will help in understanding approximate home ranges and seasonal variation in movement (Srinivasaiah et al., 2012). The sub activities will include developing individual identification profiles of elephants by trained biologists at the Division and State level, training of field staff on individual elephant identification, development of application for recording data with offline data

collection capability, availability of smartphones with field staff for data recording, and provision to charge the mobile phones in remote locations through solar-based charging systems. The data will need to be analysed at the State-level Elephant Cell and information may be shared with divisions through periodic reports. Supplementary data such as conflict incidents associated with the profiled individual elephants and physiological status (musth/ pregnancy status/ number of calves) will need to be recorded to aid individual-specific management decisions.

OBJECTIVE B.3: SECURING CRITICAL ELEPHANT CORRIDORS

Elephants are long ranging animals, moving long distance between different habitats. Corridors are the critical areas that provide uninterrupted movement access to the elephants between habitats. Hence, it is essential to secure the corridors in the context of habitat loss and fragmentation, for long term elephant conservation.

ACTIVITY B.3.1: CREATION OF CORRIDOR PROFILES FOR CRITICAL CORRIDORS AND DEMARCATION:

Corridor profiles outline the ecological significance of specific corridors and highlight the challenges to connectivity. In the State of Arunachal Pradesh, a total of nine elephant corridors were identified by the Project Elephant division of the Ministry of Environment, Forest and Climate Change (MoEF & CC), Government of India, in 2023 (PE & MoEF&CC, 2023). It is essential to regularly assess the status of these corridors and identify any challenges that need to be addressed. Additionally, further research may uncover more current or potential elephant corridors, and plans should be developed to protect these areas accordingly.

ACTIVITY B.3.2: DEVELOPMENT AND IMPLEMENTATION OF CORRIDOR MANAGEMENT PLANS:

Corridor management plans can be developed after conducting a rapid assessment of the

current status of these corridors and identifying the existing challenges. It is advisable to create corridor-specific management plans, as each corridor faces unique issues based on its location and conservation priorities. Formally recognising these corridors is important to better align conservation imperatives and development, to ensure that landscape permeability is maintained. Furthermore, the boundaries of the corridors should be made available on relevant State and national platforms, so they can be taken into account while planning development projects.

ACTIVITY B.3.3: IMPLEMENTATION OF ECOLOGICAL SAFEGUARDS FOR DEVELOPMENTAL PROJECTS, INCLUDING LINEAR INFRASTRUCTURE:

Linear infrastructure, due to its potential negative impact on forest fragmentation, has significantly affected the movement of wildlife globally. To minimise this impact, ecological safeguards are essential. The book “Eco-Friendly Measures to Mitigate Impacts of Linear Infrastructure on

Wildlife” (WII, 2016) outlines several detailed safeguards that must be considered when planning any linear infrastructure that envisage negative impacts on wildlife. The successful implementation of these safeguards requires regular consultations with multiple stakeholders, including the Border Road Organisation (BRO), National Highways and Infrastructure Development Corporation Limited (NHIDCL), National Highway Authority of India (NHAI), Public Works Department (PWD), and the Railway Department, among others. These consultations should be prioritised, especially when planning linear infrastructure that pass through elephant habitats and corridors. When properly planned, such mitigation measures offer win-win solutions for the economy and local ecology (Ament et al., 2021; WII, 2016).

Owing to its abundant water resources and topography, the State of Arunachal Pradesh is one of the Himalayan States considered for hydroelectric projects. To make these projects sustainable, it is essential to minimize adverse impacts on elephants and their habitats. In such cases, the creation of a State forum is generally advised, incorporating all the relevant line departments engaged in these developmental projects to address the critical issues.



5.3 Strategy and Action Plan for Human-Elephant Conflict Management in Arunachal Pradesh

Objective	Strategy	HQ level action	Division level action
Strategic Outcome A: Human-elephant conflicts (crop loss, property damage, human and elephant casualties) in critical divisions are reduced			
Objective A.1: Adoption of community-based crop guarding:	Strategy A.1.1: Creation of watch towers for crop guarding:	Development of Standard Operating Procedure (SOP) for VRT	Creation of permanent watch towers (RCC Buildings/Steel)
			Creation of semi-permanent watch towers (wooden/bamboo/on tree)
	Strategy A.1.2: Creation of local crop guarding teams at village level (voluntary group):		Creation of Village Response Team (VRT)
			Providing awareness, training, field gear (high power rechargeable search lights, sirens, megaphones, rain coats, boots, safety jackets etc) to VRT
Objective A.2: Prevention of damage using barriers, early warning and rapid response:	Strategy A.2.1: Development of energised fences:	Development of SOP for RRT	Installation of low cost energised fence (Single strand fence with bamboo pole)
			Installation of high cost Fence (multi strand solar fencing with concrete pole/rubble walls/railway fences/steel rope barriers) for crop protection
	Strategy A.2.2: Deployment of early warning systems (trip alarms and Artificial Intelligence-based sensors):		Establishment of elephant information sharing network (bulk SMS/WhatsApp group)
			Installation of Artificial Intelligence-based trail cameras, sensor, trip alarm
	Strategy A.2.3: Creation of Elephant Proof Trench (EPT)		Preparation of Elephant Proof Trench (EPT) at Beat/Range level
	Strategy A2.4: Creation of Rapid Response Team to monitor elephants and manage HEC		Development of human resources for RRT
			Providing infrastructure support for RRT (shelter house, control room, vehicle, dart gun, modern equipment)
			Providing Training and exposure Visits to the RRT members
	Development of protocol for rescue and rehabilitation of elephants	Creation of rescue and rehabilitation centre for elephants with advanced facilities	
Strategy A.2.5: Creation of State and District/ Division level Coordination Committee (DLCC)	Establishment of SLCC, Elephant Task Force (at State level) for human-elephant conflict management (TOR to be developed)	Constitution of DLC comprising Forest Department, District Administration, disaster management, veterinary & animal husbandry, police and other relevant agencies	

Objective	Strategy	HQ level action	Division level action
Objective A.3: Upgradation of ex-gratia system:	Strategy A.3.1: Regular and uniform documentation of HEC incidents	Creation of digital database to facilitate realtime data sharing (between divisions and HQ) and management actions	Collection and maintenance of systematic data on HEC incidents at Range and Division level
	Strategy A.3.2: Digital/app-based assessment of disbursement of claims		
	Strategy A.3.3: Refinement of current ex-gratia payment process and revision of ex-gratia rates	Assessment of current ex-gratia system and modifications as required	
Objective A.4: Adoption of elephant-safe behaviour among local communities:	Strategy A.4.1: Development and implementation of effective communication strategy on safe practices:	Development of a communication plan for HEC management	Organising regular awareness programmes (at various levels) in elephant bearing areas
			Preparation of multimedia content (posters/animation/video) and dissemination in elephant bearing areas (at locations such as bus-stops, schools, and community hall).
Strategic Outcome B: Elephant populations, habitats and corridors are conserved and protected			
Objective B.1: Reduction in unnatural elephant deaths	Strategy B.1.1: Capacity building of staff on enforcement:	Filling of vacant posts	Strengthening existing monitoring and patrolling system
		Coordination with NTCA for rolling out M-STRIPES in areas outside Tiger Reserve	Providing regular training to forest staff on Law Enforcement Monitoring (LEM) tools like M-STRIPES
			Providing equipment to the staff to implement LEM tools
			Organising exposure visit of staff for experience sharing and new learnings
	Strategy B.1.2: Improvement of monitoring to reduce elephant electrocution		Regularly monitoring of sagging electric wires and coordinate with Electricity Department to prevent elephant electrocution
Strategy B.1.3: Improvement of monitoring to reduce train-elephant collision		Coordination with Railway Department to avoid train-elephant collision, organising awareness and capacity building sessions for railway staff on elephant crossing zones and identification of vulnerable sections	
Strategy B.1.4: Provision of legal action against wildlife offence		Engagement of legal consultants to specifically handle wildlife crime cases	

Objective	Strategy	HQ level action	Division level action
Objective B.2: Conservation of elephant populations, habitats and connectivity:	Strategy B.2.1: Identification of critical elephant habitats		Fine scale mapping of elephant occupancy
			Assessment of forage selection of elephants and evaluate habitat wrt. fodder species
			Assessment of hydrology and water availability for elephants
			Mapping invasive plant species
	Strategy B.2.2: Restoration of critical elephant habitats through management intervention		Restoration of degraded habitats through Aided Natural Regeneration
			Management of invasive species by developing scalable models
			Implementation of Soil Moisture Conservation initiatives
	Strategy B.2.3: Conservation of critical elephant habitats through community participation	Notification of critical elephant habitats as management unit	
Strategy B.2.4: Estimation of elephant population and assessment of their movement:	Formation of Elephant Task Force to advice and monitor	Conducting periodic population estimation (direct and indirect methods)	
		Monitoring movement of elephants using radio telemetry	
Objective B.3: Securing critical elephant corridors:	Strategy B.3.1: Creation of corridor profile for critical corridors:	Providing legal recognition to the elephant corridors	Assessment of the present status of elephant corridors (recorded & unrecorded)
			Development of profiles for the identified elephant corridors
	Strategy B.3.2: Development and implementation of corridor management plans:		Development of corridor specific management plan
	Strategy B.3.3: Implementation of ecological safeguards for developmental projects including linear infrastructure:		Creation of a state forum on ecological safeguards for developmental project (NHAI, NHIDCL, PWD, BRO, railway, NHPC, etc.)
			Development of site specific conservation plan and mitigation mechanism for developmental projects

5.4 Division Wise Strategy Planning with Approximate Budget

Based on the assessment of elephant distribution, movement patterns, and the extent of Human-Elephant Conflict (HEC), the forest divisions of Arunachal Pradesh have been classified into three priority levels: hotspot divisions (high priority) (Annexure 2), medium priority divisions (Annexure 3), and low priority divisions (Annexure 4).

Hotspot divisions, which account for nearly 75% of all HEC incidents in the state, are areas with regular elephant movement and require urgent and comprehensive intervention. Medium priority divisions are typically located adjacent to these hotspots and experience occasional elephant movement, with comparatively lower levels of conflict. Low priority

divisions are those where elephant presence is rare or only anticipated in the near future, and where conflict is minimal or almost nonexistent.

In response, a detailed strategy and action plan has been formulated, supported by indicative budgets. This includes ground-level measures such as the construction of elephant-proof trenches, installation of solar and railway fencing, strengthening of Village Response Teams, and deploying well-equipped Rapid Response Teams. To complement these efforts, modern technologies like AI-based surveillance systems, thermal drones, and radio telemetry will enable real-time monitoring and prompt responses. In addition, softer measures, such as awareness programs in areas inhabited by elephants, regular training for forest staff on law enforcement monitoring tools, legal orientation, and the establishment of ecological safeguards to minimize the impact of infrastructure projects are provided.

Apart from that, a detailed action plan for the Headquarter (HQ) has also been prepared (Annexure 1).

The HQ level action primarily focuses on coordination, technical guidance, resource mobilisation, monitoring, communications, etc.

The budget estimates for these actions are based on experiences from other states and divisions where similar interventions have been implemented. It is important to note that these figures are indicative and should only serve as reference points during the preparation of division-level annual plans, rather than as final allocations.

This phased and priority-based approach ensures that the limited resources are directed first to the most vulnerable divisions while also preparing medium and low priority divisions for emerging challenges. By integrating immediate conflict mitigation with long-term habitat management and community engagement, the strategy aims not only to reduce HEC but also to secure the long-term coexistence of elephants and humans in Arunachal Pradesh.

Annexure 1: Headquarter level strategy and action plan for human-elephant conflict management in Arunachal Pradesh

Strategy and action plan for human-elephant conflict (HEC) management in Arunachal Pradesh		
Sl no.	HQ level action	Unit cost in Indian Rupees
1	Assess current ex-gratia system and modifications as required	As per actuals
2	Coordination with NTCA for rolling out M-STRIPES in areas outside Tiger Reserve	As per actuals
3	Creation of digital database to facilitate real-time data sharing (between divisions and HQ) and management actions	2,00,00,000.00
4	Developing communication plan for HEC management	20,00,000.00
5	Developing SOP for RRT & VRT	2,00,000.00
6	Creation of rescue and rehabilitation centre for elephants with advanced facilities	Based on DPR
7	Creation of Elephant Task Force to advice and monitor	As per actuals
8	Engagement of legal consultants to specifically handle wildlife crime cases MOU with WWF/other organisations	As per actuals
9	Establishment of Elephant Task Force (at state level) for human-elephant conflict management (TOR to be developed)	As per actuals
10	Filling of vacant posts	As per actuals
11	Notification of critical elephant habitats as management unit Other effective Area-based Conservation Measures (OECM)	As per actuals
12	Providing legal recognition to the elephant corridors Eco Sensitive Zone (ESZ)/Community Reserve (CR)/ etc.	As per actuals
13	Ecological safeguards for infrastructure projects Creation of a state forum on ecological safeguards for infrastructure project (NHAI, PWD, MOD, Etc.)	As per actuals

Annexure 2: Action Plan for human-elephant conflict management in the high priority forest divisions of Arunachal Pradesh

SI no.	Division level action	Hotspot division (high priority divisions)										Unit cost in Indian Rupees (approx.)	Unit		
		Khellong	Pakke	Banderdewa	Sagalee	Pasighat	Lohit	Nampong	Deomali						
1	Watch towers (RCC buildings/ steel)	6	6	6	3	5	5	5	6					10,00,000.00	No.
2	Watch towers (wooden/bamboo/ on tree)	4	4	12	5	6	5	5	6					1,50,000.00	No.
3	Creation of Elephant Proof Trench	5	20	20	15	20	20	30	30					1000000.00	km
4	Creation of Village Response team (VRT) and wear & tear	4	4	12	3	10	10	20	20					1,00,000.00	1 VRT (10 members)
5	Installation of single strand fence with bamboo pole	10	10	10	5	15	5	20	20					1,00,000.00	km
6	Installation of three wire solar fencing with iron/concrete post	3	5	10	2	20	5	10	10					5,00,000.00	km
7	Installation of railway fences	0	5	5	2	10	2	20	20					1,00,00,000.00	km
8	Installation of steel rope barriers	0	10	10	2	20	2	20	20					35,00,000.00	km
9	Installation of Artificial Intelligence-based trail cameras, sensor, trip alarm, in conflict areas	1	2	2	1	5	2	5	5					15,00,000.00	1 unit (AI trail camera 30, Trip alarm 10)
10	Purchasing thermal drone	1	1	1	1	1	1	1	1					6,00,000.00	No.
11	Creation of Rapid Response Team and infrastructure support to RRT (manpower, shelter house, control room, vehicle, dart gun, modern equipment)	1	1	1	1	1	1	1	1					5,00,00,000.00	1 RRT (10 members)
12	Providing elephant management training and exposure visits to the RRT members	√	√	√	√	√	√	√	√					3,00,000.00	1 exposure visit

20	Regularly monitoring of sagging electric wires and coordinate with Electricity Department to prevent elephant electrocution	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	1,00,000.00	1 event
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Annexure 4: Action Plan for human-elephant conflict management in the low priority forest divisions of Arunachal Pradesh

Low priority divisions																			
Sl no.	Division level action	Bomdila	Hapoli	Daporijo	Kamlang	Namdapha	Mehao	Kanubari	Unit cost in Indian Rupees	Unit									
1	Watch towers (RCC buildings/steel)	1	1	1	1	1	1	2	10,00,000.00	No.									
2	Watch towers (wooden/bamboo/on tree)	1	1	1	1	1	1	1	1,50,000.00	No.									
3	Creation of Elephant Proof Trench	0	0	0	0	1	0	2	10,00,000.00	km									
4	Creation of Village Response team (VRT) and wear & tear	1	1	1	1	1	1	1	1,00,000.00	1 VRT (10 members)									
5	Installation of single strand fence with bamboo pole	1	1	1	1	1	1	2	1,00,000.00	km									
6	Installation of three wire solar fencing with iron/concrete post	3	3	3	3	3	3	3	5,00,000.00	km									
7	Installation of Artificial Intelligence-based trail cameras, sensor, trip alarm in conflict areas	1	1	1	1	1	1	1	5,00,000.00	1 unit (AI trail camera 10, trip alarm 5)									
8	Providing thermal drone	1	1	1	1	1	1	1	6,00,000.00	No.									
9	Creation of Rapid Response Team and infrastructure support to RRT (shelter house, control room, vehicle, dart gun, modern equipment)	1	1	1	1	1	1	1	5,00,00,000.00	1 RRT (10 members)									

10	Providing elephant management training and exposure visits to the RRT members	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	3,00,000.00	1 exposure visit
11	Organising regular awareness programmes (at various levels) in elephant bearing areas	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	50,000.00	1 event
12	Providing regular training to forest staff on Law Enforcement Monitoring (LEM) tools like M-STripES	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	2,00,000.00	1 event
13	Providing equipment to the staff to implement LEM tools	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	2,00,000.00	1 set (GPS, mobile phone, metal detector, digital camera, tissue sample collection kit etc.)
14	Organising periodic training and legal orientation on wildlife crime	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	2,00,000.00	1 event
15	Fine scale mapping of elephant occupancy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1,00,000.00	For 5 years
16	Restoration of degraded habitats through Aided Natural Regeneration	10	50	10	10	10	10	10	10	10	10	100	100	50,000.00	ha
17	Implementation of Soil Moisture Conservation initiatives	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	50,000.00	ha
18	Monitoring of movement of elephants using radio telemetry (elephant collaring)	1	1	1	1	1	1	1	1	1	1	1	1	15,00,000.00	1 wild elephant
19	Regularly monitoring of sagging electric wires and coordinate with Electricity Department to prevent elephant electrocution	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	1,00,000.00	1 event

REFERENCES

- Ament, R., Tiwari, S. K., Butynski, M., Chen, B. S., Dodd, N., Gangadharan, A., Jayasinghe, N., Laur, A., Oppler, G., Wong, E. P., Van Der Ree, R., & Wang, Y. (2021). *Protecting Asian Elephants from Linear Transport Infrastructure: The Asian Elephant Transport Working Group's Introduction to the Challenges and Solutions*. Asian Elephant Transport Working Group. <https://doi.org/10.53847/VYWN4174>
- Anoop, N. R., Krishnan, S., & Ganesh, T. (2023). Elephants in the farm – changing temporal and seasonal patterns of human-elephant interactions in a forest-agriculture matrix in the Western Ghats, India. *Frontiers in Conservation Science*, 4, 1142325. <https://doi.org/10.3389/fcosc.2023.1142325>
- Das, G., Selvan, K., Lahkar, B., & Gopi, G. V. (2022). Effectiveness of physical barriers in mitigating human–elephant negative interactions in North-East India. *Frontiers in Conservation Science*, 3, 956568.
- FSI. (2023). *India State of Forest Report 2023*. Forest Survey of India. https://fsi.nic.in/uploads/isfr2023/isfr_book_eng-vol-1_2023.pdf
- Goswami, V. R., Yadava, M. K., Vasudev, D., Prasad, P. K., Sharma, P., & Jathanna, D. (2019). Towards a reliable assessment of Asian elephant population parameters: The application of photographic spatial capture–recapture sampling in a priority floodplain ecosystem. *Scientific Reports*, 9(1), 8578. <https://doi.org/10.1038/s41598-019-44795-y>
- Hoare, R. (2012). *Lessons from 15 years of human–elephant conflict mitigation: Management considerations involving biological, physical and governance issues in Africa*. 51.
- Kamdar, A. (2020). *Human-elephant conflict mitigation as a public good: What determines fence maintenance?*
- Karant, K. K., Gupta, S., & Vanamamalai, A. (2018). Compensation payments, procedures and policies towards human-wildlife conflict management: Insights from India. *Biological Conservation*, 227, 383–389. <https://doi.org/10.1016/j.biocon.2018.07.006>
- Khan, A., Sil, M., Thekaekara, T., Sinha, I., Khurana, R., Sukumar, R., & Ramakrishnan, U. (2023). *Serial dilution shapes genetic variation and defines conservation units in Asian elephants* (p. 2023.09.04.556173). bioRxiv. <https://doi.org/10.1101/2023.09.04.556173>
- Kshetry, A., Bhave, N., Das, P., & Athreya, V. (2021). Mahakal Blessed My Crop: Community Dynamics and Religious Beliefs Influence Efficacy of a Wildlife Compensation Program. In *Frontiers in Conservation Science* (Vol. 2). <https://www.frontiersin.org/article/10.3389/fcosc.2021.727696>
- Manigandan, K., Anjum, M., Balasundaram, R., & Krishnan, A. (2022). Patterns and determinants of human-elephant conflict in Cauvery North Wildlife Sanctuary, Tamil Nadu, Southern India. *Asian Journal of Conservation Biology*, 11(2), 302–310.
- Naha, D., Sathyakumar, S., Dash, S., Chettri, A., & Rawat, G. S. (2019). Assessment and prediction of spatial patterns of human–elephant conflicts in changing land cover scenarios of a human-dominated landscape in North Bengal. *PLOS ONE*, 14(2), e0210580. <https://doi.org/10.1371/journal.pone.0210580>
- Project Elephant, MoEF&CC, Government of India. 2023. *Elephant Corridors of India 2023* (Edition – 1/2023).
- Project Elephant. (2017). *All India Synchronized Elephant Population Estimation* (p. 28). Ministry of Environment, Forest and Climate Change, Government of India.
- Ramkumar, K., Ramakrishnan, B., & Saravanamuthu, R. (2014). Human–Elephant (*Elephas maximus*) Conflict in Southern India: People's perception on conflict and elephant conservation in Coimbatore Forest Division. *J. Sci*, 7, 2.
- Rangarajan, M., Desai, A. a., Sukumar, R., Easa, P. S., Vincent, S., Ganguly, S., Talukdar, B. K., Singh, B., Mudappa, D., Chowdhary, S., & Prasad, A. N. (2010). *Gajah: Securing the future for elephants in India*. The report of the Elephant Task Force. *Gajah*, v+179.

- Rastogi, S., Bhattacharya, S., Vimal, K., Yadav, P., Singh Negi, H., Dinerstein, E., Shah, W. A., Nagano, Y., Hirari, S., Gulick, S., & Lee, A. T. L. (2024). *Promoting Human-Elephant Coexistence through Integration of AI, Real-Time Alerts, and Rapid Response*. <https://doi.org/10.20944/preprints202406.2065.v1>
- Saklani, A., Kumar, D., Gayathri, A., & Krishnan, A. (2018). The railway-line fence: A new passive elephant barrier at Bannerghatta National Park, southern India. *Gajah*, 48, 20-23.
- Sangay. (2014). Human-Wildlife Conflict in the Mountains of SAARC Region: Compilation of Successful Management Strategies and Practices. In *SAARC Forestry Centre* (p. 89).
- Sekar, N., & Sukumar, R. (2015). The Asian elephant is amongst the top three frugivores of two tree species with easily edible fruit. *Journal of Tropical Ecology*, 31(05), 385–394. <https://doi.org/10.1017/S0266467415000346>
- 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. <https://doi.org/10.3389/fevo.2018.00235>
- Srinivasaiah, N. M., Anand, V. D., Vaidyanathan, S., & Sinha, A. (2012). Usual Populations, Unusual Individuals: Insights into the Behavior and Management of Asian Elephants in Fragmented Landscapes. *PLoS ONE*, 7(8), e42571. <https://doi.org/10.1371/journal.pone.0042571>
- Sukumar, R. (1991). The Management of Large Mammals in Relation to Male Strategies and Conflict with People. *Biological Conservation*, 55, 93–102.
- Sukumar, R. (2016). Iconic fauna of heritage significance in India. *Indian Journal of History of Science*, 51(2), 369–379. https://insa.nic.in/writereaddata/UploadedFiles/IJHS/Vol51_2_7_RSukumar.pdf
- The Working Plan for Sonitpur East Forest Division (Northern Assam Circle), for the period of 2019-2020 to 2028-2029 by Suvasish Das IFS, SWPO. Sonitpur East Forest Division Assam Forest Department Government of Assam 2018-2019.
- van de Water, A., Henley, M., Bates, L., & Slotow, R. (2022). The value of elephants: A pluralist approach. *Ecosystem Services*, 58, 101488.
- Varma, S., Goswami, A., Kumar, U., Selvan, K. M., Srivastava, R. K., & Sukumar, R. (2019). *Atlas: Elephant Distribution, Corridors Potential Habitat Links in Arunachal Pradesh* (978 93 5407 571 1). Asian Nature Conservation Foundation (.
- Venkataraman, K. (2012). Biodiversity and its conservation. *Proceedings of the National Academy of Sciences, India Section B: Biological Sciences*, 82(Suppl 2), 271–282. <https://doi.org/10.1007/s40011-012-0096-z>
- Wildlife Institute of India. (2016). *Eco-friendly Measures to Mitigate Impacts of Linear Infrastructure on Wildlife*. Wildlife Institute of India.
- WWF-India, MOEFCC, & Project Elephant. (2022). *Field Manual For Managing Human-Elephant Conflict*.





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