



भारतीय वन्यजीव संस्थान
Wildlife Institute of India

HUMAN LEPHANT **CONFLICT** IN THE STATE OF **WEST BENGAL**

INDIA (2000 - 2025)



TRENDS,
CHALLENGES
& INSIGHTS

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Photo: Shiladitya Acharjee.

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Photo: Shiladitya Acharjee.



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A photograph of a herd of elephants in a savanna landscape. The elephants are in the foreground, partially obscured by tall grass. In the background, there are more elephants and a hazy, forested hillside under a cloudy sky.

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Photo: Shiladitya Acharjee.

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Photo: Shiladitya Acharjee.

EXECUTIVE SUMMARY

Between 2000 and 2025, 2,059 human casualties and 753 elephant deaths were recorded, with elephant mortality primarily resulting from electrocution, train collisions, and poaching. Both human casualties and elephant deaths were concentrated in the northern landscape particularly in the Dooars region, with Jalpaiguri, Gorumara Wildlife Division, and Buxa Tiger Reserve emerging as major hotspots. Kernel density analysis confirmed strong spatial clustering of conflict in these areas. Human casualties showed a significant male bias and peaked during the southwest monsoon season. Land-use and land-cover analysis indicated a 15.3% decline in forest cover accompanied by urban growth expansion 30.5%, highlighting habitat loss and fragmentation as key drivers of conflict. These findings emphasize the need for targeted, landscape-specific mitigation strategies to reduce both human casualties and elephant mortality while promoting long-term human–elephant coexistence in West Bengal.

The Landscape in Numbers

707

*Wild Elephants
(SAIEE-2025)*

25 YEARS

*Study Duration
(2000–2025)*

36 *Forest Divisions Covered*

Priority Areas and Management Implications

Elephant mortality and human casualties were concentrated in a limited number of divisions, particularly Jalpaiguri, Gorumara, Buxa Tiger Reserve east & west in Northern landscape. Jhargram, Bankur, Purulia in Southern landscape. These areas should receive priority attention.

The principals recommended actions are:

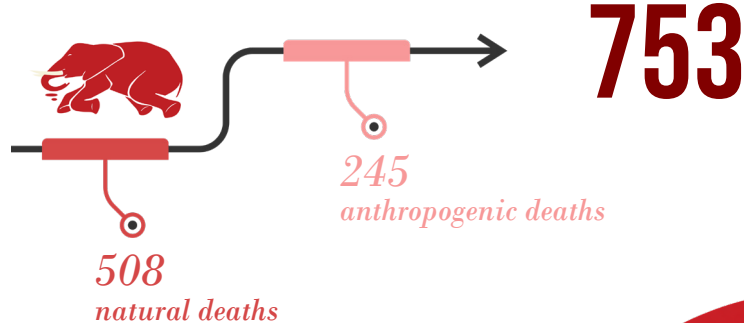
1. Strengthen barrier infrastructure through scientific placement, maintenance, and GIS-based monitoring.
2. Reduce electrocution by removing illegal fencing, improving power infrastructure, and promoting safe solar fencing.
3. Prevent train collisions using AI/DAS detection systems and wildlife crossing structures.
4. Enhance early warning systems through GPS tracking, AI surveillance, and community alert networks.
5. Strengthen Rapid Response Teams (RRTs) for timely response and conflict management.
6. Restore elephant habitats by improving forests, water sources, and ecological corridors.
7. Protect elephant corridors and maintain landscape connectivity through coordinated land-use planning.
8. Expand long-term monitoring of elephant movements to support evidence-based management & strengthen community participation through awareness, timely compensation, and improved crop protection measures.



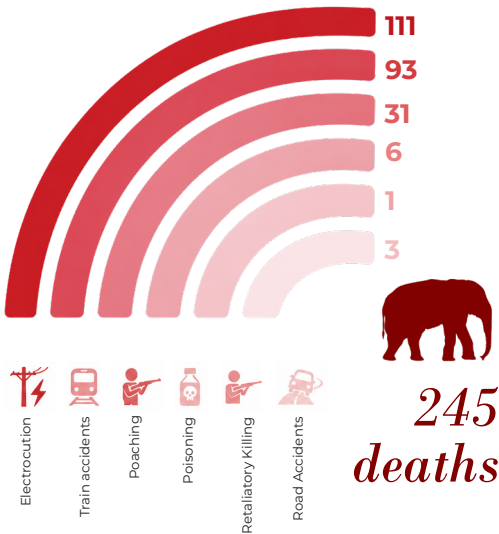
**TOTAL AREA
88,752 KM²**

An integrated, community-centred approach with effective policies and stakeholder participation is essential for long-term human–elephant coexistence in West Bengal while safeguarding biodiversity and livelihoods.

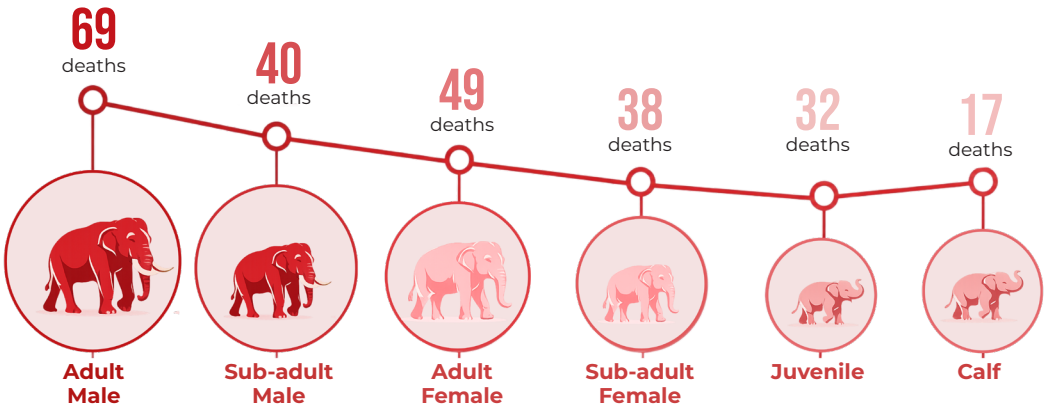
Elephant MORTALITIES



Overall DEATHS

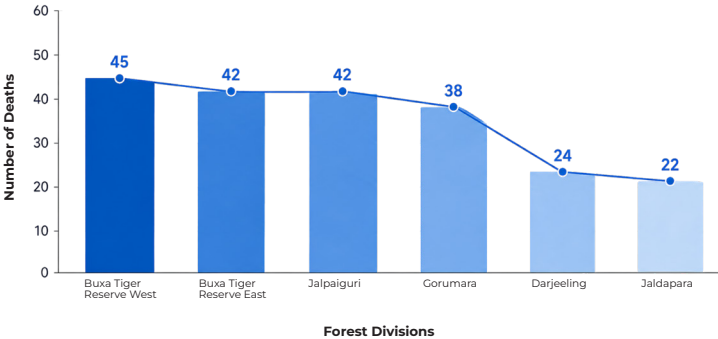


Age-Class DEMOGRAPHY



Spatial Distribution of OVERALL ELEPHANT MORTALITY

A total of 108 villages recorded elephant mortality in West Bengal, of which 91.67% (99 villages) experienced low mortality, 7.41% (8 villages) had medium mortality, and 0.93% (1 village) recorded high mortality.



These high-incidence villages represent conflict hotspots that should be prioritized for targeted mitigation measures.

Although high-mortality villages were few, they represent critical hotspots requiring targeted conservation interventions. 639 villages were affected by human–elephant conflict, with 95.00% (599 villages) experiencing low incidence, 5.16% (33 villages) medium incidence, and 1.10% (7 villages) high incidence.

Human Fatalities AND INJURIES

1761

Human fatalities

298

Human injuries

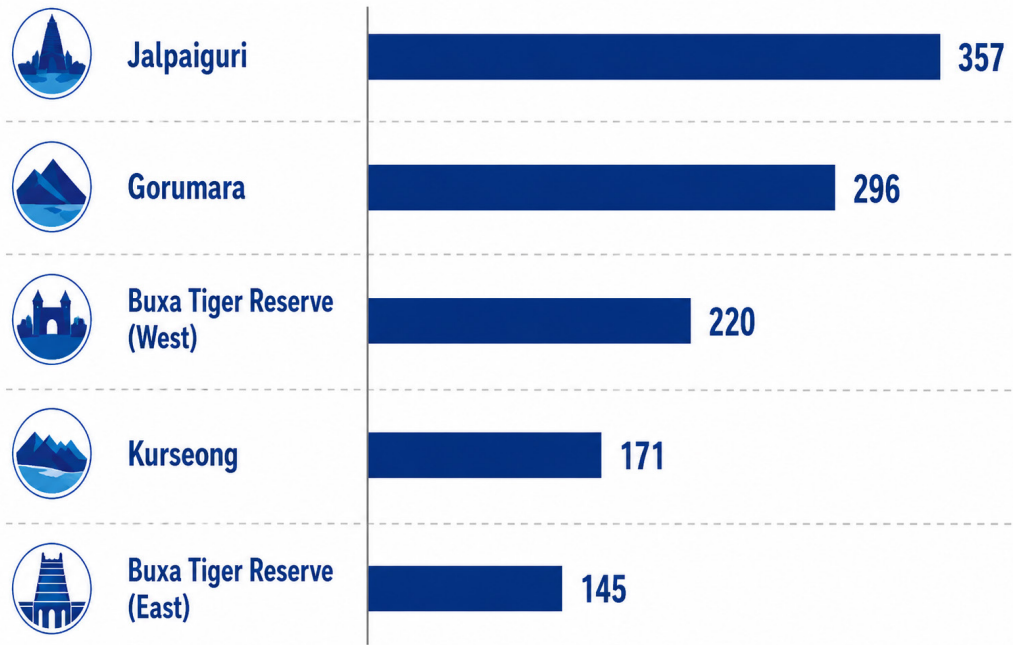




Photo: Nima Sherpa.



INTRODUCTION

Human elephant conflict (HEC) has emerged as one of the most persistent and complex conservation challenges of the twenty-first century, reflecting the intensifying interface between expanding human activities and the ecological requirements of wide-ranging megafauna. Across tropical and subtropical regions of Asia, rapid land-use change driven by agricultural expansion, infrastructure development, and demographic growth has fragmented once-contiguous habitats and disrupted long-established wildlife movement pathways (Haddad et al., 2015; de Silva et al., 2023; Chan et al., 2024). These transformations have compressed elephants into increasingly restricted and heterogeneous landscapes, where they are compelled to navigate mosaics of cropland, settlements, and linear infrastructure. The resulting interactions manifesting as crop depredation, property damage, human injury and death, and retaliatory killing of elephants highlight a fundamental paradox in conservation: species such as the Asian elephant, globally valued for their ecological roles as keystone herbivores and ecosystem engineers, are often locally perceived as threats to livelihoods and safety (Sukumar, 2003; Hoare, 2015; Fernando et al., 2005; Desai & Riddle, 2015). Increasingly, HEC is understood not as an isolated ecological issue but as a coupled socio-ecological phenomenon shaped by the interaction of environmental change, human land-use decisions, and governance systems. Accordingly, there is growing recognition that effective management requires context-dependent coexistence strategies that integrate ecological, social, and governance considerations rather than focusing solely on conflict reduction (Pandey et al., 2026b).

At the global scale, recent research highlights that HEC is projected to intensify under future scenarios of climate change, agricultural expansion, and human population growth (Guarnieri et al., 2024). Changes in climatic conditions and resource availability can alter elephant habitat suitability, movement, and space use, while declining water availability and land-use change may further increase interactions between elephants and people in human-modified landscapes (Montero-Botey et al., 2024; Guarnieri et al., 2024). These pressures

are particularly important in landscapes where natural habitats are increasingly fragmented or converted to agriculture, increasing spatial overlap between elephants, croplands, and human settlements (de Silva et al., 2023; Guarnieri et al., 2024). Seasonal variation in natural forage and the availability of cultivated crops can further influence elephant foraging and crop-raiding behaviour, with agricultural fields providing concentrated and seasonally available food resources (Sukumar, 1990; Nair & Jayson, 2021). Consequently, HEC exhibits distinct spatial and temporal patterns shaped by landscape configuration, resource availability, agricultural cycles, and the distribution of human activities (Sukumar, 1990; Nair & Jayson, 2021).

Within Asia, the challenge of HEC is especially pronounced. The Asian elephant is classified as Endangered and now occupies a fraction of its historical range, with populations distributed across fragmented and human-modified landscapes. India supports nearly 60% of the global population, making it central to the species' long-term survival (MoEFCC, 2017). Recognising the ecological and cultural importance of elephants, the Government of India launched Project Elephant in 1992 to strengthen habitat protection, secure elephant corridors, and promote long-term conservation across elephant landscapes (Pandey et al., 2026c). However, this conservation significance is accompanied by high levels of conflict, with hundreds of human and elephant deaths reported annually (MoEFCC, 2023). Despite the establishment of Elephant Reserves under Project Elephant, increasing land-use change and expanding human activities within reserve landscapes continue to challenge habitat integrity and functional connectivity (Pandey et al., 2025a). Unlike many African systems where elephants occur in relatively extensive protected areas, Asian elephants persist largely outside such boundaries, inhabiting multi-use landscapes where agriculture, settlements, and infrastructure are interwoven with forest fragments. Empirical studies across India demonstrate that conflict intensity is not solely determined by elephant density but is strongly influenced by landscape structure, availability of resources, and patterns of human land use (Goswami et al., 2015; Gubbi, 2012). Recent landscape-scale analyses from Assam further demonstrate that forest proximity, protected areas, and anthropogenic landscape features jointly influence the spatial distribution of human–elephant conflict (Athira et al., 2026). Similar long-term state-wide investigations in Jharkhand and Chhattisgarh have highlighted the importance of landscape composition and anthropogenic factors in shaping patterns of both human fatalities and elephant mortality (Pandey et al., 2025a; Roy et al., 2025a).

Eastern India forms a critical region for understanding HEC dynamics, and among its states, West Bengal presents a particularly acute and illustrative case. Despite supporting only a small proportion of India's elephant population approximately 2% the state experiences disproportionately high levels of human–elephant conflict. Previous studies have provided information that Electrocution has been the main cause of elephant deaths in the state of West Bengal, and

the 9 -year study has also stated about 726 human deaths and ~ 1200 human injuries (Majumder, 2022). Several studies have documented the emergence and intensification of HEC across both northern and southern West Bengal, highlighting the influence of landscape fragmentation, expanding agriculture, and seasonal elephant migration from neighbouring states (Chakraborty, 2015; Naha et al., 2019; Naha et al., 2020). Additional studies confirm that the state contributes significantly to national HEC-related mortality despite its relatively small elephant population, underscoring the intensity of conflict relative to distribution (Mondal et al., 2022; Chakraborty, 2022). This imbalance reflects a distinctive socio-ecological configuration in which dense human populations, agrarian livelihoods, and fragmented yet functionally critical elephant habitats intersect. The elephant range in West Bengal is organised across two ecologically distinct yet interconnected landscapes: the Terai–Dooars region of North Bengal supporting ~ 676 elephants and the lateritic forest–agriculture mosaic of South Bengal supporting ~ 31 elephants only (Qureshi et al., 2025). North Bengal, situated along the foothills of the eastern Himalayas, comprises subtropical broadleaf forests, riverine grasslands, and tea plantation mosaics that support relatively stable and resident elephant populations. Protected areas such as Buxa Tiger Reserve and Jaldapara National Park form key strongholds within a larger transboundary landscape connected to Bhutan, Assam, and Nepal. In contrast, South Bengal is characterised by fragmented dry deciduous and sal-dominated forests interspersed with agricultural land and settlements. In this region, elephant presence is largely seasonal and migratory, with herds moving from neighbouring Jharkhand and Odisha in response to habitat degradation and resource scarcity in their original ranges (Singh, 2006; Chakraborty, 2015; Majumder, 2022). These contrasting ecological settings give rise to distinct conflict regimes, with North Bengal characterised by long-term coexistence and South Bengal experiencing more recent and rapidly intensifying conflict.

The state contains 26 identified elephant corridors, the highest number for any Indian state, linking forest patches across both northern and southern landscapes, which also concentrate conflict within narrow spatial interfaces (Project Elephant, MoEFCC, 2023). Maintaining these functional corridors is essential for sustaining landscape connectivity, facilitating elephant movement, and reducing conflict across fragmented elephant habitats (Pandey et al., 2024a). These corridors traverse human-dominated matrices, including tea estates, railway lines, roads, and agricultural fields, transforming them into high-risk zones where elephants and humans frequently interact. Field-based assessments indicate that a significant proportion of forest-adjacent administrative units (mouzas) experience recurrent conflict, with districts such as Jhargram, Paschim Medinipur, and Rupnarayan emerging as persistent hotspots. Spatial analyses further demonstrate that proximity to forests, agricultural intensity, human density, and corridor configuration strongly influence the distribution and frequency of conflict events (Naha et al., 2019; Naha et al., 2020; Panja & Mistri, 2025).

Habitat degradation and declining forage availability further intensify these dynamics. Although elephants are generalist herbivores capable of consuming a wide range of plant species, forest ecosystems in parts of West Bengal—particularly in the southern landscape have undergone simplification due to monoculture plantations, extraction pressures, and fragmentation. Reduced diversity and availability of natural forage compel elephants to exploit cultivated crops such as paddy, maize, sugarcane, and banana, which offer higher caloric returns and are often located near forest edges. This shift from forest-based foraging to agricultural dependence represents a key ecological mechanism driving recurrent crop-raiding behaviour and sustaining conflict over time (Madhusudan, 2003; Naha et al., 2020). In addition, seasonal variation in resource availability influences elephant movement patterns, with conflict often peaking during crop maturation and harvest periods when agricultural fields provide highly attractive food resources.

Forest-fringe communities in West Bengal, including Scheduled Tribe groups such as the Santal, Munda, Ho, Bhumij, Lodha, and Mech–Bodo-related communities, depend heavily on smallholder agriculture and forest-based livelihoods. This close dependence on land and natural resources increases vulnerability to crop loss, property damage, and human casualties, amplifying both economic and psychological impacts of HEC. Recurrent conflict can undermine household food security and income stability, while also influencing perceptions of elephants and conservation initiatives. Empirical studies indicate that attitudes toward elephants are strongly mediated by socio-economic conditions, exposure to conflict, and the effectiveness of compensation and mitigation measures (Chakraborty et al., 2024; Nad & Basu-Roy, 2024). While elephants retain cultural and religious significance in many communities, repeated conflict events can erode tolerance and contribute to negative or pragmatic perceptions of the species.

Infrastructure development and governance challenges further complicate the conflict landscape. Railways, highways, and electrified barriers intersect key elephant movement routes, contributing to mortality through collisions and electrocution while simultaneously constraining movement and concentrating elephants into narrower pathways. Electrocution, often associated with illegal or poorly regulated electric fencing, has emerged as a major cause of elephant mortality in the state (Ghosh et al., 2025). Although a range of mitigation strategies, including compensation schemes, early warning systems, solar fencing, and elephant driving squads, have been implemented, their effectiveness remains uneven due to maintenance challenges, ecological variability, and socio-economic constraints (Chakraborty & Nabanita, 2021; Majumder, 2022). These limitations highlight the need to address underlying structural drivers of conflict rather than relying solely on reactive, site-specific interventions. Previous studies in West Bengal have improved understanding of conflict

patterns and identified several environmental and anthropogenic factors associated with human–elephant conflict. Achieving long-term coexistence therefore requires integrated landscape-level conservation strategies that combine habitat connectivity, corridor conservation, adaptive management, and community participation (Pandey et al., 2024b). Likewise, recent state-wide investigations from Jharkhand and Chhattisgarh have demonstrated the value of long-term analyses in identifying ecological drivers, mortality patterns, and persistent conflict hotspots (Pandey et al., 2025b; Roy et al., 2025b; Athira et al., 2026). However, comparable long-term state-wide assessments integrating both human and elephant mortality across the contrasting landscapes of North and South Bengal remain limited.

Building on this context, the present study analyses human–elephant conflict in West Bengal over the period 2000–2025 to quantify spatio-temporal patterns and identify key ecological and anthropogenic drivers of conflict. By integrating long-term incident data with landscape variables, this study aims to delineate conflict hotspots, examine seasonal dynamics, and provide a scientific basis for targeted and scalable mitigation strategies in the state.

1. How have the causes and spatial distribution of human fatalities and elephant mortality changed across West Bengal between 2000 and 2025?
2. Are the age, sex, and other demographic characteristics of deceased elephants associated with specific causes of mortality, particularly anthropogenic causes?
3. Are changes in land use and land cover between 2000 and 2025 associated with the spatial and temporal patterns of human and elephant mortality?



Photo: Shiladitya Acharjee.

STUDY AREA

The study was conducted in the state of West Bengal, eastern India, extending from approximately 21°25'N to 27°13'N latitude and 85°50'E to 89°53'E longitude and covering ~88,752 km². The state shares boundaries with Jharkhand, Odisha, Bihar, Assam, and Sikkim, as well as the countries Bhutan, Nepal, and Bangladesh, forming part of a broader eastern Indian elephant landscape (MoEFCC, 2017; Sukumar, 2003). Two ecologically distinct regions characterize the study area: (i) the northern Terai-Dooars belt along the Himalayan foothills, comprising moist deciduous, semi-evergreen, and riverine forests interspersed with tea plantations, and (ii) the southern and southwestern plateau fringe (Jungle Mahals), dominated by dry deciduous sal (*Shorea robusta*) forests embedded within a human-dominated agricultural matrix (Champion & Seth, 1968). Forest cover in the state is 11,752 km² (~13.2% of the total geographical area), with relatively contiguous and productive forests in the north and highly fragmented, seasonally resource-limited forests in the south (FSI, 2023). The region experiences a tropical monsoonal climate with distinct summer (March–June), monsoon (June–September), and winter (November–February) seasons, with annual rainfall ranging from ~1500 mm in the south to >3000 mm in the northern foothills (IMD, 2020).

West Bengal supports two contrasting elephant population systems of the Asian elephant. Northern districts (Alipurduar, Jalpaiguri, Darjeeling) harbor a relatively stable, resident population (~500 individuals) connected to transboundary habitats in Bhutan and northeastern India, whereas southern districts (Purulia, Bankura, Paschim Medinipur) host a smaller, fluctuating population (~100–200 individuals) that migrates seasonally from the Dalma landscape of Jharkhand and adjoining Odisha (Sukumar, 1992; MoEFCC, 2017; Chatterjee, 2020). The state has a human population exceeding 90 million, with high rural densities in forest-fringe areas where livelihoods depend on agriculture and forest resources (Government of India, 2011). Forest-

fringe communities in West Bengal, including Scheduled Tribe groups such as the Santal, Munda, Ho, Bhumij, Lodha, and Mech–Bodo-related communities (constituting about 5.08% of the total Tribal population of the Country), depend heavily on smallholder agriculture and forest-based livelihoods (Government of West Bengal, Tribal Development Department. (2011). Paddy-dominated cropping systems, along with maize, oilseeds, and sugarcane, create highly attractive foraging opportunities for elephants, particularly during monsoon and post-monsoon seasons (Chakraborty, 2015; Bera *et al.*, 2020). In the southern landscape, the relatively recent establishment of elephant presence (post-1980s) combined with fragmented habitats and expanding agriculture has intensified human–elephant interactions, whereas in the north, long-term coexistence persists within a mosaic of forests, tea estates, and settlements (Sukumar, 2003; Gubbi, 2012). Together, these ecological, climatic, and socio-economic gradients make West Bengal a critical landscape for examining spatial variability in human–elephant conflict across eastern India.



Photo: Shiladitya Acharjee.

METHODS

Collection of Elephant Mortality and Human Fatality Records

Information on Human-Elephant Conflict (HEC) incidents was compiled from all 36 Forest Divisions of West Bengal covering the period 2000 to 2025. The dataset included detailed records of elephant mortality due to both natural and anthropogenic causes and human fatalities and injuries caused by wild elephants, along with associated variables such as division name, village name, date of incident, and gender of the victim. All data were obtained directly from the West Bengal Forest Department, and divisional authorities cross-verified the entries to ensure completeness and accuracy. Only officially documented and field-confirmed cases were included in the final dataset to maintain data reliability for spatial-temporal analysis.

A total of 753 elephant mortalities and 2059 cases of HEC incidents, including human fatalities and injuries, were recorded across the major elephant-bearing forest divisions of the state, covering the period 2000-2025.

Each elephant mortality cases were classified based on mentioned details of each incident in the data as the year of incident, season: Summer (March- May), Monsoon (June- September); two monsoon period: Southwest monsoon (June-September) Northeast Monsoon (October- November), and winter (December-February), age demography of elephant, reason due to which elephant has died, place of occurrence, division wise distribution of the incidents. For elephant deaths, causes of death were categorized as outlined in Table 1.1(b).

The HEC incident details included details of human death/ injuries, place of occurrence, age, and sex. This data was further classified based on the year in which the incidents happened, age and sex of the deceased person, and season.

To examine the relationship between cause of death and elephant demography, a chi-square test was performed using R (version 4.3.1) to test the significance of associations between mortality categories and age groups. For HEC incidents, a chi-square test was performed for season vs. sex.

Table 1.1(a): Elephant age categories followed Arivazhagan and Sukumar (2008):

Age Group	Age Range
Calves	0-1
Juveniles/Yearlings	1-5
Sub- adults (Males& Females)	6-15
Adults (Males & Females)	16+

Table 1.1(b): Flowchart Illustrating the Categorisation of Elephant Mortality Factors in West Bengal.

Categories	Sub-categories	Examples
Natural	Natural causes	Stillbirth, old age, disease, heart failure, malnourishment, heat stroke, dehydration, Accidental cases like: Drowning, lightning strikes, falling from hills/slopes, Territorial fights
Poisoning	Retaliatory killings / HEC	Poisoning, direct attacks, chase-related injuries
Poaching	Poaching	Ivory removal, snares, traps
Electrocution	Electrocution	Illegal lines, low-hanging wires, fence lines
Human-made infrastructure stress	Linear infrastructure and Entrapment in drains/ canals	Train hits, vehicular, Wells, open tanks, trenches, drains

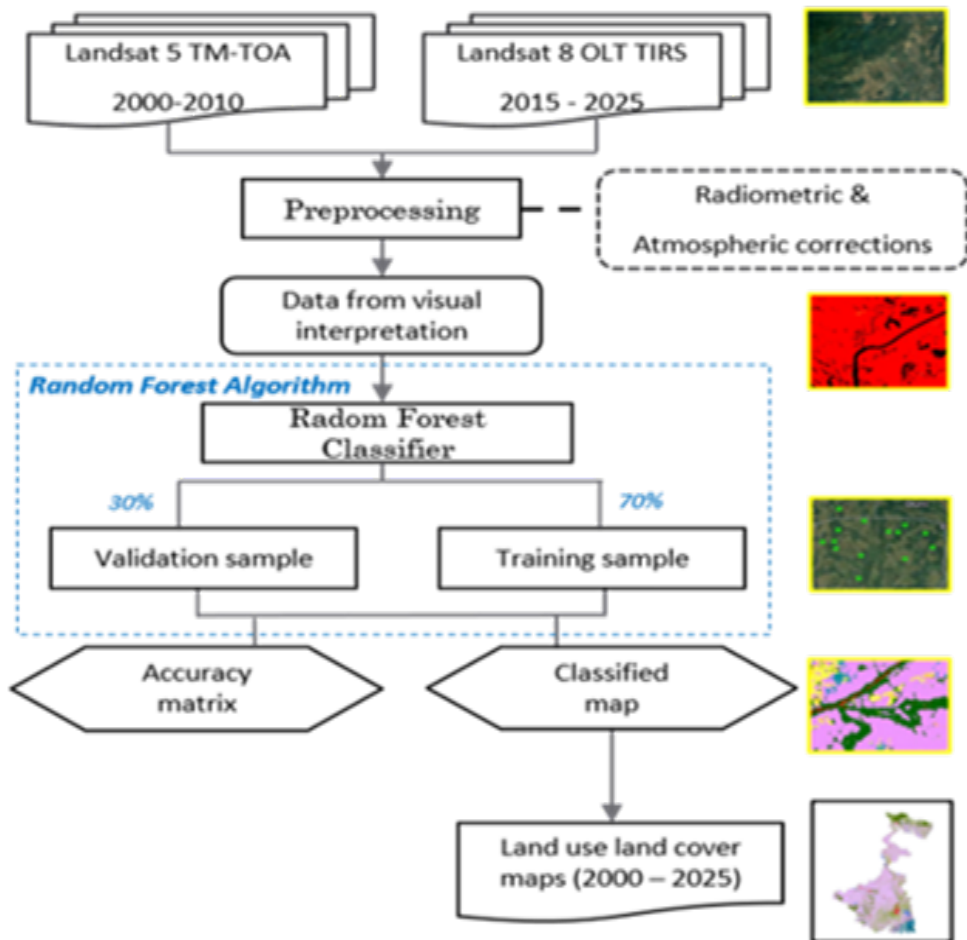


Figure 1.1: Flowchart Land Use Land Cover (LULC)

Land Use and Land Cover (LULC) Change Analysis

LULC analysis was conducted for West Bengal over 25 years to examine how landscape transformation has influenced patterns of elephant mortality. Satellite-based LULC maps were generated at five-year intervals (2000, 2005, 2010, 2015, 2020, and 2025). Google Earth Engine (GEE) was used for image preprocessing, classification, and temporal comparison. ArcGIS Pro was used for subsetting the West Bengal study area, raster dataset compilation, fragmentation analysis, distance calculations (e.g., distance to settlements, plantations, water bodies, roads), and map preparation.

Landsat imagery was classified using a Random Forest (RF) classifier from the “smileRandomForest” library, with six spectral bands (blue, green, red, near-infrared, and two shortwave infrared bands) (Fig.1.1). The spatial resolution was

maintained at 30 m, and data were projected to UTM Zone 43N for West Bengal. 10 major LULC categories were mapped: (1) Forest, (2) Water bodies, (3) Barren/open land, (4) Cropland, (5) Human settlements, (6) Scrubland, (7) Grassland, (8) Mangroves, (9) Plantation, (10) non-Forest tree cover. Temporal LULC changes across the 25 years were analysed to quantify habitat loss, fragmentation, and expansion of human-modified land uses. Particular emphasis was placed on areas showing increases in agriculture, settlements, and plantations, as these transitions are closely linked to conflict-prone zones and elephant movement pathways in West Bengal. A multi-temporal comparison highlights how land-use transitions correlate with spatial patterns of elephant mortality, providing insights for landscape-level conservation planning.

A 7 km × 7 km fishnet grid was overlaid on the fragmentation layers, and LPI and ED values were reclassified into five classes: Very Low, Low, Medium, High, and Very High. For LPI, higher classes indicate larger and more continuous forest patches, whereas lower classes indicate greater fragmentation. Conversely, higher ED classes represent greater forest fragmentation due to increased edge density, while lower classes indicate more compact and less fragmented forest landscapes. The proportion of each fragmentation class within every 7 km × 7 km grid was calculated and summarized as percentages to compare changes in forest fragmentation between 2008 and 2025 and to assess changes in forest landscape dynamics across West Bengal.

Spatial Distribution of Elephant Mortality and Human Mortalities & Injuries

Elephant mortality incidents in West Bengal were georeferenced using GPS coordinates and systematically mapped to examine their spatial distribution patterns across the state. A heat map was generated using R (version 4.3.1) to investigate the relationship between mortality frequency and geographic location. Kernel Density Estimation (KDE) was applied to identify zones with elevated mortality intensity, enabling the visualization of spatial hotspots where elephant deaths and human deaths & injuries were disproportionately concentrated. Administrative boundaries, including forest ranges, divisions, and village limits, were used as primary spatial units to contextualize mortality patterns and evaluate spatial clustering across the major elephant-bearing landscapes of West Bengal.

Landscape Fragmentation Analysis

Landscape fragmentation in West Bengal was assessed using FRAGSTATS (version 4.2) with LULC data reclassified into two primary categories: forest and non-forest. Key landscape metrics, including Patch Density (PD), Edge Density (ED), and Largest Patch Index (LPI), were computed to quantify forest structure

Table 1.2: Landscape Metrics: Definitions and Computational Formulas

Landscape Metric	Description	Formula
Patch Density (PD)	Number of patches per unit area	$PD = (N / A) \times 10,000 \times 100$
Edge Density (ED)	Total edge length per unit area	$ED = (\sum e_{ik} / A) \times 1000$
Largest Patch Index (LPI)	Percentage of total landscape area comprised by the largest patch	$LPI = (\max(a_{ij}) / A) \times 100$

across the five temporal intervals (2000,2005, 2010, 2015, 2020, 2025). These metrics provided insights into the degree of habitat fragmentation, changes in forest patch configuration, and implications for habitat connectivity across West Bengal's elephant ranges. A circular moving window with a 7 km radius was applied to calculate localized fragmentation metrics around each forest pixel, as this corresponds to a daily movement of elephants around ~7 km (Cushman *et al.*, 2010). Fragmentation metrics were further examined to assess their potential influence on elephant mortality patterns across divisions. Spatially explicit maps of PD, ED, and LPI were generated to visualize fragmentation gradients and to identify high-risk zones where reduced habitat connectivity may contribute to increased elephant movement into human-dominated landscapes. This analysis forms an important basis for understanding how changing land-use patterns affect elephant ecology and conflict risk in West Bengal.

Where: N = number of patches, A = total landscape area (m²), $\sum e_{ik}$ = sum of all edge lengths, $\max(a_{ij})$ = area of the largest patch, i, j, k = patch/edge identifiers, Units: PD (patches/100 ha), ED (m/ha), LPI (%)

Predictors of Elephant Mortality and Human Mortalities & Injuries

To identify the environmental and anthropogenic factors influencing elephant mortality in West Bengal, a generalized linear model (GLM) with a binomial distribution was implemented using R (version 4.3.1). Spatial attributes of mortality events were integrated with GIS-based environmental layers representing key landscape variables of the state. Mortality incidents were coded as 1, while pseudo-absence points (coded as 0) were generated randomly across non-mortality landscape units to allow comparison between presence and background conditions. A suite of explanatory variables representing major ecological and human-modified features in West Bengal was selected for analysis. These included distance to forest, cropland, built-up areas, major

and minor roads, water sources, railways, protected areas, elephant reserves, and plantation zones such as tea or coffee estates (Table 1.3). These predictors were chosen based on their documented influence on elephant movement, habitat selection, and conflict occurrence in the Western and Eastern Ghats landscapes. To assess multicollinearity among predictors, Variance Inflation Factors (VIF) were computed, and highly correlated variables ($VIF > 3$) were removed to ensure model stability. Model performance was evaluated using the Akaike Information Criterion (AIC), and a set of competing models was generated. Model ranking and selection followed Burnham and Anderson's (2002) information-theoretic approach, where models within $\Delta AIC \leq 2$

Table 1.3: *A Priori Hypotheses on Environmental and Anthropogenic Factors Influencing Elephant Mortalities and Human Casualties in West Bengal.*

Feature	Variable	Description and Source	A priori hypothesis (Elephant mortality)	A-priori hypothesis (Human HEC)
Land cover	Distance from Built-up (db)	Classified land cover types, such as built-up areas, cropland, forests, and waterbodies, were used to calculate distances between conflict points and each land cover type using the Near Table tool in ArcPro 3.0.0.	Higher elephant mortality near settlements due to increased human-elephant interactions.	Higher proximity may reduce HEC due to increased human activity and habitat loss.
	Distance from Cropland (dc)	Proximity to cropland increases mortality risk due to electrocution and retaliation.	Proximity to cropland increases mortality risk due to electrocution and retaliation.	Closer proximity increases HEC due to crop damage.
	Distance from Forest (df)	Mortality risk decreases with distance from forests, which provide essential resources.	Mortality risk decreases with distance from forests, which provide essential resources.	Closer proximity increases HEC as elephants move into human settlements.
	Distance from Waterways(dw)	Proximity to waterways lowers mortality risk by reducing movement into human areas.	Proximity to waterways lowers mortality risk by reducing movement into human areas.	Closer proximity increases HEC, especially in dry seasons.

Land cover	Edge density (ED)	Edge density represents the total length of transitions between different landcover types per unit area. The distance from edge density is calculated by measuring how close conflict points are to areas with high edge density using GIS spatial analysis tools.	Higher edge density increases mortality risk due to habitat fragmentation and human interaction.	Closer proximity may increase HEC due to habitat fragmentation and human activity.
	Largest Patch Index (LPI)	The Largest Patch Index measures the size of the largest continuous habitat patch within a landscape. Distance to the Largest Patch Index is calculated by determining the distance between conflict points and the largest habitat patches through GIS spatial analysis.	Elephants near large habitat patches have lower mortality risk due to resource availability.	Larger habitat patches may reduce HEC by providing suitable habitat and limiting elephant movement into human-dominated areas.
	Patch Density (PD)	The Patch Density quantifies the number and distribution of habitat patches within a landscape. Distance from the Patch Density is calculated by assessing how close conflict points are to areas with high patch density using GIS tools.	Higher patch density increases fragmentation and human-elephant conflicts.	Higher patch density increases HEC due to habitat fragmentation and increased edge effects.
	Distance from plantations (dpl)	Plantations were from Roy et al. (2016) LULC classification product, and distance is calculated by generating a near table (using ArcPro 3.0.0).	Mortality risk increases near tea gardens due to disrupted corridors and human encounters.	Closer proximity may increase HEC due to habitat loss, pesticides, and human activity.

Anthropogenic	Distance from Railways (drail)	Road and railway network shapefiles were sourced from OpenStreetMap.org, with distances calculated using the Near Table tool in ArcPro 3.0.0.	Closer proximity increases mortality risk from train collisions and habitat fragmentation.	Closer proximity increases HEC due to habitat fragmentation and human activity.
	Distance from Road (dr)	Higher mortality risk due to vehicle collisions and habitat disturbance.	Higher mortality risk due to vehicle collisions and habitat disturbance.	Higher proximity may increase HEC by facilitating human access and increasing disturbance.
	Distance from Protected Areas (dpa)	Distance between elephant mortality location and protected area boundaries was calculated using shapefiles from the Elephant Cell at the Wildlife Institute of India (WII), processed in ArcPro 3.0.0.	Lower mortality risk near protected areas due to reduced human pressure.	Lower HEC risk near protected areas due to reduced human pressure.
	Distance from Elephant Reserve (der)	Distances were measured between elephant reserves and mortality points to evaluate the role of these areas in mortality risk.	Lower mortality risk near reserves due to sufficient resources.	Lower HEC risk near elephant reserves due to resource availability.

were considered equally plausible. The final predictive model was obtained by averaging top-ranked models, providing a robust and parsimonious representation of factors driving elephant mortality in West Bengal.

Cross-validation techniques were used to evaluate predictive accuracy and reduce overfitting. Spatial predictions from the final model were used to map high-risk zones and identify landscape features strongly associated with mortality hotspots. This analytical approach enhances understanding of the ecological and anthropogenic drivers of elephant deaths and provides critical insights for targeted mitigation strategies and landscape-level planning in West Bengal.

Categorizing Villages Based on Intensity of Elephant Mortalities and Human Mortalities and Injuries

Villages in West Bengal were categorized into four mortality-intensity classes based on the total number of elephant mortalities and HEC incidents recorded within or near their administrative boundaries. The elephant mortality categories included: high-incident villages (> 10 elephant mortalities), medium-incident villages (05-10 mortalities), low-incident villages (1-05 mortalities), and no-incident villages. This classification was used to investigate potential relationships between mortality intensity and key landscape variables such as forest cover, crop cover, built-up areas, and plantation/mining areas.

The severity of Human-Elephant Conflict (HEC) was evaluated by examining the frequency of incidents across villages within the forest divisions. Villages were classified by conflict intensity: high (more than 20 incidents), medium (11-20 incidents), and low (1-10 incidents). This classification was used to investigate potential relationships between mortality intensity and key landscape variables such as forest cover, crop cover, built-up areas, and plantation/mining areas.

A Kruskal-Wallis rank sum test, a non-parametric statistical method, was employed to evaluate whether statistically significant differences existed in the median values of landscape variables among the four village categories. This approach is appropriate for datasets that violate normality assumptions and provides a robust comparison across multiple independent groups.

To further explore pairwise differences among the incident categories, a Dunn test was conducted as a post-hoc analysis. This test identifies which specific pairs of village categories (e.g., high vs. low, medium vs. no-incident) exhibit significant differences in landscape characteristics while applying appropriate corrections for multiple comparisons. Village boundary data were obtained from ArcGIS Online, using the shapefile *Indian Administrative Layer 2024*. These boundaries were used to extract landscape metrics and link them with mortality-intensity categories for statistical analysis.



RESULTS

Forest Fragmentation Pattern

The temporal distribution of landscape fragmentation metrics in West Bengal revealed marked changes between 2000 and 2025. The largest patch index showed a decrease in the proportion of grid cells within the very high class, accompanied by increases in the high, medium, low, and very low classes. This shift indicates a reduction in the dominance of large, continuous forest patches and a greater prevalence of smaller, fragmented patches. Similarly, the edge density distribution exhibited a decline in the very low class, with corresponding increases across the low, medium, high, and very high classes, reflecting greater edge development throughout the landscape. Overall, these

patterns indicate progressive forest fragmentation in West Bengal between 2000 and 2025, characterized by reduced patch continuity and increased edge complexity, with potential implications for habitat connectivity and elephant movement.

The fragmentation metrics indicate that forest fragmentation is primarily concentrated in the northern and south-western regions of West Bengal. Higher Patch Density (PD) and Edge Density (ED) values in these areas reflect the presence of numerous small, fragmented forest patches with extensive edge effects. In contrast, the Largest Patch Index (LPI) was generally low across most of the state, with relatively higher values confined to a few forest blocks, indicating that large, continuous forest patches are limited. Overall, the spatial patterns suggest increasing forest fragmentation outside the remaining core forest areas (Fig.1.3).

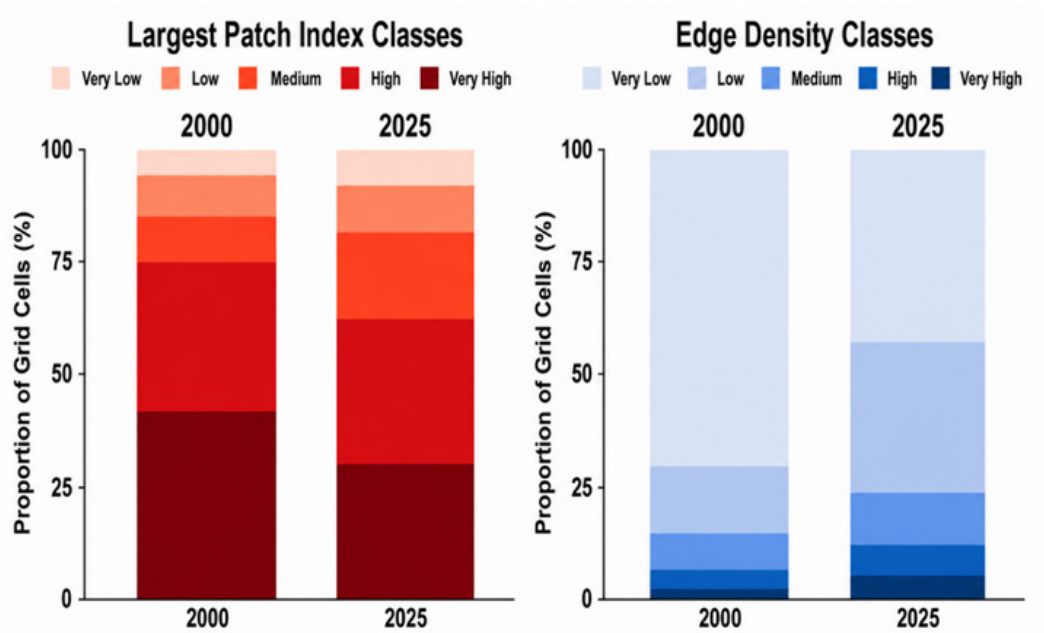


Figure 1.2(a): Temporal changes in Largest Patch Index (LPI) and Edge Density (ED) classes in West Bengal between 2000 and 2025.

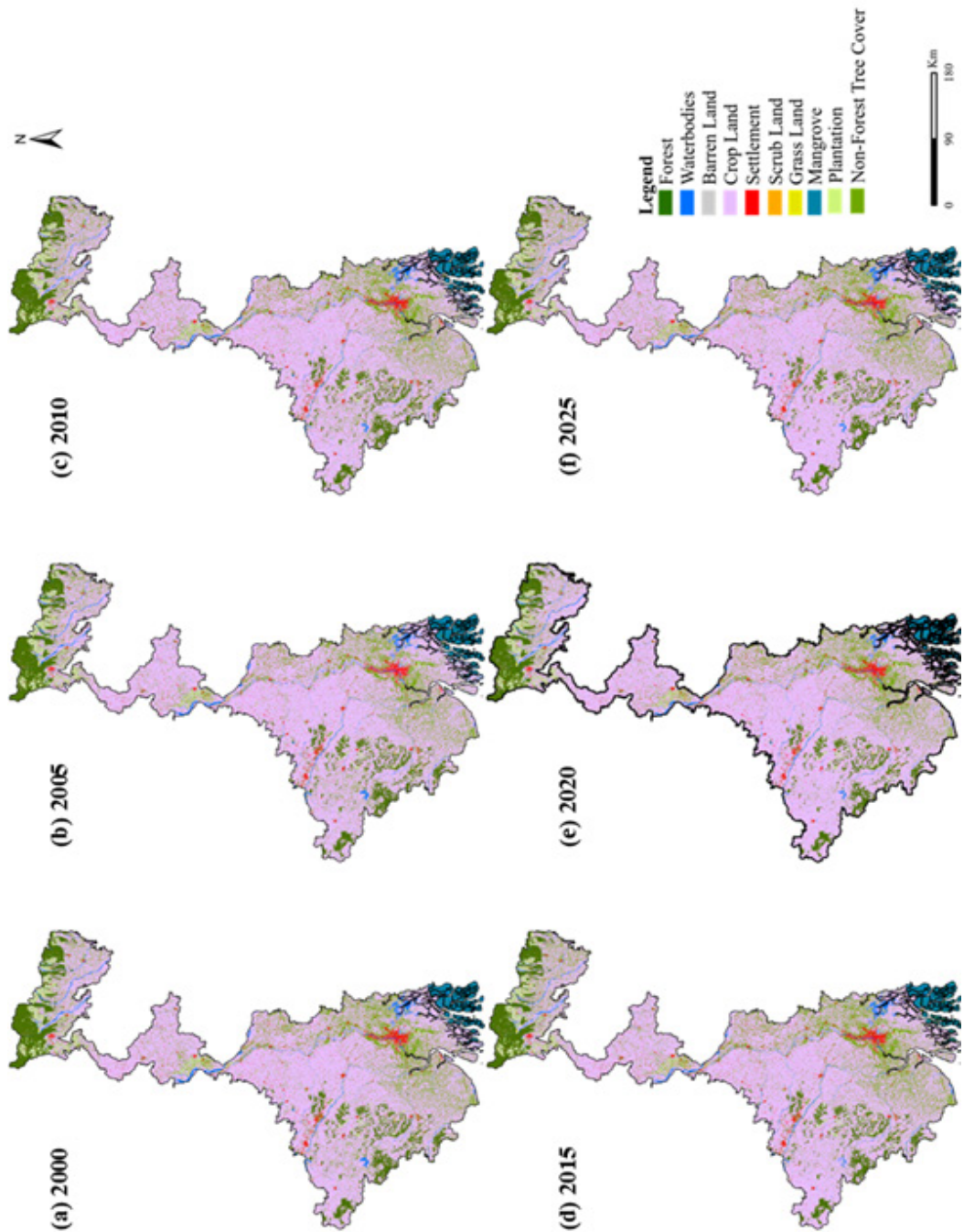


Figure 1.2(b): Land Use Land Cover (LULC) of West Bengal from year 2000-2025.

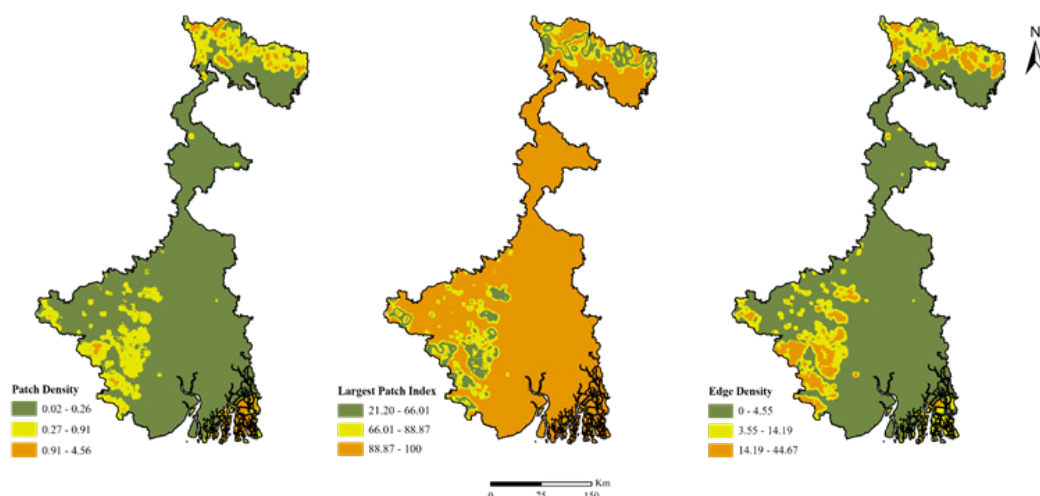


Figure 1.3: Spatial Distribution of Forest Patch Density, Largest Edge Density, and Patch Index in West Bengal, respectively.

Temporal and Seasonal Pattern of Elephant Mortality

A total of 753 elephant deaths were recorded across the forest divisions of West Bengal during the study period (2000-2025), of which 245 were attributed to anthropogenic causes and 508 to natural causes. Anthropogenic deaths were dominated by electrocution (111 cases), train collisions (93 cases), unknown (88), and resulted from poaching (31), while accidental deaths (9), poisoning (6), vehicular accidents (3), and retaliatory killing (1) accounted for relatively few cases. Elephant mortality was concentrated in the northern landscape, particularly in the Dooars region, with Buxa Tiger Reserve (West) ($n = 45$) and Buxa Tiger Reserve (East) ($n = 42$) recording the highest numbers, followed by Jalpaiguri Division ($n = 42$) and Gorumara Wildlife Division ($n = 38$). Darjeeling Wildlife Divisions ($n=24$) and Jaldapara ($n=22$) and also contributed substantially (Fig. 1.4). Hotspots were particularly concentrated in northern divisions like Jalpaiguri, Darjeeling, Kalimpong, etc and were more spatially dispersed, especially in western and southern divisions such as Bankura North, Jhargram Fig.1.6).

The distribution of mortality across age–sex classes showed a structured pattern (Fig. 1.5). Adult males accounted for the highest proportion of deaths ($n = 69$), followed by adult females ($n = 49$), sub-adult males ($n = 40$), sub-adult females ($n = 38$), juveniles ($n = 32$), and calves ($n = 17$). A chi-square test of independence indicated a significant association between age–sex class and cause of death ($\chi^2 = 220$, $df = 40$, $p < 0.001$), confirming that mortality patterns were not randomly distributed across demographic groups, with adult males disproportionately represented in anthropogenic mortality.

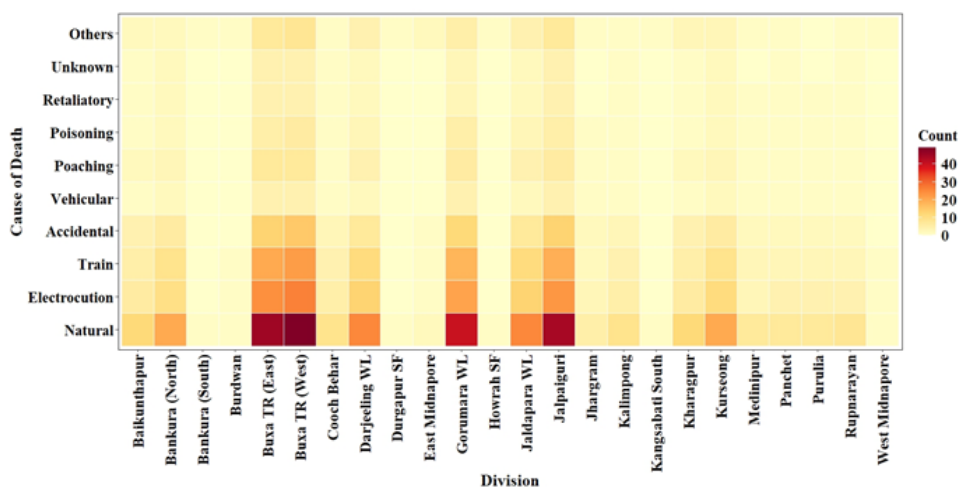


Figure 1.4: Heatmap illustrating the relationship between causes of elephant mortality and forest divisions in West Bengal, India, during 2000-2025.

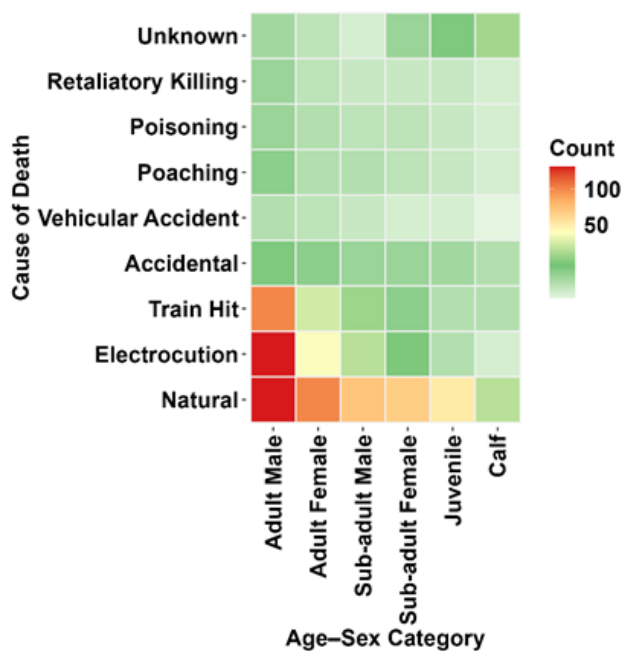


Figure 1.5: Heatmap illustrating the relationship between causes of elephant mortality and age class demography in West Bengal, India, during 2000-2025.

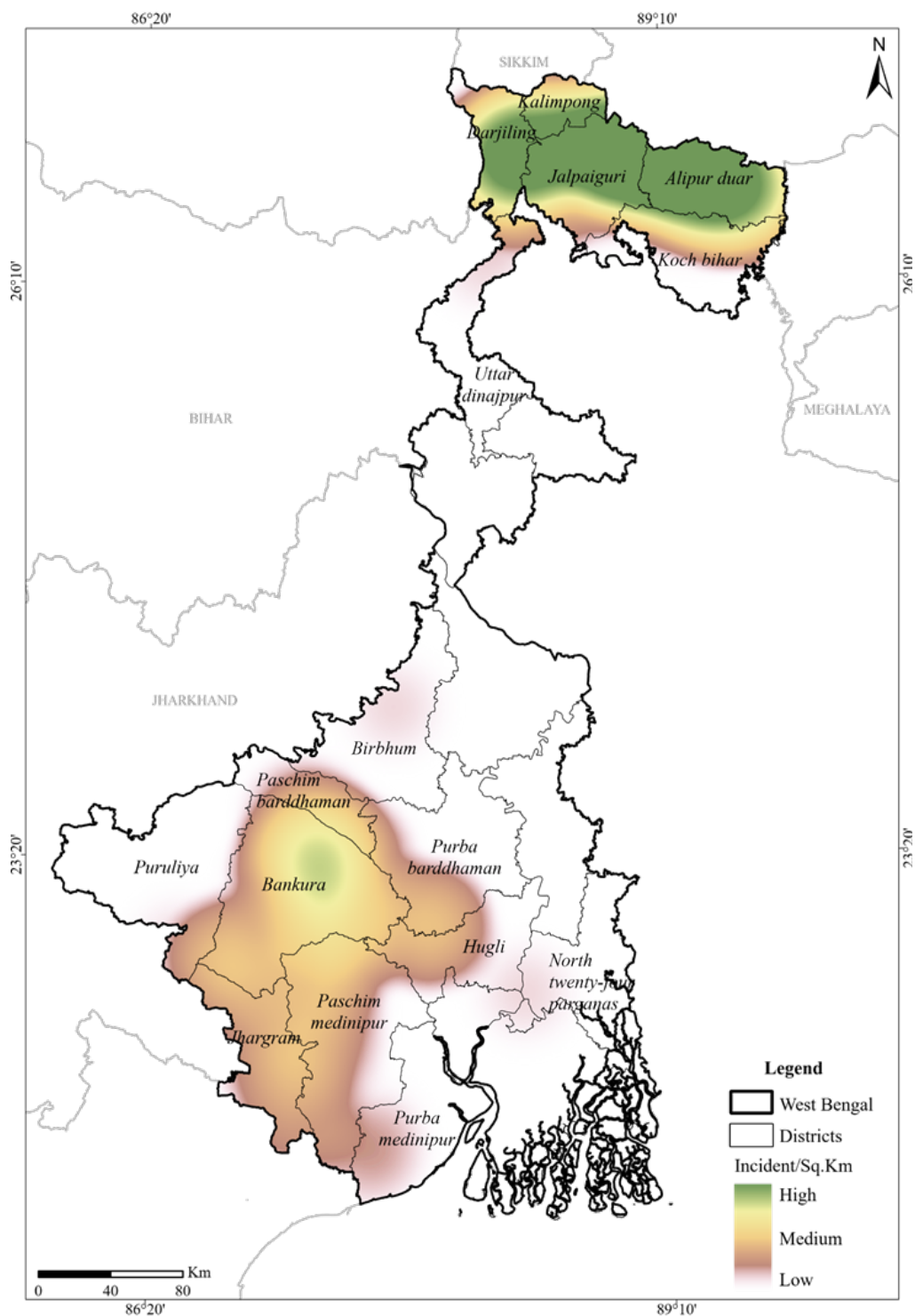


Figure 1.6: Kernel density map of West Bengal highlighting high, medium, and low mortality zones for elephant mortality in West Bengal, India, from 2000-2025. The map was created using ArcGIS Pro version 3.0.0 (<https://www.esri.com/enus/arcgis/products/arcgis-pro/overview>).

Natural Deaths of Elephants

Over the 25 years, Elephant mortality in the West Bengal state for Natural reasons was recorded as 508. Adult Male (n= 133) was the most affected category, followed by females (n = 100). (Fig.1.7).

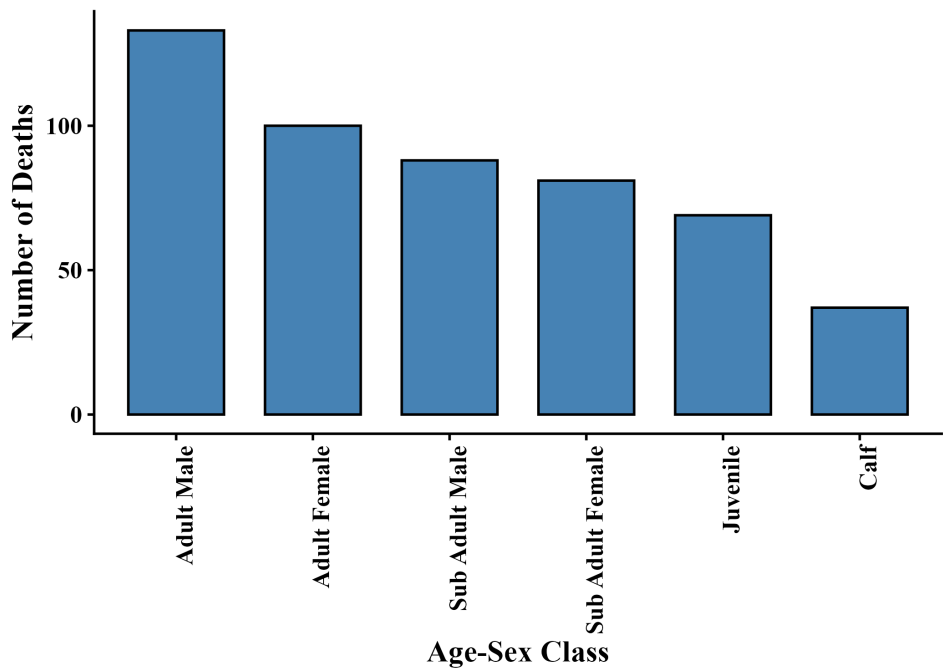


Figure 1.7: Natural causes of elephant mortality and age class demography in West Bengal, India, during 2000-2025.

Ecological and Anthropogenic Variables of Elephant Mortality

Elephant-mortality records were associated with both anthropogenic and landscape variables. The probability of an elephant-mortality record decreased with increasing distance from forests ($\beta = -0.7718$, $p < 0.001$), protected areas ($\beta = -0.7068$, $p < 0.001$), railway lines ($\beta = -0.6404$, $p < 0.001$), and roads ($\beta = -0.2350$, $p < 0.001$) (Tables 1.4 and 1.5; Fig. 1.8).

Table 1.4: Summary of log-likelihood (LogL), number of estimated parameters [df], small-sample corrected Akaike Information Criterion (AICc), relative model support ($\Delta AICc$), and Akaike weights (W_i) for candidate regression models explaining Asian elephant mortality occurrence in West Bengal.

S. No.	Model	LogL	df	AICc	$\Delta AICc$	Akaike_Weight
1	df + dpa + drail + dra	-276.9	5	563.92	0	0.2379
2	lpi + df + der + dpa + drail + dra	-275.26	7	564.75	0.83	0.1572
3	df + dpa + drail + der	-277.84	5	565.8	1.89	0.0927
4	lpi + df + dpa + drail + dra	-276.88	6	565.94	2.02	0.0866
5	df + dpa + drail	-279.23	4	566.55	2.63	0.0639
6	lpi + df + dm + dpa + drail + dra	-276.5	7	567.23	3.31	0.0455
7	lpi + df + dpa + drail + der	-277.84	6	567.85	3.93	0.0334
8	lpi + df + dpa + drail	-279.23	5	568.58	4.66	0.0232
9	lpi +df +dpla +dm +der +dpa +drail +dra	-275.16	9	568.7	4.78	0.0218
10	dpa + drail	-288.23	3	582.51	18.59	0
11	Null	-338.25	1	678.15	114.59	0
12	df + dc + dw + db + drail + dpla	-285.16	7	584.55	40.34	0.00
13	null	-338.25	1	678.51	134.29	0.00

Table 1.5: Parameter estimates (β), standard errors, z-values, p-values, and significance of ecological and anthropogenic landscape variables associated with Asian elephant mortality occurrence in West Bengal.

Predictor	Estimate (β)	Standard Error	z-value	p-value	significance
Intercept	-0.1063	0.1118	-0.951	0.342	
Distance to Forest (df)	-0.7718	0.2338	-3.301	<0.05	***
Distance to Protected Area (dpa)	-0.7068	0.1139	-6.203	<0.06	***
Distance to Railway (drail)	-0.6404	0.1383	-4.629	<0.07	***
Distance to Road (dr)	-0.235	0.1111	-2.116	<0.08	***

*Indicate statistical significance of result

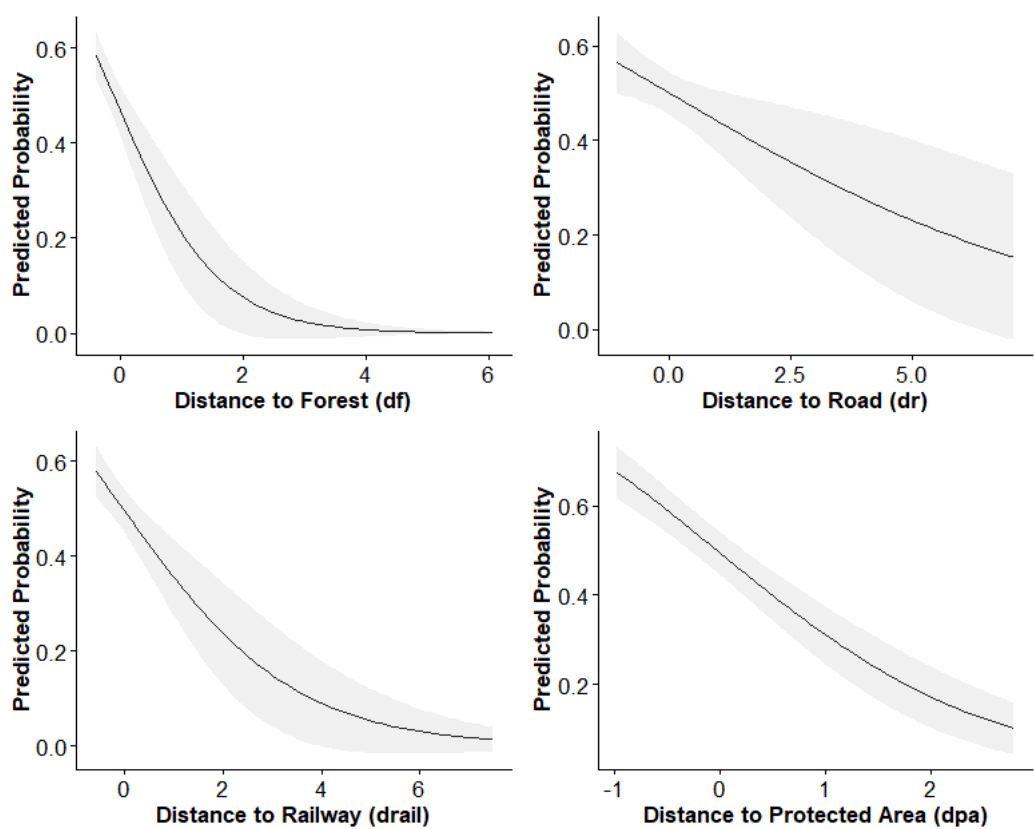


Figure 1.8: Graphs showing the probability of elephant mortality in relation to the different ecological and anthropogenic variables in West Bengal.

Temporal and Seasonal Pattern of Human Mortality and Injuries

A total of 2,059 HEC incidents were recorded in West Bengal during the study period (2000-2025), encompassing both fatalities and injuries (Fig. 1.9). The spatial distribution of these incidents was markedly uneven, with a substantial proportion of human casualties concentrated within a limited number of high-risk divisions like, Jalpaiguri emerged as the most severely affected division, reporting 357 cases, followed by Gorumara Wildlife Division (296 cases), Buxa Tiger Reserve (West) (220 cases), Kurseong (171 cases), and Buxa Tiger Reserve (East) (145 cases). Other divisions included Bankura North (120 cases), Jhargram (91 cases), and Jaldapara (89 cases) (Fig. 1.10). This pattern was also highlighted in our kernel density mapping pronouncing a spatial concentration of HEC in West Bengal, particularly within the northern landscape, with Jalpaiguri, Gorumara, and Buxa West consistently recording the highest incidents (Fig.1.11). Gender-wise analysis revealed a clear male bias in human casualties. Of the total recorded cases, 1,554 were males, and 505 were females, with males contributing disproportionately to both fatalities and injuries ($\chi^2 = 534.4$, $df = 1$, $p < 0.001$). Seasonal analysis showed that HEC incidents occurred throughout the year; however, the intensity of conflict varied across seasons. The Southwest monsoon accounted for the highest number of incidents (685 cases), followed by winter (533 cases), summer (476 cases), and post-monsoon (365 cases) (Fig.1.12). Further examination of the interaction between season and gender revealed a statistically significant association. A chi-square test of independence indicated that the distribution of male and female casualties varied across seasons ($\chi^2 = 9.62$, $df = 3$, $p = 0.022$).

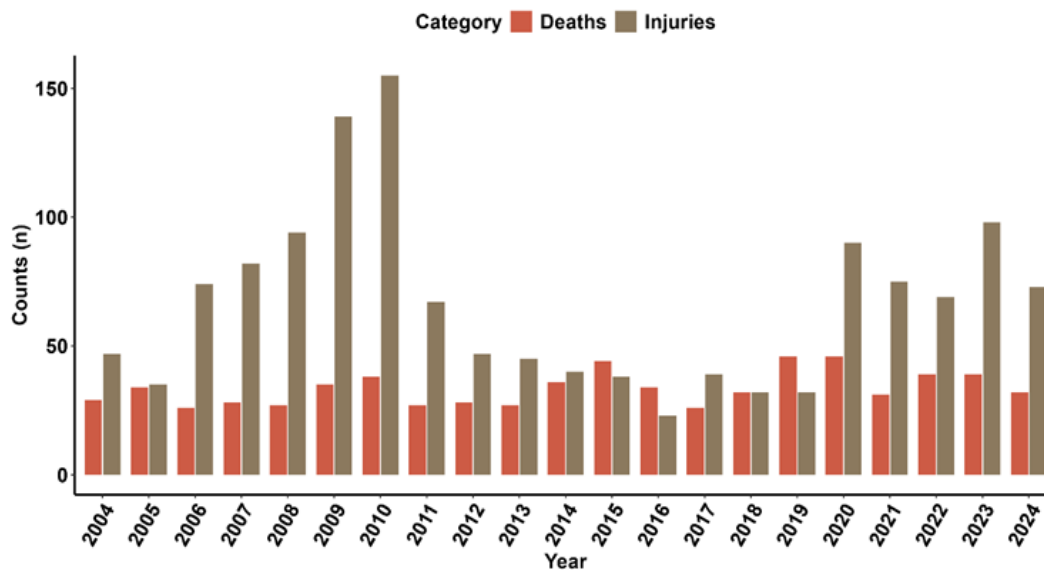


Figure 1.9: Trends in human fatalities and injuries by elephants in the State of West Bengal, India, over 25 years (2000-2025).

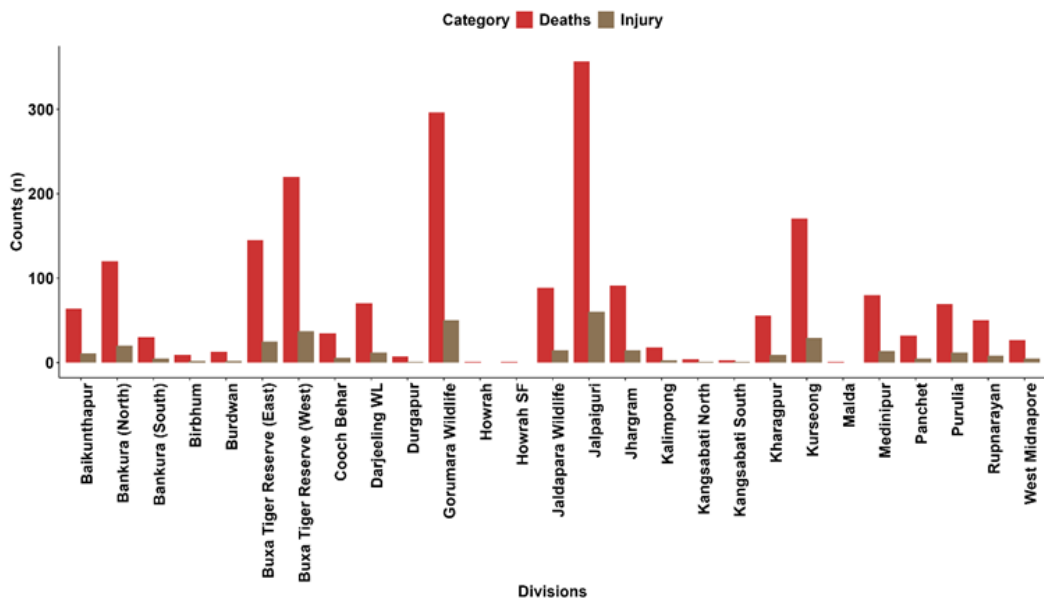


Figure 1.10: Division-wise patterns of human fatalities and injuries by elephants in the State of West Bengal, India, over 25 years (2000-2025).

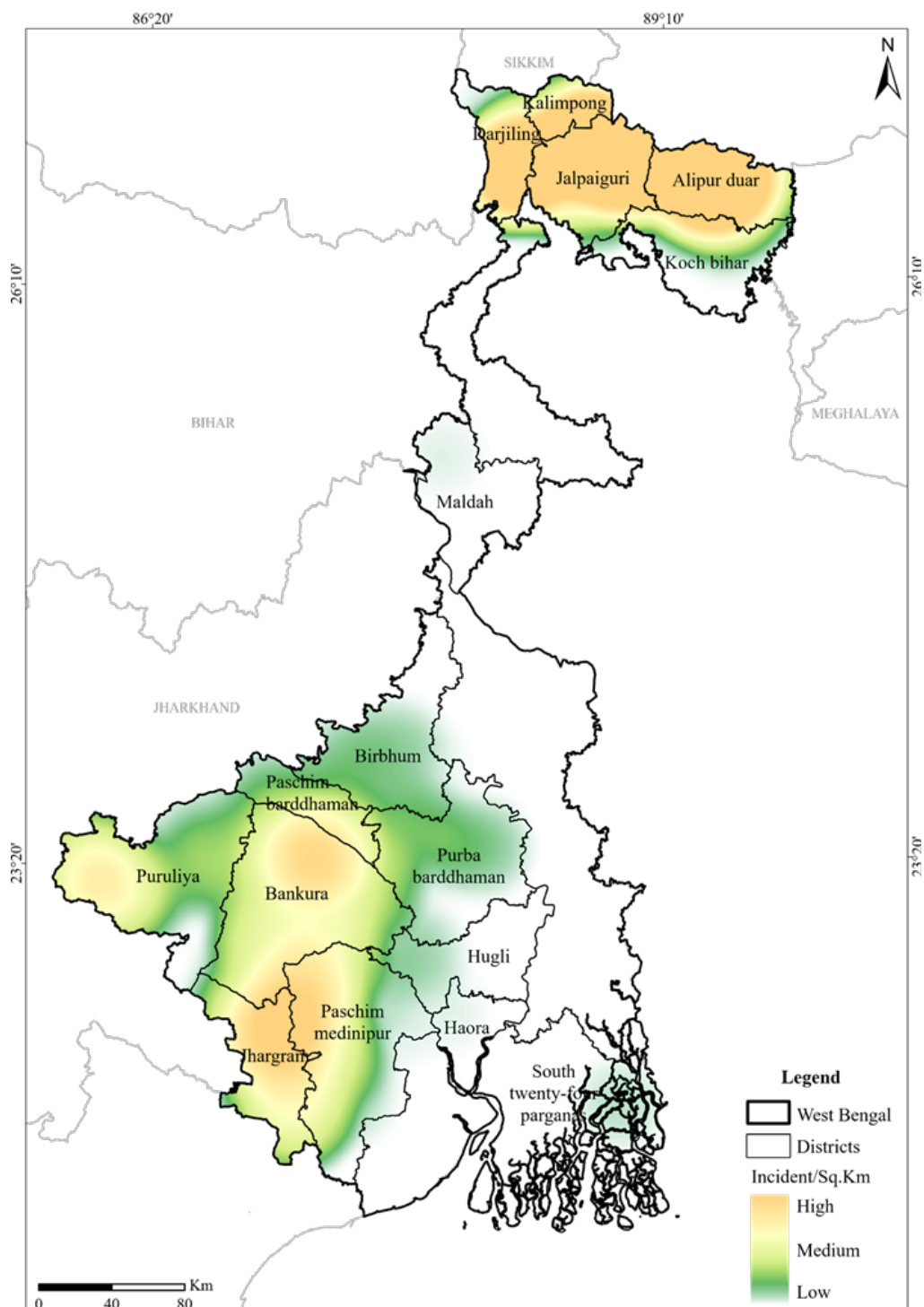


Figure 1.11: Hotspots of human deaths by elephants in the State of West Bengal, India from 2000-2025. The map was created using the kernel density tool in ArcGIS Pro version 3.0.0 (<https://www.esri.com/enus/arcgis/products/arcgis-pro/overview>).

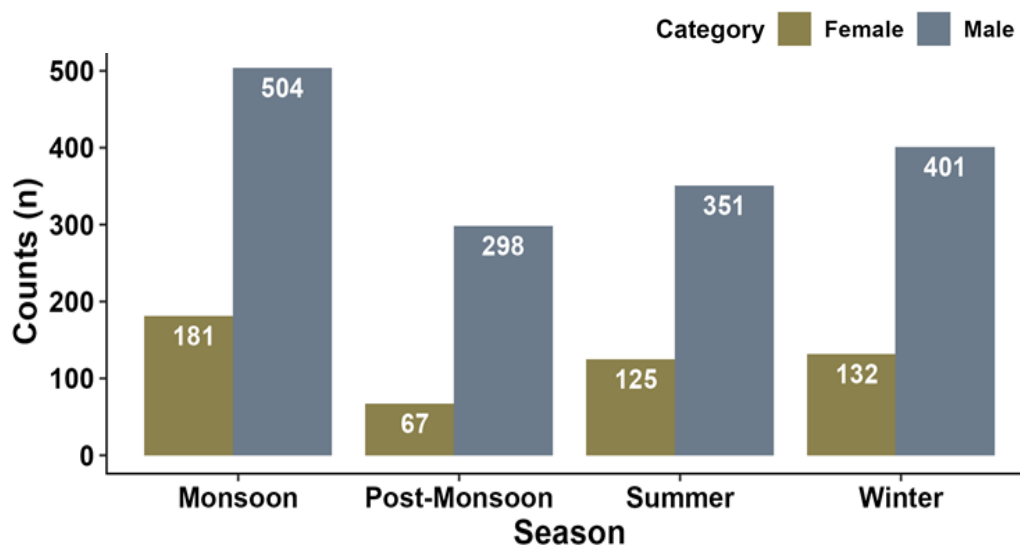


Figure 1.12: Seasonal patterns of human fatalities and injuries by elephants in the State of West Bengal, India, over 25 years (2000-2025).

Ecological and Anthropogenic Variables of Human Mortality and Injuries

Human-fatality records were associated with both anthropogenic and landscape variables. The predicted probability of human mortality decreased with increasing Largest Patch Index (LPI) ($\beta = -0.799$, $p < 0.001$), distance to plantation ($\beta = -0.110$, $p = 0.010$), and distance to protected area ($\beta = -0.107$, $p = 0.0018$). The predicted probability also decreased with increasing distance to forest ($\beta = -0.084$, $p = 0.058$) (Tables 1.6, 1.7 & Fig. 1.13;).

Table 1.6: Summary of log-likelihood (LogL), number of estimated parameters [df (K)], small-sample corrected Akaike Information Criterion (AICc), relative model support ($\Delta AICc$), and Akaike weights (W_i) for candidate regression models explaining Asian elephant mortality occurrence in West Bengal.

S no.	Model	LogL	df	AICc	$\Delta AICc$	Akaike_Weight
1	lpi + df + dpla + dpa	-2534.24	5	5078.49	0	0.4962
2	lpi + df + db + dpla + dpa	-2534.05	6	5080.12	1.63	0.2198
3	lpi + df + dpa	-2537.62	4	5083.25	4.76	0.0458
4	lpi + df + db + dpa	-2537.56	5	5085.14	6.65	0.0178
5	lpi + df	-2543.96	3	5093.92	15.44	0.0002
6	lpi + df + db	-2543.01	4	5094.03	15.54	0.0002
7	lpi + dpa	-2545.62	3	5097.24	18.76	0
8	df + db	-2806.4	3	5618.8	540.31	0
9	Null	-2853.69	1	5709.37	630.89	0

Table 1.7: Parameter estimates (β), standard errors, z-values, p-values, and significance of ecological and anthropogenic landscape variables associated with Asian elephant mortality occurrence in West Bengal.

Variable	Estimate (β)	Std. Error	z value	p-value	Significance
Intercept	0.02696	0.034	0.793	0.428	
Largest Patch Index(LPI)	-0.79894	0.0379	-21.07	<0.001	***
Distance to Forest (df)	-0.08361	0.0441	-1.898	0.058	
Distance to Plantation (dpla)	-0.11035	0.0427	-2.583	0.01	**
Distance to Protected Area (dpa)	-0.10736	0.0344	-3.121	0.0018	**

*Indicate statistical significance of result

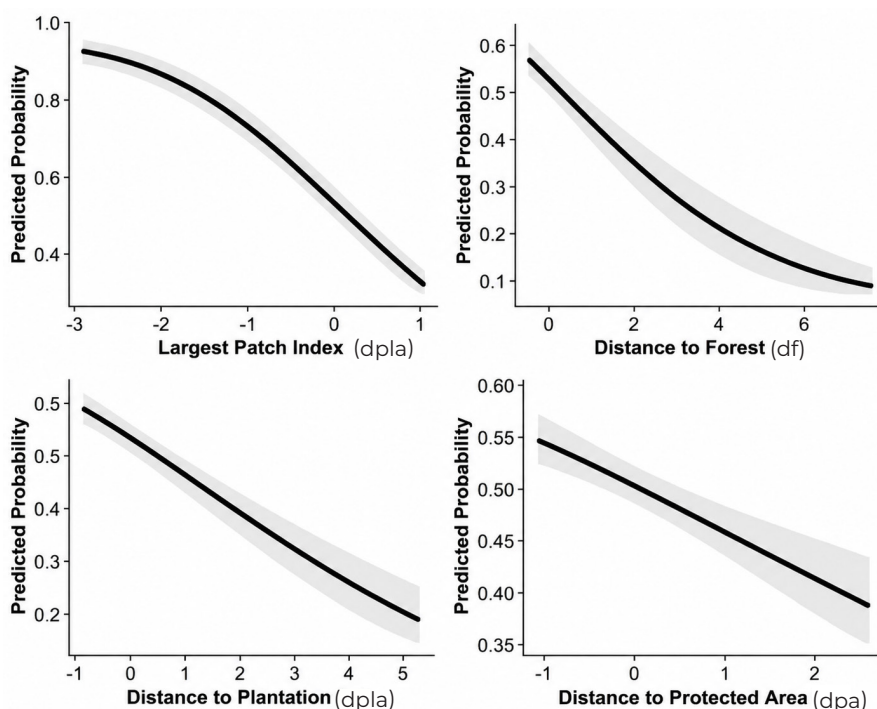


Figure 1.13: Predicted Probability of Human Fatalities & Injuries due to Human-Elephant Conflict in West Bengal Based on Environmental and Landscape Variables

Village-Level Analysis of Ecological and Anthropogenic Variables of Elephant Mortality and Human Causalities

Elephant mortality

A comprehensive examination of ecological and anthropogenic variables at the village level highlights distinct patterns across human-fatality intensity categories. Although most landscape variables showed considerable overlap among Non-Incident, Incident, Low-Incident, Medium-Incident, and High-Incident villages, road density and cropland exhibited comparatively greater variation. The Kruskal–Wallis test revealed significant differences in road ($\chi^2 = 10.655$, $df = 4$, $p = 0.031$) and crop ($\chi^2 = 44.199$, $df = 4$, $p < 0.001$) among the five incident categories in West Bengal, whereas forest, tea garden, water, railway, and built-up areas did not show significant differences ($p > 0.05$). Post hoc Dunn's test indicated that the significant variation in crop was primarily driven by differences between Incident and Non-Incident ($padj < 0.001$), Low Incident and Non-Incident ($padj < 0.001$), and Medium Incident and Non-Incident ($padj < 0.001$). Although road showed a significant overall Kruskal–Wallis result, none of the pairwise comparisons remained significant after Bonferroni correction. Similarly, comparison between Incident and Non-Incident locations showed

significant differences for road ($\chi^2 = 6.226$, $df = 1$, $p = 0.013$) and crop ($\chi^2 = 31.537$, $df = 1$, $p < 0.001$). Wilcoxon rank-sum tests confirmed significant differences between Incident and Non-Incident locations for road ($W = 186$, adjusted $p = 0.012$) and crop ($W = 3216$, adjusted $p < 0.001$), while the remaining landscape variables were not significantly different (Fig.1.14 [a-g]).

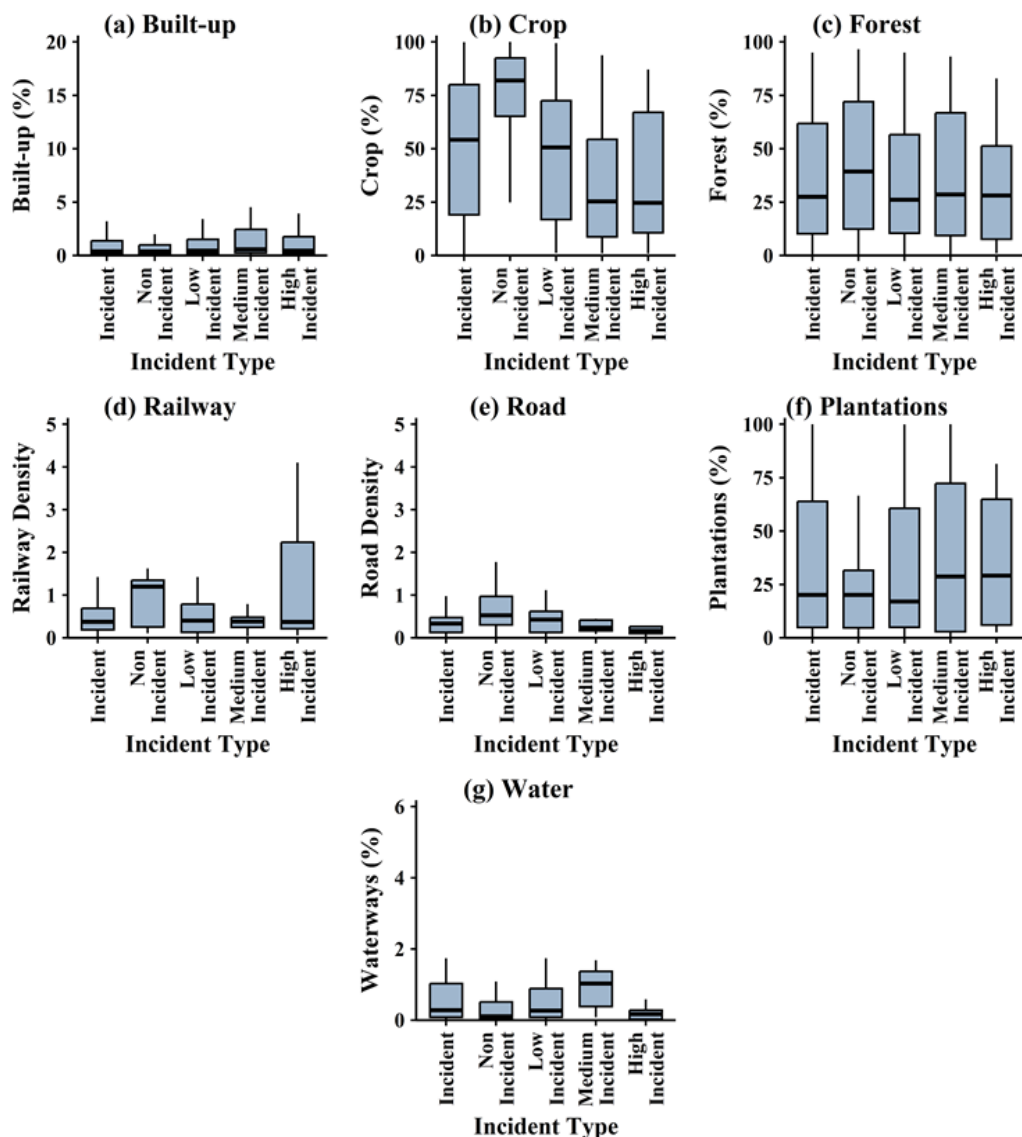


Figure 1.14: Comparison of ecological and anthropogenic variables across different incident types and non-incident villages of West Bengal.

Human mortality

A comprehensive examination of ecological and anthropogenic variables at the village level revealed distinct patterns across Non-Incident, Incident, Low-Incident, Medium-Incident, and High-Incident categories of human–elephant conflict (HEC) in West Bengal. The Kruskal–Wallis test indicated significant differences in the distribution of forest, tea garden, road, railway, and crop among the five HEC categories. However, post hoc Dunn’s test with Bonferroni correction identified significant pairwise differences only for tea garden, road, railway, and crop, whereas forest showed no significant pairwise differences after multiple-comparison adjustment.

Forest differed significantly among the HEC categories ($\chi^2 = 11.353$, $df = 4$, $p = 0.023$); however, no significant pairwise differences were detected in the post hoc analysis. Tea garden also showed significant variation among the categories ($\chi^2 = 11.146$, $df = 4$, $p = 0.025$), with High-Incident locations differing significantly from Non-Incident villages (adjusted $p = 0.022$). Road exhibited significant differences among the HEC categories ($\chi^2 = 14.351$, $df = 4$, $p = 0.006$), with a significant pairwise difference between High-Incident and Low-Incident villages (adjusted $p = 0.002$). Similarly, railway differed significantly among the categories ($\chi^2 = 19.240$, $df = 4$, $p < 0.001$), with significant differences observed between High-Incident and Medium-Incident villages (adjusted $p = 0.001$), and between High-Incident and Non-Incident villages (adjusted $p = 0.007$). The strongest differences were observed for crop ($\chi^2 = 125.320$, $df = 4$, $p < 0.001$). Post hoc Dunn’s test revealed significant differences between High-Incident and Incident, Low-Incident, Medium-Incident, and Non-Incident villages (all adjusted $p < 0.001$). In addition, Incident locations differed significantly from Non-Incident villages (adjusted $p < 0.001$), Low-Incident locations differed from Non-Incident villages (adjusted $p = 0.003$), and Medium-Incident locations also differed significantly from Non-Incident villages (adjusted $p < 0.001$) (Fig. 1.15 [a–g]).

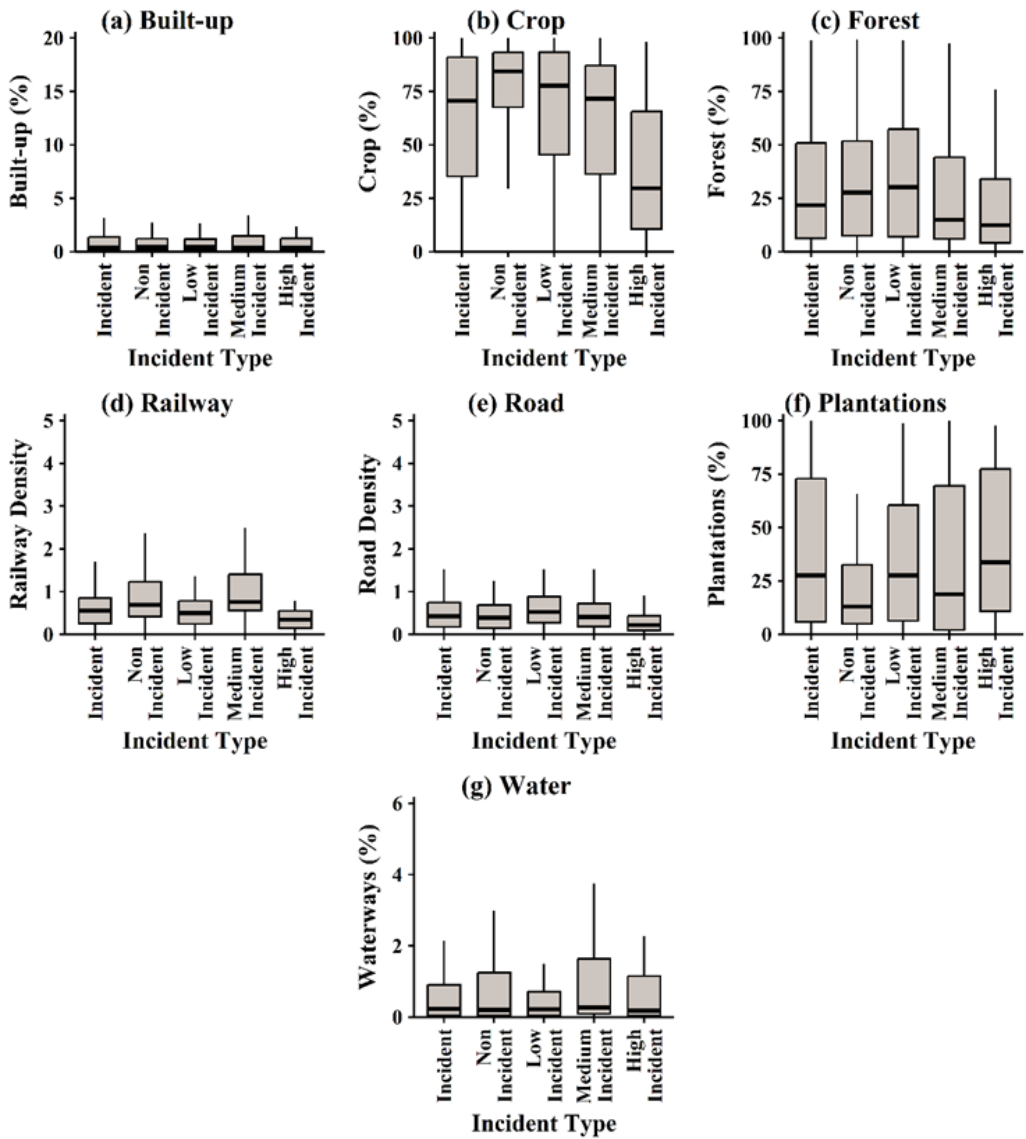


Figure 1.15: Comparison of ecological and anthropogenic variables across different incident types and non-incident villages of West Bengal.





Photo: Nima Sherpa.

SPATIAL AND TEMPORAL PATTERNS OF ELEPHANT MORTALITY AND HUMAN CASUALTIES

The results reveal a strongly structured pattern of human–elephant conflict (HEC) and elephant mortality in West Bengal, characterised by marked spatial clustering, demographic biases, and dominant anthropogenic drivers. Both human casualties ($n = 2,059$) and elephant deaths ($n = 753$) were disproportionately concentrated in the northern landscape, particularly in the Dooars region, encompassing Jalpaiguri, Gorumara, Buxa, and Jaldapara divisions. This spatial congruence indicates that high-conflict zones are not only areas of elevated risk to human populations but also hotspots of elephant mortality. Overlap between human and elephant losses has been documented in eastern and northeastern India, where high elephant densities intersect with fragmented habitats and human-dominated land use (Sukumar, 2003; Choudhury et al., 2004; Goswami et al., 2015). Comparable long-term spatial patterns have also been documented from Assam, Jharkhand, and Chhattisgarh, where landscape characteristics strongly influence conflict distribution (Pandey et al., 2026a; Roy et al., 2025a; Pandey et al., 2025b; Pandey et al., 2025c).

The dominance of northern divisions reflects the ecological and land-use characteristics of this landscape. The Dooars region supports high elephant densities, extensive forest–agriculture interfaces, and major linear infrastructure, including railway lines and power transmission networks. These features collectively increase the likelihood of encounters and mortality events. Previous studies in northern West Bengal, Assam, Jharkhand, Chhattisgarh have highlighted the role of habitat fragmentation, corridor disruption, and tea-garden landscapes in intensifying HEC (Sukumar, 1989; Fernando et al., 2005; Goswami et al., 2015; Pandey et al., 2025b; Pandey et al., 2025c). In contrast, southern and western divisions such as Bankura, Jhargram, and Purulia exhibited comparatively lower but emerging

levels of both human and elephant mortality, suggesting expanding conflict fronts associated with range shifts and changing land-use patterns, a trend also reported in central and eastern India (Sarkar et al., 2023; Chakraborty, 2015). Seasonal variation in human casualties further supports the role of environmental conditions in shaping conflict dynamics. The peak in incidents during the monsoon season suggests that dense vegetation, reduced visibility, and increased human activity in agricultural fields may elevate encounter rates. Similar seasonal peaks have been reported in elephant landscapes across India and Southeast Asia (Sukumar, 2003; Tiller et al., 2013). In the present study, the persistence of conflict across all seasons indicates that HEC in West Bengal is a chronic phenomenon rather than a seasonal anomaly.

ANTHROPOGENIC ELEPHANT MORTALITY AND DEMOGRAPHIC VULNERABILITY

Anthropogenic causes, particularly electrocution and train collisions, emerged as the primary drivers of elephant mortality beyond natural causes. The concentration of these causes in northern divisions underscores the critical role of infrastructure-related risks in elephant conservation. Train collisions in northern West Bengal have been widely recognised as a major conservation concern (Roy & Sukumar, 2017), while electrocution remains a leading cause of mortality across agricultural landscapes in India (Sukumar, 2003; Guarnieri et al., 2024). The strong association between these causes and adult male elephants observed in this study is consistent with behavioural ecology, as adult males are more likely to engage in crop-raiding and long-distance dispersal, increasing their exposure to human-modified environments (Sukumar, 1988; Fernando et al., 2005). Similar male-biased mortality patterns have been reported from southern India and Sri Lanka (Ekanayaka et al., 2011; Desai & Riddle, 2015), indicating a broadly consistent demographic risk pattern across elephant range states.

In parallel, human mortality exhibited a pronounced male bias, with males accounting for a significantly higher proportion of casualties. This pattern is widely reported in HEC studies and is typically attributed to gendered differences in livelihood activities, with men more frequently engaged in outdoor work such as farming, crop guarding, and forest-resource collection (Bandara & Tisdell, 2003; Enuakwa, 2017). The consistency of male-biased mortality across both humans and elephants highlights a behavioural dimension of risk that operates across species and is mediated by exposure patterns.

The significant association between age–sex class and cause of elephant death indicates that mortality is non-randomly distributed across the population. Adult males were disproportionately affected by anthropogenic causes, while natural mortality was more evenly distributed across age classes, including juveniles

and calves. This pattern aligns with broader ecological understanding that human-induced mortality selectively removes high-risk individuals, potentially altering population structure, behaviour, and long-term viability (Sukumar, 2003; Guarnieri et al., 2024). Comparable demographic skew has been observed in elephant populations across Asia and Africa, where selective pressures from human activities disproportionately affect specific age–sex classes (Blake et al., 2007; Wittemyer et al., 2013).

SHARED LANDSCAPE DRIVERS OF HUMAN-ELEPHANT CONFLICT AND ELEPHANT MORTALITY

The present study revealed that habitat fragmentation and the spatial distribution of human infrastructure significantly influenced elephant mortality across West Bengal. Fragmentation breaks continuous forests into smaller patches, forcing elephants to move through agricultural lands, tea plantations, settlements, and transportation corridors, thereby increasing conflict risk. Similar findings have been reported from North Bengal, and Assam further supports that habitat fragmentation and expanding human land use have intensified human–elephant conflict (Naha et al., 2019; Sukumar, 2003; Fahrig, 2003; Pandey et al., 2026a). Contiguous forest patches provide suitable habitat for elephants and reduce their movement into human-dominated landscapes. Large forest blocks maintain habitat connectivity and support natural movement patterns, thereby lowering the likelihood of conflict. Similar observations have been reported from northern West Bengal, where extensive forest patches surrounding Buxa Tiger Reserve, Gorumara National Park and Jaldapara National Park were associated with comparatively lower conflict levels than fragmented landscapes (Naha et al., 2019; Sukumar, 2003).

Conflict incidents were occurred in adjacent forested and transitional habitats used by elephants during their movement. Previous studies have similarly reported that the distribution of human–elephant conflict is influenced by landscape configuration, habitat connectivity, and seasonal elephant movements in addition to agricultural land use (Naha et al., 2019; Sukumar, 2003). Habitat fragmentation increases the frequency of elephant movement through human-dominated landscapes. Similar patterns have been documented in North Bengal, where railway corridors passing through Buxa, Gorumara and Jaldapara landscapes overlap with important elephant movement routes (Naha et al., 2019; Sukumar et al., 2003). Comparable findings have been reported from North Bengal, where conflict hotspots were concentrated around protected-area boundaries and elephant corridors (Naha et al., 2019). The positive relationship between distance from built-up areas (DB) and conflict probability indicates that incidents were relatively more common in forest–agriculture interfaces than in densely populated urban areas. This pattern reflects the tendency of elephants to move through semi-natural landscapes where forest patches, croplands, and human settlements occur in proximity, resulting in

frequent human–elephant interactions (Sukumar, 2003; Naha et al., 2019).

The village-level landscape analysis indicates that both elephant mortality and human fatalities are strongly associated with the surrounding land-use composition and infrastructure. Forest cover remained relatively consistent across conflict categories in both analyses, suggesting that habitat availability alone does not fully explain mortality patterns, whereas habitat fragmentation and the forest–agriculture interface are likely more influential drivers. Tea gardens exhibited greater variability and were more prevalent in incident and medium- to high-conflict villages, reflecting their role as important movement corridors and foraging areas for elephants. Cropland also showed substantial variation among village categories, highlighting the attraction of agricultural fields as high-quality food resources that increase the likelihood of encounters between elephants and people. Built-up areas generally occupied a small proportion of the landscape, although variations among conflict categories indicate that expanding human settlements may increase opportunities for human–elephant interactions. Similarly, differences in road and railway densities suggest that linear infrastructure can modify elephant movement patterns and elevate the risk of both elephant mortality and human fatalities through increased accessibility and habitat fragmentation. Water availability exhibited comparatively limited variation across village categories, indicating that while access to water remains an important ecological requirement, it may play a secondary role compared with land-use change and anthropogenic disturbances.

Forest edges often represent transition zones where elephants move between natural habitats and human-dominated landscapes, increasing the likelihood of encounters with people, infrastructure, and other anthropogenic threats. Similar patterns have been reported from North Bengal, where habitat fragmentation and reduced forest connectivity have intensified elephant movement through human-use areas, leading to increased mortality and conflict (Naha et al., 2019; Sukumar, 2003). Elephant mortality increased with increasing distance from cropland, suggesting that mortality events were not confined to crop-raiding locations but also occurred in surrounding forested and transitional habitats. Although croplands attract elephants due to the availability of high-quality forage, elephants frequently move through adjacent habitats where they remain vulnerable to accidents, retaliation, and other anthropogenic pressures. Similar observations have been reported in eastern and northeastern India, where the spatial distribution of elephant mortality is influenced by landscape configuration rather than cropland alone (Naha et al., 2019; Choudhury, 1999). Mortality events were relatively more frequent away from major water sources. Water bodies generally serve as essential resources and movement focal points for elephants, while surrounding habitats often provide suitable cover and reduced human disturbance. As elephants move

away from these relatively secure habitats into human-modified landscapes in search of food and other resources, their exposure to anthropogenic threats increases (Sukumar, 2003; Goswami et al., 2015). Mortality probability was significantly higher near built-up areas, railway lines, and protected-area boundaries, highlighting the importance of human infrastructure in shaping elephant mortality patterns. Expansion of settlements into elephant habitats has reduced habitat connectivity and increased opportunities for direct interactions between elephants and people. Likewise, railway lines intersect several elephant corridors in northern West Bengal, particularly around Buxa Tiger Reserve, Gorumara National Park, and Jaldapara National Park, where train collisions have become a major source of elephant mortality (Naha et al., 2019; Roy & Sukumar, 2017). The higher mortality observed near protected areas reflects the frequent movement of elephants beyond reserve boundaries into surrounding agricultural and settlement landscapes, where human activities are concentrated (Sukumar, 2003). These findings reinforce the need for landscape-level conservation strategies that integrate habitat connectivity, corridor conservation, and community participation to promote long-term human–elephant coexistence (Pandey et al., 2024b; Pandey et al., 2026a). These recommendations are also consistent with the objectives of Project Elephant, which emphasize habitat protection, corridor conservation, and conflict mitigation across India’s elephant landscapes (Pandey et al., 2026b).

CONCLUSION

The present study demonstrates that human–elephant conflict and elephant mortality in West Bengal are driven by the combined influence of landscape configuration and anthropogenic pressures. Conflict and mortality were concentrated in the northern districts, where fragmented habitats, forest–agriculture interfaces, and expanding infrastructure increase interactions between elephants and people. Adult male elephants were disproportionately affected by anthropogenic mortality, while human casualties also showed clear demographic biases. Landscape analyses further highlighted the importance of habitat fragmentation, cropland, railway corridors, settlements, and protected-area boundaries in shaping both conflict and mortality patterns. Together, these findings provide a comprehensive understanding of the spatial, demographic, and environmental factors underlying human–elephant conflict in West Bengal and offer a scientific basis for developing targeted conservation and conflict-mitigation strategies that support the long-term coexistence of people and elephants.

Suggested Measures to Minimize Human–Elephant Conflict in the State of West Bengal

Human–elephant conflict (HEC) in West Bengal is one of the most significant conservation and socio-economic challenges in eastern India. Over the 25-year study period, a total of 2,059 HEC incidents were recorded, resulting in 1,761 human fatalities and 298 human injuries, while 753 elephant deaths were documented, including 245 anthropogenic mortalities and 508 natural deaths. The conflict is particularly severe in the northern districts of Alipurduar, Jalpaiguri, Kalimpong, Darjeeling and Cooch Behar, and in the southern districts of Jhargram, Bankura, Purulia and Paschim Medinipur. Rapid urbanization, expansion of agriculture, fragmentation of forests, increasing railway networks, tea plantations and human settlements along elephant movement corridors have intensified interactions between elephants and people. Human incidents were reported in 639 villages, while elephant mortality cases were recorded in 108 villages over the 25 years.

STATE-LEVEL INITIATIVES FOR HUMAN-ELEPHANT CONFLICT MITIGATION IN WEST BENGAL

Human–elephant conflict (HEC) mitigation in West Bengal has progressively developed from conventional elephant-driving and physical barriers towards a broader management framework involving habitat and corridor management, rapid-response teams, elephant-proof barriers, technological early-warning systems, radio-telemetry, railway-safety interventions and compensation mechanisms. The management context differs substantially between North and South Bengal. In North Bengal, elephants occur within a wider transboundary landscape connected with Assam, Bhutan and Nepal, whereas South Bengal is characterised by elephants that expanded from the Dalma landscape of Jharkhand and now use the highly fragmented and human-dominated landscapes of Jhargram, Paschim Medinipur, Bankura and Purulia (Pandit & Chanda, 2019; Majumder, 2022).

Habitat Management, Corridors and Physical Barriers

In North Bengal, management has focused on keeping elephant movement routes open while reducing their entry into villages and agricultural fields. Measures such as solar-powered fencing, elephant-proof trenches (over 270 km), watchtowers, trained kunki elephants, elephant-driving teams and other non-lethal deterrents have been used alongside habitat improvement through

fodder plantations and development of water sources within forests (JICA, 2011; West Bengal Forest Department, 2017–2018; Majumder, 2022). In South-West Bengal, the state has also proposed 95.36 km of Elephant Proof Trenches (EPTs) as part of its conflict-mitigation programme (West Bengal Forest & Biodiversity Conservation Society). However, such barriers need to be carefully placed around vulnerable villages and croplands without blocking traditional elephant routes, as poorly planned barriers may simply push elephants towards neighbouring settlements and shift the conflict elsewhere (MoEFCC, 2023).

Rapid Response team and coordinated elephant management

In South Bengal, particularly in Jhargram, Paschim Medinipur, Bankura, and Purulia, efforts to reduce human–elephant conflict increasingly rely on Rapid Response Teams (RRTs), elephant-tracking teams, coordinated elephant-driving operations, and community-based early-warning systems. These measures are especially important in the region’s agricultural landscapes, where elephants frequently move beyond forest boundaries and encounters with local communities can escalate quickly. More recently, the West Bengal Forest and Biodiversity Conservation programme has sought to strengthen this response by linking technology-based elephant detection with the deployment of RRTs. Information on elephant locations and movements can be communicated to field teams and nearby communities, allowing them to respond before elephants move further into densely inhabited or cultivated areas. This approach reflects a gradual shift from primarily responding to conflict after crop damage or human encounters have occurred towards a more proactive system in which elephant movement information is used to anticipate and reduce potentially dangerous encounters (Japan International Cooperation Agency [JICA, 2024]).

AI-enabled cameras and real-time early-warning systems

A major recent development in West Bengal has been the use of AI-enabled cameras for early detection of elephants. As part of a JICA–West Bengal Forest Department pilot, 30 TrailGuard AI cameras were installed in Jhargram between 2023 and 2024, automatically sending elephant alerts to forest teams and reducing the average response time to about 18 minutes. During the pilot, JICA recorded 175 elephant detections with no HEC-related human deaths or injuries in the monitored areas (JICA, 2024). A later assessment recorded 266 real-time alerts over 4,380 trap-nights, with 74.1% of detections occurring at night, highlighting the usefulness of the system when direct monitoring is difficult (Rastogi *et al.*, 2025). Building on this approach, the state programme has proposed 200 Early Warning Systems for wild elephants, which could extend real-time monitoring to other conflict-prone areas.

Prevention of Railway related elephant mortality

Railway collisions remain an important cause of elephant mortality in West Bengal, particularly where tracks cut across elephant habitats and movement routes. Existing and recommended measures include speed restrictions, vegetation clearance for better visibility, identification of elephant crossing points, safer crossing structures, and stronger coordination between Forest and Railway personnel (PE-MoEFCC-WII, 2024). Indian Railways is also expanding AI-enabled Intrusion Detection Systems (IDS) using Distributed Acoustic Sensing (DAS), which use optical-fibre cables to detect elephant movement near tracks and send real-time alerts to loco pilots, station masters and control rooms. By December 2025, the system covered 141 route-km of Northeast Frontier Railway, with further expansion sanctioned across Northeast Frontier and South Eastern Railways (Ministry of Railways, 2025, 2026). Other measures being explored include honey-bee sound devices and thermal-vision cameras for vulnerable railway stretches (Ministry of Railways, 2026). For West Bengal, these technologies should complement rather than replace speed regulation, safe crossing structures and regular Forest–Railway coordination (PE-MoEFCC-WII, 2024).

RECOMMENDATION FOR MANAGING ELEPHANT DEATHS IN WEST BENGAL

Over the 25-year study period, elephant mortality was recorded across 207 villages in West Bengal, although the number of deaths varied considerably among locations. Raja Bhatkhawa (18) in Alipurduar stood out as the major mortality hotspot and was classified in the high-mortality category. The medium-mortality category included Raydak (8), Banarhat Tea Garden (8), Haldibari Tea Garden D (8), Dumriguri (8), Kadmagar (6), Sukhanibasti (6), Targhera (6), and Chhota Bainan (6). In contrast, 133 villages fell within the low-mortality category, showing that although elephant deaths were spread across the state, repeated mortality was concentrated in a relatively small number of locations, particularly in northern West Bengal.

Barrier Maintenance

- a. Installation only at scientifically identified conflict hotspots:** Physical barriers should be placed around vulnerable human settlements & agricultural fields, not along traditional elephant movement routes. Fences/Trenches should never block elephant pathways or force elephants to take an alternative route through human-dominated areas, as this may intensify conflict.
- b. Regular Inspection and Mapping of Fences and Trenches:** All elephant-proof fences and trenches should be inspected before and after the

monsoon, as heavy rainfall can damage fences, erode trenches and reduce their effectiveness. The Forest Department should also maintain an updated GIS database and shapefile of all fences and trenches across the state, particularly in areas regularly used by elephants. This would provide a clear record of existing barriers, help track their condition and maintenance, and allow legal and illegal electric fencing to be identified and monitored. Mapping these structures alongside elephant movement and conflict locations would also help identify barriers that may be blocking traditional movement routes or increasing conflict in nearby areas.

Electrocution

- a. **Illegal and lethal electric fencing** used for crop protection contributes to elephant electrocution in North Bengal. Community awareness, regular monitoring of fences, and promotion of regulated non-lethal electric fencing are therefore important for reducing elephant mortality (Chakraborty *et al.*, 2025).
- b. **Regular joint inspections** of electrical infrastructure, removal of illegal electric fencing, replacement with approved solar-powered barriers, raising low-hanging power lines in elephant movement areas, and village-level reporting of electrical hazards should be prioritized to reduce elephant electrocution risks.
- c. **Community Awareness and Safe Electricity Practices** Many elephant electrocution incidents in West Bengal are linked to illegal electric fencing and unsafe connections drawn directly from power lines to protect crops. Regular awareness programmes in conflict-prone villages should therefore inform farmers and local communities about the risks these practices pose to both elephants and people. Communities should be encouraged to use approved, non-lethal alternatives such as properly regulated solar-powered fencing and to report illegal or damaged electrical connections. Joint awareness and monitoring by the Forest Department, electricity authorities and local communities can help identify electrical hazards early and reduce preventable elephant deaths.

Prevention of Railway Collisions

Railway collisions remain one of the leading causes of elephant mortality in northern West Bengal, particularly along the Alipurduar–Siliguri railway line passing through elephant habitats.

- a. **Early Warning Systems:** Implementing AI-based sensors, seismic detectors, and Distributed Acoustic Sensing (DAS) along railway tracks can help detect elephant movement in real time. Integrating these with Intrusion Detection Systems (IDS) can provide timely alerts to train operators, enabling speed

reduction or stoppage to prevent collisions. DAS uses optical-fibre cables running along railway tracks to pick up vibrations created by moving elephants. When the system detects elephant movement close to the track, it sends a real-time warning so that railway staff can respond quickly. Alerts can be sent to station masters and field staff through SMS, WhatsApp or email, displayed on railway control dashboards, and communicated to loco pilots, giving them enough time to slow down or stop the train when required.

- b. Vegetation Management & Tracking Visibility:** Regular clearance of vegetation at least 30m on either side of railway tracks enhances visibility for train operators, reducing the chances of surprise encounters with elephants.
- c. Safe Elephant Crossing Structures along Railway Corridors:** The Wildlife Institute of India (WII) surveyed 17 vulnerable railway stretches in North Bengal, following which ramps were proposed at 15 level crossings to facilitate safer elephant movement across railway tracks and reduce the risk of elephant train collisions (PE-MoEFCC-WII, 2024).
- d. Habitat Management:** Habitat improvement should focus on restoring degraded forests, removing invasive plants, and improving the availability of natural forage. Waterholes should be developed within large, continuous forest areas where elephants can access water safely, rather than in small or fragmented forested areas close to settlements. This can help keep essential resources within secure elephant habitats and reduce their movement into human-dominated areas.
- e. Long-term monitoring:** Lone bulls that are repeatedly involved in conflict should be radio-collared and monitored over longer periods. Tracking their movements can show where they move, which routes they regularly use, when they approach settlements, and where conflicts are most likely to occur. Such information can help in anticipating elephant movement and planning more evidence-based management of repeatedly conflict-involved elephants and targeted measures to prevent conflict.
- f. Landscape level management:** Human elephant conflict needs to be addressed across the larger landscape level, rather than within individual forest divisions, forest range, or state boundaries. Driving elephants from one area to another only transfers the problem and can create conflict in new places. Management should instead consider elephants natural movement patterns & seasonal ranging patterns, with neighbouring divisions and states coordinating to provide safe movement routes and reduce conflict across the landscape.

RECOMMENDATIONS FOR REDUCING HUMAN DEATHS AND INJURIES

Over the 25-year study period, human casualties from elephant encounters were reported across 639 villages in West Bengal, although conflict was much more concentrated in some areas than others. The high-conflict villages were Raja Bhatkhawa (141), Junglee Mohal (51), Nimna Tandu (39), Haihai Pathar I P (34), Upper Tendu (33), Gayerkata D (25), and Mal (23). Another 25 villages were classified as medium-conflict areas, including Atiabari (20), Son Gachhi (20), New Clenco P (18), Salbari (18), Siliguri (17), Maraghat D (16) and several villages recording between 11 and 15 casualties. The remaining villages were in the low-conflict category. Overall, the pattern shows that while human–elephant conflict occurred across a large part of West Bengal, the most severe impacts were concentrated in relatively few villages, particularly in Alipurduar and Jalpaiguri districts of North Bengal.

Physical Barriers & Early Warning Systems:

- a. **Early-Warning Systems and DAS Technology:** In West Bengal, particularly in villages located close to elephant movement routes, real-time early-warning systems can help communities know when elephants are approaching and give people enough time to move to safer areas. Technologies such as infrared sensors, trip-wire alarms and Distributed Acoustic Sensing (DAS) can support existing monitoring and warning networks. DAS uses fibre-optic cables to detect vibrations produced by elephant movement and can generate alerts when elephants approach sensitive areas. Where feasible, these systems could be combined with AI-based detection, GPS/radio-collar tracking and Rapid Response Teams, allowing warnings to reach forest staff and communities quickly and reducing the risk of sudden encounters.
- b. **Use of Light-Based Deterrents:** Flashing LED lights and high-intensity torches can also be used as non-lethal deterrents in conflict-prone villages, particularly during night-time crop raiding. Strategically placed lights around vulnerable fields and settlement edges may discourage elephants from approaching and can also help local monitoring teams detect their presence. However, these should be used carefully as part of a broader community-based crop-protection system rather than relying on lights alone.

Human Safety, Awareness and Conflict Management

- a. **Village-Level Early Warning:** In conflict-prone areas of West Bengal, local alert networks can help communities know when elephants are approaching and avoid unexpected encounters. Information on elephant movement can be shared quickly through mobile-based alerts, WhatsApp/

SMS groups, local volunteers and other community communication networks, particularly during night-time movement and crop-raiding periods.

- b. Rapid Response Teams (RRTs):** Rapid Response Teams involving trained Forest Department staff and local volunteers should be strengthened in frequently affected areas. Teams can respond to elephant movement, warn nearby communities and, where necessary, use safe, non-lethal methods to guide elephants away from densely populated areas without provoking or surrounding them.
- c. Awareness and Safe Behaviour:** Regular awareness programmes should focus on simple actions that can prevent casualties, such as avoiding known elephant movement areas at night, not approaching or gathering around elephants, maintaining a safe distance, and avoiding chasing or provoking them. Special attention should be given to people involved in night-time crop guarding and communities located along frequently used elephant routes. Local residents should also be encouraged to follow Forest Department warnings and allow elephants enough space to move safely through the landscape.

Habitat Restoration and Landscape-Level Conservation

- a. Habitat Management and Restoration:** Degraded elephant habitats in West Bengal should be restored by removing invasive plants, promoting native vegetation and natural forage, and maintaining suitable water sources within larger and relatively secure forest areas. Waterholes and other habitat improvements should preferably be located away from settlements so that they do not unintentionally draw elephants closer to people. Improving food and water availability within suitable elephant habitats can reduce the need for elephants to enter villages and agricultural areas in search of resources.
- b. Protection of Elephant Corridors:** Regularly used elephant movement routes should be protected from further fragmentation, encroachment and poorly planned barriers. This is particularly important in North Bengal, where elephants move across a connected transboundary landscape, and in South Bengal, where movement frequently occurs through fragmented forests and agricultural areas. Restoration of degraded corridors with native vegetation and careful land-use planning can help elephants move more safely between suitable habitats. In agricultural areas adjoining elephant habitats, agroforestry and crops that are less attractive to elephants could also be explored as buffers.
- c. Landscape-Level Management:** HEC should be managed across the larger elephant landscape rather than separately within individual beats, ranges or forest divisions. Simply driving elephants from one area to another can shift the problem to neighbouring villages or divisions. Management should instead consider natural and seasonal elephant movements,

with neighbouring forest divisions and states sharing information and coordinating responses. In North Bengal, where elephant ranges extend beyond state and international boundaries, inter-state and transboundary coordination is especially important for maintaining safe movement routes and reducing conflict across the wider landscape.



Photo: Shiladitya Acharjee.

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APPENDIX I

*Villages in West Bengal with recorded Elephant Mortality.
(2000-2025)*

S.no	Count	Village Name	Subdistrict	District
1	18	Raja Bhatkhawa	Kalchini	Alipurduar
2	8	Raydak	Kumargram	Alipurduar
3	8	Banarhat Tea Garden	Banarhat	Jalpaiguri
4	8	Haldibari Tea Garden D	Banarhat	Jalpaiguri
5	8	Dumriguri	Naxalbari	Darjeeling
6	6	Kadmagar	Raipur	Bankura
7	6	Sukhanibasti	Nagrakata	Jalpaiguri
8	6	Targhera	Mal	Jalpaiguri
9	6	Chhota Bainan	Raina II	Purba Bardhaman
10	4	Riti	Madarihat	Alipurduar
11	4	Bishnupur	Vishnupur	Bankura
12	4	Mangpong	Kalimpong I	Kalimpong
13	3	Malangi Tea Garden	Kalchini	Alipurduar
14	3	Uttar Madarihat	Madarihat	Alipurduar
15	3	Gopalpur Tea Garden	Madarihat	Alipurduar
16	3	Dakshin Barajhar	Alipurduar I	Alipurduar
17	3	Shikarpur	Rajganj	Jalpaiguri
18	2	Sachapho	Kumargram	Alipurduar
19	2	Satali Nakadala	Kalchini	Alipurduar
20	2	Sangrampur	Barjora	Bankura
21	2	Brindabanpur	Sonamukhi	Bankura
22	2	Deucha	Barjora	Bankura
23	2	Khayerkanali	Bankura II	Bankura
24	2	Bara Chenga	Mirik	Darjeeling
25	2	Kurseong	Kurseong	Darjeeling
26	2	Bamandanga Tea Garden	Nagrakata	Jalpaiguri
27	2	Sisubari Tea Garden	Mal	Jalpaiguri
28	2	Lakshmipara Tea Garden D	Banarhat	Jalpaiguri
29	2	Maraghat Tea Garden D	Banarhat	Jalpaiguri
30	2	Bhagatpur Tea Garden	Nagrakata	Jalpaiguri
31	2	Sathkaya Tea Garden	Matiali	Jalpaiguri

32	2	Nepura	Midnapore	Paschim Medinipur
33	1	Mechhua Dhurabala Bathan	Falakata	Alipurduar
34	1	Bharnobari Tea Garden	Kalchini	Alipurduar
35	1	Satali Tea Garden	Kalchini	Alipurduar
36	1	Uttar Panialguri	Alipurduar II	Alipurduar
37	1	Madhya Khairbari	Madarihat	Alipurduar
38	1	Purba Madarihat	Madarihat	Alipurduar
39	1	Dakshin Khairbari	Madarihat	Alipurduar
40	1	Madhya Chhekamari	Madarihat	Alipurduar
41	1	Dumchi	Madarihat	Alipurduar
42	1	Birpara Tea Garden	Madarihat	Alipurduar
43	1	Panbari Khanda	Kalchini	Alipurduar
44	1	Lankapara Tea Garden	Madarihat	Alipurduar
45	1	Rahimabad Tea Garden	Kumargram	Alipurduar
46	1	Saudamini Tea Garden	Kalchini	Alipurduar
47	1	Dumchipara Tea Garden	Madarihat	Alipurduar
48	1	Dalmore Tea Garden	Madarihat	Alipurduar
49	1	Emokundi	Bankura II	Bankura
50	1	Rajarampur	Gangajalghati	Bankura
51	1	Rajda	Sonamukhi	Bankura
52	1	Telenda	Mejhia	Bankura
53	1	Basudebpur	Vishnupur	Bankura
54	1	Bhairabpur Paschim	Barjora	Bankura
55	1	Gopinathpur	Barjora	Bankura
56	1	Banjora	Mejhia	Bankura
57	1	Saluka	Barjora	Bankura
58	1	Jagannathpur	Onda	Bankura
59	1	Salda	Jaypur	Bankura
60	1	Sonamukhi	Sonamukhi	Bankura
61	1	Rampur	Bankura II	Bankura
62	1	Jharia	Barjora	Bankura
63	1	Krishna Nagar	Onda	Bankura
64	1	Saulia	Barjora	Bankura
65	1	Ganpur	Mohammad Bazar	Birbhum
66	1	Rangmohan	Mirik	Darjeeling
67	1	Nipania	Mirik	Darjeeling

68	1	Simulbari Tea Garden	Kurseong	Darjeeling
69	1	Bamonpokhari	Kurseong	Darjeeling
70	1	Farabari	Phansidewa	Darjeeling
71	1	Mohanadi	Kurseong	Darjeeling
72	1	Haihai Pathar Tea Garden II	Mal	Jalpaiguri
73	1	Jurapani	Dhupguri	Jalpaiguri
74	1	Kamarbhita	Rajganj	Jalpaiguri
75	1	Red Bank Tea Garden D	Banarhat	Jalpaiguri
76	1	Chapaguri Khanda D	Banarhat	Jalpaiguri
77	1	Binaguri Tea Garden D	Banarhat	Jalpaiguri
78	1	Mogalkata Tea Garden D	Banarhat	Jalpaiguri
79	1	Salbari	Matiali	Jalpaiguri
80	1	Nimna Tandu	Matiali	Jalpaiguri
81	1	Tandu	Nagrakata	Jalpaiguri
82	1	Lataguri	Kranti	Jalpaiguri
83	1	Khairbari	Nagrakata	Jalpaiguri
84	1	Islampur	Islampur	Uttar Dinajpur
85	1	Chhat Singimari	Cooch Behar II	Cooch Behar
86	1	Kalaberya Bhadutala	Salbani	Paschim Medinipur
87	1	Kuilibad	Garbeta I	Paschim Medinipur
88	1	Paturia	Garbeta III	Paschim Medinipur
89	1	Borojam	Garbeta III	Paschim Medinipur
90	1	Dhanghori	Garbeta I	Paschim Medinipur
91	1	Dubrajpur	Garbeta I	Paschim Medinipur
92	1	Kharikasuli	Garbeta I	Paschim Medinipur
93	1	Pacharbandh	Garbeta I	Paschim Medinipur
94	1	Nagua	Egra I	Purba Medinipur
95	1	Panchet	Potashpur II	Purba Medinipur
96	1	Rohini Tea Garden	Kurseong	Darjeeling
97	1	Mayaram	Naxalbari	Darjeeling
98	1	Nischinta	Jamboni	Jhargram
99	1	Bara Bandh	Nayagram	Jhargram
100	1	Lalgarh	Binpur I	Jhargram
101	1	Kalma Pukhuria	Nayagram	Jhargram
102	1	Tutuhya	Jhargram	Jhargram
103	1	Dalki Sol	Nayagram	Jhargram

104	1	Radha Shyampur	Jhargram	Jhargram
105	1	Manikpara	Jhargram	Jhargram
106	1	Panbu	Kalimpong I	Kalimpong
107	1	Bandoan	Bundwan	Purulia
108	1	Baranagar	Barrackpur II	North 24 Parganas



APPENDIX II

Villages in West Bengal with recorded Human Mortality and Injuries.
(2000-2023)

S.no	Count	Village Name	Subdistrict	District
1	141	Raja Bhatkhawa	Kalchini	Alipurduar
2	51	Junglee Mohal	Rajganj	Jalpaiguri
3	39	Nimna Tandu	Maynaguri	Jalpaiguri
4	34	Haihai Pathar I P	Mal	Jalpaiguri
5	33	Upper Tendu	Nagrakata	Jalpaiguri
6	25	Gayerkata D	Banarhat	Jalpaiguri
7	23	Mal	Mal	Jalpaiguri
8	20	Atiabari	Kalchini	Alipurduar
9	20	Son Gachhi	Matiali	Jalpaiguri
10	18	New Clenco P	Mal	Jalpaiguri
11	18	Salbari	Matiali	Jalpaiguri
12	17	Siliguri	Matigara	Darjeeling
13	16	Maraghat D	Banarhat	Jalpaiguri
14	15	Bhatkhawa	Kalchini	Alipurduar
15	15	Dalkajhar	Naxalbari	Darjeeling
16	15	Sisubari	Mal	Jalpaiguri
17	15	Banarhat CT	Banarhat	Jalpaiguri
18	15	Rangamati	Mal	Jalpaiguri
19	15	Mangalbari CT	Matiali	Jalpaiguri
20	15	Jhargram	Jhargram	Jhargram
21	14	Mohanadi	Kurseong	Darjeeling
22	14	Neora Majhiali	Matiali	Jalpaiguri
23	13	Uttar Shalbari D	Banarhat	Jalpaiguri
24	13	Haldibari D	Banarhat	Jalpaiguri
25	13	Kalabari N	Nagrakata	Jalpaiguri
26	13	Gangutia	Kalchini	Alipurduar
27	12	Dhouda Simla N	Nagrakata	Jalpaiguri
28	11	Dakshin Latabari	Kalchini	Alipurduar
29	11	Bandapani	Madarihat	Alipurduar
30	11	Sukna	Kurseong	Darjeeling
31	11	Tesimala	Mal	Jalpaiguri
32	11	Chanadipa D	Banarhat	Jalpaiguri

33	10	Gabaur Bachhra	Kalchini	Alipurduar
34	10	Uttar Latabari CT	Kalchini	Alipurduar
35	10	Kalchini	Kalchini	Alipurduar
36	10	Barjora CT	Barjora	Bankura
37	10	Uttar Bagdogra CT	Naxalbari	Darjeeling
38	10	Nimai	Matigara	Darjeeling
39	10	Nidam Jhora	Mal	Jalpaiguri
40	10	Batabari	Matiali	Jalpaiguri
41	9	Dumriguri CT	Naxalbari	Darjeeling
42	8	Gangajal Ghati	Gangajalghati	Bankura
43	8	Chak Patra Saer	Patrasayer	Bankura
44	8	Bamandanga	Nagrakata	Jalpaiguri
45	8	Tunbari P	Mal	Jalpaiguri
46	8	Uttar Mauamari	Maynaguri	Jalpaiguri
47	8	Aibhil	Matiali	Jalpaiguri
48	8	Matiali	Matiali	Jalpaiguri
49	8	Bhursu	Bagmundi	Purulia
50	7	Panbari Khanda	Kalchini	Alipurduar
51	7	Kamala	Barjora	Bankura
52	7	Mohorgon	Matigara	Darjeeling
53	7	Gairkata CT	Banarhat	Jalpaiguri
54	7	Mogalkata D	Banarhat	Jalpaiguri
55	7	Dhumpara N	Nagrakata	Jalpaiguri
56	7	Angrabhasa N	Nagrakata	Jalpaiguri
57	7	Sathkaya	Matiali	Jalpaiguri
58	7	Khapribhanga	Garbeta II	Paschim Medinipur
59	7	Daldali	Garbeta II	Paschim Medinipur
60	6	Bishnupur	Vishnupur	Bankura
61	6	Khoklong	Matigara	Darjeeling
62	6	Batlabari	Naxalbari	Darjeeling
63	6	Rangia	Matigara	Darjeeling
64	6	Rajpairi	Matigara	Darjeeling
65	6	Bhujia Bani	Naxalbari	Darjeeling
66	6	Madhya Shalbari D	Banarhat	Jalpaiguri
67	6	Binnaguri CT	Rajganj	Jalpaiguri
68	6	Gendrapara D	Banarhat	Jalpaiguri

69	6	Demkajhora	Mal	Jalpaiguri
70	6	Washabari	Mal	Jalpaiguri
71	5	Phulberya	Barjora	Bankura
72	5	Talanjuri	Barjora	Bankura
73	5	Binaguri D	Banarhat	Jalpaiguri
74	5	Mathachulka	Matiali	Jalpaiguri
75	5	Neoranadi	Mal	Jalpaiguri
76	5	Baranakdana	Garbeta II	Paschim Medinipur
77	5	Damdim	Mal	Jalpaiguri
78	5	Jamindardaya	Jhargram	Jhargram
79	5	Galasuli	Binpur I	Jhargram
80	4	Dakshin Satali	Kalchini	Alipurduar
81	4	Uttar Mandabari	Kalchini	Alipurduar
82	4	Nimtijhora	Kalchini	Alipurduar
83	4	Uttar Madarihat CT	Madarihat	Alipurduar
84	4	Dalgaon	Falakata	Alipurduar
85	4	Maldanga	Gangajalghati	Bankura
86	4	Rupsing	Naxalbari	Darjeeling
87	4	Simulguri	Rajganj	Jalpaiguri
88	4	Dakshin Salbari D	Banarhat	Jalpaiguri
89	4	Chalsa Mahabari CT	Matiali	Jalpaiguri
90	4	Tandu	Nagrakata	Jalpaiguri
91	4	Hridaypur N	Nagrakata	Jalpaiguri
92	4	Bhedya	Garbeta II	Paschim Medinipur
93	4	Hatia	Garbeta II	Paschim Medinipur
94	4	Bagmuri	Jhargram	Jhargram
95	4	Khas Jangal	Nayagram	Jhargram
96	4	Jangal Khas	Jhargram	Jhargram
97	3	Nimti Domohani	Kalchini	Alipurduar
98	3	Bhatpara	Kalchini	Alipurduar
99	3	Uttar Sonapur	Alipurduar I	Alipurduar
100	3	Rajabhat	Kalchini	Alipurduar
101	3	Purba Satali	Kalchini	Alipurduar
102	3	Alipurduar	Alipurduar II	Alipurduar
103	3	Upar Dihi	Bankura II	Bankura
104	3	Mandi	Gangajalghati	Bankura
105	3	Bhairabpur	Gangajalghati	Bankura

106	3	Mamrasol	Taldangra	Bankura
107	3	Shushunia	Barjora	Bankura
108	3	Panta Pari	Naxalbari	Darjeeling
109	3	Mahideb	Phansidewa	Darjeeling
110	3	Barajharu	Naxalbari	Darjeeling
111	3	Geni CT	Naxalbari	Darjeeling
112	3	Panchakulguri	Matigara	Darjeeling
113	3	Nengtichhara	Matigara	Darjeeling
114	3	Tari CT	Matigara	Darjeeling
115	3	Bara Gharia	Matigara	Darjeeling
116	3	Ujanu P	Matigara	Darjeeling
117	3	Purba Duramari D	Banarhat	Jalpaiguri
118	3	Barapatina Nutanbus	Jalpaiguri	Jalpaiguri
119	3	Ramsai	Maynaguri	Jalpaiguri
120	3	Uttar Jhor Altagram D	Banarhat	Jalpaiguri
121	3	Kumlai	Mal	Jalpaiguri
122	3	Bara Dighi	Matiali	Jalpaiguri
123	3	Dalingkote	Mal	Jalpaiguri
124	3	Dipa	Keshiary	Paschim Medinipur
125	3	Walipur	Kharagpur I	Paschim Medinipur
126	3	Medinipur	Midnapore	Paschim Medinipur
127	3	Tiakati	Midnapore	Paschim Medinipur
128	3	Nischintapur	Garbeta II	Paschim Medinipur
129	3	Jamsol	Midnapore	Paschim Medinipur
130	3	Hirasol	Garbeta II	Paschim Medinipur
131	3	Darkuli	Jhargram	Jhargram
132	3	Joypur	Binpur II	Jhargram
133	3	Ramgar	Binpur I	Jhargram
134	3	Yokprintam Khasmahal	Kalimpong I	Kalimpong
135	3	Kudna	Bagmundi	Purulia
136	3	Baghmundi	Bagmundi	Purulia
137	3	Chaka	Kashipur	Purulia
138	3	Haramadih	Arsha	Purulia
139	3	Pardi	Bagmundi	Purulia
140	3	Durgapur	Durgapur Faridpur	Paschim Bardhaman
141	2	Dalsingpara	Kalchini	Alipurduar
142	2	Madhya Satali	Kalchini	Alipurduar

143	2	Nutanpara	Alipurduar I	Alipurduar
144	2	Banchukamari	Alipurduar I	Alipurduar
145	2	Uttar Rangali Baznar	Madarihat	Alipurduar
146	2	Paschim Satali	Kalchini	Alipurduar
147	2	Karaibari	Falakata	Alipurduar
148	2	Torsa	Alipurduar I	Alipurduar
149	2	Khairbari	Madarihat	Alipurduar
150	2	Saudamini	Kalchini	Alipurduar
151	2	Bhalaidiha	Khatra	Bankura
152	2	Bagakhulia	Khatra	Bankura
153	2	Hatashuria	Barjora	Bankura
154	2	Harirampur	Barjora	Bankura
155	2	Pechhela	Raipur	Bankura
156	2	Bankura	Bankura I	Bankura
157	2	Junbede	Bankura II	Bankura
158	2	Keshiara	Gangajalghati	Bankura
159	2	Balijora	Gangajalghati	Bankura
160	2	Lalpur	Patrasayer	Bankura
161	2	Rajpur	Taldangra	Bankura
162	2	Kadamara	Simlapal	Bankura
163	2	Kharjuria	Simlapal	Bankura
164	2	Nekra Sonda	Khatra	Bankura
165	2	Oltara	Barjora	Bankura
166	2	Sonamukhi	Sonamukhi	Bankura
167	2	Tiring	Khatra	Bankura
168	2	Bahadurpur	Barjora	Bankura
169	2	Ratganj Madhabpur	Barjora	Bankura
170	2	Beliatore CT	Barjora	Bankura
171	2	Basudebpur Uttar	Barjora	Bankura
172	2	Dhulyapur	Onda	Bankura
173	2	Dubrajpur	Dubrajpur	Birbhum
174	2	Jhauguri	Matigara	Darjeeling
175	2	Sebdella	Naxalbari	Darjeeling
176	2	Gaziram	Naxalbari	Darjeeling
177	2	Kalam	Matigara	Darjeeling
178	2	Putimari	Naxalbari	Darjeeling
179	2	Dhukuria	Matigara	Darjeeling

180	2	Udaysing	Matigara	Darjeeling
181	2	Kalkut CT	Matigara	Darjeeling
182	2	Panchanai	Matigara	Darjeeling
183	2	Karaibari	Matigara	Darjeeling
184	2	Simulbari	Kurseong	Darjeeling
185	2	Kurseong	Kurseong	Darjeeling
186	2	Panthabari	Mirik	Darjeeling
187	2	Dadanpur	Arambag	Hooghly
188	2	Kalabari N	Nagrakata	Jalpaiguri
189	2	Haihai Pathar II	Mal	Jalpaiguri
190	2	Gurjang Jhora	Mal	Jalpaiguri
191	2	Diana D	Banarhat	Jalpaiguri
192	2	Dabgram P CT	Rajganj	Jalpaiguri
193	2	Mantadari	Rajganj	Jalpaiguri
194	2	Chhat Guzrimari	Rajganj	Jalpaiguri
195	2	Totopara D	Banarhat	Jalpaiguri
196	2	Haritalguri D	Banarhat	Jalpaiguri
197	2	Kathalguri D	Banarhat	Jalpaiguri
198	2	Telipara D CT	Banarhat	Jalpaiguri
199	2	Paschim Batabari	Matiali	Jalpaiguri
200	2	Bara Dighi	Matiali	Jalpaiguri
201	2	Dakshin Odlabari CT	Mal	Jalpaiguri
202	2	Kodalkati	Kranti	Jalpaiguri
203	2	Khairbari	Nagrakata	Jalpaiguri
204	2	Indong	Matiali	Jalpaiguri
205	2	Menglass	Mal	Jalpaiguri
206	2	Pakhiralay	Gosaba	South 24 Parganas
207	2	Bamunara	Bhatar	Purba Bardhaman
208	2	Guskara	Ausgram I	Purba Bardhaman
209	2	Chandrakona	Chandrakona II	Paschim Medinipur
210	2	Narayanpur	Salbani	Paschim Medinipur
211	2	Shankarbandh	Salbani	Paschim Medinipur
212	2	Golakchak	Salbani	Paschim Medinipur
213	2	Mirga	Salbani	Paschim Medinipur
214	2	Kharagpur	Kharagpur I	Paschim Medinipur
215	2	Bhula	Garbeta I	Paschim Medinipur
216	2	Tilabani	Garbeta II	Paschim Medinipur

217	2	Dumuria	Garbeta II	Paschim Medinipur
218	2	Balarampur	Garbeta I	Paschim Medinipur
219	2	Mayaram	Naxalbari	Darjeeling
220	2	Barageria	Garbeta I	Paschim Medinipur
221	2	Khatkhura	Jamboni	Jhargram
222	2	Lalgarh	Binpur I	Jhargram
223	2	Mahuli	Sankrail	Jhargram
224	2	Nischinta	Sankrail	Jhargram
225	2	Kismat Bharat Pur	Jhargram	Jhargram
226	2	Nekdaduba	Jhargram	Jhargram
227	2	Rasiagerya	Jhargram	Jhargram
228	2	Harki	Jhargram	Jhargram
229	2	Jadabpur	Nayagram	Jhargram
230	2	Jharagerya	Jhargram	Jhargram
231	2	Jorakhali	Jhargram	Jhargram
232	2	Shirshi	Jhargram	Jhargram
233	2	Katchara Damodarpur	Jhargram	Jhargram
234	2	Tapoban	Nayagram	Jhargram
235	2	Bhaluk Ghara	Nayagram	Jhargram
236	2	Rangametia	Binpur II	Jhargram
237	2	Pathra	Binpur II	Jhargram
238	2	Goaldawga	Binpur I	Jhargram
239	2	Jangal Khas	Binpur I	Jhargram
240	2	Jualbhanga	Binpur I	Jhargram
241	2	Dhengya	Binpur I	Jhargram
242	2	Dahijuri	Binpur I	Jhargram
243	2	Barrapalia	Binpur I	Jhargram
244	2	Pathra	Jhargram	Jhargram
245	2	Prayagpur CT	Kanksa	Paschim Bardhaman
246	2	Paygang Khasmahal	Lava	Kalimpong
247	2	Pratappur	Bagmundi	Purulia
248	2	Saramba	Jhalda I	Purulia
249	2	Latar	Jhalda I	Purulia
250	2	Nutandi	Jhalda I	Purulia
251	2	Gopalpur	Jhalda I	Purulia
252	2	Mahakudar	Jhalda I	Purulia
253	2	Baldi	Raghunathpur II	Purulia

254	2	Kana	Balarampur	Purulia
255	2	Patmadi	Jhalda I	Purulia
256	2	Keraya	Balarampur	Purulia
257	2	Harada	Arsha	Purulia
258	2	Nunya	Arsha	Purulia
259	2	Bongada	Bagmundi	Purulia
260	2	Shilingda	Bagmundi	Purulia
261	2	Bhagaband	Hura	Purulia
262	2	Asansol	Barabani	Paschim Bardhaman
263	1	Habibpur P	Midnapore	Paschim Medinipur
264	1	Jhar Beltali	Falakata	Alipurduar
265	1	Dakshin Parangarpar	Falakata	Alipurduar
266	1	Lachhmandabri	Falakata	Alipurduar
267	1	Jaygaon CT	Kalchini	Alipurduar
268	1	Beech	Kalchini	Alipurduar
269	1	Parmalangi	Kalchini	Alipurduar
270	1	Loknathpur	Alipurduar II	Alipurduar
271	1	Garokhuta	Alipurduar II	Alipurduar
272	1	Bariguri	Alipurduar I	Alipurduar
273	1	Raydak	Kumargram	Alipurduar
274	1	Mejbil	Alipurduar I	Alipurduar
275	1	Nepania	Madarihat	Alipurduar
276	1	Madhya Madarihat	Madarihat	Alipurduar
277	1	Madhya Chhekamari	Madarihat	Alipurduar
278	1	Dakshin Rangali Baznar	Madarihat	Alipurduar
279	1	New Lands	Kumargram	Alipurduar
280	1	Chuapara	Kalchini	Alipurduar
281	1	Hantupara	Madarihat	Alipurduar
282	1	Birpara	Madarihat	Alipurduar
283	1	Uttar Deogaon	Falakata	Alipurduar
284	1	Dheklapara	Madarihat	Alipurduar
285	1	Satali Nakadala	Kalchini	Alipurduar
286	1	Dakshin Mandabari	Kalchini	Alipurduar
287	1	Ghagra P	Alipurduar I	Alipurduar
288	1	Uttar Chhekamari	Madarihat	Alipurduar
289	1	Kurul Pahari	Khatra	Bankura
290	1	Khalpara	Raipur	Bankura

291	1	Gopalpur	Sarenga	Bankura
292	1	Shyampur	Barjora	Bankura
293	1	Ashuria Madhabpur	Barjora	Bankura
294	1	Gopkande	Barjora	Bankura
295	1	Dakharang	Sarenga	Bankura
296	1	Balarampur	Bankura II	Bankura
297	1	Kurkutia	Indpur	Bankura
298	1	Nischintapur	Indpur	Bankura
299	1	Kushtara	Vishnupur	Bankura
300	1	Bankdaha	Gangajalghati	Bankura
301	1	Bara Kumira	Gangajalghati	Bankura
302	1	Ban Ashuria	Gangajalghati	Bankura
303	1	Kamalpur	Raipur	Bankura
304	1	Chaitanpur	Sonamukhi	Bankura
305	1	Patdoha	Saltora	Bankura
306	1	Dhapali	Saltora	Bankura
307	1	Ranjitpur	Saltora	Bankura
308	1	Kujkuria	Saltora	Bankura
309	1	Rautara	Saltora	Bankura
310	1	Jam Bedya	Gangajalghati	Bankura
311	1	Muktatar	Barjora	Bankura
312	1	Monoharbati	Barjora	Bankura
313	1	Manikmara	Taldangra	Bankura
314	1	Pathardiha	Chhatna	Bankura
315	1	Dhobargram	Bankura I	Bankura
316	1	Basulitara	Bankura I	Bankura
317	1	Pataspur	Barjora	Bankura
318	1	Jaykrishnapur Sarenga	Barjora	Bankura
319	1	Lodda	Taldangra	Bankura
320	1	Asnasundarpur	Taldangra	Bankura
321	1	Gamarbani	Taldangra	Bankura
322	1	Patharjora	Taldangra	Bankura
323	1	Banskanali	Simlapal	Bankura
324	1	Budhadhara	Simlapal	Bankura
325	1	Kukrakhondar	Simlapal	Bankura
326	1	Tushkutari	Simlapal	Bankura
327	1	Machatora	Simlapal	Bankura

328	1	Mettyaldoba	Simlapal	Bankura
329	1	Bhangadeuli	Sarenga	Bankura
330	1	Bhairabpur Paschim	Barjora	Bankura
331	1	Sonergram	Barjora	Bankura
332	1	Sahebdihi	Barjora	Bankura
333	1	Kushma	Barjora	Bankura
334	1	Patpur	Onda	Bankura
335	1	Bhagarara	Vishnupur	Bankura
336	1	Arbetal	Gangajalghati	Bankura
337	1	Dhabani	Barjora	Bankura
338	1	Dublala	Raipur	Bankura
339	1	Halud Kanali	Ranibandh	Bankura
340	1	Maulasol	Raipur	Bankura
341	1	Raghunathpur	Bankura II	Bankura
342	1	Purandarpur	Bankura II	Bankura
343	1	Chhirabasta	Bankura II	Bankura
344	1	Agra	Bankura II	Bankura
345	1	Beharadihi	Bankura I	Bankura
346	1	Chura Manipur	Vishnupur	Bankura
347	1	Dharapati	Vishnupur	Bankura
348	1	Rautara	Vishnupur	Bankura
349	1	Janta	Vishnupur	Bankura
350	1	Deuli	Vishnupur	Bankura
351	1	Hanri Bhanga	Gangajalghati	Bankura
352	1	Gobinda Dham	Gangajalghati	Bankura
353	1	Shua Basa	Gangajalghati	Bankura
354	1	Nidhirampur	Gangajalghati	Bankura
355	1	Kumir Pathar	Indpur	Bankura
356	1	Kaniari	Taldangra	Bankura
357	1	Mandarbani	Barjora	Bankura
358	1	Gobindapur	Barjora	Bankura
359	1	Belut	Barjora	Bankura
360	1	Gogra	Onda	Bankura
361	1	Sundarpur	Onda	Bankura
362	1	Mauchura	Onda	Bankura
363	1	Salda	Sonamukhi	Bankura
364	1	Kamladanga	Bankura II	Bankura

365	1	Bhagra	Raipur	Bankura
366	1	Maukuri	Indpur	Bankura
367	1	Belthya	Vishnupur	Bankura
368	1	Datina Purusottampur	Onda	Bankura
369	1	Gonsai Dihi	Saltora	Bankura
370	1	Nutangram	Barjora	Bankura
371	1	Dhulla	Suri I	Birbhum
372	1	Ahammadpur	Rajnagar	Birbhum
373	1	Bakhul	Labpur	Birbhum
374	1	Jalalnagar	Illambazar	Birbhum
375	1	Sainthia	Sainthia	Birbhum
376	1	Hatara	Sainthia	Birbhum
377	1	Barabhita	Naxalbari	Darjeeling
378	1	Salbari	Kharibari	Darjeeling
379	1	Satbhaiya	Naxalbari	Darjeeling
380	1	Nandalal	Naxalbari	Darjeeling
381	1	Omi	Naxalbari	Darjeeling
382	1	Sannyasithan	Phansidewa	Darjeeling
383	1	Sannyasi Thaner Chhat	Phansidewa	Darjeeling
384	1	Bharia Danga	Phansidewa	Darjeeling
385	1	Gangaram Maler Chhat	Phansidewa	Darjeeling
386	1	Mahasing	Naxalbari	Darjeeling
387	1	Ghusuru	Naxalbari	Darjeeling
388	1	Budhkaran	Naxalbari	Darjeeling
389	1	Bataliguri	Matigara	Darjeeling
390	1	Baunibhita	Naxalbari	Darjeeling
391	1	Kamalpur	Naxalbari	Darjeeling
392	1	Jhauguri Chhat	Matigara	Darjeeling
393	1	Jugibhita	Matigara	Darjeeling
394	1	Guria	Matigara	Darjeeling
395	1	Bairatisal CT	Matigara	Darjeeling
396	1	Baniakhari	Matigara	Darjeeling
397	1	Jitu CT	Matigara	Darjeeling
398	1	Bara Mohansingh CT	Matigara	Darjeeling
399	1	Gaurcharan	Matigara	Darjeeling
400	1	Kawakhari	Matigara	Darjeeling
401	1	Bhujia Banir Chhat	Naxalbari	Darjeeling

402	1	Nunu Bairagi Chhat	Matigara	Darjeeling
403	1	Malahar	Matigara	Darjeeling
404	1	Khaprail	Matigara	Darjeeling
405	1	Darjiling	Darjeeling Pulbazar	Darjeeling
406	1	Bhubangurir Chhat	Phansidewa	Darjeeling
407	1	Dakshin Bagdogra CT	Naxalbari	Darjeeling
408	1	Tarbandha	Phansidewa	Darjeeling
409	1	Bara Adalpur Dwitiya Khanda	Matigara	Darjeeling
410	1	Chhota Adalpur	Kurseong	Darjeeling
411	1	Sivok	Kurseong	Darjeeling
412	1	Selim Hill	Kurseong	Darjeeling
413	1	Gitingy	Kurseong	Darjeeling
414	1	Khanati	Goghat I	Hooghly
415	1	Bainguri	Mal	Jalpaiguri
416	1	Bhelakoba	Jalpaiguri	Jalpaiguri
417	1	Banglajhar	Maynaguri	Jalpaiguri
418	1	Riabari D	Banarhat	Jalpaiguri
419	1	Lakshmikantapur	Banarhat	Jalpaiguri
420	1	Uttar Khagrabari	Maynaguri	Jalpaiguri
421	1	Mainaguri CT	Maynaguri	Jalpaiguri
422	1	Betgara	Maynaguri	Jalpaiguri
423	1	Jalapara D	Banarhat	Jalpaiguri
424	1	Grassmore	Nagrakata	Jalpaiguri
425	1	Chengmari	Nagrakata	Jalpaiguri
426	1	Chhar Tandu	Nagrakata	Jalpaiguri
427	1	Nagaisuri	Matiali	Jalpaiguri
428	1	Nakhati	Matiali	Jalpaiguri
429	1	Syli	Mal	Jalpaiguri
430	1	Purbba Batabari	Matiali	Jalpaiguri
431	1	Purba Kantadighi Kumarpura	Mal	Jalpaiguri
432	1	Mashaldaha	Harischandrapur II	Malda
433	1	Amragari	Amta II	Howrah
434	1	Chaudanga	Cooch Behar II	Cooch Behar
435	1	Sonari Kakribari	Cooch Behar II	Cooch Behar
436	1	Narayanpur	Mangolkote	Purba Bardhaman
437	1	Kusumgram	Manteswar	Purba Bardhaman

438	1	Eruar	Bhatar	Purba Bardhaman
439	1	Patikhaldanga	Manteswar	Purba Bardhaman
440	1	Sinhali	Manteswar	Purba Bardhaman
441	1	Sahapur	Manteswar	Purba Bardhaman
442	1	Batagram	Ausgram I	Purba Bardhaman
443	1	Haora	Galsi I	Purba Bardhaman
444	1	Pashchim Chandipur	Ausgram II	Purba Bardhaman
445	1	Nere	Salbani	Paschim Medinipur
446	1	Rangamatia	Salbani	Paschim Medinipur
447	1	Kandramari	Keshiary	Paschim Medinipur
448	1	Dhengbahara	Salbani	Paschim Medinipur
449	1	Kharka Soli	Salbani	Paschim Medinipur
450	1	Tushphela	Salbani	Paschim Medinipur
451	1	Lalgere	Salbani	Paschim Medinipur
452	1	Pirakata	Salbani	Paschim Medinipur
453	1	Kendasol	Salbani	Paschim Medinipur
454	1	Benagere	Salbani	Paschim Medinipur
455	1	Jorakusumi	Salbani	Paschim Medinipur
456	1	Pirrakuli	Salbani	Paschim Medinipur
457	1	Jorakushmi	Salbani	Paschim Medinipur
458	1	Banshiroysol	Salbani	Paschim Medinipur
459	1	Baylasol	Midnapore	Paschim Medinipur
460	1	Maupal	Salbani	Paschim Medinipur
461	1	Tarashuli	Salbani	Paschim Medinipur
462	1	Khasjangal	Salbani	Paschim Medinipur
463	1	Nanasol	Salbani	Paschim Medinipur
464	1	Kank Sol	Salbani	Paschim Medinipur
465	1	Gaighata	Salbani	Paschim Medinipur
466	1	Sundarpur	Salbani	Paschim Medinipur
467	1	Chihardalan	Salbani	Paschim Medinipur
468	1	Garmal	Salbani	Paschim Medinipur
469	1	Bagmari	Salbani	Paschim Medinipur
470	1	Leluakala	Kharagpur I	Paschim Medinipur
471	1	Rajpura	Kharagpur I	Paschim Medinipur
472	1	Tongagerya	Kharagpur I	Paschim Medinipur
473	1	Panch Mahali	Kharagpur I	Paschim Medinipur

474	1	Kalaikunda CT	Kharagpur I	Paschim Medinipur
475	1	Risa	Kharagpur I	Paschim Medinipur
476	1	Amgobra	Midnapore	Paschim Medinipur
477	1	Deuldanga	Midnapore	Paschim Medinipur
478	1	Kharikasuli	Midnapore	Paschim Medinipur
479	1	Ulta	Midnapore	Paschim Medinipur
480	1	Paschimdhorasol	Debra	Paschim Medinipur
481	1	Bhiknagar	Garbeta I	Paschim Medinipur
482	1	Asnasuli	Garbeta I	Paschim Medinipur
483	1	Metiabari	Garbeta I	Paschim Medinipur
484	1	Jamdoba	Garbeta I	Paschim Medinipur
485	1	Andharia	Garbeta II	Paschim Medinipur
486	1	Pinrrasuli	Garbeta II	Paschim Medinipur
487	1	Kenkanali	Garbeta II	Paschim Medinipur
488	1	Betjharla	Garbeta II	Paschim Medinipur
489	1	Dulia	Garbeta II	Paschim Medinipur
490	1	Jhaljhali	Garbeta I	Paschim Medinipur
491	1	Habla	Garbeta I	Paschim Medinipur
492	1	Pathri	Salbani	Paschim Medinipur
493	1	Jamunabali Basantpur	Midnapore	Paschim Medinipur
494	1	Gorabari	Garbeta II	Paschim Medinipur
495	1	Kharkata	Garbeta I	Paschim Medinipur
496	1	Chhota Nakdana	Garbeta II	Paschim Medinipur
497	1	Krismat Hirapari	Narayangarh	Paschim Medinipur
498	1	Lalir Dihi	Salbani	Paschim Medinipur
499	1	Patajharla	Salbani	Paschim Medinipur
500	1	Kuldiha	Salbani	Paschim Medinipur
501	1	Dhanghari	Salbani	Paschim Medinipur
502	1	Baramesa	Salbani	Paschim Medinipur
503	1	Doarkhol	Kharagpur I	Paschim Medinipur
504	1	Dherua	Midnapore	Paschim Medinipur
505	1	Pal Gerya	Narayangarh	Paschim Medinipur
506	1	Gangani	Garbeta I	Paschim Medinipur
507	1	Pataner Chhat	Matigara	Darjeeling
508	1	Siliguri	Rajganj	Jalpaiguri
509	1	Rohini	Kurseong	Darjeeling

510	1	Ranichera	Mal	Jalpaiguri
511	1	Relagaria	Sankrail	Jhargram
512	1	Kapgari	Jamboni	Jhargram
513	1	Beragari	Jamboni	Jhargram
514	1	Bhadai	Jamboni	Jhargram
515	1	Murakati	Jamboni	Jhargram
516	1	Gadrasol	Jamboni	Jhargram
517	1	Nehar	Sankrail	Jhargram
518	1	Amjhatia	Sankrail	Jhargram
519	1	Gundur Ghura	Sankrail	Jhargram
520	1	Tikarpara	Sankrail	Jhargram
521	1	Bhurkundi	Sankrail	Jhargram
522	1	Dhansol	Sankrail	Jhargram
523	1	Khanakul	Jhargram	Jhargram
524	1	Mukundapur	Sankrail	Jhargram
525	1	Nimai Nagar	Nayagram	Jhargram
526	1	Kalma Pukhuria	Nayagram	Jhargram
527	1	Suabansa	Jhargram	Jhargram
528	1	Satyadihi	Jhargram	Jhargram
529	1	Chenchur Gerya	Jhargram	Jhargram
530	1	Sagbandi	Jhargram	Jhargram
531	1	Nayagram	Nayagram	Jhargram
532	1	Gobra Sol	Nayagram	Jhargram
533	1	Tilia	Nayagram	Jhargram
534	1	Damda Sol	Nayagram	Jhargram
535	1	Mura Kati	Nayagram	Jhargram
536	1	Bara Ningui	Nayagram	Jhargram
537	1	Kukurmuri	Jamboni	Jhargram
538	1	Khas Jangal	Nayagram	Jhargram
539	1	Rehara	Jamboni	Jhargram
540	1	Kutusgerya	Jhargram	Jhargram
541	1	Olda	Sankrail	Jhargram
542	1	Sugnibansa	Jhargram	Jhargram
543	1	Kashia	Jhargram	Jhargram
544	1	Khas Jangal	Jhargram	Jhargram
545	1	Bhaudi	Jhargram	Jhargram

546	1	Jangal Kurachi	Sankrail	Jhargram
547	1	Purna Pani	Sankrail	Jhargram
548	1	Kalsi Bhanga	Jhargram	Jhargram
549	1	Baishtampur	Binpur II	Jhargram
550	1	Amlatora	Binpur II	Jhargram
551	1	Gobindapur	Binpur II	Jhargram
552	1	Hardamkhana	Binpur II	Jhargram
553	1	Kaliam	Binpur II	Jhargram
554	1	Jhetiara	Binpur II	Jhargram
555	1	Dhenganadar	Binpur II	Jhargram
556	1	Chandabila	Binpur II	Jhargram
557	1	Pindra	Binpur II	Jhargram
558	1	Jarkasuli	Binpur I	Jhargram
559	1	Aulia	Binpur II	Jhargram
560	1	Jangalkhas	Binpur I	Jhargram
561	1	Khasjangal	Binpur I	Jhargram
562	1	Bandgora	Binpur I	Jhargram
563	1	Hanrulia	Binpur I	Jhargram
564	1	Dhanghari	Binpur I	Jhargram
565	1	Bandhagara	Binpur I	Jhargram
566	1	Kumarbandh	Binpur I	Jhargram
567	1	Tikarampur	Binpur I	Jhargram
568	1	Kismat Barakola	Binpur I	Jhargram
569	1	Dolkunda	Binpur I	Jhargram
570	1	Nutandi	Binpur I	Jhargram
571	1	Gopinathpur	Binpur I	Jhargram
572	1	Dhanghori	Binpur I	Jhargram
573	1	Bara Jhariamura	Binpur I	Jhargram
574	1	Rathbera	Binpur I	Jhargram
575	1	Dingla	Binpur I	Jhargram
576	1	Netai	Binpur I	Jhargram
577	1	Sakhisol	Binpur I	Jhargram
578	1	Lalgarh Jangalkhas	Binpur I	Jhargram
579	1	Krishna Kumari	Binpur I	Jhargram
580	1	Dihikalyanpur	Binpur I	Jhargram
581	1	Gopiballavpur	Gopiballavpur I	Jhargram

582	1	Banshidharpur	Gopiballavpur I	Jhargram
583	1	Marunia	Gopiballavpur II	Jhargram
584	1	Bali Pal	Gopiballavpur II	Jhargram
585	1	Khas Jangal	Jhargram	Jhargram
586	1	Kadokota	Nayagram	Jhargram
587	1	Sankapat	Gopiballavpur II	Jhargram
588	1	Ramgar	Gopiballavpur II	Jhargram
589	1	Belaberya	Gopiballavpur II	Jhargram
590	1	Ichhapur CT	Durgapur Faridpur	Paschim Bardhaman
591	1	Mahal CT	Pandabeswar	Paschim Bardhaman
592	1	Panagar	Kanksa	Paschim Bardhaman
593	1	Manikara	Kanksa	Paschim Bardhaman
594	1	Samsing Khasmahal	Gorubathan	Kalimpong
595	1	Pagrang Bong Khasmahal	Gorubathan	Kalimpong
596	1	Yang Makum Khasmahal	Kalimpong I	Kalimpong
597	1	Burda	Bagmundi	Purulia
598	1	Koreng	Bagmundi	Purulia
599	1	Dhekia	Bagmundi	Purulia
600	1	Parsa	Bagmundi	Purulia
601	1	Kushumtikri	Bagmundi	Purulia
602	1	Kanrda	Bagmundi	Purulia
603	1	Kuchrirakha	Bagmundi	Purulia
604	1	Bhitpani	Bagmundi	Purulia
605	1	Alkusi	Bagmundi	Purulia
606	1	Gandhudi	Bagmundi	Purulia
607	1	Chorda	Bagmundi	Purulia
608	1	Ghorabandha	Bagmundi	Purulia
609	1	Kutidih	Jhalda I	Purulia
610	1	Gutniya	Jhalda II	Purulia
611	1	Bhursa	Arsha	Purulia
612	1	Chekya CT	Jhalda II	Purulia
613	1	Maramu	Jhalda II	Purulia
614	1	Chirugara	Jhalda II	Purulia
615	1	Chiruhatu	Jhalda II	Purulia
616	1	Guridi	Jhalda II	Purulia

617	1	Dumari	Balarampur	Purulia
618	1	Uparjari	Arsha	Purulia
619	1	Baram	Arsha	Purulia
620	1	Gurahata	Arsha	Purulia
621	1	Satra	Arsha	Purulia
622	1	Darbaria	Balarampur	Purulia
623	1	Sagma	Balarampur	Purulia
624	1	Jambani	Balarampur	Purulia
625	1	Bhalukgajar	Kashipur	Purulia
626	1	Ajodhya	Bagmundi	Purulia
627	1	Chhatrajara	Bagmundi	Purulia
628	1	Kalijharna	Bagmundi	Purulia
629	1	Pattanr	Arsha	Purulia
630	1	Bhuda	Arsha	Purulia
631	1	Juri	Arsha	Purulia
632	1	Gopalpur	Purulia II	Purulia
633	1	Matipur	Hura	Purulia
634	1	Damankiari	Kashipur	Purulia
635	1	Makhyada	Kashipur	Purulia
636	1	Mangpong	Kalimpong I	Kalimpong
637	1	Jhalda	Jhalda I	Purulia
638	1	Matha	Bagmundi	Purulia
639	1	Jamuria	Jamuria	Paschim Bardhaman



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