ASSAM

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

ELEPHANT - HUMAN CONFLICT IN THE STATE OF ASSAM, INDIA (2000-2023)

TRENDS, CHALLENGES & INSIGHTS

March 2025

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Acknowledgements

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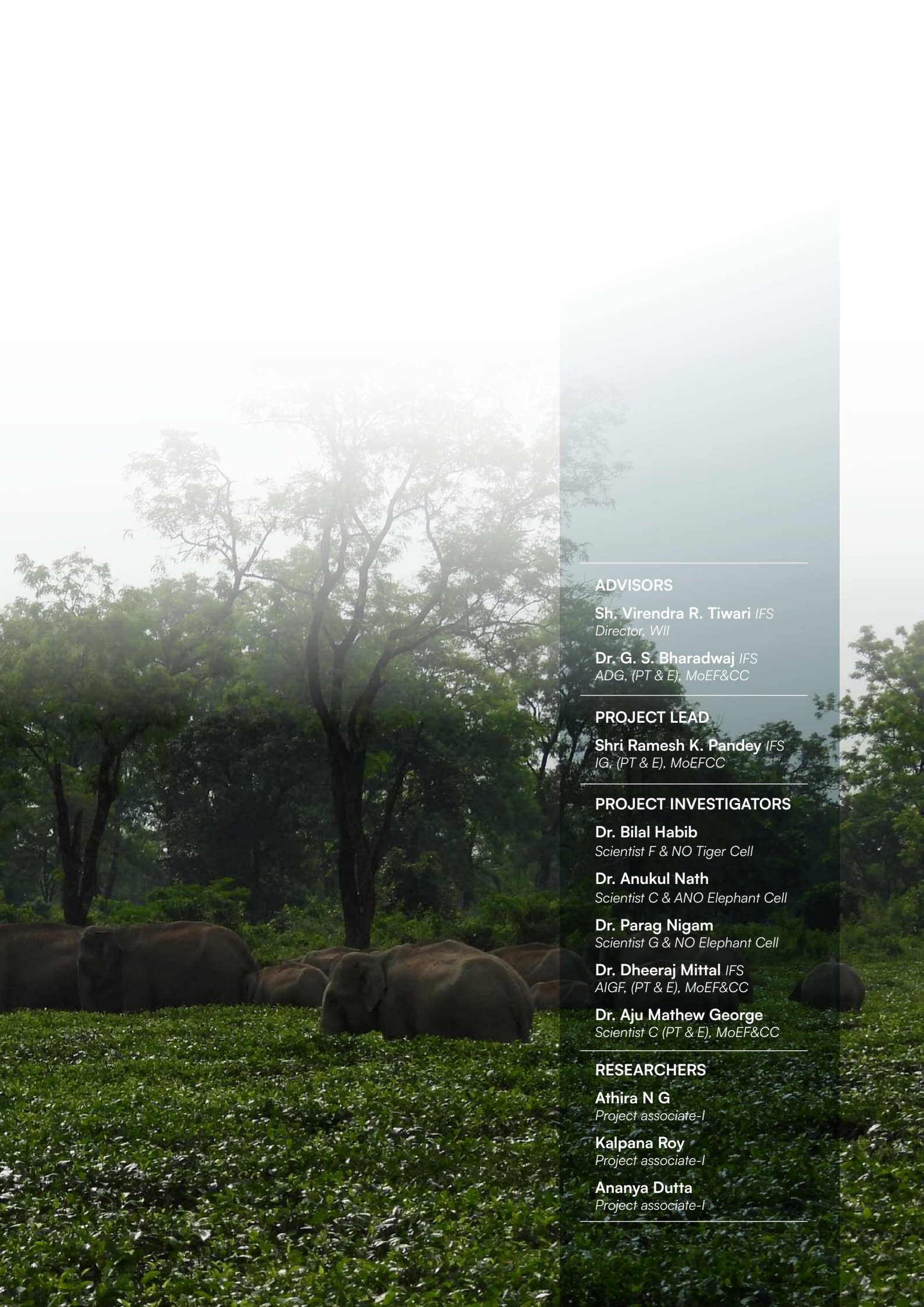

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EXECUTIVE SUMMARY

Human-elephant conflict (HEC) in Assam has been a persistent and growing challenge, resulting in significant losses for both humans and elephants. The pressure on elephant habitats has escalated as landscape has shown an increase in agriculture, settlements, and development projects, leading to more frequent interaction between human and elephant. This report examines the trends in Human-elephant conflict over the last 23 years (2000—2023), analysing the underlying factors driving conflicts and attempt has been given to formulate mitigation strategies to foster coexistence between local communities and elephants. To analyse conflict patterns, a comprehensive approach was used, combining spatial analysis and field observations. Information was gathered from forest department records and on-site surveys to identify conflict-prone areas. Changes in land use land cover were examined to understand their impact, while relationships between landscape characteristics, conflict severity, and various causes of elephant mortality were evaluated.

Data Collection

Data collected from **21 FOREST DIVISIONS**

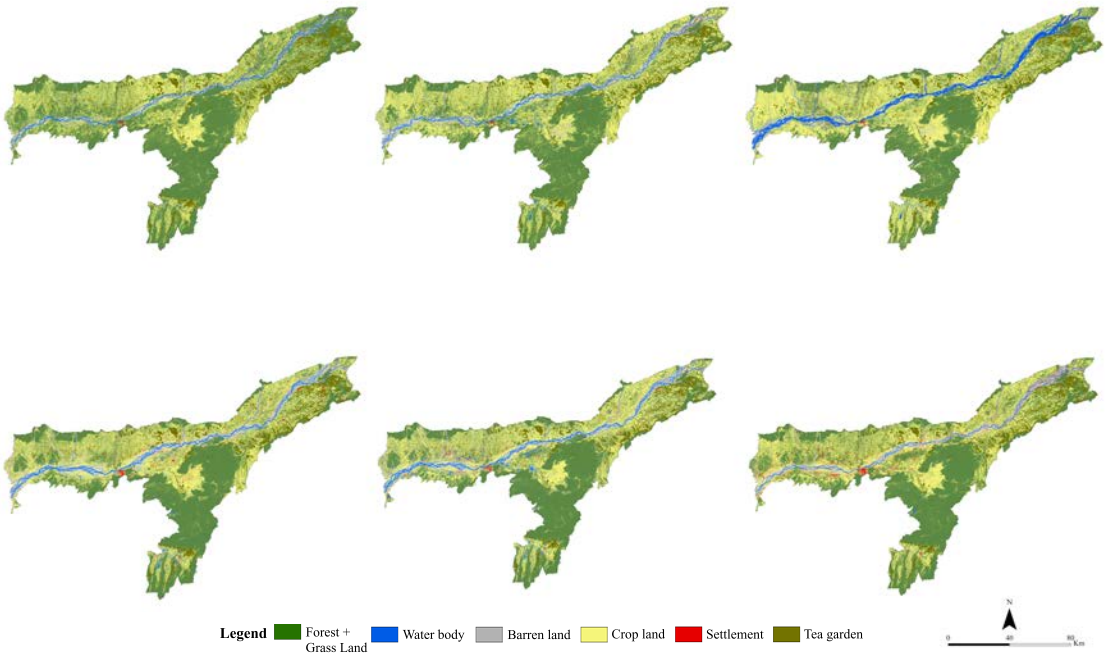
(2000-2023)

Data segregation: Human Deaths/Injuries and Elephant Mortality

Temporal trends : Year wise and Seasonal trends of HEC incidents

Spatial trends : Mapping conflict hotspots, LULC changes, predictors of conflict

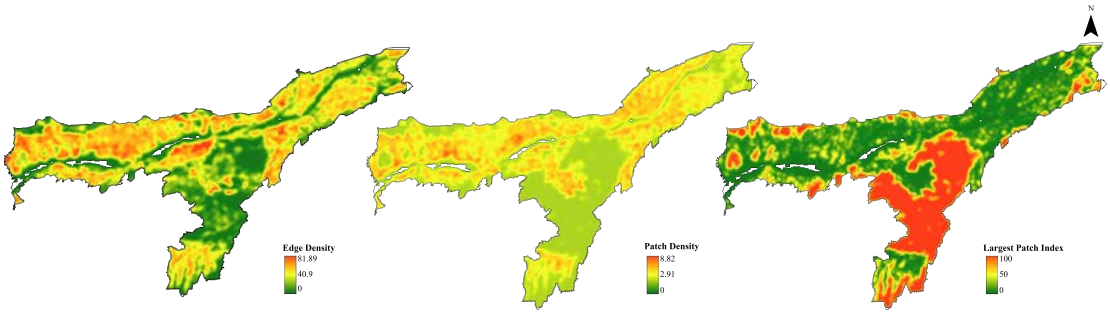
LULC (2000-2024) **12%** change in forest area **5.23%** increase in urban area



Selected Landscape Matrices (Forest Cover)

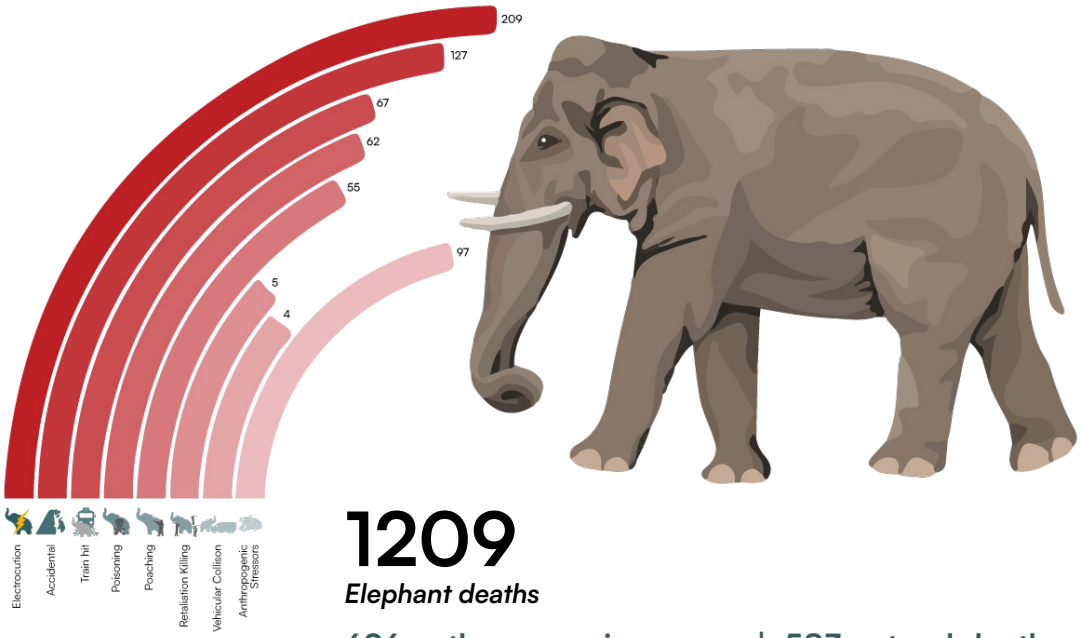
Edge Density
Largest Patch Index
Patch Density

The northern and eastern regions of Assam are highly fragmented, characterized by high edge density and low connectivity, due to urbanization and agricultural expansion. The central region of Assam is partially fragmented but still contains few connected patches. In contrast, southern Assam has better forest connectivity with a large contiguous patch such as jhum cultivation, though it remains at risk of fragmentation due to human activities.



Elephant Mortality

Over the past 23 years, 1,209 elephants have died in Assam, with 626 deaths attributed to various anthropogenic activities and 583 resulting from natural causes.



1209
Elephant deaths

626 anthropogenic causes | 583 natural deaths

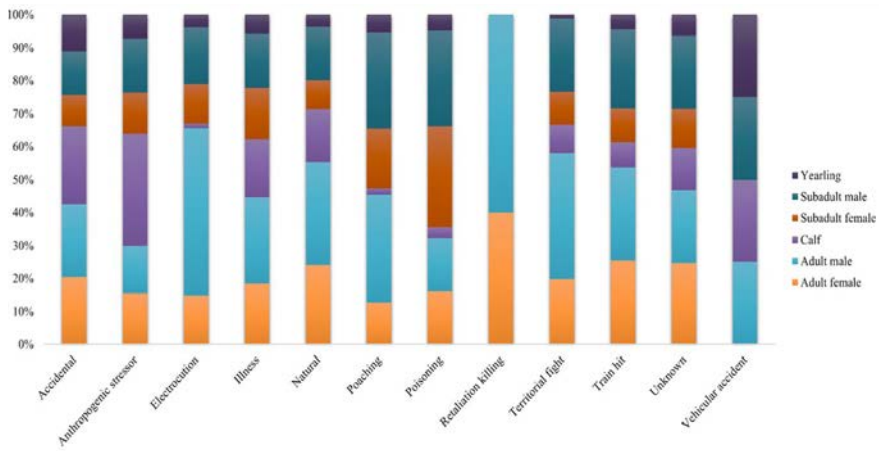
Electrocution emerged as the leading cause of human-induced mortality (209 deaths), followed by accidental deaths (127), various other anthropogenic stressors (97), train collisions (67), poaching (55), poisoning (62) retaliatory killings (5) and vehicle collisions (4) have also contributed to elephant deaths. The districts reporting the highest number of elephant fatalities include Nagaon Territorial, Sonitpur West, Dhanasiri, and Karbi Anglong East.

The post-monsoon period recorded the highest number of fatalities. As forest degradation continues, elephants are increasingly forced into human settlements, where they are more vulnerable to electrocution, train collisions, and other infrastructure-related hazards (trenches, drains, water canals *etc.*).

Age Class Demography

Adult males, the ecological keystones of elephant population, are the most affected by anthropogenic factors, particularly electrocution and retaliatory killings. This can threaten the long-term stability of elephant populations in the area, as males play a crucial role in social structures, gene flow, and maintaining healthy herd dynamics.

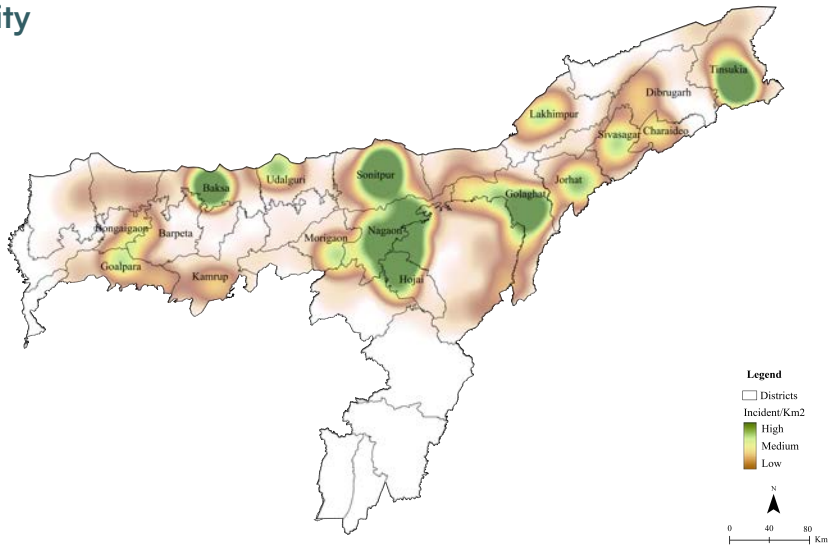
199 Adult males
120 Sub adult males
108 Adult females
85 Sub-adult females
75 Calf
85 Yearlings



Area characterized by proximity to agricultural fields, human settlements, and fragmented forest patches, have reported multiple elephant mortalities due to electrocution, train accidents, and poisoning over the years. The expansion of railway tracks and poorly maintained power lines, illegal use of electricity from distribution lines for fencing has contributed significantly to elephant deaths, highlighting the urgent need for action-based mitigation of HEC.

Spatial Distribution of Elephant Mortality

Nagaon Territorial ***(76)***
Sonitpur West ***(71)***
Dhansiri ***(48)***
Karbi Anglong East ***(47)***
Golaghat ***(46)***
Sivasagar ***(38)***



1806

Incidents

Human Mortality

Between 2000 and 2023, 1,468 people lost their lives, and 337 were injured in encounters with elephants in Assam.

1468 Human Deaths | 337 Human Injuries

Spatial Distribution of Human Casualties

(including fatalities & injuries)

Areas where human-elephant interactions are frequent are near highly fragmented forests, agricultural fields, and encroached elephant corridors. Human expansion into elephant ranges has disrupted their migratory routes, often forcing them to enter human settlements in search of food and water, further escalating conflict.

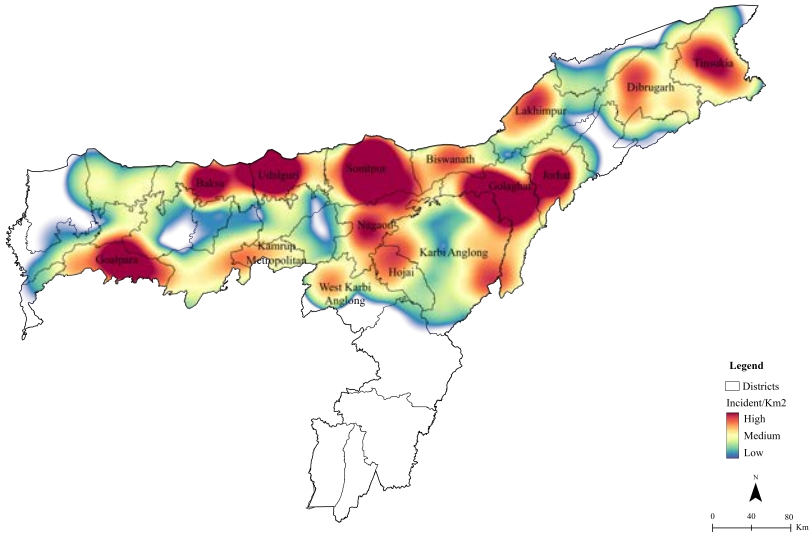
Sonitpur West *(202)*

Udalguri *(202)*

Golaghat *(202)*

Sonitpur East *(177)*

Goalpara *(175)*

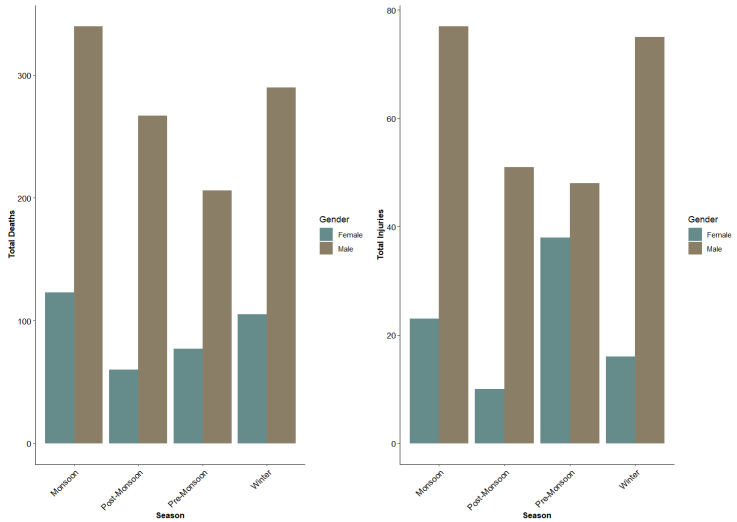


Seasonal variation in gender distribution of human casualties caused by HEC

Seasonal patterns emerge as a significant driver of conflict, with the monsoon season witnessing heightened incidents of human fatalities and injuries. During this period, increased agricultural activities coincide with the seasonal movements of elephants.

Conflict incidents peaked during the monsoon

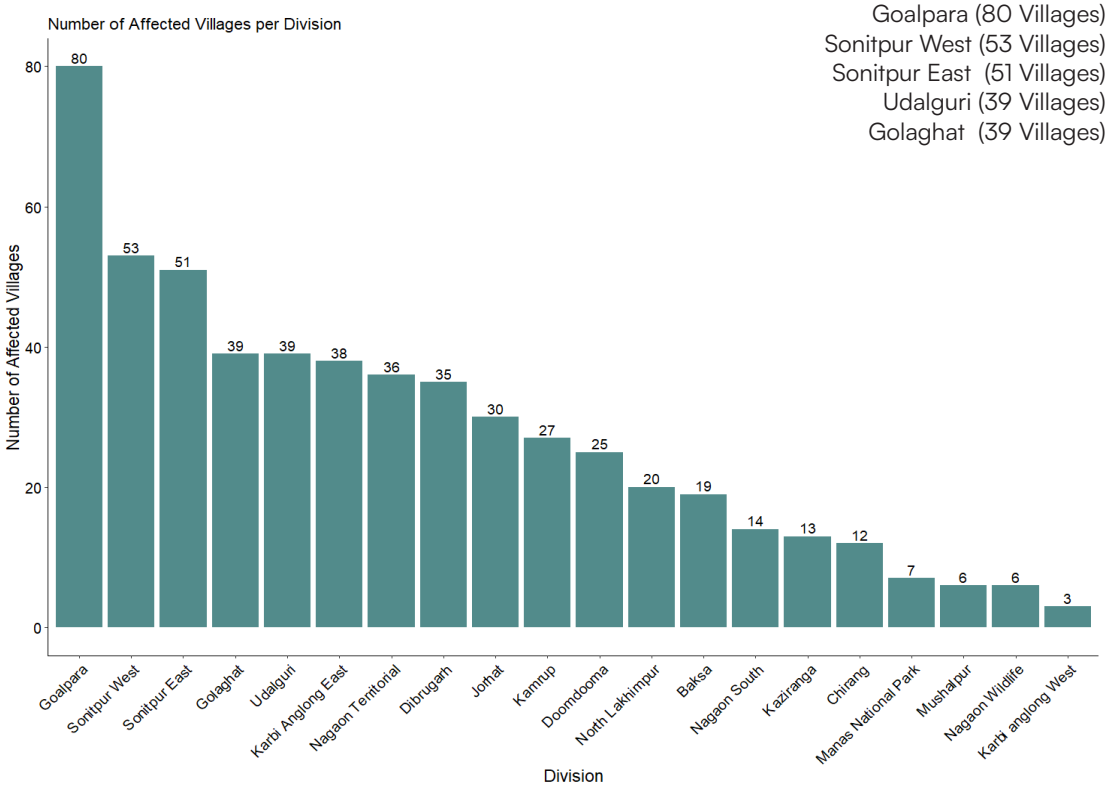
Male victims were significantly more prevalent across all seasons.



Villages affected by HEC, categorized by divisions

527 villages experienced conflicts over last **23** years.

Goalpara (80 Villages)
Sonitpur West (53 Villages)
Sonitpur East (51 Villages)
Udalguri (39 Villages)
Golaghat (39 Villages)



Categorization of incident villages

	ELEPHANT MORTALITY *217 villages*	HUMAN MORTALITY *527 villages*
HIGH > 20	3 VILLAGES	12 VILLAGES
MEDIUM: 11-20	7 VILLAGES	22 VILLAGES
LOW: 1-10	207 VILLAGES	488 VILLAGES

Behroni (27 deaths)
Digboi (26 deaths)
Natum Salona tea estate (25 deaths)

Likhak Gaon (73 incidents)
Jorhat (41 incidents)
Ambari (40 incidents)
Uttar Dimakuchi & Jogigaon (30 incidents)
Gor Mara Gaon (28 incidents)
Golampatty & Nagaon (26 incidents)
Kathalguri (24 incidents)

The increase in conflicts is closely linked to deforestation, growing human settlements, and agricultural expansion. Elephants are drawn to cropland, especially during the harvest season, leading to more frequent encounters with farmers and local communities. The widespread cultivation of paddy, and other high-energy crops has made agricultural fields an easy and attractive food source for elephants. Additionally, the degradation of forest corridors has disrupted elephant movement patterns, compelling them to navigate through human settlements. The rising human population has also intensified pressure on available land, reducing space for elephants and increasing the risk of conflict.

Addressing this conflict requires a multi-faceted approach that balances conservation with the socio-economic realities of affected communities. Strengthening local participation through awareness programs and cooperative conflict resolution training can help reduce retaliatory killings. Enforcing proper maintenance of power lines and constructing dedicated overpasses and underpasses along railway tracks can significantly lower elephant mortality rates. Habitat restoration efforts must focus on securing and restoring degraded elephant corridors while preventing further encroachment into key habitats. The use of AI-powered early warning systems, and real-time GPS tracking can also help mitigate conflict by alerting communities to elephant presence. Encouraging diversified land-use practices, such as buffer zones with unpalatable crops for elephants and agroforestry, can provide alternative livelihood options and reduce direct competition between humans and elephants.

Furthermore, targeted conflict management in high-risk zones such as Sonitpur, Goalpara, Udalguri and Karbi Anglong is crucial. Implementing site-specific interventions, such as rapid response teams and compensation schemes for affected farmers, can alleviate tensions and discourage retaliatory killings. Strengthened legal and policy measures, including stricter regulations on land use in designated elephant corridors and enhanced monitoring mechanisms for power line safety, are necessary to reduce human-induced elephant mortality. Establishing continuous monitoring frameworks will allow authorities and conservationists to assess the effectiveness of mitigation strategies and make necessary adjustments over time.

Human-elephant conflict in Assam is a complex challenge, but strategic conservation efforts, community-driven initiatives, and science-backed policy interventions can help mitigate its impact. Ensuring the long-term coexistence of humans and elephants requires a holistic approach that integrates ecological research with on-the-ground conservation strategies. Future efforts should prioritize habitat restoration, technological innovations, and strong policy enforcement to create a sustainable framework for managing human-elephant conflict in the region. By balancing conservation efforts with human development, Assam can safeguard its elephant population while promoting the well-being of local communities.

CHAPTER 1:
Elephant Mortality in the State of Assam (2000-2023)

1.1. Introduction

Human-elephant conflict is a complex conservation issue that impacts elephant populations in Asia and Africa. As human activity expands into elephant habitats, interactions between people and elephants have become more frequent, often with negative outcomes for both parties (Srinivasaiah *et al.*, 2012; Gunawansa *et al.*, 2023a; Tang *et al.*, 2024). Elephants are forced to approach human settlements closely in pursuit of food and water as a result of habitat loss brought on by deforestation and agricultural growth (Anuradha *et al.*, 2019; Anoop *et al.*, 2023). For example, in Sri Lanka, the relationship between declining forest cover and elephant deaths highlights the serious effects of habitat degradation on elephant populations (Gunawansa *et al.*, 2023b; Köpke *et al.*, 2023). In recent years, human elephant conflict causes a significant number of human and elephant deaths, escalating tensions and impeding conservation effort (Shaffer *et al.*, 2019). It is estimated that incidents involving elephant conflicts in India claim the lives of over 400 humans each year. Through crop depredation, particularly of staple food crops, they harm >500,000 families (Shaffer *et al.*, 2019). Similarly, farmers retaliate by killing 100 elephants to get rid of "problem" animals (Majumder, 2022a). Furthermore, socioeconomic factors influence the frequency and intensity of disputes, including shifts in agricultural techniques and population expansion (Anjum, Balasundaram, & Krishnan, 2023; Tripathy *et al.*, 2021).

In Indian subcontinent, Assam is one of the strongholds of elephant population (Talukdar and Choudhury, 2017). The varied habitats of Assam, which include moist deciduous forests, grasslands and alluvial flood plains that offer vital resources for elephant survival, emphasize the region's significance for elephants. However, rapid decline of elephant habitats in Assam because of deforestation and expansion of agriculture is key of human-elephant conflict. According to government estimates, 3,555 sq km of Assam's forests are encroached by illegal settlers (Medhi & Kar, 2016.; Hazarika, 2017). Mostly, low-income marginal or immigrant communities typically settle near or inside forested areas. Such communities may lack government support and have limited financial resources to absorb wildlife-related losses (Forest Survey of India, 2011). Previous studies anticipated that loss of elephant habitat has been especially severe because of natural forests being converted into tea plantations and other agricultural area In Assam, the frequency of reported conflicts began to rise noticeably after the early 1980s (Chartier *et al.*, 2011a). Over the years, conflicts between humans and elephants have led to casualties on both sides, exacerbated by the expansion of agriculture and rising human population density (Chartier *et al.*, 2011b; Naha *et al.*, 2019; Köpke *et al.*, 2021). Since the 1980s, Assam in Northeast India has seen armed conflict along ethnolinguistic and religious lines because of immigration, forest commoditization, complex land regulations and the establishment of tea estates sparked ethnic violence and armed warfare (Baruah, 1957). The conflict caused extensive damage 50% of western Assam's forests. The majority of deforestation occurred as a result of illicit logging, and widespread fuelwood collection for sale contributed to forest degradation (Sinha, 2012). Currently, Assam has a high population density and widespread agricultural activities, making human-elephant conflicts particularly severe in the state. Elephants often cause financial losses for farmers by destroying property and raiding crops (Chartier *et al.*, 2011b). Previous studies concluded that the primary driver of human-elephant conflict in Assam is habitat loss due to deforestation and agricultural expansion. This has led to elephants venturing into human settlements in search of food and water, particularly during the harvesting season. The primary driver of human-elephant conflict in Assam is habitat loss due to deforestation and agricultural expansion. This has led to elephants venturing into human settlements in search of food and water, particularly during the harvesting season (Chartier *et al.*, 2011b). Previous studies found that conflicts were more intense during certain months, such as July-August and October-January, and are concentrated near forest boundaries. Crop raiding is a major issue, with paddy fields being the most affected (Shameer *et al.*, 2024). In addition, single bull elephants are more frequently involved in conflicts than herds, although herds are responsible for most crop raiding incidents. Elephants spent an average of approximately 5 hours during crop-raiding incidents, with durations ranging from 15 minutes to 15 hours (Naha *et al.*, 2019). In some cases, this even results in locals killing elephants in retaliation (Zimmermann *et al.*, 2009). Despite the increasing incidents of elephant killings, there have been no comprehensive studies examining the factors driving these incidents. While human-elephant

conflict is widely recognized as a major conservation challenge, the specific causes behind elephant killings—whether retaliation, poaching, habitat loss, or other socio-economic factors—remain largely unexplored. Understanding these underlying drivers is crucial for developing effective mitigation strategies and conservation policies. Without empirical research, efforts to address the issue may lack precision, making it difficult to implement targeted interventions that can reduce elephant mortality and promote coexistence.

In this regard, we attempted to explore and address the following questions within the context of Assam:

(a) Temporal and Spatial Dynamics: How have the causes of elephant mortality and their spatial distribution in Assam changed over the past two decades (2000-2023)?

(b) Association with Age and Demography: Is there a significant association between the age and demographic characteristics of deceased elephants and specific causes of mortality, with a particular focus on anthropogenic causes?

(c) What are the landscape and human induced features influence elephant mortality?

We hypothesize that changes in land use and land cover, including the loss of natural vegetation, followed by landscape modification, and the intensification of agricultural practices and urbanization, serve as significant predictors of increasing elephant mortality in Assam. Additionally, we anticipate that the proximity of elephant habitats to protected areas and the rapid expansion of linear infrastructure, such as roads and railways, contribute to the increasing frequency of elephant mortality incident. Other potential drivers may include habitat degradation due to intensive cattle grazing near forest edges and the distance from essential water sources.

1.2. Study Area

Assam is located in northeast India, between latitudes 24° and 28° N and longitudes 89.5° and 96° E. Bhutan and Arunachal Pradesh are its northern neighbours, while Nagaland and Manipur lay to the east. Meghalaya, Tripura, Mizoram, and Bangladesh surround it to the south, while West Bengal is its western neighbour. The area encompasses 78,438 km² and extends from the Brahmaputra Valley in the north to the Barak Valley in the south, including the center districts of Karbi Anglong and Dima Hasao. As of July 2024, the population was ~ 36.16 million. Elevations range from near sea level to hills that rise to 1965 meters (Das *et al.*, 2014) . The importance of Assam as an elephant habitat cannot be overstated. It is a critical region for the conservation of Asian elephants. Assam's terrain, known for its great biodiversity, comprises mix plains, valleys, forests, river systems, hilly terrains and agricultural areas that serve as important habitats for elephants. It has various habitats which include tropical evergreen forests, deciduous forests, bamboo groves, grasslands, and wetlands. The state's forests are classed as tropical wet evergreen, tropical semi-evergreen, tropical moist deciduous, and subtropical broadleaved hill forests (Gogoi and Rao, 2022). Tropical evergreen forests are in the Eastern Himalayan foothills and are distinguished by extensive canopy cover and a diversity of tree species such as Dipterocarpus, Shorea and Mesua. In contrast, deciduous woods shed their leaves periodically and are dominated by species such as Sal (*Shorea robusta*) and Teak (*Tectona grandis*) (Hazarika *et al.*, 2008). It has various protected areas that are critical for wildlife protection, including Manas National Park, Kaziranga National Park, and Pabitora Wildlife Sanctuary. These landscapes are vital habitats for a variety of animals, including the Asian elephant, Bengal tiger, Indian rhinoceros, and many bird species (Hazarika and Saikia, 2013; Palei *et al.*, 2024). Manas and Kaziranga National Parks are UNESCO World Heritage Sites, known for their distinct ecosystems and great biodiversity (Nath *et al.*, 2009). The state has a moist wet climate with heavy rainfall, annual average rainfall ranges between 2000-3000 mm annually, which falls during June-September, especially during the monsoon season, which influences elephant habitat and behavior (Hazarika *et al.*, 2008). These climatic conditions promote lush vegetation that supports huge herbivores such as elephants, but they also cause seasonal floods that interrupt both human and elephant activities (Lahkar *et al.*, 2021a). With a large elephant population and herds that travel periodically between forest areas and agricultural fields. These movements frequently result in human-elephant conflicts, particularly in areas next to protected forests like as Manas National Park and Kaziranga National Park (Palei *et al.*, 2024). This state also has corridor that connects protected places and elephant populations from Nameri National Park and Sonai Rupai Wildlife Sanctuary (Palei *et al.*, 2024).

1.3. Data Analysis

1.3.1. Categorization of Datasets

A comprehensive database of 1,209 elephant mortality cases was compiled, spanning five temporal intervals: 2000-2005, 2006-2010, 2011-2015, 2016-2020, and 2021-2023. Among these, 626 cases were attributed to human-induced causes and 583 were of natural deaths. For each mortality incident, the following parameters were recorded: (1) cause of death,

(2) timing of the incident (year, month, and season: monsoon, post-monsoon, summer, and winter), (3) mortality by forest division, (4) age and demographic characteristics of the deceased elephant. Causes of death were categorized as outlined in Table 1. Accidental deaths included incidents caused by natural calamities such as drowning in river, lightning strikes, and falling from hills. Natural deaths encompassed causes such as heart attacks, old age, and stillbirths, territorial fights, illness. To investigate the relationship between the causes of death and elephant age demographics, chi square test was done using R (version 4.3.1) to assess the statistical significance of the observed associations. Age groups were categorized as calves (0—1 year), juveniles or yearlings (1—5 years), sub-adult males and females (6—15 years), and adult males and females (16+ years) (Arivazhagan and Sukumar, 2008).This approach aimed to identify the age groups most susceptible to threats and provide insights into targeted conservation efforts.

Table 1.1 Flowchart Illustrating the Categorization of Elephant Mortality Factors in Assam

Causes of Elephant Deaths	Indirect/Direct Sources	Categories
Stillbirth, old age, heart attacks, illness, mal-nourishment, heat stroke, dehydration	Natural	Natural
Drowning, lightning strikes, falling from hills	Natural calamities	Natural
Accidental	Accidental as written in Forest Department Data	Accidental
Poisoning	Retaliation killing, HEC	Poisoning
Poaching	Illegal wildlife trade, HEC	Poaching
Stuck in drains, trench, falling into canals and wells	Human-made infrastructure stress	Anthropogenic stressors
Electrocution, Train Hits, Vehicular accidents	Human-made infrastructure stress	Anthropogenic causes

1.3.2. Land Use and Land Cover (LULC) Change Analysis

LULC analysis was conducted for Assam over a 23-year period using satellite data at five-year intervals (2000, 2005, 2010, 2015, 2020, and 2023) to detect changes in land-use patterns and correlate them with human-elephant conflict data. Google Earth Engine (GEE) was employed for image processing and classification, while ArcGIS Pro was used for subsetting the study area, raster dataset collection, fragmentation analysis, distance calculations, and map preparation. Landsat imagery was classified into five LULC categories: (1) forest & grassland, (2) water bodies, (3) barren land, (4) agriculture, (5) human settlement, (6) tea gardens using a Random Forest (RF) classifier from the "smileRandomForest" library (Bhungeni *et al.*, 2024). Six spectral bands (blue, green, red, near-infrared, and two shortwave infrared bands) were selected for classification. The spatial resolution was 30 m, and the study area was projected to UTM Zone 46. Temporal changes in LULC were analyzed over the 24-year period, providing insights into habitat alterations. (Fig.1.1)

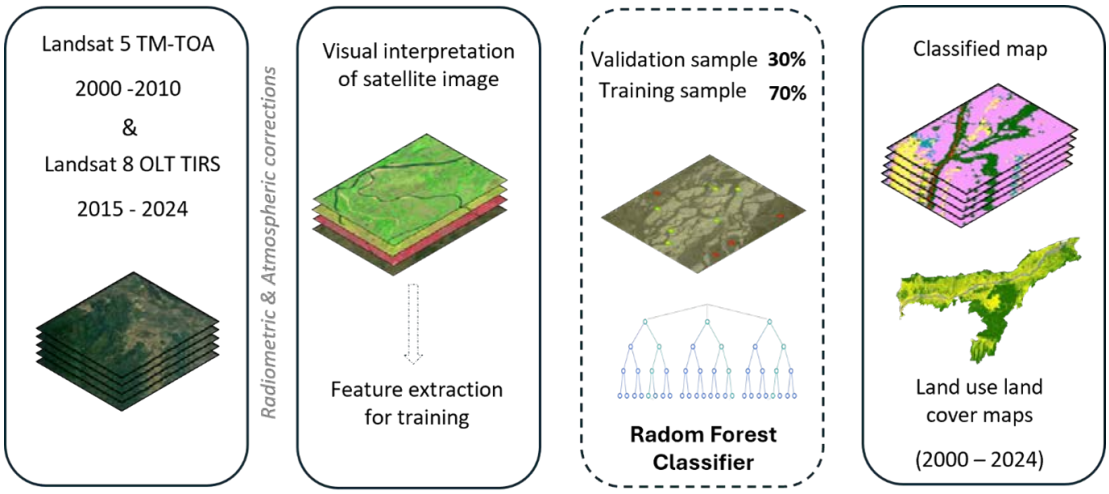


Figure 1.1. Flowchart Depicting Land Use Land Cover (LULC) Change Analysis Methods for Assam (2000—2023)

1.3.3. Spatial Distribution of Elephant Mortality

Elephant mortality incidents were georeferenced using GPS coordinates and systematically mapped to analyse their spatial distribution. A heat map was generated in R (version 4.3.1) to explore the relationship between mortality rates and geographic location. Kernel Density Estimation (KDE) was utilized to identify high mortality zones, highlighting hotspots (Poledník *et al.*, 2023). Administrative divisions and village boundaries served as primary spatial units for analysis.

1.3.4. Landscape Fragmentation Analysis

Landscape fragmentation was assessed using FRAGSTATS (version 4.2) with LULC data reclassified into forest and non-forest categories. Targeted landscape metrics were calculated, including Patch Density (PD), Edge Density (ED), and Largest Patch Index (LPI), to characterize forest structure across five-time intervals. These metrics provided insights into forest fragmentation patterns and their implications for habitat connectivity and ecological processes. These metrics were derived to access their influence on elephant mortality patterns. Additionally, we mapped these metrics to visualise spatial distribution across the study area.

Table 1.2. Landscape Metrics: Definitions and Computational Formulas

Landscape metrics	Description	Formula
Patch density (PD)	Number of patches per unit area.	$PD = \frac{N}{A}$ (10,000) (100)
Edge density (ED)	Reports edge length on a per unit area.	$ED = \frac{\sum_{k=1}^{m} p_{ik}}{A}$ 1000
Largest patch index (LPI)	Quantifies the percentage of total landscape area comprised by the largest patch.	$LPI = \frac{max_{j}^{n} p_{ij}}{A}$ 100
N= Number of patches in the landscape A = Total landscape area(m^2)		

1.3.5. Predictors of Elephant Mortality

To investigate environmental and anthropogenic factors influencing elephant mortality, a generalized linear model (GLM) with a binomial distribution was implemented in R (version 4.3.1). Spatial analysis was integrated with GIS layers representing key variables, including land use, proximity to settlements, roads, water sources, and protected areas. Mortality incidents were coded as 1, while pseudo-absence points (coded as 0) were randomly generated across the study area. Eight explanatory variables were selected for analysis: distance to forest, cropland, built-up areas, roads, water sources, railways, protected areas, elephant reserves, and tea gardens (Table.1.3). Multicollinearity was assessed using Variance Inflation Factors (VIF), and models were ranked using the Akaike Information Criterion (AIC). Cross-validation techniques evaluated model robustness, and the optimal model was selected by averaging candidate models with $\Delta AIC \leq 2$ (Burnham and Anderson, 2002), ensuring a robust understanding of factors influencing mortality trends and spatial hotspots.

Table 1.3. A Priori Hypotheses on Environmental and Anthropogenic Factors Influencing Elephant Mortalities in Assam

Feature	Variable	Description and Source	A-priori hypothesis
Land-cover	Distance from Built-up (db)	Classified landcover types, such as built-up areas, cropland, forests, and waterbodies, were used to calculate distances between conflict points and each landcover type using the Near Table tool in ArcPro 3.0.0.	Higher elephant mortality near settlements due to increased human-elephant interactions.
	Distance from Cropland (dc)		Proximity to cropland increases mortality risk due to electrocution and retaliation.
	Distance from Forest (df)		Mortality risk decreases with distance from forests, which provide essential resources
	Distance from Water bodies (dw)		Proximity to waterbodies lowers mortality risk by reducing movement into human areas.
	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.
	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.
	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.
	Distance from Tea gardens (dtea)	Tea gardens extracted from Roy *et al.* (2016) LULC classification product and distance is calculated by generating near table (using ArcPro 3.0.0)	Mortality risk increases near tea gardens due to disrupted corridors and human encounters.
Anthro-pogenic	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.	Close proximity increases mortality risk from train collisions and habitat fragmentation
	Distance from Road (dr)		Higher mortality risk due to vehicle collisions and habitat disturbance.
	Distance form 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.
	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.

1.3.6. Categorizing villages based on intensity of elephant mortalities

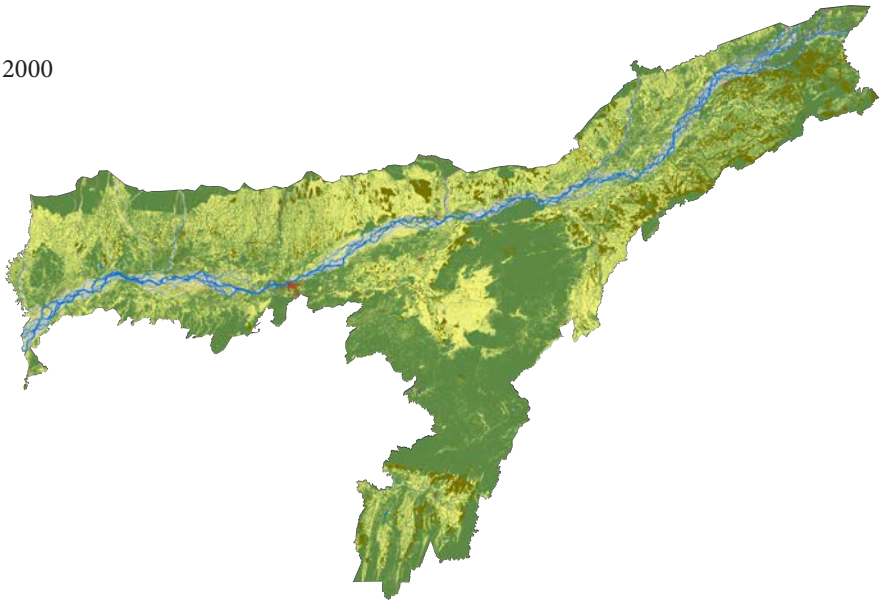
Villages were categorized into high incident (> 20 elephant mortalities), medium incident (11-20 elephant mortalities), low incident (1-10 elephant mortalities) and no incident villages to investigate the relationship between landscape variables (forest cover, crop cover, built-up areas, and mining areas), by Kruskal-Walli's rank sum test. This non-parametric test evaluates whether there are statistically significant differences in the medians of the landscape variables among the defined incident categories. To further explore potential differences between specific incident categories, the Dunn test was applied as a post-hoc analysis. This test is appropriate for pairwise comparisons following a Kruskal-Walli's test, correcting for multiple comparisons to identify specific pairs of incident categories where significant differences may exist. The village boundaries were obtained from the ArcGIS Online, shapefile : Indian Administrative Layer 2024.

1.4. Results

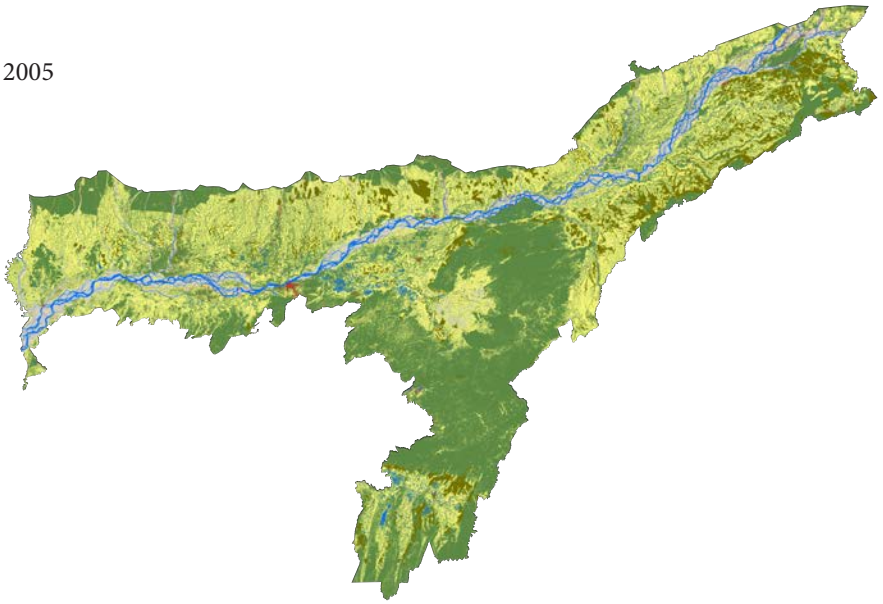
1.4.1. Land use Land Cover

The Land Use Land Cover (LULC) analysis from 2000 to 2024 shows significant changes across landcovers. Forest area has changed by 12.7%, with drops between 2000—2005 (-5.47%) and 2020—2024 (-4.88%). Water bodies and barren land experienced fluctuations over years. Cropland expanded 8.36% (2000—2005) but faced a change (-19.45%) from 2015 to 2020. Built-up areas showed a massive urban expansion in 2024 (+5.23%). The transition matrix highlights that forest is primarily being converted to cropland and built-up areas, while cropland fluctuates between expansion and decline. Barren land shows instability due to natural and anthropogenic factors, and urban areas continue to expand. This aligns with studies on LULC changes in India, showing the distribution and changes in these land cover types over years (Fig 1.2 a-f) (Jubilee, 2024).

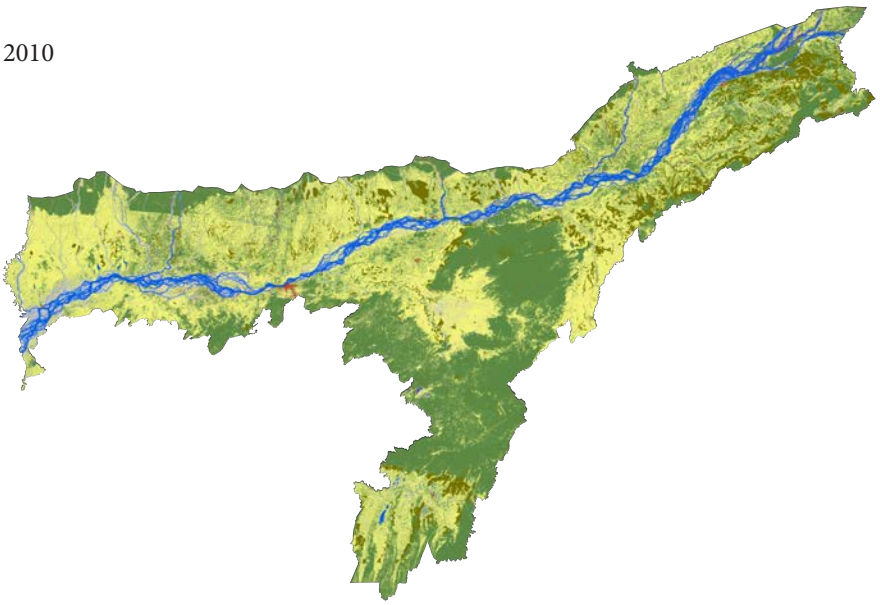
a) Year 2000



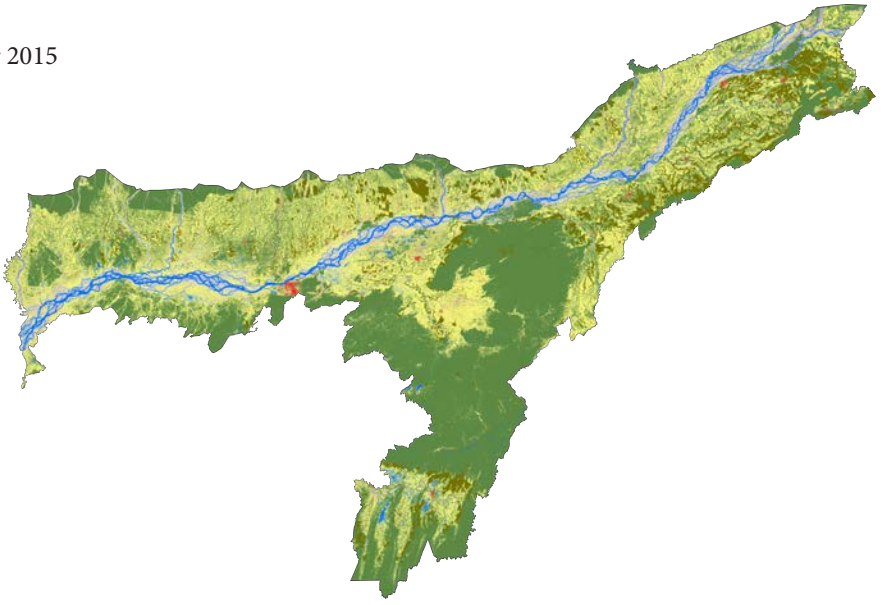
b) Year 2005



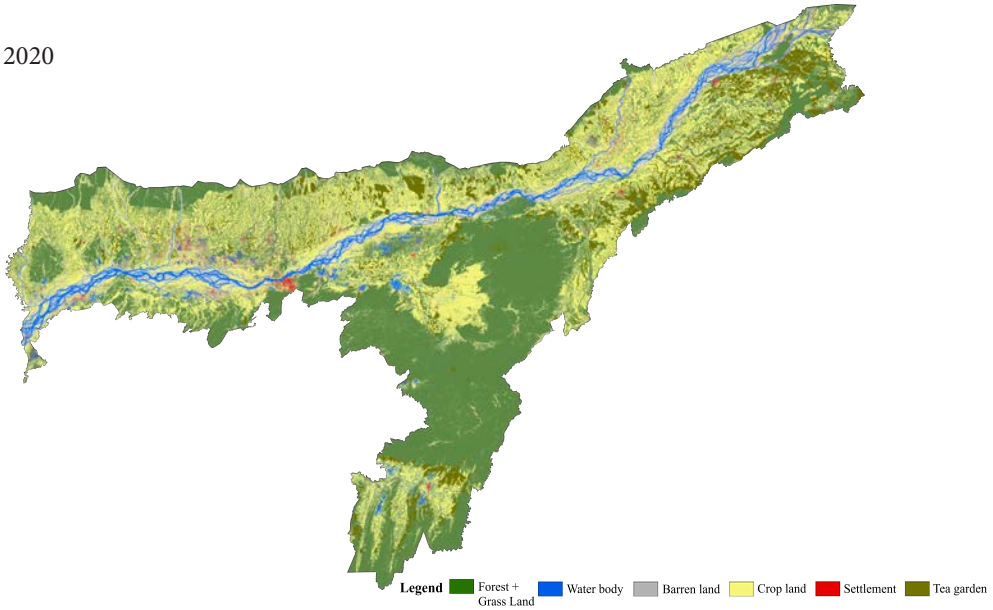
c) Year 2010



d) Year 2015



e) Year 2020



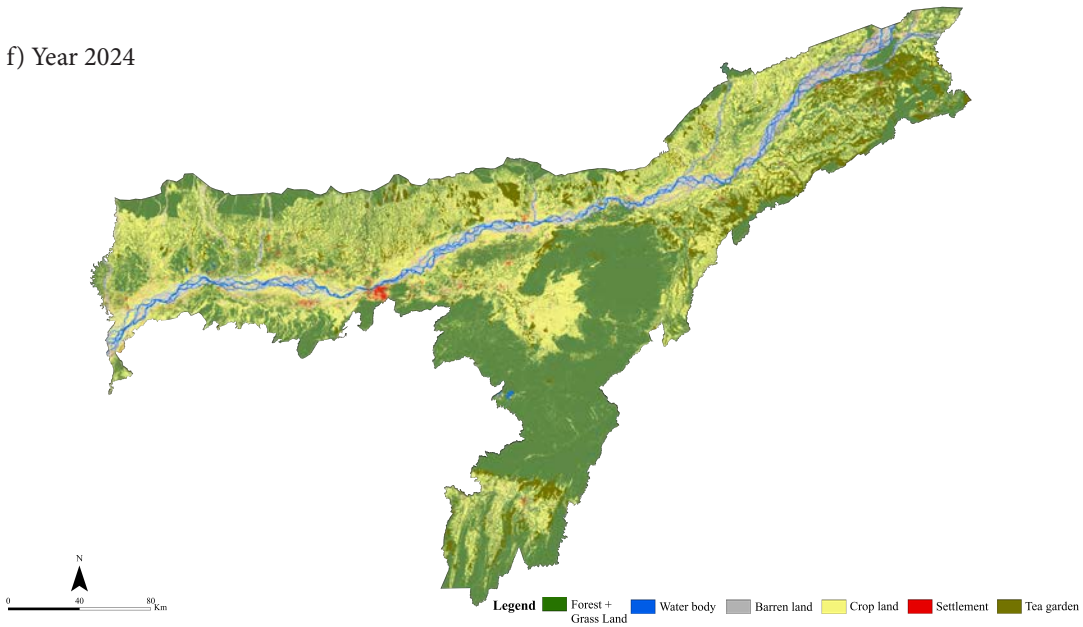
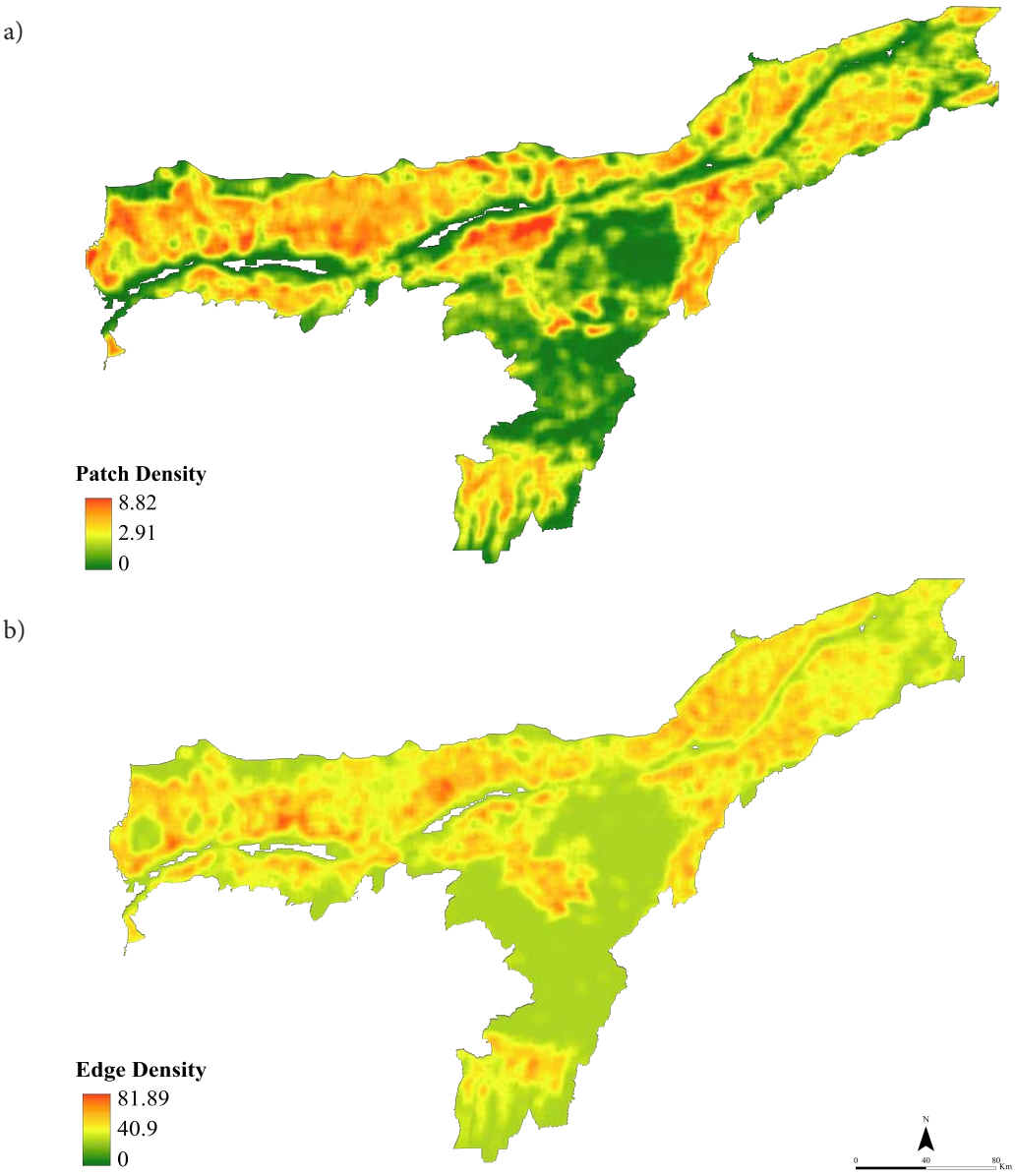


Figure 1.2. Land Use and Land Cover Change Patterns in Assam (2000—2023)(a-f respectively): A comprehensive analysis of spatial and temporal transformations in Assam's landscape, highlighting shifts in forest cover, agricultural expansion, urbanization, and water body dynamics over a 23-year period.



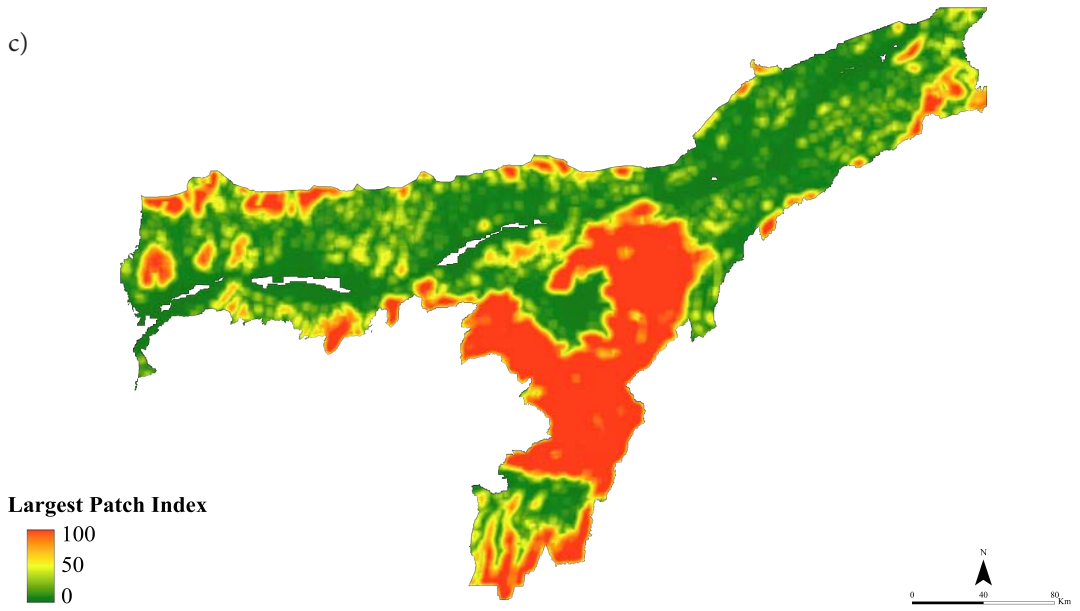


Figure 1.3. (a-c) Spatial Distribution of Patch Density, Edge Density, & Largest Patch Index for forest cover in Assam respectively.

1.4.2. Temporal pattern and Seasonality

Over the past 23 years, a total of 1,209 elephant deaths have been reported in Assam. Among these, 583 were due to natural causes [including natural deaths (344), territorial fights (81)]and unknown factors (158) while 626 were attributed to various anthropogenic causes. The highest numbers of elephant mortality occurred in 2016 (48 deaths; Fig.1.4). Among the anthropogenic causes electrocution (209 ; χ^2 = 74.729, df = 5, p <0.0001) accounted highest number of elephant deaths, followed by accidental (127), Anthropogenic stressors (97), train collision (67), poisoning (62), retaliatory killing (5), vehicular collision (4) (Fig. 1.5).Distribution of death due to various anthropogenic causes across age group differed significantly (χ^2 = 33.502, df = 15, p =0.003), with the highest number of deaths occurring among adult males (199), sub adult males (120), adult females (108), sub-adult females (85), calf (75) and yearlings (39) (Fig.1.4). Distribution of elephant fatalities across seasons revealed post-monsoon season has the highest number of elephant fatalities (209; χ^2 = 60.3, df = 3, p <0.0001), followed by monsoon (190) and winter (144), pre-monsoon (83).

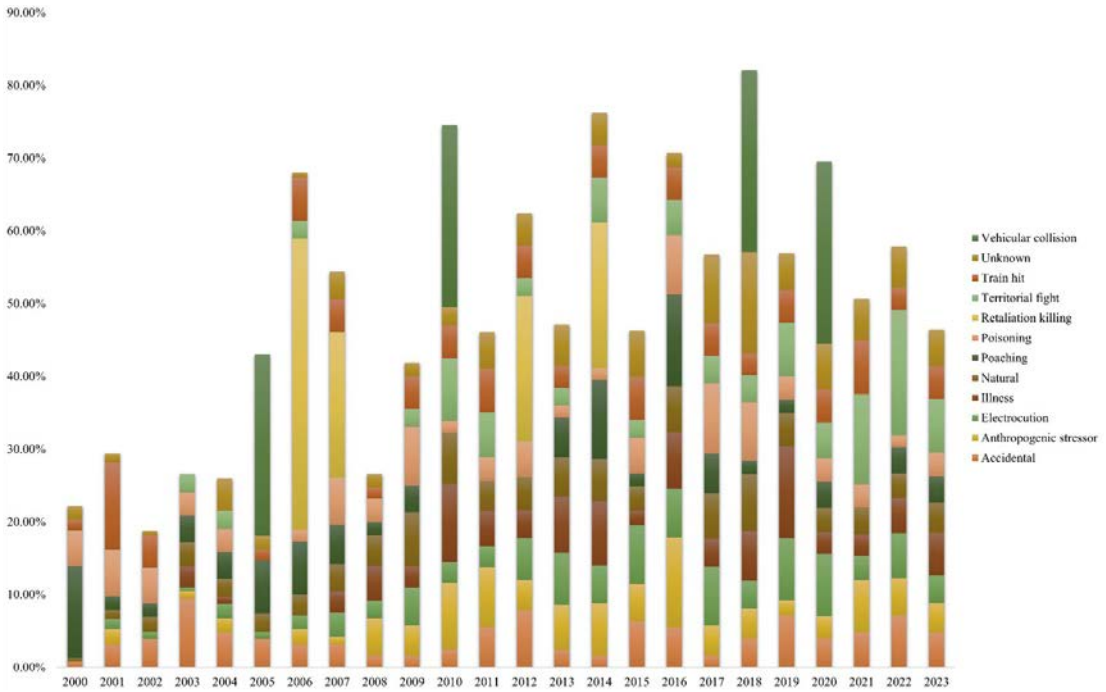


Figure 1.4. Temporal Trends in Elephant Mortality by Age Class and Cause in Assam (2000—2023)

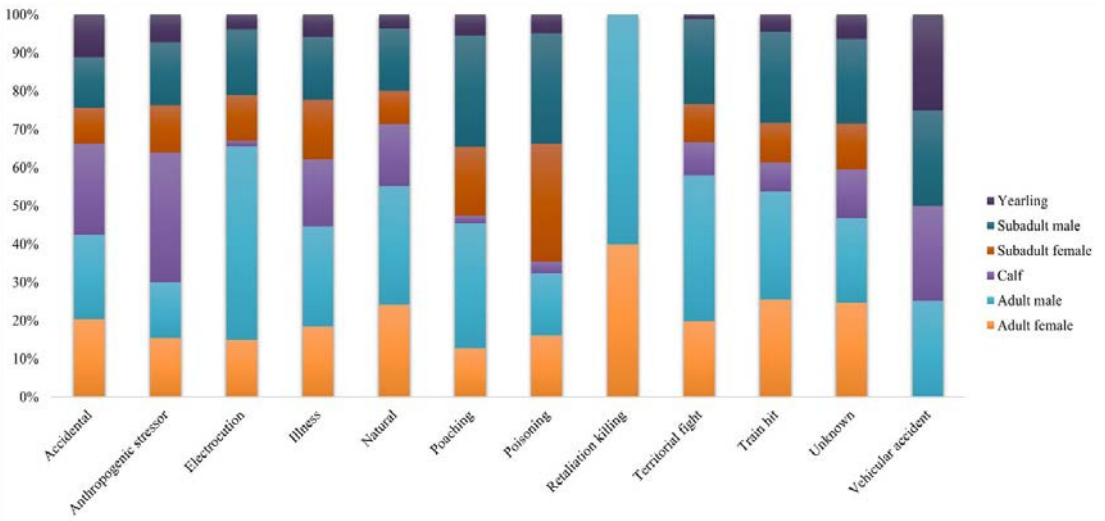


Figure 1.5. Graph showing causes of elephant deaths and their age-class demographics in Assam from 2000 to 2023

1.4.3. Natural causes of elephant mortality in Assam

Out of 1209 elephant mortality in Assam, natural causes were accounted for a total of 583 cases. Within this category, natural deaths had the maximum number of elephant deaths (344) which includes old age, heart-attacks and stillbirths, drowning, struck by lightning, falling from hills, age group distribution showed adult males (102) and adult females (77) had the highest mortality, followed by sub-adult male (56), sub-adult female (37), calves (57), yearling (15). Territorial fight included a total of 81 deaths, with highest recorded in adult males (31), adult female (16), followed by sub-adult males (18), sub adult females (8), calves (7) and yearlings (1). In unknown cases (158) of elephant mortality, adult males (35) and adult females (39), calves (20) and yearlings (10) were impacted (Fig. 1.6).

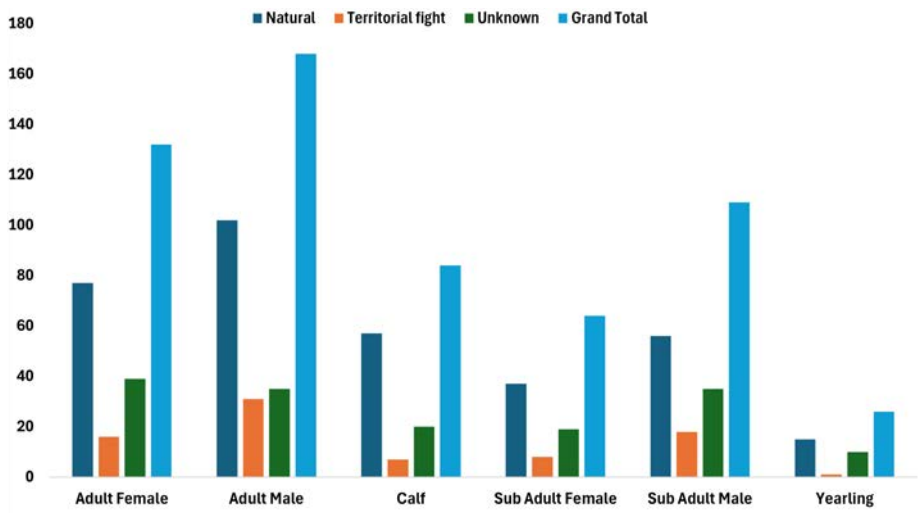


Figure 1.6. Age class- distribution in Natural deaths category for elephant deaths in Assam

1.4.4. Elephant Mortality Across Divisions: Causes and Spatial Distribution

Elephant fatalities documented across various divisions revealed the highest number of fatalities in Nagaon Territorial (76), followed by Sonitpur West (71), Dhanasiri (48), Karbi Anglong East (47), Golaghat (46), and Sivasagar (38). This pattern is also evident in our kernel-density map, which highlights hotspots for elephant fatalities across the state (Fig. 1.7). The leading cause of the fatalities, emerged to be electrocution with the highest number recorded in Nagaon Territorial (36), Sivasagar (29), Dhansiri (20), Golaghat, Nagaon South and Goalpara (14), and Sonitpur West (11). After electrocution accidental elephant deaths were found to be the second largest cause of death highest in Sonitpur West (32), Nagaon territorial (22), Golaghat (15), and Karbi Anglong East (12). The least fatalities divisions are Dhemaji (1), Haltugaon (4) and Chirang (7) (Fig1.8).

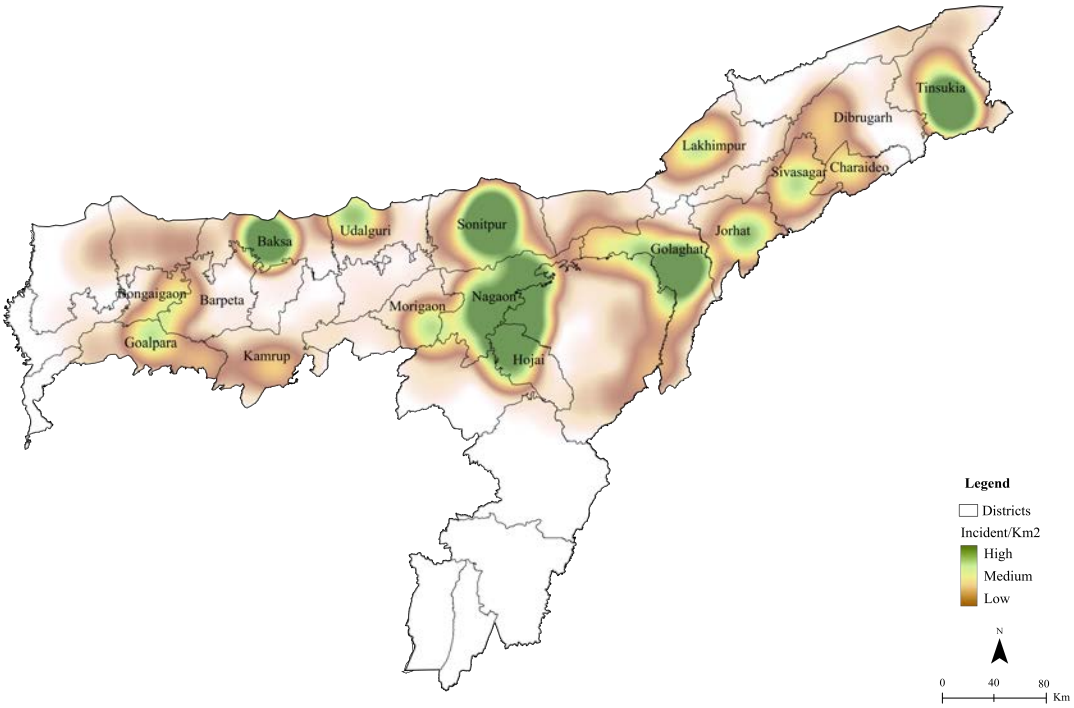


Figure 1.7. Kernel Density map visualizing the intensity and distribution, highlighting areas with higher elephant mortality in Assam (2000—2023).

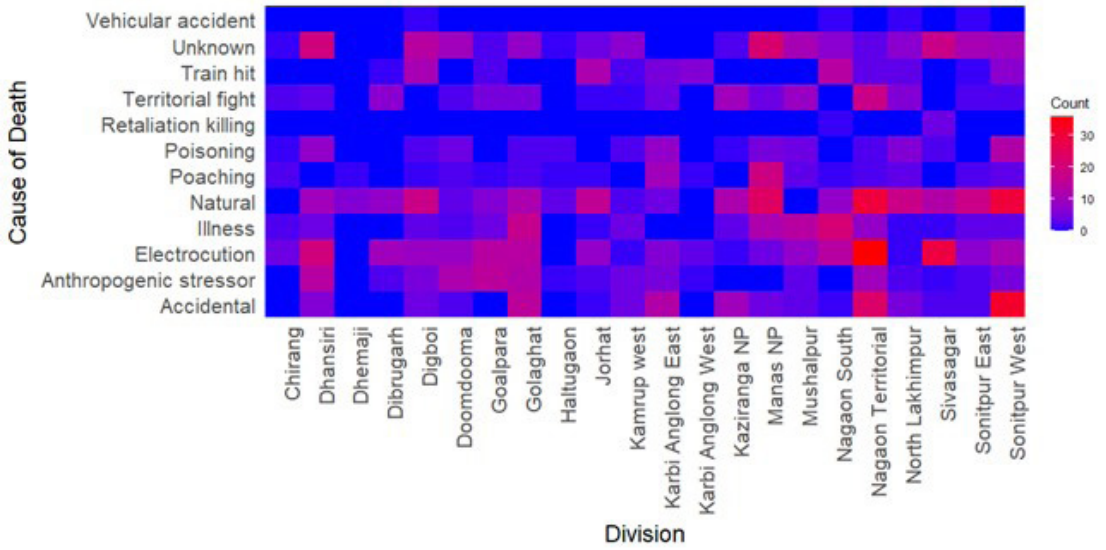


Figure 1.8. Graph Depicting the Relationship Between Causes of Elephant Mortality and Divisions of Assam, with the red-highlighted sections emphasizing the predominant cause of mortality in each respective division.

1.4.5. Elephant Mortality in Villages Across Assam

Elephant mortalities have been recorded in 217 villages (Appendix 1), with highest mortality recorded in 3 villages, medium mortality in 7 villages, low mortality in 204 villages. With highest mortalities recorded in Behroni (27 deaths), Digboi (26 deaths), Natum Salona tea estate (25 deaths), Ambari tea estate (20 deaths), Golampatty (18 deaths), Ambari and Nagaon (16 deaths), Athubhanga (14 deaths), Hojai (12 deaths). Villages experiencing high elephant mortality exhibit distinct ecological and anthropogenic attributes. Built-up density is greater in high-incident villages, whereas non-incident villages exhibit the lowest levels (Kruskal Wallis χ^2 = 137.17, df = 4, p <0.0001, Fig.1.9a), with post-hoc Dunn's test confirming that built-up density is significantly higher in incident villages (p <0.00001). Water sources remain relatively stable across all incident village categories (χ^2 = 1.967, df = 3, p = 0.579; Fig.1.9b). Number of railway lines are higher in villages with elevated elephant fatalities (χ^2 = 26.925, df = 4, p <0.0001 Fig.1.9c).

Dunn's test confirms that villages having higher elephant fatalities have significantly more railway lines compared to non-incident villages ($p < 0.01$). Cropland cover is substantially greater in high-fatality villages (χ^2 =7.876, df = 4, p = 0.09; Fig.1.9d). Post-hoc Dunn's test further confirms that cropland cover is significantly higher in incident villages compared to non-incident ones ($p = 0.031$). Tea garden cover is more prominent in high-incident villages ($\chi^2 = 4.113$, df = 4, p = 0.390; Fig. 1.9e). However, Post hoc Dunn's test does not show significant difference between incident and non-incident villages. Finally, forest cover does not significantly differ between incident and non-incident villages ($\chi^2 = 2.572$, df = 4, p = 0.63; Fig.1.9f).

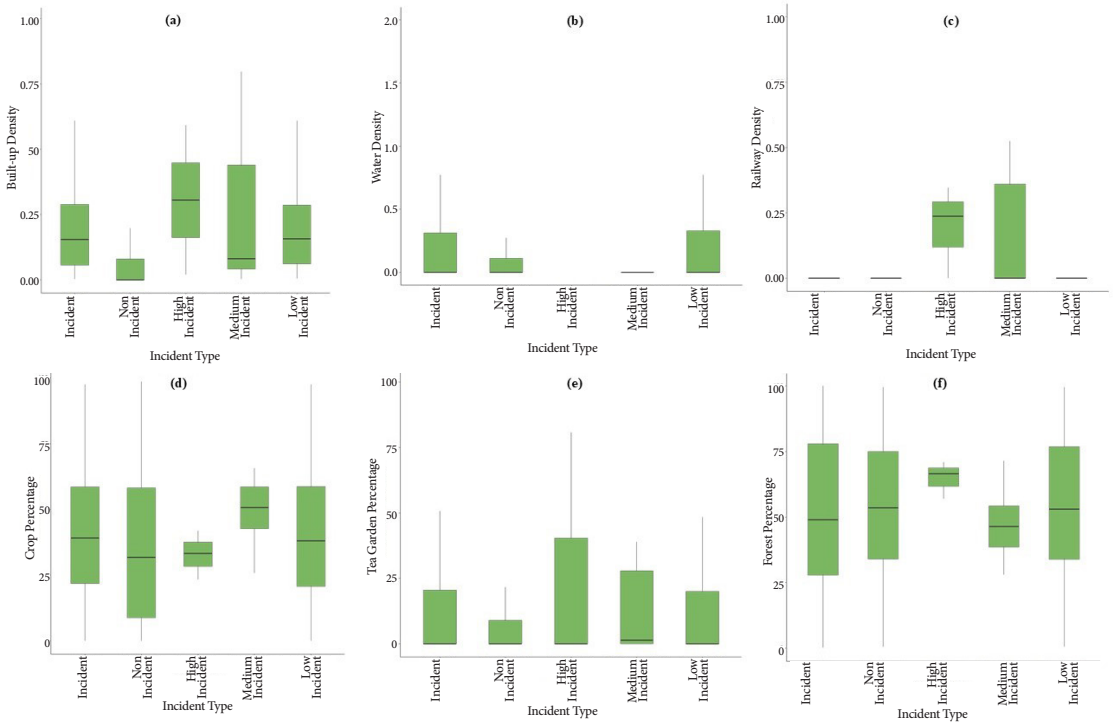


Figure 1.9. Boxplot Illustrating the distribution of elephant fatalities across various incident categories, including incident villages, non-incident villages, high incident villages, medium incident villages, low incident villages, providing insights into the variation in mortality levels across different regions.

1.4.6. Ecological and Anthropogenic Drivers of HEC

The probability of elephant mortality was significantly influenced by both landscape and anthropogenic factors. Elephant deaths were more frequent near water bodies ($p < 0.001$), forests ($p = 0.013$), built-up areas ($p < 0.001$), elephant reserves ($p < 0.001$), roads ($p < 0.001$), protected areas ($p = 0.033$), and railways ($p = 0.045$) (Table.1.4, 1.5; Fig. 1.10).

Table 1.4. Summary statistics loglikelihood (LogL), degrees of freedom (df), Akaike Information Criteria (AICc), relative support for hypothesis (Δ AICc), Akaike weights (Wi) of candidate regression model explaining Elephant deaths in Assam.

Model	*LogL*	*df*	*AICc*	*ΔAICc*	*Wi*
dw + df + db + der + dpa + dr + drail	-752.786	8	1521.689	0	0.46
dw + df + db + der + dpa + dr + pd + drail	-752.657	9	1523.458	1.769776	0.19
dw + df + db + der + dpa + dtea + dr + lpi + pd + drail	-751.227	11	1524.667	2.978453	0.10
dw + df + db + der + dpa + dr + lpi + pd + drail	-752.637	10	1525.452	3.763333	0.07
dw + dr + df + dc + db + dtea + der + dpa	-753.911	9	1525.966	4.277388	0.05
dw + df + dc + db + der + dpa + dtea + dr + lpi + pd + drail	-751.196	12	1526.643	4.954326	0.04
dw + dr + df + dc + db + dtea + der + dpa + lpi + pd + drail	-751.196	12	1526.643	4.954326	0.04
dw + dr + df + dc + db + dtea + der + dpa + lpi	-753.851	10	1527.879	6.189934	0.02
dw + dr + df + dc + db + dtea + der	-756.355	8	1528.825	7.136293	0.01
dw + dr + df + dc + db + dtea + der + dpa + lpi + pd	-753.833	11	1529.878	8.189428	0.01
dr + df + dc + db + dtea + der + drail	-779.933	8	1575.983	54.294	0.00
intercept only (Null model)	-867.82	1	1737.644	215.9552	0.00

Table 1.5. Parameter estimates effect (β), standard errors (S.E), and probabilities of ecological and anthropogenic variables in determining mortality of Asian elephant due to various anthropogenic activity.

Predictor	*Estimate*	*Std. Error*	*z value*	*Pr(>|z|)*	*Significance*
(Intercept)	-0.12	0.07	-1.84	0.07	.
Distance to water (dw)	0.65	0.10	6.32	0.001	***
Distance to forest (df)	-0.20	0.08	-2.49	0.01	*
Distance to built-up (db)	-1.07	0.19	-5.78	0.001	***
Distance to elephant reserve (der)	-0.57	0.07	-7.89	0.001	***
Distance to protected areas (dpa)	0.14	0.07	2.13	0.03	*
Distance to road (dr)	-0.39	0.11	-3.55	0.001	***
Distance to railways (drail)	-0.15	0.08	-2.00	0.05	*

**Indicate statistical significance of result*

1.5. Discussion

The spatial analysis of elephant mortality hotspots, coupled with landscape fragmentation metrics, reveals that areas with high elephant mortality are located near human settlements, croplands, and linear infrastructures such as roads and railways. This is in line with previous studies indicating that human settlements and infrastructure are major drivers of human-elephant conflict (Moeng and Basupi, 2024). The kernel density maps also show a spatial clustering of elephant deaths in regions where agricultural land and forest areas intersect, highlighting the obstruction of movement corridors and the increased frequency of human-elephant interactions in these areas.

The LULC change analysis further demonstrates that deforestation and the expansion of agricultural areas have led to increased habitat fragmentation, which has severe consequences for elephant movement and mortality. As forest cover has changed by 12.7%, with drops between 2000-2005 (-5.47%) and 2020-2024 (-4.88%), elephants are forced to navigate through increasingly fragmented landscapes, heightening their exposure to human settlements and

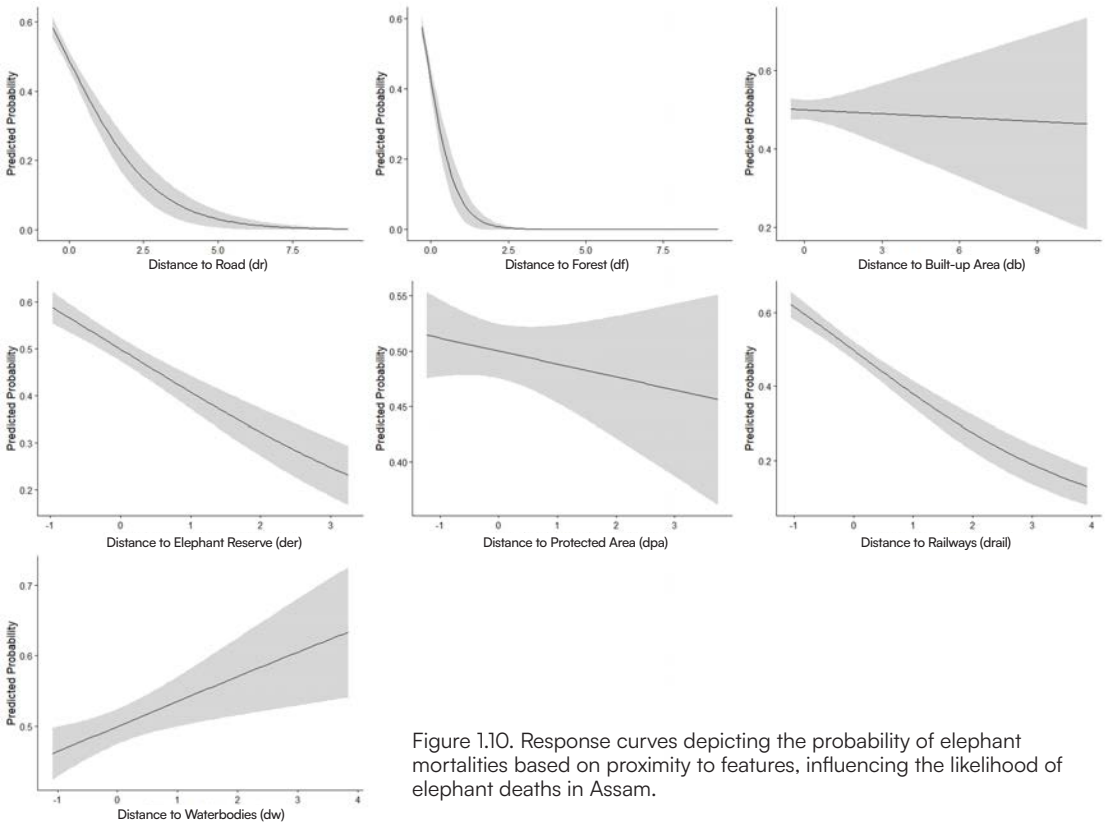


Figure 1.10. Response curves depicting the probability of elephant mortalities based on proximity to features, influencing the likelihood of elephant deaths in Assam.

agricultural land. The expansion of built-up areas, particularly near critical elephant habitats, amplifies the risks of human-elephant conflict, as elephants venture closer to these human-dominated spaces in search of food and water. To test this hypothesis, the proximity analysis was done to find out the role of environmental and anthropogenic variables in elephant mortality in which water sources, croplands, and railways were identified as significant predictors of elephant mortality, highlighting the interaction between elephants and human-modified landscapes. These findings align with studies from other regions, highlighting water sources and agricultural lands as key attractants for elephants, which unintentionally elevate their risk of conflict.

In Assam, electrocution has been identified as the leading cause of anthropogenic elephant mortality. Our findings align with previous studies indicating a significant rise in electrocution-related fatalities since 2016, particularly in regions such as Dhansiri and Chirang (Kalam *et al.*, 2020). Notably, adult males are disproportionately affected, likely due to their larger size and greater mobility within elephant herds. This finding aligns with previous studies highlighting the vulnerability of adult males to anthropogenic stressors, given their large home ranges and the increased likelihood of interaction with human-made infrastructure (Shaffer *et al.*, 2019). Retaliatory killings, which peaked at 40% of all elephant mortalities in 2006, have remained a serious concern. Villages such as Behroni (27 deaths), Digboi (26 deaths), Natum Salona tea estate (25 deaths), which have experienced the highest mortality rates, exhibit significant crop cover, indicating the strong correlation between agriculture and increased conflict. The temporal analysis indicates that poaching and retaliation killings, though declining overall, showed elevated incidents, which coincide with significant incidences of crop damage and heightened human-elephant conflict, suggesting a direct relationship between economic losses and retaliatory actions against elephants. Such patterns are consistent with findings from other regions where elephant depredation of crops leads to retaliatory killings by farmers, further exacerbating conflict (Sengupta *et al.*, 2020; Palita and Purohit, 2008; Venkataraman *et al.*, 2005; Neupane *et al.*, 2018). Adult males, the ecological keystones of elephant populations, are the most affected by anthropogenic mortality factors, particularly electrocution and retaliatory killings. This can threaten the long-term stability of elephant populations in the area, as males play a crucial role in social structures, gene flow, and maintaining healthy herd dynamics (Ladue *et al.*, 2012).

The strong influence of railways on elephant mortality is of particular concern, as railway collisions remain one of the leading causes of elephant fatalities in Assam, especially along the Habaipur-Diphu corridor (Ahmed *et al.*, 2022). Given the high frequency of rail-related fatalities, several measures are being implemented

globally, including underpasses and overpasses for safe crossings (reducing the likelihood of accidents), fencing and funnelling system along railway lines (towards designated crossing points) (Pandey *et al.*, 2024b, 2024a), elevated tracks (for minimising the collision risk) (Dodd *et al.*, 2024) Habitat connectivity and speed regulations in high -wick zones initiatives helping in maintaining natural movement corridor. Studies have demonstrated AI-based smart surveillance with thermal cameras (Kumar *et al.*, 2022)an acoustic and seismic warning systems (Van Den Ende and Ampuero, 2021) are effective in reducing elephant-train collisions DAS (Distributed Acoustic sensing) based Intrusion Detection System (IDS) on sensitive railway stretches, strategic signboards (to alert loco-pilot for wildlife crossing zones) and scheduling good trains during low elephant activity. Regular clearing of vegetation (at least 30m of either side of tracks), for improving visibility for both train operators and elephants. Joint railway- forest teams patrolling tracks, enforce waste disposal restrictions and improve coordination through WhatsApp groups. Future railway projects in elephant landscapes must integrate mitigation plans, including electrification-proofing and vehicle-restricting barriers at crossings (Dodd *et al.*, 2024).

The findings also indicate that high-mortality zones tend to coincide with regions of intense agricultural activity and low forest cover, further supporting the hypothesis that landscape modification due to agricultural expansion significantly contributes to increased human-elephant conflict in Assam. The observed correlation between high crop cover and elephant mortality aligns with previous research, which suggests that economic losses incurred by farmers directly influence conflict severity. Temporal fluctuations in poaching and retaliatory killings, particularly during 2014 and 2016, further indicate that conflict escalation coincides with heightened crop depredation events, reinforcing the need for targeted conflict mitigation measures.

High-mortality zones are predominantly located near human settlements, croplands, and linear infrastructures such as roads, railways. The loss of forest cover, heightening their exposure to human-dominated areas and intensifying conflict risk. These findings are in line with earlier studies emphasizing the role of habitat fragmentation in elevating conservation challenges (Lahkar *et al.*, 2021b; Giliba *et al.*, 2023). Additionally, the significant influence of railways on elephant mortality, particularly along the Habaipur-Diphu corridor, is alarming. Given the high frequency of rail-related fatalities (Ahmed *et al.*, 2022), proactive mitigation measures such as railway fencing, early warning systems, and speed regulations in high-risk zones are imperative. High conflict villages like Bheroni, Digboi, and Natum Salona tea estate exhibit high agriculture activities near forest fringes. These hotspots for high elephant mortalities need immediate attention. To reduce fatalities, it is important to ensure elephant corridors are free from any obstruction in these villages by expanding agriculture land and tea garden that have blocked the migratory paths. Additionally, community awareness programme should be part of continuous exercise to minimize the HEC, particularly areas dominated by tea gardens. To prevent elephant movement in villages with high agricultural activities, introduction of buffer zones with unpalatable crops (such as chili, citrus, and tobacco) around farmlands to deter elephants.

Overall, our study underscores the urgent need for holistic conservation strategies that integrate habitat restoration, conflict mitigation, and infrastructure modification to minimize elephant mortality. Strengthening human-elephant coexistence through community engagement, habitat connectivity restoration, and improved policy interventions is essential to ensuring the long-term survival of elephant populations in the region. Future research should focus on longitudinal monitoring of mortality trends, assessing the efficacy of mitigation measures, and fostering landscape-scale conservation approaches that balance human livelihoods with elephant conservation priorities. Collaborative efforts among Forest departments, training officials in advanced technologies, DAS based IDS can enhance monitoring movement of elephants in the area, regular training programmes for railways and forest department officials on these emerging technologies will improve response efficiency and coordination.

CHAPTER 2:
Human Fatalities in the State of Assam (2000-2023)

2.1. Introduction

Human Elephant Conflict (HEC) is a major emerging concern in the field of conservation and social sciences. HEC distinguished by direct and indirect acquaintances between humans and elephants, which manifest in property devastation, crop raiding, and some human and elephant deaths (Sukumar, 2003). In India, HEC is an immense problem, with thousands of incidents causing enormous economic losses, deaths, and injuries to humans and elephants every year (Majumder, 2022b). Largely due to encroachment of forested habitat, expansion of agriculture, and fragmentation of migratory routes which compel elephants into proximity to human habitations. Moreover, such encounters not only represent a threat to wildlife populations due to retaliatory kills but also place substantial economic and psychological strains on local communities that depend on agricultural and natural resources for their sustenance (Shaffer *et al.*, 2019a; Köpke *et al.*, 2024a). In India, elephants had always held an equal place with other animals in terms of cultural and religious value to the country and they are revered for their representation of wisdom, strength, and good fortune (Krishna, 2010). Even the mention of giant elephants appears in ancient texts and folklore showing the deep respect humans have for these gigantic creatures who are described as incarnations of the god Ganesha, the remover of obstacles and herald of good fortune (Sukumar, 2011). Elephants in the rural areas were christened as protectors of the forests and formed an essential part of numerous rituals and functions (Fernando *et al.*, 2008). This Co-existence was made possible through contiguous and extensive forests that provided ample resources for elephants and minimized their need to enter human settlements (Sukumar, 2006). In the Northeastern part of India, Assam is well known for its rich biodiversity and extensive habitats for elephants. The rich variety of ecosystems that exist in the state, from Brahmaputra Valley to grasslands to tropical forests, makes for an ideal habitat for a substantial population of Asian elephants (*Elephas maximus*). With an estimation of 5828, the elephants of Assam number more than a fair share of India's elephant count. The landscapes so offered have the required diverse ecological niches within which elephants could flourish, a fact that makes India host to more than 60% of the world population of Asian elephants (Baskaran *et al.*, 2011).

The local communities in Assam have had long experiences of living with elephants, a relationship that can be best described as being of venerated fear (Gubbi, 2012a). To vast populations of Assamese communities, the elephants stand for power, fortune, and a symbol of the divine in the cultural and religious life. The population pressure, however, with the improved population of over 36.16 million in Assam, the pressure on land and resources surged; as a consequence, there were great clearances of forests for urbanization, infrastructure, and cultivation (Borah *et al.*, 2005). Ever increasing urbanization, and continuous habitat destruction due to deforestation and encroachment led to increase in human-elephant interactions in Assam. Due to habitat displacement, elephants are compelled to enter human-dominated areas in quest of water and food that frequently leads to fatalities. The expansion of monoculture plantation, particularly tea, which is one of the major crops in Assam, has also encroached into the habitats of elephants (Borah *et al.*, 2018). Most often, these plantations have replaced biodiverse forests that provide various ranges of food resources for elephants. Infrastructure development in terms of railways, roads, and dams has also fragmented habitats by the cutting of elephant corridors and thereby isolating populations (Menon *et al.*, 2017). These form barriers that exclude elephants from using their resources and concentrate them in areas of high human use, thus causing a competition for space (Menon *et al.*, 2017). Expansion of human settlement into surveyed areas has however, brought people and elephants into direct encounters, often forcing elephants to forage in the new settlements (Gubbi, 2012).

The current study aims to analyse the patterns of human mortality due to human-elephant conflict in Assam, identify influencing factors, and prioritize villages for targeted mitigation measures. The specific objectives are as follows:

a) understanding the patterns (both spatial and temporal) of human mortality due to HEC in Assam

b) to investigate the factors influencing human mortality including the impact of land use and land cover (LULC) on human mortality resulting from human-elephant conflict

c) to prioritize villages with varying levels of conflict for implementing targeted mitigation measures.

We hypothesize that human mortality due to human elephant conflict varies significantly across Assam, with higher mortality rates in areas closer to critical elephant habitats and corridors. We also expect that human-mortality due to HEC have significant seasonal variation, with higher rates occurring during certain times of the year. Besides, specific demographic groups, such as age and gender, are expected to be disproportionately affected by HEC across different regions in Assam. We also expect that Human mortality rates increase in proximity to factors predicting human-elephant conflict, such as water sources, crop fields, and forest edges.

This study would enable the prioritization of areas for targeted mitigation measures and contribute to a detailed understanding of HEC impacts and support effective strategies to reduce human mortality and manage conflicts in Assam.

2.2. Study Area

Assam lies in northeast India between latitudes 24° and 28°N and longitudes 89.5° and 96°E. Its northern neighbours are Bhutan and Arunachal Pradesh, while in the east lie Nagaland and Manipur. Meghalaya, Tripura, Mizoram, and Bangladesh surround it to the south, and West Bengal is its western neighbour. It has an area of 78,438 km², covering the Brahmaputra Valley in the north down to the Barak Valley in the south; it also covers the central districts around Karbi Anglong and Dima Hasao. The population is approximately 36.16 million as of July 2024. Elevations range from near sea level to hills rising to 1965 meters. The Brahmaputra River and its tributaries create a fertile plain ideal for agriculture. The annual average rainfall ranges between 2000-3000 mm annually, which falls during the rainy season in June-September. A tropical monsoon climate is the characteristic climatic factor characterized by hot, humid summers and mild winters with heavy rainfall during the wet season. Assam is a state high in biodiversity, and nature reserves and national parks cover big areas; Kaziranga, Manas, and Dibru-Saikhowa National Parks are inhabited by endangered species like the Indian rhinoceros, Bengal tiger, and Asian elephant. Concerning this, previous review conducted shows that Assam's forests contribute significantly to the State's ecological landscape and biodiversity. They include the subtropical, semi-deciduous, and tropical rainforests, which cover a larger area of the State and provide habitat to various species (Menon *et al.*, 2017). Assam's forests are very veritable to its ecological landscape and biodiversity (Choudhury, 2004). These deciduous forests' lower altitudes may host mixed flora and fauna, while the forested plains of the Brahmaputra valley are dynamic ecosystems with many herbivores and carnivores reported by different researchers. The Asian elephant needs to inhabit these kinds of forests because they afford adequate food and space. These same plants and animals that are sustained by deciduous forests are essential for elephant conservation (Sukumar, 1989). Elephants can maintain the health of forests through seed dispersal and, hence, creating flukes for the growth of new plants (Poulsen *et al.*, 2021).

The ethnic mosaic of the state — Bodos, Karbi's, Misings, and others contributes to the vibrant cultural tapestry through festivals such as Bihu and classical dance like Sattriya.Assamese language coexists with languages like Bodo and Karbi, presenting a linguistic diversity (Das,2021). The traditional crafts like Assamese silk handloom weaving, bamboo & cane work have huge contribution to make up the cultural identity and economy of the state. The greatest proportion of the population in Assam lives in rural areas and makes a living from agriculture. Indigenous communities like Bodos, Karbis have traditionally drawn sustenance and parts of their culture from forests (Das, 2021). Loss of forest cover has entailed the displacement of these communities and reduced biodiversity, increasing human-wildlife conflicts, especially with Asian elephant. This environmental degradation increased socio-economic challenges making continuity of traditional lifestyles associated with these communities very difficult (Silva *et al.*, 2023).

Assam has been agriculturally important producer of rice and tea because of the existence of fertile plains of the Brahmaputra and Barak valley, which is particularly suitable for the cultivation of these two crops. Tea gardens more specifically from Jorhat and Dibrugarh is immensely crucial for the state's economy. Continuing deforestation has had adverse effects on agricultural productivity because of the depletion of soil fertility (Bhowmik *et al.*, 2015). The literacy rate of Assam is now about 80.5% as of 2021, denoting gaps still prevail between the urban and rural areas (Government of Assam, 2021).

2.3. Methodology

2.3.1. Collection of HEC Occurrences

Information on Human-Elephant Conflict (HEC) incidents was collected from 21 Divisional Forest Offices in Assam, spanning the years 2000 to 2023. The data encompassed details like the division name, village, incident dates, human fatalities and injuries (with gender specifics). The forest divisions played a role in verifying the data, ensuring its precision.

2.3.2. Land Use and Land Cover, Spatial Distribution of HEC, and Village level of HEC

The dataset included 1,806 instances of human fatalities and injuries caused by wild elephants over

23 years in Assam. It was segmented into 5-year intervals: 2000-2005, 2006-2010, 2011-2015, 2016-2020, and 2021-2023. The incidents were categorized by death and injury, gender, year, season, division, and whether they occurred inside or outside protected areas. To illustrate spatial conflict hotspots, kernel density estimation maps were generated using ArcGIS with a 200-meter output cell size for precise geolocation. 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), and low (1-10). The village boundaries were obtained from the ArcGIS Online, shapefile : Indian Administrative Layer 2024. Land Use Land Cover (LULC) maps for Assam were developed using Landsat 5 TM and Landsat 8 OLI imagery for the years 2000, 2005, 2010, 2015, 2020, and 2024. Landscape fragmentation was analysed with FRAGSTATS (v4.2) to compute key landscape metrics. The input data from LULC maps were reclassified into forest and non-forest categories using the ArcGIS Spatial Analyst tool. Metrics like Patch Density (PD), Edge Density (ED), and Largest Patch Index (LPI) were calculated to effectively capture landscape characteristics and to run GLM analysis. A 7 km moving window analysis, consistent with the average elephant movement patterns (Hassan *et al.*, 2023) ,was used to produce continuous surfaces that represent both localized and broader spatial conflict patterns.

2.3.3. Factors Influencing Human Fatalities & Injuries

To examine the factors influencing HEC incidents, spatial data were used for variables such as distances to forests, croplands, urban areas, roads, waterways, protected areas, elephant reserves, and mines. Fragmentation metrics like Patch Density (PD), Largest Patch Index (LPI), and Edge Density (ED) were extracted to assess landscape structure and fragmentation in conflict zones. These variables were derived from satellite imagery, converted into vector formats, and aligned with conflict points for each corresponding year. Using the "Generate Near Table" tool in GIS, the shortest distances between conflict points and these features were calculated. These distance values, along with fragmentation metrics, served as predictor variables, while human fatalities and injuries were the response variables (Table. 2.1). Generalized Linear Models (GLMs) were used for model selection with the ''MuMIn'' package in R. The models were constructed based on pre-set hypotheses, ensuring the inclusion of variables relevant to HEC. Before building the models, all variables were z-transformed, and multicollinearity was checked. Models were ranked using the Akaike Information Criterion (AIC). Cross-validation techniques evaluated model robustness, and the optimal model was selected by averaging candidate models with $\Delta AIC \leq 2$ (Burnham and Anderson, 2011). Each HEC event involving human fatalities was coded as 1, while pseudo-points (areas without conflict) were randomly assigned a value of 0. Pseudo-points were generated near conflict zones within the study area, ensuring spatial separation while retaining contextual relevance. Specifically, the pseudo-points were created at least 1 km away from actual conflict points to maintain appropriate spatial separation. The global model which included all predictor variables, encountered convergence issues. As a result, the model estimates were unreliable. The second model successfully converged, providing stable parameter estimators. Model selection criteria, including that the refined model performed comparably to the global model while avoiding convergence issues. Thus, the second model was considered more appropriate for interpretation and further analysis.

Table 2.1. A Priori Hypotheses on Environmental and Anthropogenic Factors Influencing Human Mortalities and Injuries in Assam

Feature	Variable	Description & Source	A-Priori Hypothesis
Landcover	Distance from Built-up (db)	Extracted from classified landcover; distance calculated using Near Table tool (ArcPro 3.0.0).	Higher proximity may reduce HEC due to increased human activity and habitat loss.
	Distance from Cropland (dc)	Distance from cropland calculated using Near Table tool (ArcPro 3.0.0).	Closer proximity increases HEC due to crop damage.
	Distance from Forest (df)	Distance from forest calculated using Near Table tool (ArcPro 3.0.0).	Closer proximity may increase HEC as elephants move into human settlements.
	Distance from Waterbodies (dw)	Distance from waterbodies calculated using Near Table tool (ArcPro 3.0.0).	Closer proximity increases HEC, especially in dry seasons.

	Distance from Tea Gardens (dtea)	Extracted from Roy *et al.* (2016) LULC classification; distance calculated using Near Table tool (ArcPro 3.0.0).	Closer proximity may increase HEC due to habitat loss, pesticides, and human activity.
Anthropo-genic	Distance from Roads (dr)	Distance calculated using Near Table tool (ArcPro 3.0.0).	Closer proximity increases HEC due to habitat fragmentation and human activity.
	Distance from Protected Areas (dpa)	Shapefiles from Elephant Cell, WII; distance calculated using Near Table tool (ArcPro 3.0.0).	Conflict may rise near protected area edges due to human presence.
	Distance from Elephant Reserve (der)	Distance calculated using Near Table tool (ArcPro 3.0.0).	Increased elephant movement near reserves may lead to higher HEC.

2.4. Results

2.4.1. Temporal pattern and Seasonality

From 2000 to 2023, a total of 1,806 human-elephant conflict incidents were recorded in Assam, including 1,468 deaths and 337 injuries. The highest number of deaths were recorded in the year 2017 (Fig.2.1). The seasonal distribution of incidents revealed the highest number of cases during the monsoon season. Incidents involving male victims were significantly higher across all seasons (χ^2 = 17.75, df = 3, p = 0.00049) (Fig.2.2). The division-wise analysis revealed that Sonitpur West (110 deaths,92 injuries) recorded the highest number of incidents, followed by Goalpara (175 deaths), Udalguri (168 deaths, 34 injuries), Sonitpur East (156 deaths, 21 injuries), and Golaghat (110 deaths, 92 injuries) (Fig.2.3). Over the years 527 villages were affected by human elephant conflict (Appendix 2), Goalpara reported the maximum number of impacted villages (80), followed by Sonitpur West (53), Sonitpur East (51), and Udalguri (39) (Fig. 2.4). Kernel density estimation further highlights these divisions as hotspots for human-elephant conflict, with a high density of incidents concentrated in and around these areas (Fig. 2.5).

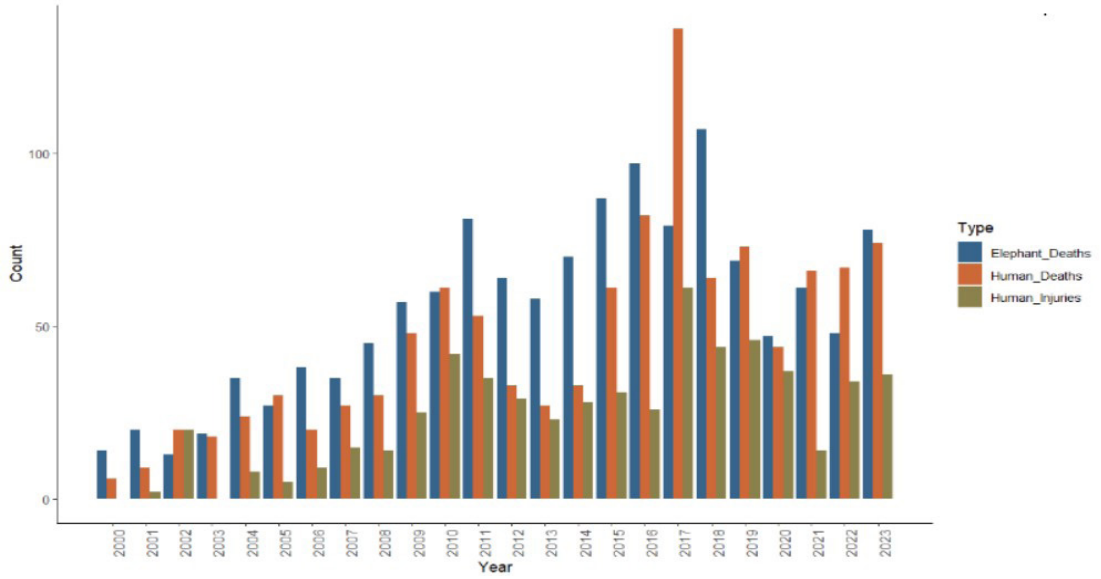


Figure 2.1. Trends in Human Fatalities and Injuries Due to Human-Elephant Conflict in Assam (2000-2023

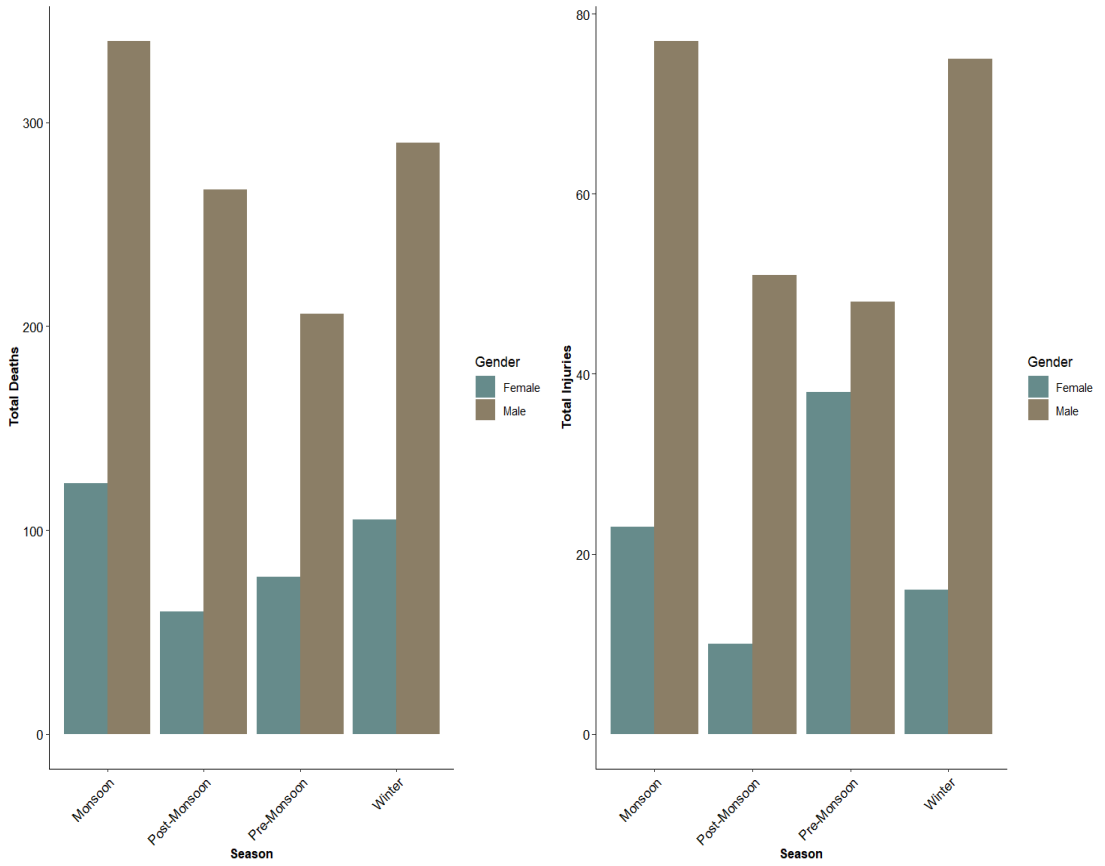


Figure 2.2. Seasonal Variation in Human Deaths and Injuries Due to Human-Elephant Conflict: Gender-Wise Distribution Across All Seasons

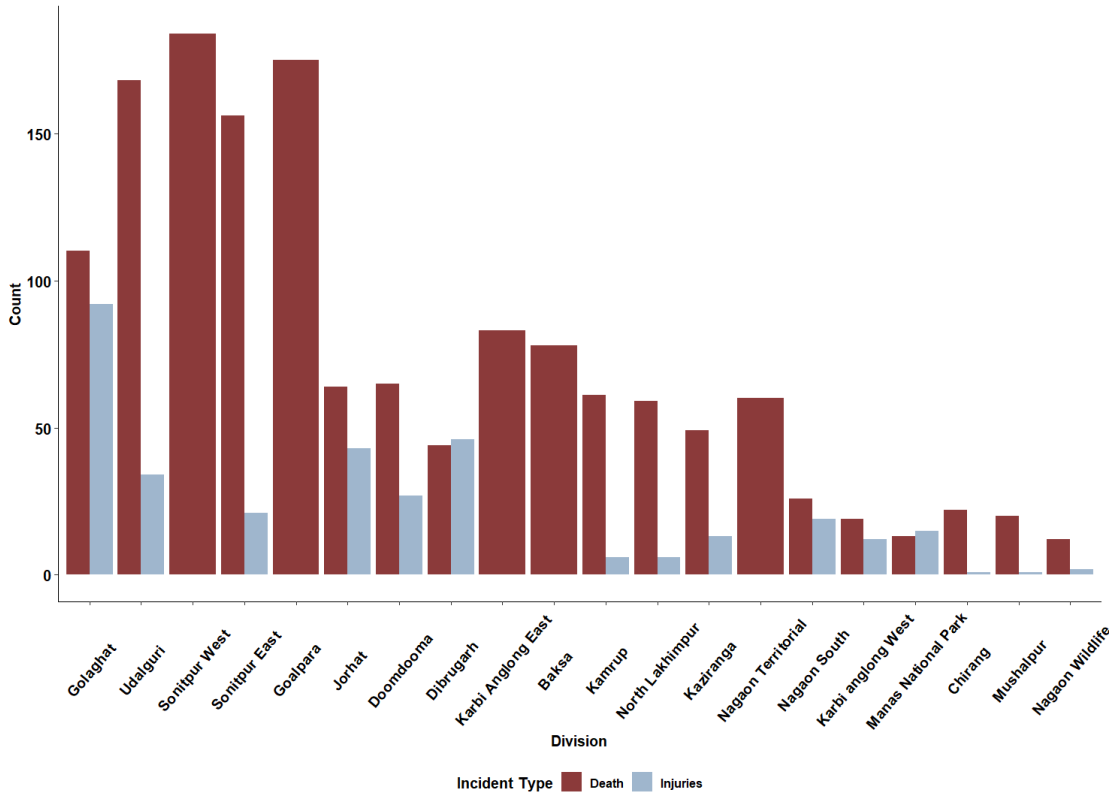


Figure 2.3. Division-Wise Distribution of Human Deaths and Injuries Resulting from Human-Elephant Conflict in Assam (2000-2023)

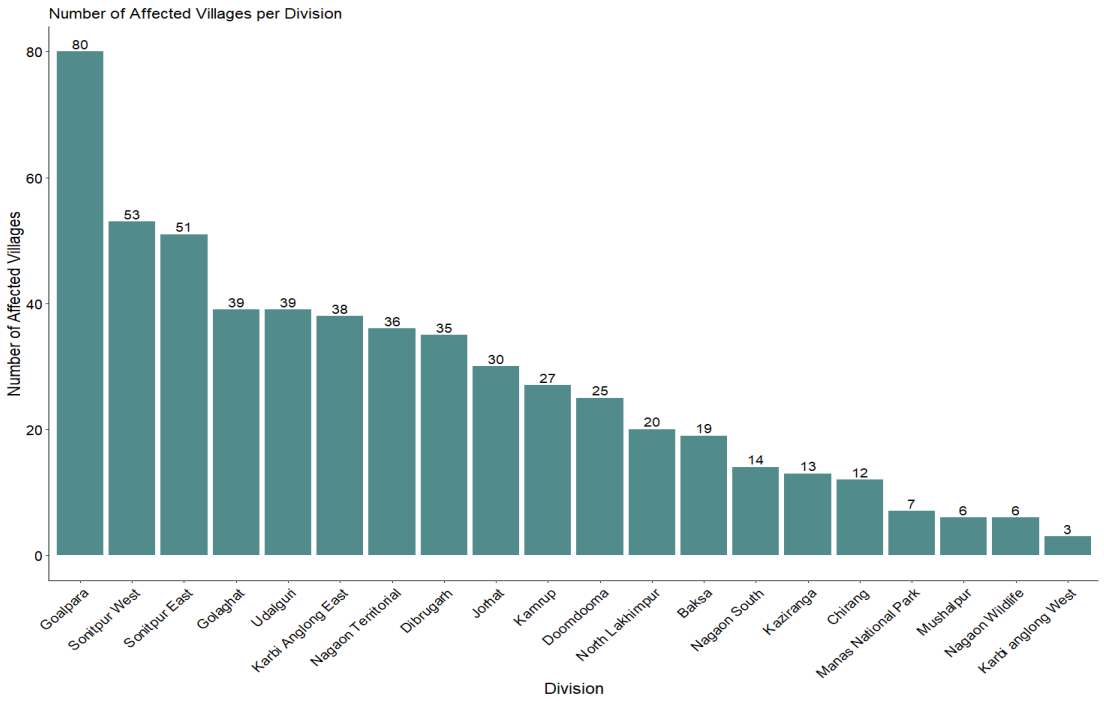


Figure.2.4. Division-Wise Distribution of Villages Affected by Human-Elephant Conflict in Assam (2000-2023)

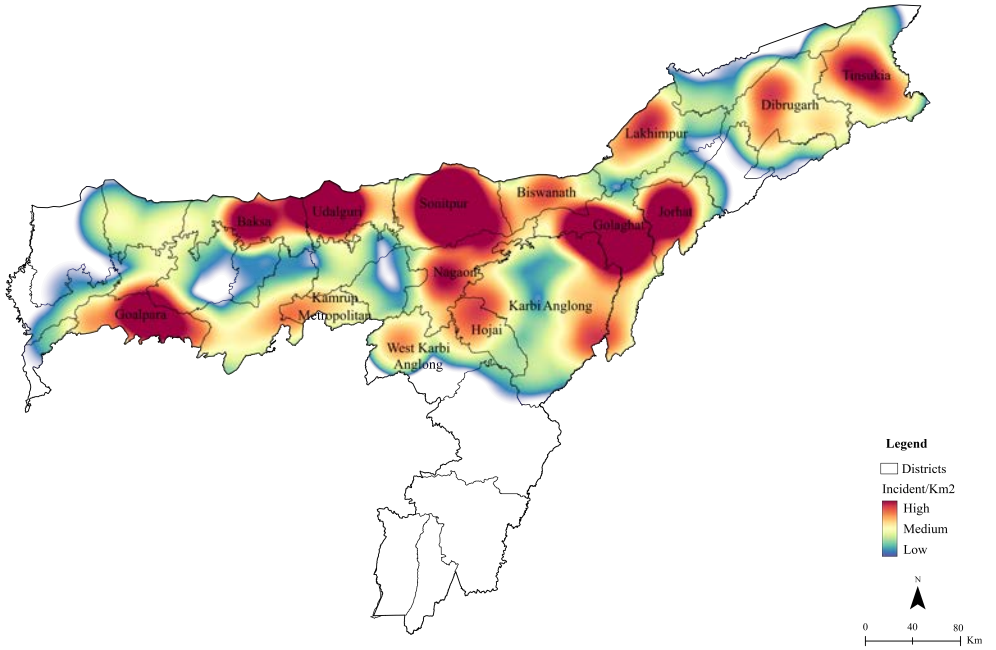


Figure.2.5. Hotspots of Human Deaths and Injuries Due to Human-Elephant Conflict in Assam (2000-2023)

2.4.2. Ecological and Anthropogenic Drivers of HEC

Proximity to natural and human-modified landscapes significantly influences human-elephant conflict probability. Conflict likelihood increased with proximity to water bodies (β = 0.37, p < 0.001). highlighting the role of resource availability in driving elephant movement. Incidents were more frequent near forests (β = -0.05, p = 0.15), crop land (β = -0.06, p = 0.33), built-up (β = -0.189, p = 0.05), elephant reserve (β = -0.15, p < 0.001) and tea garden (β = -0.08, p = 0.04), indicating strong spatial overlap between elephants and humans in these areas. Additionally, a decline in conflict was observed with increasing edge density (β = 0.17, p < 0.001) (Table. 2.2 & 2.3; Fig. 2.7).

Table 2.2. Summary statistics loglikelihood (LogL), degrees of freedom (df), Akaike Information Criteria (AICc), relative support for hypothesis (Δ AICc), Akaike weights (Wi) of candidate regression model explaining HEC in Assam

Model	LogL	df	AICc	ΔAICc	Wi
dw + dr + df + dc + db + der + dpa + dtea + lpi + pd + ed (global)	-2143.6	12	4311.26	0	0.5
dw + dr + df + dc + db + der + dtea + lpi + pd + ed	-2145.2	11	4312.56	1.304	0.26
dw + dr + dc + db + der + dtea + lpi + pd + ed	-2146.3	10	4312.68	1.422	0.24
dw + dr + df + db + dtea + lpi + pd + ed	-2154	9	4326.05	14.79	0
dw + dr + db + dtea + lpi + pd + ed	-2155.6	8	4327.2	15.946	0
dw + dr + df + dc + db + dtea + lpi + pd + ed	-2153.6	10	4327.32	16.064	0
dw + dr + dc + db + dtea + lpi + pd + ed	-2154.7	9	4327.4	16.137	0
dw + dr + lpi + pd + ed	-2163	6	4338.02	26.758	0
dw + dr + df + dpa + lpi + pd	-2163.1	7	4340.15	28.888	0
dw + df + dr + dtea + lpi	-2182.1	6	4376.32	65.061	0
dw + dr + der + pd	-2204.2	5	4418.47	107.207	0
dw + dr	-2217.7	3	4441.37	130.111	0
dtea + der + dr	-2219.8	4	4447.62	136.364	0
dtea + der + dc + db + ed + dw	-2237.6	7	4489.18	177.918	0
dr	-2249.7	2	4503.36	192.102	0
null	-2397.9	1	4797.8	486.541	0

Table 2.3. Parameter estimates effect (β), standard errors (S.E), and probabilities of ecological and anthropogenic variables in determining the human elephant conflict in Assam.

Estimate	Std. Error	z value	Pr(>|z|)	Significance
(Intercept)	-0.001	-0.038	0.97	
Distance to waterbodies (dw)	0.379	7.404	0.001	***
Distance to road (dr)	-0.654	-8.274	0.001	***
Distance to forest (df)	-0.059	-1.452	0.15	
Distance to croplands (dc)	-0.069	-0.970	0.33	
Distance to built-up (db)	-0.189	-1.931	0.05	
Distance to elephant reserve (der)	-0.159	-4.089	0.001	***
Distance to tea garden (dtea)	-0.086	-2.048	0.04	*
Largest patch index (lpi)	-0.531	-7.883	0.001	***
Patch density (pd)	-0.385	-6.509	0.001	***
Edge density (ed)	0.171	3.494	0.001	***

**Indicate statistical significance of result*

2.4.3. Human Fatalities and Injuries Due to Human-Elephant Conflict at the Village Level

Our village-level analysis reveals distinct patterns across various factors associated with human-elephant conflict in Assam. Forest percentage is relatively consistent across all categories, high-conflict villages tend to have smaller and more fragmented patches. Built-up areas are almost negligible in high-conflict villages, whereas medium-conflict villages show the highest built-up percentages, followed by low-conflict and non-conflict areas. Road density is lowest in high-conflict villages, with non-conflict areas having the highest density, indicating better infrastructure in

regions with fewer conflicts. Tea garden percentage in medium-conflict villages having the highest concentration, while high-conflict villages have relatively lower tea garden percentages. Crop percentage is stable across categories, though medium- and high-conflict villages exhibit slightly lower percentage. Water density is highest in non-conflict villages, while high-conflict villages show the lowest density (Fig.2.8a- 2.8f). Post hoc test was done for each variable where water, tea gardens, road, built-up came as significant variables (Table 2.4).

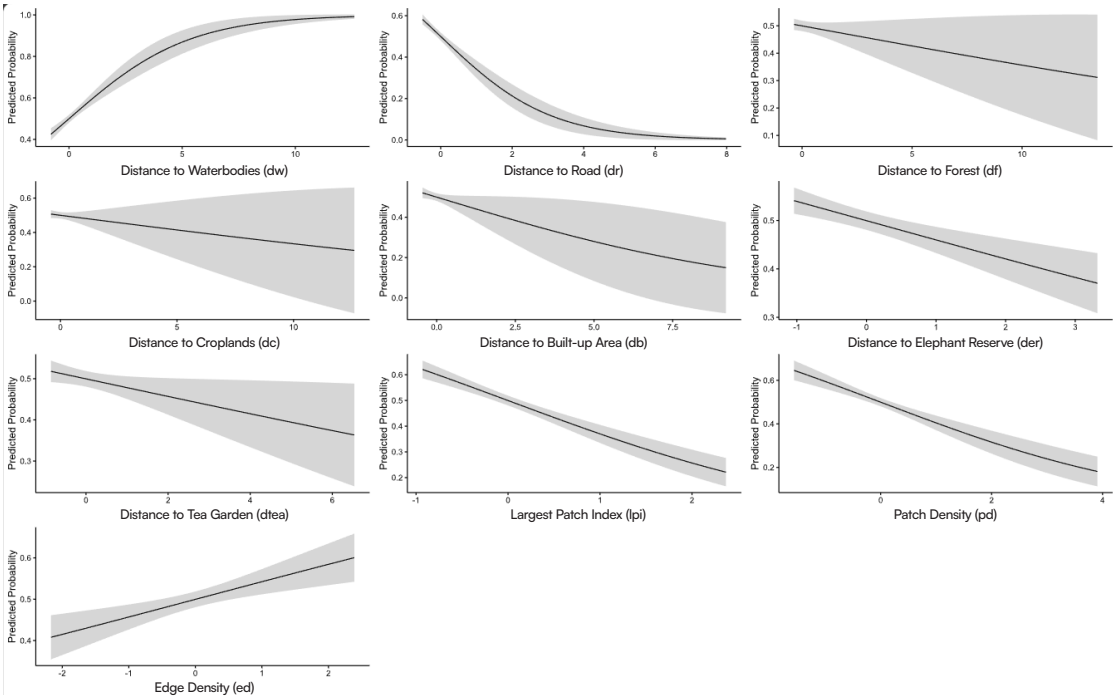


Figure 2.7. Predicted Probability of Human Fatalities & Injuries due to Human-Elephant Conflict in Assam Based on Environmental and Landscape Variables.

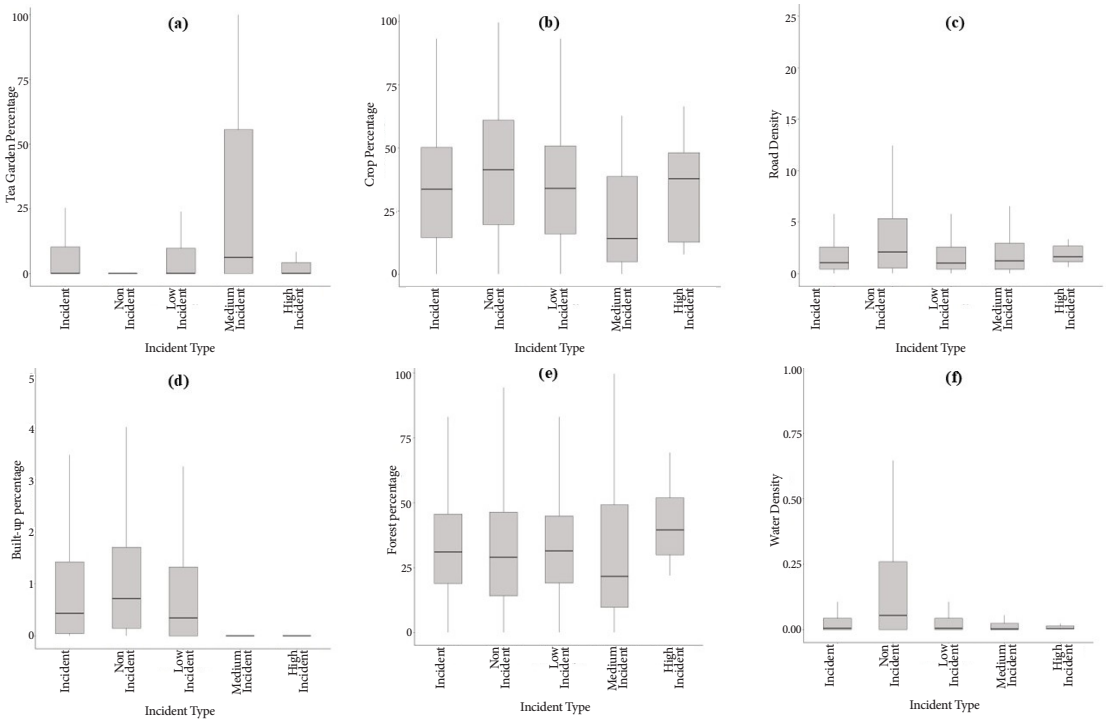


Figure 2.8. Spatial Proximities of Human-Elephant Conflict Sites to Key Landscape Features

Table 2.4. Kruskal-Wallis's test results for different land-use variables in relation to incident type. Dunn's post-hoc test: performed for significant results, and adjusted p-values.

Variable	Kruskal-Wallis(χ^2)	df	p-value	Significance	Significant Post-hoc Comparisons	p-adj	p-adj. significance
Forest	4.8554	3	0.18	not significant	-	-	-
Water	64.801	3	0.00	***	Incident vs Low Incident (p=2.60e-14)	0.00	****
Road	17.89	3	0.00	***	Incident vs Low Incident (p=0.001)	0.00	***
Builtup	6.7863	3	0.08	not significant	-	-	-
Crop	11.21	3	0.01	*	Incident vs Medium Incident (p=0.005)	0.03	*
TeaGarden	18.674	3	0.00	***	Incident vs Low Incident (p=0.02)	0.03	*

**Indicate statistical significance of result*

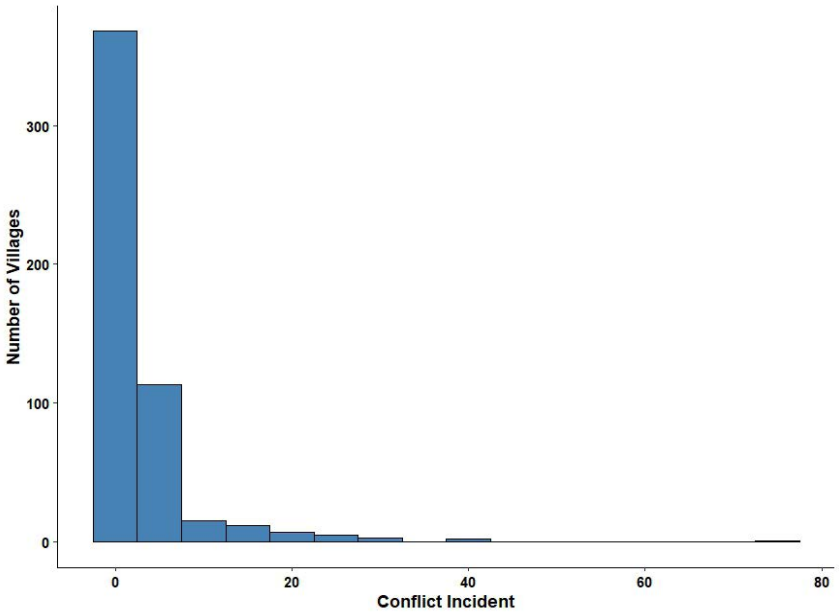


Figure 2.9. Distribution of Human-Elephant Conflict Incidents Across Villages in Assam

2.5. Discussion

This study provides a comprehensive analysis of the factors driving human-elephant conflict (HEC) in Assam, highlighting the temporal and spatial patterns of conflict and their correlation with various ecological and anthropogenic variables. Seasonal patterns emerge as a significant driver of conflict, with the monsoon season witnessing heightened incidents of human fatalities and injuries. During this period, increased agricultural activities coincide with the seasonal movements of elephants, who are drawn to cultivated areas in search of food. This seasonal trend aligns with global patterns observed in other regions, such as Africa, where elephants are similarly attracted to agricultural land during the rainy season, leading to escalated conflict with local communities (Blake *et al.*, 2008). These findings highlight the need for targeted conflict mitigation strategies, including seasonal monitoring and community engagement during periods of high conflict. Landscape fragmentation is identified as a critical factor influencing the frequency and intensity of conflict in Assam. Proximity to fragmented forest patches, characterized by high edge density and patch density, contributes to the creation of conflict hotspots. Fragmented habitats often disrupt elephant movement and force elephants to

venture into agricultural and urban areas in search of food and water. Districts such as Sonitpur East and Goalpara, which feature a mosaic of protected areas, agricultural fields, and fragmented forests, were identified as major conflict zones. These results align with previous studies that have emphasized the role of habitat fragmentation in exacerbating HEC (Sukumar, 2006; Talukdar *et al.*, 2024). At the village level, the analysis reveals that high-incident villages exhibit narrower forest cover ranges, suggesting that habitat degradation and reduced forest connectivity are key contributors to conflict. Conversely, non-incident villages tend to have more contiguous forest cover, providing refuge for elephants and reducing the likelihood of encounters with humans. Urbanization (built-up areas) emerge as significant anthropogenic drivers of conflict.

Villages with higher percentages of built-up areas are associated with medium- and high-conflict levels, whereas non-incident villages, characterized by minimal urbanization, benefit from reduced human-elephant interactions. The expansion of built-up areas near elephant habitats often overlaps with traditional elephant corridors, intensifying conflict potential. Transport infrastructure such as roads and railways further influence conflict dynamics. While roads in non-incident areas act as barriers to elephant movement, their lower densities in high-conflict zones reflect less developed, remote areas where elephants have greater access to their former habitats. The role of tea gardens, a dominant land-use type in Assam, is particularly noteworthy. Acting as transitional zones between forests and human settlements, tea gardens provide forage for elephants but simultaneously increase the likelihood of human-elephant encounters.

Villages with significant tea garden coverage, particularly medium-incident villages, exhibit heightened conflict levels. Tea gardens often serve as buffer zones, yet their proximity to built-up areas and reduced forest connectivity complicates the coexistence of humans and elephants. These findings align with study that highlighted the impact of monoculture plantations on elephant movement patterns and conflict escalation. Tea gardens, while beneficial for local economies, pose unique challenges in mitigating HEC (Madhusudan *et al.*, 2015), especially in areas like Golaghat and Chirang, where elephant corridors overlap with human settlements. Water availability also plays a critical role in shaping conflict intensity. Villages with higher water densities tend to experience fewer incidents of HEC, as access to sufficient water sources reduces competition between humans and elephants. In contrast, high-conflict villages with limited water availability are more prone to encounters, as elephants are driven into human settlements in search of water. This pattern supports findings from other studies that emphasize the importance of water resources in mitigating human-wildlife conflicts (Gubbi *et al.*, 2014). The factors influencing HEC further corroborates the influence of ecological and anthropogenic factors on HEC. Landscape metrics such as edge density, largest patch index, and patch density were identified as significant predictors of conflict. Fragmented forest patches with high patch density are strongly correlated with increased conflict frequency, underscoring the critical role of habitat fragmentation. Similarly, urbanization, measured by built-up area coverage, is positively associated with conflict, particularly in medium-conflict villages. These results are consistent with the findings the importance of maintaining contiguous forest patches to reduce the risk of HEC (Leimgruber *et al.*, 2003).

2.6. Conclusion

This study provides a comprehensive analysis of the human-elephant conflict (HEC) in Assam, revealing its complex and multifaceted nature, driven by the interplay of seasonal variations, ecological changes, and anthropogenic pressures. High-conflict villages like Likhak Gaon (73 incidents), Jorhat (41 incidents), Ambari (40 incidents), Uttar Dimakuchi & Jogigaon (30 incidents), Gor Mara Gaon (28 incidents), Golampatty & Nagaon (26 incidents) Kathalguri (24 incidents) in Assam are marked by habitat fragmentation, increasing urbanization, and limited water resources, which exacerbate conflicts between humans and elephants. The findings highlight the urgent need for integrated and context-specific mitigation strategies that address the root causes of these conflicts. Effective mitigation measures in Assam have focused on restoring forest connectivity, regulating urban expansion, and improving water accessibility in conflict-prone regions. Research indicates that approaches such as establishing elephant corridors, promoting habitat restoration, and creating buffer zones between human settlements and elephant habitats have proven successful in reducing conflict. Additionally, community-based initiatives, such as awareness campaigns, volunteer programs, and training local communities on coexistence strategies, have shown promising results in minimizing human-elephant encounters. In contrast, ineffective measures often include poorly planned compensation schemes, which fail to address the underlying socio-economic drivers of conflict, and top-down policies that lack community involvement.

Given the varied success of different strategies across Assam's diverse regions, it is crucial to adopt a tailored approach for high-conflict divisions. Strategies that incorporate both ecological restoration and community engagement, along with targeted land-use planning and seasonal monitoring, can significantly mitigate HEC. Collaboration between local communities, wildlife authorities, and environmental organizations is essential to implement these measures effectively. Combining ecological restoration, community engagement, and policy interventions, must be employed to address the challenges of human-elephant conflict in Assam. By learning from existing research and adopting proven mitigation practices, we can foster a sustainable and peaceful coexistence between humans and elephants in high-conflict areas.

CHAPTER 3:
Suggested Measures to minimize Human-Elephant Conflict in the State of Assam

Over the past 23 years, 626 elephants have died, while 1,468 people lost their lives and 337 were injured. Our analysis showed that most elephant deaths were caused by electrocution, followed by train accidents, and retaliatory killings. A total of 744 villages experienced repeated conflicts. Among the 217 villages where elephant deaths occurred, 95.39% had low mortality, 3.23% had medium mortality, and only 1.38% experienced high mortality. Although high-mortality (elephant) incident villages are few, they are critical and need urgent action. Managing both low-intensity and high-impact zones is important for reducing elephant deaths and improving conservation efforts. Similarly, among the 527 villages affected by human deaths due to HEC, 92.61% experienced low mortality. 4.17% of villages had medium mortality, while 2.28% had high mortality, making them conflict hotspots. Targeted solutions in these high-risk areas and better prevention measures in low and medium risk areas are crucial to reducing human deaths. Based on these patterns, it is essential to adopt different mitigation measures for human casualty and elephant mortality. This will help with the specific challenges and make conflict management more effective.

3.1. Recommendations for managing Elephant Deaths in Assam

In the state of Assam, human deaths due to human-elephant conflict have been recorded across 527 villages, whereas elephant deaths have been observed in 217 villages over the past 23 years. Notably, villages like Likhak Gaon (73 incidents), Jorhat (41 incidents), Ambari (40 incidents), Uttar Dimakuchi & Jogigaon (30 incidents), Gor Mara Gaon (28 incidents), Golampatty & Nagaon (26 incidents) Kathalguri (24 incidents) have experienced a high frequency conflict. A significant portion of these incidents has occurred in the divisions of Sonitpur East, Sonitpur West, Jorhat, Baksa, Nagaon Wildlife, Golaghat, Kaziranga, Karbi Anglong West, Karbi Anglong East, Dibrugarh, Doomdooma, Udalguri, North Lakhimpur, Manas National Park, Goalpara, Hojai, Kamrup.

Electrocution followed by poaching and train collisions were major causes of elephant mortality in Assam. The specific recommendations for each these causes highlighted below:

3.1.1. Electrocution

Highest number of mortality due to electrocution recorded in Bheroni, Doom Dooma, Nambar, Lalung Gaon, Likhak Gaon and Hojai. The specific recommendations are as follows:

Community awareness & safe electricity practices

Electrocution incidents occur due to illegal direct connections from distribution lines to electric fences, often used by villagers for crop protection. Raising awareness on the dangers of such practices is essential. Therefore, it is advisable to conduct workshops and awareness campaigns in the above-mentioned villages those are prone to electrocution.

District administration along with all other stake holders needs to make a framework for monitoring for any kind of illegal high voltage fencing. No electric fence should be directly connected to distribution lines, as this creates a high-voltage hazard for both wildlife and humans. Strict monitoring and penalties must be enforced to prevent such illegal practices. Alternative fencing solutions, such as solar-powered or low-voltage battery-operated fences, should be promoted as safer and more sustainable options. For instance, in Assam's Subankhata area, a 14-kilometer fence benefited about 1,000 households and approximately 100 elephants, reducing conflicts without causing harm to the elephants.

Regular Inspection and Maintenance of Power Infrastructure

Electrocutions result from direct contact with illegal distribution line fencing rather than main power lines. Regular inspections and maintenance of transformers, poles, and electrical connections will help identify and rectify hazardous setups. Ensuring that power lines maintain safe clearance heights and remain properly insulated will further minimize the risk of accidental electrocution. Strict legal action must be taken against unauthorized connections to prevent future incidents.

By improving infrastructure, enhancing community participation, and enforcing strict policies, elephant fatalities caused by electrocution can be significantly reduced, ensuring the safety of both wildlife and human populations. Additionally, the Assam Forest Department should collaborate with the Assam Power Distribution Company Limited (APDCL) to address this issue effectively.

3.1.2. Poaching

Poaching poses a significant threat to Asian

elephant populations in regions such as Bheroni, Sam Singnar, Kherbari, and North Lakhimpur. To effectively combat this issue, a multifaceted approach is essential, incorporating enhanced patrolling, community engagement, rapid response mechanisms, awareness initiatives, advanced surveillance.
Key Anti-Poaching Measures are as follows:

Strengthening patrols by increasing well-trained forest frontline staff with proper resources can enhance on-ground surveillance and deter poachers, while collaboration between government bodies, NGOs, and local communities is crucial for effective enforcement. Community-based monitoring fosters responsibility and enables early reporting of poaching activities, enhancing protection efforts. Deploying specialized, well-equipped rapid response teams can handle poaching incidents, increasing the likelihood of apprehending offenders. Awareness campaigns play a key role in educating communities about wildlife conservation and the legal consequences of poaching, helping to shift attitudes and discourage illegal activities. Investing in ranger training and modern equipment ensures they are well-prepared to combat poaching effectively. Additionally, promoting alternative livelihoods such as eco-tourism and handicrafts provides sustainable income opportunities, reducing dependence on poaching-related activities and contributing to long-term conservation efforts.

3.1.3. Collison with Train

Mitigating train-elephant collisions in regions such as Digboi, Nagaon, and Doom Dooma necessitates a multifaceted approach that integrates technological innovations, infrastructural modifications, and collaborative efforts between various stakeholders. Following strategies can be adopted are as follows:

Construction of dedicated underpasses, overpasses and ramps

Developing wildlife passages, such as underpasses and overpasses, facilitates safe crossings for elephants, thereby minimizing track-related accidents. These structures should be strategically located based on elephant movement patterns and corridor usage to ensure their effectiveness, the WII report on specifications of mitigation measures should be referred.

Real-Time Monitoring and Alert Systems

Implementations of AI-based surveillance in India have demonstrated success in averting potential mishaps. Distributed Acoustic Sensing (DAS) technology, using fiber optic cables, can identify elephant movements through vibrations, offering a cost-effective and wide-coverage solution. Incorporating RFID tags on elephants can further enhance monitoring, allowing for automated alerts at key locations. Implement on all sensitive stretches and level crossings.

Enhanced Coordination Between Railway and Forest Departments

Establishing a robust communication framework between railway authorities and wildlife conservation agencies is essential. This includes deputing forest department personnel in railway control rooms to facilitate real-time information exchange and deploying elephant trackers to monitor movements near tracks. Such collaborative efforts have been recommended to proactively address and mitigate train-elephant collisions.

Installation of Signage and Sensitization of Train Crews

Erecting clear signage to warn locomotive pilots about identified elephant corridors, coupled with training programs to sensitize train crews about elephant behaviours and emergency response protocols, can significantly reduce accidents. Awareness and preparedness are key components in preventing collisions.

Vegetation Management Along Tracks

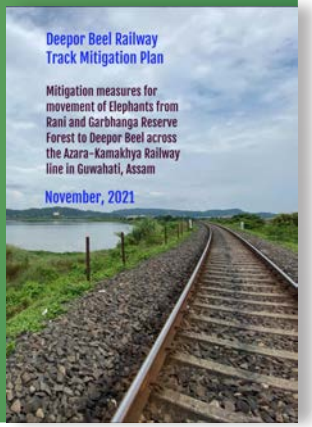
Regular clearance of vegetation at least 30m on either side of railway tracks enhances visibility for train operators, reducing the chances of surprise encounters with elephants. Maintaining clear lines of sight is a practical measure to prevent accidents.

3.2. Recommendations for managing Human deaths and injuries in Assam

Over 23 years, out of 527 villages, 12 villages are classified as high conflict areas, 22 villages are classified as medium conflict areas, and 488 villages are classified as low conflict areas based on the number of human deaths and injuries. Among the high-conflict villages, Likhak Gaon recorded the highest number of human deaths at 73, followed by Jorhat (46) and Ambari (40). Other villages with severe human-elephant conflict include Uttar Dimakuchi and Jogigaon (30 each), Gor Mara Gaon (28), Nagaon and Golampatty (26 each), Kathalguri and Kaliani Block (24 each), Pachim Paneri (23), and Kamaidap (21). These villages have been the most severely affected by human-elephant conflict and urgently require targeted mitigation measures. HEC management requires addressing the causes to ensure long-term coexistence. the causes involve immediate mitigation measures such as physical barriers, including electric fences, trenches, and deterrents, to prevent elephants from entering human settlements and farmlands. However,

Mitigation Measures for Elephant Corridor in Deepor Beel

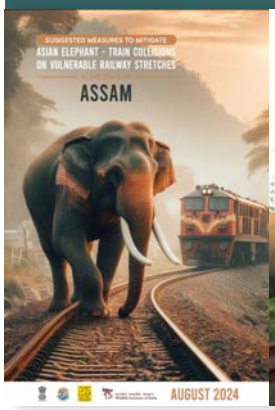
Ministry of Railways, Govt. of India has already approved the implementation of mitigation measures across the Deepor Beel to ease the movement of the elephants across the landscape. The approved mitigation measures include 03 underpasses of 200, 100 and 100 m with minimum height of 7m and a viaduct of 3.5km with a minimum height of 7m.

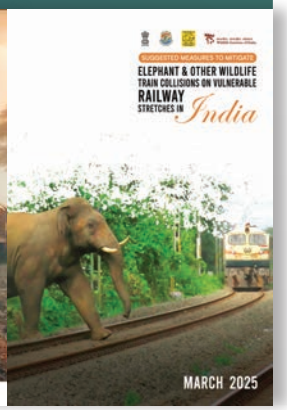


Suggested Mitigation Measures to minimize Asian elephant-train collisions on vulnerable railway stretches in the State of Assam

Wildlife Institute of India and Project Elephant Division has surveyed 7 railway stretches totalling 110.01 km for suggesting mitigation measures to ease the movement of elephants across the landscape. Based on joint survey by WII, PE, MoEFCC, Assam Forest Department and Ministry of Railways, 131 level crossings with ramps, 9 bridge modifications. 1 underpass and fencing at 1 site along with landscaping, light and sound barriers have been recommended. The details of these measures has been published in a report (PE-MoEFCC-WII (2024). SuggestedMeasures to Mitigate Asian Elephant- Train Collisions on Vulnerable Railway Stretches in the state of Assam. Project Elephant Division, Ministry of Environment, Forest and Climate Change, Government of India and Wildlife Institute of India. Pp. 66)

The details are also available on the portal (Elephant Railway Portal) developed for the purpose of monitoring the implementation of mitigation measures.





these measures alone are not sustainable without addressing the ultimate causes, which focus on protecting and restoring elephant habitats. Ensuring sufficient space, food, and water through habitat restoration, afforestation, and securing wildlife corridors reduces the need for elephants to move into human-dominated areas. A balanced approach is essential for effective and sustainable HEC management while conserving elephant populations and their ecosystems.

The site-specific mitigation measures are as follows:

3.2.1. Physical Barriers and Early Warning Systems

Solar-Powered and Non-Lethal Electric Fencing: Installing low-voltage, elephant-friendly electric fencing (5—6 kV) along village peripheries can deter elephants without causing harm. Proper maintenance and community engagement in monitoring these fences are essential for long-term effectiveness.

Trip-Wire Alarms and Motion Sensors: Advanced warning systems, such as infrared motion sensors and trip-wire alarms, can detect elephant presence and alert communities in real-time. The integration of AI-based predictive models and GPS collar tracking of elephant herds can further enhance early-warning networks.

Use of Light-Based Deterrents: Research has demonstrated that LED flashing lights and high-intensity torches can deter elephants at night, reducing crop raiding.

3.2.2. Human Safety, Awareness, and Conflict Management

Village-Level Early Warning Systems: Establishing community-based elephant alert networks using mobile apps (*e.g.*, Gaj Yatra) and radio messaging systems can help disseminate real-time warnings, reducing the risk of direct encounters.

Formation of Rapid Response Teams (RRTs): Trained local youth and forest department personnel should be equipped with non-lethal deterrents (firecrackers, chili smoke bombs, acoustic devices) to guide elephants away safely. In Assam, NGO's, in collaboration with

local communities and the Forest Department, established seven RRUs in districts like Majuli, Jorhat, Sivasagar, and Tinsukia, enhancing early warning systems and promoting coexistence.

Formation of Anti-Depredation Squads: Establishing community-based squads trained to safely drive elephants away from human settlements can reduce conflict incidents. These squads, equipped with knowledge and tools, act as first responders during potential conflict situations.

Warning Signages: Installing multilingual signages at strategic locations alerts both locals and travelers about elephant crossing zones, reducing accidental encounters. NGO's initiative in Assam's Udalguri, Baksa, and Tamulpur districts involved placing 20 pairs of signages, effectively minimizing surprise encounters and vehicle collisions.

3.2.3 Agricultural Strategies and Crop Protection

Cultivation of Elephant-Resistant Crops: Studies suggest that chili (*Capsicum* spp.), ginger (*Zingiber officinale*), garlic (*Allium sativum*), and citrus fruits are unpalatable to elephants and can serve as buffer crops around high-risk farmlands.

Use of Bio-Fences and Natural Deterrents: Planting thorny species such as Agave (*Agave americana*) or Cactus (*Opuntia* spp.) along village borders provides a natural deterrent against elephants.Beehive fences have been employed in countries like Kenya and Sri Lanka to deter elephants from entering agricultural areas. The concept leverages elephants' natural aversion to bees. When elephants disturb these fences, the agitated bees act as a deterrent.

3.2.4. Compensation Mechanisms and Policy Implementation

Compensation for Crop Loss & Human Casualties: Governments should implement fast compensation schemes with minimal delays, ensuring that affected communities receive financial relief in short time.

3.2.5. Habitat Restoration and Landscape-Level Conservation

Protection of elephant corridor: protecting corridors ensures easy movement and minimizes encounters with human settlements. The restoration of corridors with native vegetation and strategic land-use planning can improve safe passage.

Strategic Land-Use Planning: Collaborative planning with local communities ensures that land-use practices align with conservation goals, reducing human-elephant conflicts. This includes zoning regulations and community engagement to promote coexistence.

Community-Led Afforestation Initiatives: Gethsemane Man-made Forest (Bhairabkunda) Starting in 2005, six villages in Assam's Udalguri district collaborated to regenerate barren forest land, leading to the creation of the Gethsemane Man-made Forest. This 7.36 km^2 forest now hosts diverse flora and fauna, including elephants, which has contributed to a reduction in HEC in the area.

Elephant Transit Homes: Sri Lanka's Udawalawe Elephant Transit Home: Established in 1995, this facility rehabilitates orphaned elephant calves for eventual release into the wild. Such initiatives help maintain elephant populations while reducing the likelihood of conflict with human settlements.

3.3. Elephant Corridors Near High-Conflict Villages

Table 3.1 The following key elephant corridors, as identified in the "Right of Passage" report, are critical for mitigating human-elephant conflict:

Elephant Corridor	Adjacent Villages
Kaziranga—Karbi Anglong Corridor	Kaziranga National Park, Nambar Lang Protham F V, Sam Singnar
Kaziranga—Hojai Corridor	Hojai, Nagaon, Natum Salona T E
Kaziranga—Nagaon Corridor	Nagaon, Athubhanga, Nambar Lalung Gaon
Kaziranga—Golaghat Corridor	Golampatty, Duborani, Grant
Kaziranga—Tezpur Corridor	Tezpur, Likhak Gaon, Gor Mara Gaon
Kaziranga—Doom Dooma Corridor	Doom Dooma, Digboi, Kherbari
Kaziranga—Jorhat Corridor	Jorhat, Kathalguri T E, Holongpar Forest Reserve
Kaziranga—North Lakhimpur Corridor	North Lakhimpur, Fenkhati Gaoni, Paikan Pt Ii
Kaziranga—Sonitpur Corridor	Amaribari T E, Ambari, Phumen Ingti
Kaziranga—Baksa Corridor	Ambari, Kalikura Pt Ii, Baladmari Char Pt I

Table 3.2: Human-elephant conflict hotspots: Villages where both elephant mortality and human casualties occurred with count

Human mortality Count	Elephant mortality Count	Village Name	Division
73	9	Likhak Gaon	Sonitpur West
46	5	Atilagaon	Jorhat
40	16	Ambari	Baksa
28	6	Gor Mara Gaon	Sonitpur West
26	16	Nagaon	Nagaon Wildlife
26	18	Golampatty	Golaghat
21	3	Kamaidap	Karbi Anglong West
20	2	Hatigarh T E	Udalguri
19	8	Gopalpur	North Lakhimpur
19	3	Khatangpani Gaon	Doomdooma
18	1	Ikorajan Bagicha	Kaziranga
18	2	Modhupur Deori Fv	Dibrugarh
17	4	Bedeti Pathar	Sonitpur East
16	27	Bheroni	Kaziranga
15	7	Baladmari Char Pt I	Goalpara
14	11	Doom Dooma	Dibrugarh
13	5	Nambar Lang Protham F V	Karbi Anglong East
13	6	Paikan Pt Ii	Goalpara
12	1	Barjuli T E	Sonitpur West

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Appendix 1: Villages in Assam with recorded Elephant Mortality (2000-2023)

S.No.	Elephant Mortality Count	Village Name	Division	Admin-istrative level	Rural / Urban	House-hold	Popula-tion	Male%	Female%	Area (Ha)
1	27	Bheroni	Manas National Park	Village	Rural	139	732	50.95628	49.04372	206.5822
2	26	Digboi	Digboi	Town	Urban	4643	21736	50.44166	49.55834	452.8394
3	25	Natum Salona T E	Nagaon Territorial	Village	Rural	281	1389	49.74802	50.25198	334.5397
4	20	Amaribari T E	Sonitpur West	Village	Rural	97	462	49.35065	50.64935	636.8806
5	18	Golam-patty	Golaghat	Village	Rural	297	1322	49.39486	50.60514	152.8722
6	16	Ambari	Mushalpur	Village	Rural	753	3359	49.35993	50.64007	276.1462
7	16	Nagaon	Nagaon South	Town	Urban	27320	121628	50.68076	49.31924	1100.977
8	14	Athubhan-ga	Nagaon Territorial	Village	Rural	7	37	48.64865	51.35135	512.3579
9	12	Hojai	Nagaon South	Town	Urban	7049	36638	51.20913	48.79087	276.4745
10	11	Doom Dooma	Doom-dooma	Town	Urban	4243	21572	53.19859	46.80141	784.2617
11	10	Sibsagar	Sivasagar	Town	Urban	12534	50781	53.0218	46.9782	665.5112
12	10	Nambar Lalung Gaon	Nagaon Territorial	Village	Rural	441	2119	50.30675	49.69325	141.6324
13	9	Likhak Gaon	Sonitpur West	Village	Rural	539	2392	52.92642	47.07358	351.5071
14	9	Sam Singnar	Karbi Anglong East	Village	Rural	32	161	51.5528	48.4472	445.6403
15	9	Fenkhati Gaoni	North Lakhimpur	Village	Rural	233	1071	51.2605	48.7395	186.1456
16	8	North Lakhimpur	North Lakhimpur	Town	Urban	13993	59814	51.57154	48.42846	1678.075
17	7	Baladmari Char Pt I	Goalpara	Village	Rural	407	2388	51.9263	48.0737	599.8513
18	6	Kalikura Pt Ii	Manas National Park	Village	Rural	180	918	52.17865	47.82135	100.6527
19	6	Dhekiajuli	Sonitpur West	Town	Urban	4767	21579	51.425	48.575	369.6792
20	6	Duborani	Dhansiri	Village	Rural	401	1824	49.83553	50.16447	240.6655
21	6	Langtuk Engti	Karbi Anglong East	Village	Rural	0	0	0	0	677.0147
22	6	Paikan Pt Ii	Goalpara	Village	Rural	770	3510	50.02849	49.97151	310.4664
23	6	Tezpur	Sonitpur West	Town	Urban	17808	75540	51.28409	48.71591	1323.871
24	6	Gor Mara Gaon	Sonitpur West	Village	Rural	367	2283	59.92116	40.07884	210.7159
25	6	Phumen Ingti	Karbi Anglong West	Village	Rural	36	181	49.72376	50.27624	961.2289
26	5	Kathalguri T E	Jorhat	Village	Rural	658	3174	51.35476	48.64524	710.6921
27	5	Kampur Town	Nagaon Territorial	Town	Urban	2342	10371	50.42908	49.57092	751.9783
28	5	Badalapa-ra T E	Dhansiri	Village	Rural	1030	5626	49.20014	50.79986	921.5287
29	5	Jorhat	Jorhat	Town	Urban	23075	97946	51.9572	48.0428	2057.626

30	5	Uttar Sonari Pt	Sivasagar	Village	Rural	14	70	45.71429	54.28571	208.1929
31	5	Holongpar Forest Reserve	Jorhat	Village	Rural	3	9	44.44444	55.55556	2871.52
32	5	Grant	Doom-dooma	Village	Rural	1475	6893	50.96475	49.03525	1086.149
33	5	Kherbari	Karbi Anglong West	Village	Rural	87	453	50.11038	49.88962	92.55793
34	5	Kaziranga National Park	Kaziranga National Park	Village	Rural	66	203	98.02956	1.970443	35554.88
35	4	Dakhin Makra	Chirang	Village	Rural	411	1984	51.86492	48.13508	815.3611
36	4	Haltugaon	Haltugaon	Village	Rural	90	440	50.45455	49.54545	226.9726
37	4	Bedeti Pathar	Sonitpur East	Village	Rural	122	605	52.2314	47.7686	232.2656
38	4	P Vomli	Karbi Anglong West	Village	Rural	19	83	48.19277	51.80723	910.5924
39	4	Tara T E	Doom-dooma	Village	Rural	196	1010	48.81188	51.18812	279.2747
40	4	Singarijan T E	Sivasagar	Village	Rural	165	794	48.74055	51.25945	77.91889
41	4	Silapani	Goalpara	Village	Rural	689	3544	51.21332	48.78668	169.4353
42	4	Barli Bosti	Karbi Anglong East	Village	Rural	23	117	44.44444	55.55556	1204.976
43	4	Lepetkatta Bagisha	Dibrugarh	Village	Rural	106	515	48.34951	51.65049	234.5472
44	3	Garudha-ria Gaon	Dibrugarh	Village	Rural	73	436	52.75229	47.24771	235.2699
45	3	Barkhal	Kamrup west	Village	Rural	101	459	46.84096	53.15904	46.24198
46	3	Kachubil	Manas National Park	Village	Rural	168	726	49.44904	50.55096	115.2438
47	3	Toplak-howa	Goalpara	Village	Rural	311	1637	51.37447	48.62553	291.6066
48	3	Doboka	Nagaon South	Town	Urban	2375	13118	50.88428	49.11572	319.7547
49	3	Nagaon	Kamrup west	Village	Rural	62	293	47.44027	52.55973	234.5534
50	3	Nonoipara Basti	Dhansiri	Village	Rural	141	778	49.87147	50.12853	170.0496
51	3	Bhuyan Gaon	Sivasagar	Village	Rural	193	927	49.62244	50.37756	189.5085
52	3	Dakhin Sonari Habi	Sivasagar	Village	Rural	154	686	49.41691	50.58309	345.1444
53	3	Dehing Kalghar	Dibrugarh	Village	Rural	94	542	50.55351	49.44649	227.5318
54	3	Thurajan Grant	Golaghat	Village	Rural	278	1304	50.6135	49.3865	318.12
55	3	Tarapara	Goalpara	Village	Rural	623	2783	51.1678	48.8322	201.2936
56	3	Khatang-pani Gaon	Doom-dooma	Village	Rural	309	1484	51.01078	48.98922	206.1834
57	3	Rajen Teron	Karbi Anglong East	Village	Rural	64	406	57.63547	42.36453	77.5321

58	3	Thengal Gaon	Dhansiri	Village	Rural	350	1569	49.77693	50.22307	465.0218
59	3	Hindu	North Lakhimpur	Village	Rural	70	427	52.45902	47.54098	164.6511
60	3	Kamaidap	Karbi Anglong West	Village	Rural	0	0	0	0	1302.042
61	3	Khaling-duar Rf	Dhansiri	Village	Rural	635	3065	51.41925	48.58075	5723.861
62	3	Tea Gar-den Jelam	Dhansiri	Village	Rural	49	185	50.81081	49.18919	201.1564
63	2	Gohain Gaon	Sivasagar	Village	Rural	210	995	50.65327	49.34673	269.3487
64	2	Purani Goroibari	Dhansiri	Village	Rural	534	2526	49.48535	50.51465	360.5525
65	2	Kundarbil	Dhansiri	Village	Rural	323	1507	50.56403	49.43597	674.3903
66	2	Mikir Par Uria	Nagaon Territorial	Village	Rural	97	495	52.12121	47.87879	93.81461
67	2	Juripar	Nagaon Territorial	Village	Rural	996	5000	50.4	49.6	505.8776
68	2	Hahsara Barali Gaon	Nagaon Territorial	Village	Rural	398	1562	50.25608	49.74392	249.9578
69	2	Sarupather	Nagaon Territorial	Village	Rural	452	2294	51.6565	48.3435	149.7206
70	2	Barduar Tea Gar-den	Kamrup west	Village	Rural	1010	4794	51.08469	48.91531	982.1966
71	2	Guwahati	Kamrup west	Town	Urban	100947	433771	51.7379	48.2621	7650.472
72	2	Hatigarh T E	Dhansiri	Village	Rural	513	2503	53.29604	46.70396	1008.467
73	2	Bhutia-chang Te	Dhansiri	Village	Rural	1045	5447	49.75216	50.24784	1022.203
74	2	Handique Gaon	Jorhat	Village	Rural	2	5	60	40	176.884
75	2	Pokajora Gaon	Dhansiri	Village	Rural	190	925	51.24324	48.75676	354.5632
76	2	Ghogora Req Grant	Sonitpur West	Village	Rural	139	687	54.58515	45.41485	187.8431
77	2	Tankeswar Baruah Grant	Dhansiri	Village	Rural	170	835	51.61677	48.38323	124.0115
78	2	Tarajuli	Sonitpur West	Village	Rural	481	2377	50.14724	49.85276	481.2119
79	2	Sonari	Sivasagar	Town	Urban	4571	19810	52.40283	47.59717	291.9256
80	2	Murphu-loni	Karbi Anglong East	Village	Rural	166	779	51.98973	48.01027	553.459
81	2	Leteku Basti	Golaghat	Village	Rural	254	1264	48.57595	51.42405	343.2374
82	2	Dibrugarh	Dibrugarh	Town	Urban	31552	144063	51.78776	48.21224	1415.414
83	2	Mahajan-para	Goalpara	Village	Rural	190	759	50.19763	49.80237	126.0167
84	2	Rangamati Gaon	Sonitpur West	Village	Rural	251	1166	52.31561	47.68439	302.9249
85	2	Urpad Bill	Goalpara	Village	Rural	0	0	0	0	365.7525

86	2	Makum Killa Forest Village	Digboi	Village	Rural	98	486	52.05761	47.94239	170.5477
87	2	Langtuk Ronghang	Karbi Anglong East	Village	Rural	80	472	51.27119	48.72881	371.6848
88	2	Khumtai Grant Khumtai	Golaghat	Village	Rural	321	1467	50.17042	49.82958	1159.563
89	2	Bokakhat	Dibrugarh	Town	Urban	2257	10143	51.04999	48.95001	245.2572
90	2	Dhansiri T E	Karbi Anglong East	Village	Rural	16	82	54.87805	45.12195	1216.395
91	2	Thakurbari T E	Sonitpur West	Village	Rural	74	362	47.23757	52.76243	316.171
92	2	Bherbheri Gaon	Sonitpur West	Village	Rural	345	1643	51.30858	48.69142	328.5459
93	2	Panipota T E	Sonitpur West	Village	Rural	148	667	48.42579	51.57421	365.5337
94	2	Chepana Nc	Manas National Park	Village	Rural	24	107	53.27103	46.72897	1892.737
95	2	Nonke Suklaba-gan	Dhansiri	Village	Rural	190	1031	54.60718	45.39282	1048.262
96	1	Kachari Gaon	Dibrugarh	Village	Rural	119	583	51.97256	48.02744	239.8454
97	1	Bahbari	Mushalpur	Village	Rural	892	4214	51.02041	48.97959	284.0517
98	1	Bartalowa	Haltugaon	Village	Rural	736	3527	52.48086	47.51914	59.013
99	1	Uttar Runikhata	Chirang	Village	Rural	253	1251	50.43965	49.56035	277.4569
100	1	Koilamoila Fv	Chirang	Village	Rural	951	4843	50.91885	49.08115	1226.855
101	1	Dabosila Dabkhila	Dhansiri	Village	Rural	127	553	49.00542	50.99458	167.8182
102	1	Borthal Kachari Gaon	Mushalpur	Village	Rural	957	5393	50.86223	49.13777	174.9032
103	1	Pabhakati	Nagaon Territorial	Village	Rural	10	47	57.44681	42.55319	225.992
104	1	Balikoria Kharjara	Mushalpur	Village	Rural	758	3361	49.80661	50.19339	73.55178
105	1	Bolama Koiborta	Sivasagar	Village	Rural	154	801	53.30836	46.69164	118.3769
106	1	Bherbheri	Kamrup west	Village	Rural	86	385	54.02597	45.97403	252.3085
107	1	Jambari	Dhansiri	Village	Rural	1127	5763	50.94569	49.05431	564.2172
108	1	Niz Lawk-howa	Sonitpur West	Village	Rural	564	2832	51.12994	48.87006	537.9715
109	1	Batiamari	Mushalpur	Village	Rural	234	1176	44.98299	55.01701	255.8308
110	1	Khata Pathar	Jorhat	Village	Rural	10	39	61.53846	38.46154	73.99913
111	1	Bharalowa Sonari	Jorhat	Village	Rural	717	3390	51.65192	48.34808	280.1729
112	1	Borkhalia Gaon	Jorhat	Village	Rural	443	2074	51.59113	48.40887	146.2923
113	1	Jereng-abari	Dibrugarh	Village	Rural	88	481	50.31185	49.68815	326.6658
114	1	Longdong Basti	Nagaon Territorial	Village	Rural	9	27	48.14815	51.85185	194.2885

115	1	Sensuwa	Nagaon Territorial	Village	Rural	555	2546	50.62844	49.37156	90.08288
116	1	Kamakhya N C	Nagaon Territorial	Village	Rural	1	1	100	0	416.0693
117	1	Hatkhula	Nagaon Territorial	Village	Rural	175	798	48.49624	51.50376	171.9676
118	1	Bamun-gaon	Nagaon Territorial	Village	Rural	326	1498	52.73698	47.26302	127.3363
119	1	Nakhula Gaon	Nagaon Territorial	Village	Rural	667	3150	52.31746	47.68254	207.5816
120	1	Sessakuch N C	Dibrugarh	Village	Rural	81	384	56.51042	43.48958	321.8484
121	1	Nichinta	Goalpara	Village	Rural	118	547	47.34918	52.65082	242.7455
122	1	Golai Aoc Block Gaon	Digboi	Village	Rural	53	288	49.65278	50.34722	243.6416
123	1	Gereki	Nagaon Territorial	Village	Rural	699	3464	52.194	47.806	328.4307
124	1	Saru Rad-ha Ati	Nagaon Territorial	Village	Rural	376	2188	49.36015	50.63985	204.8913
125	1	Dakur Vita	Goalpara	Village	Rural	142	703	48.36415	51.63585	547.2023
126	1	Dahajatia	Kamrup west	Village	Rural	321	1612	50.80645	49.19355	88.75105
127	1	Satgharia	Dhansiri	Village	Rural	425	1809	49.25373	50.74627	202.7332
128	1	Missa	Nagaon Territorial	Village	Rural	783	3887	50.34731	49.65269	466.864
129	1	Gosain Chapori	Sonitpur East	Village	Rural	271	1266	47.23539	52.76461	284.1747
130	1	Ranga Gara Bil Gaon	Sonitpur East	Village	Rural	251	1295	51.42857	48.57143	157.4801
131	1	Akabil Gaon	Sonitpur West	Village	Rural	49	268	54.10448	45.89552	192.7029
132	1	Dhekiajuli Bagan	Sonitpur West	Village	Rural	814	4100	47.56098	52.43902	530.1094
133	1	Sangia Major Chuk	Sonitpur East	Village	Rural	280	1137	48.63676	51.36324	129.2
134	1	Balimora Gaon	Jorhat	Village	Rural	296	1429	51.29461	48.70539	244.2148
135	1	Singari Jan T E	Sonitpur West	Village	Rural	391	1969	49.2128	50.7872	146.9124
136	1	Rupajuli T E	Sonitpur West	Village	Rural	153	712	49.7191	50.2809	172.1585
137	1	Baniamari Pt Ii	Chirang	Village	Rural	118	600	50.16667	49.83333	50.48199
138	1	Christian Gaon	Golaghat	Village	Rural	146	648	52.16049	47.83951	132.1202
139	1	Grant	Digboi	Village	Rural	11	50	46	54	186.3311
140	1	Bapu Pathar	Digboi	Village	Rural	18	107	53.27103	46.72897	124.2711
141	1	Namti Bangali Borgohain	Sivasagar	Village	Rural	1108	5084	51.45555	48.54445	662.2464
142	1	Borsila Grant	Sivasagar	Village	Rural	137	608	49.17763	50.82237	263.8998
143	1	Darapara Pt Ii	Goalpara	Village	Rural	72	311	51.76849	48.23151	123.6842

144	1	Romai Gabharu	Doom-dooma	Village	Rural	212	1021	51.71401	48.28599	572.0293
145	1	Dangari Pathar	Doom-dooma	Village	Rural	1	6	66.66667	33.33333	95.75766
146	1	Na Gaon	Doom-dooma	Village	Rural	348	1717	50.55329	49.44671	230.4936
147	1	Hatimuria	Kamrup west	Village	Rural	182	913	50.05476	49.94524	223.9541
148	1	Koibortta Gaon	Jorhat	Village	Rural	0	0	0	0	240.2368
149	1	Nowjan	Sivasagar	Village	Rural	517	2357	50.53034	49.46966	445.9515
150	1	Haya Grant	Nagaon Territorial	Village	Rural	178	847	49.58678	50.41322	504.7666
151	1	Kaurhagi	Manas National Park	Village	Rural	148	867	48.55825	51.44175	426.218
152	1	Singari Basti	Nagaon South	Village	Rural	455	2311	50.62743	49.37257	235.4171
153	1	Killing Nepali Gaon K N Basti	Karbi Anglong East	Village	Rural	9	39	53.84615	46.15385	76.18212
154	1	Kawaimari	Doom-dooma	Village	Rural	5	32	43.75	56.25	153.6883
155	1	Deopani	Kaziranga National Park	Village	Rural	155	832	50.12019	49.87981	153.088
156	1	Charengia	Dhansiri	Village	Rural	212	916	50.87336	49.12664	203.7805
157	1	Bhaluk Mari Gaon	Sonitpur West	Village	Rural	121	596	51.34228	48.65772	243.0229
158	1	Jogi Bosti	Sonitpur West	Village	Rural	83	485	50.10309	49.89691	773.4413
159	1	Bongijuli	Sonitpur West	Village	Rural	714	3752	50.5597	49.4403	236.7743
160	1	Tepojan	Golaghat	Village	Rural	58	301	47.84053	52.15947	105.2819
161	1	Jationi	Golaghat	Village	Rural	86	429	47.78555	52.21445	343.7627
162	1	Miripathar	Sivasagar	Village	Rural	130	771	64.59144	35.40856	157.8001
163	1	Jamira	Sivasagar	Village	Rural	150	710	50.56338	49.43662	281.978
164	1	Rangbong Pathar	Golaghat	Village	Rural	613	3054	50.68762	49.31238	584.6405
165	1	Shyamraipur Bagan	Golaghat	Village	Rural	91	401	52.1197	47.8803	540.2611
166	1	Panikora Gaon	Golaghat	Village	Rural	237	1066	50.84428	49.15572	152.6026
167	1	Bebejia Likchan	Golaghat	Village	Rural	163	823	51.15431	48.84569	389.4344
168	1	Borbil	North Lakhimpur	Village	Rural	362	2056	52.6751	47.3249	458.0679
169	1	Ikorajan Bagicha	Golaghat	Village	Rural	569	2660	51.20301	48.79699	277.4117
170	1	Numaligarh Block	Golaghat	Village	Rural	189	948	51.05485	48.94515	609.9488
171	1	Rakhyasini Jangle Block	Goalpara	Village	Rural	533	2768	51.04769	48.95231	446.0074
172	1	Rakhyasini Pahar	Goalpara	Village	Rural	117	662	51.66163	48.33837	173.6338
173	1	Bura Raja	Nagaon Territorial	Village	Rural	248	1250	50.8	49.2	451.071

174	1	Hatigarh	Nagaon Territorial	Village	Rural	178	854	50	50	445.943
175	1	Udalguri T E	Digboi	Village	Rural	273	1504	50	50	161.909
176	1	Deopani Chapori	Doom-dooma	Village	Rural	74	406	54.6798	45.3202	873.152
177	1	Balisuti Bangali	Sonitpur West	Village	Rural	0	0	0	0	217.8545
178	1	Mizibari Pathar	Sonitpur West	Village	Rural	55	293	51.53584	48.46416	149.9486
179	1	Diplonga	Sonitpur East	Village	Rural	85	390	53.33333	46.66667	84.11767
180	1	Gathiapara	Goalpara	Village	Rural	377	1692	49.8818	50.1182	425.3392
181	1	Raj Bharal	Sonitpur West	Village	Rural	455	2378	49.78974	50.21026	188.1862
182	1	Bhito Suti Gaon	Sonitpur East	Village	Rural	695	3446	50.66744	49.33256	199.8935
183	1	Sun Kro	Karbi Anglong East	Village	Rural	12	76	53.94737	46.05263	442.5922
184	1	Man Singnar	Karbi Anglong East	Village	Rural	35	216	51.85185	48.14815	426.4263
185	1	Simalu Guri Gaon	Sonitpur West	Village	Rural	350	1703	51.9084	48.0916	311.6628
186	1	Hokoma	Sonitpur East	Village	Rural	492	2378	51.72414	48.27586	318.7799
187	1	Sar Ik Rongphar	Karbi Anglong East	Village	Rural	15	94	54.25532	45.74468	678.8913
188	1	Sonari Gaon	Golaghat	Village	Rural	82	387	50.1292	49.8708	365.2826
189	1	Choukana Bil	Golaghat	Village	Rural	78	400	51.75	48.25	447.1281
190	1	Lalmati	Karbi Anglong East	Village	Rural	101	622	52.2508	47.7492	640.7432
191	1	Milonpur	Kaziranga National Park	Village	Rural	56	300	50.33333	49.66667	84.66587
192	1	Central Range Manja	Karbi Anglong East	Village	Rural	280	1509	51.02717	48.97283	235.4369
193	1	Kachuga-on	Golaghat	Village	Rural	291	1307	49.34966	50.65034	453.385
194	1	Sangmi Hanse	Karbi Anglong East	Village	Rural	20	112	58.92857	41.07143	253.9023
195	1	Hamukjan	Sivasagar	Village	Rural	23	138	46.37681	53.62319	444.1298
196	1	Sar Engti	Kaziranga National Park	Village	Rural	6	41	58.53659	41.46341	248.6632
197	1	Kahibari Pt I	Goalpara	Village	Rural	72	339	50.14749	49.85251	365.1924
198	1	Hemphu Ingti Gaon	Karbi Anglong East	Village	Rural	14	83	54.21687	45.78313	182.3283
199	1	Golaghat	Golaghat	Town	Urban	9646	41989	51.23485	48.76515	493.1353
200	1	Garanga Grant Gaon	Golaghat	Village	Rural	339	1678	50.89392	49.10608	331.3901

201	1	Balijan	North Lakhimpur	Village	Rural	41	192	51.04167	48.95833	120.9769
202	1	Sarthe Takbi	Karbi Anglong East	Village	Rural	150	845	52.30769	47.69231	937.0434
203	1	Tinsukia	Golaghat	Town	Urban	25845	116322	53.56081	46.43919	1862.465
204	1	Hatigarh Grant	Jorhat	Village	Rural	242	1045	50.52632	49.47368	241.5091
205	1	Lumding Rly Col CT	Nagaon South	Town	Urban	5425	22658	50.82973	49.17027	324.3396
206	1	Barjuli T E	Sonitpur West	Village	Rural	979	4950	49.79798	50.20202	429.8348
207	1	Hatibari T E	Sonitpur West	Village	Rural	63	310	52.90323	47.09677	74.85431
208	1	Sessa T E	Sonitpur West	Village	Rural	171	784	49.7449	50.2551	273.4976
209	1	Sonajuli T E	Sonitpur West	Village	Rural	212	1055	48.62559	51.37441	346.3696
210	1	Guwahati	Mushalpur	Town	Urban	129822	528563	51.84358	48.15642	11142.18
211	1	Samuka	Kamrup west	Village	Rural	299	1439	51.56359	48.43641	765.9519
212	1	Bihubor Grant	Sivasagar	Village	Rural	391	1695	50.79646	49.20354	314.0759
213	1	Murkong Selek Part Iii	Dhemaji	Village	Rural	75	345	56.23188	43.76812	56.15577

Appendix 2: Villages in Assam with recorded Human Mortality (2000-2023)

S.No.	Human Causalities Count	Village Name	Division	Administrative level	Rural / Urban	Household	Population	Male%	Female%	Area (Ha)
1	73	Likhak Gaon	Sonitpur West	Village	Rural	539	2392	52.92642	47.07358	351.5071
2	46	Jorhat	Jorhat	Town	Urban	23075	97946	51.9572	48.0428	2057.626
3	40	Ambari	Baksa	Village	Rural	753	3359	49.35993	50.64007	276.1462
4	30	Uttar Dimakuchi	Udalguri	Village	Rural	872	4032	50.91766	49.08234	264.0501
5	30	Jogigaon	Kaziranga	Village	Rural	277	1316	51.06383	48.93617	305.3294
6	28	Gor Mara Gaon	Sonitpur West	Village	Rural	367	2283	59.92116	40.07884	210.7159
7	26	Nagaon	Nagaon Wildlife	Town	Urban	27320	121628	50.68076	49.31924	1100.977
8	26	Golampatty	Golaghat	Village	Rural	297	1322	49.39486	50.60514	152.8722
9	24	Kathalguri	Udalguri	Village	Rural	201	985	48.52792	51.47208	237.6494
10	24	Kaliani Block	Golaghat	Village	Rural	363	1501	53.56429	46.43571	285.9079
11	23	Pachim Paneri	Udalguri	Village	Rural	164	809	48.45488	51.54512	228.8056
12	21	Kamaidap	Karbi anglong West	Village	Rural	0	0	0	0	1302.042
13	20	Hatigarh T E	Udalguri	Village	Rural	513	2503	53.29604	46.70396	1008.467
14	20	Borgoria Chapori Gaon	Golaghat	Village	Rural	66	369	47.96748	52.03252	267.617
15	19	North Lakhimpur	North Lakhimpur	Town	Urban	13993	59814	51.57154	48.42846	1678.075
16	19	Khatangpani Gaon	Doomdooma	Village	Rural	309	1484	51.01078	48.98922	206.1834
17	18	Ikorajan Bagicha	Kaziranga	Village	Rural	569	2660	51.20301	48.79699	277.4117
18	18	Dibrugarh	Dibrugarh	Town	Urban	31552	144063	51.78776	48.21224	1415.414
19	17	Bedeti Pathar	Sonitpur East	Village	Rural	122	605	52.2314	47.7686	232.2656
20	17	Balijan Gaon	Jorhat	Village	Rural	254	1239	49.39467	50.60533	341.6044
21	16	Bheroni	Kaziranga	Village	Rural	139	732	50.95628	49.04372	206.5822
22	15	Agia Part Ii	Goalpara	Village	Rural	319	1576	52.85533	47.14467	174.0315
23	15	Baladmari Char Pt I	Goalpara	Village	Rural	407	2388	51.9263	48.0737	599.8513
24	15	Namani Gaon	Sonitpur West	Village	Rural	998	4917	51.45414	48.54586	263.0012
25	15	Kachari Gaon T E	Sonitpur West	Village	Rural	416	2005	50.12469	49.87531	207.1018
26	14	Doom Dooma	Dibrugarh	Town	Urban	4243	21572	53.19859	46.80141	784.2617
27	13	Odala	Udalguri	Village	Rural	188	895	51.06145	48.93855	415.6545
28	13	Paikan Pt Ii	Goalpara	Village	Rural	770	3510	50.02849	49.97151	310.4664

29	12	Seconi Pathar	Kaziranga	Village	Rural	222	1181	49.36494	50.63506	572.9822
30	12	Pakhiura N C	Goalpara	Village	Rural	122	729	51.71468	48.28532	195.0829
31	12	Barjuli T E	Sonitpur West	Village	Rural	979	4950	49.79798	50.20202	429.8348
32	11	Nizlaluk	North Lakhimpur	Village	Rural	642	2780	50.21583	49.78417	147.67
33	10	Dimakuchi Te	Udalguri	Village	Rural	531	2614	48.04897	51.95103	613.8586
34	10	Mazbat Town	Udalguri	Village	Rural	832	3629	51.39157	48.60843	221.0548
35	10	Moran Town CT	Dibrugarh	Town	Urban	1879	8434	51.73109	48.26891	100.9179
36	9	Kouwanipa-thar	Golaghat	Village	Rural	785	3856	50.64834	49.35166	867.6271
37	9	Leteku Basti	Golaghat	Village	Rural	254	1264	48.57595	51.42405	343.2374
38	8	Pub Hawli	Baksa	Village	Rural	159	774	47.28682	52.71318	269.4951
39	8	Akabil Gaon	Sonitpur West	Village	Rural	49	268	54.10448	45.89552	192.7029
40	8	Na Gaon	Doom-dooma	Village	Rural	348	1717	50.55329	49.44671	230.4936
41	8	Hojai	Nagaon South	Town	Urban	7049	36638	51.20913	48.79087	276.4745
42	8	Adarsha Gaon	Golaghat	Village	Rural	234	1002	49.1018	50.8982	1590.848
43	8	Guwahati	Kamrup	Town	Urban	129822	528563	51.84358	48.15642	11142.18
44	7	Kalikura Pt Ii	Manas National Park	Village	Rural	180	918	52.17865	47.82135	100.6527
45	7	Nonke Don-gargaon	Baksa	Village	Rural	131	750	50.93333	49.06667	517.267
46	7	Barkhal	Kamrup	Village	Rural	101	459	46.84096	53.15904	46.24198
47	7	Kachubil	Manas National Park	Village	Rural	168	726	49.44904	50.55096	115.2438
48	7	Major Chuk	Sonitpur East	Village	Rural	474	2063	50.84828	49.15172	238.1969
49	7	Chekonidha-ra CT	Jorhat	Town	Urban	2182	9026	49.96676	50.03324	1816.102
50	7	Tankeswar Baruah Grant	Udalguri	Village	Rural	170	835	51.61677	48.38323	124.0115
51	7	Khumung Phai	Golaghat	Village	Rural	0	0	0	0	288.922
52	7	Bilatia	Golaghat	Village	Rural	315	1424	53.72191	46.27809	1078.034
53	7	Lata Jori	Golaghat	Village	Rural	201	899	50.50056	49.49944	185.9617
54	7	Choukana Bil	Golaghat	Village	Rural	78	400	51.75	48.25	447.1281
55	7	Thakurbari T E	Sonitpur West	Village	Rural	74	362	47.23757	52.76243	316.171
56	7	Goybari	Baksa	Village	Rural	811	4200	50.5	49.5	2317.944
57	6	Doboka	Nagaon South	Town	Urban	2375	13118	50.88428	49.11572	319.7547
58	6	Gohpur T E	Sonitpur East	Village	Rural	157	791	49.81037	50.18963	210.0444

59	6	Deopani	Sonitpur East	Village	Rural	155	832	50.12019	49.87981	153.088
60	6	Kaziranga	Kaziranga	Village	Rural	70	330	50	50	81.29074
61	6	Mahajanpara	Goalpara	Village	Rural	190	759	50.19763	49.80237	126.0167
62	6	Tipamia Bongali	Dibrugarh	Village	Rural	62	303	50.82508	49.17492	171.7368
63	6	Ser Malong	Karbi Anglong East	Village	Rural	26	121	52.89256	47.10744	451.4304
64	6	Saethe Terang	Karbi anglong West	Village	Rural	11	79	50.63291	49.36709	289.011
65	6	Bherbheri Gaon	Sonitpur West	Village	Rural	345	1643	51.30858	48.69142	328.5459
66	6	Sonajuli T E	Sonitpur West	Village	Rural	212	1055	48.62559	51.37441	346.3696
67	6	Bogajuli	Baksa	Village	Rural	1074	5492	50.45521	49.54479	4809.612
68	6	Parbotipur	North Lakhimpur	Village	Rural	511	2289	52.5557	47.4443	856.497
69	6	Phumen Ingti	Karbi Anglong East	Village	Rural	36	181	49.72376	50.27624	961.2289
70	5	Khena Alli Bari	Kamrup	Village	Rural	255	1260	49.04762	50.95238	204.374
71	5	Palasbari	Kamrup	Town	Urban	1034	4925	50.13198	49.86802	989.5194
72	5	Khamariga-on	Baksa	Village	Rural	214	997	49.94985	50.05015	322.1054
73	5	Kataligaon	Mushalpur	Village	Rural	303	1529	50.0327	49.9673	442.6733
74	5	Guwahati	Sonitpur East	Town	Urban	100947	433771	51.7379	48.2621	7650.472
75	5	Keheru Khanda Pather Gaon	Sonitpur East	Village	Rural	556	2825	51.46903	48.53097	191.2356
76	5	Dhekiajuli	Sonitpur West	Town	Urban	4767	21579	51.425	48.575	369.6792
77	5	Naziratng Gaon	Doom-dooma	Village	Rural	158	847	48.87839	51.12161	222.8675
78	5	Raikata Islampur	Nagaon South	Village	Rural	513	3006	50.96474	49.03526	274.8082
79	5	Bagidhola Bagan	Golaghat	Village	Rural	291	1313	49.58111	50.41889	215.3935
80	5	Numaligarh Bagicha	Golaghat	Village	Rural	1127	5140	49.53307	50.46693	632.5196
81	5	Naharsala	Karbi Anglong East	Village	Rural	22	118	53.38983	46.61017	333.8242
82	5	Kaziranga National Park	Kaziranga	Village	Rural	66	203	98.02956	1.970443	35554.88
83	5	Golaghat	Golaghat	Town	Urban	9646	41989	51.23485	48.76515	493.1353
84	4	Uttar Runikhata	Chirang	Village	Rural	253	1251	50.43965	49.56035	277.4569
85	4	Hatigaon	Nagaon Territorial	Village	Rural	352	1343	50.63291	49.36709	198.7166
86	4	Purani Goroibari	Udalguri	Village	Rural	534	2526	49.48535	50.51465	360.5525
87	4	Bharali For-est Village	Dibrugarh	Village	Rural	56	282	53.19149	46.80851	24.54565

88	4	Bhutiachang Te	Udalguri	Village	Rural	1045	5447	49.75216	50.24784	1022.203
89	4	Rekamari Gaon	Sonitpur West	Village	Rural	281	1437	49.82603	50.17397	601.369
90	4	Katani Bari	Sonitpur East	Village	Rural	265	1386	50.2886	49.7114	548.2661
91	4	Sarai Jania	Sonitpur East	Village	Rural	277	1313	51.40899	48.59101	214.3966
92	4	Gog	Kamrup	Village	Rural	328	1700	51.58824	48.41176	188.8621
93	4	Atherikhat Jungle	Udalguri	Village	Rural	352	1625	49.96923	50.03077	433.9187
94	4	Monabari Pathar	Sonitpur East	Village	Rural	0	0	0	0	89.38358
95	4	Chengeli Mari Pathar	Sonitpur West	Village	Rural	135	689	50.79826	49.20174	252.3461
96	4	Haladhi Bari Na Gaon	Dibrugarh	Village	Rural	62	295	50.84746	49.15254	188.1805
97	4	Rangbong Pathar	Golaghat	Village	Rural	613	3054	50.68762	49.31238	584.6405
98	4	Balizan	Golaghat	Village	Rural	162	793	53.21564	46.78436	725.2697
99	4	Mohmaiki CT	Kaziranga	Town	Urban	1292	5639	50.27487	49.72513	501.5418
100	4	Futuripara	Goalpara	Village	Rural	509	2921	51.42075	48.57925	445.0677
101	4	Gathiapara	Goalpara	Village	Rural	377	1692	49.8818	50.1182	425.3392
102	4	Tengabasti	Sonitpur East	Village	Rural	229	1234	49.43274	50.56726	171.8899
103	4	Dighali Pt I	Goalpara	Village	Rural	181	822	50.60827	49.39173	147.6086
104	4	Sokordhara	Golaghat	Village	Rural	236	1086	48.89503	51.10497	537.5803
105	4	Dergaon	Golaghat	Village	Rural	187	839	49.58284	50.41716	174.5705
106	4	Sa Vat Terang	Karbi Anglong East	Village	Rural	5	43	51.16279	48.83721	240.6648
107	4	Upar Kachari	Sonitpur West	Village	Rural	66	322	45.96273	54.03727	86.06477
108	4	Hatibari T E	Sonitpur West	Village	Rural	63	310	52.90323	47.09677	74.85431
109	4	Dakshin Debasthan	Karbi anglong West	Village	Rural	1011	5856	51.1612	48.8388	211.2142
110	4	Grant	North Lakhimpur	Village	Rural	139	679	49.63181	50.36819	1747.813
111	3	Khorikotia Grant	Jorhat	Village	Rural	373	1686	52.25386	47.74614	496.1795
112	3	Bagarikhuti	Baksa	Village	Rural	411	1968	51.72764	48.27236	555.3878
113	3	Kahikuchi	Sonitpur East	Village	Rural	41	170	45.29412	54.70588	137.244
114	3	Sonapur Gaon CT	Sonitpur East	Town	Urban	1133	5771	52.41726	47.58274	286.0367
115	3	Kendubam	Kamrup	Village	Rural	17	70	48.57143	51.42857	268.1947
116	3	Ouguri	Sonitpur West	Village	Rural	415	1802	49.00111	50.99889	332.7418
117	3	Mokebari	Kamrup	Village	Rural	77	390	53.58974	46.41026	1329.684
118	3	Dahela	Goalpara	Village	Rural	532	2469	50.18226	49.81774	847.5368

119	3	Bamunpara	Goalpara	Village	Rural	121	588	51.36054	48.63946	122.2148
120	3	Uzara Gaon Uzra Gaon	Nagaon Wildlife	Village	Rural	142	692	51.87861	48.12139	171.6897
121	3	Boiragimoth Kachari Gaon	Dibrugarh	Village	Rural	817	3665	51.15962	48.84038	307.6714
122	3	Dakur Vita	Goalpara	Village	Rural	142	703	48.36415	51.63585	547.2023
123	3	Hatigarh Te	Udalguri	Village	Rural	918	4366	50.16033	49.83967	637.0927
124	3	Uttar Geru-ajhar	Udalguri	Village	Rural	126	604	52.31788	47.68212	387.4479
125	3	Newly	Udalguri	Village	Rural	35	182	51.64835	48.35165	137.1759
126	3	Paneri T E	Udalguri	Village	Rural	984	4801	51.30181	48.69819	737.5297
127	3	Sastrapara	Udalguri	Village	Rural	326	1637	50.7025	49.2975	395.1324
128	3	Khalihamari	Sonitpur East	Village	Rural	171	788	50.88832	49.11168	224.4082
129	3	Kalaigaon Bagicha	Udalguri	Village	Rural	414	1900	53.21053	46.78947	517.8165
130	3	Singari Jan T E	Sonitpur West	Village	Rural	391	1969	49.2128	50.7872	146.9124
131	3	Balijan	Dibrugarh	Village	Rural	195	972	51.95473	48.04527	398.4636
132	3	Samdang T E	Doom-dooma	Village	Rural	134	591	48.56176	51.43824	59.76235
133	3	Makum	Sonitpur East	Town	Urban	3494	16923	51.82296	48.17704	352.7272
134	3	Tarajuli	Sonitpur West	Village	Rural	481	2377	50.14724	49.85276	481.2119
135	3	Kakojan R F	Doom-dooma	Reserve Forest	Rural	0	0	0	0	1633.803
136	3	Uttar Kari Bil	Sonitpur East	Village	Rural	289	1562	52.04866	47.95134	535.6581
137	3	Murphulani Bagan Gaon	Golaghat	Village	Rural	1161	5531	51.22039	48.77961	1207.921
138	3	Upper Dil-laji Adivashi Gaon	Karbi Anglong East	Village	Rural	54	257	55.64202	44.35798	119.6679
139	3	Hatimora Putta	Golaghat	Village	Rural	68	375	70.93333	29.06667	360.9901
140	3	Mahmarang	Kamrup	Village	Rural	119	551	51.72414	48.27586	72.4411
141	3	Upahupara	Udalguri	Village	Rural	466	1923	51.32605	48.67395	86.81203
142	3	Deopani Chapori	Doom-dooma	Village	Rural	74	406	54.6798	45.3202	873.152
143	3	Bardikarai-bali Chapori	Sonitpur East	Village	Rural	10	51	52.94118	47.05882	227.9367
144	3	Niraiati Gaon	Sonitpur West	Village	Rural	291	1217	48.97288	51.02712	457.2118
145	3	Gutlong Gaon CT	Sonitpur East	Town	Urban	2323	10900	50.17431	49.82569	356.3067
146	3	Parmai Gauli Gaon	Sonitpur East	Village	Rural	296	1523	51.80565	48.19435	256.4283
147	3	Bhito Suti Gaon	Sonitpur West	Village	Rural	695	3446	50.66744	49.33256	199.8935
148	3	Saikia Chuburi Dekar Gaon	Sonitpur West	Village	Rural	1181	4937	49.34171	50.65829	239.3998

149	3	Batiamari	Sonitpur East	Village	Rural	308	1757	50.82527	49.17473	261.9773
150	3	Rajen Teron	Karbi Anglong East	Village	Rural	64	406	57.63547	42.36453	77.5321
151	3	Dhamar Reserve	Goalpara	Village	Rural	563	2861	50.82139	49.17861	715.8347
152	3	Seajuli	North Lakhimpur	Village	Rural	102	529	52.93006	47.06994	101.6999
153	3	Block	Doom-dooma	Village	Rural	359	1694	51.94805	48.05195	243.2281
154	3	Chepana Nc	Manas National Park	Village	Rural	24	107	53.27103	46.72897	1892.737
155	3	Kukurkata	Goalpara	Village	Rural	163	798	49.74937	50.25063	94.69879
156	2	Bijni	Chirang	Town	Urban	2926	13257	50.40356	49.59644	263.2868
157	2	Nonke Angarkata	Baksa	Village	Rural	3219	16264	51.34038	48.65962	2284.362
158	2	Kuhimari	North Lakhimpur	Village	Rural	96	541	49.16821	50.83179	184.1511
159	2	Elengmari	Chirang	Village	Rural	51	247	48.98785	51.01215	231.398
160	2	Tepechia	Kamrup	Village	Rural	330	1570	49.10828	50.89172	275.23
161	2	Hudumpur	Kamrup	Village	Rural	328	1510	50.59603	49.40397	283.8003
162	2	Hatidhura F V	Chirang	Village	Rural	170	979	49.23391	50.76609	1116.413
163	2	Dagaon Katahi	Kamrup	Village	Rural	372	1781	49.97193	50.02807	210.7949
164	2	Bhaku-wamari	Nagaon Territorial	Village	Rural	391	2169	51.59059	48.40941	139.6293
165	2	Bankakata	Kamrup	Village	Rural	383	1872	51.38889	48.61111	353.3779
166	2	Nonke Don-gargaon	Baksa	Village	Rural	1366	6688	49.91029	50.08971	1246.42
167	2	Borigaon	Udalguri	Village	Rural	15	58	51.72414	48.27586	127.0029
168	2	Boria Gaon	Jorhat	Village	Rural	335	1512	51.19048	48.80952	464.43
169	2	Nareng Pachani Gaon	Jorhat	Village	Rural	171	731	51.57319	48.42681	283.3494
170	2	Bharalowa Sonari	Kaziranga	Village	Rural	717	3390	51.65192	48.34808	280.1729
171	2	Tukura Pt Ii	Goalpara	Village	Rural	397	2039	51.79009	48.20991	328.2458
172	2	Borghat T E	Nagaon Territorial	Village	Rural	238	1174	48.63714	51.36286	1689.093
173	2	Lakhipur Tc	Goalpara	Town	Urban	2927	15633	51.46805	48.53195	812.6089
174	2	Ghunusha Habi	Nagaon Territorial	Village	Rural	633	3257	50.96715	49.03285	156.9366
175	2	Padumoni Na Gaon	Dibrugarh	Village	Rural	53	245	51.83673	48.16327	107.2095
176	2	Allia	Baksa	Village	Rural	155	866	50.11547	49.88453	284.423
177	2	Barangabari	Baksa	Village	Rural	279	1358	50.22091	49.77909	505.8599
178	2	Labdangguri Pathar	Manas National Park	Village	Rural	220	1036	51.06178	48.93822	253.2346

179	2	Garubandha	Nagaon Wildlife	Village	Rural	221	1603	50.46787	49.53213	282.0825
180	2	Dadhia F V	Dibrugarh	Village	Rural	570	3379	52.11601	47.88399	157.9715
181	2	Lalabori	Goalpara	Village	Rural	400	1810	48.45304	51.54696	421.0375
182	2	Dorapara	Goalpara	Village	Rural	471	1941	51.72591	48.27409	297.9243
183	2	Amguri	Nagaon Territorial	Village	Rural	223	995	52.36181	47.63819	237.3459
184	2	Naharbari Chah Bagisa	Jorhat	Village	Rural	416	1997	48.02203	51.97797	141.8271
185	2	Rangalu Gaon	Nagaon Territorial	Village	Rural	580	2969	50.0842	49.9158	275.7881
186	2	Nambar Lalung Gaon	Nagaon Territorial	Village	Rural	441	2119	50.30675	49.69325	141.6324
187	2	Barchapahi	Kamrup	Village	Rural	7	25	60	40	194.5206
188	2	Hojobari	Kamrup	Village	Rural	221	1097	50.95716	49.04284	115.881
189	2	Godaimari Pathar	Nagaon Wildlife	Village	Rural	610	3445	51.55298	48.44702	327.826
190	2	Dibrual Changmai	Dibrugarh	Village	Rural	300	1300	52.15385	47.84615	155.5257
191	2	Bokul Maj Gaon	Dibrugarh	Village	Rural	391	1765	51.3881	48.6119	407.7692
192	2	Paharsing Para	Goalpara	Village	Rural	493	2644	50.34039	49.65961	286.6342
193	2	Majuli Te	Udalguri	Village	Rural	1092	5217	50.31627	49.68373	954.5208
194	2	Niz Gerua-jhar	Udalguri	Village	Rural	314	1660	51.20482	48.79518	274.1966
195	2	Kalikhola Kalikhola Nc	Udalguri	Village	Rural	306	1582	51.45386	48.54614	717.475
196	2	Badalapara T E	Udalguri	Village	Rural	1030	5626	49.20014	50.79986	921.5287
197	2	Dakhin Nalbari	Udalguri	Village	Rural	232	1074	49.34823	50.65177	101.5436
198	2	Ranga Gara Bil Gaon	Sonitpur East	Village	Rural	251	1295	51.42857	48.57143	157.4801
199	2	Gataimara	Sonitpur East	Village	Rural	55	298	51.67785	48.32215	299.0834
200	2	Bargang	Sonitpur East	Village	Rural	385	1966	50.10173	49.89827	134.2973
201	2	Khara Pt Ii	Goalpara	Village	Rural	349	1526	50.13106	49.86894	202.4513
202	2	Kamalabaria N C CT	Jorhat	Town	Urban	2335	10071	54.3938	45.6062	250.1253
203	2	Dedrupar Grant	Jorhat	Village	Rural	312	1561	49.13517	50.86483	326.9912
204	2	Pokajora Gaon	Jorhat	Village	Rural	190	925	51.24324	48.75676	354.5632
205	2	Lezaihula Gaon	Dibrugarh	Village	Rural	183	748	50.66845	49.33155	240.2411
206	2	Dhakual Gaon	Dibrugarh	Village	Rural	114	520	51.15385	48.84615	169.5745
207	2	Barson Gaon	Sonitpur West	Village	Rural	178	937	50.48026	49.51974	497.6307
208	2	Phutuka Pathar	Jorhat	Village	Rural	92	429	53.84615	46.15385	512.7199
209	2	Garamur Phutuki Chapori	Jorhat	Village	Rural	598	2820	52.41135	47.58865	372.3518

210	2	Phulguri Nepali	Sonitpur West	Village	Rural	286	1506	50.2656	49.7344	179.294
211	2	Ghogora Req Grant	Sonitpur West	Village	Rural	139	687	54.58515	45.41485	187.8431
212	2	Garudharia Gaon	Dibrugarh	Village	Rural	190	980	51.53061	48.46939	575.5987
213	2	Kathal Guri	Sonitpur West	Village	Rural	100	501	50.8982	49.1018	151.4831
214	2	Rangali Pathar	Dibrugarh	Village	Rural	296	1333	50.93773	49.06227	166.6303
215	2	Ahom Gaon	Doom-dooma	Village	Rural	243	1115	49.41704	50.58296	290.7959
216	2	Lazai Miri Gaon	Dibrugarh	Village	Rural	316	1830	51.20219	48.79781	168.702
217	2	Romai Gabharu	Doom-dooma	Village	Rural	361	1849	51.64954	48.35046	67.51854
218	2	Rabar Guri Gaon	Doom-dooma	Village	Rural	91	456	48.68421	51.31579	304.6103
219	2	Nakoidhara	Dibrugarh	Village	Rural	54	265	48.67925	51.32075	376.3884
220	2	Jungthung Jungthung	Nagaon Territorial	Village	Rural	1	3	66.66667	33.33333	179.3975
221	2	Kalakhowa Gaon	Jorhat	Village	Rural	707	3137	50.36659	49.63341	189.6631
222	2	Pachim Matia	Goalpara	Village	Rural	911	4405	50.30647	49.69353	681.2726
223	2	Singari Basti	Nagaon South	Village	Rural	455	2311	50.62743	49.37257	235.4171
224	2	Chiring Khat	Dibrugarh	Village	Rural	110	504	51.38889	48.61111	257.7038
225	2	Karibil Kachari	Sonitpur East	Village	Rural	152	696	50.71839	49.28161	126.7643
226	2	Satai Ban Gaon	Sonitpur West	Village	Rural	334	1888	51.27119	48.72881	2788.97
227	2	Sonai Nepali	Sonitpur West	Village	Rural	276	1514	44.45178	55.54822	165.0175
228	2	Sadharu Ghop	Sonitpur East	Village	Rural	160	768	52.08333	47.91667	277.6587
229	2	Biswanath Chariali	Sonitpur East	Town	Urban	4454	19145	51.03682	48.96318	582.4889
230	2	Rangbong Pathar	Golaghat	Village	Rural	202	1072	51.49254	48.50746	334.9858
231	2	Shyamraipur Bagan	Golaghat	Village	Rural	91	401	52.1197	47.8803	540.2611
232	2	Dabli	Goalpara	Village	Rural	172	847	50.41322	49.58678	460.5748
233	2	Bebejia Likchan	Kaziranga	Village	Rural	163	823	51.15431	48.84569	389.4344
234	2	Bilbagan	North Lakhimpur	Village	Rural	13	90	45.55556	54.44444	636.0287
235	2	Kuruabahi Satra	Golaghat	Village	Rural	772	3641	50.31585	49.68415	741.4519
236	2	Hatibandha	North Lakhimpur	Village	Rural	123	635	49.6063	50.3937	316.9605
237	2	Ouguri Chapori	Golaghat	Village	Rural	324	1564	49.87212	50.12788	157.0711
238	2	Moniram Tisso	Karbi Anglong East	Village	Rural	5	54	57.40741	42.59259	303.9949
239	2	Daha Chuburi	Udalguri	Village	Rural	297	1295	48.57143	51.42857	270.6868
240	2	Sonari Gaon	Nagaon Territorial	Village	Rural	645	3183	51.02105	48.97895	750.5949

241	2	Natum Salo-na T E	Nagaon Territorial	Village	Rural	281	1389	49.74802	50.25198	334.5397
242	2	Purana Sadiya	Doom-dooma	Village	Rural	121	661	49.01664	50.98336	830.5182
243	2	Ram Hari Char Pt Iii	Goalpara	Village	Rural	112	657	51.90259	48.09741	594.4476
244	2	Moh Khuti	Karbi Anglong East	Village	Rural	89	440	52.72727	47.27273	418.6021
245	2	Hindu Gaon	North Lakhimpur	Village	Rural	153	728	51.78571	48.21429	135.6443
246	2	Kursapakhri Pt I	Goalpara	Village	Rural	249	1207	52.60978	47.39022	482.6633
247	2	Bormota	Sonitpur East	Village	Rural	424	1957	51.20082	48.79918	168.8222
248	2	Patpara Pt Iii	Goalpara	Village	Rural	60	268	53.73134	46.26866	117.9123
249	2	Thekashu Pt I CT	Goalpara	Town	Urban	993	4384	50.27372	49.72628	179.6175
250	2	Tarapara	Goalpara	Village	Rural	623	2783	51.1678	48.8322	201.2936
251	2	Pengerigarh Grant	Doom-dooma	Village	Rural	917	4378	50.18273	49.81727	619.7687
252	2	Mali Pather Gaon	Dibrugarh	Village	Rural	181	878	52.3918	47.6082	195.6067
253	2	Upartola Pt Iii	Goalpara	Village	Rural	318	1428	49.92997	50.07003	186.4866
254	2	Naharani Reserve Grant	Sonitpur West	Village	Rural	115	566	49.29329	50.70671	126.8413
255	2	Sar Ik Rong-phar	Karbi Anglong East	Village	Rural	15	94	54.25532	45.74468	678.8913
256	2	Benjamin Taro	Karbi Anglong East	Village	Rural	37	188	48.93617	51.06383	30.30078
257	2	Lukhurakho-nia Gaon	Golaghat	Village	Rural	233	1131	50.30946	49.69054	485.6063
258	2	Narlongati Adorsha Rongpi	Karbi Anglong East	Village	Rural	32	193	47.66839	52.33161	25.06306
259	2	Borjuri T E	Kaziranga	Village	Rural	245	1201	50.45795	49.54205	317.0533
260	2	Bokulbari	North Lakhimpur	Village	Rural	119	578	52.07612	47.92388	155.5593
261	2	Silapani	Goalpara	Village	Rural	689	3544	51.21332	48.78668	169.4353
262	2	Kahibari Pt I	Goalpara	Village	Rural	72	339	50.14749	49.85251	365.1924
263	2	Sarthe Tisso Gaon	Karbi Anglong East	Village	Rural	0	0	0	0	173.5641
264	2	Rajmitapan-tai	Goalpara	Village	Rural	485	2606	51.72678	48.27322	243.6301
265	2	Nidanpur Pt Ii CT	Goalpara	Town	Urban	1490	7954	50.99321	49.00679	242.6951
266	2	Sunderpara Pt Iv	Goalpara	Village	Rural	1543	6969	50.26546	49.73454	293.7898
267	2	Dhekiajuli Ahom	North Lakhimpur	Village	Rural	67	289	49.82699	50.17301	216.3751
268	2	Bengenak-howa Grant	Golaghat	Village	Rural	712	3332	51.17047	48.82953	301.8401
269	2	Bhoga Gaon	Golaghat	Village	Rural	560	2542	56.05822	43.94178	167.8031
270	2	Bongaon	Golaghat	Village	Rural	701	3174	50.81916	49.18084	472.2192

271	2	Wopeng Rongpi Gaon	Karbi Anglong East	Village	Rural	17	89	50.5618	49.4382	649.6636
272	2	Tezpur	Sonitpur East	Town	Urban	17808	75540	51.28409	48.71591	1323.871
273	2	Lumding Rly Col CT	Nagaon South	Town	Urban	5425	22658	50.82973	49.17027	324.3396
274	2	Rajabahar Gaon	Jorhat	Village	Rural	122	589	49.06621	50.93379	252.2421
275	2	Bhairab-kunda	Udalguri	Village	Rural	50	273	52.74725	47.25275	124.3699
276	2	Khalingdu-ar Rf	Udalguri	Village	Rural	635	3065	51.41925	48.58075	5723.861
277	2	Damara Patpara CT	Goalpara	Town	Urban	955	4922	49.34986	50.65014	841.9427
278	2	Dumopaham N C	Kamrup	Village	Rural	31	200	51	49	2292.101
279	1	Amguri	Chirang	Village	Rural	102	475	50.10526	49.89474	216.0598
280	1	Simlaguri Forest Block	Chirang	Village	Rural	483	2243	52.29603	47.70397	1356.006
281	1	Dibuwal Dihingia Gaon	Dibrugarh	Village	Rural	615	2906	50.44735	49.55265	199.2419
282	1	Pachim Salpara	Nagaon Wildlife	Village	Rural	659	3621	51.09086	48.90914	496.8688
283	1	Podomani	Nagaon South	Village	Rural	456	2491	51.98715	48.01285	196.2817
284	1	Barkandoli Grant	Nagaon Territorial	Village	Rural	181	872	49.65596	50.34404	264.5783
285	1	Paharpur	Baksa	Village	Rural	260	1334	49.32534	50.67466	352.6649
286	1	Karkhela	Baksa	Village	Rural	186	993	52.46727	47.53273	276.8562
287	1	Kalipur	Baksa	Village	Rural	92	428	48.59813	51.40187	244.6088
288	1	Kalipur	Baksa	Village	Rural	192	891	49.83165	50.16835	212.6046
289	1	Mahendra Nagar	Baksa	Village	Rural	302	1454	51.51307	48.48693	436.105
290	1	Tangabari	Baksa	Village	Rural	255	1276	50.94044	49.05956	177.0266
291	1	Udmari	Udalguri	Village	Rural	244	1498	55.14019	44.85981	244.7296
292	1	Dighali Chapori	Sonitpur East	Village	Rural	16	99	51.51515	48.48485	63.01257
293	1	Tukrajhar Ii	Chirang	Village	Rural	110	525	45.90476	54.09524	257.9282
294	1	Puradia	Chirang	Village	Rural	171	833	49.81993	50.18007	280.2593
295	1	Dakhin Dimoria	Kamrup	Village	Rural	280	1339	50.26139	49.73861	175.1626
296	1	Barangajuli	Udalguri	Village	Rural	256	1450	54.62069	45.37931	616.2757
297	1	Kumar Kai-barta Gaon CT	Jorhat	Town	Urban	1829	8056	50.8565	49.1435	305.4588
298	1	Dolaigaon Pt I Ii and Iii	Chirang	Village	Rural	957	4185	51.6129	48.3871	247.428
299	1	Jarabari Pathar	Kamrup	Village	Rural	0	0	0	0	259.8586
300	1	Dakhin Pat	Doom-dooma	Village	Rural	208	934	49.0364	50.9636	311.454
301	1	Naltali	Nagaon Territorial	Village	Rural	572	2557	52.28784	47.71216	417.0801

302	1	Sidhakhowa	Udalguri	Village	Rural	648	3206	51.93387	48.06613	306.2668
303	1	Sakmuthi T E	Nagaon Territorial	Village	Rural	178	857	49.35823	50.64177	552.9225
304	1	Niz Borbha-gia	Nagaon Territorial	Village	Rural	223	1035	50.14493	49.85507	214.5295
305	1	Masua	Kamrup	Village	Rural	351	1784	51.34529	48.65471	228.7812
306	1	Noakhat	Manas National Park	Village	Rural	228	1132	49.91166	50.08834	204.0538
307	1	Madarbari	Mushalpur	Village	Rural	398	2084	49.47217	50.52783	484.8873
308	1	Simlabari	Baksa	Village	Rural	876	4357	50.63117	49.36883	776.4902
309	1	Hatisal Chapori	Jorhat	Village	Rural	123	659	47.64795	52.35205	185.9211
310	1	Kotikuchia Gaon	Jorhat	Village	Rural	372	1753	51.96805	48.03195	257.7573
311	1	Bagari	Karbi Anglong East	Village	Rural	278	1223	50.77678	49.22322	435.9771
312	1	Toplakhowa	Goalpara	Village	Rural	311	1637	51.37447	48.62553	291.6066
313	1	Bakaitari Pt Ii	Goalpara	Village	Rural	422	1660	48.37349	51.62651	286.0668
314	1	Jamuguri	Sonitpur East	Village	Rural	492	2269	50.68312	49.31688	276.0035
315	1	Deorichila Bandha	Sonitpur East	Village	Rural	367	1504	49.13564	50.86436	213.2199
316	1	Niz Pub-thoria	Nagaon Territorial	Village	Rural	310	1264	46.99367	53.00633	302.0458
317	1	Jakhala-bandha Town	Nagaon Territorial	Village	Rural	1012	4625	50.57297	49.42703	153.3506
318	1	Garikuri	Nagaon Territorial	Village	Rural	258	1070	48.59813	51.40187	83.30527
319	1	Khan Baha-dur Grant	Nagaon Territorial	Village	Rural	0	0	0	0	269.2867
320	1	Phulaguri	Goalpara	Village	Rural	355	1673	50.50807	49.49193	244.5243
321	1	Bhorbhuri Gaon	Dibrugarh	Village	Rural	55	262	53.05344	46.94656	76.03411
322	1	Hajua Gaon	Baksa	Village	Rural	147	677	52.43722	47.56278	148.8414
323	1	Hahchara	Baksa	Village	Rural	313	1582	48.60936	51.39064	150.0964
324	1	Gyatigaon	Goalpara	Village	Rural	337	1474	46.47218	53.52782	226.661
325	1	Gerua Gaon	Nagaon Territorial	Village	Rural	341	1747	50.31483	49.68517	210.6115
326	1	Mornai	Goalpara	Village	Rural	628	2572	49.6112	50.3888	385.6408
327	1	Dalgoma	Goalpara	Village	Rural	392	1845	50.89431	49.10569	280.5304
328	1	Lajum Gaon	Doom-dooma	Village	Rural	78	414	50	50	286.9788
329	1	Chilimkhowa	Nagaon Territorial	Village	Rural	289	1242	50.80515	49.19485	433.4376
330	1	Longjap	Nagaon Territorial	Village	Rural	851	4114	51.0209	48.9791	815.7852
331	1	Abrar Vita	Goalpara	Village	Rural	413	2251	51.13283	48.86717	216.7919
332	1	Chabua Grant T E	Dibrugarh	Village	Rural	316	1482	50.06748	49.93252	977.9224

333	1	Athagaon	Kamrup	Village	Rural	861	3738	52.59497	47.40503	548.3087
334	1	Rupahi Bhakat Gaon	Nagaon Wildlife	Village	Rural	430	2007	49.92526	50.07474	213.6997
335	1	Mamudpur Pt Ii	Goalpara	Village	Rural	530	2623	51.27716	48.72284	145.9047
336	1	Baghjan N C	Dibrugarh	Village	Rural	25	146	50	50	734.5215
337	1	Na Gaon	Dibrugarh	Village	Rural	207	989	53.08392	46.91608	235.0091
338	1	Goalpara	Goalpara	Town	Urban	11617	53430	50.47726	49.52274	3474.943
339	1	Dhani Para	Kamrup	Village	Rural	112	553	51.35624	48.64376	128.6255
340	1	Boladmari	Goalpara	Village	Rural	589	2939	51.51412	48.48588	235.0996
341	1	Missa	Nagaon Territorial	Village	Rural	783	3887	50.34731	49.65269	466.864
342	1	Kampur Town	Nagaon Territorial	Town	Urban	2342	10371	50.42908	49.57092	751.9783
343	1	Salmara	Goalpara	Village	Rural	146	914	53.06346	46.93654	54.1108
344	1	Bormoina-paria Gaon	Jorhat	Village	Rural	323	1441	50.10409	49.89591	211.4691
345	1	Bholatar	Udalguri	Village	Rural	83	451	50.77605	49.22395	123.104
346	1	Bamunju-ligaon	Udalguri	Village	Rural	123	593	49.57841	50.42159	226.7219
347	1	Bholatar	Udalguri	Village	Rural	261	1274	53.61068	46.38932	1037.659
348	1	Ujanpara	Kamrup	Village	Rural	252	1133	51.27979	48.72021	374.5668
349	1	Naharani Basti Gaon	Sonitpur West	Village	Rural	241	1310	50.22901	49.77099	790.268
350	1	Rahini Bil Gaon	Sonitpur West	Village	Rural	141	723	51.59059	48.40941	143.1169
351	1	Patidoi Bher-ala Gaon	Sonitpur West	Village	Rural	974	4891	51.31875	48.68125	207.0765
352	1	Hatbor	Sonitpur East	Village	Rural	325	1512	50.92593	49.07407	400.322
353	1	Metera	Sonitpur East	Village	Rural	18	107	53.27103	46.72897	206.7196
354	1	Balikuchi	Kamrup	Village	Rural	110	579	54.05872	45.94128	223.9054
355	1	Bedeti T E	Sonitpur East	Village	Rural	322	1397	48.17466	51.82534	307.221
356	1	Bihmari Jarani	Sonitpur East	Village	Rural	263	1432	50.83799	49.16201	403.6308
357	1	Nathkuchi	Kamrup	Village	Rural	656	2986	50	50	612.5348
358	1	Garikuri	Sonitpur East	Village	Rural	54	252	47.61905	52.38095	187.6943
359	1	Atherikhat T E	Udalguri	Village	Rural	679	3172	48.92812	51.07188	225.9699
360	1	Barangajuli T E	Udalguri	Village	Rural	703	3350	48.38806	51.61194	632.4432
361	1	Mazbat T E	Udalguri	Village	Rural	310	1602	48.31461	51.68539	257.0894
362	1	Hatibill	Udalguri	Village	Rural	103	486	52.88066	47.11934	163.5989
363	1	Bhogdal	Sonitpur West	Village	Rural	236	1235	51.90283	48.09717	271.4048
364	1	Paghali	Nagaon Territorial	Village	Rural	800	3483	49.35401	50.64599	234.9102

365	1	Sal Forest Dakur Vita	Goalpara	Village	Rural	50	245	49.38776	50.61224	273.166
366	1	Hatichungi Moran Gaon	Jorhat	Village	Rural	227	1009	49.05847	50.94153	215.5754
367	1	Chotohapjan T E	Sonitpur West	Village	Rural	42	192	50.52083	49.47917	161.2694
368	1	Rangajan Grant	Jorhat	Village	Rural	357	1652	49.6368	50.3632	264.0981
369	1	Handique Gaon	Jorhat	Village	Rural	2	5	60	40	176.884
370	1	Charala Pathar	Nagaon Territorial	Village	Rural	0	0	0	0	180.5866
371	1	Tiniali Bazar	Nagaon South	Village	Rural	324	1744	52.52294	47.47706	286.4366
372	1	Niz Bahbari	Sonitpur West	Village	Rural	299	1524	50.98425	49.01575	403.7632
373	1	Dekar Gaon	Sonitpur West	Village	Rural	153	784	53.31633	46.68367	370.7254
374	1	Bogar Gaon	Jorhat	Village	Rural	211	959	52.45047	47.54953	240.7137
375	1	Panbari	Sonitpur West	Village	Rural	135	692	48.55491	51.44509	147.1446
376	1	Hatibari T E	Sonitpur West	Village	Rural	75	347	47.26225	52.73775	109.2168
377	1	Tamukubari Pt Ii	Goalpara	Village	Rural	302	1298	51.92604	48.07396	81.61715
378	1	Dongpara	Nagaon Territorial	Village	Rural	224	1277	49.96085	50.03915	537.4335
379	1	Jaypur Chah Bagicha	Dibrugarh	Village	Rural	619	2879	50.64258	49.35742	243.6714
380	1	Chakali Bhoria Gaon	Dibrugarh	Village	Rural	193	900	50.88889	49.11111	168.8881
381	1	Raidang Bongali Gaon	Doom-dooma	Village	Rural	59	296	50.67568	49.32432	105.4322
382	1	Baghbari Gaon	Doom-dooma	Village	Rural	183	912	49.67105	50.32895	119.5258
383	1	Dipotahat Khola	Sonitpur West	Village	Rural	606	2706	49.37177	50.62823	235.957
384	1	Kakapathar	Doom-dooma	Village	Rural	190	939	50.90522	49.09478	229.8801
385	1	Dangari Pathar	Doom-dooma	Village	Rural	1	6	66.66667	33.33333	95.75766
386	1	Gakhir Bheti Gaon	Doom-dooma	Village	Rural	151	823	50.30377	49.69623	142.1316
387	1	Raja Pahar	Nagaon Territorial	Village	Rural	7	31	38.70968	61.29032	59.80448
388	1	Dhanuhar Basti	Nagaon South	Village	Rural	792	4192	52.09924	47.90076	519.6397
389	1	Ambari	Goalpara	Village	Rural	791	4108	51.85005	48.14995	193.6614
390	1	Maran Gaon	Sonitpur East	Village	Rural	581	2859	51.06681	48.93319	253.9135
391	1	Sidhabari Pt I	Goalpara	Village	Rural	618	2960	49.39189	50.60811	333.4179
392	1	Grant	Jorhat	Village	Rural	1475	6893	50.96475	49.03525	1086.149
393	1	Radhanagar	Nagaon South	Village	Rural	670	3111	50.17679	49.82321	322.7199
394	1	Pabhoi T E	Sonitpur East	Village	Rural	340	1603	49.46974	50.53026	190.9612

395	1	Pabhoi T E	Sonitpur East	Village	Rural	69	347	48.41499	51.58501	163.5553
396	1	Pub Matia	Goalpara	Village	Rural	249	1045	50.90909	49.09091	95.19511
397	1	Niz Biswa-nath	Sonitpur East	Village	Rural	500	2511	51.89168	48.10832	49.19786
398	1	Bhoraguri	Nagaon Territorial	Village	Rural	246	1097	49.68095	50.31905	358.7699
399	1	Ranga Gara Huzz	Nagaon Territorial	Village	Rural	1046	4985	51.334	48.666	177.0402
400	1	Borogandua	Goalpara	Village	Rural	10	67	50.74627	49.25373	95.60174
401	1	Bhogbari Satra Bhog-bari Pathar	Nagaon South	Village	Rural	125	530	52.83019	47.16981	208.7774
402	1	Lanka Mb	Nagaon South	Town	Urban	7406	36805	51.16153	48.83847	472.8161
403	1	Am Tola Bori	Sonitpur East	Village	Rural	161	718	51.81058	48.18942	235.2847
404	1	Ameloga F V	Sonitpur West	Village	Rural	69	348	43.10345	56.89655	223.8363
405	1	Palash Pather Gaon	Sonitpur West	Village	Rural	514	2504	51.39776	48.60224	179.9308
406	1	Dopdopi	Sonitpur West	Village	Rural	334	1634	50.97919	49.02081	153.1968
407	1	Chakalia	Dibrugarh	Village	Rural	301	1612	49.87593	50.12407	187.5554
408	1	Barbari Amc Area CT	Doom-dooma	Town	Urban	626	2884	50.55479	49.44521	396.4319
409	1	Bhalukjuli	Goalpara	Village	Rural	31	168	50.59524	49.40476	120.4584
410	1	Deulguri Pt Ii	Goalpara	Village	Rural	108	527	49.33586	50.66414	309.6883
411	1	Dijoo Pathar	North Lakhimpur	Village	Rural	511	2525	50.73267	49.26733	263.2027
412	1	Thurajan Grant	Golaghat	Village	Rural	278	1304	50.6135	49.3865	318.12
413	1	Joying Gaon	North Lakhimpur	Village	Rural	299	1469	48.80871	51.19129	444.1961
414	1	Borbil	Dibrugarh	Village	Rural	362	2056	52.6751	47.3249	458.0679
415	1	Hemari Tisso	Karbi Anglong East	Village	Rural	23	113	53.09735	46.90265	70.04852
416	1	Nagachang Amlaiguri Basti	Karbi Anglong East	Village	Rural	12	54	50	50	401.1654
417	1	Affala Gaon	Golaghat	Village	Rural	256	1523	53.57846	46.42154	585.8241
418	1	Da Gaon	Golaghat	Village	Rural	395	1720	52.55814	47.44186	136.7042
419	1	Barchapari Bagicha	Kaziranga	Village	Rural	1226	5793	49.6116	50.3884	634.6975
420	1	Kangther Kramsa	Golaghat	Village	Rural	9	42	57.14286	42.85714	5134.593
421	1	Behora	Golaghat	Village	Rural	852	4054	49.08732	50.91268	476.4701
422	1	Ujirer Char Nc Fakir Para	Goalpara	Village	Rural	4	21	38.09524	61.90476	568.1162
423	1	Charai Kuruka	Sonitpur East	Village	Rural	0	0	0	0	265.3509
424	1	Kalyanpur	Goalpara	Village	Rural	35	164	51.82927	48.17073	276.8642

425	1	Daimukhiya Gaon	Doom-dooma	Village	Rural	417	2046	51.51515	48.48485	150.1017
426	1	Rakhyasini Garopara Pt Ii	Goalpara	Village	Rural	406	2204	53.35753	46.64247	160.3465
427	1	Bura Raja	Nagaon Territorial	Village	Rural	248	1250	50.8	49.2	451.071
428	1	Bhatiapara	Goalpara	Village	Rural	226	1177	54.12065	45.87935	148.6765
429	1	Dakaidal	Goalpara	Village	Rural	432	2121	51.5323	48.4677	143.8502
430	1	Seajuli Patta	North Lakhimpur	Village	Rural	168	826	51.57385	48.42615	70.95473
431	1	Dakhin Gaon Deodhani	North Lakhimpur	Village	Rural	93	440	50.68182	49.31818	97.48676
432	1	Diplonga	Sonitpur East	Village	Rural	85	390	53.33333	46.66667	84.11767
433	1	Arun Bagan	Sonitpur West	Village	Rural	252	1267	50.67088	49.32912	260.6512
434	1	Pub Dairang	Goalpara	Village	Rural	342	1980	53.28283	46.71717	579.8404
435	1	Ratnapur	Sonitpur West	Village	Rural	53	237	46.83544	53.16456	39.40065
436	1	Lal Tapu	Sonitpur East	Village	Rural	342	2013	50.91903	49.08097	1744.873
437	1	Khekapara	Goalpara	Village	Rural	221	1024	50.97656	49.02344	316.9442
438	1	Dighali	Goalpara	Village	Rural	171	780	47.94872	52.05128	517.8687
439	1	Boistompara	Goalpara	Village	Rural	277	1403	50.81967	49.18033	193.2283
440	1	Sarapara Pt Ii	Goalpara	Village	Rural	164	735	50.47619	49.52381	218.1876
441	1	Kathakuthi Pt I	Goalpara	Village	Rural	509	2309	50.93114	49.06886	179.6238
442	1	Pub Jira	Goalpara	Village	Rural	286	1463	49.96582	50.03418	317.6538
443	1	Na Pam Gaon	Sonitpur East	Village	Rural	904	4105	51.32765	48.67235	186.8058
444	1	Kathakuthi Pt Vi	Goalpara	Village	Rural	110	494	48.38057	51.61943	150.8887
445	1	Maila Gaon	Sonitpur West	Village	Rural	120	536	51.49254	48.50746	439.6371
446	1	Joyram Engti	Karbi Anglong East	Village	Rural	18	86	55.81395	44.18605	258.1152
447	1	Kharuvas	Goalpara	Village	Rural	813	4411	50.17003	49.82997	322.7684
448	1	Madhurana Terang F V	Karbi Anglong East	Village	Rural	63	344	52.61628	47.38372	342.5442
449	1	Wive Rongpi	Karbi Anglong East	Village	Rural	14	82	51.21951	48.78049	204.7001
450	1	Kakajan Gaon	Doom-dooma	Village	Rural	195	986	49.4929	50.5071	352.8928
451	1	Borbil	Dibrugarh	Village	Rural	292	1378	51.23367	48.76633	229.6575
452	1	Ananda Bagan	North Lakhimpur	Village	Rural	562	2714	51.28961	48.71039	595.2891
453	1	Panidaria Gaon	Dibrugarh	Village	Rural	327	1527	50.55665	49.44335	64.80041

454	1	Sensowa	Golaghat	Village	Rural	140	621	51.52979	48.47021	250.9065
455	1	Abhaipuria Gaon	Dibrugarh	Village	Rural	107	571	50.08757	49.91243	105.6041
456	1	Maj Kapa-huwa	Dibrugarh	Village	Rural	261	1295	51.04247	48.95753	236.4299
457	1	Sing Bey	Karbi Anglong East	Village	Rural	27	124	47.58065	52.41935	20.13036
458	1	Longthu Rongphar F V	Karbi Anglong East	Village	Rural	48	289	49.13495	50.86505	50.43984
459	1	Sarapara	Goalpara	Village	Rural	383	1859	52.77031	47.22969	417.6165
460	1	Khilamara	Goalpara	Village	Rural	98	529	48.9603	51.0397	143.4369
461	1	Barigaon	Goalpara	Village	Rural	166	828	51.69082	48.30918	441.3495
462	1	Chondro Rongpi Gaon	Karbi Anglong East	Village	Rural	16	89	49.4382	50.5618	257.9365
463	1	Langteroi	Karbi Anglong East	Village	Rural	14	82	41.46341	58.53659	166.1295
464	1	Nanda Mura	Karbi Anglong East	Village	Rural	12	54	50	50	1574.206
465	1	Ambari	Karbi Anglong East	Village	Rural	53	240	57.08333	42.91667	1141.06
466	1	Phulbari Gaon	Golaghat	Village	Rural	126	616	49.51299	50.48701	407.7642
467	1	Bura Phang-so	Karbi Anglong East	Village	Rural	0	0	0	0	658.7437
468	1	Phuloni Bazar	Karbi Anglong East	Village	Rural	80	373	53.8874	46.1126	16.02016
469	1	Longki Milik	Kaziranga	Village	Rural	14	63	49.20635	50.79365	306.6207
470	1	Central Range Manja	Karbi Anglong East	Village	Rural	280	1509	51.02717	48.97283	235.4369
471	1	Pak Et Bey	Karbi Anglong East	Village	Rural	44	334	45.80838	54.19162	63.99315
472	1	Biren Teron	Karbi Anglong East	Village	Rural	17	96	55.20833	44.79167	97.17559
473	1	Karkashi	Goalpara	Village	Rural	218	919	49.51034	50.48966	281.3955
474	1	Kothal Bagan	Karbi Anglong East	Village	Rural	29	158	53.79747	46.20253	1168.959
475	1	Kharijapikon CT	Goalpara	Town	Urban	1141	5550	51.06306	48.93694	208.2752
476	1	Ketkibari	Goalpara	Village	Rural	192	880	48.75	51.25	105.3541
477	1	Damribhasa	Goalpara	Village	Rural	587	2976	50.60484	49.39516	191.4456
478	1	Fenkhati Gaoni	North Lakhimpur	Village	Rural	233	1071	51.2605	48.7395	186.1456
479	1	Rupkotia	Golaghat	Village	Rural	273	1253	52.59377	47.40623	405.7903
480	1	Dhekial Gaon	Golaghat	Village	Rural	459	2082	47.88665	52.11335	293.4218

481	1	Senchowa	North Lakhimpur	Village	Rural	92	481	50.31185	49.68815	215.3497
482	1	Sissupani	Kaziranga	Village	Rural	30	145	54.48276	45.51724	100.5387
483	1	Tinsukia	Dibrugarh	Town	Urban	25845	116322	53.56081	46.43919	1862.465
484	1	Rajapukhuri	Karbi Anglong East	Village	Rural	570	2453	49.28659	50.71341	742.6504
485	1	Hatibari T E	Sonitpur West	Village	Rural	144	745	47.65101	52.34899	152.4314
486	1	Patgaon T E Harchura	Sonitpur West	Village	Rural	63	319	50.47022	49.52978	471.8594
487	1	Lepetkatta Bagisha	Dibrugarh	Village	Rural	106	515	48.34951	51.65049	234.5472
488	1	Dolang Basti F V	Sonitpur West	Village	Rural	23	102	42.15686	57.84314	257.658
489	1	Bosa Gaon	Jorhat	Village	Rural	311	1484	50.9434	49.0566	519.1356
490	1	Bam Gaon	Sonitpur West	Village	Rural	168	819	49.93895	50.06105	122.3174
491	1	Udmari Gaon	Sonitpur East	Village	Rural	152	690	47.3913	52.6087	140.3557
492	1	Panipota T E	Sonitpur West	Village	Rural	148	667	48.42579	51.57421	365.5337
493	1	Pub Samarali	Nagaon Territorial	Village	Rural	576	3278	50.15253	49.84747	985.2367
494	1	Patgaon	Kamrup	Village	Rural	146	664	49.09639	50.90361	131.2937
495	1	Phoolbari	Udalguri	Village	Rural	145	726	53.58127	46.41873	112.3723
496	1	Ajagar Pahar N C	Goalpara	Village	Rural	167	977	52.20061	47.79939	3556.649
497	1	Nonke Suk-labagan	Udalguri	Village	Rural	190	1031	54.60718	45.39282	1048.262
498	1	Napun	Jorhat	Village	Rural	142	926	53.34773	46.65227	291.5071
499	1	Sikari Tisso	Karbi Anglong East	Village	Rural	20	98	51.02041	48.97959	605.4144
500	1	Mongrai	Goalpara	Village	Rural	83	442	49.54751	50.45249	213.042
501	1	Jaldhapara	Goalpara	Village	Rural	103	478	50.83682	49.16318	67.99924
502	1	Chatabari Pt Ii	Goalpara	Village	Rural	123	534	51.68539	48.31461	672.7226
503	1	Santipur	North Lakhimpur	Village	Rural	248	1243	49.47707	50.52293	494.2212
504	1	Saboltari	Goalpara	Village	Rural	443	2314	49.87035	50.12965	303.5466

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