

Human wildlife conflict in forest fringe and mitigation strategies with reference to Goalpara District, Assam

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ABSTRACT

The present study investigates human–wildlife conflict in forest fringe areas of Goalpara district, Assam, with a focus on identifying its patterns, causes, impacts, and mitigation strategies. The study is based on primary data collected through household surveys, interviews, and focused group discussions, along with secondary data from forest department records and relevant literature. The findings reveal that crop damage is the most common form of conflict, primarily caused by elephants with peak incidents occurring during the harvesting and monsoon seasons. Significant economic losses, particularly in agriculture, highlight the vulnerability of rural livelihoods dependent on farming. The study also identifies key drivers of conflict such as habitat fragmentation, deforestation, agricultural expansion, and the absence of effective wildlife corridors. Although local communities employ various traditional and modern mitigation measures, their effectiveness remains limited due to lack of resources and long-term planning. Overall, the study emphasizes the need for integrated conflict management strategies combining ecological restoration, improved compensation mechanisms, and community-based conservation approaches to reduce human–wildlife conflict in the region.

Keywords: Human–Wildlife, Investigates, Mitigation Strategies, Forest Fringe, Agriculture.

1. INTRODUCTION

Human-wildlife conflict (HWC) has become an urgent social and environmental problem in regions that are rich in biodiversity as a result of the rising overlap between human settlements and natural areas. This is particularly true in countries that are still developing. Animals are forced to seek food and shelter in places that are populated by people as a consequence of habitat fragmentation, which has been caused by deforestation, the construction of infrastructure, and the expansion of agricultural production. Studies conducted on conservation on a global scale have shown that over the last two decades, HWC outbreaks have been much more frequent and severe, having an effect not only on human livelihoods but also on wildlife populations [1][2]. Conflict situations are very prevalent in forest fringe areas in India, which is a key problem for both policy and management [3]. This is because forest ecosystems in India maintain a large variety of animals.

In the context of India, human-wildlife conflict is closely related with changes in land use, population pressure, and a decline in the quality of the forest. Elephants and other herbivores have been known to cause damage to crops and property in a number of states, including Assam, Uttarakhand, Karnataka,

and Odisha. These states have recorded several incidences involving these animals. It has been noted by the Ministry of Environment, Forest, and Climate Change (MoEFCC) that these conflicts are not just ecological problems, but also major challenges to the livelihoods of rural communities who are reliant on agricultural and forest resources [4]. Elephants are responsible for a considerable number of crop raids and human deaths in Northeast India, particularly in fragmented forest landscapes, according to studies [5]. This is especially true in areas where the forest landscape is fractured. Retaliatory measures against animals are often taken as a result of these confrontations, which further exacerbates the difficulties associated with conservation.

Because of its deep forest cover, abundant animal population, and quickly developing human settlements, Assam is one of the most conflict-prone areas in India. It is situated in the Eastern Himalayan biodiversity hotspot, which is one of the most important biodiversity hotspots in the world. In spite of the fact that the state is home to significant elephant corridors and protected areas, traditional migration routes have been interrupted as a result of increased encroachment and habitat degradation. According to research, human-elephant conflict is most acute in the villages on the outskirts of Assam, which are located in areas where seasonal agricultural cultivation encourages animal activity [6]. Due to the fact that the cohabitation of agricultural and wildlife in close vicinity has resulted in recurrent economic losses, social suffering, and occasional human deaths, this field has become an essential one for the study of conflict mitigation [7].

The Goalpara district, which is the subject of the current investigation, is situated in a crucial location in lower Assam. It shares biological borders with surrounding wooded landscapes that are home to a wide variety of animal species. The forest edge regions of this district are often visited by elephants, particularly during the harvesting and cropping seasons. This is especially true at the times of year when the fields are being harvested. Previous regional evaluations have suggested that the fragmentation of habitats, the reduction in forest cover, and the absence of buffer zones that are effective are important causes of conflict in this area [8]. In addition, the problem has been further compounded by the poor efficacy of compensation systems and customary mitigating techniques, which has led to unhappiness among the people who are directly affected [9].

It is necessary to take a multi-faceted strategy in order to reduce the amount of conflict that occurs between humans and animals. This approach should include ecological restoration, community engagement, and public policy initiatives. There have been suggestions made on successful techniques for lessening the severity of conflicts [10]. Some of these initiatives include the restoration of habitat connectivity, early warning systems, solar fence, and community-based monitoring. On the other hand, the effectiveness of these policies is primarily dependent on the competence of local officials to execute them and the ongoing backing of the government. Under these circumstances, it is of the utmost need to investigate the patterns, causes, and tactics for mitigating human-wildlife conflict in the Goalpara area in order to create solutions that are particular to the region and guarantee the preservation of wildlife as well as the protection of livelihoods.

2. OBJECTIVES

- To analyze the nature, frequency, and patterns of human–wildlife conflict in forest fringe areas of Goalpara district, Assam.
- To identify the major causes and socio-economic impacts of human–wildlife conflict on local communities.
- To assess existing mitigation strategies and evaluate their effectiveness in reducing human–wildlife conflict.

3. METHODOLOGY

3.1 Study Area Description

The present study was conducted in the forest fringe regions of Goalpara district, Assam, which is characterized by dense forest patches, agricultural land, and human settlements in close proximity to protected forest areas. The region forms an important ecological transition zone where frequent movement of wild animals, especially elephants, is observed into human habitation areas. The selection of this study area is based on the high incidence of human–wildlife conflict incidents reported over recent years, including crop damage, property destruction, and occasional human injuries. The socio-economic dependence of local communities on agriculture and forest resources further intensifies the interaction between humans and wildlife, making it a suitable site for examining conflict patterns and mitigation strategies.

3.2 Research Design

The study adopted a descriptive and analytical research design to systematically examine the nature, causes, and mitigation strategies of human–wildlife conflict in the selected forest fringe areas. A mixed-method approach was used, combining both quantitative and qualitative data to ensure a comprehensive understanding of the issue. Quantitative data helped in assessing the frequency, type, and severity of conflict incidents, while qualitative insights were used to understand community perceptions, adaptive responses, and existing mitigation practices. This design allowed for an in-depth interpretation of the socio-ecological dynamics influencing human–wildlife interactions in the study region.

3.3 Data Collection Methods

Primary data were collected through structured household surveys, semi-structured interviews, and focused group discussions (FGDs) with local residents living in the forest fringe villages of Goalpara district. Key informant interviews were also conducted with forest officials, local leaders, and wildlife management personnel to gather expert perspectives on conflict management practices. Secondary data were obtained from forest department reports, government publications, and relevant research studies. The combination of multiple data sources ensured data triangulation and improved the reliability and validity of the findings.

3.4 Sampling Technique and Sample Size

A multistage sampling technique was employed to select representative villages and respondents from the forest fringe areas. Initially, conflict-prone villages were identified based on forest department records and local reports. From these villages, households were selected using a simple random sampling method to avoid selection bias. The sample size was determined based on population distribution and research feasibility, ensuring adequate representation of different socio-economic groups. This approach helped in capturing diverse experiences of human–wildlife conflict across the study area.

3.5 Data Analysis Techniques

The collected data were analyzed using both descriptive and inferential statistical methods. Descriptive statistics such as frequency, percentage, and mean were used to summarize the nature and extent of human–wildlife conflicts. Qualitative data from interviews and FGDs were analyzed through thematic analysis to identify recurring patterns related to conflict causes, impacts, and mitigation strategies. Comparative analysis was also used to examine differences in conflict intensity across villages. The integration of quantitative and qualitative findings provided a holistic understanding of the human–wildlife conflict scenario in Goalpara district.

4. RESULTS

Table 1: Frequency of Human–Wildlife Conflict Incidents Reported by Respondents

Type of Conflict	Frequency (No. of Households)	Percentage (%)
Crop damage	162	81%
Property damage	98	49%
Human injury	21	10.5%
Livestock loss	64	32%
No major conflict	18	9%

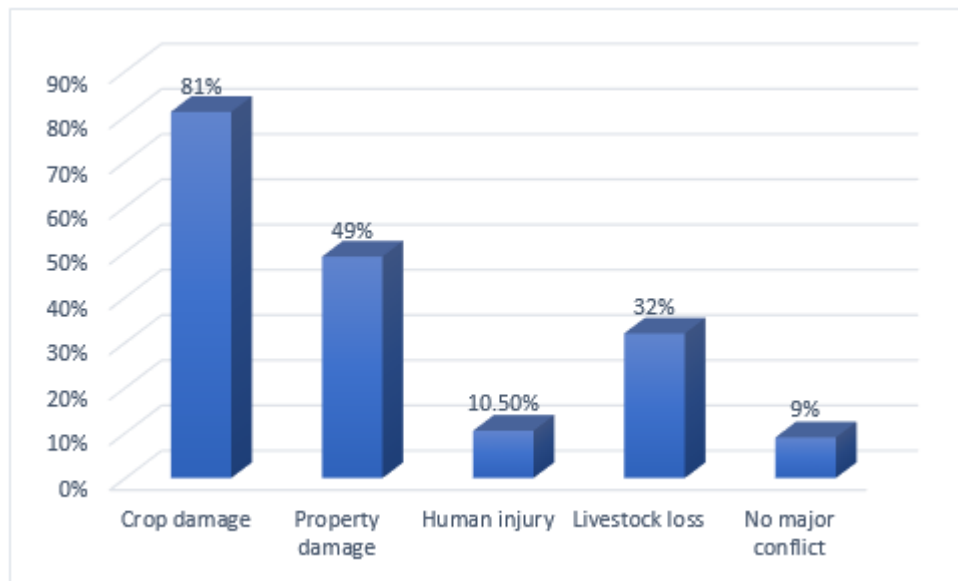


Figure 1: Frequency of Human–Wildlife Conflict Incidents Reported by Respondents

The data presented in Table and figure clearly indicate that crop damage is the most dominant form of human–wildlife conflict in the forest fringe areas of Goalpara district, affecting 81% of surveyed households. This highlights the strong dependence of local communities on agriculture, particularly paddy cultivation, which becomes highly vulnerable to wildlife intrusion. Property damage (49%) and livestock loss (32%) further reflect the expanding range of wildlife movement into human settlements, suggesting that conflict is not limited only to agricultural fields but also extends to residential areas. Although human injury cases are relatively lower (10.5%), their presence signifies a serious safety concern for villagers. The small proportion of households reporting no conflict (9%) confirms that human–wildlife interaction is widespread and persistent across the study area.

Table 2: Major Wildlife Species Involved in Conflict

Wildlife Species	Frequency of Incidents	Percentage Contribution (%)
Elephant	140	70%
Monkey	38	19%
Others	15	7.5%

Table reveals that elephants are the most significant contributors to human–wildlife conflict, accounting for 70% of reported incidents, This indicates that large-bodied herbivores and omnivores are primarily responsible for crop raiding and property destruction due to their high food requirements and mobility

across fragmented landscapes. The presence of monkeys (19%) in conflict reports further suggests that even smaller species are increasingly adapting to agricultural environments. The “others” category (7.5%) indicates minor but diverse wildlife interactions. Overall, the data reflect a strong overlap between wildlife habitats and human agricultural zones, particularly for elephant corridors, which appear to be severely disturbed in the region.

Table 3: Seasonal Variation in Conflict Incidents

Season	Conflict Intensity	Key Reason
Summer	Moderate	Water scarcity
Monsoon	High	Crop availability & movement
Winter	Very High	Harvest season
Post-harvest	Low	Reduced crop availability

The seasonal pattern shown in Table demonstrates that human–wildlife conflict intensity is not uniform throughout the year but varies significantly with climatic and agricultural cycles. The highest conflict levels occur during winter, primarily due to the harvesting season when crops such as paddy become highly attractive to wildlife. Monsoon season also records high conflict intensity as increased vegetation growth and animal movement coincide with agricultural activity. Summer shows moderate conflict due to water scarcity driving wildlife toward human settlements, while post-harvest periods experience comparatively lower conflict due to reduced food availability in fields. This seasonal fluctuation highlights the strong ecological link between wildlife behavior and agricultural practices in the study region.

Table 4: Estimated Economic Loss per Household per Year

Loss Category	Average Loss (INR)	Households Affected (%)
Crop loss	18,000–45,000	78%
Property damage	5,000–20,000	42%
Livestock loss	8,000–30,000	28%

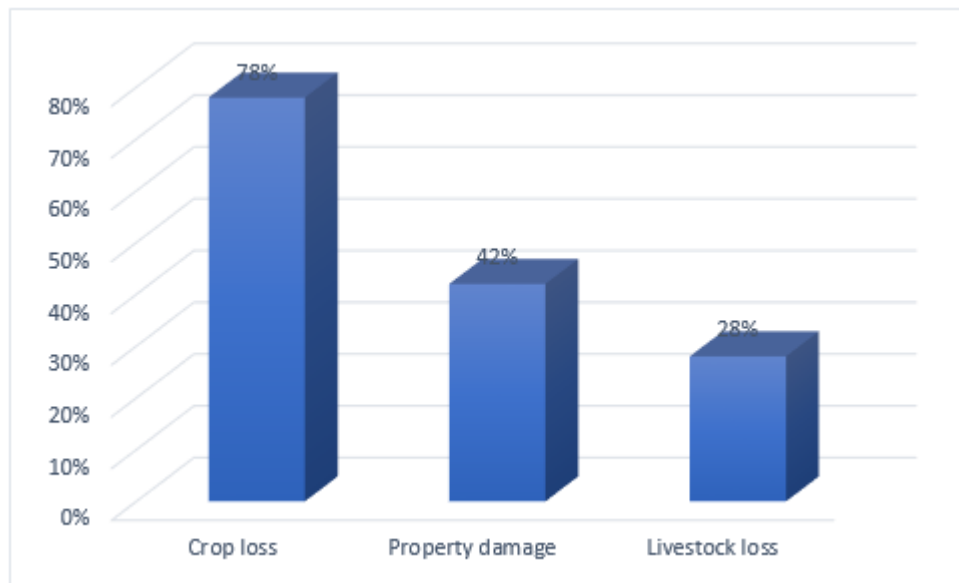


Figure 3: Estimated Economic Loss per Household per Year

The results in Table and figure demonstrate that crop loss is the most economically damaging consequence of human–wildlife conflict, with average losses ranging between INR 18,000–45,000 per household annually, affecting nearly 78% of respondents. This level of loss significantly impacts rural livelihoods, especially for small and marginal farmers who rely heavily on seasonal agriculture. Property damage (42%) and livestock loss (28%) further add to the financial burden, indicating that households face multiple layers of economic vulnerability. The cumulative effect of these losses often leads to increased debt, reduced agricultural investment, and livelihood insecurity. The findings clearly show that human–wildlife conflict is not only an ecological issue but also a major socio-economic challenge in the region.

Table 5: Causes of Human–Wildlife Conflict (Perception-Based Responses)

Cause of Conflict	Respondents Agree (%)
Habitat fragmentation	86%
Deforestation	78%
Agricultural expansion	74%
Lack of forest corridors	69%
Water scarcity in forests	61%

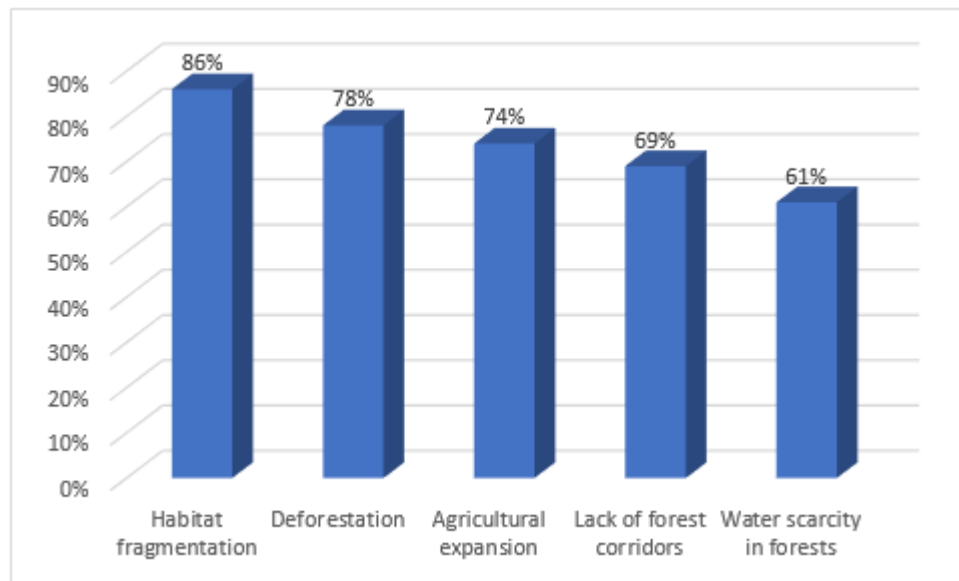


Figure 4: Causes of Human–Wildlife Conflict (Perception-Based Responses)

Table and figure highlights that habitat fragmentation (86%) is perceived as the most critical cause of human–wildlife conflict, followed closely by deforestation (78%) and agricultural expansion (74%). These findings suggest that large-scale land-use changes have significantly reduced natural wildlife habitats, forcing animals to enter human settlements in search of food and space. The lack of forest corridors (69%) further intensifies this movement by restricting safe animal migration routes. Additionally, water scarcity in forest areas (61%) contributes to seasonal wildlife displacement. Overall, the data indicate that human-induced environmental changes are the primary drivers of escalating conflict in Goalpara district.

Table 6: Mitigation Strategies Adopted by Local Communities

Mitigation Measure	Usage Rate (%)	Effectiveness Level
Fire and noise methods	72%	Low–Moderate
Solar fencing	38%	Moderate
Watch towers	45%	Moderate
Crop guarding (night)	68%	Low
Trapping/relocation	12%	Low

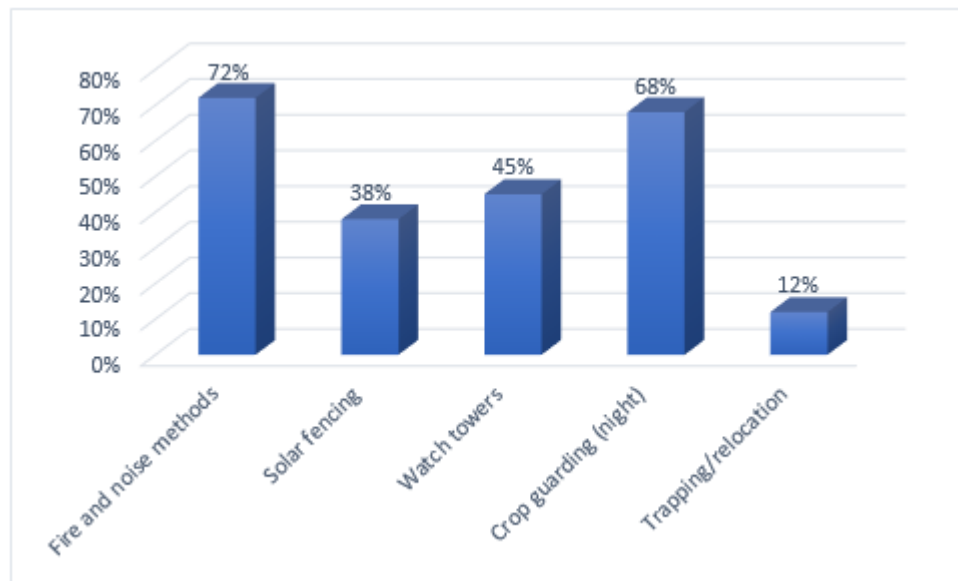


Figure 5: Mitigation Strategies Adopted by Local Communities

The findings in Table and figure show that local communities primarily rely on traditional and low-cost mitigation methods such as fire and noise-making (72%) and night-time crop guarding (68%). While these strategies are widely practiced, their effectiveness is largely limited and short-term. Measures such as solar fencing (38%) and watch towers (45%) are moderately effective but are not uniformly accessible due to cost and maintenance requirements. Trapping or relocation methods (12%) are rarely used and are often discouraged due to ecological and legal constraints. Overall, the data indicate that although communities actively attempt to protect their livelihoods, there is a lack of long-term, sustainable, and scientifically supported mitigation infrastructure

Table 7: Perception of Government Support and Compensation

Response Category	Percentage (%)
Satisfied	18%
Partially satisfied	34%
Dissatisfied	48%

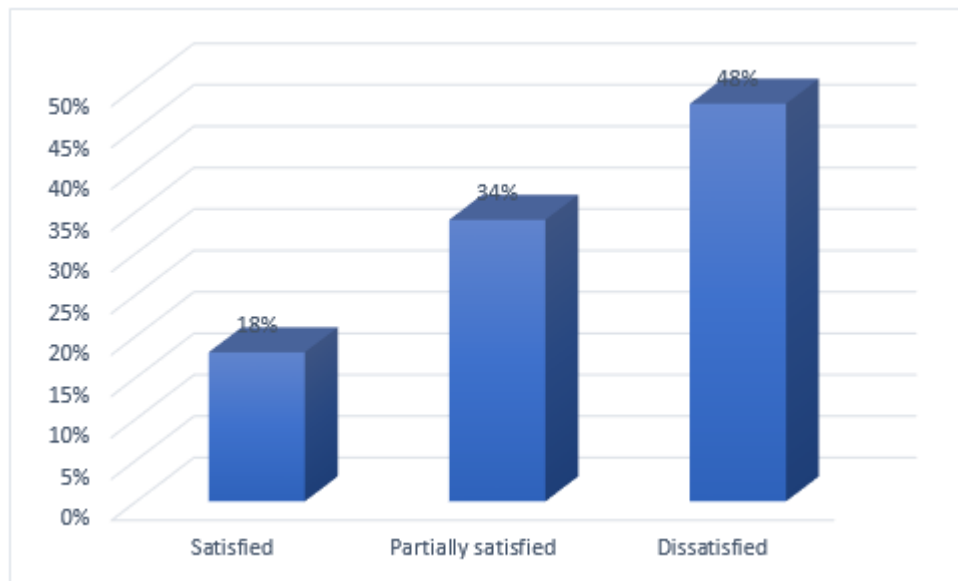


Figure 6: Perception of Government Support and Compensation

Table and figure reveals a generally negative perception of government compensation and support systems among respondents, with 48% expressing dissatisfaction and only 18% reporting satisfaction. A significant proportion (34%) falls under partial satisfaction, indicating inconsistency in compensation delivery and adequacy. The dissatisfaction is mainly attributed to delays in compensation processing, insufficient financial support, and complex claim procedures. This reflects a gap between policy implementation and ground-level realities. The findings suggest that while government schemes exist to support affected households, their effectiveness is limited due to administrative inefficiencies and lack of timely response mechanisms, thereby reducing community trust in institutional support systems.

The results clearly indicate that human–wildlife conflict in the forest fringe areas of Goalpara district is primarily driven by habitat loss, seasonal wildlife movement, and agricultural dependence. Crop damage is the most dominant impact, leading to significant economic losses for rural households. Elephants are the main conflict species, with peak incidents occurring during the harvesting season. Although several community-based mitigation strategies are practiced, their effectiveness remains limited. Furthermore, dissatisfaction with government compensation schemes highlights the need for more efficient and timely conflict management policies.

5. DISCUSSION

The findings of the present study on human–wildlife conflict in the forest fringe areas of Goalpara district, Assam, indicate that crop damage by elephants remains the most dominant form of conflict, largely driven by habitat fragmentation, agricultural expansion, and declining forest resources. These results are consistent with broader regional studies which emphasize that shrinking wildlife corridors and land-use change are primary drivers of increasing conflict intensity in Northeast India [11]. The seasonal pattern of conflict, particularly its peak during harvesting periods, further supports earlier observations that agricultural cycles strongly influence wildlife movement into human settlements. The study also highlights significant economic losses and community dissatisfaction with compensation mechanisms, reflecting systemic gaps in conflict mitigation policies and implementation at the ground

level. Similar concerns have been reported in other forest fringe regions of India, where limited effectiveness of traditional deterrent methods and weak institutional support continue to challenge long-term coexistence strategies. Overall, the results reinforce the need for integrated landscape-level planning, improved habitat connectivity, and stronger community-based mitigation approaches to achieve sustainable human–wildlife coexistence.

6. CONCLUSION

The study on human–wildlife conflict in the forest fringe areas of Goalpara district, Assam, clearly demonstrates that increasing interaction between humans and wildlife is primarily driven by habitat loss, land-use changes, and shrinking forest resources, which force animals such as elephants into agricultural and residential areas. The research highlights that crop damage and associated economic losses are the most severe consequences faced by local communities, significantly affecting their livelihood security and socio-economic stability. Although various mitigation strategies such as fencing, guarding, and traditional deterrents are being practiced, their limited effectiveness underscores the need for more sustainable and scientifically informed solutions. Furthermore, dissatisfaction with compensation mechanisms reflects gaps in policy implementation and institutional support. Therefore, a holistic approach involving habitat restoration, strengthening of wildlife corridors, community participation, and efficient government intervention is essential for long-term mitigation of human–wildlife conflict in the region.

REFERENCES

1. Natarajan, M. (2024). Rapid assessment of human–elephant conflict: a crime science approach. *Crime Science*, 13(1), 24.
2. Gross, E., Jayasinghe, N., Brooks, A., Polet, G., Wadhwa, R., & Hilderink-Koopmans, F. (2021). *A future for all: the need for human-wildlife coexistence*. WWF, Gland, Switzerland). Design and infographics by Levent Köseoglu, WWF-Netherlands Text editing by Proofread NOW. com Cover photograph: DNPWC-WWF Nepal, 3.
3. Purathekandy, A., Oommen, M. A., Wikelski, M., & Subramani, D. N. (2024). An agent-based model of elephant crop raid dynamics in the Periyar–Agasthyamalai complex, India. *Ecological Modelling*, 496, 110843.
4. Daimary, R., & Kumar, A. (2024, December). Identifying and mapping human-elephant conflict hotspots in Goalpara, Assam, Northeast India, using geospatial approaches. In *2024 IEEE India Geoscience and Remote Sensing Symposium (InGARSS)* (pp. 1-4). IEEE
5. Nayak, M., & Swain, P. K. (2022). From fear to festivity: Multi-stakeholder perspectives on human-elephant conflict and coexistence in India. *Journal of Public Affairs*, 22(2), e2496
6. Talukdar, N. R., Choudhury, P., & Ahmad, F. (2023). Assessment of spatio-temporal distribution of human-elephant conflicts: a study in Patharia Hills Reserve Forest, Assam, India. *GeoJournal*, 88(1), 383-396.

7. Anjali, P., & Subramani, D. N. (2021). Inter and intra-annual spatio-temporal variability of habitat suitability for Asian elephants in India: A random forest model-based analysis. arXiv preprint arXiv:2107.10478.
8. Daimary, R., & Kumar, A. (2024, December). Identifying and mapping human-elephant conflict hotspots in Goalpara, Assam, Northeast India, using geospatial approaches. In 2024 IEEE India Geoscience and Remote Sensing Symposium (InGARSS) (pp. 1-4). IEEE.
9. Nad, C., Roy, R., & Roy, T. B. (2022). Human elephant conflict in changing land-use land-cover scenario in and adjoining region of Buxa tiger reserve, India. *Environmental Challenges*, 7, 100384.
10. Kochprapa, P., Savini, C., Ngoprasert, D., Savini, T., & Gale, G. (2024). Mitigating Human-Elephant conflict in Southeast Asia. *Tropical Natural History*, 24, 70-83.
11. Wilson, S., Davies, T. E., Hazarika, N., & Zimmermann, A. (2015). Understanding spatial and temporal patterns of human–elephant conflict in Assam, India. *Oryx*, 49(1), 140-149.