Community Perspectives on Elephant Conservation in Eastern Nepal

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Understanding people's attitudes towards elephants (*Elephas maximus*) is crucial for formulating appropriate policies for species conservation and mitigating human-elephant conflict (HEC). Therefore, this study aimed to assess attitudes and perceptions toward elephant conservation in Udayapur District, eastern Nepal. Based on information from key informants (n = 10) and focus group discussions (n = 3), a total of 97 households were selected for a semi-structured questionnaire survey to collect data on human-elephant incidents. Half of the respondents (50%) identified crop damage as the primary issue caused by wild elephants, and nearly half (46%) reported an increase in HEC over the past five years (2016-2020). The majority (60%) claimed habitat encroachment as a major cause of HEC in the study area. Approximately 46% of respondents use fire-related techniques to mitigate such conflicts. Moreover, more than half of the respondents (62%) showed a low willingness to conserve elephants, which was significantly influenced by their education level [$\chi^2(2) = 9.43$, $p < 0.001$] and occupation [$\chi^2(2) = 7.81$, $p < 0.05$]. The findings of this study will help develop management interventions that benefit communities and elephants through effective HEC mitigation.

Keywords: Attitudes, Crop damage, Conflict, Mitigation, Willingness

Human-wildlife conflict (HWC) has long been recognized as one of the most challenging issues for human-dominated landscapes and wildlife conservation (Anand & Radhakrishna, 2017; Dhami et al., 2023). The expansion of human settlements and agricultural fields has led to massive habitat destruction, fragmentation, changes in land-use patterns, and reduced landscape connectivity (Li et al., 2018; De Silva & Srinivasan, 2019). Such activities alter available resources for both humans and wildlife populations, which results in various types of conflict, such as crop-raiding, livestock depredation, property damage, human casualties, the retaliatory killing of wildlife, and even the extinction of endangered species (Madden, 2004; Pant et al., 2016; Kandel et al., 2023). Conflicts become extremely controversial when people are attacked by species that are globally threatened and legally protected, such as the Bengal tiger (*Panthera tigris tigris*), the common leopard (*Panthera pardus*), the greater one-horned rhino (*Rhinoceros unicornis*), and the Asian elephant (*Elephas maximus*) (Acharya et al., 2016). Human-elephant conflict (HEC) is an increasingly serious issue in the lowland Terai region of Nepal, posing a major challenge to effective conservation of elephants (Acharya et al., 2016; Neupane et al., 2018b).

The Asian elephant (hereafter referred to as elephant) is an umbrella species found in the tropical and subtropical forests of Asia, including Nepal. It holds both ecological and cultural importance. Ecologically, elephants disperse seeds and act as ecosystem engineers, maintaining healthy forest ecosystems (Zungu & Slotow, 2022). Culturally, they are significant in Asian religions and have historically

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contributed to livelihoods and even military activities (Greene, 2021; Ram et al., 2024).

The Asian elephant is classified as '*Endangered'* on the IUCN Red List of Threatened Species and is listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (Choudhury et al., 2008; CITES, 2017). In Nepal, the species is legally protected under the National Parks and Wildlife Conservation Act of 1973 (GoN, 1973).

The Terai region of Nepal is home to a fragmented population of Asian elephants (>200 individuals) (Ram & Acharya, 2020). However, the conflict has escalated significantly during the last few decades (Silwal et al., 2017) due to rising encroachment and forest conversion in the southern lowlands of the Terai and Chure regions (Ram, 2014). This has an extensive impact on elephant habitats and migratory paths (Pradhan et al., 2011). Elephants are forced into closer proximity to humans as a result of habitat degradation, which leads to an increased level of conflicts over territory and resources (White & Ward, 2010; Liu et al., 2017). Elephants' attacks on people represent the most severe form of HEC. Besides, crop loss, property damage, and safety concerns are other consequences of HEC (Dickman, 2010; Gross et al., 2021). For instance, HEC events other than casualties were reported higher in western Nepal, whereas human and elephant casualties were higher in the central and eastern regions (Koirala et al., 2021).

Studies regarding local people's attitudes and perceptions could be a multidisciplinary approach for mitigating HWC events. They are very crucial for assessing changes in the pattern of HWC and pinpointing the present and historical context of local attitudes and perceptions toward community-based wildlife conservation (Basak et al., 2022). Such studies provide insight into how local communities respond to wildlife-related economic losses, how they accept government laws safeguarding wildlife, and their willingness to coexist with wildlife despite suffering and witnessing the conflict (Mir et al., 2015). Communities living in proximity to wildlife habitats often experience human attacks, crop damage, and livestock depredation, influencing local attitudes and perceptions regarding wildlife (Bagchi & Mishra, 2006). Few studies have found that people's perceptions of wildlife conservation are influenced by several socio-economic factors, including sex, age, ethnicity, income, and education (Kellert, 1994). However, there are very few studies on people's attitudes and perceptions toward conflict-prone species. Therefore, it is critical to understand people's perceptions and attitudes regarding major conflict-causing megafauna, such as elephants, and incorporate those perspectives into mitigation efforts (Almeida et al., 2014).

Research on human-elephant conflict (HEC) in Nepal has primarily focused on understanding the patterns and distribution of conflicts (Neupane et al., 2013; Acharya et al., 2016; Dangol et al., 2020; Kurmi & Koju, 2021; Ram et al., 2021a), their severity (Shrestha, 2007; Pant et al., 2016; Neupane et al., 2018a), and potential mitigation strategies (Neupane et al., 2018b; Khanal, 2020). However, relatively few studies have examined the attitudes and perceptions of local people toward HEC (Thapa & Dhakal, 2014; Chaudhary et al., 2021). Understanding local people's perceptions and their willingness to support elephant conservation is crucial for effectively mitigating and managing HEC. Therefore, this study aimed to assess the conservation perspectives of local people regarding HEC in the Udayapur district of Eastern Nepal. The findings are expected to inform forest authorities and other local stakeholders in developing community-focused management strategies that promote safe coexistence between humans and elephants while integrating existing local knowledge.

Materials and methods

Study area

The study was conducted in Udayapur District (lat. 26°30' and 27°11' N, long. 86°10' and 87°10' E) of eastern Nepal, which is a part of the Inner Terai located in Koshi Province (Figure 1). The region lies between Parsa National Park (PNP) and Koshi Tappu Wildlife Reserve (KTWR). Both protected areas are part of the Chure-Terai Madhesh Landscape (CTML), which runs east-west through the Himalayan foothills and Terai plains. The study area provides habitat for diverse wildlife, including the Asian elephant (*Elephas maximus*), Chinese pangolin (*Manis pentadactyla*), sloth bear (*Melursus ursinus*), striped hyena (*Hyaena hyaena*), Indian crested porcupine (*Hystrix indica*), rhesus macaque (*Macaca mulatta*), and barking deer (*Muntiacus muntjak*) (Bhandari et al., 2025). The region is also rich in floral diversity, with dominant species such as sal (*Shorea robusta*), katus (*Castanopsis* spp.), chilaune (*Schima wallichii*), and khair (*Senegalia catechu*) (Subba & Pokharel, 2021).

This landscape encompasses the habitat range and migratory route of elephants in Nepal, where

significant habitat loss and fragmentation have led to severe habitat degradation events (Ram et al., 2021a). Each year, approximately 100 elephants are estimated to migrate from West Bengal, India, to Nepal via the eastern border, primarily during September to October and May to June. They then continue their movement through KTWR up to the Udayapur and Sindhuli districts of Nepal (Mallick, 2012; Ram et al., 2021a). The study area comprises ten wards within three municipalities of Udayapur District, including five wards in Triyuga Municipality, two wards in Katari Municipality, and three wards in Belaka Municipality. The local inhabitants primarily support their livelihoods through agriculture and livestock farming, producing crops such as paddy, barley, bananas, maize, wheat, mustard, and vegetables, and raising cows, buffalo, oxen, and goats.

Selection of effective HEC zone

A preliminary field visit was carried out in August 2021 for 20 days to identify suitable municipalities and wards with conflict incidents and households of victims for a detailed survey. During this period, ten key informant interviews (KIIs) were conducted, followed by three focus group discussions. Key informants included representatives from Agriculture and Forestry University (n = 1), chairpersons and executive members of Community Forest Users' Groups (CFUGs) (n = 2), forest officers (n = 2), KTWR staff (n = 2), and the local community (n=3), as they are the concerned conservation stakeholders who can provide complementary insights on human-elephant conflict (HEC).

Three focus group discussions (FGDs) were conducted with local political leaders, farmers residing near forest areas, and local elites because they are directly or indirectly involved in decision-making, are primary victims of crop damage, and play influential roles in shaping community perspectives on HEC. KIIs provided technical, policy, and management insights, while FGDs allowed us to understand collective community perceptions and validate local patterns of conflict. In addition, secondary information, including HEC-reported cases and annual reports, was reviewed from the Division Forest Office, Triveni, Udayapur, and

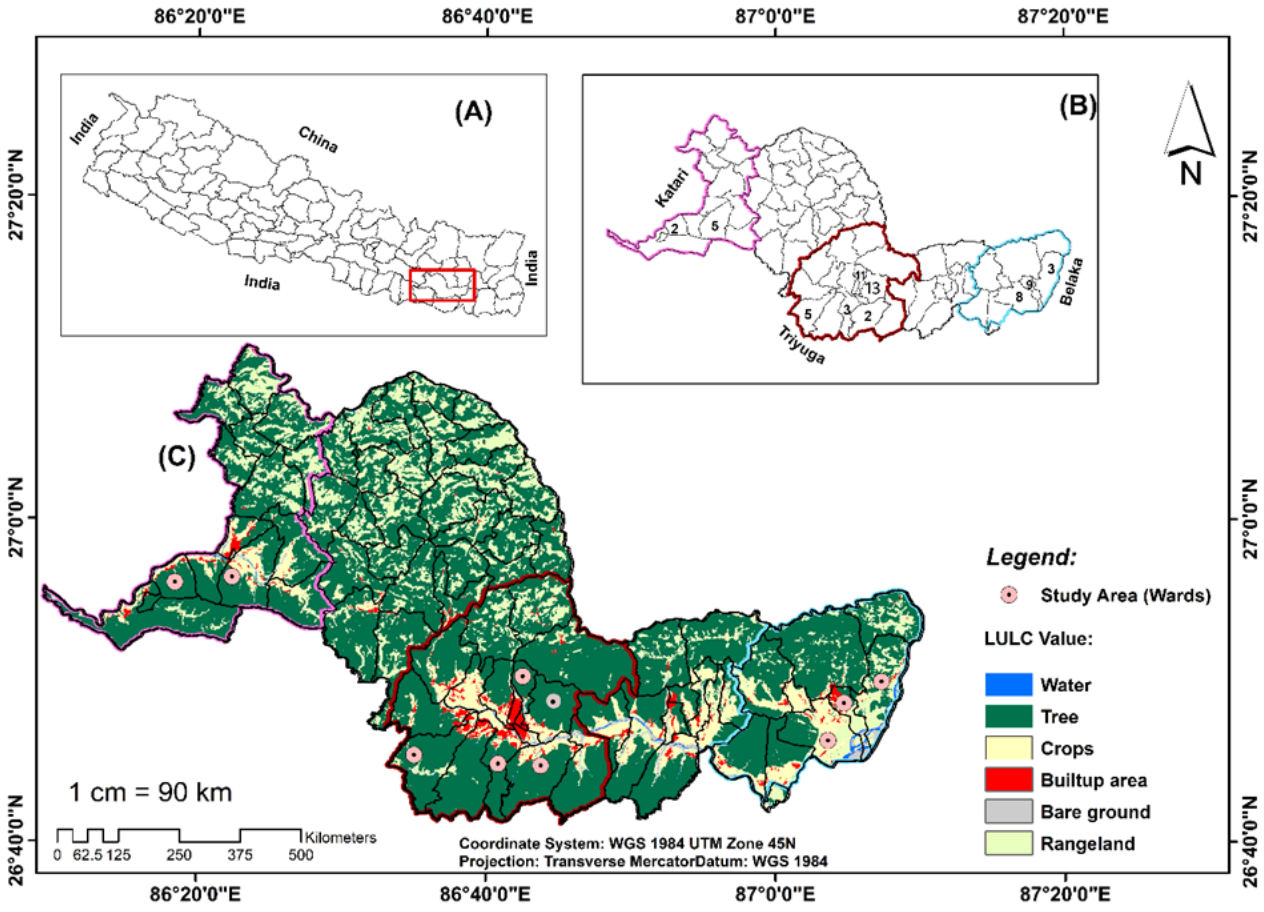

Figure 1 (A): Map of Nepal with district layer highlighting Udayapur District (study area); (B): Map of Udayapur District with local wards layer highlighting study area wards; (C): Land Use/ Land Cover map of the study area

the Division Forest Office, Udayapur, Gaighat, to identify conflict zones in the study area.

We found ten local wards within the three municipalities of the district as major HEC zones, based on general trends of HEC events over the past few years (Figure 2).: five wards in Triyuga Municipality (ward no. 2, 3, 5, 11, and 13), two wards in Katari Municipality (ward no. 2 and 5), and three wards in Belaka Municipality (ward no. 3, 8, and 9).KIIs also revealed that the primary causes of HEC in Udayapur District are linked to the habitat proximity of elephants. Most conflicts occur around the Belaka and Triyuga municipalities due to elephant movement from KTWR, while in Katari Municipality, conflicts arise from its proximity to PNP, where elephants frequently cross the Kamala River during the summer when water levels are low.

Household interview

In September 2021, 97 households were interviewed using a stratified systematic sampling approach, in which the first household was purposely selected based on its proximity to the forest area in Triyuga and Belaka Municipalities, as well as the Kamala Riverbank in Katari Municipality. The remaining households were selected systematically, with every 10th household selected for sampling (Figure 3). A total of 36 households from Belaka, 50 households from Triyuga, and 11 households from Katari Municipality were selected for the household survey. The variation in sample size reflects the differing frequency of HEC events across municipalities. While households were selected randomly within each municipality, a larger proportion was drawn from Belaka and Triyuga, where conflicts are more frequent, to ensure adequate representation of affected households. We acknowledge that this approach may place greater weight on high-conflict areas, but it allowed us to capture the range of HEC experiences across the district. A set of semi-structured questionnaires was prepared in the English language and then translated and administered in Nepali during the survey. Before conducting a household survey, a set of questionnaires was tested with a small number of samples to ensure clarity and relevance. Before each interview, respondents were informed about the objectives of the study and obtained their verbal consent. Each interview lasted approximately 20-30 minutes per respondent. One available representative family member, familiar with HEC events (preferably the oldest, with a minimum age of 18), from each household was interviewed without bias toward gender or family rank (head/non-head). All surveys were conducted during the morning and evening time periods to ensure the availability of at least one elder member in each household.

Questionnaire design

We used semi-structured questionnaire forms for the survey, which included a combination of open-ended and closed-ended questions related to HEC (see Supplementary File). First, we collected respondents' socio-demographic information, including gender, age, occupation category (farming or non-farming), education category (primary/basic, medium to high school, higher secondary), and the major crops grown on their agricultural land (paddy, maize, millet, wheat, vegetables, or sugarcane). Respondents were asked about the major threats they faced from wild elephants, the season when conflict severity was highest, and the trends of HEC in the

Figure 2 (A): Paddy crop damage by elephant in the study area; (B): Traditional house wall damage by elephant in the study area

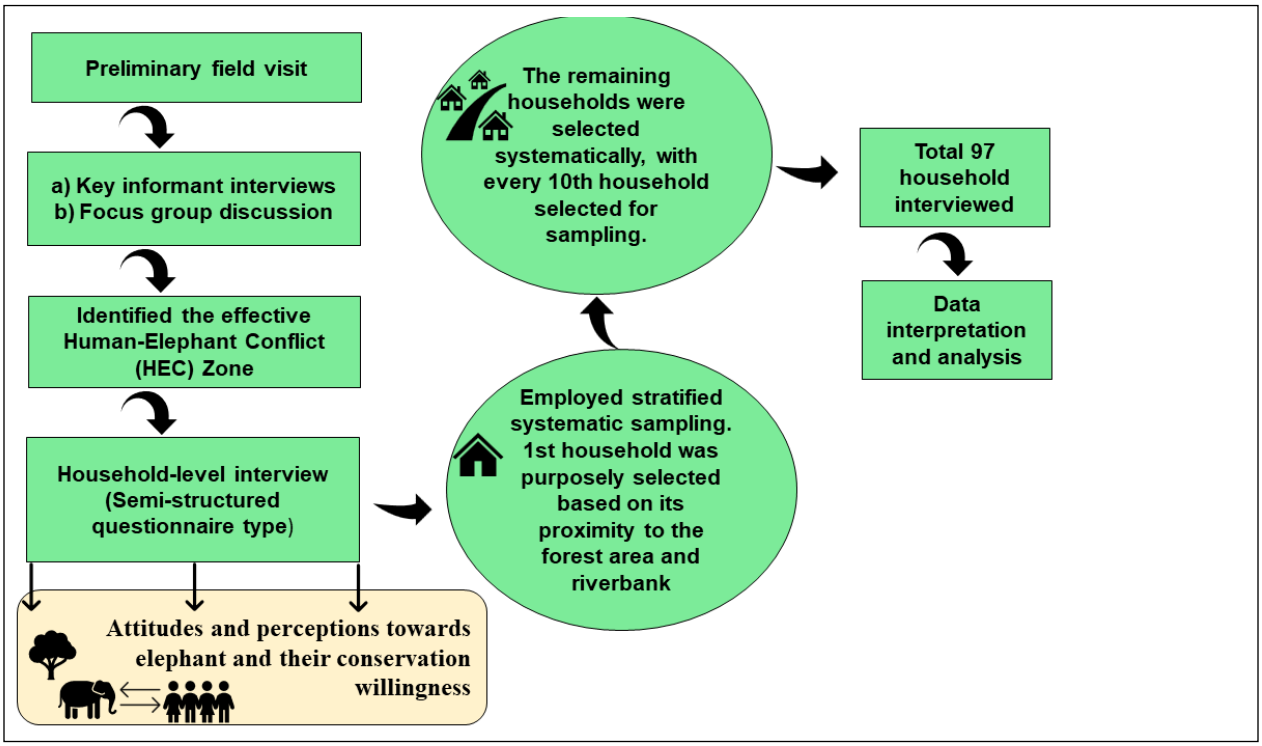

Figure 3: Conceptual framework of the methodology

region over the past five years (2016–2020). We also inquired about the reasons behind HEC, adopted mitigation measures, and recommended strategies for government authorities. Finally, we assessed their willingness to engage in elephant conservation through three ordinal responses: high, moderate, and low.

Data analysis

The data were analyzed using descriptive statistics, cross-tabulations, and the rank-based nonparametric Kruskal–Wallis test. This test was used to assess the association of willingness level to conserve elephants by gender, occupation, and education level. Dependent variable was ordinal responses (willingness level: high, medium, and low), while the independent variables were gender (male, female), occupation (farming, non-farming), and education level (primary/basic, medium to high school, higher secondary). The associated *p-value* for each test was less than 0.05 (at a 95% confidence level), indicating statistical significance. All the analyses were completed using R-Studio (R Core Team, 2020).

Results

Socio-demographic characteristics

Of the 97 respondents, 57% (n = 55) were male and 43% (n = 42) were female. The majority of respondents (43%) were adults (26-44 years old), followed by middle-aged (45-59 years old, 22%), elderly (60 years and older, 22%), and young adults (18-25 years old, 13%). The occupation category of most of the respondents was farming (77%), followed by non-farming (23%). Of the total respondents, 57% have received only a primary/basic education, followed by a medium to high school education (36%), and a higher secondary education (7%). Most households (67%) grew paddy as their primary crop, followed by maize (28%), vegetables (2%), sugarcane (1%), millet (1%), and wheat (1%) (Table 1).

Threats from wild elephants

Crop damage was reported by most households (50%) as the major threat caused by wild elephants over the previous five years (Figure 4A). A higher proportion of the respondents (41%) experienced the most conflict events during the summer season (June-August), while 32% experienced them in winter (December-February), 15% in spring (March-May), and 12% in autumn (September-November) (Figure 4B). Over the same period, 46% of respondents said HEC had increased, 39% said it had decreased, and 15% said it had remained constant (Figure 5). The mean ($x \pm SD$) annual harvest loss in 2020, as reported by respondents, was 0.093 ± 0.178 hectares. Most respondents reported paddy (54%) as the most raided by wild elephants, followed by wheat (24%), maize (14%), vegetables (5%), and millet (3%).

Table 1: Socio-demographic characteristics of the respondents

Attribute	Category	Number	Percentage
Gender	Male	55	57
	Female	42	43
Age	Young adults (18-25 years)	13	13
	Adults (26-44 years old)	42	43
	Middle-aged (45-59 years)	21	22
	Elderly (60 years and older)	21	22
Occupation	Farming (Agriculture)	75	77
	Non-farming (Business, Government job, Private job, Foreign labor, Student, Self-employed)	22	23
Education	Primary/basic education (1-5 class)	55	57
	Medium to high school (6-10 class)	35	36
	Higher secondary and above (above 10 class)	7	7
Major grown crops	Paddy	65	67
	Maize	27	28
	vegetables	2	2
	Sugarcane	1	1
	Millet	1	1
	Wheat	1	1

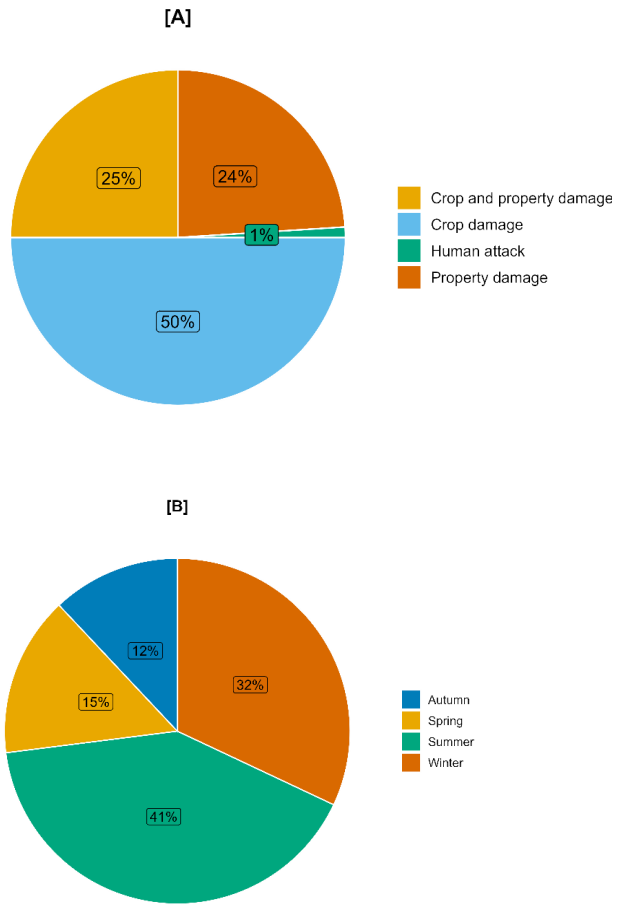

Figure 4 [A]: Major HEC incidents faced by the respondents from 2016 to 2020 and [B]: Season-wise HEC incidents experienced by the respondents

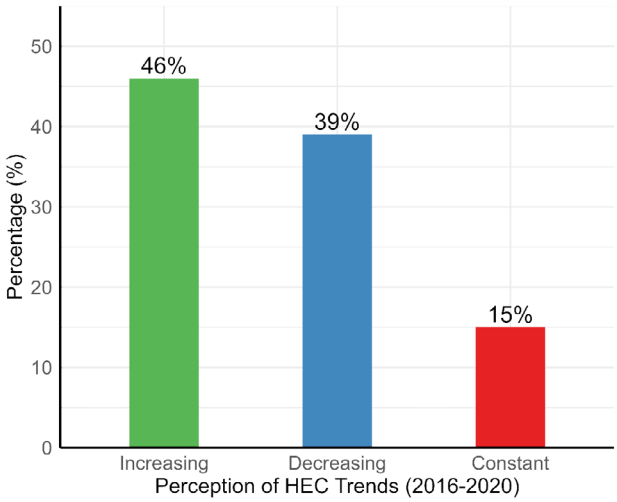

Figure 5: Perception of respondents on HEC trends from 2016 to 2020

Perceived reason behind the HEC

Most respondents (60%) indicated that the encroachment of elephants' natural habitat was a reason for HEC, while 22% reported that elephants unknowingly entered human settlements and damaged crops and properties. Similarly, 18% of respondents stated that elephants preferred consuming agricultural crops.

Adopted mitigation measures and suggested mitigation strategies

Most respondents (46%) reported using fire (throwing firecrackers and fire bursts at elephants) as a mitigation strategy, followed by sound or shouting techniques (18%), throwing stones at wild elephants (10%), and

watchtowers (10%) to monitor the elephant herds (Figure 6). Additionally, 16% of respondents had not employed any mitigation strategy to date against HEC. Furthermore, 37% of respondents suggested enhancing the prompt payment of relief funds under existing wildlife damage relief schemes to mitigate HEC for the concerned government authorities (MoFE, 2023). Similarly, 24% suggested monitoring conflict-prone elephants and 22% suggested installing electric fences. In contrast, 18% of respondents were unaware of the recommended mitigation measures.

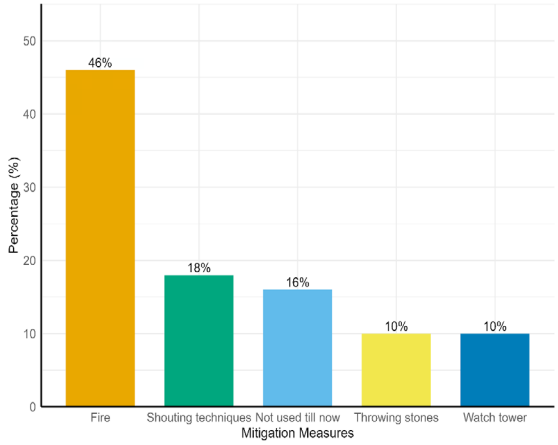

Figure 6: Mitigation strategies adopted by respondents in the study area

Willingness for elephant conservation

Most respondents (62%) reported low levels of willingness to conserve elephants, stating that the animals damage their crops and property. This was followed by a high willingness level (24%) and a moderate willingness level (14%), with respondents indicating that they would contribute to elephant conservation by sensitizing local people about the ecological role of elephants, informing the nearest forest authorities about conflict-prone elephants, and applying all the available mitigation measures. A Kruskal-Wallis test revealed no significant differences in willingness level [$\chi 2 = 3.16$, $p = 0.205$] across gender. However, significant differences were observed across education categories [$\chi^2 = 9.43$, $p < 0.001$], with respondents having primary/basic education exhibiting lower willingness toward elephant conservation. Similarly, significant differences were found across occupation categories [$\chi^2 = 7.81$, $p < 0.05$], where respondents engaged in farming showed comparatively lower willingness toward elephant conservation than those in the non-farming.

Discussion

HEC incidents in the study area

In our study, the majority of respondents reported crop damage as the primary threats associated with wild elephants. Udayapur produces a variety of agricultural products, including paddy, rice, maize, which provide high nutritional value for elephant herds and likely drive their movement into farmland area. Additionally, the eastern region hosts a large migratory herd of elephants (>100) as well as some residential individuals but expanding settlements and agricultural lands along their routes lead to conflict resulting in crop damage (Ram et al., 2021a; Yadav et al., 2014). Further research is needed to understand the main factors driving elephant movement in the region.

The majority of the crops damage cases were reported from the buffer zone communities of KTWR. Crops cultivated near the forest edge are particularly vulnerable, as elephants are strongly attracted to palatable and nutritious agricultural products compared to available forage in the forest (Sukumar, 1992). Consequently, conflicts tend to be higher along the boundaries of protected areas (Chen et al., 2016). Among the various crops cultivated, respondents reported paddy as the crop most frequently damaged by elephants in our study area, which aligns with previous studies (Santiapillai et al., 2010; Neupane et al., 2018a). Local people have experienced raiding of paddy fields more frequently during the harvesting period i.e., in November (late autumn) and December (pre-winter), when grains reach full maturity and offer high-energy, protein-rich food for elephants. Some respondents also reported frequent damage to stored grain and structural property by wild elephants in the study area. This may be because local people in the Terai region (lowlands) of Nepal store grains in their homes, and elephants are attracted to such grains when they move in search of food around settlements.

Most respondents reported that HEC had increased in the study area over the last five years (2016–2020). They agreed that elephant's natural habitat encroachment is the main reason for the rising incidents of HEC. Local people observed more fragmentation of elephant habitat outside protected areas due to high pressure of encroachment and developmental activities. Forest fragmentation and the increasing migration of elephants from India to Nepal are major causes of rising HEC in the country (Pradhan et al. 2011). The increasing human population in the Terai and Chure regions

has led to a higher rate of deforestation, especially in the Chure region (0.18% annually) (DFRS, 2015). Moreover, remaining forests are increasingly fragmented by large-scale infrastructure development, including the Madan Bhandari Highway, Udayapur cement industry, and rapid urban expansion. These developments act as barriers to elephant movement (Ram et al., 2021b), ultimately leading to higher incidents of HEC in the region (Lamichhane et al., 2018; Mukeka et al., 2019).

Mitigation measures

Our findings show that most local people use traditional methods, like fire, throwing stones, sounds, or shouting, to reduce human-elephant conflicts (Neupane et al., 2018a; Chaudhary et al., 2021). These methods are simple and low-cost (Fernando et al., 2008; Neupane et al., 2017) but they can be reactive, risky, and may sometimes exacerbate conflicts (Chakraborty, 2018; Buffum et al., 2020).

Most respondents suggested improving wildlife damage relief by ensuring timely compensation for crop damage, property loss, injuries, and fatalities (Pokhrel & Aryal, 2020). Some respondents recommended using electric fences, which are more effective than traditional methods in deterring elephants (Shrestha et al., 2007; Ram et al., 2022). However, high installation and maintenance costs often make traditional techniques more practical (Noga et al., 2015; Dhakal & Thapa, 2019). Community-based mitigation measures that are scientifically grounded and feasible are recommended, such as "biological fences" (eg. bamboo and apiculture), or unpalatable crops (tea, tobacco, chilli, and mentha) around settlements (Fernando et al., 2009; Shaffer et al., 2019; Ram et al., 2021a), supported by subsidies, market access, and insurance. Integrated settlements and community grain storage can also reduce conflict cases (Ram et al., 2021b).

Respondents also suggested monitoring elephants that cause conflicts. GPS collars and drones can track their movements in real time, provide early warnings, and help reduce human-elephant conflicts (Graham et al., 2012; Thakur et al., 2015). Integrating elephant movement into agriculture, infrastructure, and settlement planning can prevent habitat encroachment (Ram et al., 2021a). Community involvement in monitoring can also be valuable, particularly in resource-limted (Neupane et al., 2017).

However, many respondents did not suggest or use any mitigation measures, highlighting the need for targeted awareness and behavior-change programs (Chaudhary et al., 2021). These programs should focus on small landholders, resource-dependent, less-educated, and marginalized ethnic groups near forests, as they are most affected by human-elephant conflicts (Karanth & Nepal, 2012; Ram et al., 2022).

Willingness level of respondents

In our study, the low level of willingness to conserve elephants due to crop and property damage clearly indicates that HEC is a significant barrier to conservation efforts. Such low willingness towards elephant conservation could create negative perceptions and attitudes, thereby limiting local support for sustainable conservation (Sampson et al., 2019; Shaffer et al., 2019).

Education was a significant predictor of respondents' willingness to participate in conservation. Those with higher levels of education showed greater willingness to engage in conservation efforts, consistent with the findings of Bandara and Tisdell (2005). Similarly, respondents engaged in farming occupations reported lower willingness to participate in elephant conservation. This may be explained by the significant damage caused by elephants, which directly impacts the livelihoods of farmers who predominantly depend on their crops for food and income (Abdullah et al., 2019; Su et al., 2020).

However, substantial with lower proportion of respondents expressed a high or moderate level of willingness to engage in conservation efforts. Local people's positive attitudes towards elephants may be due to their recognition of the ecological role of elephants. Moreover, elephants are also symbolized and worship as goddess in the Hindu community. We suggest strengthening support for conservation initiatives for wild elephants in areas with limited conservation awareness, by engaging local people who are already inclined to support elephant conservation.

Conclusion and conservation implication

The study found that HEC incidents have increased over the past five years (2016-2020) in Udayapur district of eastern Nepal. While no human casualties were reported, significant crop damage (mainly paddy) was the major problem faced by the local people due to conflict incidents. The local people exhibited low willingness to conserve elephants, which was significantly influenced by their education level and occupation. We recommend community-

based initiatives, such as forming rapid-response youth groups, implementing behavior-change communication, and promoting collaboration between forest authorities and communities, to improve attitudes toward elephant conservation. Respondents suggested using electric fences and watchtowers, improving wildlife damage relief payments, and monitoring elephant behavior to reduce HEC in the study area. Compensation mechanisms have been effective but could be improved with emergency relief funds and streamlined procedures. Habitat encroachment was identified as the primary cause of HEC. Therefore, conservation authorities should manage historical elephant migratory routes (West Bengal–Indo-Nepal Eastern Border–Koshi Tappu Wildlife Reserve and westwards) through sustainable management plans.

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Author contribution

BB: Conceptualization, methodology, field work, validation, formal analysis, writing original draft, Writing, review & editing; **NKC**: Conceptualization, formal analysis, writing original draft, Writing, review & editing; **NC**: Conceptualization, field work; **SG**: Writing original draft, Writing, review & editing; **BD**: Writing review & editing; **AGC**: Conceptualization, field work; **BN**: Writing, review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Abdullah, A., Sayuti, A., Hasanuddin, H., Affan, M., & Wilson, G. (2019). People's perceptions of elephant conservation and the human-elephant conflict in Aceh Jaya, Sumatra, Indonesia. *European Journal of Wildlife Research*, *65*, 1–8. https://doi.org/10.1007/s10344-019-1307-1

Acharya, K. P., Paudel, P. K., Neupane, P. R., & Köhl, M. (2016). Human-wildlife conflicts in Nepal: Patterns of human fatalities and injuries caused by large mammals. *PLoS One*, *11*(9), e0161717. https://doi.org/10.1371/journal.pone.0161717

Almeida, A., Vasconcelos, C., & Strecht-Ribeiro, O. (2014). Attitudes toward animals: A study of Portuguese children. *Anthrozoös*, *27*(2), 173–190. https://doi.org/10.2752/175303714X13903827487403

Anand, S., & Radhakrishna, S. (2017). Investigating trends in human-wildlife conflict: is conflict escalation real or imagined? *Journal of Asia-Pacific Biodiversity*, *10*(2), 154–161. https://doi.org/10.1016/j.japb.2017.02.003

Bagchi, S., & Mishra, C. (2006). Living with large carnivores: predation on livestock by the snow leopard (Uncia uncia). *Journal of Zoology*, *268*(3), 217–224. https://doi.org/10.1111/j.1469-7998.2005.00030.x

Bandara, R., & Tisdell, C. (2005). Changing abundance of elephants and willingness to pay for their conservation. *Journal of Environmental Management*, *76*(1), 47–59. https://doi.org/10.1016/j.jenvman.2005.01.007

Basak, S. M., Hossain, M. S., O'Mahony, D. T., Okarma, H., Widera, E., & Wierzbowska, I. A. (2022). Public perceptions and attitudes toward urban wildlife encounters–A decade of change. *Science of the Total Environment*, *834*, 155603. https://doi.org/10.1016/j.scitotenv.2022.155603

Bhandari, B., Dhami, B., Kc, N., Mahatara, P., Neupane, A., Gosai, S., Udaya, A., Phuyal, N., & Ghimire, P. (2025). Habitat and anthropogenic determinants of chinese pangolin (*Manis pentadactyla*) burrow occupancy in Udayapur, eastern Nepal: Implications for site specific conservation. *Ecology and Evolution*, *15*(6), e71493. https://doi.org/10.1002/ece3.71493

Buffum, B., Husband, T. P., & Shrestha, S. (2020). Assessment of community-based activities to reduce human–elephant conflict in Nepal. In

Terrestrial Ecosystems and Biodiversity (pp. 3–15). CRC Press.

Chakraborty, S. (2018). Perception and attitude of local people towards human-elephant conflicts around Mahananda wildlife sanctuary, West Bengal, India. *Perception*, *3*(2).

Chaudhary, A., Timilsina, S., Gautam, S., & Subedi, P. B. (2021). An assessment of the human-elephant conflict in Sapahi and Kakadi Village of Kolhabi Municipality, Bara, Nepal. *Our Nature*, *19*(1). https://doi.org/10.3126/on.v19.i1.41223

Chen, Y., Marino, J., Chen, Y., Tao, Q., Sullivan, C. D., Shi, K., & Macdonald, D. W. (2016). Predicting hotspots of human-elephant conflict to inform mitigation strategies in Xishuangbanna, Southwest China. *PloS One*, *11*(9), e0162035. https://doi.org/10.1371/journal.pone.0162035

Choudhury, A., Lahiri Choudhury, D. K., Desai, A., Duckworth, J. W., Easa, P. S., Johnsingh, A. J. T., & Wikramanayake, E. (2008). *Elephas maximus*. IUCN red list of threatened species. https://doi.org/10.2305/IUCN.UK.2008.RLTS.T7140A12828813.en

CITES. (2017). *Appendices I, II, and III, Convention on international trade in endangered species of wild fauna and flora*. https://cites.org/eng/app/appendices.php

Dangol, D., Ghimire, A., & Bhattarai, S. B. (2020). Human-elephant conflict in the buffer zone of Chitwan National Park, Nepal. *Nepalese Journal of Zoology*, *4*(1), 36–43. https://doi.org/10.3126/njz.v4i1.30671

De Silva, S., & Srinivasan, K. (2019). Revisiting social natures: People-elephant conflict and coexistence in Sri Lanka. *Geoforum*, *102*, 182–190. https://doi.org/10.1016/j.geoforum.2019.04.004

DFRS. (2015). *State of Nepal's forests*. Kathmandu, Nepal: Forest Resource Assessment (FRA), Department of Forest Research and Survey.

Dhakal, B., & Thapa, B. (2019). Residents' perceptions of human–elephant conflict: Case study in Bahundangi, Nepal. *Environment, Development and Sustainability*, *21*, 461–481. https://doi.org/10.1007/s10668-017-0047-1

Dhami, B., Bhusal, A., Adhikari, B., Miya, M. S., Maharjan, S. K., Neupane, D., & Adhikari, H. (2023). Habitat suitability and conflict zone mapping for the blue bull (*Boselaphus tragocamelus*) across Nepal. *Animals*, *13*(5), 937. https://doi.org/10.3390/ani13050937

Dickman, A. J. (2010). Complexities of conflict: the importance of considering social factors for effectively resolving human–wildlife conflict. *Animal Conservation*, *13*(5), 458–466. https://doi.org/10.1111/j.1469-1795.2010.00368.x

Fernando, P., Janaka, H. K., Ekanayaka, S. K. K., Nishantha, H. G., & Pastorini, J. (2009). A simple method for assessing elephant body condition. *Gajah*, *31*, 29–31.

GoN. (1973). *National parks and wildlife conservation act*. Nepal: Government of Nepal, Nepal Law Commission.

Graham, M. D., Adams, W. M., & Kahiro, G. N. (2012). Mobile phone communication in effective human elephant–conflict management in Laikipia County, Kenya. *Oryx*, *46*(1), 137–144. https://doi.org/10.1017/S0030605311001104

Greene, A. M. (2021). Speaking with an upside-down tongue: Reflections on human-elephant multispecies culture in northern Thailand. *Gajah*, (53).

Gross, E. M., Lahkar, B. P., Subedi, N., Nyirenda, V. R., Klebelsberg, E., & Jakoby, O. (2021). Elephants in the village: Causes and consequences of property damage in Asia and Africa. *Conservation Science and Practice*, *3*(2), e343. https://doi.org/10.1111/csp2.343

Kandel, S. R., Neupane, B., Miya, M. S., Sadadev, B. M., Khatri, N. D., & Dhami, B. (2023). An emerging issue of human leopard conflict in the human dominated landscape of mid hills: A case study from Tanahun district of Nepal. *International Journal of Zoology*, *2023*(1), 5690289. https://doi.org/10.1155/2023/5690289

Karanth, K. K., & Nepal, S. K. (2012). Local resident's perception of benefits and losses from protected areas in India and Nepal. *Environmental management*, *49*(2), 372-386. https://doi.org/10.1007/s00267-011-9778-1

Kellert, S. R. (1994). Public attitudes toward bears and their conservation. *Bears: Their Biology and Management*, *9*, 43–50.

Khanal, P. (2020). *Human. Elephant Conflict Measures in Mechinagar Municipality, Jhapa'Nepal*. Central Department of Zoology.

Koirala, R. K., Weihong, J. I., Timilsina, Y. P., & Raubenheimer, D. (2021). Patterns, perceptions, and spatial distribution of human-elephant (*Elephas maximus*) incidents in Nepal. *Journal of*

Threatened Taxa, *13*(6), 18441–18452. https://doi.org/10.11609/jott.6107.13.6.18441–18452

Kurmi, S., & Koju, N. P. (2021). Spatiotemporal association of human-elephant conflict around Parsa National Park, Nepal. *Nepalese Journal of Zoology*, *5*(1), 8–12. https://doi.org/10.3126/njz.v5i1.38283

Lamichhane, B. R., Persoon, G. A., Leirs, H., Poudel, S., Subedi, N., Pokheral, C. P., Bhattarai, S., Thapaliya, B. P., & De Iongh, H. H. (2018). Spatio-temporal patterns of attacks on human and economic losses from wildlife in Chitwan National Park, Nepal. *PloS One*, *13*(4), e0195373. https://doi.org/10.1371/journal.pone.0195373

Li, W., Liu, P., Guo, X., Wang, L., Wang, Q., Yu, Y., Dai, Y., Li, L., & Zhang, L. (2018). Human-elephant conflict in Xishuangbanna Prefecture, China: Distribution, diffusion, and mitigation. *Global Ecology and Conservation*, *16*, e00462. https://doi.org/10.1016/j.gecco.2018.e00462

Liu, P., Wen, H., Harich, F. K., He, C., Wang, L., Guo, X., Zhao, J., Luo, A., Yang, H., & Sun, X. (2017). Conflict between conservation and development: cash forest encroachment in Asian elephant distributions. *Scientific Reports*, *7*(1), 6404. https://doi.org/10.1038/s41598-017-06751-6

Madden, F. (2004). Creating coexistence between humans and wildlife: global perspectives on local efforts to address human–wildlife conflict. *Human Dimensions of Wildlife*, *9*(4), 247–257. https://doi.org/10.1080/10871200490505675

Mallick, J. K. (2012). Trans-boundary human-elephant conflict in the Indo-Nepal Terai landscape. *Methods*, *39*(4), 7–13.

MoFE (2023). Guidelines for distribution of relief against wildlife damage. Ministry of Forests and Environment https://dnpwc.gov.np/en/guideline-and-directive/.

Mir, Z. R., Noor, A., Habib, B., & Veeraswami, G. G. (2015). Attitudes of local people toward wildlife conservation: A case study from the Kashmir Valley. Mountain research and development, 35(4), 392-400. https://doi.org/10.1659/MRD-JOURNAL-D-15-00030.1

Mukeka, J. M., Ogutu, J. O., Kanga, E., & Røskaft, E. (2019). Human-wildlife conflicts and their correlates in Narok County, Kenya. *Global Ecology and Conservation*, *18*, e00620. https://doi.org/10.1016/j.gecco.2019.e00620

Neupane, B., Budhathoki, S., & Khatiwoda, B. (2018a). Human-elephant conflict and mitigation measures in Jhapa District, Nepal. *Journal of Forest and Livelihood*, *16*(1), 103–112.

Neupane, B., Khatiwoda, B., & Budhathoki, S. (2018b). Effectiveness of Solar-powered Fence in Reducing Human-Wild Elephant Conflict (HEC) in Northeast Jhapa District, Nepal. *Forestry: Journal of Institute of Forestry, Nepal*, *15*, 13–27.

Neupane, D., Johnson, R. L., & Risch, T. S. (2013). Temporal and spatial patterns of human-elephant conflict in Nepal. *2013 International Elephant & Rhino Conservation & Research Symposium Proceedings*, 1–11.

Neupane, D., Kunwar, S., Bohara, A. K., Risch, T. S., & Johnson, R. L. (2017). Willingness to pay for mitigating human-elephant conflict by residents of Nepal. *Journal for Nature Conservation*, *36*, 65–76. https://doi.org/10.1016/j.jnc.2017.02.004

Noga, S. R., Kolawole, O. D., Thakadu, O., & Masunga, G. (2015). Small farmers' adoption behaviour: Uptake of elephant crop-raiding deterrent innovations in the Okavango Delta, Botswana. *African Journal of Science, Technology, Innovation and Development*, *7*(6), 408–419. https://hdl.handle.net/10520/EJC183309

Pant, G., Dhakal, M., Pradhan, N. M. B., Leverington, F., & Hockings, M. (2016). Nature and extent of human–elephant *Elephas maximus* conflict in central Nepal. *Oryx*, *50*(4), 724–731. https://doi.org/10.1017/S0030605315000381

Pokharel, M., & Aryal, C. (2020). Human-wildlife conflict and its implication for conservation at Sundarpur, Udayapur, Eastern Nepal. *International Journal of Environment*, *9*(2), 217–233. https://orcid.org/0000-0002-0726-6501

Pradhan, N. M. B., Williams, A. C., & Dhakal, M. (2011). Current status of Asian elephants in Nepal. *Gajah*, *35*, 87–92.

R Core Team, R. (2020). *R: A Language and Environment for Statistical Computin*g. R Foundation for Statistical Computing.

Ram, A. K. (2014). Geospatial Modeling to Assess Asian Elephant. *Elephas Maximus*.

Ram, A. K., & Acharya, H. (2020). Status distribution and habitat use by Asian elephants in Nepal. *A Compendium of Conservation Bulletien*, 155–160.

Ram, A. K., Lamichhane, B. R., Subedi, N., Yadav, N. K., Karki, A., Pandav, B., Brown, C., Khatri, T.B., & Yackulic, C. B. (2024). Dynamic occupancy modelling of Asian elephants (*Elephas maximus*) reveals increasing landscape use in Nepal. *Scientific Reports*, *14*(1), 20023. https://doi.org/10.1038/s41598-024-70092-4

Ram, A. K., Mondol, S., Subedi, N., Lamichhane, B. R., Baral, H. S., Natarajan, L., Amin, R., & Pandav, B. (2021a). Patterns and determinants of elephant attacks on humans in Nepal. *Ecology and Evolution*, *11*(17), 11639–11650. https://doi.org/10.1002/ece3.7796

Ram, A. K., Yadav, N. K., Kandel, P. N., Mondol, S., Pandav, B., Natarajan, L., Subedi, N., Naha, D., Reddy, C. S., & Lamichhane, B. R. (2021b). Tracking forest loss and fragmentation between 1930 and 2020 in Asian elephant (*Elephas maximus*) range in Nepal. *Scientific Reports*, *11*(1), 19514.

Ram, A. K., Yadav, N. K., Subedi, N., Pandav, B., Mondol, S., Khanal, B., Kharel, D.K., Acharya, H.B., Dhakal, B.K., Acharya, K.P., Baral, H.S., Dahal, B.R., Mishra, R., Naha, D., Pradhan, N.M.B., Natarajan, L., & Lamihhane, B. R. (2022). Landscape predictors of human elephant conflicts in Chure Terai Madhesh Landscape of Nepal. *Environmental Challenges*, *7*, 100458. https://doi.org/10.1016/j.envc.2022.100458

Sampson, C., Leimgruber, P., Rodriguez, S., McEvoy, J., Sotherden, E., & Tonkyn, D. (2019). Perception of human–elephant conflict and conservation attitudes of affected communities in Myanmar. *Tropical Conservation Science*, *12*, 1940082919831242. https://doi.org/10.1177/194008291983124

Santiapillai, C., Wijeyamohan, S., Bandara, G., Athurupana, R., Dissanayake, N., & Read, B. (2010). *An assessment of the human-elephant conflict in Sri Lanka*. https://doi.org/10.4038/cjsbs.v39i1.2350

Shaffer, L. J., Khadka, K. K., Van Den Hoek, J., & Naithani, K. J. (2019). Human-elephant conflict: A review of current management strategies and future directions. *Frontiers in Ecology and Evolution*, *6*, 235. https://doi.org/10.3389/fevo.2018.00235

Shrestha, R., Bajracharya, S., & Pradhan, N. M. B. (2007). A case study on human-wildlife conflict in Nepal. *A Report Submitted to the WWF Nepal Program. Nepal*.

Silwal, T., Kolejka, J., Bhatta, B. P., Rayamajhi, S., Sharma, R. P., & Poudel, B. S. (2017). When, where and whom: assessing wildlife attacks on people in Chitwan National Park, Nepal. *Oryx*, *51*(2), 370–377. https://doi.org/10.1017/S0030605315001489

Subba, B. R., & Pokharel, S. (2021, April). Faunal Diversity of Tapli Rural Municipality, Udayapur, Province 1, Nepal. In Integrating Biological Resources for Prosperity. A Proceedings of the National Conference, Biratnagar, Nepal.

Su, K., Ren, J., Yang, J., Hou, Y., & Wen, Y. (2020). human-elephant conflicts and villagers' attitudes and knowledge in the Xishuangbanna Nature Reserve, China. *International Journal of Environmental Research and Public Health*, *17*(23), 8910. https://doi.org/10.3390/ijerph17238910

Sukumar, R. (1992). *The Asian elephant: Ecology and management*. Cambridge University Press.

Thakur, A. K., Yadav, D. K., & Jhariya, M. K. (2015). Human-elephant conflict scenario in corridors of Northern Chhattisgarh. *Journal of Plant Development Sciences*, *7*(11), 821–825.

Thapa, B., & Dhakal, B. (2014). Human-elephant conflict: Household impact assessment in Bahundangi VDC, Nepal. *University of Florida. (A Report)*.

White, P. C. L., & Ward, A. I. (2010). Interdisciplinary approaches for the management of existing and emerging human–wildlife conflicts. *Wildlife Research*, *37*(8), 623–629. https://doi.org/10.1071/WR10191

Yadav, B. R., Dutta, C., Chalise, M. K., & Williams, C. (2014). Human-Asian wild elephant (*Elephas maximus*) conflicts and its socio-economic consequences in and around the protected areas of Central Terai, Nepal. *Banko Janakari*, *24*(1), 47–54. https://doi.org/10.3126/banko.v24i1.13490

Zungu, M., & Slotow, R. (2022). A systematic review of the success and unintended consequences of management interventions on African elephants. *Pachyderm*, *63*, 99-139. https://doi.org/10.69649/pachyderm.v63i.499

Supplementary File

Questionnaire form

Title: Community Perspectives on Elephant Conservation in Eastern Nepal

Name of the interviewer: Location with household no: Housing type:
Date & time:

I. SOCIOECONOMIC CHARACTERISTICS OF THE RESPONDENTS

i) Name of the respondents:

ii) Gender…. **iii) Age:** …...

iv) Primary occupation: a) Farming b) Government job c) Private job d) Business e) Foreign labor f) Student g) Self-employed

v) Education: a) Illiterate b) Primary/basic education (1-5 class) c) Medium to high school (5-10 class) d) Higher secondary and above (above 10 class)

vi) Landholding:

vii) Major crops raised in agricultural land:

viii) Have you grown any crops or fruits in your home garden?

II. PERCEPTIONS REGARDING HUMAN-ELEPHANT CONFLICT

i) How much human-elephant conflict is befalling in your community?

a) Low b) moderate c) high d) extremely high

ii) How they are creating the conflict/ problem?

a) Crop damage b) Property damages c) Human Attack/injuries/fatalities d) Livestock Attack/injuries/fatalities e) other (please specify)

iii) Have you or anyone in your household suffer from any problem/threats from elephant from past 5 years (2016 - 2020)? If yes then please specify the following;

a) Crop damage b) Property damages c) Injuries of family member d) Death of family member d) Livestock Attack/injuries/fatalities. *If so then, have you submitted any application letter in request for compensation in your District's Divisional Forest Office or Sub-divisional Office? a) Yes b) No……*
……
……

iv) About how much of harvest did you lost during last year from elephant problem?

a) less than 10% b) about 25% (one quarter) c) about 33% (about one third) d) about 50% (one half) e) more than 50%

v) What types of crop does elephant damage most?.....
.....

vi) At what season of the year does elephant damage the crops most?

a) Spring (March-May) b) Summer (June-August) c) Autumn d) (September-November) e) Winter (December-February) f) Equally in all the seasons

vii) What do you suppose the reasons for the elephant entering your community and causing a problem?

a) Elephant natural habitat encroachment b) Unknowingly elephant enter to human's area and damage crops and property c) Elephant like to consume human-raised crops d) Elephant hate human and likely to attack them

vii) How is the current human-elephant conflict trend in your community in comparison to the past years?

a) Increasing b) Same c) Decreasing

III) MITIGATION MEASURES

i) What mitigating measures are you undertaking right now to minimize the elephant's threats and problems?

a) Fire b) fire crackers c) physical barriers (concrete wall, electric fences) d) watch towers e) planting alternative crops if any……

ii) In your village/community, what do you think the most successful mitigation techniques that government agencies should undertake to prevent human-elephant conflict?

……

IV) CONSERVATION ATTITUDES

i) What is your willingness-level to contribute in reducing human-elephant conflict and initiating conservation efforts? And why?

a) High b) moderate c) low d) Not at all

……
……

ii) Is it necessary for Nepal to protect elephants? And why is that?

a) Yes b) No

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Comments:……
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————Thank you for your kind participation! **……**