International Journal of
Life Sciences
International Peer Reviewed Open Access Refereed Journal

Int. J. of Life Sciences, 2023; 11 (1): 37-45
ISSN:2320-7817(p) | 2320-964X(o)

Research Article Open Access

People's perception towards Human Wildlife Conflicts in Forest – Agricultural landscape in the Eastern Ghats of Erode District, Tamil Nadu.

Chinnappan Gunasekaran[1]*, Balaguruswami Kaviya[2] and Jayaraman Dharmaraj[3]

[1]Assistant Professor and Research Supervisor, [2]Research Scholar, Unit of Conservation Biology Laboratory, Department of Zoology, Bharathiar University, Coimbatore. 641 046. Tamil Nadu, India.
[3]Assistant Professor, PG & Research Department of Zoology, Sri Vijay Vidyalaya College of Arts & Science, Nallampalli, Dharmapuri-636807. Tamil Nadu, India.
*Corresponding author Email: guna.buconbio@gmail.com

Manuscript details:

Received: 19.12.2022
Accepted: 14.02.2023
Published: 25.04.2023

Cite this article as:
Chinnappan Gunasekaran, Balaguruswami Kaviya and Jayaraman Dharmaraj (2023) People's perception towards Human Wildlife Conflicts in Forest – Agricultural landscape in the Eastern Ghats of Erode District, Tamil Nadu, *Int. J. of Life Sciences*, 11 (1): 37-45.

Available online on http://www.ijlsci.in
ISSN: 2320-964X (Online)
ISSN: 2320-7817 (Print)

ABSTRACT

The growing demand for more people and the ensuing changes in land use that are incompatible with wildlife habitat on the forest edges also significantly add to the issue. Episodes of these conflicts (HWC) have escalated and have been a significant source of concern for local people living close to protected areas because human settlements have encroached on the boundaries of forests. Common manifestations of these confrontations include crop raiding incidents and attacks by wild animals. As a result of a rise in human-animal conflict in the Erode Forest Division's, forest border communities. Since our study's primary goal was to understand how people perceive these disputes, we conducted household interviews in four villages in Erode District. The study's findings suggest that respondents have negative attitudes toward animals and little knowledge of the forest department's conservation activities. The responders are keen to work with the forest department to develop a solution to reduce conflict-related incidents.

Keywords: Human Animal Conflict, Human Perception, Crop damage.

INTRODUCTION

The contrasting wildlife and human activity in space and time, which has an impact on either human, wildlife, or both, is known as human-wildlife interaction (HWI) (Lischka *et al.,* 2018). These interactions might range from being constructive to being destructive (Lischka *et al*., 2018). The term "human-animal conflict" (HAC) is used to refer to the unfavourable effects of human-wildlife interactions. Currently, overexploitation and agricultural practises including crop and livestock production pose the greatest dangers to

species (Maxwell *et al*., 2016). As a result, HWC may weaken support for conservation efforts and contribute to the extinction of certain species, which emphasises the need to comprehend HWC drivers. Wildlife habitats have been occupied or fragmented as human-dominated environments have continued to grow. Traces of human influence can still be seen in some environments even when they are not occupied (Li *et al*., 2020). Human activities are placing enormous strain on one-third of the world's protected regions (Jones *et al*., 2018), and the number of these pursuits away from protected areas is rising (Tapia-Armijos *et al*., 2017). There exist protection gaps because, as a result of inadequate scientific planning and funding, protected area networks frequently do not encompass all natural habitats of all species in a region (Gabriel *et al*., 2014, Fonseca and Venticinque, 2018). Numerous places that is been transformed into human-dominated landscapes Possibly the best scenario for species survival because these "gap" zones cannot be properly safeguarded. When unpleasant interactions or confrontations take place, both wildlife and humans experience a wide range of issues.

The most vulnerable setting for HAC is the ecologically delicate a transitional area between the natural world and human-made landscapes (Wekesa, Steyn, & Otieno, 2011). The frequency of these encounters increases when human wants and ensuing activities have a negative influence on animals, despite the fact that this is a natural ecological process (Dorji *et al*., 2018; Gurung, Chettri, Sharma, *et al*., 2019). Through daily actions, humans have an indirect as well as direct impact on wildlife (Kanagaraj, Araujo, Barman, *et al*., 2019; Karanth & Kudalkar, 2017; Nyhus, 2016). Detrimental ecological changes (climate change, deforestation, land degradation, reduced natural landscape) and socioeconomic shifts (spontaneous urbanisation, raising the degree of artificiality, industrialization, colonisation, quickening population growth, overstressed public service centres, unemployment, growth in crime rate) in transitional landscape indirectly affect wildlife by reducing their natural habitats, rising extreme weather events (warm, cold, floods, droughts), and reducing their availability of food and water (Gupta, Rajvanshi, & Badola, 2017; Kandel, Gurung, Chettri, Ning, & Sharma, 2016; Naha, Sathyakumar, Dash, *et al*., 2019; Naha, Sathyakumar, & Rawat, 2018; Rawat, 2014). As a result, the adverse ecological and socio-economic changes along the buffer zone of natural habitats speed up the detrimental interactions between humans and wildlife, which negatively impact human life by destroying crops, destroying settlements, terrorising the community, and injuring or killing people and their pets (Holland, Larson, & Powell, 2018; Joshi, Dinerstein, Wikramanayake, *et al*., 2016). As a result, it has become vital to research both human activities and the changing behaviour of wildlife near protected areas in order to lessen the HAC. Although some recent studies (Dasgupta & Ghosh, 2015; Roy & Sukumar, 2017) imply that the majority of human-wildlife conflicts occur as a result of human interference in and around wildlife habitats, other studies consider it to be a natural ecosystem occurrence (Sathyakumar, Bashir, Bhattacharya, *et al*., 2011; Sherchan & Bhandari, 2017). But according to recent studies, anthropogenic and ecological variables have cumulatively had an increasing impact on human-wildlife confrontations around the world.

The majority of the affected communities don't report the issue to the proper agencies despite the fact that many farmers suffer as a result of wildlife crop raiding due of a lack of communication. Another issue is that farmers perceive animals as government property and compare the government to a nasty neighbour who neglects to compensate them when their animal damages crops (Naughton-Treves 1998). Past studies have shown that in order to establish conservation operations successfully, local support and participation are crucial (Fiallo and Jacobson 1995).

The number of livestock and agricultural products that agro-pastoral communities lose to wildlife annually is estimated to range between 10 and 15 percent (Madhusudan and Sankaran, 2010). These losses might not appear important on a national scale, but they can have a big impact on the communities that are impacted. Numerous affected families and individuals are among the world's least wealthy people. (Barua *et al*., 2013). The consequences of HWC on households (HHs) are said to be detrimental for a number of HH-level outcomes, including income, health, and other socioeconomic factors (Methorst *et al*., 2020; Sampson *et al*., 2021; Yang *et al*., 2020). Since such conflict scenarios have not before been examined in the Erode district, the findings of the current study will be useful for managing wildlife in this area in the future. Understanding the viewpoint of those who reside in the district's conflict zones was crucial.

STUDY AREA

The Erode District is situated above the Mean Sea Level of 171.91 metres, between 10 36" and 11 58" of North Latitude, and between 76 49" and 77 58" of East Longitude. Karnataka State borders Erode District to the north-west, Coimbatore District to the west, Tiruppur District to the south, Namakal District to the north-east, and Karur District to the east. 5722 square kilometres, or about 4.4% of the state's total area, make up the Erode District. The eastern portion of this district has a dry climate, whereas the western portion has a semi-dry climate. The different soil types depend on the location. The majority of the soil in this district is red loam or red sand, which is good for growing crops including paddy, groundnuts, sugarcane, turmeric, tobacco, corn, and tapioca. In this district, the ground water table ranges from 15 feet to 50 feet in wet areas to 50 feet to 110 feet in dry areas. 39.76% of the total geographic area may be used for cultivation during the year. Net area seeded makes for 97.58% of the total cropped area, while area sown more than once accounts for 2.42% of the net area sown. Food crops account for 55.79% of the total cropped area, while non-food crops account for 44.21%. Reserved Forest and Land The district's total geographic area, or 39.76%, is made up of forest area. Sathyamangalam Tiger Reserve and the forest of Erode Division (territorial). Before the Eastern Ghats meet the Western Ghats at Nilgiris, this territorial forest division, a complex hilly area, forms the Eastern Ghats' most significant mountain range. Various types of flora and animals make up the enormous elephant terrain. This area is one of the most diverse habitats for different life-forms since it is connected to the Nilgiris and Kollegal forests of the state of Karnataka, which are further connected to the Wyanaad and Cauvery forest-scapes, respectively. Wildlife involved in these conflicts includes Indian Peafowl (*Pavo cristatus*), Chital/Spotted deer (*Axis axis*), Wild Pig (*Sus scrofa*), Asian Elephant (*Elephas maximus*), and Bonnet Macaque (*Macaca radiata*).

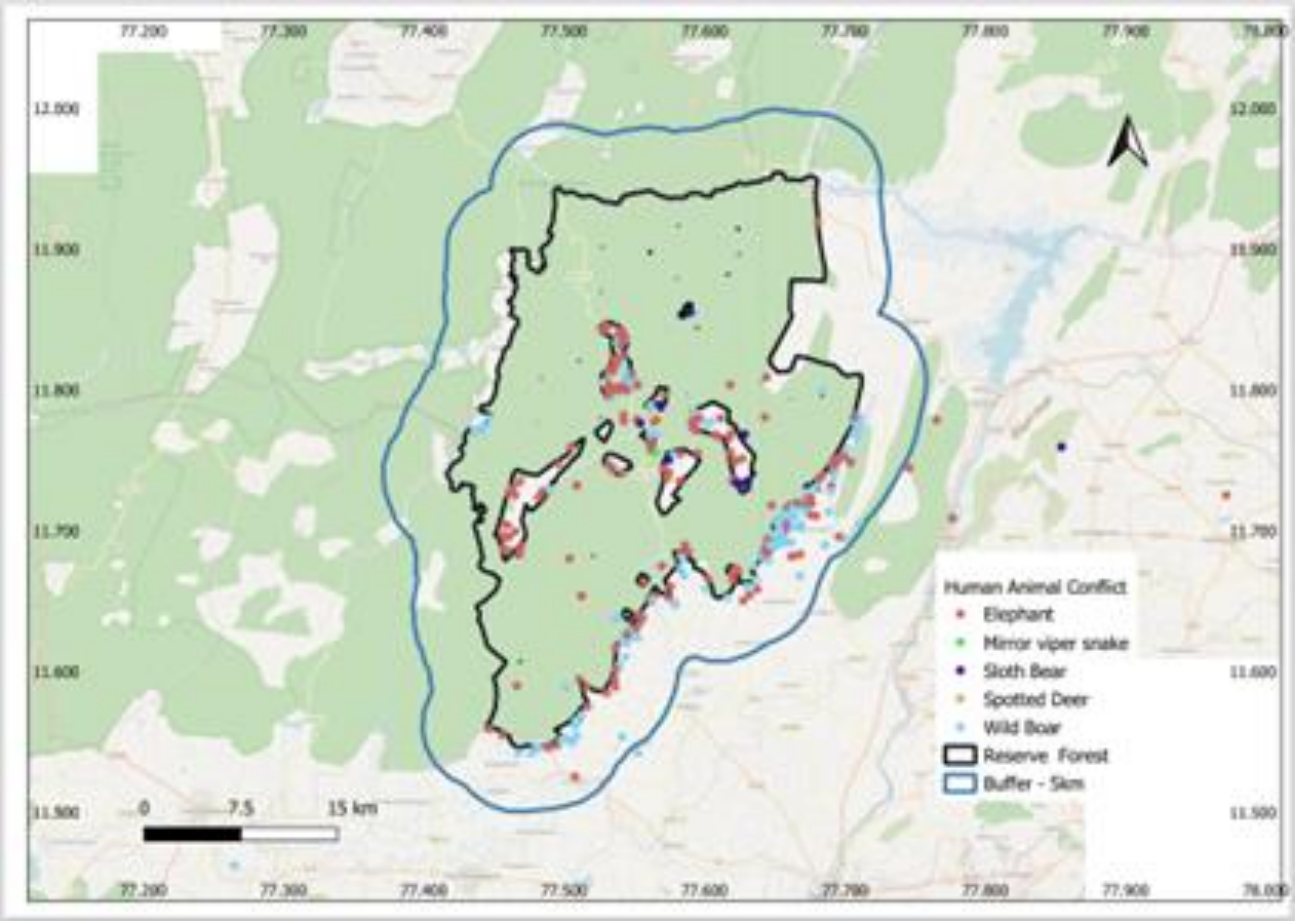

Figure:2 - Map showing movement of wild animal around the buffer zone (5 kms)

METHODS

Three villages close to the Chennampatti range of the Erode Forest Division (EFD) underwent a structured questionnaire survey. The settlements that were picked have the highest number of human-animal conflict incidences in this area. The survey consisted of 28 questions and focused on the socioeconomic position of the family, the species involved in conflicts, the nature of the occurrences, people's perceptions of such human-wildlife conflict, and attitudes toward ecological preservation. We spoke with each responder for an average of 15 to 25 minutes. Male family head interviews made up the majority of the interviews, wherein if the family head was not present during the time of interview, options were presented to the women. Interviews were conducted with three different groups of people: those who live right next to the forest boundary and are frequently involved in conflicts with wild animals; those who live quite a distance from the forest boundary and are rarely affected by conflicts; and those who are aware of conflicts but are not directly impacted by those caused by wild animals.

RESULTS

Socio-economic Background

Interviews were conducted with 107 respondents, of whom 67.93% were men and 32.07% were women. The respondents' age ranged between 20 to 85 years, and they completed the structured questionnaire. 5.62 percent of the 107 people interviewed had attended primary school, 17.76 percent had finished their education, 10.29 percent had graduated, 50.46 percent had never attended school, and 15.8 percent were unsure about their educational backgrounds. The majority of the respondents' families (96.22%) mostly derived their income from agriculture, and respondents were chosen from a variety of occupational backgrounds. Daily earnings, a private business, a teacher, and an entrepreneur accounted for the remaining 3.77% of income. The respondents had dogs in 86% of cases, goats in 29.9%, buffalo in 5.61%, and cattle in 93% of cases. 77.14% of the interviewees had ancestry in the study area, where 7.62% had lived for more than 50 years. 6.67% are under 20 years, 8.57% are between 30 and 50 years. The percentage of land that the respondents farmed was as follows: > 1 acre: 22.86%, 1 to 2.9 acres: 34.29%, 3 to 4.9 acres: 21.90%, and 5 acres: 20.95%.

Crop raiding, Protection measures and Compensation

In this region, the primary crops grown include bananas (*Musa paradisia*), groundnuts (*Arachis hypogaea*), fodder grass (*Pennissetum purpureum*), coconuts (*Cocus nucifera*), turmeric (*Curcuma longa*), maize (*Zea mays*), and sugarcane (*Saccaram officinarum*). Other agricultural species include millets, vegetables, flowers, tapioca (*Berghia major*), cotton (*Gossypium sp.*), muskmelon (*Cucumis melo*), and watermelon (*Citrullus lanatus*). Asian Elephant (*Elephas maximus*), Wild Boar (*Sus scrofa*), Sloth Bear (Melursus ursinus), Bonnet Macaque (*Macaca radiata*), Peacock (*Pavo cristatus*), and Spotted Deer are the species that the respondents reported seeing (*Axis axis*). Wherein visitation is ranked as 100% regular for wild boar (*Sus scrofa*), 100% regular for peacock, and varying for Asian elephant (*Elephas maximus*) with regular visits at 37.04%, twice or three times per month at 6.48%, unpredictable at 30.56%, summer at 9.26%, and cropping seasons at 6.48%. spotted deer, which is reported by 50% of the respondents (40.57% regularly, 9.43% seasonally), is rare (6.48%), visits agriculture but does no harm (3.70%), and the respondents used a variety of typical mitigation techniques, such as fire, fabric fencing, torches, and crackers. However, the respondents thought that these mitigations were ineffective since the animals had become accustomed to all of these conventional techniques. As a result, the dogs that protect the farmlands at night (65%) currently warn the respondents. The Forest Department has implemented night patrolling to protect farmers from large herbivore that raid the crops at night. As a result, any incidents reported, the department vehicle arrives to the location followed the animal leaves the farm land once it spots the department vehicle, as expressed by 42% of the respondents.

The mitigations used by respondents in the research area are shown in Figure 1. The study area's respondents currently use battery fencing 50.94%, diamond fencing 2.83%, stone fencing for 3 feet 2.83%, and hanging fence in a patch as a group initiative. However, 43.40% of the farmers said they couldn't afford any mitigation measures. There is a need for a long-term approach to decrease the conflict situations and mitigate the wild animals from farms. In order to address this conflict issue, it was questioned, and 89.72% of respondents were able to provide a response. 29.91% of respondents said they wanted

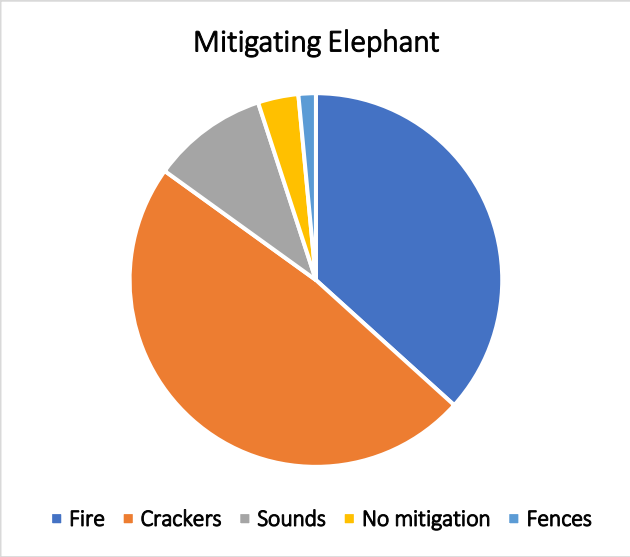

Figure: 1a

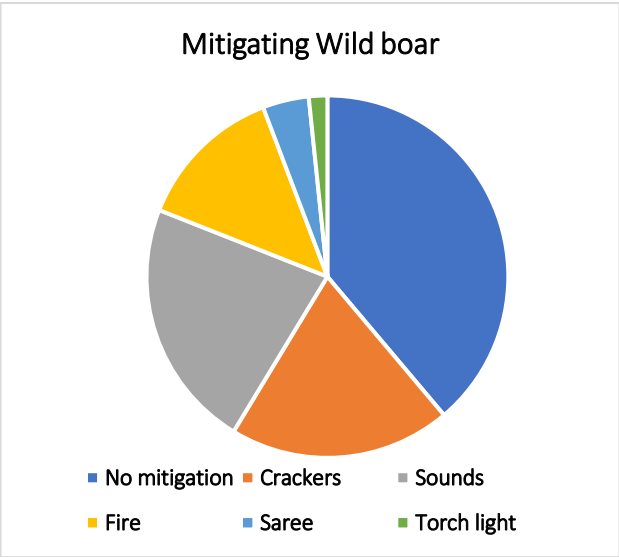

Figure: 1b

Figure: 1 – Mitigations used to ride the wild animals from farm lands

assistance from the organisation in charge of the forest with some solutions to help resolve this conflict; 28.97% said the forest department should erect a battery fence or hanging fence along the forest's boundaries, followed by regular maintenance work being done by people; 11.21% said they should deepen the trench and conduct regular maintenance; 12.148% said they should erect a compound wall for 10 metres along the trench; and 3.74% said they should erect barriers and restrict movement.

Regarding compensation 10.28% of the respondents have received compensations and 89.28% of the respondents have not utilized compensation provided by the Tamil Nadu Government towards crop loss by wildlife. Respondents' perceptions of applying for compensation, 30.84% are unwilling to do so, 27.10% find it unsatisfactory, 20.50% believe the process is lengthy, 3.74% are dissatisfied with applying for compensation because crop value has decreased, 1.87% have applied but haven't received compensation, and only 15.89% are willing to do so. 86.22% of respondents reported conflict situations to the forest department, whereas 14.4% did not inform them.

Perception of human-animal conflict and attitude towards conservation

Majority of the respondents put the mantle of preventing crop depredations mainly of forest department where in the animals are sole property of the forest department. Conservation aspects was not observed within the respondents. The figure 2 states the number of HAC incidents that occurred near the forest boundaries as per recorded received from the department. The conflict incidents take place up to the five kilometres from the boundary of the forests.

DISCUSSION

According to Mulonga *et al*. (2003), HWC is irregularly distributed in both place and time, but it is quantitatively ubiquitous and mainly depends on the density of and closeness to HH of animals. Both natural and human factors are crucial for determining the presence and number of animals (Boer *et al*., 2013). For HWC to happen, an HH must be exposed to wildlife, and this exposure relies on the surrounding environment. Each human group has its own culture and set of values, which has allowed humans to cohabit with other animal species (Anand *et al*., 2018; Gross, *et al*., 2019).

Asian elephants are revered as gods and are known locally as "Periyaswami," according to the current study's observations, which indicate that people deal with high levels of stress related to wild boar (known locally as "Muruthaar") and that most respondents have little to no negative feelings about elephant raids

unless there is frequent occurrence of conflict incidents. However, wild boar and peacock are regarded as threats that contribute significantly to crop raiding, and since people find it depressing to defend their crops from these animals because they failed to do so, respondents remain accustomed to and perplexed to address the conflict records of these animals. There is a need for action because more than 95% of households rely primarily on agriculture for their subsistence. The conflict between humans and wildlife worsens when the needs and behaviours of animals undermine human aims or when human ambitions negatively affect the requirements of wildlife (Xu et al., 2019).

The main reason for the residents' negative sentiments toward conservation is the study area's significant economic loss from agricultural damage brought on by wildlife. Because 77% of the respondents have resided in the research area since they were youngsters, or for more than seven decades, most respondents claimed that there has been an increase in wild animal visits to crops in the recent ten years. At least 14 crops are susceptible to attacks from Asian elephants and wild boars. According to the responders, animals like elephants and wild boars cause more severe damage to entire crop fields and render them useless in addition to directly hurting crops. Particularly, the digging and wallowing habits of wild boars in the field cause holes that, if unchecked, can damage farming equipment and endanger machine operators. They also damage buildings, fences, and other infrastructure.

Despite the fact that 50% of respondents had some form of education, only 11% had claimed for compensation. Additionally, attitudes on seeking ex-gratia (compensation) for harm caused by wild animals are still mixed and often negative. 92% of people report animal visits to the forest department for croplands, with most of them only mentioning night time visits from animals. When it comes to mitigation strategies, people use a variety of lethal and non-lethal techniques, such as setting fire to the ground, lighting fireworks, making loud noises, erecting battery fences, torchlight, colourful sarees as fences, scarecrows, and using dogs to guard the land, among other things. We discovered that there are several conventional methods that are still in use in the research region and are efficient at reducing confrontations between people and wildlife, such as creating compound walls and stone fences for a distance of three feet, followed by battery fences above the fence. Lethal and non-lethal approaches can be distinguished between these. We discovered that a few of the lethal methods in use have a detrimental effect on both the environment and individuals. As a result, we conclude that actions must be taken to preserve present traditional knowledge in order to preserve sustainable practices that will lessen conflicts between people and wildlife.. Additionally, we discovered that no traditional method is ever completely effective (100%) due to things like cost, labour, time, and environmental and social effects. These methods must be used as a last resort because some of them have a negative effect on the ecosystem and the targeted species.

Farmers were obliged to create a variety of traditional ways to lessen their susceptibility and losses as a result of crop raiding and livestock predation by wild animals in numerous Indian states (Chetri, *et al*., 2019; Naha, *et al*., 2018; Konig *et al*., 2020). These methods involve physically excluding wild animals to lessen conflicts between people and nature. The design, level of craftsmanship used in building, and upkeep all affect how successful such safeguards are. To keep wild animals out of agricultural regions, barriers including fences, stonewalls, ditches, and moats are used (Pradhan, 2018). Cost is a significant element that restricts the use of physical barriers. The price of building a physical barrier is influenced by a number of elements, such as the species in question, the terrain, and the barrier's design. Conflicts that are more intense have a major effect on both people and wildlife. Deterrents like fencing are commonly used in prevention and deterrence tactics to instil fear or change behaviour (Mumby and Plotnik, 2018). Adopting such techniques, however, necessitates investments, which may lower HH income due to trade-offs between preventative costs and lost revenue from agricultural losses (Osipova *et al*., 2018). The indirect consequences of conflict, which are harder to measure, include missed chances with stakeholders, diminished psychosocial welfare, interruption of livelihoods, and food insecurity (Barua *et al*., 2013; Drouilly *et al*., 2020; Hoare, 2012; Yang *et al*., 2020).

It is urgently necessary to combine traditional approaches with contemporary scientific knowledge. By enhancing the current approach, they will be more successful at settling problems between people and

wildlife. The existing knowledge of conventional mitigation methods at the landscape level needs to be strengthened and documented by regional NGOs and concerned government authorities. The prevention of HWC is essential to the preservation and recovery of many species and poses a significant obstacle to the preservation of biodiversity and sustainable development. However, the core causes of HWC are intricate socio-economic, political, and ecological problems (Mosimane *et al*., 2014; Mutanga *et al*., 2015).

HWC could ultimately contribute to the failure of local conservation efforts. (Stoldt *et al*., 2020). For instance, community-based conservation (CBC) efforts seek to balance socioeconomic growth and wildlife conservation (creating synergies). These actions have been demonstrated to significantly boost wildlife populations (Meyer *et al*., 2021b). People's perceptions and attitudes regarding conservation may play a significant role in the success or failure of CBC activities, and if people receive net benefits from conservation, they are more likely to develop positive attitudes toward wildlife (Stormer *et al*., 2019). The success of CBC initiatives may be adversely affected by unfavourable attitudes and viewpoints regarding conservation (Whitham *et al*., 2015). For conservation partitioners to properly address all parties involved and build a comprehensive strategy, it is crucial that they have a deeper understanding of ecological and physiological processes that span both human and animal behaviour as well as the surrounding environment.

CONCLUSION

The management of HEC mitigation is a diverse, complex issue that calls for numerous measures and is currently at the forefront of elephant conservation. As better governance models are developed in the coming years, additional conflicts like those caused by wild boar and peacock can also be taken into account. In order to reduce HWC, the Forest Department can assist the locals in clearing brush from around agricultural areas because this brush provides a daytime haven for wild pigs. Local residents can act as opinion leaders to sway choices and promote innovative ideas. Education of the populace would be a way of exploring the communities and it might allow the decision makes to incorporate the populace in future actions. It is seen that the respondents lack knowledge regarding wildlife, compensation (ex-gratia), and forestry. Alternative cropping can also be used in regions where there are frequent conflict occurrences and the majority of the study area's population works in agriculture. Consequently, during awareness efforts, the public could be informed about a second source of income.

Conflict of Interest: None of the authors have any conflicts of interest to disclose. All the authors approved the final version of the manuscript.

REFERENCES

Anand, S., Binoy, V.V., Radhakrishna, S., 2018. The monkey is not always a God: attitudinal differences toward crop-raiding macaques and why it matters for conflict mitigation. Ambio 47 (6), 711–720.

Barua, M., Bhagwat, S.A., Jadhav, S., 2013. The hidden dimensions of humanewildlife conflict: health impacts, opportunity and transaction costs. Biol. Conserv. 157, 309e316.

Boer, W.F. de, van Langevelde, F., Prins, H.H.T., Ruiter, P.C. de, Blanc, J., Vis, M.J.P., Gaston, K.J., Hamilton, I.D., 2013. Understanding spatial differences in African elephant densities and occurrence, a continent-wide analysis. Biol. Conserv. 159, 468–476.

Chetri, M., Odden, M., Devineau, O., Wegge, P., 2019. Patterns of livestock depredation by snow leopards and other large carnivores in the central Himalayas, Nepal. Glob. Ecol. Conserv. 17, e00536. doi:10.1016/j.gecco.2019.e00536.

Dasgupta, S., & Ghosh, A. K. (2015). Elephant-railway conflict in a biodiversity hotspot: Determinants and perceptions of the conflict in northern West Bengal, India. Human Dimensions of Wildlife, 20(1), 81–94. https://doi.org/10.1080/10871209.2014.937017.

Dorji, S., Rajaratnam, R., Falconi, L., Williams, E. S., Sinha, P., & Vernes, K. (2018). Identifying conservation priorities for threatened Eastern Himalayan mammals. Conservation Biology, 32(5), 1162–1173. https://doi.org/10.1111/cobi.13115.

Drouilly, M., Kelly, C., Cristescu, B., Teichman, K.J., O'Riain, M.J., 2020. Investigating the hidden costs of livestock guarding dogs: a case study in Namaqualand, South Africa. J. Vertebr. Biol. 69, 16.

Fiallo, E.A. and Jacobson, S.K. (1995) Local communities and protected areas: attitudes of rural residents towards conservation and Machalilla National Park, Ecuador. Environmental Conservation, 22 (3), 241±249.

Fonseca, C., Venticinque, E., 2018. Biodiversity conservation gaps in Brazil: A role for systematic conservation planning. Perspect. Ecol. Conser. 16 (2), 61–67.

Gabriel, J., Jaime, V., Francisco, E., 2014. The role of native Forest plantations in the conservation of Neotropical birds: The case of the Andean alder. J. Nat. Conserv. 22, 547–551.

Gross, E.M., Lahkar, B.P., Subedi, N., Nyirenda, V.R., Lichtenfeld, L.L., Jakoby, O., 2019. Does traditional and advanced guarding reduce crop losses due to wildlife? A comparative analysis from Africa and Asia. J. Nat. Conserv. 50, 125712. doi:10.1016/j.jnc.2019.125712.

Gupta, N., Rajvanshi, A., & Badola, R. (2017). Climate change and human–wildlife conflicts in the Indian Himalayan biodiversity hotspot. Current Science, 113(5), 846–847.

Gurung, J., Chettri, N., Sharma, E., Ning, W., Chaudhary, R. P., Badola, H. K., ..., Shah, G. M. (2019). Evolution of a trans boundary landscape approach in the hindu kush Himalaya: Key learnings from the Kangchenjunga landscape. Global Ecology and Conservation, 17, e00599. https://doi.org/10.1016/j.gecco.2019.e00599.

Hoare, R., 2012. Lessons from 15 years of human-elephant conflict mitigation: management considerations involving biological, physical and governance issues in Africa. Pachyderm 60–74.

Holland, K., Larson, L. R., & Powell, R. B. (2018). Characterizing conflict between humans and big cats Panthera spp: A systematic review of research trends and management opportunities. PLoS One, 13(9), e0203877. https://doi.org/10.1371/journal.pone.0203877, 7.

Jones, K.R., Venter, O., Fuller, R.A., Allan, J.R., Maxwell, S.L., Negret, P.J., Watson, J.E. M., 2018. One-third of global protected land is under intense human pressure. Science 360 (6390), 788–791.

Joshi, A. R., Dinerstein, E., Wikramanayake, E., Anderson, M. L., Olson, D., Jones, B. S., Hahn, N. R. (2016). Tracking changes and preventing loss in critical tiger habitat. Science Advances, 2(4), e1501675. https://doi.org/10.1126/sciadv.1501675.

Kanagaraj, R., Araujo, M. B., Barman, R., Davidar, P., De, R., Digal, D. K., Gopi, G. V., Goyal, S. P. (2019). Predicting range shifts of Asian elephants under global change. Diversity and Distributions, 25(5), 822–838. https://doi.org/10.1111/ddi.12898.

Kandel, P., Gurung, J., Chettri, N., Ning, W., & Sharma, E. (2016). Biodiversity research trends and gap analysis from a transboundary landscape, Eastern Himalayas. Journal of Asia-Pacific Business, 9(1), 1–10. https://doi.org/10.1016/j.japb.2015.11.002.

Karanth, K. K., & Kudalkar, S. (2017). History, location, and species matter: Insights for human wildlife conflict mitigation from India. Human Dimensions of Wildlife, 22 (4), 331–346. https://doi.org/10.1080/10871209.2017.1334106.

König, H.J., Kiffner, C., Kramer-Schadt, S., Fürst, C., Keuling, O., Ford, A.T., 2020. Human–wildlife coexistence in a changing world. Conserv. Biol. 34 (4), 786–794. doi:10.1111/cobi.13513.

Li, G., Gao, J., Li, L., Hou, P., 2020. Human pressure dynamics in protected areas of China based on nighttime light. Glob. Ecol. Conserv. 24, e01222.

Lischka, S., Teel, T., Johnson, H.E., Reed, S.E., Breck, S., Carlos, A.W.D., Crooks, K.R.A., 2018. Conceptual model for the integration of social and ecological information to understand human-wildlife interactions. Biol. Conserv. 225, 80–87.

Madhusudan MD, Sankaran P. 2010. Seeing the Elephant in the Room: Human–Elephant Conflict and the ETF Report. Economic and Political Weekly XLV, 29-31.

Maxwell, S.L., Fuller, R.A., Brooks, T.M., Watson, J.E.M., 2016. Biodiversity: the ravages of guns, nets and bulldozers. Nature 536, 143–145.

Methorst, J., Arbieu, U., Bonn, A., Bohning-Gaese, ¨ K., Müller, T., 2020. Non-material contributions of wildlife to human well-being: a systematic review. Environ. Res. Lett. 15, 93005.

Meyer, M., Klingelhoeffer, E., Naidoo, R., Wingate, V., Borner, ¨ J., 2021b. Tourism opportunities drive woodland and wildlife conservation outcomes of communitybased conservation in Namibia's Zambezi region. Ecol. Econ. 180, 106863.

Mosimane, A.W., McCool, S., Brown, P., Ingrebretson, J., 2014. Using mental models in the analysis of human–wildlife conflict from the perspective of a social–ecological system in Namibia. Oryx 48, 64–70.

Mulonga, S., Suich, H., Murphy, C., 2003. The Conflict Continues: Human Wildlife Conflict and Livelihoods in Caprivi (DEA Research Discussion Paper).

Mumby, H.S., Plotnik, J.M., 2018. Taking the elephants' perspective: remembering elephant behavior, cognition and ecology in human-elephant conflict mitigation. Front. Ecol. Evol. 6.

Mutanga, C.N., Vengesayi, S., Muboko, N., Gandiwa, E., 2015. Towards harmonious conservation relationships: a framework for understanding protected area staff-local community relationships in developing countries. J. Nat. Conserv. 25, 8–16.

Naha D, Sathyakumar S, Rawat GS. Understanding drivers of human-leopard conflicts in the Indian Himalayan region: Spatiotemporal patternsof conflicts and perception of local communities towards conserving large carnivores. PLoS ONE. 2018; 13(10):

Naha, D., Sathyakumar, S., & Rawat, G. S. (2018). Understanding drivers of human-leopard conflicts in the Indian Himalayan region: Spatio-temporal patterns of conflicts and perception of local communities towards conserving large carnivores. PLoS One, 13(10), e0204528. https://doi.org/10.1371/journal.pone.

Naughton-Treves, L. (1998). Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. Conservation Biology, 12(1), 156–168.

Nyhus, P. J. (2016). Human-wildlife conflict and coexistence. Annual Review of Environment and Resources, 41, 143–171. https://doi.org/10.1146/annurev-environ110615-085634.

Osipova, L., Okello, M.M., Njumbi, S.J., Ngene, S., Western, D., Hayward, M.W., Balkenhol, N., 2018. Fencing solves human-wildlife conflict locally but shifts problems elsewhere: a case study using functional connectivity modelling of the African elephant. J. Appl. Ecol. 55, 2673–2684.

Pradhan, V. 2018. Developing strategies to mitigate human wildlife conflict in the Sikkim Himalayas, India. Report, ATREE, Gangtok, Sikkim, India.

Rawat, P. K. (2014). GIS development to monitor climate change and its geohydrological consequences on non-monsoon crop pattern in Lesser Himalaya. International Journal of Computers and Geosciences, 70, 80–95.

Roy, M., & Sukumar, R. (2017). Railways and wildlife: A case study of train-elephant collisions in northern West Bengal, India. In L. Borda-de-Água, R. Barrientos, P. Beja, & M. H. Pereira (Eds.), Railway ecology (pp. 157–178). Switzerland: Springer.

Sampson, C., Rodriguez, S.L., Leimgruber, P., Huang, Q., Tonkyn, D., 2021. A quantitative assessment of the indirect impacts of human-elephant conflict. PLoS One 16, e0253784.

Sathyakumar, S., Bashir, T., Bhattacharya, T., & Poudyal, K. (2011). Assessing mammal distribution and abundance in intricate eastern Himalayan habitats of Khangchendzonga, Sikkim, India. Mammalia, 75(3), 257–268. https://doi.org/10.1515/mamm.2011.023.

Sherchan, R., & Bhandari, A. (2017). Status and trends of human-wildlife conflict: A case study of Lelep and Yamphudin region, Kanchenjunga conservation area, Taplejung. Conservation Science, 5(1), 19–24.

Stoldt, M., Gottert, ¨ T., Mann, C., Zeller, U., 2020. Transfrontier conservation areas and human-wildlife conflict: the case of the Namibian component of the KavangoZambezi (KAZA) TFCA. Sci. Rep. 10.

Stormer, N., Weaver, L.C., Stuart-Hill, G., Diggle, R.W., Naidoo, R., 2019. Investigating the effects of community-based conservation on attitudes towards wildlife in Namibia. Biol. Conserv. 233, 193–200.

Tapia-Armijos, M.F., Homeier, J., Munt, D.D., 2017. Spatio-temporal analysis of the human footprint in South Ecuador: Influence of human pressure on ecosystems and effectiveness of protected areas. Appl. Geogr. 78, 22–32.

Wekesa, B. W., Steyn, G. S., & Otieno, F. A. O. (2011). A review of physical and socio-economic characteristics and intervention approaches of informal settlements. Habitat International, 35(2), 238–245.

Whitham, C.E.L., Kun, S., Riordan P. (2015) People and protected areas: understanding attitude alignment for more effective conservation. J. Resour. Ecol. 6, 281–292.

Xu, J.Y., Wei, J.Y., Liu, W.H., 2019. Escalating human-wildlife conflict in the Wolong Nature Reserve, China: a dynamic and paradoxical process. Ecol. Evol. 9, 7273–7283.

Yang, H., Lupi, F., Zhang, J., Liu, J., (2020) Hidden cost of conservation: a demonstration using losses from human-wildlife conflicts under a payments for ecosystem services program. Ecol. Econ. 169, 106462.

.