

# Spatial distribution of human–elephant negative interactions in Gudalur Forest Division in the Nilgiris

The Asian Elephant *Elephas maximus* is an endangered and keystone species (Ramakrishnan & Saravanamuthu 2010) categorized under Schedule I of the Indian Wildlife (Protection) Act, 1972. Over the past few decades many developmental and destructive activities of humans have severely fragmented the forests. The elephant is one of the most negative interaction-prone wildlife species in India causing large scale damage to crops and human lives. Human-Elephant negative interactions (HENI) refers to conflicts (sic) between humans and elephants. Some of the negative effects of elephants to humans include crop-raids, deaths and injuries to humans and livestock (Tchamba 1995) and similar negative impact of human being to elephants include retaliatory killings, electrocution and other fatal injuries and deaths. Such demands, developmental and agricultural activities have drastically reduced and fragmented elephant habitats, which is the key conservation problem (Baskaran et al. 2007; Daniels & Vencatesan 2008).

The settlements are located in close proximity to forest and farmer's irrevocable dependence on food crops and livestock. Since 80 per cent of the elephant's range lies outside of the protected areas, overlap with human activities is inevitable (Granados et al. 2012). HENI can include crop-raiding, damage to village infrastructure or homes and injury to or death of cattle and occasionally people. Here we present a one-sided statistics of the negative interactions in the landscape.

The Nilgiri–Wynaad is an area that had sufficient forested lands and the state could establish control by abolishing the traditional Janmam rights, and the state also wanted to counter and halt the large-scale migrations of human groups from Kerala State. Davidar (1972) stated that this forest division had sizeable elephant population during migration between the Mudumalai Wildlife Sanctuary and

Silent Valley National Park through Nilambur and New Amarambalam reserve forest tracts of Kerala.

The man-made activities such as mining operations were extensively recorded during nineteenth century. Mines were abandoned when they failed but other development activities such as coffee, tea and forest plantations continued. Once there was contiguous forest cover of the Gudalur plateau which acted as a linkage between the forests of Kerala, Tamil Nadu, and Karnataka, facilitated the movement of wild animals, especially migration of elephants and to some extent of Gaur. Rapid and excessive development of plantations has resulted in the formation of forest patches which triggered the animals to go outside the forest areas in search of food creating interaction situation in this division.

With this background the present study was carried out in the Nilgiri–Wynaad Plateau to assess the status of HENI and to assess the species involved and compensation paid. The HENI is posing a major challenge to the conservation of Asian Elephants, and resolving HENI is the major concern among the conservation community (Tchamba 1995).

## STUDY AREA

Gudalur division situated at the convergence of Kerala, Karnataka and Tamil Nadu, lies between 11.37 and 11.57°N and 76.53 and 76.25°E covering an area of 484.4 km<sup>2</sup>. Gudalur division forms an undulating terrain with low hills and valleys. The average elevation of the area is about 1,000 m. The Nilgiris–Wayanad lies west of the Nilgiri Plateau and south-west of the Sigur plateau (which is an extension of the Mysore plateau). Steep slopes of the range of hills and peaks, e.g., The Kundah form the eastern boundary of the Nilgiris–Wayanad. This division lies west of the Nilgiris Plateau and is bound on the north by Benne R.F of Mudumalai Wildlife

Sanctuary, on the east by a range of hills with steep slopes and the Kundah peak, on the south-east by Nilgiris division, on the south and south-west by the New Amarambalam forests of Kerala State and on the west and north-west by the Kerala State. The division lies in Gudalur and Pandalur taluk of Nilgiris District. The approximate length of forest boundary of Gudalur division is 72 km.

## RESULT

Human-Elephant Negative Interactions issues recorded in and around Gudalur forest division from the year 2017 to 2023.

A total of 45 human casualties were recorded caused by elephants over the past seven years (2017–2023) in Gudalur Forest Division. Of these, the year 2023 recorded highest number of human

deaths (n = 9), followed by 2018 (n = 8) and seven human deaths each in 2020 and 2022.

In contrast, fewer human deaths were recorded in 2017 and 2021. A total of 61 human injuries were caused by elephants from 2017 to 2023. The highest number of human injuries were occurred in 2018 (n = 19) followed by 2019 (n = 11) and 2017 (n = 10). A total of 171 crop damage incidents were reported. The year 2023 had the highest number of crop damage incidents (n = 64). The lowest number of crop damage incidents was recorded in 2020 (n = 4).

A total of two hundred and 63 property damage incidents were caused by elephants. The highest number of property damage incidents were occurred in 2022 (n = 61) followed by 2023 (n = 59) and 2017 (n = 51). The lowest number of property damage incidences were recorded in 2019 (n = 16).



Location map of Gudalur Forest Division.

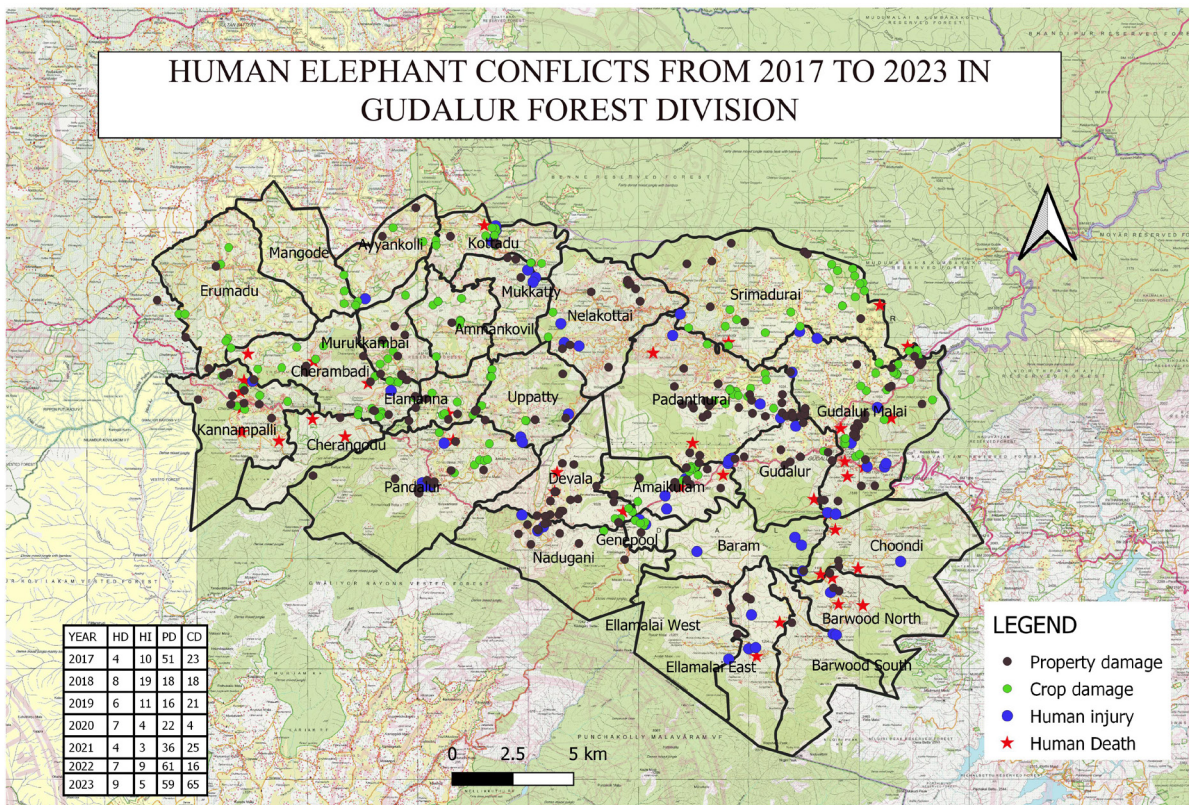
## HUMAN CAUSALITIES

Totally, 45 human casualties were recorded due to HENI for the past seven years (2017–2023) in Gudalur Forest Division, of which, the year 2023 attributed highest number of human deaths (n = 09) followed by 2018 (n = 8) and each seven human casualties in 2020 and 2022. Among these years, the lowest number of human deaths (n = 4) were recorded in 2021. Among the casualties, most of the victims were male (n = 33) than females (n = 12).

Totally, 44 human deaths were recorded from 2017 to

Human-Elephant Negative Interactions issues recorded in and around Gudalur forest division from the year 2017 to 2023.

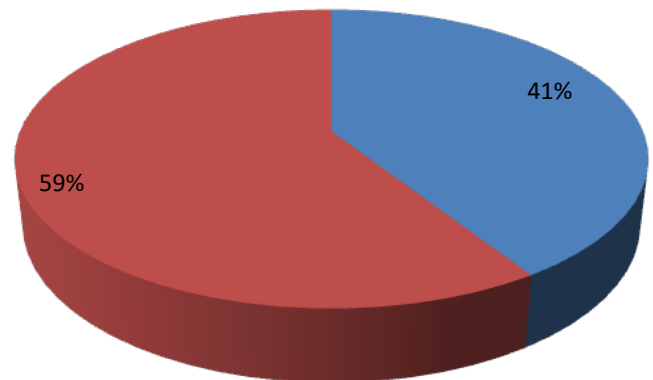
	Year	Total number of human deaths caused by elephants	Total number of human injuries caused by elephants	Total number of crop damage incidences caused by elephants	Total number of property damage incidences caused by elephants
1	2017	4	10	23	51
2	2018	8	19	18	18
3	2019	6	11	21	16
4	2020	7	4	4	22
5	2021	4	3	25	36
6	2022	7	9	16	61
7	2023	9	5	64	59
Total		45	61	171	263



**Spatial distribution of human–elephant negative interactions in Gudalur Forest Division.**

2023 in Gudalur forest division. It is very important to note that there was not much difference noticed in human deaths that occurred between outside (51%) and inside of the forest areas (41%).

■ Inside RF ■ Outside RF



**Location of human deaths occurred from 2017 to 2023**

### HUMAN INJURIES

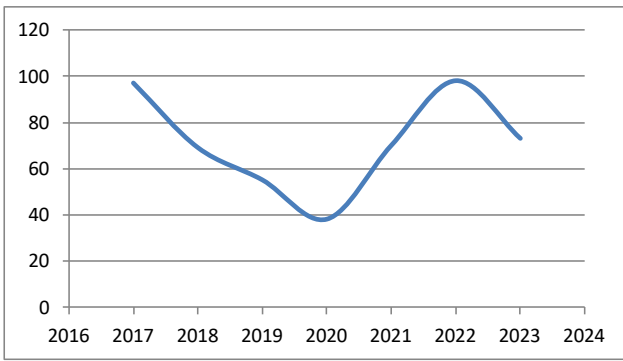
A total of 61 human injuries were caused by elephants from 2017 to 2023 in Gudalur forest division. Of which highest number of human injuries were recorded in the year 2018 (n = 19) followed by 2019 (n = 11), 2017 (n = 10), and 2022 (n = 9). On the contrary, lowest number of human injuries were recorded in the year 2020 (n = 4).

### CROP DAMAGE

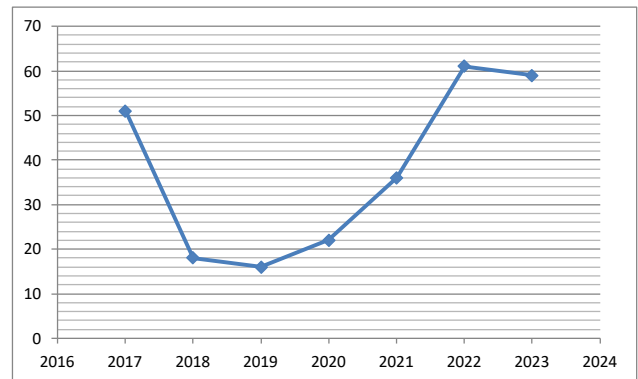
Totally, 171 crop damages were caused by elephants in the past seven years (2017–2023) in Gudalur Forest Division. Of which, the year 2023 attributed highest number of crop damages (n = 64) followed by 2021 (n = 25) and 2017 (n = 23). The lowest number of crop damages recorded in the year of 2020 (n = 4).

### PROPERTY DAMAGE

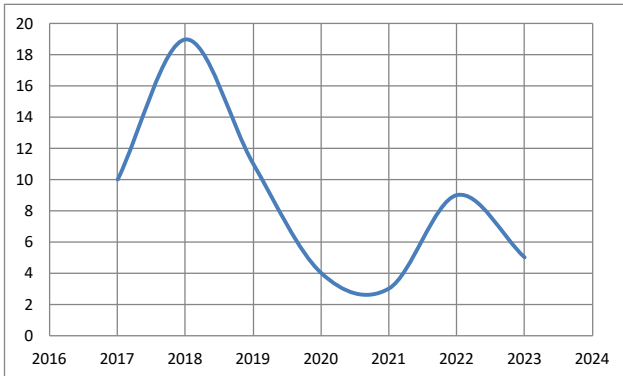
Totally, 263 property damages were caused by elephants for the past 19 years (2017–2023) in Gudalur Forest Division, of which, the year 2022 attributed highest number of crop damages (n = 61) followed by 2023 (n = 59) and 2017 (n = 51). The lowest number of property damages was recorded in the year 2019 (n = 16).



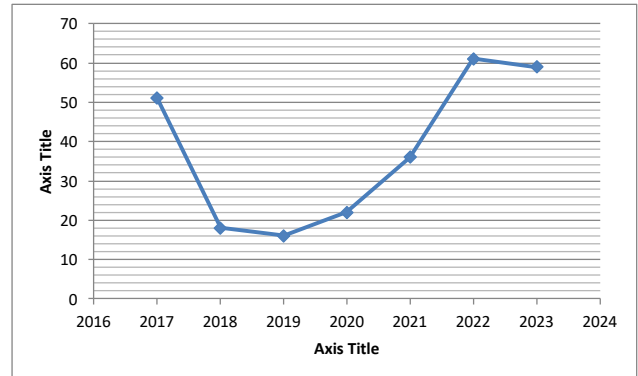
**Human deaths caused by elephants from 2017 to 2023**



**Crop damage caused by elephants from 2017 to 2023**



**Human injuries caused by elephants from 2017 to 2023.**



**Property damages caused by elephants from 2017 to 2023.**

## DISCUSSION

In India, the human population has increased from 252 million in 1911 to 1200 million in the current scenario, which resulted in tremendous pressure on forestland and other produces in India. The proliferation of the human population and its ever-increasing needs would deplete the natural wealth through inappropriate development strategies to cope with the demand. Over few decades, there has been shrinkage of potential habitats due to various land use changes which forms the major cause for the loss of crucial habitats to Asian Elephant populations (Daniel 1980). Human activities are the ultimate cause of this rapid biodiversity loss, as unprecedented numbers of people compete with other species to meet the growing per capita demands for land and resources (WRI 2000; McKee 2003). Loss of human life and the property damage were the most serious form of HENI according to the ranking by local communities (Campbell et al. 2000; Sitati & Ipara 2007). Crop damage accounts for major type of interaction followed by human deaths in Asia (Lahiri-Chowdhury 1980; Sukumar 1985; Dey

1991; Balasubramanian et al. 1995; Zhang & Wang 2003; Bandara & Tisdell 2003; Ramakrishnan 2007) and Africa (Tchamba 1995; O'Connell-Rodwell et al. 2000; Smith & Kasiki 2000; Sitati et al. 2003).

The estimated 28,000 wild elephants in India are distributed over an area of about 109,500 km<sup>2</sup>, about three per cent of the country's geographical area. In some of these tracts, a segment of the elephant population killed an average of 350 people annually over the last five years (2005–2010) (Lenin & Sukumar 2011). In the present study 45 human casualties were recorded due to human-elephant conflicts (HEC) over the past seven years (2017–2023) in Gudalur Forest Division. Of these, the year 2023 recorded the highest number of human deaths (n = 9), followed by 2018 (n = 8), and 2020 and 2022 (n = 7 each human deaths). In contrast, fewer human deaths were recorded in 2017 and 2021. Most of the human deaths occurred outside of the forest areas and sizeable number of human deaths were recorded inside forest areas.

Ramakrishnan (2007) pointed out that the indiscriminate growth in the construction of buildings in the forms of resorts, educational institutions, ashrams and amusement parks in the fringes of the corridors considerably affects the movement of elephants which becomes a cause for the HENI. In the present study, 61 human injuries caused by elephants were recorded from 2017 to 2023 in Gudalur Forest Division. The highest number of human injuries occurred in 2018 (n = 19), followed by 2019 (n = 11), and 2017 (n = 10). Fewer human injuries were recorded in 2021. About 171 crop damage incidents were reported in and around the Gudalur Forest Division. The year 2023 had the highest number of crop damage incidents (n = 64), followed by 2021 (n = 25). The lowest number of crop damage incidents was recorded in 2020 (n = 4).

Property damage caused by elephants is one of the criteria to evaluate the intensity of HENI in a particular area or particular place. Totally, 263 property damage incidents caused by elephants were reported in Gudalur Forest Division from 2017 to 2023. The highest number of property damage incidents occurred in 2022 (n = 61), followed by 2023 (n = 59), and 2017 (n = 51). The lowest number of property damage incidents was recorded in 2019 (n = 16).

## CONCLUSION AND RECOMMENDATIONS

The present study of HEC paved a way for suggesting the following recommendations for the better management of this forest division for the long-term conservation of wildlife.

- I. It is necessary to ensure and protect the Nilambur to Mudumalai via O'Valley corridor. Since the major land areas in this corridor are belonged to wealthy planters, it would be easily negotiated and secured in this corridor.
- II. Awareness creation through education and some biological (eco-friendly) mitigation measures needs to be suggested for the conflict areas through participatory approach in this forest division.
- III. As long-term measure, intensive management of elephant migratory routes

will be needed (Ramkumar et al. 2014a). Also, management strategies in this division should be aimed at regulating land use changes in private lands at least 2 km from forest boundary, habitat improvement in forest foothill and detailed research on factors of human-elephant conflict and new techniques on control measures.

## ACKNOWLEDGEMENTS

Our sincere thanks to the district forest officer, forest range officers, forest guards, forest watchers and anti-poaching watchers, anti-depredation squads of Gudalur Forest Division for providing all logistic supports in the field during the data collection periods.

## REFERENCES

- Balasubramanian, M., N. Baskaran, S. Swaminathan & A.A. Desai (1995).** Crop raiding by Asian elephants *Elphas maximus* in the Nilgiri Biosphere Reserve, southern India, pp. 350–367. In: Daniel, J.C. & H.S. Datye (eds.). *A week with elephants: Proceedings of the International Seminar on the Conservation of Asian Elephant, June 1993*. Bombay Natural History Society, 535 pp.
- Bandara, R. & C. Tisdell (2003).** The economic value of conserving Asian elephant: Contingent valuation estimation for Sri Lanka. *Gajah* 22: 22–29.
- Baskaran, N., G. Kannan & U. Anbarasan (2007).** Conservation of the elephant population in the Anamalais-Nelliampathy and Palani Hills (Project Elephant Range: 9), southern India. Final Report to United States Fish & Wildlife Service. Asian Nature Conservation Foundation, Bangalore.
- Campbell, D.J., H. Gichohi, A. Mwangi & L. Chege (2000).** Land use conflict in Kajiado district, Kenya. *Land Use Policy* 17(4): 337–348.
- Daniel, J.C. (1980).** The Status of Asian Elephants in the Indian Sub-continent. *Elephant* 1(4): 16-28.
- Daniels, R.J.R. & J. Vencatesan (2008).** *Western Ghats: Biodiversity, people and Conservation*. Rupa Publications India Pvt. Ltd, 148 pp.
- Davidar, E.R.C. (1972).** Investigation of elephant migration paths in the Nilgiri Hills and inquiry into impediments to the free movement elephants there and 230 recommendations for the provision of corridors for their movement. Unpublished report to IUCN/SSC Asian Elephant Specialist Group, Journal of Bombay Natural History Society, 20 pp.

**Dey, S.C. (1991).** Depredation by wildlife in fringe areas in north Bengal with special to elephant damage. *The Indian Forester* 117(10): 901–908.

**Granados, A., R.B. Weladji & M.R. Loomis (2012).** Movement and occurrence of two elephant herds in a human-dominated landscape, the Be'noue' Wildlife Conservation Area, Cameroon. *Tropical Conservation Science* 5(2): 150–162.

**Lenin, J. & R. Sukumar (2011).** *Action Plan for the Mitigation of Elephant-Human Conflict in India*. Final Report to the U.S. Fish and Wildlife Service. Asian Nature Conservation Foundation, Bangalore.

**McKee, J.K. (2003).** *Sparing nature: The conflict between human population growth and Earth's biodiversity*. Rutgers University Press, 224 pp.

**O'Connell-Rodwell, C.E., T. Rodwell, M. Rice & L.A. Hart (2000).** Living with the modern conservation paradigm: can agricultural communities co-exist with elephants? A pre-year case study in east Caprivi, Namibia. *Biological Conservation* 93(3): 381–391.

**Ramakrishnan, B. & K. Ramkumar (2007).** Land acquisition perspectives of vital elephant corridors in the Coimbatore and Sathyamangalam Forest Divisions, Tamil Nadu, south India. Final Report. Wildlife Trust of India, New Delhi.

**Ramakrishnan, B. & R. Saravanamuthu (2010).** *Elephant – the key stone species*. Tamil Nadu State Council for Science and Technology and Indo American Wildlife Society, Chennai.

**Ramkumar, K., B. Ramakrishnan & R. Saravanamuthu (2014).** Crop damage by Asian Elephants *Elephas maximus* and effectiveness of mitigating measures in Coimbatore Forest Division, south India. *International Research Journal of Biological Sciences* 3(8): 1–11.

**Sitati, N.W. & H. Ipara (2007).** The role of tourism development and benefit sharing in mitigating human-elephant conflict in the Mara ecosystem, Kenya, pp. 71–80. In: Kloek E.M. & Rene van der Dium (eds.). *Tourism and nature in Africa. Thematic proceedings of Association for Tourism and Leisure Education (ATLAS) Africa conferences*.

**Sitati, N.W., M.J. Walpole, R.J. Smith & N. Leader-Williams (2003).** Predicting Spatial Aspects of Human-elephant conflict. *Journal of Applied Ecology* 40(4): 667–677.

**Smith, R.J. & S.M. Kasiki (2000).** A spatial analysis of human-elephant conflict in the Tsavo ecosystem, Kenya. A Report to the African Elephant Specialist Group, Human-Elephant Conflict Task Force, of IUCN, Gland, Switzerland, 73 pp.

**Sukumar, R. (1985).** Ecology of Asian elephant *Elephas maximus* and its interaction with man in south India. Ph.D., thesis. Indian Institute of Science, Bangalore.

**Tchamba, M.N. (1995).** The problem elephants of Kaele: a challenge to elephant conservation in northern Cameroon. *Pachyderm* 19: 26–32.

**World Resources Institute (2000).** *World Resources 2000–2001: People and ecosystems—the fraying web of life*. World Resources Institute, Washington, DC., 389 pp.

**Zhang, L. & N. Wang (2003).** An initial study on habitat conservation of Asian elephant *Elephas maximus*, with a focus on human elephant conflict in Simao, China. *Biological Conservation* 112(3): 453–459.

**P. Girikaran<sup>1</sup> & B. Ramakrishnan<sup>1\*</sup>**

<sup>1</sup>Department of Wildlife Biology, Stone House Hill Post, Government Arts College, Udthagamandalam, The Nilgiris, Tamil Nadu 643002, India.  
E-mail: ramkiwildlife2011@gmail.com\* (corresponding author)

**Citation:** Girikaran, P. & B. Ramakrishnan (2025). Spatial distribution of human–elephant negative interactions in Gudalur Forest Division in the Nilgiris. In: *Zoo's Print* 40(9): 06–11.