

## Human-Elephant Conflict in Dhenkanal Forest Division, Odisha, India

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**Abstract:** We investigated the human-elephant conflict in eight different ranges in Dhenkanal forest division, Odisha, India. Elephants were responsible for human casualty, large-scale crop and property damage; which caused serious human–elephant conflicts in the region were assessed. During 2001-2012, a total 64 human killing and 9 human injury cases caused by elephants were recorded. Damage to agricultural crops by elephant was of varying extents. As a result, people have developed antagonistic attitude towards the elephant which adversely affect conservation efforts.

**Key words:** Human-elephant conflict • Asian elephant • Crop damage • Depredation • Dhenkanal forest division

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### INTRODUCTION

India holds the largest population of Asian elephants in the wild [1]. The rapid increases in anthropogenic activities in elephant range areas in the past decade, human-elephant conflicts have become a measure problem for wildlife managers in India. Habitat fragmentation and loss have caused an escalation of elephant-human conflict, as elephants foray into agricultural lands to feed on cultivated crops. Manslaughter by elephants and injuring and killing of elephants by irate farmers accompany this conflict [2].

The state of Odisha harbours 72% of the elephant population in the eastern region of India which is about 7% of the Indian elephant population [3]. According to 2012 elephant census, Odisha harbours 1930 elephants including 208 adult bull-elephants, 756 adult cow-elephants, 126 sub-adult bull-elephants, 331 sub-adult cow-elephants, 46 adult/sub-adult of unknown sex, 184 juvenile and 279 calves in 43 Forest/Wildlife divisions out of 50 division of the state [4]. Conflict between humans and elephants occurs wherever they coexist, especially in the interface between elephant habitat and agricultural land or human settlements [5]. However, fewer studies have been carried out on human-elephant conflict at Odisha [6-9, 5]. Keeping the

above facts in view, the present investigation attempted to investigate human elephant conflict in Dhenkanal forest division (DFD) of Odisha, India.

**Study Area:** The study area, Dhenkanal forest division (Fig. 1) is located between 20° 17' 48" N to 21° 31' 37" N and 84° 40' 08" E to 85° 15' 44" E spreading over an area of 2909.54 square kilometers (Sq. Km.). The stated area include 35.68% of forest area (i.e., 1038.19 Sq. Km.) with 87 reserve forest blocks (511.71 Sq. Km.), 28 protected reserved forest blocks (218.54 Sq. Km.), revenue forests (295.95 Sq. Km.) and un-demarcated forests (0.54 Sq. Km.). The terrain is undulating with hill and hillocks of varying heights with an altitude ranging from 76m to 634.6m. The highest peak (634.6m) is “Kapilash” peak. The maximum temperature at DFD fluctuates between 30-44°C where as minimum temperature between 13-30°C. Monsoon commences from June and continues up to the end of September [10]. The annual rainfall ranges between 21mm and 33mm (average rainfall 1421mm in 73 rainy days). The vegetation of the study area includes tropical semi-ever green forests and mixed deciduous forests. DFD includes eight forest ranges namely Dhenkanal, Kamakhya Nagar East (KNE), Kamakhya Nagar West (KNW), Hindol, Mahabirod, Bhuban, Kapilash and Sadangi ranges. According to 2012 elephant

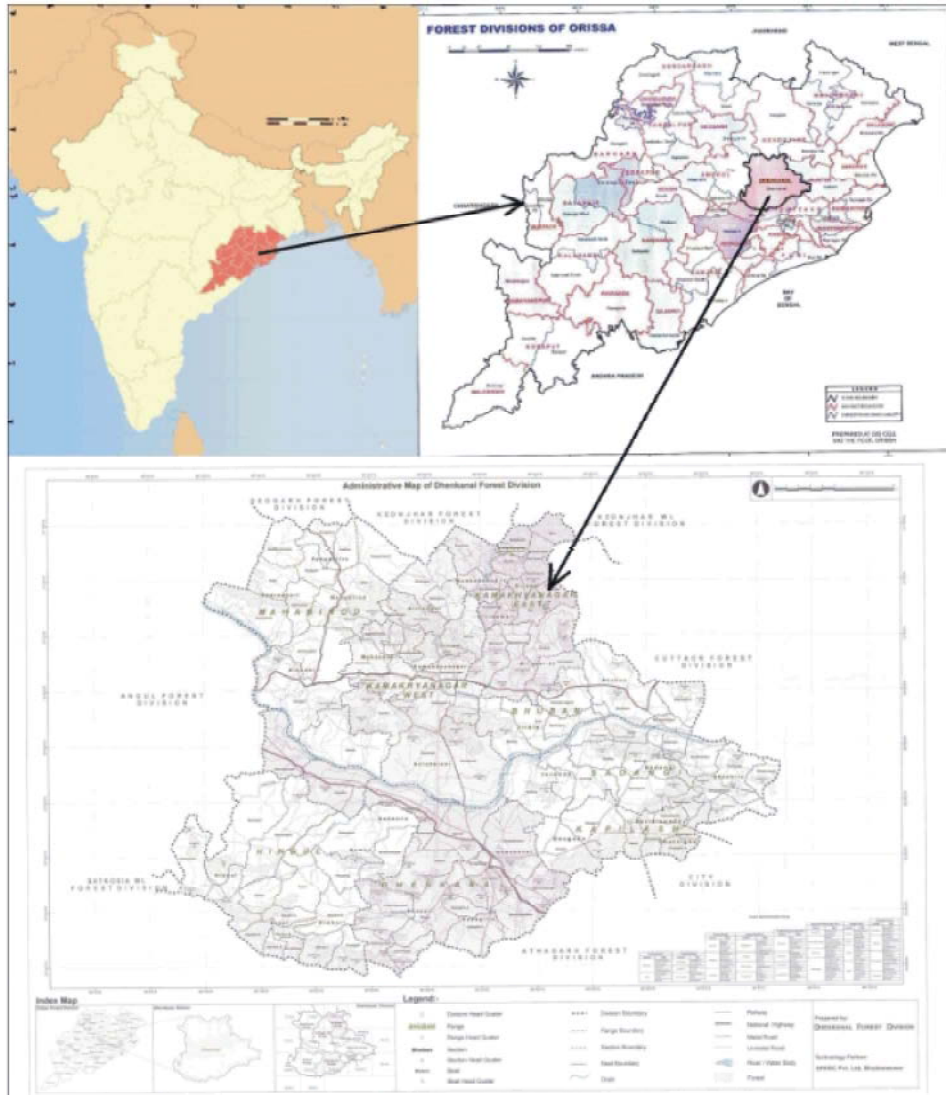


Fig. 1: Map showing the location of Dhenkanal forest division, Odisha, India

census, Dhenkanal harbours 162 elephants including 23 adult bull-elephants, 52 adult cow-elephants, 8 sub-adult bull-elephants, 41 sub-adult cow-elephants, 3 adult/sub-adult of unknown sex, 23 juvenile and 12 calves in its eight forest ranges [4].

### MATERIAL AND METHODS

The available past conflict records from 2001 to 2012 at eight forest ranges of DFD, Odisha is utilized to analyze HEC status at DFD. Information on HECs were collected from the villages located in and around protected areas and managed forests of eight ranges of DFD as questionnaires. The questionnaire collect information on

victim died or injured by elephant (age and sex of victim, circumstance of attacks, time of attack), extent of crop damage, composition of raided crop, compensation paid for the losses, attitude and expectations of local people towards the HEC situations. Besides, information on incident of death of elephants i.e., cause of death, place of death, age and sex of the elephant died on that region were collected and analyzed.

### RESULTS

**Human Death:** During 2001-2012, a total of 75 human casualties by elephants were recorded in eight ranges of DFD, which includes 9 cases of human injury (12%) and

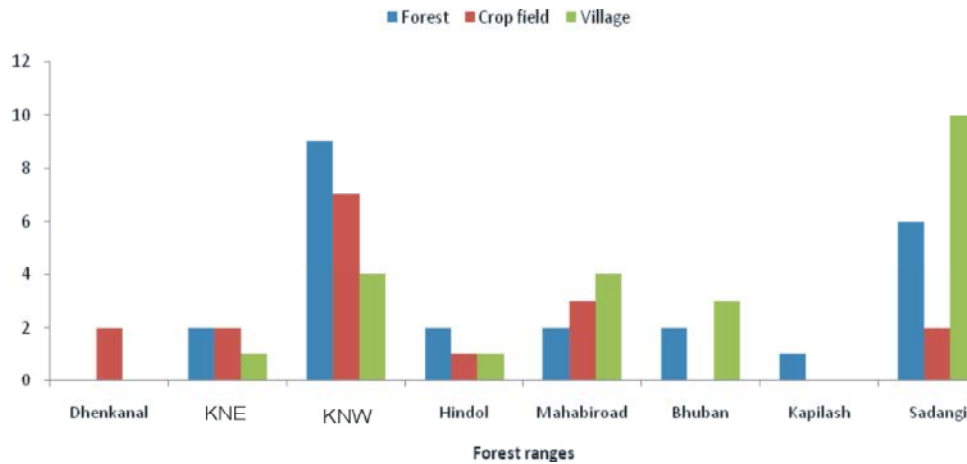


Fig. 2: Place of human casualties by elephants in different states during 2001 to 2012

64 cases of human death (88%). In human death cases, 51 times the victim was a man and 13 times, a woman; whereas in human injury cases 6 times the victim was a man and 3 times a woman. Maximum cases of human casualty occurred in KNW range (n=21, 29%), followed by Sadangi (n=20, 27%), Mahabirod (n=11, 15%), Dhenkanal (n=5, 7%), KNE (n=5, 7%), Hindol (n=5, 7%) and Bhuban (n=5, 7%) and Kapilash (n=1, 1%).

On consideration of age of the victims, out of 64 human deaths by highest number of cases occurred in the age group of 31-40 years (n=26) followed by 41-50 years (n=11), 51-60 years (n=9), 21-30 years (n=8), above 60 years (n=5), 1-10 years (n=4) and 11-20 years (n=1).

On consideration monthly variation of human death, highest number was observed in January (n=10, 16%), followed by September (n=8, 13%), December and April (n=7, 11% each), March and August (n=6, 9% each), October (n=5, 8%), June and November (n=4, 6%), May (n=3, 5%) and February and July (n=2, 3%) during 2001-2012. Human casualties were comparatively less during February and July (n=2, 3%) and May (n=3, 5%). Highest number of incidences of human deaths by elephant attack occurred between 00:00-06:00 hours (n=23), followed by 06:00-12:00 hours (n=20), 18:00-24:00 hours (n=14) and 12:00-18:00 hours (n=7).

Elephants were responsible for maximum human casualties in forests (37%), followed by villages (36%) and a less incidence occurred in crop fields (27%) (Fig. 2). Highest human casualties occurred in the forests and crop field of KNW, whereas human casualty due to HEC was highest in Sadangi forest range.

Most of these casualty happened when people were

engaged in forest produce collection, livestock grazing, farming activities i.e., walking through crop fields, during crop protection, harvesting and defecation activity in open field or agricultural land. Monthly variation in human death is given in Fig. 4. Besides human casualty, between 2001 and 2012, 15 cattle killed, 10740.71 acer crop damage and 360 incidences of house damage happened in DFD (Table 1).

**Crop Damage:** Cropping pattern of DFD has three different cropping seasons, June to November- Kharif; November to March- Rabi, January to June-summer crops. Incidences of crop raiding by elephants had recorded sporadically throughout the year during the study. Crops eaten by elephants in different ranges of DFD included paddy (*Oryza sativa*), gram (*Cicer aretinum*), sugarcane (*Saccharum officinarum*), maize (*Zea mays*), madua (*Elusine corocana*) and jack fruits (*Artocarpus heterophyllus*), mango (*Mangifera indica*), cashew (*Anacardium occidentale*) and vegetables. The highest incidences of crop raiding was recorded in paddy (94.25%±1.19%) followed by sugarcane (2.13%±0.91%), mango (1.00%±0.25%), jack fruit (0.88%±0.44%) gram (0.75%±0.38%), maize (0.5%±0.49%), cashew (0.25%±0.38%) and vegetables(0.25%±0.38%). Participants of the survey reported that elephants caused damage to both young and mature crops. In Hindol forest range, damage to rice crop by elephants was highest (96%). Maiza, cashew and vegetable crops were least affected by elephants. Different crops affected in raiding activity at different forest ranges are given in Fig. 3.

Table 1: Human death, crop and property damage due to HEC at DFD, Odisha

Year	Human Death (in nos.)	Human Injury (in nos.)	Cattle Kill (in nos.)	Crop damage (in Acre)	House damaged (in nos.)	Elephant Death (in nos.)
2001	3	0	0	4.22	0	3
2002	3	1	1	281.95	1	4
2003	5	0	2	1303.08	2	2
2004	5	1	0	414.67	2	7
2005	5	1	0	167.86	3	4
2006	4	0	0	986.89	2	1
2007	3	0	1	527.12	47	2
2008	6	1	0	1038.57	4	6
2009	3	2	1	1376.72	31	7
2010	9	1	2	1445.38	43	11
2011	13	1	3	2087.19	72	9
2012	5	1	5	1107.06	153	13
Total	64	9	15	10740.71	360	69

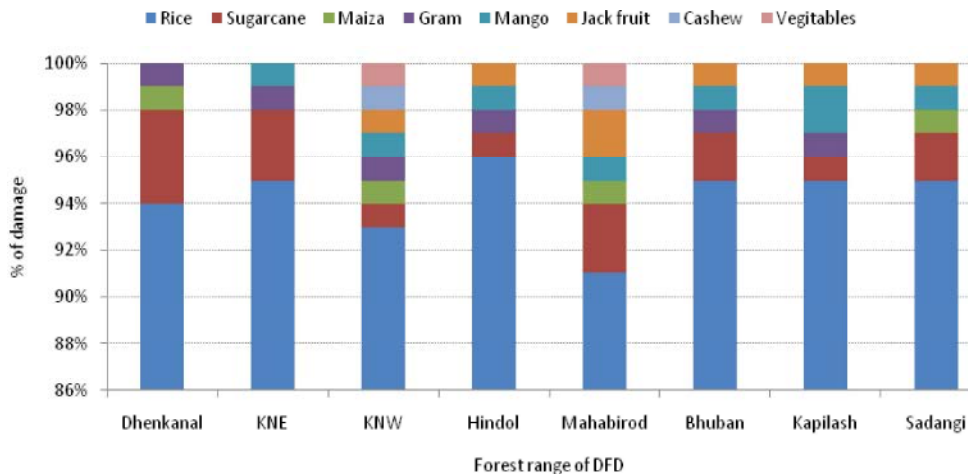


Fig. 3: Agricultural crop damage by elephants in 8 different ranges during 2001-2012

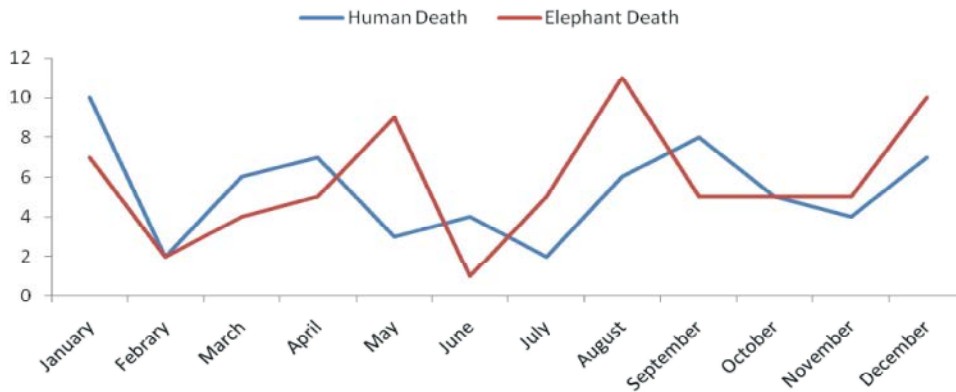


Fig. 4: Monthly variation of human and elephant deaths.

**Elephant Death:** Between 2001 and 2012 a total of 69 elephants had died at DFD which includes 19 adult males, 23 adult females, 10 juveniles and 17 calves. The causes of death were poaching (1), electrocution (18), accidental (2), disease (11), dehydration (8), natural death (22) and unknown causes (7). Monthly variation of elephant death is given in Fig.4.

## DISCUSSION

Sites of human settlements are usually prime habitats with best water resources, fertile soil and high potential plant productivity [11]. The wide-ranging movement of elephants in human modified landscapes frequently creates opportunities for contact and conflict with people.

In DFD, elephant habitats interspersed with in villages and crop fields resulting in frequent encounters with humans. During this period, most of the human casualties by elephants occurred in the periphery of the protected areas or managed forests and few occurred inside. Most of these attacks were accidentals and occurred when these victims ventured into the forest for collection of non-timber forest produce in forests, fuel wood, fodder medicinal plants, or to graze their livestock and while working in their crop fields or providing crop protection or moving in vicinity of villages. Males were found to move extensively inside forest for collection of non-timber forest produce and they engaged more in agricultural fields for farming activity. So they were exposed more and succumbed to elephant attacks more than the females.

Damage inflicted by elephants at the forest-agriculture interface is widely concerned due to high crop loss through consumption and trampling [12, 13]. An increased trend of crop raiding was recorded during the study period. Though crop raiding was observed throughout the years, paddy was the primarily affected crop that being raided (94.25%±1.19%) by the elephants. There were reports of crop depredation by elephants in different regions of India that occurs throughout the year with the availability of crop [12, 14-17]. Chowdhury *et al.* [14] in their study at the northern part of West Bengal quantified depredation frequencies, 57% for paddy between August to January, 21% for maize between March to June and 22% for other minor mixed crops between February and July.

Crop raiding by elephant is reported exclusively a nocturnal activity [12, 18-20] to avoid the associated risk of harassment. But there are reports of crop raiding even during the day hours in fragmented and densely human populated areas [14]. In the present study the crop raiding incidences during night time were recorded.

As per Wildlife (Protection) (Orissa) Amended Rules 2002 (Rule – 45) compensation grants of Rs.100000.00 for human killed, Rs.33330.00 for permanent injury, Rs.2000.00 and treatment in government hospital for temporary injury, Rs.1000.00 per acre for crop damage within 5km area around the forest, Rs.3500.00 completely damaged house, Rs.2000.00 for partial damaged house, Rs.1500.00 for cow/bullock killed, Rs. 2000.00 buffalo killed and Rs.500.00 for calf killed in HEC incidences. Sahu and Das, during their study conducted during the years 2005-06 reported that, compensation paid is inadequate in the case of human death, injury, crop damage and house damage [5]. The compensation grants have been increased to Rs. 200000.00 for human killed, Rs.75000.00 for permanent injury Rs.5000.00 and treatment in government hospital for

temporary injury, Rs.1000.00 per acre for crop damage within 5km area around the forest, Rs.10000.00 completely damaged house, Rs.2000.00 for partial damaged house, Rs.1500.00 for cow/bullock killed, Rs. 5000.00 buffalo killed and Rs.2500.00 for calf killed in HEC incidences under Wildlife (Protection) (Orissa) Amended Rules 2011.

It was found that the local people use different indigenous method to drive away the elephants which includes, making noise by shouting, drum beating, crackers etc., flying flashing ribbons or plastic strips that produce sounds, throwing burning fire woods and stones, application of chilli powder, torch light, co-operative guarding. These activities were found effective to some extent. Depending upon the severity 'kunki' elephants (captive trained elephants) were used for anti-depredation activity. In India traditional, cultural and religious attitudes towards wild animals make local people tolerant towards wildlife, despite the damage of their crops and livestock [21]. The problem with wildlife is that the people who wish to preserve it are rarely those who have to bear the cost. Though positive attitude towards wildlife and their habitat still persists among the fringe dwelling villagers, many of them expect more intensive crop, human life and property saving initiatives from the Forest Department of Odisha.

## CONCLUSION AND RECOMMENDATIONS

With continuous loss of habitable qualitatively as well as quantitatively, elephants are forced to extend their range and raid crops to meet their energy requirements. During such forays elephants come into village or agricultural lands, which ultimately lead to confrontation with human and HEC. Despite the growing concern and measures adopted to deal with the human-elephant conflict to-date, the problem still remains unresolved. Physical barriers, electric fencing, olfactory repellents, distress noise, co-operative guarding of crops are often seen as the enduring solution in human-elephant conflict situations. Creation of pools and check dam inside the forest to ensure water availability may help in mitigating the conflict as elephants used water sources in human areas. Quick settlement of claims would be of benefit in developing positive attitude in local people and mitigation of HEC. An integrated community development and elephant habitat conservation practice can be useful to reduce the conflict by developing economic and social tolerance to damage caused by elephants. Education and awareness programs on the ecology and behavior of elephant and on mitigation strategies should be initiated for villagers in affected areas.

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