

Human-Elephant Conflict: A Case Study from Bamra (WL) Forest Division, Sambalpur, Odisha, India

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Abstract: The State of Odisha is represented by a sizable pachyderm population. These large animals are facing the problems of their habitat being fragmented by different anthropogenic activities. Therefore Human Elephant Conflict (HEC) has emerged as a serious issue in the recent past causing severe loss to the life and property of the people, particularly of those residing in villages around forest patches. These conflicts very often lead to death of the pachyderms as well. In the present paper an attempt has been made to document the HEC in five different Ranges of Bamra (Wildlife) Forest Division of Odisha, where human casualties and large-scale crop and property damage caused by elephants are being reported from time to time. During the period 2001-2017, a total of 19 human killings and 2 human injury cases caused by elephants and 23 nos of elephant deaths due to various reasons have been recorded, apart from damage to agricultural crops of varying extent by elephants. The human elephant conflict in the region has resulted into antagonistic attitude of people towards the elephants, which is adversely affecting to the conservation efforts.

Key words: Asian Elephant • Bamra (WL) Forest Division • Crop damage, Depredation • Human-elephant conflict

INTRODUCTION

The term Human Elephant conflict (HEC) refers to the negative interaction between the human beings and elephants and its resultant impact on people and their resources as well as on the elephants and their habitat. Such conflicts occur wherever the two species co-exist, especially in the interface between elephant habitat, agricultural land and human settlements [1]. Although HEC is of worldwide occurrence, the conflicts between humans and wildlife are more intense in the tropics, where wildlife competes directly with the rapidly increasing human population in terms of demand over scarce land and other natural resources. The HEC has been recognised as old as human civilization. However, during the recent times the conflict is more intense due to destruction, reduction and fragmentation of habitat of wild elephants by anthropogenic activities to cater various needs of human beings. The conflict has taken such a dimension that in certain region of the World, the elephants are gradually being endangered and subsequently extinct i.

Elephants found all over the World are of two types i.e. Asian Elephant (*Elephas maximus*) and African Elephant (*Loxodonta africana*). Once upon a time, the range of Asian Elephants was known to have extended from the Euphrates and Tigris river in West Asia to the Yangtze-Kiang river in China and perhaps beyond it [2]. But the Asian Elephants are now confined to only 13 Asian countries viz. India, Bhutan, Bangladesh, China, Cambodia, Indonesia, Laos, Myanmar, Malaysia, Nepal, Sri Lanka, Thailand and Vietnam. In contrast, the African Elephants are more frequent in their distribution and they are found in 37 African countries [3]. As per a report of International Elephant Foundation, 2017, the total number of Asian elephants is around 30,000-50,000 [4] in wild.

Habitat destruction due to anthropogenic activities and fragmentation of natural habitat is responsible for extinction of many species from the earth. The present rate of extinction of 10 to 20 thousand species per year is estimated to eliminate 10 million species of plants and animals from the earth surface by the year 2050 due to a variety of human activities. Elephants are one of such animal species facing the problem of endangerment

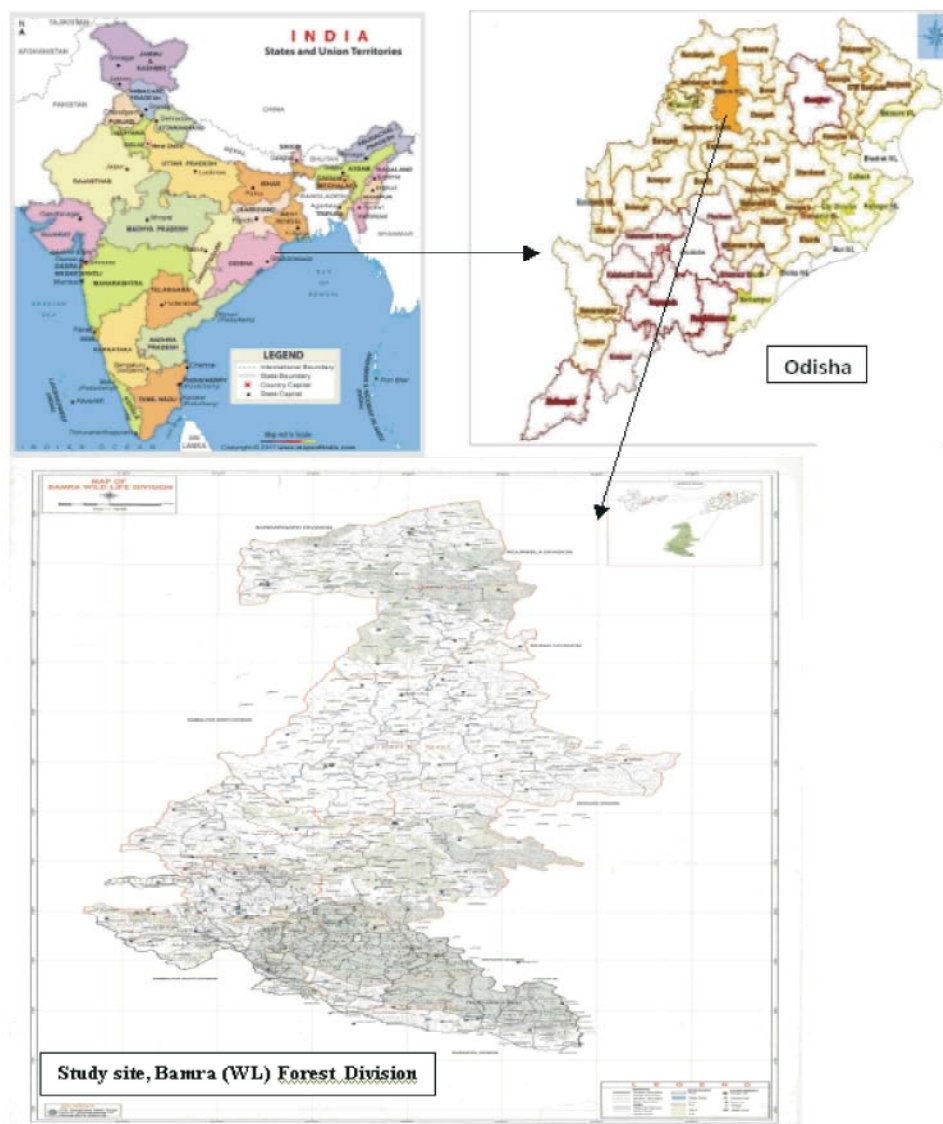


Fig. 1: Map showing the location of Bamra (WL) Forest Division in Odisha, India

followed by extinction in many parts of the World. As these are gigantic animal and require large areas of natural forest range as their habitat, the elephant become the first species to suffer the consequences of human developmental activities [5]. Due to continuous loss of habitat quantitatively as well as qualitatively, elephants are forced to extend their range by coming out of their natural habitat and raid agricultural crops to meet their energy requirements. During such forays elephants intrude into villages or agricultural lands and human settlements inside forests. Under such circumstances HEC is inevitable.

The problem of HEC is equally acute with African Elephants [6]. In Mozambique 79 numbers of instances of

Human-Elephant conflicts have been reported between 1997 and 2004 [7]. The elephant population of some African countries such as Botswana, South Africa, Tanzania and Zimbabwe are however, showing an increasing trend. Zimbabwe has an elephant population of around 90,000 [8] where as the elephant carrying capacity of the country has been estimated to be less than 40,000 [3]. As per a report of International Elephant Foundation, 2017, India has a population of 23,900 – 32,900 of Asian Elephants in wild [4]. Such an increase in both elephant population along with the increase in human population is believed to have resulted in to an increased HEC which is posing severe negative impact on our efforts to the biodiversity conservation.

Table 1: The elephant census since 1999.

Year	1999	2002	2005	2007	2010	2012	2015	2017
No. of elephants counted	183	201	192	194	152	176	102	94

As per the latest report of Odisha Wildlife Census, 2017 the population of elephants have increased from 1827 to 1976, between 1999 to 2017 which is about 8.15% (Fig. 1). A simultaneous increase in human population during this period has resulted in shrinkage of forest cover and per capita availability of land for survival of the two species and the consequence is more number of HEC. Man-Elephant conflict has become one of the most challenging problems in modern wildlife management throughout the world. However fewer studies have been carried out on Human Elephant Conflict. In Odisha, Sahu and Das, [1]; Swain, [9]; Swain and Patnaik, [10]; Sar and Lahiri-Choudhury, [11]; Sar and Lahiri-Choudhury, [12] and Pradhan *et al.* [13] have made such studies in different regions of the Odisha. In the present paper an attempt has been made to investigate and document the HEC in Bamra Wild Life Forest Division of Sambalpur district of Odisha. This is the first study report on Bamra (WL) Forest Division of Sambalpur Circle, Odisha, India.

Study Area: The study area, Bamra(WL) Forest Division, Smablpur, Odisha, was reorganised as a forest division on 1st October 2003. It includes 5(WL) Ranges i.e- Bamra, Kuchinda, Jamankira, Badrama and Khalasuni. The Bamra (WL) Forest Division is located between Lat. 21° 15'56" N to 22° 11' 21"N and Long. 84° 8' 8" E to 84° 37' 49" E. The total Geographical area of the Division is 253682.219 ha. and total forest area is 120369.779 ha., which includes 21 RF Blocks-72990.519 ha, 62 PRF Blocks- 27130.57 ha, 10 DPF Blocks- 841.819 ha, 26 VF Blocks- 253.23 ha and 19153.641 ha area under Revenue forests. The forest of the study area is tropical dry deciduous type. Sal (*Shorea robusta*) is the dominant tree species in the entire forest division. Bamra (WL) Forest Division has been classified into two major sub groups viz., 3C and 5B of Champion and Seth [14]. Accordingly, the forest of the study area is moist deciduous and tropical dry deciduous in nature. The area experiences three distinct seasons i.e. summer, rainy and winter in a year. April, May and June are the hottest months of the year when the temperature goes up to 48°C and November, December and January are the coldest months of the year with a minimum temperature of 7°C. The area experiences heavy rainfall during July, August and September and the annual average rainfall is around 1260 mm.

Pachyderms in Bamra Wildlife Division: The Bamra Wildlife Division is known for the rich pachyderm population. The Division has two wildlife sanctuaries viz. The Badrama & the Khalasuni Sanctuaries, which are ideal places for habitation of elephants. First Elephant census in Bamra Wildlife Division was taken up in 1979 and a total of 179 elephants were enumerated. Periodical census of elephants in Bamra Wildlife Division is being taken up since 1999. The results of elephant census since 1999 are presented in given Table 1.

As per the 2017 elephant census report published by Forest Department, Govt. of Odisha, 94 elephants have been reported in 5 forest ranges of the Bamra (WL) Forest Division, which includes 09 adult bull-elephants, 29 adult cow-elephants, 03 sub-adult bull-elephants, 23 sub-adult cow-elephants, 13 juvenile and 17 calves. The peculiar variable trend in which the number of elephants reported in different census in Bamra Wildlife Division is attributable to the migration of elephants from Bamra Wildlife Division to the neighbouring Sambalpur, Rairakhol, Jharsuguda, Deogarh, Bonei, Rourkela and Sundergarh Divisions.

Cropping pattern of Bamra (WL) Forest Division reveals three different cropping seasons, June to December- Kharif; January to March- Rabi, January to June- summer crops. Incidences of crop raiding by elephants are being reported sporadically throughout the year. Crops eaten by elephants in different ranges of Bamra (WL) Forest Division includes paddy (*Oryza sativa*), gram (*Cicer aretinum*), sugarcane (*Saccharum officinarum*), maize (*Zea mays*) etc.

Although this division harbours a good number of elephants with adequate availability of fodder species and water, their requirement of large land mass for moving forces them to migrate to adjacent divisions i.e Sambalpur, Rairakhol, Jharsuguda (Sambalpur Circle), Bonai, Deogarh, Rourkela and Sundargarh (Rourkela circle) causing inter divisional and inter circle migration of elephant .

MATERIALS AND METHODS

The available official HEC records from 2001 to 2017 at five forest ranges of Bamra (WL) Forest Division, Odisha were collected from the State Forest Department, Govt. Of Odisha to analyze HEC status at Bamra (WL)

Forest Division. Information on HECs were also collected from the villages located in and around protected areas and managed forests of the five ranges of Bamra (WL) Forest Division through interaction. The information collected through questionnaire on victim died or injured by elephant, extent of crop damage, composition of raided crop, attitude and expectations of local people towards the HEC situations. Besides, information on incident of death of elephants i.e., causes of death, place of death, age and sex of the elephant died on that region were collected and analyzed.

RESULTS

During 2001-02 to 2016-17, a total of 21 (19 death and 2 injured) human casualties caused by elephants were recorded in five ranges of Bamra (WL) Forest Division, which includes 2 cases of human injury (9.5%) and 19 cases of human death (90.5%). Maximum cases of human

casualty occurred in Bamra range (n=8, 42%), followed by Kuchinda (n=5, 26%), Badrama (n=3, 16%), Khalasuni (n=2, 11%), Jamankira (n=1, 5%).

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. Besides human casualty between 2001 and 2017, 3811.139 acre of crop damage and 65 incidences of house damage happened in Bamra (WL) Forest Division (Table 2).

Analysis of monthly variation of human death (Fig. 3) indicated that highest number of human death was observed in January (n=4, 21%) and November (n= 4, 21%), followed by March, April, May, July and August (n=2, 53% each) and June (n= 1, 5%) during 2001-02 to 2016-17. No Human casualties were recorded during February, September, October and December.

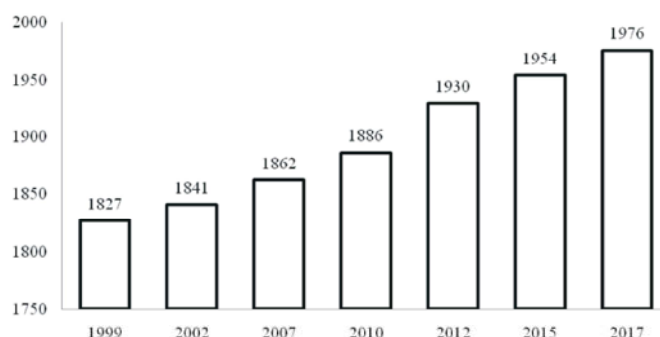


Fig. 2: Elephant Population in the State of Odisha during the year 1999 to 2017

Source: Forest and Environment Department, Govt. of Odisha, Census Reports

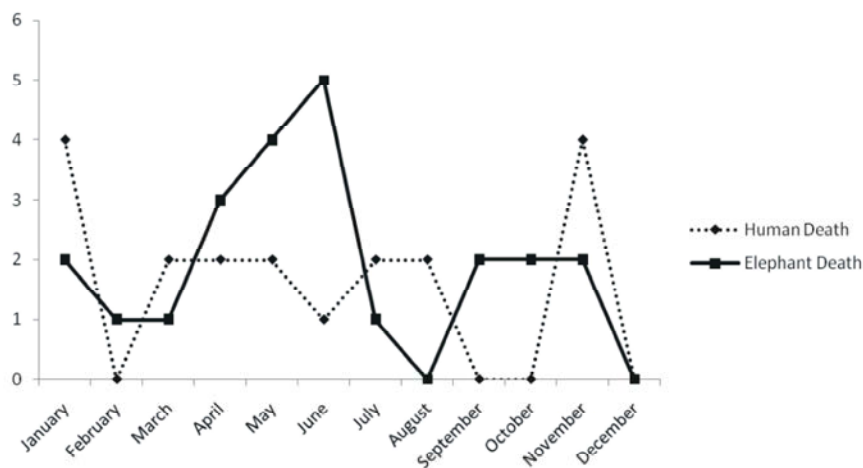


Fig. 3: Monthly variation of human and elephant deaths in Bamra (WL) forest division from 2001-02-2016-17

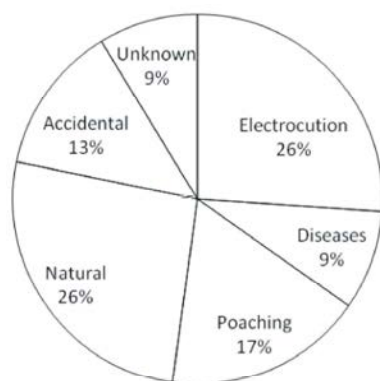


Fig. 4: Elephant Deaths in Bamra (WL) Forest Division from 2001-02 to 2016-17 due to different causes

Table 2:

Division	Year	Death of Elephant	Human death by elephant	Human injured by elephant	House damaged by elephant	Extent of Crop damaged (in Ac)
Bamra (WL)	2001-02	1	2	1	0	180.76
	2002-03	0	1	0	2	779.78
	2003-04	1	2	0	22	627.48
	2004-05	2	0	0	12	44.64
	2005-06	1	1	0	5	29.71
	2006-07	0	1	1	0	0
	2007-08	1	2	0	4	75.81
	2008-09	4	2	0	0	102.97
	2009-10	2	5	0	0	392.2
	2010-11	3	0	0	0	226.31
	2011-12	3	0	0	0	317.98
	2012-13	1	1	0	0	46.985
	2013-14	3	0	0	13	51.5397
	2014-15	0	1	0	7	44.8652
	2015-16	1	1	0	0	631.4719
	2016-17	0	0	0	0	258.6367
Total		23	19	2	65	3811.139

Table 3: Crop damage by Elephants in 5 different ranges of Bamra (WL) forest division during 2001-02 to 2016-17. (in acre)

Forest Range	Year															
	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Bamra	0	634.31	4.28	1.17	3.09	0	63.2	91.69	321.35	93.1	150.52	3.4	9.0882	15.433	23.857	77.2755
Kuchinda	180.76	115.16	171.84	38.6	17.12	0	0	0	0	20.4	91.77	3.45	26.542	18.668	0	4.1947
Jamankira	0	0	6.88	0	5.18	0	0	0	0	17.63	32.01	0	10.75	4.777	21.614	29.5305
Badrama	0	30.31	20.76	4.87	1.5	0	12.61	11.28	49.08	93.13	31.08	22.965	5.16	4.198	582.1	110.363
Khalasuni	0	0	0	0	2.82	0	0	0	21.77	2.05	12.6	17.17	0	1.7895	3.906	37.273
Total	180.76	779.78	627.48	44.64	29.71	0	75.81	102.97	392.2	226.31	317.98	46.985	51.54	44.865	631.47	258.6367

Table 4: Compensation paid in Bamra Wildlife Division for crop damage and Human death after 2012 Notification of F & E Department.

Year	Compensation Paid		
	Human Death	Human Injury	Crop Damage (in Rupees) @Rs.1000/- per Acre.
2012-13	1	0	469850.00
2013-14	0	0	515397.00
2014-15	1	0	448654.00
2015-16	1	0	6314719.00
2016-17	0	0	2586367.00
Total	3	0	10334987.00

During 2001-02 to 2016-17, a total of 23 numbers of elephant death were recorded in five ranges of Bamra (WL) Forest Division in Fig. 5. Maximum cases of Elephant death occurred in Badrama (n=10, 43%), followed by Kuchinda (n=8, 35%), Jamankira (n=4, 18%). Bamra range (n=1, 4%), Khalasuni (n=0, 0%). Analysis of monthly variation of Elephant death (Fig. 3) indicated that (of Elephant death) highest number observed in June (n=5, 22%) and May (n= 4, 17%), April (n= 3, 13%), February, March and July (n= 1, 13%), followed by January, September, October and November (n=2, 35% each) during 2001-02 to 2016-17. No Elephant death was recorded during August and December.

Between 2001-02 to 2016-17 a total of 23 nos of elephants had died at Bamra (WL) Forest Division which includes 10 adult males, 10 adult females, 1 Juvenile and 2 Calves. The cause of death (Fig. 4) were electrocution (n=6, 26%), Diseases(n= 2, 9%), Poaching(n= 4,17%), Natural (n= 6, 26%), Accidental (n=3, 13%) and Unknown (n= 2, 9%). During the study period of 16 years showed that the maximum 4 nos of elephant's death were occurred in 2008-09 year. Crops affected in raiding activity at different forest ranges of Bamra (WL) Forest Division are given in Table 2.

DISCUSSION

Sites of human settlements are usually prime habitats having a perennial source of water (natural or manmade) and fertile soil having high potential for plant productivity [15]. Such human settlements area with good water sources and green vegetation, near a forest area attract the wild elephants to intrude in to human habitats. The wide-ranging movement of elephants in human modified landscapes frequently creates opportunities for the wild elephants to come in contact and conflict with the people. In Bamra (WL) Forest Division, elephant habitats are found interspersed with in villages and crop fields, resulting in frequent encounters with humans. It has been observed that, most of the human casualties by elephants occurred in the periphery of the protected areas or managed forests and very few casualties occurred inside the forests. Most of these confrontations were accidentals and occurred when these victims ventured into the forest for collection of non-timber forest produce from the forests like fire wood, fodder, medicinal plants, or to graze their livestock and while working in their crop fields or providing crop protection or moving in the vicinity of villages.

Crop raiding by elephant is reported to be exclusively a nocturnal activity [16] 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 [17]. In the present study it was found that all the crop raiding incidences had occurred during night time.

It was also found that the local people use different indigenous method to drive away the elephants which includes, making noise by shouting, drum beating, bursting of crackers, creating fire by burning woods, using torch light and co-operative guarding. These activities were found effective to some extent. In India traditional, cultural and religious attitudes towards wild animals make local people tolerant towards wildlife, despite the damage of their crops and livestock [18]. 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.

Compensation in Elephant Cases: As per Odisha Wildlife Protection Amended Rules 2011, Notification no- 8F (WL) 6/2011 5266/F& E, dt: 23.03.2011 monetary compensation are being paid to people for the loss of life and property due to HEC. A compensation of Rs.2,00,000.00 for human killed, Rs.75,000 for permanent injury, Rs.5000.00 for treatment in government hospital for temporary injury are being paid by the government to the victims or their legal heirs. Similarly a sum of Rs:5,000.00 per acre is being paid for crop damage within 5km area around the forest. A sum of Rs:10,000.00 and Rs. 2000.00 are being paid for completely and partially damaged house. Damage to live stocks is being compensated at the rate of Rs.5000.00 for cow/bullock/ buffalo and Rs.2500.00 for calf killed in HEC incidences.

In Odisha Wildlife Protection Amended Rules 2012, Notification no- 8F (WL) 1/2012 6380/F& E, dt: 11.04.2012 the monetary compensation only revised for crop damage from Rs. 5,000.00 to Rs.10,000.00 per acre is being paid to people within 5km area around the forest.

As per Odisha Wildlife Protection Amended Rules 2014, Notification no- 8F (WL) 6/2014 13505/F& E, dt: 22.07.2014 monetary compensation are being paid to people for the loss of life and property due to HEC. A compensation of Rs:3,00,000.00 for human killed, Rs.1,00,000 for permanent injury, Rs.5000.00 for treatment in government hospital for temporary injury are being paid by the government to the victims or their legal heirs.

Similarly a sum of Rs:10,000.00 per acre is being paid for crop damage within 5km area around the forest. A sum of Rs:10,000.00 and Rs: 2000.00 are being paid for completely and partially damaged house. Damage to live stocks is being compensated at the rate of Rs.5000.00 for cow/bullock/ buffalo and Rs.2500.00 for calf killed in HEC incidences.

In Bamra (WL) division the compensation paid after the issuance of Notification no- 8F (WL) 1/2012 6380/F& E, dt: 11.04.2012 in Table 3.

CONCLUSION AND RECOMMENDATIONS

Due to continuous loss of habitat quantitatively as well as qualitatively, elephants are forced to extend their range and raid crops to meet their energy requirements. During such forays of elephants intrude into villages or agricultural lands and human settlements inside forests. 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, distress noise, co-operative guarding of crops is often seen as the enduring solution in human-elephant conflict situations [19]. Creation of pools and water harvesting systems inside the forest to ensure water availability may help in mitigating the conflict as elephants have been reported to have used water sources in human areas [20,21]. Quick settlement of claims would be of great 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 behaviour of elephant and on mitigation strategies should be initiated for villagers in affected areas.

ACKNOWLEDGEMENTS

The authors are thankful to Principal Chief Conservator of Forests (WL) & Chief Wild Life Warden, Odisha, Forest & Environment Department, Government of Odisha for his permission in conducting the study. We extend our sincere thanks to Sri Lalit Kumar Tewari, RCCF, Sambalpur and Sri Sanath Kumar N., DFO Bamra (WL) Division for their valuable support to carry out this work. We are also thankful to front line staff, villagers and victims for their co-operation during the interaction with them. Thanks are also due to Sri Rajanikanta Patel, Field Assistant O/o RCCF, Sambalpur for his help of field visit and data collection.

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