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## Evaluation of crop depredation by Asian Elephant (*Elephas maximus*) in Badrama Wildlife Sanctuary, Odisha, India

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### ABSTRACT

We investigated the human-elephant conflict in eight different ranges in Badrama Wildlife Sanctuary under Bamra (Wildlife) 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 2011-12 – 2015-16, a total of 03 nos. of human killing and 380 human injury cases caused by elephants were recorded. Damage to agricultural crops by elephant was of varying extents i.e. 212.89 acres. As a result, people have developed an antagonistic attitude towards the elephant which adversely affects conservation efforts.

**Keywords:** Human-elephant, conflict, Asian elephant, Crop damage, Depredation, BWLS.

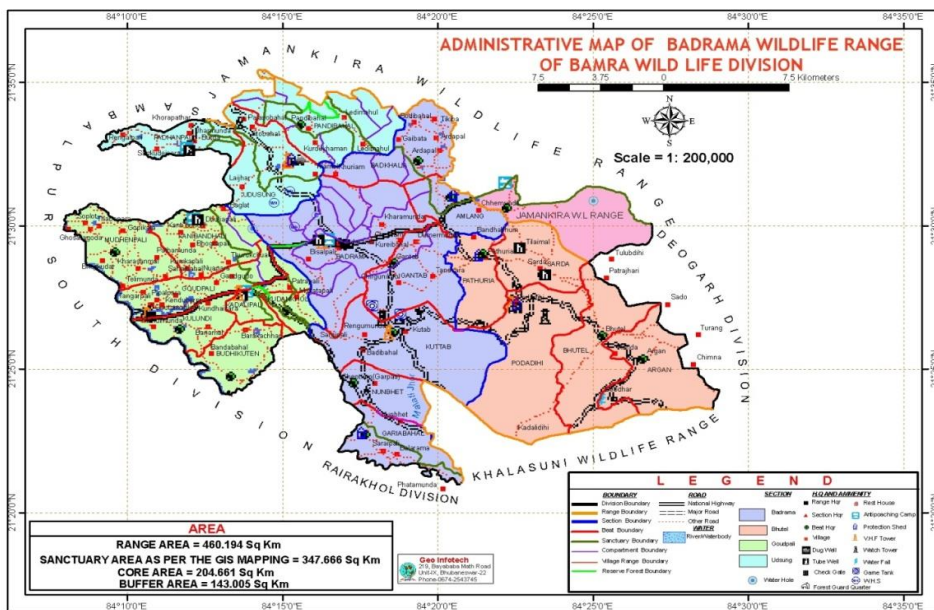
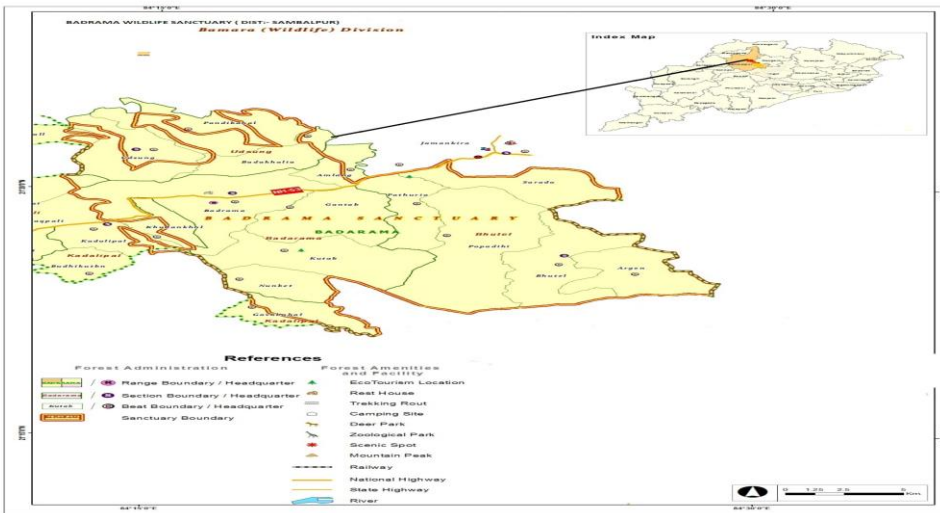
### 1. INTRODUCTION

Globally, wild elephants are present in 50 countries, 13 of which are in Asia and 37 in Africa. At present the number of wild Asian elephants (*Elephas maximus*) is between 35,000 and 50,000 ([www.elephantcare.org](http://www.elephantcare.org)), while the number in captivity is around 16,000. The trend in almost all Asian range states has been a drastic decline in wild elephant numbers, due to a range of anthropogenic factors related to increasing human population, loss and degradation of forest habitat, fragmentation of breeding populations and increasing human-elephant conflict (HEC). The Asian elephant is categorized as an endangered species in the Red List of the World Conservation Union (IUCN, 2008: [www.iucnredlist.org](http://www.iucnredlist.org)) and is classified with the Convention for International Trade of Endangered Species (CITES, [www.cites.org](http://www.cites.org)).

Elephants play an important role as 'keystone' and 'umbrella' species, maintaining biodiversity of the ecosystems they inhabit. Due to their requirement for large areas of forest habitat, conservation of elephants will automatically ensure the conservation of other species that co-exist in the same habitat. However, they can also modify the environment in positive as well as negative ways by their actions. The elephant is also a 'flagship' species, especially in Asian countries, being closely associated with the social and cultural aspects of people, and this factor can be harnessed to promote its conservation. Many studies have been carried out on HEC both in Asia (Sukumar 2003; Jayawardena 2004; de Silva & de Silva 2007) and Africa (Hoare 1999; Walpole & Linkie 2007), but despite the lessons learnt and the wide range of measures and management strategies that have been employed to mitigate HEC (Nelson et al. 2003; Osborn & Anstey 2007; Fernando et al. 2008), the intensity of the problem is clearly increasing. Asian Elephant (*Elephas maximus*) is categorized as an endangered species in IUCN list 2009, struggling for their survival due to habitat loss and fragmentation. Due to these factors habitat become narrow patches in most of their range countries, which triggered in human – elephant conflicts in most parts of their range. The major reason for the habitat loss and habitat fragmentation is the developmental activities taking places in the elephant habitat such as laying highways, railway tracks, constructing dams and forest being converted into commercial plantation like tea and coffee plantation and massive area under agricultural crops cultivation resulted both in habitat loss and habitat fragmentation which leads to Human elephant conflict. Habitat factors are important in determining the nature and extent of crop raiding by elephants; thus the reduction of natural habitat or its fragmentation may leave elephants with little choice but to seek a part of their forage needs from cultivated fields (Sukumar 1985b, 1989).

**2. STUDY AREA**

The Badrama Wildlife Sanctuary is located in between 21° – 20' to 21° – 40' N latitude and 84° – 10' to 84° – 30' E longitude . The Sanctuary comes under the administrative jurisdiction of Badrama Range and Jamankira Range of Bamra Wildlife Division. Major parts of the Sanctuary area comes under Kuchinda Sub-Division of Sambalpur District and part under Deogarh District in the State of Orissa. The sanctuary has been constituted vide notification No.8F (W) – 90/87-23397/FFAH, dated. 17.12.87 of Government of Orissa comprising whole of Ushakothi Reserve Forest excluding compartment No. 1, whole of Badrama Reserve Forest, part of Binjipali Reserve Forest comprising compartment no.9, 10,11,12,13, & 14 and part of Additional Kansar Reserve Forest. The total area of the Sanctuary is 304.03 Sq. Km.



**3. METHODS**

The available past conflict records from 2011-12 to 2015-16 in this Wildlife Sanctuary is utilized to analyze. Information on HECs was collected from the nearby villages of the Sanctuary 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. Information of Human Elephant Conflicts/crop depredation were collected through village survey and existing information collected from the range offices. Information such Name of the village, village proximity to forest periphery, types of crops, no. of animals raided crops and extent of damage was collected from the village survey.

**4. RESULT**

The data for the last 5 yrs 2011 – 12 to 2015 – 16 were examined. Since last five years, 3 nos. of people were being killed by elephant and 5 nos. of elephant death was recorded in Badrama Wildlife Sanctuary. A total 380 no. of families being affected due to their crop damaged of 212.89 acres by elephants were assessed. Peak depredation seasons were August and October to January. Most of human killing was by lone male tuskers and depredation of crop by elephant herd when they pass between two habitats. Especially, the damage of paddy field by elephant is going on since last five years. Besides, Damage to agricultural crops by elephant was of varying extents. The encounter rate (ER) is very high in 2012-13 in comparison to other year. The details are tabulated below:

**Table 1: 2011-12**

S no.	Village	Effectted Person	Area damaged in Acr.
1	Kutab	3	2.39
2	Rengumunda	2	3.9
3	Badrama	18	7.91
4	Nunvet	3	4.05
5	Udsung	3	1.15
6	Tileimal	01	0.63
7	Kharmunda	05	4.45
8	Sanbadibahal	03	0.95
9	Gadpati	01	0.75
10	Amlang	02	4.90
<b>Total</b>		<b>41</b>	<b>31.08</b>

**Table 2: 2012-13**

S no.	Village	Effectted Person	Area damaged in Acr.
1	Badrama	3	2.66
2	Mudhenpali	2	4.0
3	Kharmunda	5	0.619
4	Biswalpali	1	0.53
5	Chinimahul	1	0.90
6	Dumermunda	2	0.856
7	Tansara	1	1.02
8	Odsung	8	4.16
9	Tileimal	3	2.26
10	Sarda	1	0.58
11	New Burda	2	0.8
12	Titobahal	2	0.64
13	Kutab	1	0.56
14	Amlang	2	0.64
15	Badkhalia	1	0.36
16	Pathuria	2	0.86
17	Phalsabhal	1	0.83
18	Burda	1	0.69
<b>Total</b>		<b>39</b>	<b>22.965</b>

**Table 3: 2013-14**

S no.	Village	Effectted Person	Area damaged in Acr.
1	Kutab	8	4.371
2	Kharmunda	8	4.536
3	Amlang	4	3.703
4	Rengumunda	2	2.672
5	New Burda	2	1.77
6	Nunvet	2	0.687
7	Sarda	3	2.007
8	Badrama	9	6.1835
9	Biswalpali	6	2.81
10	Bandhabhuin	4	3.164
11	Cheptam	1	1.241
12	Dumermunda	2	1.898
13	Gadpati	2	0.38
14	Gantab	3	1.339
15	Sanbadibahal	4	0.993
16	Tansara	3	1.55
17	Kantiali	1	0.648
18	Kushali	1	0.68
19	Mundhenpali	3	2.322
20	Pathuria	5	2.03
21	Tileimal	2	1.13
22	Kanibandhali	7	5.8255
23	Pathamunda	1	0.60
	Bhograpal	1	0.452
<b>Total</b>		<b>84</b>	<b>52.992</b>

**Table 4: 2014-15**

S no.	Village	Effectted Person	Area damaged in Acr.
1	Sarda	4	3.741
2	Kanibandhali	1	0.799
3	Pathuria	4	2.8015
4	Mundhenpali	11	7.379
5	Kantiali	1	1.553
6	Biswalpali	1	0.9135
7	Dumermunda	1	0.64
8	Podadihi	3	1.77
9	Badkhalia	1	0.8585
10	Badrama	2	0.665
11	Rengumunda	2	1.136
12	Cheptam	1	0.778
13	Amlang	2	1.1
<b>Total</b>		<b>34</b>	<b>24.1345</b>

**Table 5: 2015-16**

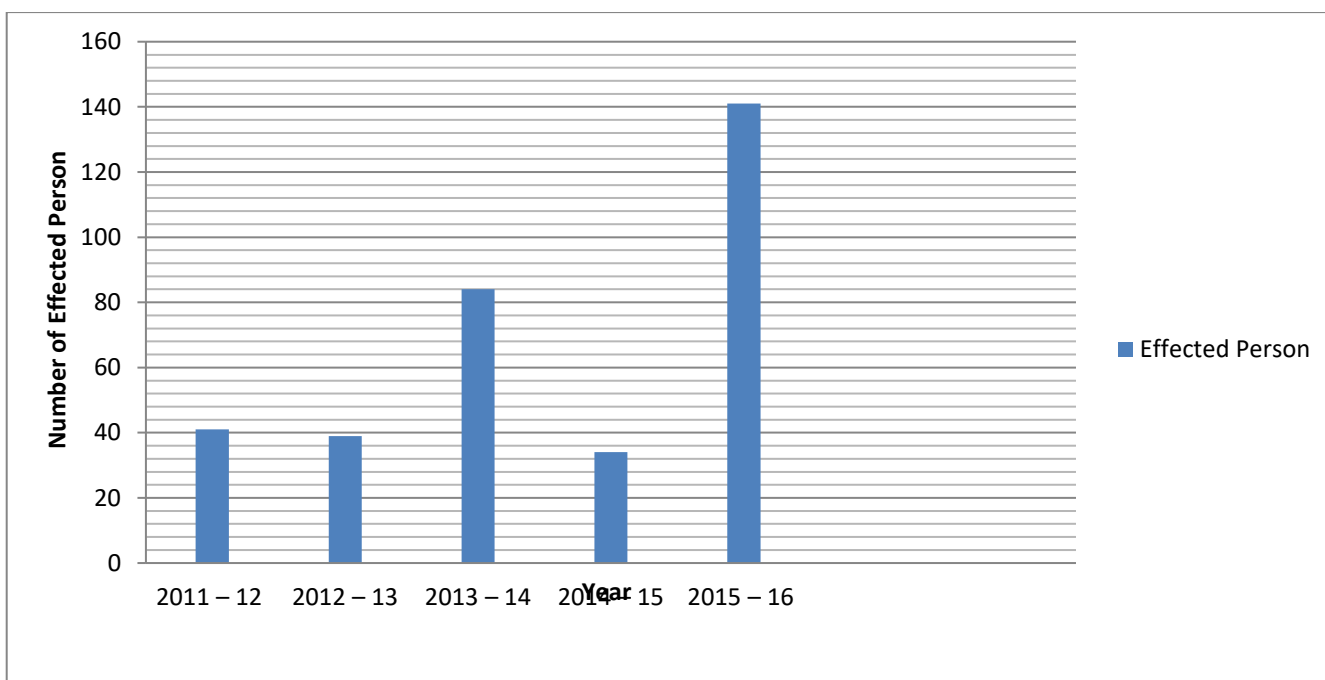
S no.	Village	Effectted Person	Area damaged in Acr.
1	Gantab	4	1.448
2	Titobahal	2	0.576
3	Tileimal	18	6.51
4	Newburda	4	2.408
5	Dumermunda	2	1.675
6	Kutab	5	2.919
7	Biswalpali	6	2.569
8	Tansara	2	1.444
9	Badrama	4	3.618
10	Kharmunda	3	1.588
11	Deodhar	1	0.564
12	Odising	19	9.925
13	Laijhar	2	1.216
14	Rengumunda	2	1.779
15	Kanibandhali	23	8.313
16	Bhograpal	6	2.309
17	Sarda	10	4.333
18	Salohi	6	1.8345
19	Podadihi	2	0.898
20	Pathuria	6	1.728
21	Brahmanipali	2	1.4505
22	Amlang	4	3.3305
23	Mundhenpali	7	5.261
24	Badkhalia	1	0.606
25	Haldibahal	4	2.332
26	Chinimahul	2	0.5795
27	Bandhabhuin	5	2.815
28	Gariabahal	4	3.179
29	Cheptam	1	0.492
30	Lunabheta	1	0.535
31	Turkichuan	1	0.1
32	Kumkapali	9	3.0925
33	Kantiali	2	0.6
34	Sareipali	1	0.815
35	Saplat	5	2.275
36	Padhanpali	1	0.61
37	Burda	3	1.7985
38	Jharmunda	2	1.4
39	Badturang	1	0.806
40	Baghlat	1	0.3
<b>Total</b>		<b>141</b>	<b>81.719</b>

**Table 6: Abstract of Crop damaged in Badrama Wildlife Sanctuary during last five years**

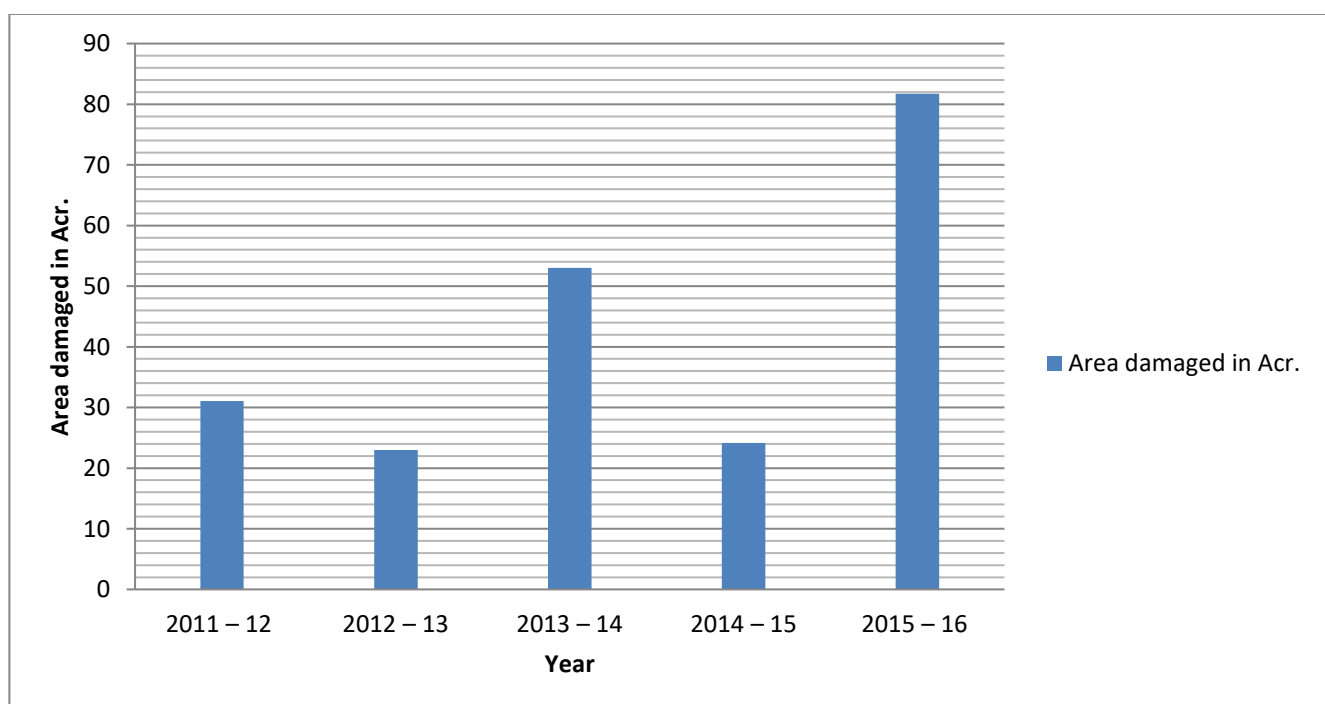
	Effectted Person	Area damaged in Acr.
2011 – 12	41	31.08
2012 – 13	39	22.965
2013 – 14	84	52.992
2014 – 15	34	24.134
2015 – 16	141	81.719
<b>Total</b>	<b>380</b>	<b>212.89</b>

**Table 7: Encounter Rate**

Year	No. of villages Roamed	Area damaged	ER (n)
2011-12	10	31.08	0.32175
2012-13	18	22.965	0.783801
2013-14	23	52.992	0.434028
2014-15	13	24.134	0.538659
2015-16	40	81.719	0.489482



**Graph. 1: Number of person affected during last five years in BWLS**



**Graph. 2: Area damaged during last five years in BWLS**



## 5. DISCUSSION



Over all 212.89 Acr. area of agricultural field have been affected and damaged by wild elephant in and around the BWLS and 380 nos. of persons have been injured. In this Sanctuary, the rate of crop depredation gradually increases during the study periods. It is analysed and found that during 2015-16 the crop depredation is maximum. This result reflects the human disturbance is maximum as compared to four successive years (2011-12, 2012, 2012-13, 2013-14). The reason of the Human–Elephant Interface and crop depredation are basically human disturbances within the habitat of the Elephant, habitat fragmentation and deficiency of fodder species of elephant. In total, 57 species of plants (13 grass, five shrubs, two climber, one herb and 36 tree species) belonging to 27 taxonomic families were eaten by Asian elephants (Table-8). So that the elephant roam to nearby villages for searching of foods. Elephants damaged more than six different types of major cultivated plants where rice, maize, sugarcane, and banana were the most common. Elephants damaged more than six different types of major cultivated plants where rice, maize, sugarcane, and banana were the most common. Due to disturbances of habitat of elephants (*Elephas maximus*) started to roam the human habitat and agricultural field to meet their food scarcity. It is suggested that elephant fodder plant species should be planted and steps should be taken to reduce the human disturbances within the elephant habitat area by promotion awareness programme. It is also suggested to take awareness among the forest personnel as well as village dwellers to plant more saplings to increase the massive food availability in the forest where the elephants are residing in the habitat or take care for the conservation of the fodder species cited in the Table-8, to feed elephants in their natural habitat will give natural support to them. Some of the important species also found in the habitat scattered form among the existing species of elephant's fodder, which may be sufficient itself to nurture the elephants in ex situ environment. Such conservation of elephant habitat with fodder species and its types plantation with real time implementation in the practice may eradicate or minimize the HEC on the land mass.

Table 8: Elephant Preferred Food Plant

S no.	Botanical Name of Plant Species	Family	Parts Used	Local Name
1	<i>Carya arborea Roxb.</i>	Lecythidaceae	Leaves	Kumbhi
2	<i>Buchanania lanzan</i>	Anacardiaceae	Leaves	Char
3	<i>Lannea coromandelica</i>	Anacardiaceae	Leaves	Moi
4	<i>Mangifera indica</i>	Anacardiaceae	Fruits	Amba
5	<i>Semecarpus anacardium</i>	Anacardiaceae	Leaves	Bhalia
6	<i>Holarrhena pubescens</i>	Apocyanaceae	Leaves	Kurei
7	<i>Borassus flabellifer</i>	Arecaceae	Fruits	Tala
8	<i>Cocos nucifera</i>	Arecaceae	Fruits	Nadia
9	<i>Anogeissus latifolia</i>	Combretaceae	Young shoots	Dhaura
10	<i>Combretum decandrum</i>	Combretaceae	Leaves	Atundi
11	<i>Terminalia bellirica</i>	Combretaceae	Leaves	Bahada
12	<i>Terminalia chebula</i>	Combretaceae	Leaves, Fruits	Harida
13	<i>Terminalia tomentosa</i>	Combretaceae	Leaves	Asan
14	<i>Dilenia pentagyna</i>	Convolvulaceae	Entire plant	Rai
15	<i>Shorea robusta</i>	Dipterocarpaceae	Leaves, Bark	Sal
16	<i>Casia fistula</i>	Fabaceae	Leaves	Sunari
17	<i>Diospyrus melanoxylon</i>	Ebenaceae	Leaves, Fruits	Kendu
18	<i>Artocarpus heterophyllus</i>	Moraceae	Fruits	Panasa
19	<i>Ficus benghalensis</i>	Moraceae	Leaves, Fruits	Bara
20	<i>Pterocarpus marsupium</i>	Fabaceae	Leaves	Bija
21	<i>Butea monosperma</i>	Fabaceae	Leaves	Palasha
22	<i>Phyllanthus emblica</i>	Phyllanthaceae	Leaves, Fruits	Amla
23	<i>Aegle marmelos</i>	Rutaceae	Fruits	Belo
24	<i>Chloroxylon swietenia</i>	Rutaceae	Leaves	Bheru
25	<i>Limonia acidissima</i>	Rutaceae	Fruits	Kaitha
26	<i>Flacourtia jangomas</i>	Saliaceae	Leaves	Baincha
27	<i>Madhuca indica</i>	Sapotaceae	Leaves, Fruits	Mahula
28	<i>Smilax zeylanica</i>	Smilacaceae	Leaves	Muturi

## 6. ACKNOWLEDGEMENT

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