

Crop damage incidences caused by Asian Elephants (*Elephas maximus*. L) in Gudalur Forest Division, The Nilgiris, Tamil Nadu.

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Abstract

Crop damage incidences caused by elephants in the fragmented landscape of Gudalur Forest Division (GFD) of the Nilgiris, Tamil Nadu, India were recorded from 2007 to 2016 (10 Years). Data on crop raiding pattern were collected through questionnaire survey from the villages and ten years secondary data on conflict issues were collected from the records of the forest department. The analysis of the data revealed that totally eighty five crop damage incidences were recorded in and around the Division and totally rupees 7, 55930 INR was spent as a compensation by the forest department. Totally ten food crops were damaged by elephants. Of which Paddy (*Oriza sativa*) was most damaged with a maximum compensation of Rs. 403330/- followed by Plantain (*Musa paradisia*) (Rs. 253500/-) and Pepper (*Piper nigrum*) (Rs. 33500/-). On the contrary the damage and compensation were less for Coffee (*Coffea Arabica*) (Rs. 3000/-), Tapioca (*Berghia major*) (Rs.3000/-) and Ginger (*Zingiber officinale*) (Rs.5000/-). The results clearly indicated that fragmentation of habitat is the main cause for the conflict issues in the entire division. Both female herds and loners including *Makhnas* (tuskless male) raided the crops considerably across the division. Therefore, it is unreasonable to treat conflict as an aberration, rather it must be recognized at the very outset that conflict can, at best, only be managed, and never eliminated. The Elephant Proof Trench (EPT) and other preventive methods can be considered as only short term measure. The results indicate long term conservation and monitoring system are essential to mitigate human-elephant conflict issues in GFD.

Key words: Asian elephant, Human elephant conflict, Crop damage, Gudalur Forest Division, The Nilgiris

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INTRODUCTION

Various anthropogenic pressures led to loss of habitat quality, which forced elephants to extend their traditional range and raid crops to meet out their daily requirements. During such forays elephants invade into human properties and confrontations become inevitable. Fragmentation of habitat leading to trapping of elephants in isolated patches with cultivation all around are mentioned as the factors responsible for crop raiding in South India (Sukumar,1990). Further, factors such as degradation of habitat, competition for water, movement pattern, palatability and nutritive value of crops also led to crop depredation (Sukumar, 1990; Balasubramanian *et al.*, 1995; Ramakrishnan *et al.*, 1997). Crop raiding has been documented in Kerala by Veeramani and Jayson (1995) and Veeramani *et al.* (1996). Gopinathan (1990) has also recorded the crop raiding problem in Wayanad Wildlife Sanctuary, Kerala. Crop raiding and economic loss due to elephants were reported from

Bihar by Datye and Bhagwat (1993). Similar studies were also conducted in the Western Ghats, especially in Nilgiris by Sukumar (1990) and Balasubramanian *et al.* (1995). Similarly more than hundred fragmentations of 484.4 sq.km in Gudalur Forest Division (GFD), Tamil Nadu, India act as a serious impediment for elephants to move through human habitations to access one fragment to another and resulted high HEC (Human-Elephant Conflict) in this division. However the Division gets less attention in terms of scientific study and no detailed information is available on this aspect. This paper is a quantification and documentation of the crop damage caused by elephants in the GFD, and estimation of the economic loss of the crops caused by elephants.

STUDY AREA

The Gudalur Forest division (GFD), situated at the convergence of Kerala, Karnataka and Tamil Nadu, lies between 11°22' and 11°34' N and 76°32' and 76°15' E covering an area of 484.4 sq.km. This forest division is surrounded by Sigur Plateau on the east, Nilambur-Wynad on the west, Mudumalai-Wynad on the north and Nilambur forest on the south. The tropical wet evergreen and moist deciduous forests are

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the major forest types of Gudalur division which form part of the Nilgiri Biosphere Reserve. The other forest types represented are semi-evergreen and South Indian moist mixed deciduous forests on the western side thinning into heavy scrub of the dry deciduous forests on the east. During 1969, the Tamil Nadu Tea Plantation Corporation (TANTEA) moved into the area in a bigger way and cleared the tropical evergreen forests and grassland areas and planted tea to settle repatriates from Sri Lanka. Other severe man made damage hampered the vegetation was encroachments. Migrants who move into Gudalur in the 1950s and early 1960s from Kerala have had land deeds. These activities resulted in vast area of forest habitat to become fragmented and made into small patches of forests that lead to isolation of elephant population due to loss of forest connectivity.

MATERIALS AND METHODS

Questionnaire method was applied to assess the crop damage caused by elephants. Elephant raided crop fields were visited in all villages and thereby information was gathered through "broad and open ended" questions given to the respondents as an opportunity to express his/her views freely (Balakrishna and Ndhlovu, 1992). The questionnaire survey was conducted from May 2013 to August 2016. Totally 190 persons were interviewed in and around Gudalur Forest Division to assess the crop damage incidents. Information such as number of elephant visits and raids, economic loss caused by elephants, intensity of crop damages, preventive measures used to drive away the elephants were collected. These data were pooled together to quantify crop damage issues. Similarly secondary data were collected from the forest department records to understand the intensity of crop damage caused by elephants in GFD.

RESULT

A total number of eighty five crop damage incidences were recorded in and around Gudalur Forest Division and totally rupees 7,55,930 INR was spend as a compensation by the forest department during 2007 to 2016. Among the Forest Ranges, the Pitherkad Forest Range (FR) had highest number of crop damage incidences caused by elephants (60 incidences/year) which was followed by Gudalur (14 incidences/year), Cherambadi (9 incidences/year) and Pandalur Forest Range (2 incidences/year). Range-wise compensation for crop damage showed that Pitherkad (FR) range received highest amount (Rs. 5,09,225) followed by Gudalur FR (Rs. 1,36,700), Cherambadi (Rs. 1,07,505) and Pandalur (Rs. 2,500). On the contrary no crop damage incidence was recorded in the Ovalley FR. (Table 1).

The results on the extent of crop damage caused by elephants in Gudalur Forest Division revealed that totally ten food crops were recorded. Of which Paddy

Table.1. Crop damage caused by elephants in the Gudalur Reserve Forest Division during 2007 to 2016

S. No.	Forest Range (FR)	No. of incidences (n)	Compensation Rs. (INR)
1	Gudalur	14	136,700
2	Pandalur	2	2,500
3	Ovalley	0	0
4	Cherambadi	9	107,505
5	Pitharkad	60	509,225
Total		85	755,930

Table.2. Compensation paid for crop damage incidences in the Gudalur Forest Division.

S. No.	Elephant damaged crop species	Scientific Name	Frequency of Damage (N)	Compensation (Rs. INR)
1	Arecanut	<i>Areca catechu</i>	8	26,000
2	Banana	<i>Musa paradisia</i>	18	253,500
3	Cardamom	<i>Elettaria cardamomum</i>	2	10,000
4	Coconut	<i>Cocos nucifera</i>	2	7,000
5	Coffee	<i>Coffea Arabica</i>	2	3,000
6	Ginger	<i>Zingiber officinale</i>	1	5,000
7	Paddy	<i>Oriza sativa</i>	39	403,330
8	Pepper	<i>Piper nigrum</i>	6	33,500
9	Tea	<i>Camellia sinensis</i>	6	11,600
10	Tapioca	<i>Berghia major</i>	1	3,000

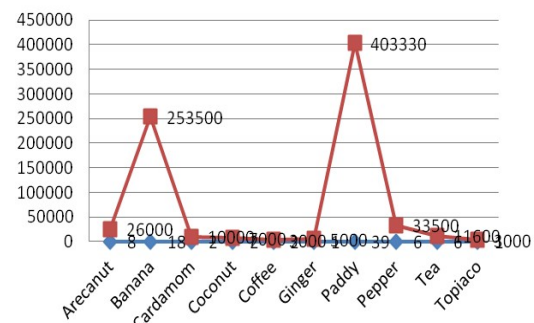


Fig. 1. Compensation paid for damaged crop species in Gudalur Forest Division.

(*Oriza sativa*) was heavily damaged with a maximum compensation of 4,03,330 INR followed by Plantain (*Musa paradisia*) (2,53,500) and Pepper (*Piper nigrum*) (3,3500). Coffee (*Coffea arabica*) (3,000), Tapioca (*Berghia major*) (3,000) and Ginger (*Zingiber officinale*) (5000) were less damaged with less amount of compensation (Table 2 and Fig. 1).

Date on the year-wise crop damage by elephants showed that year 2016 attributed more number of crop damage incidences (N=16) (Rs.1,80,002 INR) which was followed by 2014 (N=14) (Rs. 1,67,375 INR) and 2013 (N=9) (Rs. 81,625 INR). Interestingly

year 2006 recorded no crop damage incidence by elephants in GFD. (Table 3).

Date on month-wise crop damage incidences by elephants revealed that the month of July (n=23, 27.06%) showed the highest percentage of crop damage caused by elephants followed by August (n=17, 20 %).

Table. 3. Year -wise crop damage incidents caused by elephants in and around the Gudalur Forest Division.

S. No.	Year	No. of incidences (n)	Compensation amount Rs. (INR)
1	2007	4	5,500
2	2008	6	12,048
3	2009	0	0
4	2010	2	20,000
5	2011	6	67,580
6	2012	3	63,200
7	2013	9	81,625
8	2014	14	167,375
9	2015	16	158,600
10	2016	25	180,002
Total		85	755,930

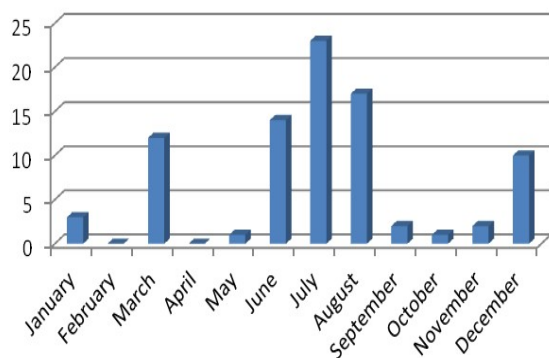


Fig.2. Month-wise crop damage incidents caused by elephants in Gudalur Forest Division.

■ Dry season (Jan-May) ■ Wet season (June-Dec)

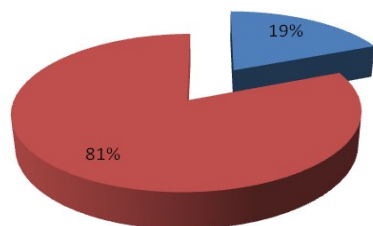


Fig.3. Season wise crop damage incidents caused by elephants in and around the Gudalur Forest Division

Table.4. Month-wise frequency of crop damage incidences in the Gudalur Forest Division.

Months	Frequency of incidences (n)	Relative %	Compensation Rs. (INR)
January	3	3.53	13,300
February	0	0	0
March	12	14.12	110,475
April	0	0	0
May	1	1.18	10,000
June	14	16.47	99,950
July	23	27.06	253,575
August	17	20	167,580
September	2	2.35	35,000
October	1	1.18	3,000
November	2	2.35	27,000
December	10	11.76	36,050

On the contrary during the months of May (n=1, 1.18%) and October (n=1, 1.18%) very few number of crop damage incidences were recorded in the year. However, no crop damage incidence was record in the month of February (Table 4 and Fig. 2).

Season-wise crop raiding pattern by elephants showed that wet season received highest proportion (81%) of crop raiding incidences when compared to dry season (19%) in the Gudalur Forest Division (Figure 3).

DISCUSSION

Crop raid by elephants has been reported from almost all elephant ranges in Asia as well as Africa, where elephants survive in fragmented and disturbed habitats. India has a long history of human-elephant conflict issues. Competition over space and resources by ever growing human population has made the problem severe. In many places, exploitation of forest resources beyond its safe use capacity has led to habitat degradation and altered the habitat quality drastically. Depleted resources across its home range have forced elephants to forage outside the protected areas thus finding themselves in human dominated landscapes.

Once the habitat is fragmented or reduced in size, animals which are living in that area become isolated and hemmed in small patches of forest surrounded by vast area of agriculture crops, tea estates and settlements. The present study indicates that villagers in Gudalur forest division experienced crop loss and human deaths due to elephants, and elephant deaths are due to high fragmentation of habitat which leads to conflict. Elephants, being a wide ranging species require large area to forage. The Gudular forest division is completely fragmented because of establishment of tea estates, expansion of lands for agriculture and

human settlements which led to severe human elephant conflicts. The estate labourer's quarters were extensively damaged by elephants rather than other man made constructions. Studies suggested that the elephants used the microhabitats during the dry season when deciduous forests became unpalatable (Sukumar, 1989; Baskaran, 1998). The swamps have been extensively used by elephants during the dry season to meet out their food and water requirements. The swamps are now converted into labourer's quarters where tea and coffee do not grow. Another reason could be the elephant preferable food plants such as plantain, jack and

Photo plate 1. Crop damage caused by elephants in and around the Gudalur Forest Division.



mangoes are planted by the labourers in their premises which could trigger the elephants to come towards houses and damage the quarters when they get disturbed by the people. Among the forest ranges Pitharkad and Gudalur ranges faced more crop damage incidences than other forest ranges, which could be due to the fact that Gudalur forest range is located adjacent to the protected area of Mudumalai Tiger Reserve (MTR). The probability of animal's migration from MTR to adjacent forest of Gudalur forest range is more, where extensive agriculture and settlements are relatively more which could be the reason for the high incidences of conflicts recorded in the particular forest range.

Loss of corridors between dry deciduous forests (Mudumalai WLS) and evergreen forests (Silent Valley NP) could be the another major factor for the heavy crop

damage incidences in this forest division. The Gudalur and Pitharkad forest ranges had crop losses while Cherambadi range was affected by asset loss (labour quarters) by elephants. Both female herds and loners including *Makhnas* (tusk less male) raided the crops considerably across the division. Therefore, it is unreasonable to treat conflict as an aberration, rather it must be recognized at the very outset that conflict can, at best, only be managed, and never eliminated. The Elephant Proof Trench (EPT) and other preventive methods can be considered as only short term measures, which may provide some immediate relief. In addition to EPT, modern tools using mobile communications such as mobile alerts and alarms and early warning systems about elephant presence can be tried. As long term measure and intensive management of elephant migratory routes is needed (Ramkumar *et al.*, 2014). 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 foothill forests and detailed research on factors of human – elephant conflict and new techniques on control measures. Private lands located at least 200 m from forest should be freed from all sorts of physical barriers. In case of electric fencing, where ever it is an absolute need, fuse system should be made mandatory to avoid usage of high voltage in electric fences. The fuse system, if high voltage is used, will make the fence dis-functional and also the data recorded in the fuse monitor can be used as evidence in case of need. Water sources could be provided along every 5 km in the forest foothills during summer, to negotiate the need for elephants to move further inlands into human areas.

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