

## Past, Present and Future of Wild Elephants in Maharashtra, India

Prachi Mehta\* and Jayant Kulkarni

*Wildlife Research and Conservation Society, Pune, Maharashtra, India*

\*Corresponding author: [prachimehta1@gmail.com](mailto:prachimehta1@gmail.com)

**Abstract.** From 2002 onwards, wild elephants began extending their range into Maharashtra State from the adjoining state of Karnataka. At present, three groups comprising a total of 11 elephants have become resident in Kolhapur and Sindhudurg Districts of Maharashtra. The intensity of crop damage is high because the elephants are feeding on plantation crops that are available throughout the year. From 2002 to 2013, Maharashtra recorded 10,200 crop damage cases by elephants, 13 elephant deaths and 10 human deaths, and paid Rs. 90,248 million (US\$ 1,641 million) as crop compensation to farmers. Efforts are required to maintain the integrity of forests in the area by disallowing commercial plantations. Involvement of farmers in crop guarding will help reduce crop damage and quantum of ex-gratia payment.

### Introduction

Maharashtra State in western India did not have resident wild Asian elephants (*Elephas maximus*) in the recent past, though there are records of their sporadic presence. The 17<sup>th</sup> century Maharashtra Gazetteer mentions the presence of elephants in Dhule and Nandurbar Districts in North-Western Maharashtra (Chitam-palli 1983). In 1940 the Maharaja of Kolhapur introduced a few wild elephants from Karnataka to the Radhanagri Wildlife Sanctuary but the elephants returned to Karnataka (Chitampalli 1983). In 1956 a tusker that ventured into the Amboli forest in Kolhapur District from North Kanara District of Karnataka was killed (Dharmakumarsinhji 1998). In 1960 another tusker entering Ajra Range in Kolhapur District and damaging crops was chased away by local people to the forest of Chowkul in Sindhudurg District and from there the elephant returned to Karnataka (Dharmakumarsinhji 1998).

The above incidents refer to the region of Western Maharashtra adjacent to Karnataka State. There are also some records pertaining to Eastern Maharashtra. An incident in the 1960s refers to a stray elephant herd from Orissa State venturing into Allapalli forests of eastern Maharashtra (Chitampalli 1983). There are several pits in

Nawegaon Sanctuary in eastern Maharashtra for capturing elephants suggesting that wild elephants may have entered the area many years ago (Chitampalli 1983). Therefore, it appears that elephants have been making forays into the eastern and western parts of Maharashtra State since a long time without becoming resident.

During early 1970s, North Kanara District had 5 herds totalling about 130 elephants who roamed in the fragmented forests raiding crops and getting persecuted by farmers (Nair & Gadgil 1980; Prasad *et al.* 1980). By 1980, most of the elephants were shot by people and only 2 isolated herds remained with very few elephants (Gadgil 1985; Daniels *et al.* 1995). Since 1997, the elephants in North Kanara made steady northward movements till they reached Maharashtra (Mehta *et al.* 2011). In 1997 elephants from Dandeli-Anshi Tiger Reserve (DATR) in North Kanara moved north towards Golihalli and Nagargalli Ranges of Belgaum District, reaching Khanapur in 2001. Kolhapur and Belgaum Districts of Karnataka are located on the Eastern side of the Western Ghats at an elevation of 500 to 700 masl, while the coastal Sindhudurg District of Maharashtra is at a lower elevation. Between them are extremely steep escarpments of the Western Ghats. There are very few routes that elephants can take to descend from the Deccan

plains to the coast across the escarpment. One of the routes is from Maan Village in Belgaum District to Mangeli Village in Sindhudurg District that was used by elephants to enter Maharashtra for the first time in recent history.

The present instance of range extension of elephants into Maharashtra began in November 2002 when a group of seven wild elephants entered Mangeli village of Sindhudurg District in Southern Maharashtra. After staying in the area for two weeks they went back to Karnataka. The elephants returned in April 2003 by the same route in a group of 11. There were sporadic reports of 2, 5, 7 and 11 elephants making to and fro movements throughout the year. During 2004-05 the elephants extended their range to enter Sawantwadi Range of Sindhudurg District and the state of Goa (Kulkarni *et al.* 2008).

In November 2004 the Forest Department launched an operation wherein 16 elephants were driven back to Karnataka, but four elephants remained behind. Meanwhile, in November 2004 another group of seven elephants from Karnataka entered Chandgad Range of Kolhapur District in Maharashtra. They left the next day but came again in a bigger group in February 2005 and remained in the area till May 2006. (Kulkarni *et al.* 2008). By 2007 the elephants consolidated their range in Maharashtra and settled in Kudal Range of Sindhudurg District, and Chandgad and Ajra Ranges of Kolhapur District (Fig. 2). Gradually the elephants discovered other routes for moving between Kolhapur and Sindhudurg Districts. There were also some routes that were used for crossing from Karnataka to Kolhapur and from Sindhudurg to Goa.

In 2009, bowing to public pressure, the Maharashtra Forest Department conducted an operation to capture and translocate elephants from Sindhudurg. Four elephants were captured. Two died during the operation, one of which was a juvenile that had previous injuries. The remaining two were released near Kankumbhi in Karnataka, which is about 100 km away from the place they were captured, but both elephants came back to the same region within a week. (RFO Sawantwadi, pers. comm.).

At present (2013) there are three elephant groups in Maharashtra. One group consisting of a tusker, a female, a juvenile and one calf is in Chandgad Range of Kolhapur (DCF Kolhapur, pers. comm.). Another group consisting of a tusker, 2 females and 1 calf is in Kudal Range and the third group of 1 tusker, 1 female and 1 calf is near Tilari Reservoir in Sindhudurg District (DCF Sawantwadi Division, pers. comm.).

Our study was carried out during 2007-08 and 2010-11 to assess crop and economic damages due to elephants and its impact in Maharashtra.

## Methods

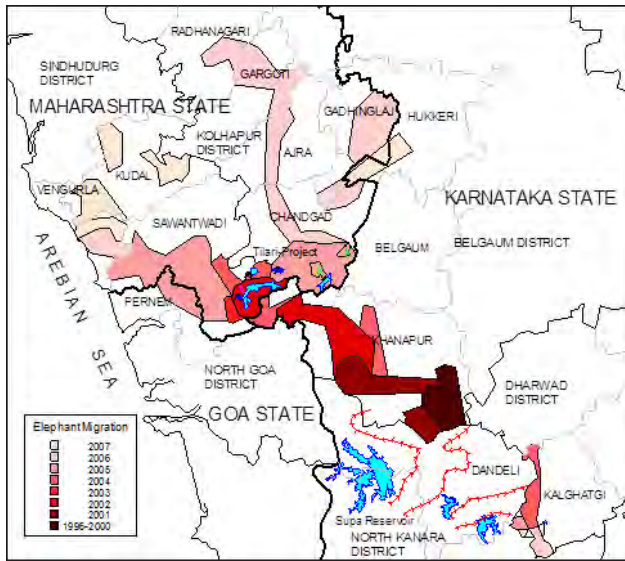
### Study area

The study area comprising of Kolhapur and Sindhudurg Districts, is located in southwest Maharashtra (Fig. 1). Although Sindhudurg has higher forest cover (49.3% of the district) than Kolhapur (23.1% of the district), forests in both districts are fragmented (Kulkarni & Mehta 2013).

Sindhudurg is the southernmost coastal district of Maharashtra and lies between the Arabian Sea to its west and the Western Ghats on the east. Sindhudurg District has an altitude ranging from



**Figure 1.** Map of Maharashtra-North Kanara landscape.

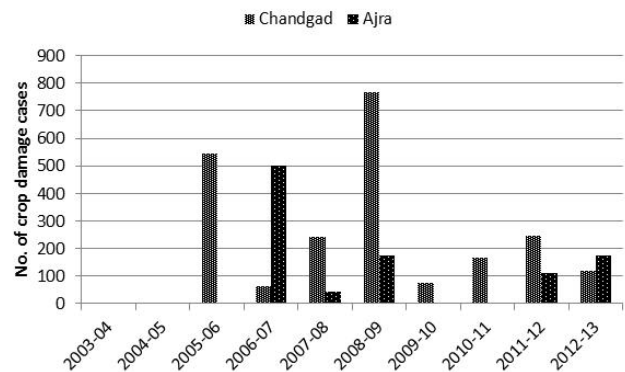


**Figure 2.** Range extension by elephants from Karnataka to Maharashtra and Goa.

sea level to 904 masl at Amboli. The main forest types are tropical semi-evergreen and moist deciduous. Kolhapur District is located mainly on the Deccan Plateau with its western border lying on the eastern slopes of the Western Ghats. The main forest types are tropical semi-evergreen, moist mixed deciduous and dry deciduous.

*Methodology*

The entry points of elephants from Karnataka to Maharashtra and movement of elephants between Kolhapur and Sindhudurg were identified by field surveys and interviews with local villagers and Forest Department field staff. The identified entry points and routes were surveyed on foot and GPS positions taken (Fig. 2). Data on crop damages and ex-gratia payment was obtained from the Forest Department and used to derive patterns of elephant movement.



**Figure 3.** Range-wise crop damage cases in Kolhapur District.

Selectivity of individual crops by elephants was estimated using Jacob’s selectivity index. Selectivity is calculated using the formula:

$$S = (r - p) / (r + p - 2rp)$$

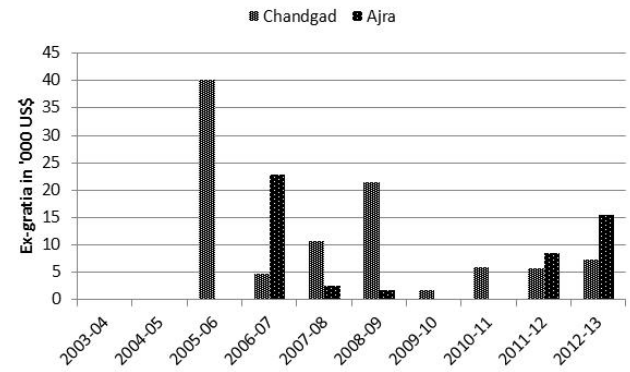
Where r is the proportion of crop damage cases for the particular crop and p is the proportion of area under the crop compared to total area under crops in the district. Selectivity ranges from -1 to 1 where -1 indicates complete avoidance and 1 indicates high preference. Area under cultivation for each crop was obtained from Agriculture Department records. Value for crops damaged was calculated according to Government rates.

**Results and discussion**

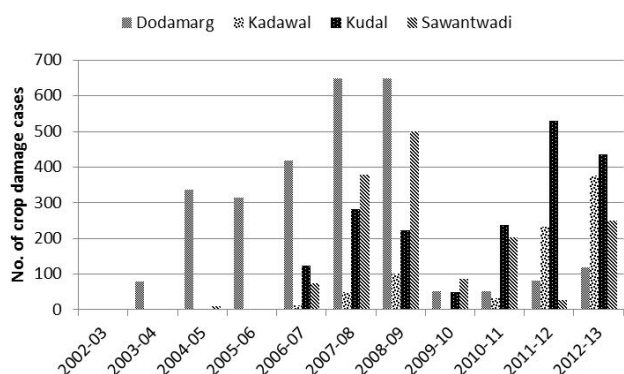
*Crop damage in Kolhapur District*

From 2004 to 2013, Kolhapur District recorded 3,254 cases of crop depredation by elephants. The peak crop damage took place from 2005 to 2009. From 2004 to 2013, Kolhapur District paid Rs. 8.14 million (US\$ 148,000) as ex-gratia payment to the affected farmers. The total number of crop damages in Sindhudurg from 2002 to 2013 was almost twice that of Kolhapur with 6,946 cases reported for which a total ex-gratia payment of Rs. 82 million (US\$ 1.49 million) was paid.

Of the two affected forest ranges in Kolhapur District, Chandgad Range was most affected by crop depredation by elephants. Of 3254 cases, 2042 (62 %) were in Chandgad Range (Fig. 3). From 2011 onwards, elephants were active again in Chandgad and Ajra Ranges. From 2002 to 2013, Rs. 4.9 million (US\$ 89,000) has been paid for crop damage in Chandgad Range (Fig. 4).



**Figure 4.** Range-wise ex-gratia paid in Kolhapur District.



**Figure 5.** Range-wise crop damage cases for Sindhudurg District.

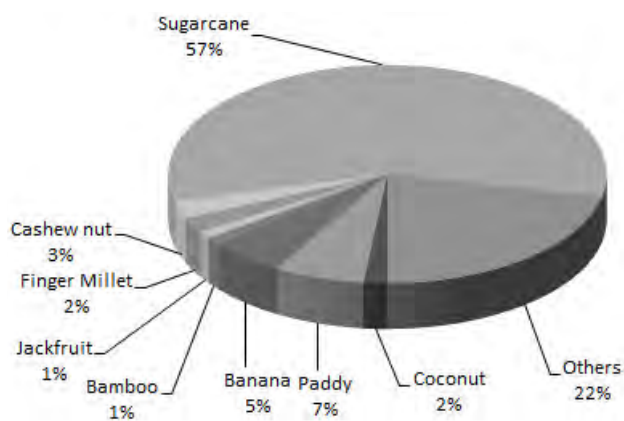
*Crop damage in Sindhudurg District*

In Sindhudurg District, Dodamarg Range had the most (40 %) crop damage cases followed by Kudal (27 %) Sawantwadi (21%) and Kadawal Ranges (11%). In 2007-09, crop damage reached a peak in Dodamarg Range with 640 cases. From 2009 onwards crop damage in Dodamarg Range decreased while it began to show an increase in Kudal and Sawantwadi Ranges (Fig. 5).

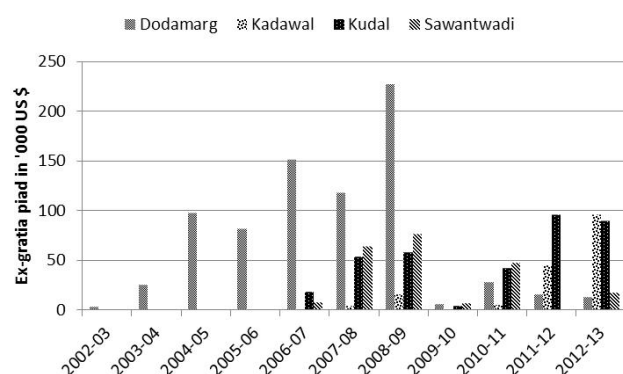
In Sindhudurg District, highest ex-gratia of Rs. 40 million (US\$ 0.75 million) has been paid in Dodamarg Range, followed by Kudal Range (Rs. 19 million, US\$ 0.35 million) and Sawantwadi Range (Rs. 10 million, US\$ 0.21 million; Fig. 6).

*Types of crops damaged*

In Kolhapur sugarcane was the prime target of elephants forming 57% of all crop damage cases (Fig. 7). Other crops such as paddy (7%) and banana (5%) were raided in much lower proportions. In Sindhudurg (Fig. 8) the main



**Figure 7.** Types of crops damaged by elephants in Kolhapur District.

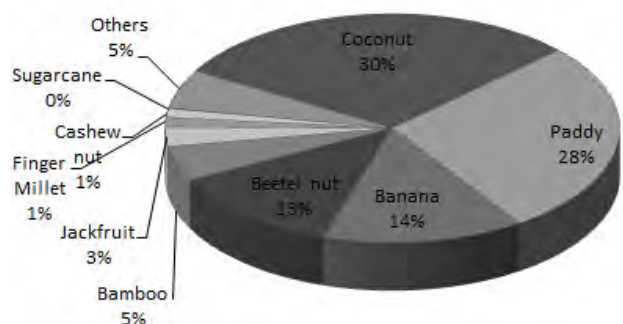


**Figure 6.** Range-wise ex-gratia payment for Sindhudurg District.

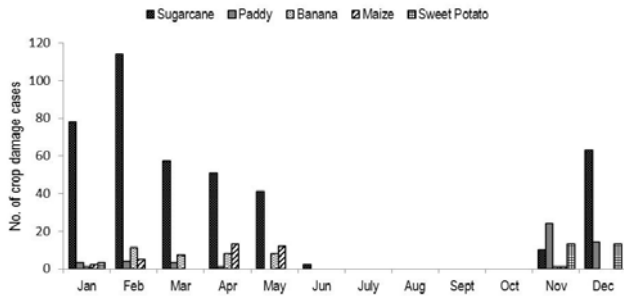
crops damaged were coconut (30 % of cases), paddy (28%), banana (15%), areca nut (13%) and bamboo (5%). Together these five crops accounted for 89% of crop damage cases. The crop damage in Sindhudurg was heavily tilted towards plantation crops since these formed a high percentage of the area under cultivation.

*Annual pattern of crop damage*

In Kolhapur, crop raiding mainly takes place from January to May and then again in November and December with a peak in February. There is hardly any raiding from June to October (Fig. 9). Sugarcane raiding is much higher than other crops for all months except November when it is surpassed by paddy. In Kolhapur, paddy forms the major proportion of raids on cereal crops. Sugarcane is raided for seven months of the year, followed by paddy (5 months), banana and maize (3 months) and sweet potato (2 months). Other crops such as coconut, groundnut, cashew, jackfruit, finger millet and bamboo are raided for a period of 2 to 3 months. Incidence of raids on banana are recorded from February to May, maize from January to May, and Sweet potato in



**Figure 8.** Types of crop damaged by elephants in Sindhudurg District.



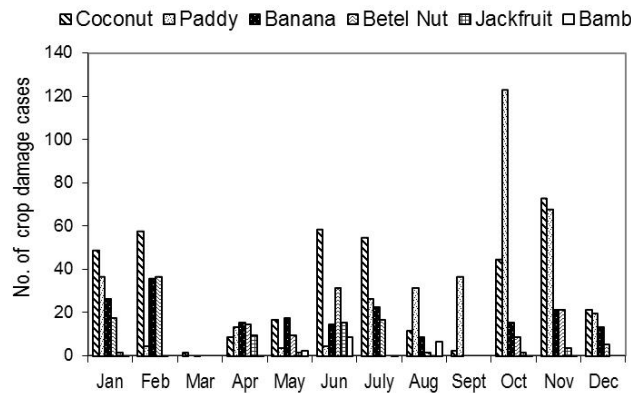
**Figure 9.** Monthly pattern of crop damage in Kolhapur District.

December. There are a few cases of depredation on chilli from June to September.

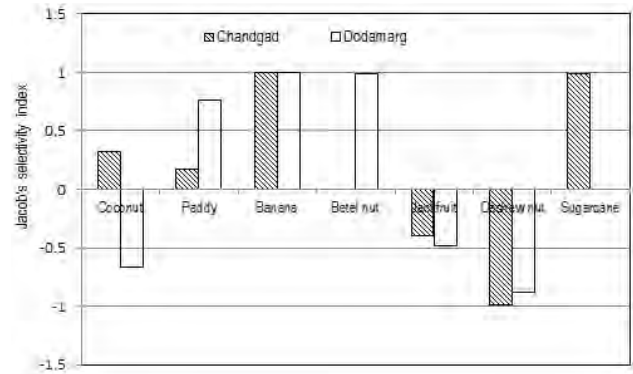
The crop depredation pattern in Sindhudurg is distinctly different from Kolhapur as it occurs throughout the year (Fig. 10). The number of cases of non-cereal crops is much higher than cereal crops in most months. From July onwards the number of cases of cereal crops increases and is highest in October. The cases of cereal crops are mostly paddy with a few of finger millet. Raiding of cereal crops is quite high from July to November corresponding to the paddy and finger millet ripening season. Damage to coconut is fairly high in most months of the year. Elephants raid coconut and paddy for 9 months of the year, banana for 10 months, areca nut, bamboo and jackfruit for 3 to 4 months.

#### *Crop selectivity and area damaged*

Elephants show a high preference for banana, areca nut and coconut in Dodamarg Range of Sindhudurg District. They show a high preference for sugarcane in Chandgad Range of Kolhapur District. Paddy is a preferred crop in both sites.



**Figure 10.** Monthly pattern of crop damage in Sindhudurg District.



**Figure 11.** Selectivity for various crops in Chandgad and Dodamarg Ranges.

Surprisingly, selectivity for coconut is negative in Sindhudurg though most people consider coconut to be a highly preferred food plant of elephants (Fig. 11).

#### *Economic value of crop damage*

The plantation crops coconut and areca nut show a high economic value while paddy shows a much lower economic value of damage. Economic value of damage to banana is also higher than paddy though the area under banana crop is much lower than paddy (Tables 1 & 2).

**Table 1.** Area (in ha) of individual crops damaged by elephants (2005-06).

Crop	Chandgad Range	Dodamarg and Sawantwadi
Paddy	8.9	82.6
Sugarcane	86.0	
Coconut		73.1
Banana	0.4	23.0
Cashew nut	1.0	12.7
Areca nut		12.2
Finger millet	2.0	3.1
Sweet potato	4.5	
Bamboo		4.4
Jackfruit		3.5
Mango		1.9
Groundnut	1.2	
Potato	0.3	
Chilli	0.3	
Maize	0.2	
Teak		0.1
<b>Total</b>	<b>104.8</b>	<b>216.6</b>

**Table 2.** Estimated value of damage (in US\$) to major crops in the two Districts (2005-06).

Crop	Sindhurg	Kolhapur
Coconut	132,810	-
Areca nut	48,982	-
Banana	8,272	-
Paddy	4,090	-
Sugarcane	-	25,000
Total	194,154	25,000

### *Ex-gratia payment*

About 325 crop damage cases are recorded every year in Kolhapur District for which on average Rs. 2,400 (US\$ 44) is paid, while in Sindhurg District almost double the number i.e. 630 cases are recorded per year with an average of Rs. 12,000 (US\$ 220) paid (Table 3). The amount paid in Sindhurg District is much higher because the majority of cases related to plantation crops such as coconut and areca nut that have a high ex-gratia payment rate of Rs. 2000 per tree (US\$ 40) as they are considered high value crops. The main crop in Kolhapur District is sugarcane, the ex-gratia payment rate for which is relatively low at Rs. 400 (US\$ 7) per ton.

Ex-gratia payment is a relief to the affected farmer and therefore it should not be a means of monetary benefit. While the ex-gratia payment for each coconut tree was Rs. 2000 (US\$ 36), the plantation owners are demanding Rs. 5000 (US\$ 91) to bring it on par with the rate in Goa State.

**Table 3.** Average ex-gratia payment (in US\$) per case for crop depredation in the two Districts.

Year	Kolhapur	Sindhurg
2003-04	-	310
2004-05	48	283
2005-06	73	257
2006-07	48	283
2007-08	44	174
2008-09	24	255
2009-10	42	77
2010-11	34	228
2011-12	39	178
2012-13	75	180

In Dodamarg and Sawantwadi Ranges of Sindhurg district many commercial plantation owners are residents of South India. The farms are managed by employees and often crop protection measures are not in place. Because of the large farm size and amount of crops damaged the Forest Department has to pay large amounts of compensation. A few such farmers have received payments of Rs. 600,000 to 1,500,000 (US\$ 10,900 to 27,000) while the subsistence farmers whose agricultural crops are damaged cannot get more than the prescribed upper limit of Rs. 15,000 (US\$ 267) (Kulkarni *et al.* 2008). Although the quantity of crop damaged and monetary loss may be less in the case of a marginal farmer, he suffers more because he loses a large share of his food production for the year. At present plantation owners can get unlimited ex-gratia payment. Therefore there is no pressure on them to protect their crops. In Zimbabwe, Kenya and Mozambique, 80 % reduction in crop damage was observed where the farmers took up active guarding in their own fields (Parker & Anstey 2002; Parker *et al.* 2007). Linking ex-gratia payment to crop guarding measures taken by the farmers may motivate farmers to actively guard the crops.

### *Encounters with elephants*

Since 2002, 10 human deaths and 21 human injury cases have taken place due to conflict with elephants in Kolhapur and Sindhurg Districts. There have been no deaths in Kolhapur District since 2006. In Sindhurg District the last death was in 2008. The number of human injury cases was higher in Sindhurg District than Kolhapur District (Table 4).

In the initial period when elephants arrived in Maharashtra, there was very little public awareness on keeping a safe distance from wild

**Table 4.** Total ex-gratia paid (in US\$) for human deaths and injury from 2004 to 2013.

District	Deaths	Ex-gratia	Injury	Ex-gratia
Kolhapur	5	14,544	6	2,096
Sindhurg	5	18,180	15	10,519
Total	10	32,744	21	12,615

elephants. All the encounters between people and elephants took place in daytime. Therefore it is likely the people failed to detect the presence of elephants or did not realize the risk of being close to elephants. For example a forest labourer lost his life as he was fascinated by a sub-adult elephant and ventured closer for a better look. In some cases, especially in Gadhinglaj Taluka of Kolhapur District, people took to pelting the animals with stones. In one such incident the elephant charged and killed one person. Three persons were injured during elephant driving operations in Sindhudurg District.

### *Elephant deaths*

There have been 13 elephant deaths in Maharashtra between 2002 and 2010. Of these, 7 elephant deaths have been recorded in Kolhapur District and 6 in Sindhudurg District (Table 5). Although most elephant deaths have been classified as natural deaths, many of them are due to retaliatory actions by the farmers in Maharashtra and Goa.

### *Conflict mitigation measures taken by Forest Department*

The Kolhapur and Sawantwadi Divisions are following various practices to manage the human-elephant conflict in their area. This includes regular tracking of elephants in order to alert farmers of elephant presence in their area, conducting elephant drives, making water holes

and fodder plots, and construction of elephant proof trenches (EPT) and solar fences. The barriers are constructed between Maharashtra and Karnataka state, on the Reserve Forest boundaries and district boundaries.

### *Management of elephant conflict in Maharashtra*

EPTs and solar fences in Maharashtra have several drawbacks (Kulkarni & Mehta 2011). Firstly streams and water courses are common. It is impossible to construct EPTs across streams and gaps remain. Secondly the entire landscape is occupied by humans. Because of this there are roads and pathways that cross barriers everywhere and this defeats the very purpose of barriers. Most government owned solar fences were dysfunctional owing to lack of maintenance while privately owned fences were in working condition. In Karnataka, poor performance of Forest Department constructed barriers was attributed to lack of responsibility of maintenance (Nath & Sukumar 1998; Kulkarni *et al.* 2007).

Managing elephants in Sindhudurg is difficult because of the hilly terrain and high interspersion of private land and forest. The forest blocks in Kolhapur are less fragmented than Sindhudurg and the terrain in Chandgad and Ajra Ranges is relatively flat, so it is easier to manage elephants in Kolhapur. Managing conflict with elephants effectively requires minimizing crop damage by active crop guarding by local farmers and preventing encounters with elephants.

**Table 5.** Elephant deaths in Kolhapur and Sindhudurg Districts from 2006 to 2010.

Year	Range	Location	Deaths	Composition	Cause of Death
2006	Chandgad	Jelugade	4	3 Females, 1 Male	Electrocution
2006	Radhanagri	Pharale	1	1 Male	Pneumonia
2008	Chandgad	Patne	2	2 Males	Falling into well
Total Kolhapur District			7		
2004	Sawantwadi	Shrirange	1	Calf	Malnutrition
2009	Kudal		2	Male	During tranquillization and capture operation
2009	Nivaje		1	Sub-adult female	Worm infection
2009	Bawlat near Danoli		1	Male calf	Wounds on mouth and hip inflicted by people
2010	Kudal	Rangana Tulsuli	1	Male	Natural
Total Sindhudurg District			6		

At present many villagers in Dodamarg Range in Sindhudurg District are selling private forest land and farmland to plantation owners from Kerala and Tamil Nadu. These entrepreneurs clear existing forests and now plant oil palm, rubber, coconut and banana (Fig. 12). In Mangeli the local community owns large areas of land in a system known as community forest or *Kumri*. The total *Kumri* land with the community is nearly 10,000 acres (Kulkarni & Mehta 2013). Conversion of these private forests to plantations will result in forest fragmentation and may increase human-elephant conflict. The forest in Chandgad Range is subject to anthropogenic pressure and encroachment, causing degradation of elephant habitat. These should be protected and restored.

#### *Importance of involving local community*

Studies on human wildlife conflict have indicated that for successful conflict resolution decentralization of responsibility is very important (Osborn & Anstey 2002). Whenever the entire responsibility of reducing the conflict is on the government, it has met with poor results (Hill *et al.* 2002; Osborn & Parker 2002; Kulkarni *et al.* 2008; Zimmerman *et al.* 2009; Mehta *et al.* 2011). Under the present system in Maharashtra while the government spends a lot of money in installing fences, barriers, conducting drive operations, vigilance, patrolling and making ex-gratia payments to affected people, local communities act as observers. This culture of dependency is not effective in resolving



**Figure 12.** Community forest in Mangeli Village being cleared for rubber plantation.

the conflict as local people are unwilling to take active steps to prevent crop damage. We suggest initiation of community-based conflict management by introducing low-cost and simple crop protection measures such as setting up community guarding and use of trip alarms, chilly smoke, chilly rope and bee-hive fences in the area to keep the elephants out of crop fields. Implementing such initiatives in North Kanara region has met with considerable success (Mehta *et al.* 2011; Mehta 2012).

#### *Future of elephants in South Maharashtra - North Karnataka*

Presence of a small population of elephants in Maharashtra does not add much to the conservation value of elephants as a whole. However it has greater significance as these elephants are part of the North Kanara elephant population. An inter-state elephant reserve will help in preventing further fragmentation of forests in this region. There needs to be coordination and dialogue between forest officers of the two states in terms of objectives, strategy and action to be taken for management of elephants. A broader view is also necessary in terms of species conservation beyond day to day management of human elephant conflict. Although the number of elephants in Maharashtra is very few at present, it is likely to increase in the future. This has value for long-term elephant conservation across the two States.

#### **Acknowledgments**

We thank the Ministry of Environment and Forests, New Delhi for a grant, which enabled this study. We are grateful to Maharashtra Forest Department for granting permission for the study and to officers of Kolhapur and Sawantwadi Divisions for logistic support. We thank Prithviraj Fernando for his valuable inputs that helped in improving the manuscript. We thank Umesh Hiremath for fieldwork on this project.

#### **References**

Chitampalli M (1983) *Pakshi Jay Digantara*. B.L. Kulkarni, Nagpur, India. pp 119-130.



- Daniels RJR, Gadgil M & Joshi NV (1995). Impact of human extractions on tropical humid forests in the Western Ghats of Uttar Kannada, South India. *J. of Applied Ecology* 32: 832-864.
- Dharmakumarsinhji RS (1998) *Reminiscences of Indian Wildlife*. Oxford University Press, New Delhi.
- Gadgil M (1985) Status of wild mammals in Karnataka. In: *State of Environment Report, Karnataka. Chapter 6*. pp 22-34.
- Hill C, Osborn F & Plumtre AJ (2002) *Human-Wildlife Conflict: Identifying the Problem and Possible Solutions. Albertine Rift Technical Report Series Vol. 1*. Wildlife Conservation Society.
- Kulkarni J, Mehta P, Boominathan D & Chaudhuri S (2007). *A Study of Man-Elephant Conflict in Nagarhole National Park and Surrounding Areas of Kodagu District in Karnataka, India*. Final Report, Envirosearch, Pune.
- Kulkarni J, Mehta P & Hiremath U (2008) *Man-Elephant Conflict in Sindhudurg and Kolhapur Districts of Maharashtra, India; Case Study of a State Coming to Terms with Presence of Wild Elephants*. Final Report, Envirosearch, Pune.
- Kulkarni J & Mehta P (2011) *Action Plan for the Management of Elephants in Maharashtra*. Submitted to Maharashtra Forest Department, Wildlife Research and Conservation Society, Pune.
- Kulkarni J & Mehta P (2013) *A Study of Status, Distribution and Dynamics of Private and Community Forests in Sahyadri-Konkan Corridor of Maharashtra Western Ghats*. Technical Report submitted to CEPF-ATREE, Wildlife Research and Conservation Society, Pune.
- Mehta P, Kulkarni J & Hiremath U (2011) *Pilot Project for Mitigation of Human Elephant Conflict in North Kanara District, Karnataka, India*. Report submitted to CEPF-Atree Western Ghats Program, Wildlife Research and Conservation Society, Pune.
- Mehta P (2012) *How to Protect your Crops from Elephants. A Handy Guide for Farmers and Forest Department*. Wildlife Research and Conservation Society, Pune.
- Nair VP & Gadgil M (1980) The status and distribution of elephant population of Karnataka. *Journal of the Bombay Natural History Society* 75: 1000-1016.
- Nath C & Sukumar R (1998) *Elephant-Human Conflict in Kodagu, Southern India: Distribution Patterns, People's Perceptions and Mitigation Methods*. Unpublished report, Asian Elephant Conservation Centre, Bangalore.
- Osborn FE & Anstey SG (2002) *Elephant/Human Conflict and Community Development around the Niassa Reserve, Mozambique. Field Training in Community-Based Crop Protection MZEP*. Report to WWF SARPO.
- Osborn FE & Parker GA (2002) *Living with Elephants II*. MZEP, Chisipite, Harare, Zimbabwe.
- Parker GE, Osborn FV, Hoare RE & Niskanen LS (eds) (2007) *Human-Elephant Conflict Mitigation: A Training Course for Community-based Approaches in Africa*.
- Parker GE & Anstey S (2002) *Human-Elephant Conflict and Community Development in Niassa Province, Mozambique. Report on Field Training and Implementation of Community-based Crop Protection Methods, Matchedje Village, Sanga District, Niassa Province*. MZEP Report to WWF SARPO.
- Prasad NP, Nair V, Sharachandra H & Gadgil M (1980) On factors governing the distribution of wild mammals in Karnataka. *Journal of the Bombay Natural History Society* 75: 718-743.
- Zimmermann A, Davies TE, Hazarika N, Wilson S, Chakrabarty J, Hazarika B & Das D (2009) Community-based human-elephant conflict management in Assam. *Gajah* 30: 34-40.