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THE 'STATE OF AFFAIRS' OF THE ASIAN ELEPHANT *ELEPHAS MAXIMUS*
IN THE HOSUR AND DHARMAPURI FOREST DIVISIONS OF TAMIL NADU, INDIA

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We discuss the state of affairs of the Asian Elephant in the Hosur and Dharmapuri forest divisions based on studies undertaken from November 2006 to June 2007, and also through a comparison of the situation prevailing there as reported from an earlier study in the late 1980s to early 1990s. The situation of elephants in the two divisions is alarming due to the decline in elephant population from dispersals and unnatural deaths, skewed sex-ratio in favour of females, severe habitat loss and degradation, proliferation of the exotic weed *Lantana camara*, problems of human-elephant conflict, and from other human-related pressures on the forests.

Key words: *Elephas maximus*, Eastern Ghats, Hosur reserve forest, Dharmapuri reserve forest, population, conservation issues, human-elephant conflict, *Lantana camara*

INTRODUCTION

The elephants of the Hosur and Dharmapuri (henceforth, Hosur-Dharmapuri) reserve forests came into the limelight during the mid-1980s with the first reported instance of elephant dispersals in India (Ramesh Kumar and Desai 1992; Manakadan *et al.* 2010), a phenomenon subsequently reported in a few other elephant ranges, primarily due to habitat loss, fragmentation and degradation (see Sarma and Easa 2006; Singh 2002). The elephants that dispersed from Hosur-Dharmapuri forests colonised two sites in southern Andhra Pradesh, a state that did not have a history of elephant presence for 200 years (Manakadan *et al.* 2010; Syam Prasad and Reddy 2002).

Investigations into the issue of elephant dispersal and colonisation are important to help wildlife managers understand the reasons for dispersals and more efficiently manage problems associated both with dispersal and colonisation. Hence, after undertaking a study in one of the colonised sites, Koundinya Wildlife Sanctuary (Daniel *et al.* 2006), we undertook a study in the Hosur-Dharmapuri forests from Nov. 2006 to Jun. 2007 (Daniel *et al.* 2008). In this paper, we discuss the state of affairs of the Asian Elephant in the Hosur-Dharmapuri forest divisions based on the studies undertaken, and also in comparison with the situation reported prevailing during an earlier study (Ramesh Kumar 1994).

STUDY AREA

The contiguous reserve forests of Hosur and

Dharmapuri forest divisions (11°48' –12°44' N; 77°30' – 78°47' E) fall under the districts of Krishnagiri and Dharmapuri of Tamil Nadu (Fig. 1) and are part of the Eastern Ghats mountain range of peninsular India. The Hosur Forest Division (1,280 sq. km) has seven ranges: Jawalagiri, Denkanikotta, Anchetty, Urigam, Rayakotta, Hosur, and Krishnagiri. The Dharmapuri Forest Division (876 sq. km) consists of the Hogenakal and Pennagaram ranges. There is a long-pending proposal to demarcate and declare a portion of the Hosur-Dharmapuri area as a sanctuary. Forest tracts that adjoin Hosur-Dharmapuri are Bannerghata National Park in the north and Cauvery Wildlife Sanctuary in the west.

The altitude ranges from 400 to 1,000 m above msl. The two main drainages are Doddahalli in the west and Chinnar in the east, both draining into the River Cauvery which runs along its southwestern boundary. The rainfall is primarily from the southwest monsoon varying from 700 to 950 mm/annum. During winter (December–February), the temperature often falls below 10 °C. The maximum temperature is generally under 25 °C, and seldom crosses 35 °C (Ramesh Kumar 1994; Subiah 1982).

The forest is predominantly the dry mixed deciduous type. There are a few small patches of dry evergreen species in the Denkanikotta range. Dry deciduous and scrub forest occur around the boundary of forests and along roads due to high biotic pressures. Riverine forests occur along the banks of Cauvery, Doddahalli, Chinnar and semi-perennial streams. This forest tract was well known for sandalwood (*Santalum album*), and protection to this and other timber species began during Tipu Sultan's rule. Large areas were brought under

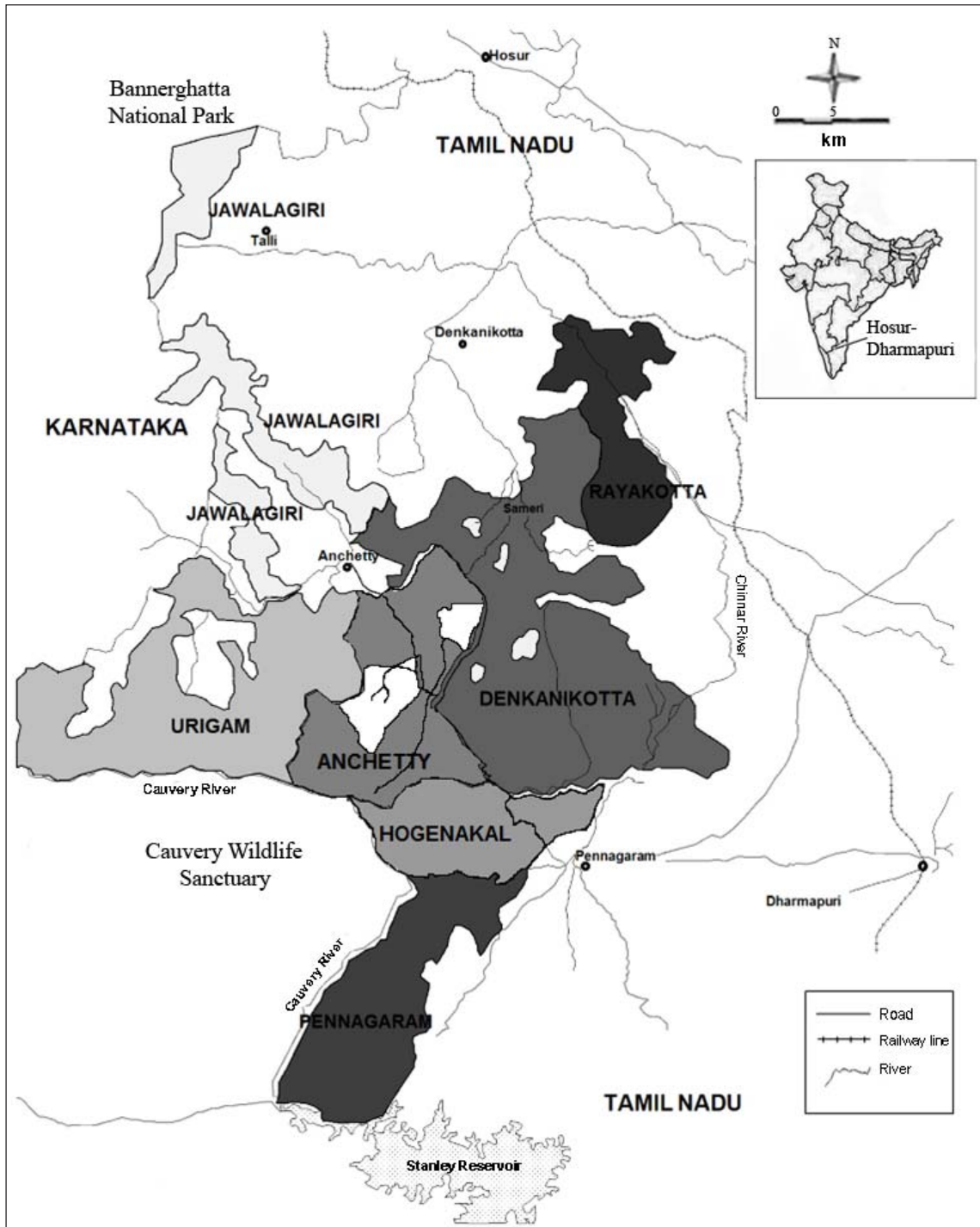


Fig.1: Map showing the seven elephant inhabited ranges of the Hosur-Dharmapuri forest divisions (excluding Hosur and Krishnagiri ranges) with adjoining areas

British rule through treaties with Tipu in 1792 and 1799. After this, the forests underwent relentless exploitation, especially for sandalwood and timber, till they were notified as reserve forests in 1886. Nevertheless, the forests, due to their status as reserve forests where locals have some rights to the land, continued to experience significant destruction through

permitted or illegal grazing and exploitation of bamboo, fuelwood, timber and minor forest produce. The exotic shrub *Lantana camara* has spread extensively throughout the forest (Ramesh Kumar 1994; Subiah 1982).

There are 27 enclave and around 95 fringe villages with cultivated areas (largely in the plains) in the Hosur-

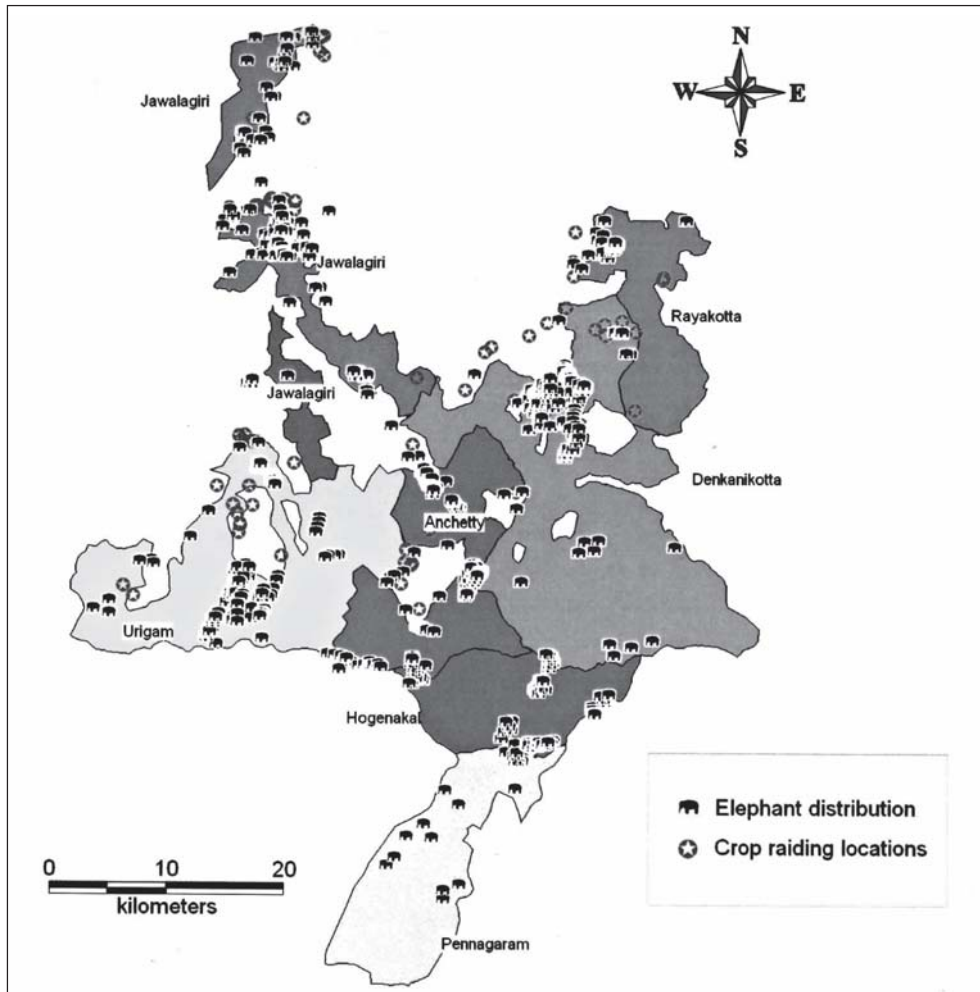


Fig. 2: Distribution of elephants in the seven elephant inhabited ranges of Hosur-Dharmapuri forests from Nov. 2006 to Jun. 2007 – based on sightings, indirect signs, and crop-raiding records

Dharmapuri division with a total human population of around 80,000. The major sources of revenue/employment for the locals are from agriculture, livestock rearing, wood-cutting, sale of non-timber forest produce, sericulture, fruit juice and dry food processing, granite extraction, and brick manufacturing. A recent development is the construction of farm houses and resorts. Ragi (*Eleusine coracana*), other minor millets, and pulses are the major crops in the area, besides paddy, banana, sugarcane, cotton, groundnut, and vegetables. Cattle and sheep of the enclosure and fringe villages are permitted to graze in the forest. The entry of goats is banned but it is not uncommon to see goats accompanying other livestock in the forests. The density of livestock varies between 77 animals/sq. km to 272 animals/sq. km in the different areas, with an average density of 165 animals/sq. km (Subiah 1982).

METHODOLOGY

Two of the nine ranges of the Hosur Forest Division

(namely, Hosur and Krishnagiri ranges) lie amidst human habitation areas and have patchy vegetative cover, and have not been frequented by elephants since the past few decades (Ramesh Kumar 1994). Because of this and following Ramesh Kumar (1994) study, our studies were confined to only seven ranges, namely, Jawalagiri, Denkanikotta, Anchetty, Urigam, Rayakotta, Hogenakal and Pennagaram.

The methodologies of the studies are as follows:

Elephant Population and Distribution: All the seven ranges were surveyed extensively with efforts to cover all areas thoroughly and equally, and all direct (sightings) and indirect evidence (dung, feeding signs and tracks) of elephant presence were recorded with GPS. Information of elephant presence was also solicited from herdsmen, woodcutters, and Forest Department field personnel.

Biotic Pressures: Quantification of biotic pressures (namely, woodcutting, grazing using dung abundance as an index, and weeds) was carried out using >5 km belt transects,

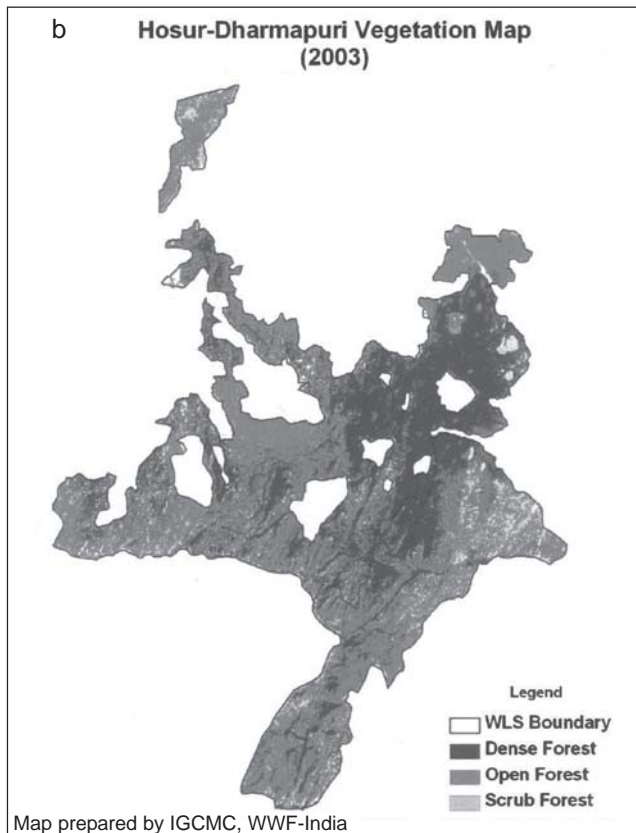
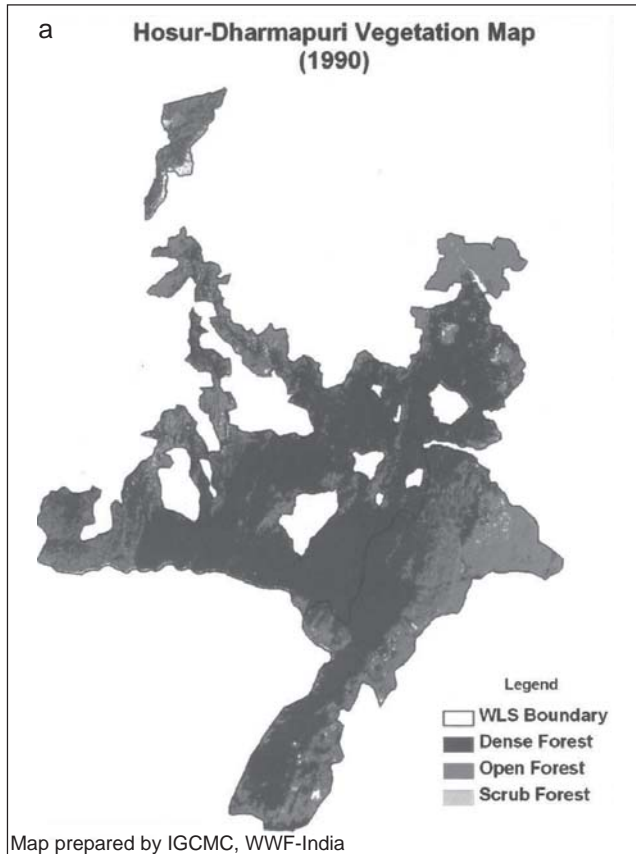


Fig. 3: Past and present forest cover in seven elephant inhabited ranges of Hosur-Dharmapuri

orienting from 13 village boundaries towards the forest interiors. Data was collected at 100 m intervals for a length of 100 m (width of 2 m on either side), recording the tree species (>10 cm girth), number of cut trees/stems, and the abundance of cattle dung. The presence of the weed *Lantana camara* was sampled at the end of each 100 m segment using a 5 sq. m quadrat.

Human-Elephant Conflict (HEC): Information on past HEC cases was obtained from Forest Department records and published data (Ramesh Kumar 1994). For current HEC data, besides relying on current crop compensation claims in Forest Department records, we carried out a HEC survey in 92 villages. The data recorded included the villages raided, crop species raided, property damaged, the extent and nature of the damage, and the age-sex and group size of the raiding elephants. The distances of the raided crop fields to nearby water sources were also recorded.

Changes in Forest Cover: Topographic maps and recent (2003) and old (1990) satellite imageries of the study area were procured and classified using GIS techniques for assessing changes in the forest cover over the years. The imageries used were: 1990 (Landsat, 30 m resolution; Feb. and Dec. 1990; 4 images), and 2003 (IRS, P4/L-3; 30 m resolution – after rescale from 24 m; Sep. and Dec. 2003; 4 images).

RESULTS

Population and Distribution of Elephants

A total of 5 bulls (2 adults and 3 subadults) and five herds in different areas were sighted from November 2006 to June 2007. The bulls consisted of an adult and a subadult tusker in Denkanikotta Range, a subadult tusker in Urigam Range, a subadult tusker in Anchetty Range and a *makhna* in Jawalagiri Range. Two bulls, a *makhna* and a subadult bull, died during the study, the *makhna* being the one sighted earlier. The five herd sightings consisted of a minimum of 6 animals in the Jawalagiri Range, 15 in Denkanikotta Range, 15 in Anchetty Range, 12 in Hogenakal Range and 8 in Pennagaram. A total of 195 dung and 340 feeding signs of elephants were recorded from November 2006 to June 2007 (Fig. 2), which revealed that elephants ranged in all the seven ranges.

Changes in Forest Cover

Comparison of the past (1990) and the recent (2003) imageries of the vegetation cover of Hosur-Dharmapuri forest division (Fig. 3) revealed that dense forest cover had decreased from 1,006.4 sq. km to 529.6 sq. km, open forest had increased from 359.8 to 634.4 sq. km, and scrub forest had increased from 27.1 to 205.7 sq. km. Overall, the images revealed that

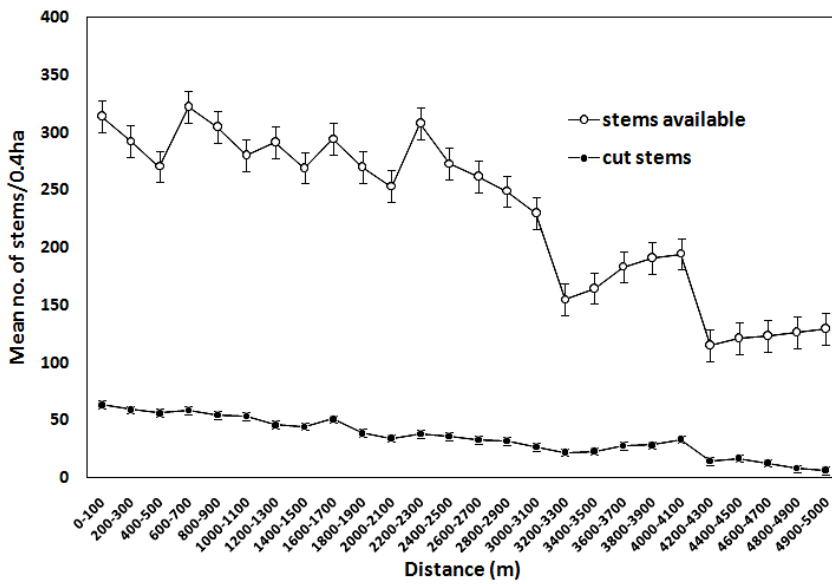


Fig. 4: Woodcutting pressures from 13 village boundaries towards interior forests in Hosur-Dharmapuri

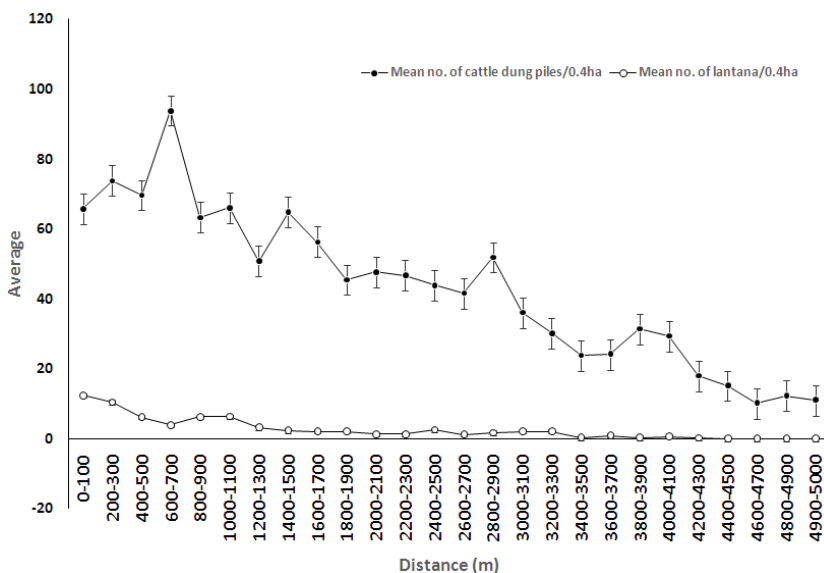


Fig. 5: Abundance of cattle dung piles and *Lantana camara* from 13 village boundaries towards interior forests in Hosur-Dharmapuri

the forests of Hosur-Dharmapuri have become significantly more open due to loss of tree cover.

Biotic Pressures

Woodcutting: The number of cut stems was recorded to gradually decrease with increase in distance from villages (Fig. 4), as woodcutting is more prevalent near village borders. However, the results also revealed that woodcutting extends throughout the forest mainly because the forest has enclave villages within its confines.

Grazing: The density of cattle dung showed a decline

with increase in distance from villages till around 2.5 km (Fig. 5). Thereafter, there was a sharp increase due to the proximity to the next village. After this, there was again a decline as transects were not laid in the direction of adjoining villages but as far away as possible from them. The decline in dung density towards forests besides being related to higher grazing pressures near villages is also a result of reduced defecating rates. It is well known that cattle tend to defecate more in the morning as they move out into the forest and again in the evenings on their way back. This pattern is exploited in many areas by releasing cattle in the late mornings and then bringing them back by evening so that the deposited dung can be collected for manure. Overall, the results showed that grazing by livestock is rampant throughout the forest.

Lantana camara: The exotic weed *Lantana camara* was recorded throughout the forest; its abundance was more near villages due to higher biotic disturbances (Fig. 5). Its spread was found to depend on soil type, being scarce and with poor growth in crystalline soil areas.

Human-Elephant Conflict

Human Mortalities: Human mortalities from elephants were almost an annual feature with a total of 21 deaths reported from 2001 to 2008 (Fig. 6), averaging 2.8 human deaths/year. We recorded two human deaths in one day by a bull elephant during the study period, and two more deaths were subsequently reported within a year.

Elephants Mortalities: Seventy-four elephant deaths were reported from 1991 to 2008 (Fig. 7), averaging 4.5 elephant deaths/year. The majority of the deaths were reported as natural deaths, but in the absence of timely post-mortems or early detection of the carcasses, it is difficult to accurately know the actual cause of death, and many such cases get reported as due to natural causes. Passing off poached animals or animals killed during crop raiding as natural death also frees the Forest Department from problems that would arise if reported otherwise. Five mortalities were recorded during the study period: a subadult tusker shot in a

crop field at Denkanikotta, a cow that died due to “delivery complications” in Anchetty Range, a subadult cow casualty reportedly from anthrax in the Anchetty Range, an adult *makhna* that fell into a well at the outskirts of Rayakotta Range, and a cow that died of “old age” in the Rayakotta Range.

Crop Raiding: Forest Department records had 1,685 crop damage claims from 2001 to 2008 (Fig. 8). The data showed a sharp increase in crop raids during 2006–07 and 2007–08, but according to locals and some Forest Department personnel, this was only because the new Divisional Forest Officer was keen that all affected villagers received compensation and took serious efforts in this direction. We recorded a total of 48 raids spread over 30 villages from November 2006 to March 2007. The majority (94%) of the raids was by family herds (Fig. 9).

DISCUSSION

Decline in Elephant Population:

Ramesh Kumar (1994), who carried out an intensive study from December 1988 to January 1993, estimated the resident elephant population of the Hosur-Dharmapuri forests at an “annual minimum” of around 17 bulls and 241 individuals of family units, totalling 258. The Synchronized Elephant Census (SEC) of 1998 reported around the same population, namely 277 animals (AERCC 1998). However, the 2002 SEC reported significantly higher numbers: 590 for Hosur and 243 for Dharmapuri (Anon. 2002). Considering the difficult terrain, large areas to be covered, trained manpower requirements for such an exercise, and the earlier tendency of the Forest Department staff to show higher growth population figures of wildlife in their areas, we feel the 2002 SEC figure is erroneous. The fact that these forests are contiguous with other forests permitting movement of elephants between sites also adds to the problem – in spite of the census being conducted simultaneously over elephant ranges.

Comparison of past and present figures revealed a decline in the elephant population over the years. Ramesh Kumar recorded 17 resident bulls, but we recorded only 5 bulls, two of which died later. Also suggesting to the decline are the mortalities of 74 elephants reported from 1991 to 2008. There were also possibilities of unrecorded mortalities, especially in the adjoining Cauvery Wildlife Sanctuary, where the infamous elephant poacher Veerapan was active till 2004.

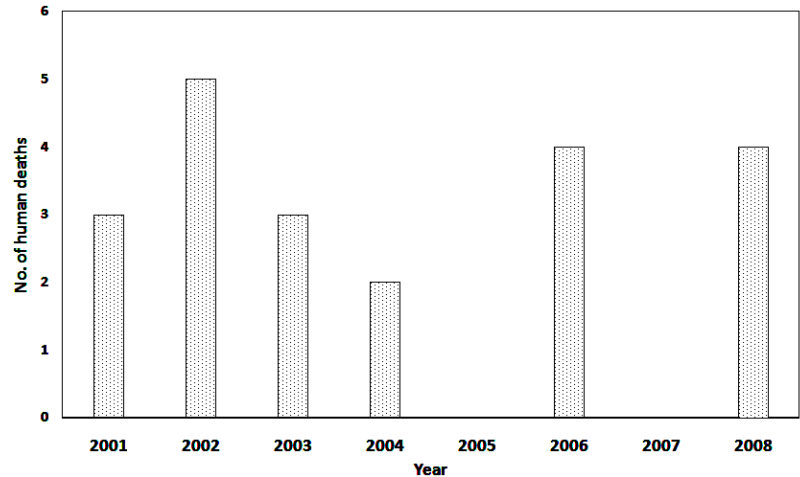


Fig. 6: Manslaughter in the Hosur-Dharmapuri area from 2001–2008

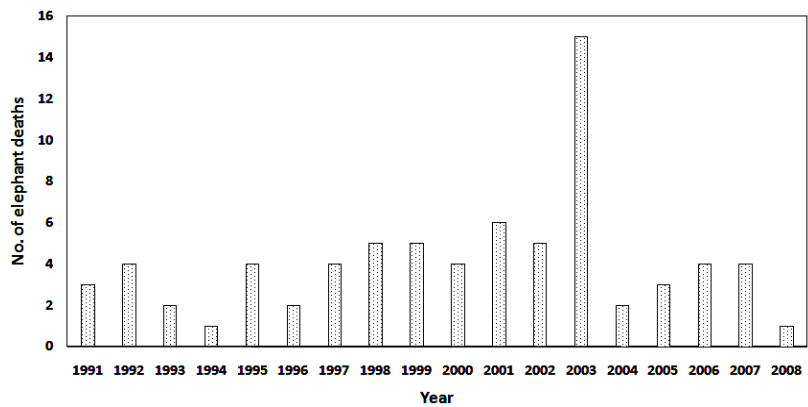


Fig. 7: Elephant mortalities in the Hosur-Dharmapuri area from 1991–2008

He was reported to have been responsible for poaching around 200 tuskers in the southern Eastern Ghats areas (Sukumar 1989a).

Skewed Sex-Ratio: Besides a decline in population, the sightings show a skewed sex ratio in favour of females, again suggesting to poaching pressures on tuskers. Analysis of the records of herds sighted and photographed revealed very few males (*c.* 15%) in the 5–15 age group; and only juveniles with small tusks were recorded in family herds.

Habitat Loss and Degradation: Ramesh Kumar (1994) attributed that the major cause for habitat degradation in Hosur-Dharmapuri was human exploitation of tree species. Our studies on biotic pressures and analysis of past and present forest cover through GIS also revealed the continuing loss of tree cover. The connectivity of this tract to Bannerghatta NP and the reserve forest of Kanakapura Forest Division in the northwest is almost lost with the existing corridors (Chattiramdoddi and Kempthahalli corridors) being only about 1.5 km wide (AERCC 1998). And, as mentioned earlier,

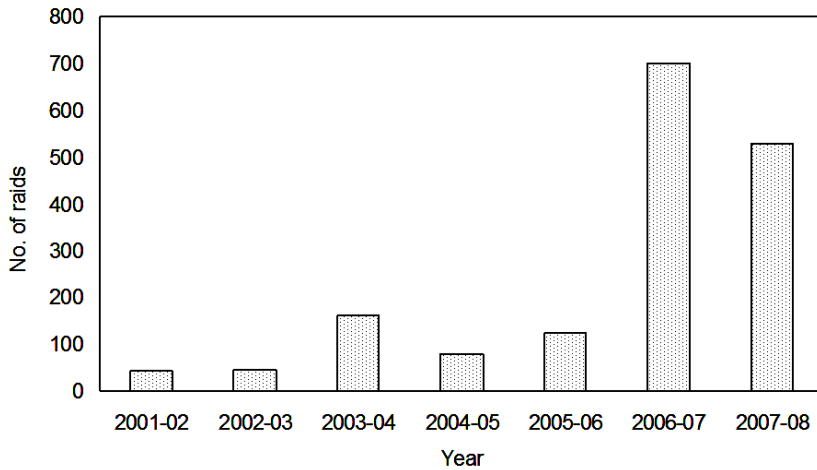


Fig. 8: Crop raiding in the Hosur-Dharmapuri area (2001–2008)

elephants have not been reported in the relatively open Hosur and Krishnagiri ranges for the past few decades. The pressures on the forest are from fringe and enclave villages, which depend on the forest for firewood and timber, minor forest produce, and grazing. Many of the tree (and shrub) species affected are the browse species of elephants. Illegal extraction of bamboo, a favourite food plant of elephants is also rampant. Ramesh Kumar (1994) had cautioned about the depletion of bamboo resources and its future adverse impact on elephants. Grazing pressure is severe leading to depletion of grass species, and the situation is further aggravated by the low rainfall in the region and the proliferation of the exotic shrub *Lantana camara*. Grass is an important component in the diet of elephants and could determine their movements in some areas (McKay 1973; Santiapillai *et al.* 2003; Sivaganesan and Johnsingh 1995; Sukumar 1989b, 1990; Sukumar and Ramesh 1995).

Proliferation of *Lantana camara*: The exotic weed *Lantana camara* occurs throughout the forest, and is

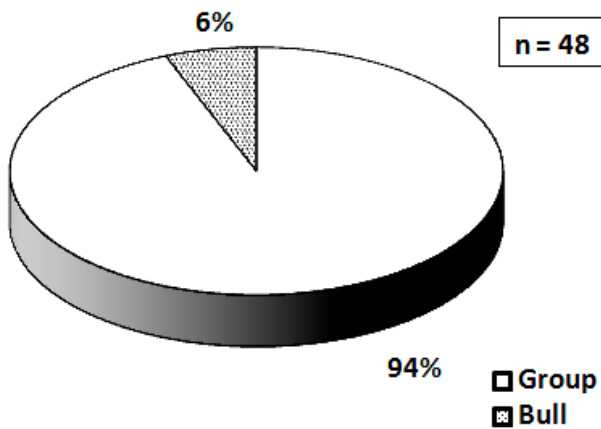


Fig. 9: Proportion of crop raiding by bulls and family herds in the Hosur-Dharmapuri area (Nov. 2006 to Jan. 2007).

especially more abundant in degraded forest and non-crystalline soil areas. Ramesh Kumar (1994) found the species to be widespread even during his study. The loss of native vegetation brought about by grazing and fuel-wood have facilitated its proliferation. Besides being of no food value to elephants, *Lantana* suppresses the growth of native species, including grass. Another negative impact of *Lantana* is that its wood is highly combustible and fires, especially those taking place after a gap of a few years, burn with greater intensity due to build-up of combustible material. Another invasive is *Prosopis chilensis*, but this species

generally occurs only where the soil is loamy and around cattle pen areas, clearings, and at the outskirts of villages.

Decline of Preferred Food Species: Other than decline of food resources due to woodcutting, elephants are destructive feeders pushing down trees, breaking branches and debarking, thus killing them and opening up the canopy (Craig 1995; Guy 1989; Laws 1970; Wing and Buss 1970). Feral elephants have caused an alarming decline of some plant species in Interview Island (Andamans) and forming gaps and creation of secondary forest in the closed evergreen forest (Sivaganesan and Kumar 1995). Preferred food species are the first to decline. Ramesh Kumar (1994) found the density of *Ziziphus xylopyrus*, a preferred food plant of elephants, to be highest in the Rayakotta Range but also found use of the species by elephants to be heavy in the range. Vegetation sampling carried out by us over ranges (Daniel *et al.* 2008) revealed that the density of *Z. xylopyrus* is now extremely low in the Rayakotta Range, most probably due to elephant use over the years. *Z. xylopyrus* is highly preferred by elephants and was reported to have a 15% annual mortality rate in Mudumalai Wildlife Sanctuary (Tamil Nadu) due to elephant use (Daniel *et al.* 1995; Sivaganesan and Sathyanarayana 1995) and a decline was also reported in Koundinya Wildlife Sanctuary (Manakadan *et al.* 2010). Sivaganesan and Sathyanarayana (1995) also recorded serious declines in other preferred tree species in Mudumalai. Another species that had been nearly wiped out in Mudumalai is *Boswellia serrata*, which is now confined to the inaccessible hills of the Moyar Gorge (Daniel *et al.* 1987).

Fire: We recorded fire incidences in five ranges during summer, including a major fire in the Jawalagiri Range. Fire is cited to be beneficial in tall grass situations that offer poor dry season grazing for herbivores, which also benefits elephants (Santiapillai *et al.* 1995; Sukumar 1990; Sukumar and Ramesh 1995). However, fire also results in the dominance of fire

resistant species (Guy 1989; Sukumar 1990; Sukumar and Ramesh 1995), which may not be palatable to elephants. The role of fire (especially in combination with elephant depredations) in converting woodland into open savannah is well-known (Craig 1995; Guy 1989; Laws 1970; Wing and Buss 1970). Considering the overall scarcity of grass and the other biotic pressures in HDRF, fire is expected to further stress the habitat impacting food availability for elephants.

Human Disturbances: Other than disturbance from woodcutters and graziers entering the forest on a daily basis, there is regular movement of people on the roads and paths leading to enclave and bordering villages. Another major disturbance is the 24-hour traffic on the Pennagaram-Hogenakal road to the Hogenakal waterfall, an important tourist spot. There are also a number of small temples in the forest which attract significant tourist traffic. Besides the disturbances, a lot of garbage gets generated by the tourists and pilgrims.

Crop Raiding: Even though the Hosur-Dharmapuri forest tract covers a large area (2,056 sq. km), it has a convoluted boundary with several projections and indentations, besides having numerous small and large village enclaves within its expanse. Such conditions increase the interface of forest with agriculture and human habitation areas, thereby resulting in a higher degree of crop raiding. Crop raiding is reported to have been not acute in the past but reached critical levels during the 1980s and early 1990s (Ramesh Kumar 1994). Comparison of the intensity of crop-raiding during this and the earlier study is not really possible due to the differences in the time frame and nature of the two studies. The data available with the Forest Department is also not totally reliable as except for human deaths (and to a lesser degree elephant deaths), reporting of claims, cases registered and compensation amounts given is dependent on many factors. However, our studies revealed that crop raiding is widespread all over the two divisions. Ramesh Kumar found the frequency of raids between solitary bulls and family herds to be about the same. Findings of most studies show that bulls raid crops more frequently (Balasubramanian *et al.* 1995; Datye and Bhagwat 1995; Daniel *et al.* 1995; Sukumar 1986b). Significant reduction of HEC on removal of bulls has been documented in Karnataka (Appaya 1992) and Koundinya Wildlife Sanctuary (Manakadan *et al.* 2009), suggesting that bulls were the primary crop raiders in those sites. However, family herds were found to be the main crop raiders in Hosur-Dharmapuri during this study. The reason for this, besides the decline in bull population, is probably habitat loss and degradation, making them more dependent on crop fields for food. This dependency compels family herds

to take the risk of raiding crops inspite of the presence of calves.

CONCLUSION

The Eastern Ghats support the last tracts of forests and wildlife of the eastern Indian Peninsula. Even these are facing serious threats due to the pressures of the growing human population (Krishna Raju and Reddi 1990; Price 1977; Pulliah 2002) affecting elephant populations (AERCC 1998; Daniel *et al.* 1995; 2006, 2008; Manakadan *et al.* 2010; Ramesh Kumar 1994; Srivastava 2002; Sukumar 1986a, b; Sukumar 1989a, b). Ramesh Kumar (1994) had found the situation of elephants and their habitat in Hosur-Dharmapuri to be threatened even in the late 1980s and early 1990s. Things have further worsened judging from the high mortality of elephants, increase in crop raiding by family herds, and the continuing severe pressures facing the habitat as reported in this study.

The forests and elephants of Hosur-Dharmapuri reserve forests face threats from heavy livestock grazing, competition for water resources, woodcutting, exploitation of bamboo, collection of minor forest produce, proliferation of the invasive *Lantana camara*, outbreaks of fire, increase in road network and traffic, among others, also resulting in severe levels of HEC. Besides local threats, Hosur-Dharmapuri face external threats due to its proximity to the towns of Bengaluru (=Bangalore), Hosur, Dharmapuri, and Krishnagiri. During surveys, we recorded around 70 (fuel-wood based) brick kilns in the area with a concentration in the Jawalagiri Range. These mainly cater to the construction boom happening in Bengaluru and elsewhere. The pressures will only increase in the coming years with growing human populations both in rural areas and nearby towns. The human population of the former undivided Dharmapuri district has risen by 16.7% since 1991 and has now a density of *c.* 297 individuals/sq. km. Krishnagiri and Hosur are two large towns in Krishnagiri district, while Dharmapuri is the main town in Dharmapuri district. Hosur, which was earlier a village, has developed into a busy industrial town and manufacturing base for major Indian companies with a population of about 84,000 people. The metropolis of Bengaluru, 40 km from Hosur, is expanding rapidly. The human population of Bengaluru is now around 6.5 million, having grown by 34.8% during the last ten years.

Considering all these, there is an urgent need to tackle the conservation issues facing the forest and its elephants, or there will be further exodus of elephants out of the area, as witnessed during the 1980s. The conservation initiative in Hosur-Dharmapuri has to be essentially linked to the rest of the contiguous tract of the southern Eastern Ghats ranges, as

the establishment of large and contiguous protected areas is crucial for the long-term survival of wildlife (see Johnsingh *et al.* 2010) and especially elephants which have a large home range. The adjoining forest divisions of this region face threats of their own and these forests are gradually getting degraded and fragmented due to various developmental activities and biotic pressures (AERCC 1998). Hence, it is vital that the forest integrity and habitat quality over this entire tract is ensured for the overall survival of elephants and that each site is not looked at in isolation.

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