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Review Article

Conservation perspective of Asian Elephants (*Elephas maximus*) in Tamil Nadu, Southern India

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Abstract

The Asian Elephant (*Elephas maximus*) in India is endangered due to degradation, loss and fragmentation of habitat and poaching for ivory. Rapid economic growth and increasing aspirations of the growing human population have had numerous adverse impacts, of which development projects such as dams, mines, railways and highways, industries and expansion of agriculture have taken a toll of elephant habitats leading to increase in human–elephant conflicts over most parts of their range. Further, ivory poaching especially in south India has resulted in a skewed sex ratio that in some population it is reduced to 1adult male for every 100 of adult female. The skewed ratio in favour of females is a clear indication that poaching has had a very adverse impact on the elephant population. The continued habitat loss, degradation and fragmentation may result in isolation of populations interfering with the genetic connectivity between populations. Establishing connectivity of the habitat, wherever required, will help migration of elephant populations from one habitat to another. A well drafted conservation plan should be in place to protect habitats and the species in its natural habitat.
Key words: *Elephas maximus*, habitat loss, fragmentation and ivory poaching.

Introduction

The Asian elephant (*Elephas maximus* Linnaeus) is globally categorized as Endangered (A1 cd) (IUCN,1996) and is placed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). In India it is listed under Schedule 1 of the Wildlife (Protection) Act,1972. Historically, the range of the Asian elephant extended from the Euphrates and Tigris rivers in West Asia to the Yangtze-Kiang River and perhaps beyond in China (Olivier,1978). The Asian elephant is an important flagship species for the conservation of biodiversity as well as a cultural symbol of the people of this region. The widely distributed Asian elephant population of the Indian subcontinent as well as both continental and insular Southeast Asia has been reduced markedly. Today the Asian elephant is believed to number about 45,000 in the wild and is distributed across several populations over South and Southeast Asia (Sukumar,2003). The population of elephants has been affected adversely by a growing human population and the resultant destruction of natural habitats for settlement and cultivation. Besides habitat loss, the large-scale capture of elephants in the past has also caused its decline. Thus, the Asian elephant has suffered due to enormous loss of its habitat and continued capture for taming over a 4000-year period in human history.

In India its range today covers only 3% of the geographical area of the country (Sukumar,2003) as opposed to virtually the entire landscape in the historical past. Southern India holds the largest regional populations of the Asian elephant, estimated at 13,000-15,000 elephants (Sukumar,2003). Although ivory poaching is widespread in Asian countries where substantial proportions of male elephants are tuskers, one region that has been particularly affected in recent times is southern India (Sukumar,1989). This region also has the largest regional concentrations of elephants in Asia (Sukumar and Santiapillai, 1996). Given the very high proportion of tusked male elephants here, the southern Indian region was also home to perhaps the largest numbers of tuskers until recent times when this situation changed (Ramakrishnan *et al*.,1998). Rampant poaching for ivory since about the 1970s has resulted in many populations in southern India suffering from extremely skewed sex ratios among adults (Ramakrishnan *et al*.,1998) that could have deleterious demographic consequences.

Further, the loss of elephant habitat through spread of agriculture, commercial activities such as plantations of tea and coffee,

and developmental activities such as hydroelectric and irrigation projects, roads, railway lines and mining, have resulted in an escalation of elephant–human conflict as elephants make forays into agricultural lands to feed on cultivated crops (Sukumar 1989). Manslaughter by elephants and injuries to or killing of elephants by irate farmers accompany these conflicts. It is estimated that an average of 50 people are killed in southern India alone by elephants every year, a significant proportion of these occurring within settlements and cultivation (Venkataraman *et al.*, 2002). In the country the figures are much higher, averaging about 200 cases of manslaughter annually (Bist,2002). These conflicts create negative 3sentiments against the setting up of Protected Areas and other conservation strategies for wildlife especially large charismatic species such as elephants and tigers.

The difference in the past and present distribution of the elephant in India is an indicator of the drastic deterioration of habitat, large scale captures historically and ivory poaching, all of which have led to the progressive decline and reduction of the elephant population in the country. Conservation action requires a strategic framework based on an objective assessment of the variations in elephant habitats and population attributes of elephants, and threats to their well being. Project Elephant instituted and funded by the Government of India since 1992, aims to conserve elephant populations, their habitats and overall biodiversity in eleven designated elephant reserves across the country (Anon,1993;Sukumar and Santiapillai,1996, Bist,2002), most of these reserves are spread across more than one State.

Southern India consists of four elephant reserves that contain a mosaic of vegetation types and ecosystems harbouring high diversity of flora and fauna. Elephant densities vary considerably across these reserves; Elephant reserve No.7 covering largest area of over 12000km^2, across Karnataka, Kerala and Tamilnadu and a minimum population of 6300 elephants. The largest single population of elephants in Asia today is found in this reserve (AERCC,1998). Reserve No.8 with an estimated population of 956 elephants is spread across the states of Tamilnadu and Kerala. Reserve No.9, popularly known as Anamalai, Nelliyampathy and Palani Hill reserve located in the Southern part of Western Ghats south of the Palghat Gap, extends over 5700km^2 with an estimated population of 2000 elephants (AERCC,1998). Reserve No.10, extends over 3364^2 and has an estimated population of 1500 (AERCC,1998) covering Tamil Nadu and Kerala.

Present population of Elephant in the State

In Tamil Nadu elephants are found along the Western Ghats and the Eastern Ghats. Elephants are distributed from the Nilgiri Hills south till Kanniyakumari in the Western Ghats. In the Eastern Ghats they are found from Erode to Krishnagiri districts. Major populations are found in the Western Ghats. During 2002 the elephant census revealed that there are about 3000 elephants across the State, but the recent census (2007) showed that the population has since increased to 3867 across the State. The single largest population of elephants in the State is in the Nilgiri district of Tamil Nadu.

Demography

Information on the population of a species in the wild is an important attribute for judging its future for conservation and management. Theory and empirical evidence suggest that demography is usually of immediate importance in determining the minimum viable size of a wild population. This is especially true for a species like elephants, which is larger in size and contributes to a high proportion of biomass, and also, often coming into conflict with people. The age-structure of elephant population could be measured by standard photographic and visual techniques adapted by Sukumar,1989 and Arivazhagan and Sukumar,2008.The structure of the population in the Nilgiri landscape and Anamalai landscape showed that the about 45% of the elephant population consists of adults while the remaining 55% were in the sub-adult, juvenile and calf category. According to Arivazhagan, (2005) 44% of the elephant population in Mudumalai Tiger Reserve (erstwhile Mudumalai Wildlife Sanctuary) was in the adult category, 24% in sub-adult category, 24% in juvenile category and 8% were calves. The sex ratio of elephants is skewed in favor of females in the State. The sex ratio of adult male to female was 1:25 in Mudumalai Tiger Reserve (Arivazhagan, 2005) and 1:10 in Anamalai Tiger Reserve of Tamilnadu (Baskaran *et al*.,2007). However, as the sample size is low in the Anamalai

population, the sex ratio arrived by authors may not be correct. The female-biased sex ratio observed in the two major populations indicates that selective poaching of males has impacted sex ratio of these population. Ramakrishnan *et al*.,(1998) described that rampant poaching for ivory since about the 1970s has resulted in many populations in southern India suffering from extremely skewed sex ratios among adults that could have deleterious demographic consequences. The skewed sex ratio will affect the birth rate in the population; that will lead to wider inter-calving interval of the population. Arivazhagan,(2005) states that skewed sex ratio observed in three study populations in southern India resulted in the low fecundity rate and wider inter-calving interval.

Conservation Issues

Conservation issues can be divided into two distinct categories; 1) Activities that affect elephants directly such as hunting/poaching and capture, 2) Developmental activities and human activities leading either to the loss of elephant habitat or its qualitative degradation.

1) Ivory poaching

Although ivory poaching is widespread in Asian countries where substantial proportions of male elephants are tuskers, one region that has been particularly affected in recent times is southern India (Sukumar,1989). This region also has the largest regional concentrations of elephants in Asia (Sukumar and Santiapillai,1996). Given the very high proportion of tusked male elephants here, the southern Indian region was also home to perhaps the largest numbers of tuskers until recent times when this situation changed (Ramakrishnan *et al*.,1998). An estimated 100 male elephants were killed in the country every year by ivory poachers between 1980 and 1986. This has seriously affected the male and female ratio in many areas. As we mentioned above, ivory poaching has led to an adult male to female ratio of 1:25 as was observed in the Mudumalai Tiger Reserve, Nilgiris (Arivazhagan,2005). It is a clear indication that poaching has had a very adverse impact on the population and at this stage, even the loss of one male is a very serious concern. While poaching has depleted the male population, the female population has been increasing over several decades. This is leading to local overabundance of elephants, especially in protected areas and can have adverse impacts on vegetation and therefore on habitat quality, and also increase in the conflict with surrounding human population. Baskaran *et al*. (1995) described that the elephants are having an adverse impact on their preferred food tree species, this problem is yet to be assessed and its implications understood.

2) Habitat Loss

The major conservation issue today remains the exploitation of the elephant habitat, leading to qualitative degradation and fragmentation of the habitat. This problem is related to the increase in India's human population, from 252 million in 1911 to 843.93 million in 1991 and over 1.0 billion in 2009. Biotic pressures from such a large population have led to the loss of much of the village and private forests. Irrespective of the suitability of the area for permanent agriculture, degradation of such lands into wastelands happens due to defective agricultural practices and absence of appropriate soil conservation measures. This has further increased the dependence of the local people and their cattle on the forests, and is ultimately accelerated throughout the elephant ranges in the country. In Tamilnadu 22877km^2 are under forest cover which constitutes 17.59% of the geographical area of the State. Out the total forest area in the State, elephants are distributed in approximately 7899km^2 area covering both Western and Eastern Ghats. The continued loss, degradation and fragmentation of the elephant habitat reduce the elephant's range and leads to human elephant conflicts. Further loss would be very adverse impacts on elephant populations.

Apart from habitat loss and degradation conversion of natural forests to commercial timber and monoculture plantations etc has affected the elephant habitat seriously. Constructions of dams, hydroelectric project, railways, roads, reservoirs and establishment of human settlements in flat areas and in the valleys have also fragmented the elephant habitat and disrupted habitual migration patterns by fragmenting the habitat.

Corridors

Over a few decades the vast elephant ranges have been fragmented and precariously connected by narrow corridors due to expansion of human habitations and agriculture, indiscriminate growth of various

development activities, severe biotic pressures, etc. "Forest corridors" can be defined as the 'narrow strips of forests connecting two habitats that facilitate major functions such as exchange of genes between populations, dispersal, provide access to variety of seasonal foraging grounds, and prevention of faunal collapse' (Saunders *et al*., 1991). Elephant corridors have received lot of attention in conservation and are widely used in devising conservation strategies, especially in recent years, with the reduction of contiguous habitats into islands.

Of late, a few studies have stressed the importance of corridors for elephants in the Nilgiri Biosphere Reserve (NBR). Davidar, (1972) first surveyed the status of elephant corridors in the Nilgiri District of Tamilnadu. Sukumar,(1985) described that elephant population from the Eastern Ghats use the Moyar Valley which has the connectivity to the northern part of the reserve. Ali,(1990) evaluated status of elephant corridors south of the Palghat gap in the Western Ghats. Desai (1991) reported the importance of preserving Sigur plateau in the Nilgiri hills which link the Mudumalai Tiger Reserve (erstwhile Mudumalai Wildlife Sanctuary). The use of Moyar Valley and Kallar Corridors by elephants from Mudumalai Tiger Reserve for migrating to the Eastern Ghats and movement between Mudumalai Tiger Reserve and Sigur reserve forests through crucial corridors such as Masinagudy, Singara Road and Masinagudy–Moyar were reported by Baskaran *et al*., (1995). Sivasubramanian and Sivaganesan,(1996) have studied the interaction of elephants with fauna and flora in the Sujalkuttai–Bannari Corridor of the Sathyamangalam Forest Division. Desai (1991) and Desai and Baskaran, (1996) have reported the importance of various corridors located in the protected areas, reserve forests and private estates in the NBR. Silori and Mishra (1995) and Ramakrishnan *et al.,* (1997) mainly focused on the impact of human interference on the integrity of elephant corridors in the Nilgiri North and Sathyamangalam Forest Divisions respectively. Sukumar and Sivaganesan, (2000) prepared a detailed map showing important elephant corridors in South India.

To address the issue and for long-term conservation of elephants, it is important to maintain viable populations within viable habitats and this could be maintained by linking the fragmented habitats by protecting and strengthening the existing corridors. Realizing this need, the Wildlife Trust of India (WTI), in collaboration with a team of elephant researchers, forest officials of various states, its regional partner Asian Nature Conservation Foundation (ANCF) and other NGOs has identified 88 elephant corridors in India and published a report entitled "Right of passage: Elephant Corridors of India" (Menon *et al*, 2005). Although the need of the corridors for the Asian elephants has been reported by many studies, the significance of the corridors to elephants in terms of ecological aspects as well as conflict issues had been studied in detail only recently by Ramakrishnan, (2008). Ramakrishnan and Ramkumar, (2008) have documented for the first time in our country all ground realities that would help to prepare specific securing plans for the corridors of Coimbatore, Sathyamangalam, Nilgiris and Anamalai elephant ranges on behalf of the Wildlife Trust of India. This report contains information on extent of use of corridors by elephants, degree of human-elephant conflict, traffic intensity if highways bisect the corridor, corridor dependent villages, artifacts, ownership names, survey numbers, guideline and market values of the private lands which are needed to be acquired especially to increase the width of the corridors.

Human-elephant conflicts

Large-scale conversion of forest areas due to increasing human pressure is the main reason behind the increasing trend of human-elephant conflicts in the plains of the Nilgiri Biosphere Reserve. During the recent past, conflicts between man and elephants had escalated throughout the range. It has been reported that there is an increase in the local density of elephants, which is due to strong anti-poaching activities by the Forest Department. Nevertheless their range has diminished radically due to increase of human induced activities such as indiscriminate development, conversion for agriculture, hydro-electric projects etc. When the interactions between elephants and human beings become very close, undoubtedly there would be a conflict between man and elephant. Elephants cause crop depredation, and the attacks on human beings leads to injuries, severe wounds and ultimately to death. Besides, the elephants also cause damage to human properties.

Sukumar and Gadgil,(1988) stated that elephants prefer feeding on crops because of greater nutritive content and palatability of crops. Another possible crop raiding strategy adopted by elephants is that, especially males, is related to social organization and the "high risk, high gain" that increases their fitness (Sukumar, 1991). The pattern of crop raiding by elephants and immediate reasons behind it might vary locally, but several of the above factors may play a significant role under particular circumstances. On the other hand not all the elephants in the population raid crops (Balasubramanian, *et al*.,1995).

Elephants use corridors as part of their ranging between habitats. The quality of elephant corridors is mostly affected by various anthropogenic pressures and development activities. These pressures on the corridors reduce the resource availability to elephants, which in turn leads to crop raiding and other human-elephant conflicts at the forest fringes. Conversion of elephant corridors into estates, buildings and crop cultivation sites results in crop damage and human causalities (Santiapillai, 1987; Sukumar, 1990; Easa and Sankar,1999). Every year more than 100 human beings and 40-50 elephants are killed during crop raiding in India (Johnsingh and Panwar,1992; Menon, Asian Elephant Conservation Center. Unpublished Report). Baskaran *et al*.,(2007) mentioned that in Southern Tamil Nadu namely Dindugal and Theni forest divisions recorded 10 human causalities during 2005 alone.

Plate -1: Elephants passing through tea plantation due to habitat fragmentation

Ramakrishnan and Durairasu, (2002 and 2004) found that Mangalapalayam and Colonyputhur villages recorded greater quantum of elephant-related damages in the Coimbatore forest division. The maximum gross loss in these two villages was, Rs. 281,000 and Rs. 191,600 respectively in a year. Elephants did not raid the agricultural fields of chilly, grapes, marigold, turmeric, cotton, gingili and onion. Paddy, lablab, sugarcane and coconut fields were raided more frequently by elephants in most of the corridor fringe areas. The crop fields of ragi and sorghum were the most frequently and destructively raided areas scoring nil value of the CEBI. Apart from natural death, more than 50% of elephants died due to electrocution and all such elephants were in the age category of 15-25 year old viable bulls. Nineteen men and four women were killed by elephants over a period of ten years in the study corridors between 1994 and 2004. Human beings were killed mostly during the pre and post dry season periods, most of them in the age of 40-50 years category.

Plate -2: Elephant death due to train accident near Coimbatore

Ramakrishnan, (2008) found that there are about 248 bore wells in the close proximity of 17 villages in three corridors of Coimbatore forest division, the distance of bore wells between corridor and crop fields was ranging from 50 to 1500 meters. Further, thirty six giant constructions, seven national and state highways and three railways lines were bisecting the corridor in Coimbatore forest division and this is cause for concern.

On the other hand Kumar *et al*., (2004) observed that in the Valparai Plateau of Anaimalais Tiger Reserve, elephants are mostly moving through tea estates during night hours and avoid the proximity of human settlements. Elephants raid mainly grain storage buildings especially Govt. ration shops and noon meal schools. So far, 157 conflict incidents were recorded over one year, during the incidents, one elephant death and one human casualty were observed. The monetary

loss of about Rs.758,116 (annual monetary loss about Rs.35/hectare) was incurred. According to the Forest Department secondary data from 1994 to 2003 revealed at least three human casualty in a year by elephants in the central part of the Valparai plateau in Anamalai Tiger Reserve.

Plate -3: A sub-adult male elephant electrocuted near Coimbatore Forest Division

Plate-4: A elephant herd crossing the Elephant Proof Trench (EPT) near Coimbatore

Biotic threats to corridor

Protected area such as Sanctuaries, National Parks and Tiger Reserve are subjected to various anthropogenic pressures. Ramakrishnan (2008) observed that fuel-wood collection, livestock grazing and people moving through corridors are the major activities recorded in the crucial elephant corridors in NBR. These activities led to the degradation of the corridors resulting in loss of connectivity between habitats and increased the various human-elephant conflict issues. Sukumar (1990) described that isolation of elephant population is largely due to degradation of its habitats caused by human activity and fragmentation.

Discussion

Degradation of habitat is the major threat to elephants in India and as a result elephant populations have been isolated in some places in Tamil Nadu. In addition, poaching has also contributed to the population decline especially in southern India (Sukumar, 1989, Ramakrishnan *et al*. 1998 and Arivazhagan and Sukumar 2005). Habitat fragmentation and habitat loss may affect the movement of elephants between habitat and populations, resulting in no genetic connectivity. Such populations are susceptible to genetic degradation and are highly vulnerable. For any species, in this condition, a critical size of population is crucial, below which it is more or less doomed to extinction within a certain period of time. Therefore conservation is to maintain the size of the population at a level that safeguards it against extinction over a time period. For conserving elephants first we should conserve and protect the habitat and to improve the viability and integrity of these habitats wherever necessary. Existing traditional corridors should be opened up for linking the parts of the habitats being used by elephants for their migration.

Since, elephant reserves are covering more than one State; interstate co-operation is a must to conserve wide-ranging species such as elephants. Within the State itself elephants are well protected in the Protected Areas such as Sanctuaries and National Parks - the same effort should be extended to outside Protected Areas (reserve forest) in a way that landscape level decision should be taken rather than individual Protected Areas to conserve the species. Implement welfare measures through eco-development and mitigation of man-elephant conflicts, to nurture and restore the traditional sympathy and tolerance of the people living in and around elephant areas who are increasingly falling victims to elephant depredation.

Another issue that concerns elephant survival is the ivory poaching. Take concrete measures to protect the elephants from ivory poaching and other threats to their survival. Elephants are being long-ranging animals they are protected well in Protected Areas such as Sanctuaries and National Parks. The same elephants ranging (moving) outside Protected Areas are vulnerable to poaching and sometime get into conflicts where the habitat is fragmented. Therefore decision should be made at landscape level rather than individual Protected Area.

Rangarajan *et al*., (2010) stated that only about 27 percent of the area of Elephant Reserves is legally protected under the PA network. Almost 30 percent of the Elephant

Reserves is outside the purview and control of the Ministry of Environment and Forests (Government of India) and the State Forest Departments. In such a scenario, unlike Project Tiger, the conservation of elephants requires better coordination and support of other ministries and a much higher financial support. State forest departments and NGO's must pay special attention to procure crucial corridors for free movement of elephants between habitats, making the elephant population viable in the State. Ramakrishnan, (2008) reported that the crucial corridors in Tamil Nadu should be procured immediately and the elephant movement and human activity monitored as well. Conservation of the species and habitat should go along with people's interest, therefore improve or increase the compensation amount for those who lose their crops and life due to elephants. Awareness about the ecological importance of conserving the flagship species have to be created among the public especially those who are living close to elephant habitats, and who get affected by elephants both directly and indirectly.

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