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Asian Elephant and Bannerghatta National Park in Eastern Ghats, Southern India

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Introduction

The Asian elephant (*Elephas maximus*) is the largest living land mammal and is presently endangered. There are only around 50,000 elephants in the wild and another 16,000 in captivity distributed across 13 Asian countries today (Sukumar 1989). India has approximately 50% of the total population of wild elephants (20,000 to 25,000) distributed across 18 states/union territories; with South India supporting around 10,000 elephants in the wild (Project Elephant 2008). The confluence of the Western and Eastern Ghats at the Nilgiris in Tamil Nadu state supports the largest Asian elephant population in southern India. These two ranges of mountains are unique in terms of the diversity of species and habitat. While the Western Ghats is one among the 25 biodiversity hotspots of the world, the Eastern Ghats represents the last largest remaining scrub forest for elephants among its range countries. This major elephant habitat of southern India has been declared as the 'Nilgiris and Eastern Ghats Elephant Reserve' by Project Elephant; a conservation initiative of the Government of India (Alva 1994).

The Nilgiris and Eastern Ghats Elephant Reserve is one of the largest Elephant Reserves in India with an area of 11,000 km². The Karnataka part of this reserve is called the 'Mysore Elephant Reserve' which includes the Bannerghatta National Park (BNP) (Fig. 1). The BNP although administratively one of the smallest National Parks (102.74 km²) in India, geographically is contiguous with the largest remaining scrub forests of the country. It is linked to the Hosur forest division of the Tamil Nadu state to the

Southeast and the Kanakapura forest division of the Karnataka state to the Southwest. These forest divisions further connect to the forest tracks of the Cauvery Wildlife Sanctuary eventually joining the Nilgiri Biosphere Reserve of Western Ghats forest at Nilgiris, stretching through Malimahadeshwara hills, Biligiri Ranga Temple Sanctuary, Kollegal Forest Division and Sathyamangala Forests (Singh 2008).

Profile of Bannerghatta National Park (BNP)

The park lies between 12° 34' and 12° 50' N latitudes and between 77° 31' and 77° 38' E longitudes (Rajeev 2002). The park area has been divided into three wildlife ranges, Viz. Bannerghatta, Harohalli and Anekal Wildlife Range for the convenience of administration. It is highly irregular in shape and measures a maximum of 26 km in length from North to South and varies between 0.3 and 5 km in width



Figure 1. Map showing the status of habitat contiguity and location of Bannerghatta National Park. Source: modified map of ANCF, IISc.

from East to West. The geology shows that the rocks are of the oldest formation revealing crypto crystalline to coarse granites and complex gneiss. The terrain is highly undulating with a mean altitude of 865 m and ranges between 700 and 1035 m above msl. The park receives an average annual rainfall of 937 mm ranging between 728 and 1352 mm spread across 8 months (April–November) with the maximum rainfall (50%) normally occurring between August and October. The park has no rivers originating or flowing through it but has several streams. There are more than 50 water holes in the park and many of them are natural and are constantly renovated to augment their water holding capacity along with a few manmade ones (Rajeev 2002).

The scrub and deciduous vegetation are the major vegetation types seen in the park. The scrub vegetation is seen mostly along the fringes whereas the dry deciduous type is seen in the upper regions and valleys, and watercourses. The low lying areas are covered with moist deciduous vegetation.

The park is a home to several species of mammals, amphibians, reptiles and birds apart from the endangered Asian elephant (*Elephas maximus*). The other prominent mammals seen in the park include Indian gaur (*Bos gaurus*), sambar deer (*Cervus unicolor*), spotted deer (*Axis axis*), leopard (*Panthera pardus*), wild dog (*Cuon alpinus*), wild boar (*Sus scrofa*), sloth bear (*Melurus ursinus*), pangolin (*Manis crassicaudata*), common mongoose (*Herpestes vitticollis*), slender loris (*Loris lardigradus*), and black naped hare (*Lepus nigricollis*). The park has a notable diversity of birds with more than 222 species identified and recorded (Singh 2008).

Status of the Asian elephant in BNP

The elephants are found to be distributed in the entire park. Within the habitat, the elephants seem to have preferences to some locations, which are called ‘micro hot spots’ (Fig. 2). These hot spots are characterized by thick vegetation cover, shade, soft surface and proximity to water sources with least or no human pressure. The usage of these hot spots by the elephants can be recognized by

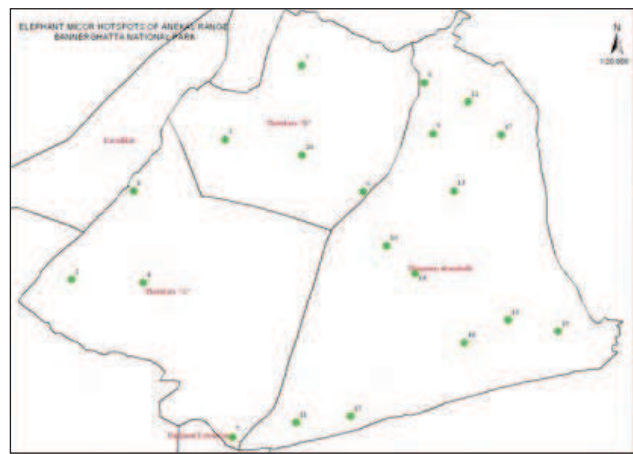


Figure 2. Location of elephant micro-hotspots in Anekal wildlife range of the park.

the pronounced occurrence of signs such as dung piles and feeding.

There is also seasonality of elephant presence in the park leading to fluctuation in their number. The fluctuations facilitate the presence of more elephants in Bannerghatta and Anekal ranges of the park. To move between these two ranges, they have to traverse through Harohalli range. The Karadikkal-Madeswara elephant corridor located in Harohalli range is acting as a link between the two. The corridor measures about 1 km in length and 0.3–0.4 km in width connecting northern and southern portion of the park (Varma *et al.* 2005).

The South India synchronized elephant census conducted during 2002, 2005 and 2007 by the Project Elephant, Government of India has estimated a mean density of 0.68, 0.71 and 1.41 elephants/km² (Table 1) respectively for the park (AERCC 2002, 2006; Bhaskaran *et al.* 2007).

The mean density results suggest an increasing trend in the elephant population. While the recent census estimates a population of 148 elephants for the park, the forest staff involved in the elephant

Table 1. Estimated elephant numbers in Bannerghatta National Park (source: AERCC 2002, 2006; Bhaskaran *et al.* 2007).

Year	Elephants per km ²	Mean number of elephants	95% CI	
			lower	upper
2002	0.68	71	21	121
2005	0.71	74	52	160
2007	1.41	148	105	191



Figure 3. A herd with calves in the park.

driving operations and farmers living adjacent to the park boundary opine that the number to be more than 200, with the migratory elephants moving in, during the cropping season.

Our personal observations indicate the presence of a high number of calves in the park coinciding with the arrival of the migratory elephants (Fig. 3). However, except for the regular census numbers and a base line study no reliable figures are available for the elephants in this landscape.

Human habitation, habitat disturbance and elephant conservation issues

There are about 117 human settlements located within 5 km from the boundary surrounding the park and 5 human settlements existing within the Park. The communities living in these settlements are Gowda, Reddy, Lingayath and Scheduled tribes such as Aadi Karnataka, Hakkipikki', Iruliga, Lambani etc. (Singh 2008). Majority of the community appear to be not literate and form the economically lower strata of the society. The local communities mostly depend on agricultural farming for their livelihood. Cattle keeping is the other common occupation observed among the community.

Majority of the community in the southern parts of the park does farming in only one season depending on the monsoon and during the other two seasons they work as daily wage labours in road works, quarry sites and small scale industries in the nearby towns to make a living. Some work as regular agricultural labours in the lands owned by the Gowda and Reddy communities who are

the big farmers in the region, farming all through the year supported by modern (Fig. 4) irrigation facilities. The communities in the northern part of the park show a gradual shift from agriculture to business activities such as real estate, stone quarry, hotel and restaurants, industrial employment etc., owing to the rapid urbanization in that area.

The disturbance in the park appears to be prominent and more crucial. The forest department records reveal that encroachment of forest land in the park is one of the major disturbances to the elephant's in the park with as many as 300 cases being registered as on 2008. The local people are also observed to be involved in the illegal mining of sand deposits along the watercourses inside the park. The Sandalwood tree cutting by poachers (about 35 cases were registered as on April 2008 in the forest department offence register) and incidences of illicit fuel wood collection and timber smuggling are common in the park (Singh 2008), resulting in the formation of more open patches and degradation of the forest whilst reducing the effective area available for elephants use. The hacking of bamboo by the locals for basket making and other bona fide reasons are observed in the park which may further reduce the amount of forage available for the elephants as bamboo is one of the important food species of elephants. The prevailing granite rock formations in the park and its proximity to the Bangalore city have resulted in the rampant stone quarrying in the landscape leading to further disturbance to elephants in the region.

In addition, the park has a network of about 144 km forest roads covering most of the interior areas



Figure 4. Traditional water harvest structure.

for regular inspection and night patrolling. Some of these roads are asphalted and/ or metalled to connect bordering villages, far off towns and cities, with periodical maintenance, resulting in habitat fragmentation and disturbance by the unregulated vehicular movement. That apart, the increasing demand for the land by city dwellers developing townships is also putting heavy pressure on the land surrounding northern, north-east and north-west parts of the national park. This is transforming the landscape into a concrete jungle with increased developmental activities at a faster rate than seen never before.

A few settlements located close to the park are known to brew illicit country liquor, which may also be an attraction for the elephants to trespass into human settlements. In northwest corner of the park, there is a distillery with 1000 acres of eucalyptus and scrub jungle along with a large water tank. These brewing units with large private forest may be attracting and providing habitat to elephants during day time and offer the crop fields to raid in the night (AERCC 1998).

These ever increasing human activities around park, shrinking habitat due to encroachments, fragmentation by roads and degradation of habitat due to biotic pressures such as fire wood collection (Fig. 5), cattle grazing and poaching of trees perhaps are contributing to reduction in the area available for elephants to use in the park leading to elephant incursions into the surrounding human habitations culminating in the human elephant conflict.



Figure 5. Fire wood collection by the local community in the park.

Table 2. Summary of crop damages and compensation paid by the Forest Department from 1997 to 2008. Source: BNP Management Plan (2002-2004 & 2008-09 to 2012-13).

Year	# crop damages	Compensation [USD*]
1998-1999	428	9446
1999-2000	1085	29,228
2000-2001	1165	34,647
2001-2002	1247	25,850
2005-2006	1477	42,983
2006-2007	825	24,761
2007-2008	500	13,055

*1 USD = 43 Indian Rupees

Status of human-elephant conflict in the park

According to the local communities HEC did not exist until the declaration of this forest as a National Park in the year 1971. According to them, elephants used to stray into the human habitations very rarely, which they eagerly used to wait for observing. But over a span of 4 decades the opinion of the elephant being a gentle giant has changed to that of a destructive animal due to the severity of the conflict through increase in crop depredations and human deaths/injury. The local community also feels that the conflict situation in the park is increasing and serious.

Crop depredations: The crop damages (Fig. 6) were recorded by the forest department at the Office of the Deputy Conservator of Forests and these damages were compensated to certain extent through the compensation scheme of the forest department. On an average 900 (SE=151.93, ranges from 470-1477) compensation claims are registered per year. The year 2005-2006 recorded the maximum number (1477) of crop depredations resulting in an economic loss of INR 18,48,250 (US\$ 42,982) to the farmers (Table 2).

Human deaths/injury: The data on human deaths and injuries recorded for a period of 8 years between 1997 and 2008 revealed that on an average 2 people are killed and another 2 people are injured each year by the wild elephants (Table 3). Most of the human deaths have occurred in the crop fields while guarding during night, and on roads during commute.

Table 3. Summary of human deaths and injuries reported from 1997 - 2008 (BNP Management Plan 2002-04 & 2008-09 to 2012-13).

Year	#		Compensation [USD*]
	deaths	injured	
1998-1999	3	1	3140
1999-2000	3	1	4884
2000-2001	2	2	3372
2001-2002	2	1	2047
2005-2006	3	6	8384
2006-2007	1	4	3665
2007-2008	2	1	7442

*1 USD = 43 Indian Rupees

Elephant death/ injury: On an average two elephants are killed in this park due to human elephant conflict every year. The major cause of death was found to be electrocution (Fig. 11) caused by illegal power lines drawn by farmers intentionally around their crop fields and elephants coming in contact with low lying high tension electricity distribution lines maintained by the State Electricity Board. The data on elephant deaths in the park during the last 11 years is given in Table 4.

Influence of human elephant conflict on conservation of elephant in the park

The relatively small size of this park, already fragmented and degraded, coupled with a high density elephant population is jeopardizing the local community through the ever increasing human elephant conflict. The season of arrival of the migratory elephants also coincides with



Figure 6. Crop damage by elephants in the park.

the peak cropping season in the landscape thus making the crops highly vulnerable to raids. All these factors may have been and continue to result in the increasing number of encounters between the man and elephants, leading to not only loss of crops and human lives but also elephants in retaliation. The recent past three incidents of elephant killing using fire arms which was never a trend in the park clearly indicates that the people are increasingly losing their patience and becoming aggressive to elephants. In most of these cases, it is the free roaming potential breeding bull elephants, which become the victim. This if unchecked, may lead to the skewed sex ratios and genetic issues threatening the very survival of elephants in this landscape.

Conclusion

The survival of Asian elephants in this region is very much dependent on the protection and preservation of the habitat namely the Bannerghatta National Park and also mitigation

Table 4. Summary of elephant deaths and injuries reported between 1997 and 2008. Source: BNP Management Plan (2002-2004 & 2008-09 to 2012-13).

Sl. #	Year	# deaths	Reason of elephant death			
			poaching	electrocution	natural	other
1	1997-1998	1		1		
2	1998-1999	2		1		1 (intoxication)
3	1999-2000	4	1	2		1 (fall from steep slope)
4	2000-2001	3		3		
5	2001-2002	1			1	
6	2002-2003					
7	2003-2004	3		2		1 (tympny)
8	2004-2005	3		1	1	1 (impaction)
9	2005-2006	4		1	1	2 (gunshot + accident)
10	2006-2007	1				1 (premature birth)
11	2007-2008	1				1 (liver failure)



Figure 7. Elephant death due to electrocution in retaliation to crop raids..

of human-elephant conflict. This requires an in-depth understanding of the elephant population, its habitat usage pattern, status of habitat in terms of types, fragmentation etc. Information on land use around the park particularly on cropping patterns will be crucial. The status of crop raiding, economic losses to farmers due to depredations and destruction of property and loss of human life needs to be clearly understood. Information on elephant mortality will also be crucial to the understanding of the overall conflict status in this region. Data on elephant barriers and their efficacies will throw light on reasons for elephant incursions to human settlements. Studying community perspective on elephants and conflict will be imperative to any community based initiatives to mitigate human elephant conflict in this area.

Information thus collected through proper research methods will eventually enable the formulation of management strategies for mitigation of human-elephant conflict, which is the main conservation threat to the survival of Asian elephants in Bannerghatta National Park.

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