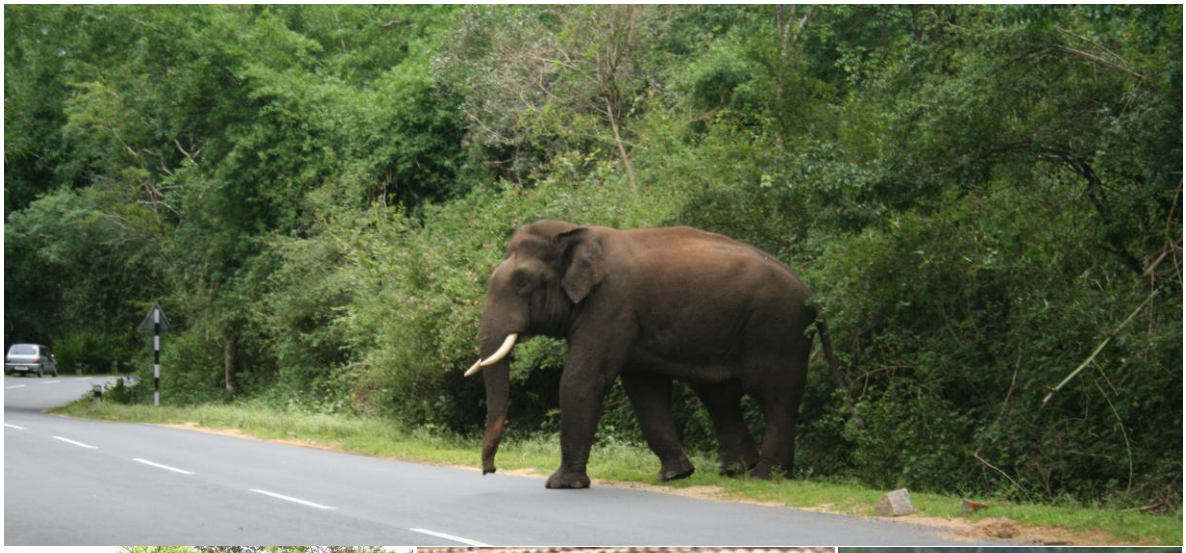
Conservation Plan for Securing Selected Elephant Corridors in Southern Western Ghats

Final report

Project Period: December 2009 to July 2011



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Contents

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Introduction

The elephant conservation in India has been threatened by the shrinkage, degradation, fragmentation and resource exploitation by human activities thereby altering the extent and spatial configuration of their habitat and in few cases restricting them into small pocketed herds in *habitat islands*. This has constricted the elephant herds into protected areas and few intact forests surrounded by human-dominated landscape leading to increased human-elephant conflict. About 400-450 people lose their lives every year due to elephants and crops worth millions of rupees are damaged apart from property. At many places, this has resulted in the retaliatory killings of elephants.

The elephant habitat of Mysore- Nilgiri Biosphere landscape marking the confluence of the Western and Eastern Ghats at the Nilgiris supports one of the largest populations of elephants in the country and is also home to a diverse range of fauna and flora, many of which are endemic to this region. While the Western Ghats is one of the 34 biodiversity hotspots of the world, the Eastern Ghats represents the largest remaining scrub forest for elephants among its range countries. They also form part of the Brahmagiri-Nilgiri-Eastern Ghats landscape identified by Elephant Task Force (Anon, 2010) and includes six elephant reserve covering an area of 15320 Km^2. However, the landscape is also dominated by large human population which has resulted in degradation and fragmentation of the habitat and increased incidences of human-wildlife conflict which needs to be urgently addressed. Most of the conservation efforts in our country is largely confined to the Protected Areas (PAs) but it is equally important to protect the larger landscape as areas beyond the PAs supports equally high biodiversity and sizeable elephant population. These important wildlife habitats have however been fragmented at many places and it is very important that the critical wildlife areas are linked to accord greater protection, habitat availability and genetic viability to the species or this could result in pocketing them into smaller habitats and increased Human Elephant Conflict (HEC).

Thus for the long-term conservation of elephants, it is important to maintain viable populations within viable habitats and this could be maintained by linking the fragmented ones 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).

Taking this forward, the current project identifies and documents the current status of seven elephant corridors (Chamraj nagar – Talamalai at Punjur, Chamraj nagar – Talamalai at Muduhalli, Tali, Karadikkal – Madeswara, Nilambur Kovilagam – New amarambalam, Kottiyur – Peria and Peria at Pakranthalam) in the Mysore-Nilgiri biosphere reserve landscape to monitor usage by elephants and other wild animals, assess the level of dependence of local community on the corridor forest to prepare a conservation plan for securing and management of the corridors in this region.

OBJECTIVES

The project aims to work in few selected elephant corridors of Mysore-Nilgiri biosphere reserve landscape to understand its current status and functionality and prepare plans for securement and management of the corridors.

Specific objectives

- Assessing the current land status of the corridor
- Monitor usage by elephants and other wild animals
- Mapping and demarcation of the corridor
- Assess the level of dependence of local community on the corridor forest
- Awareness and information to local people, developmental agencies and vehicle drivers passing through the corridors through signages
- Prepare securing plan for individual corridors

The corridor taken up for groundtruthing includes:

1. Chamrajnagar- Satyamangalam - This area has two corridors
   a) **Chamrajnagar-Talamalai at Punjur** --The corridor connects the Punjur Range of Chamrajnagar WL division and Hasanur Range of Satyamanagalam Division

   b) **Chamrajnagar-Talamalai at Muddahalli**–The corridor also connects the Chamrajnagar WL divison with Satyamanagalam Forest division and lies between Talavadi and Muddahalli village.
2. **Tali -** The corridor connect Bannerghatta NP and northern part of Hosur division with southern part of Hosur division.

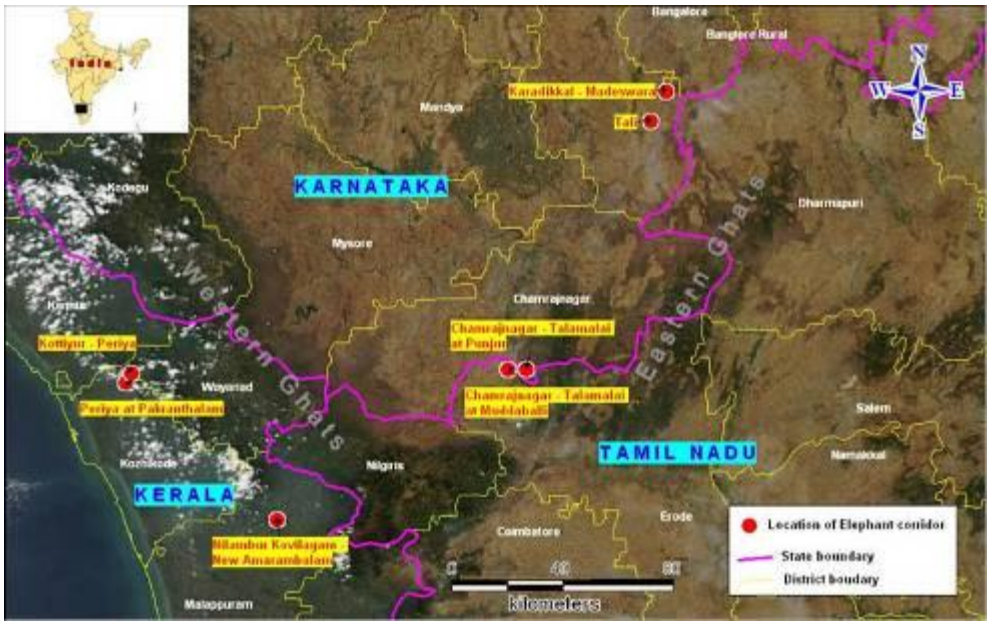
3. **Karadikkal-Madeswara -** the corridor is between northern and southern portion of Bannerghatta NP; the corridor is located between Bilaganaguppa and Jayapuradoddi settlemenst connecting Karadikkal and Madeswara state forests.

4. **Periyar at Pakranthalam**- The corridor connects Northern and southern portion of Periya RF in Wayanad north Division along the Mananthavadi- Kuttiadi road at Pakranthalam.

5. **Nilambur Kovilakam-New Amarambalam in Nilambur Forest Division** – The corridor connects Nilambur and Manjeri Kovilakams (Nilambur north division) with New Amarambalam RF (Nilambur south Division).

4. **Kottiyur – Periya** –The corridor connects Kottiyur RF of Kannur forest division with Periya RF of North Wayanad Division

Fig 1 Map of the Mysore-Nilgiri landscape showing the corridors being groundtruthed



METHODOLOGY

Both primary and secondary data were collected during groundtruthing of the corridors. Primary data were collected for extent of corridor usage by elephants, vegetation quality, biotic threats, traffic intensities on the roads that are bisecting the corridors, corridor connectivity between habitats, corridor dependent villages, the socio economic status of the people and peoples' perception for securing the corridor land. Secondary data were collected for the variables such as elephant census and human elephant conflict cases from the forest department to estimate the elephant population in and around the studied corridors as well as conflict status for the past few years. Other details such as landholder's name, extent of area, legal status of the land were collected from the Village Administration Officer (VAO) of the respective corridor areas.

Usage of corridors by elephants

Belt transect method was used to assess the dung/pellet/dropping/scat density of elephants and other wild animals in all the seven corridors. The length and width of the belt transects varied from 1000 x 5 m to 2000 x 10m based on terrain, visibility and availability of contiguous forest in the seven selected corridors. Variables such as number and status of dung/scat/pellet/dropping groups were recorded. To strengthen the details on corridor usage by elephants, census reports or data were obtained from the forest ranges, which are very close to the present studied corridors. Using the Computer Software Distance 6.0 version the elephant population is estimated.

$$\text{Elephant dung density (Y)} = \frac{\text{Total number of dung piles (N)}}{\text{Total no. of transects x Length (L) x Width (W)}}$$

$$Y = \frac{N}{L \times 2W}$$

Both block and water hole count data were collected from forest department and analysed to understand the demographic profile of the elephants.

Assessment of habitat quality

Habitat quality assessment of the corridors was carried out to determine tree species composition, availability of elephant food plant species, regeneration and recruitment classes of trees and ground cover variables. Plots of 20m x 10m, at an interval of 200m were laid along the transects of one kilometer (Dinerstein, 1979; Sivaganesan, 1991; Ramakrishnan, 2008). The length of transects varied between 1 to 2 km based on size of the corridor. Variables such as tree species, height and girth at the breast height (GBH) were recorded for each individual tree (GBH> 20cm). Within the plot, one sub-plot of 5m x 2m was laid to record ground cover such as grass, herb, shrub and climbers.

Availability of ecological resources

Encounter survey was undertaken in the forest trails and footpaths of the corridor area to record the availability of ecological resources to elephants such as fruit bearing trees, shade trees and natural saltlicks. The information on the availability of seasonal and perennial water sources was collected using questionnaire survey from the local forest field staff and tribes.

Threats to the corridor

The present and potential threats to the corridor were identified by direct observation and discussion with local villagers and officials of the forest department

Vehicular traffic intensity

The highways bisecting the corridors were monitored for two days; first day between 06.00 and 18.00 hrs and second day between 18.00 and 06.00 hrs in a month for a period of three months to quantify the vehicle traffic intensity round the clock. Vehicles were divided in to four categories based on their size i.e. heavy vehicle, six wheelers, four wheelers and two wheelers. The data collected was used to understand the vehicle intensity peak hour in a day.

Socio-economic assessment

The questionnaire was designed to collect had two sets of information - firstly data on human activities within the corridors were collected using structured questionnaire survey method. Purpose of visit by the people to the corridors was recorded from the stake holders. These data sources were used to measure the level of disturbances to the corridors (Johnsingh, *et al.*, 1990; Badola and Mishra, 1995; Silori and Mishra, 1995; Sunderraj *et al.*, 1995). Secondary informations were collected through Open ended questionaires giving the respondent an opportunity to express their views without any inhibition (Balakrishnan and Ndhlovu, 1992; Ramakrishnan, 1997). This method was used to collect data on major human activities in the corridor. The interview was restricted to people living within the corridors.

Mapping

The corridor lands were identified and mapped by GPS survey in the ground. The 3D and thematic maps were prepared by ArcGIS 10 software using Landsat Mosaic-EarthSat 2003 from USGA/NASA website and ASTER L1B data were obtained through the online Data Pool at the NASA Land Processes Distributed Active Archive Center (LP DAAC), USGS/Earth Resources Observation and Science (EROS) Center, Sioux Falls, South Dakota (http://lpdaac.usgs.gov/get_data).

Identifying critical area for securing

The lands located very close or blocking the corridors were identified by foot survey. The variables such as presence of dung piles, feeding sign, traditionally used footpaths and crop depredation intensities by elephants were collected and marked using Global Positioning System (GPS) to identify the lands if necessary to secure. This GPS coordinates were superimposed on the Survey of India topo sheet to know the present area availability and extent of area to be secured whereever necessary for the free movement of elephants between larger habitats The guideline and market value of the lands were collected from the registrar office and local people to estimate approximate cost requirement for securing.

1. Chamrajnagar – Talamalai at Punjur corridor

Alternate Name : Punjur – Kolipalya Corridor

The corridor connects the Chamrajnagar and Sathyamangalam Forest Division at Punjur. In 1990, tribals from the BRT were rehabilitated in this corridor and the forest area was cleared for cultivation. This has obstructed the movement of elephants along this tract. To the east of the Punjur valley, there is insignificant movement along the steep hill slopes, while to the west of Kolipalya there are human settlements and cultivation. This corridor starts from Honnemara Gate in the east, Banavadi village on west running between Bejilpalya and Muneeswara Colony and ending at Hosabodu tribal settlement crossing the National Highway (Sathyamangalam-Chamrajnagara, NH-209) at sanctuary game road near stone crusher.

a. Location: This corridor lies between 11^0 05' – 11^0 07' N and 76^0 46' – 76^0 48' E in the eastern part of the Chamrajnagar District and is bounded in the north by K Gudi range of the Chamrajnagar WLS, in the south by Talamalai RF, east by Hasanur range and west by Talamalai RF (Fig. 1). This corridor begins at the border of K Gudi range in the north linking Thalavadi Range in Chickally section in the south through Punjur range between Bejilpalya and Kumbeswaran Gudi villages and goes up to Hosabodu village. The terrain is gently undulating. Honnahole river is the perennial water source to elephants in this region. Seasonal water sources such as Kal kere, Thangalati kere, Kaaramala kere are also available near to this corridor. Apart from perennial and seasonal water sources, the Karnataka Forest Department (KFD) has constructed artificial water tanks at Honnemarada kere, Hulisutta kere and Devera kere for elephants and other wild animals. Vegetation ranges from Sub tropical thorn forest to mixed deciduous (Champion and Seth, 1968) and Eucalyptus plantations available in the corridor. Rich Bamboo patches are also available to elephants for browse and cover. The tree cover is dominated by *Randia dumetorm, Erthroxylan monogumum and Chloroxylon swietenia*.

b. Connectivity: K Gudi Range of Chamrajnagar Wildlife Division and Thalavadi Range of Sathyamangalam Reserve Forest Division through Punjur range (Chamrajnagar WLS).

c. Average length and width: The length of the corridor 3600 – 4050 meters and the effective width ranges from 40 meters to 100 meters.

Fig 1. *3D map showing Satellite Imagery of Chamrajnagar-Talamalai at Punjur corridor at landscape level*

1. Extent of elephant usage

Table 1. Elephant population in and around the corridor area

Year	AF	SAF	JF	AM	SAM	JM	C	MAKHNA	UI	TOTAL
2003-2004	23			1			6	3	12	45
2005-2006	25			6			6			37
2007-2008	30	8	5	8			13			64
2009-2010	25	8	5	7	3	4	13		1	66

(Source: Synchronized elephant census report for the year 2005, 2007 & 2010; Annual Wildlife census report for the year 2003, Dung density was calculated for this present study)

Adult Male and Female	1: 5.3
Adult Female and Calf	1:3.0
Elephant density per Km^2	0.92

BRT Elephant population	550-600
Sathyamangalam population	850-900

Census result revealed that an average of 50–75 elephants extensively use this corridor as part of their annual seasonal home range (Table 1). The questionnaire also reveals that both loaners and female led family herds are frequently sighted by the local people especially during October and November in and around the corridor areas (Fig. 2). Kumara and Rathnakumar (2010) estimated that 1.7 elephants per Km^2 for entire BRT WLS. This study was carried out between October 2009 and April 2010, which conincides with the seasonal influx of elephants into BRT WLS.

Fig 2 Elephants in the corridor forest (left) and a tusker crossing the NH 209 in the corridor (right)

2. Assessment of habitat quality

Table. 2. Vegetation status in the Punjur corridor (Sampled Area 0.3 Ha.)

S.No	Local name	Scientific Name	Tree Frequency	Average GBH (cm)	Average Height (m)	Lopping	WC	RC	RG	Elephant Food species
1	Alamaram	*Ficus bengalensis*	1	198	8	1				√
2	Angirkai								4	
3	Beluga	*Dalbergia lanceolaria*	5	33.2	4.24					
4	Chenagi	*Lagerstoremia parviflora*	3	24	3		1			
5	Jagadai		3			1	2			
6	Jagalgantti	*Diospyros montana*	4				4	2		
7	Kaarai	*Randia dumetorum*	11			2	9	6		√
8	Karungali	*Acacia chundra*	4	22	2.45			2		√

9	Konnai	*Cassia fistula*							2	
10	Korivi	*Ixora Pavetta*	9	20.25	2.8	1		2		
11	Kuruva									
12	Lantana	*Lantana camara*						38	49	
13	Moongil	*Bambusa aurundinacea*						7		√
14	Navel	*Syzygium cumini*	2			1	1			√
15	Neviladi	*Vitex altissima*	5	32.61	4.2			2		√
16	Papata	*Paverta indica*						14	20	
17	Paalai	*Wrightia tinctoria*	1	42	6.5					√
18	Pongum	*Pongamia pinnata*	1					1		
19	Purusu	*Chloroxylon swietenia*	22	28.2	4.14	3	4	4	3	
20	Sellai	*Ficus virens*	7	15.2	1.78				1	√
21	Sembulichan	*Erythroxylum monogynum*	26	20.15	3.20	1	5	4	3	
22	Siru kadalai	*Grewia hirsuta*						4	14	√
23	Somi	*Soymida febrifuga*	5	11.4	1.4					√
24	Teak	*Tectona grandis*						4	6	√
25	Thailamaram	*Eucalyptus Spp.*							2	√
26	Thandrasi	*Maytenus emarginatus*	5	9.4	1.52				2	√
27	Udupai	*Eriolaena chookeriana*	3				3	2		√
27	Ulpa		11	34.5	5.35		3		1	√
29	Vela	*Acacia leucophloea*	1	35	4.5				1	√

2.a. Trees, regeneration and recruitment status

A total of 29 plant species were recorded in the 0.3 ha. sampled area. Of these 16 species were considered to be elephant food plants. It was quite interesting to note that the *Eucalyptus Spp*. were extensively debarked by elephants in this corridor (Fig 3).

Fig 3 Eucalyptus tree demarked by elephant

2.b. Ground cover status

Table 3. Ground cover availability in the punjur corridor (Sampled Area 0.015 Ha.)

Ground cover variables	**Percent availability**
Shrub	22
Herb	16
Climbers	1.3
Grass	60.7

The ground cover result revealed that the grass cover was more than shrub cover followed by herbs and climbers (Table 3). Although, considerable number of cattle population graze every day in and around corridor area, still the grass cover was not much affected because all of them were short grasses and spread on the ground. But the livestock grazing pressure was evidenced from the less proportionate of herbs (16%) and climbers (1.3%) of the over all ground cover. Apart from biotic threat, the livestock are also the transmitter for many contagious diseases.

2. c. Availability of ecological resources to the elephants in the corridor

Table 4. Availability of ecological resources in the Chamrajnagar-Talamalai at Punjur corridor (Sampled Area = 0.3 ha)

S.No	Name of the ecological resources	Total numbers
1	Water source (Seasonal)	3
2	Water source (Perennial)	1
3	Fruit bearing trees	6
4	Shade trees	6
5	Natural salt licks	3
6	Elephant food species	16
7	Non-elephant food species	13

The corridor attributes more than 50% of elephant food species in the overall vegetation cover (Table 4). The availability of other ecological resources also plays a major role for the elephants to use this corridor effectively. Especially bamboo patches and natural saltlicks are available in plenty in this corridor (Fig. 4).

Fig. 4 Natural saltlick (left) and perennial water source (right) in the corridor area

3. Threats to the corridor

3. a. Developmental activities in the corridor fringe area

Table 5. New constructions emerged in the recent past in adjoining areas of the corridor

Name	Activities in progress	Forest Range
Road side Dhaba about 300 meters from Punjur Forest Check post	A night restaurant is operational adjoining the corridor area near Punjur Forest Check post. Generally elephants cross the high way during night hours. The vehicle as well as people disturbance at the restaurant might affect the movement of elephants. On the other hand, thrown out food wastes with plastic containers might on one hand attracts animals and also leads to constipation which would further result to impaction and death of animals.	Punjur
Emerging resort near the Road side Dhaba (Fig. 6)	Near to the Dhaba (road side resturant) a resort is under construction. Presently this resort is not active, but in near future this might start for tourism purpose. Since the location is very near to the corridor, this would create severe problem for the elephant movement.	Punjur

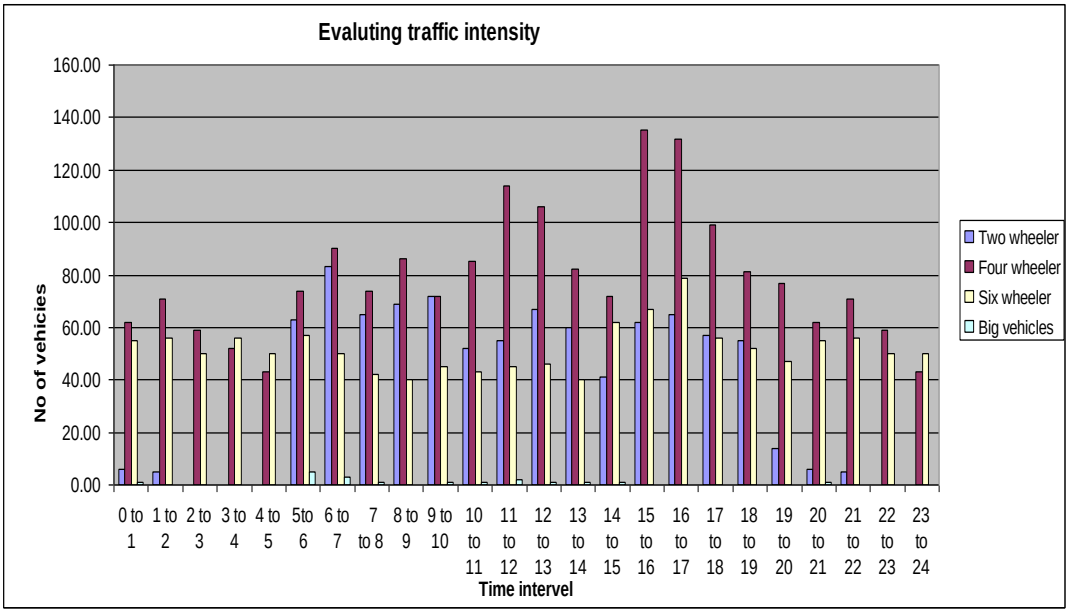
Fig 5: Roadside resort in the corridor

3.b. Corridor dependent villages/forest settlements

1. Hossabodu
2. Srinivasa Puram
3. Muneeswara Colony
4. Punjur
5. Banavadi
6. Edthe Gouda Doddi
7. Bejipalya

3. c. Traffic intensity

Fig. 6. Traffic intensity round the clock in Chamrajnagar-Talamalai at Punjur corridor



The traffic intensity was recorded round the clock for three full days on the highway between Sathyamangalam and Chamrajnagar (NH 209), which bisects the Chamrajnagar-Talamalai at Punjur corridor. Fortunately the movement of heavy vehicles seemed to be very low. On the other hand six wheelers and four wheelers were more shuttling between Chamrajnagar and Sathyamangalam through out the day. An average of 85 vehicles per hour was observed during the study period. The movement of vehicles was observed round the clock; four wheelers were observed very high between 1500 and 1600 hrs (Fig. 6). These vehicles were mostly pickup trucks carrying vegetables from the agriculture lands to Chamrajnagar, Sathyamangalam and Mettupalayam vegetable markets. Elephants mostly cross the highway during evening hours to access water holes and move between habitats.

4. Human elephant conflict

Table 6. HEC status in and around the Chamrajnagar-Talamalai at Punjur corridor recorded during 2003– 2009

Year	Elephant death	Human death	Crop relief fund paid so far by the forest department (Rs.)
2003	1		
2004	1	1	
2005	1		
2006	1	1	12950
2007	2		16500
2008	2		75200
2009			140460

(Source: Forest department official data collected from the Punjur Range Office)

The frequency of elephant deaths due to electrocution and crop relief fund paid during 2003–2009 revealed an increasing trend in human-elephant conflict from the year 2006. Although sporadic human deaths were reported during 2003–2006, no further human loss was reported from 2007 onwards (Table 6).

The land use has changed drastically along the corridor and in fringe areas in last two decades. Tribal settlements were converted into civil constructions and conversion of barren lands into palatable agriculture practice are the major land use changes in these areas resulting in shrinkage of corridor width from 1000 meters to 100 meters that were extensively used by the elephants till the last few decades. The lack of corridor width has forced elephants to venture out in adjacent agricultural land and human habitations resulting in increased crop depredation and economic loss to the farmers. To address the issue, the Karnataka Forest Department dug Elephant Proof Trenches (EPT) in all corridor fringe villages. But due to poor maintenance and negligible community participation among the villagers, the EPT has become ineffective. The revenue village farmers use all sort of mitigating measures to drive away the elephants. The crude electric fences fixed by un-professional people have resulted in death of elephants at the corridor fringe areas in past. The alarming fact was the age and sex category of the electrocuted

elephants. Most of the elephants killed due to electrocution were adult males (n=2) and early or prime puberty (n=2) males.

Financial support for crop depredation was not paid to the three tribal settlements namely, Hosabodu, Srinivasapuram and Muneeswara Colony which are exactly on the corridor because these settlements were established by the forest department using forest lands. Relief fund is not paid to the forest settlements as per the Karnataka Forest Department norms and conditions.

5. Lands identified for securing

The ground truthing result clearly revealed that the width of the corridor has drastically reduced from 1000 meters to 100 meters and minimum width is 40 meters at certain points. The width of 100 meters is not sufficient for free movement of elephants between BRT and Sathyamangalam. Approximately about 1500 elephants are found in these two major landscapes and an average of 75-100 elephants use this corridor for annual migration between these landscapes at a minimum. Therefore considering the importance of the corridor, it is suggested to increase the width of the corridor to facilitate animal movement as well as a mean to mininise human-elephant conflcit.

Fig 7: WTI field officials groundtruthing the corridor along with local forest officals

Table 7. List of land owners living in Hosabodu tribal settlement

S.No	Name	Father name	Village	Priority
1	Mathesa	Pasuvanan	Muneeswara colony	P1
2	Pasuvanan	Matha Gowda	Muneeswara colony	P1
3	Kolle Gowda	Matha Gowda	Hosapodu	P1
4	Matha Gowda	Nange Gowda	Hosapodu	P1
5	Aane VeraGowda	Nersery KundaGowda	Hosapodu	P1
6	Thata SennangaGowda	Poisa Matha	Hosapodu	P1
7	Katti Sennanjegowga	Kollathy Veregowga	Hosapodu	P1
8	Shivanna	Thambudi JadeGowda	Hosapodu	P1
9	Thodda Jadematha	Thodda JadeGowda	Hosapodu	P1
10	Shidha	Kalluve Gowda	Hosapodu	P1
11	Madhava	Kembburaj	Hosapodu	P1
12	PK Kumbe Gowda	Kade Gowda	Hosapodu	P1
13	Kethey Gowda	Kunnu matheGowda	Hosapodu	P1
14	Vitheamma	Kumbe Gawda	Hosapodu	P1
15	Guddemathe Gowda	Malle Gowda	Hosapodu	P1
16	Madhava	Kolare MatheGowda	Hosapodu	P1
17	Chekku sennengeGowda	Mathe Gowda	Hosapodu	P1
18	Malle Gowda	Kurave Gowda	Hosapodu	P1
19	Toppi kumbeGowda	KetheGowda	Hosapodu	P1
20	Nagaraj	Sidhe Gowda	Hosapodu	P1
21	Sidhe Gowda	Mare Gowda	Hosapodu	P1
22	Dhodda Alagan	Sidhe Gowda	Hosapodu	P1
23	Sennane matheGowda	Sennane Gowda	Hosapodu	P1
24	Madhava	Jade Gawda	Hosapodu	P1
25	Paise Shidha	Paise MatheGowda	Hosapodu	P1
26	Mare Gowda	Dodda JadeGowda	Hosapodu	P1
27	Jadayappa	Malle Gowda	Hosapodu	P1
28	Jadayamathamma	Madha Gowda	Hosapodu	P1
29	Jadayappa	Kaalve Gowda	Hosapodu	P1
30	Kethey Gowda	Kethey Gowda	Hosapodu	P1
31	Kooguri shitheGowda	Kooguri KumbeGowda	Hosapodu	P1
32	Rngamma(D/O)	Nange Gowda	Hosapodu	P1
33	Dhashe Gowda	Kethe Gowda	Hosapodu	P1
34	Basuva Gowda	Kurhi Matha Gowda	Hosapodu	P1
35	Kunde Gowda	Dodda JadeGowda	Hosapodu	P1
36	Masannma	Kunnu matheGowda	Hosapodu	P1
37	Sikku Aitha	Kada Gowda	Shinivasa puram	P1

38	Avudi Sennangemma	Jengu Gowda	Srinivasa puram	P1
39	Vangayam	Madha Gowda	Muneeswara colony	P1

Table 8. List of land owners living in Srinivasapuram tribal settlement

S.No	Name	Father name	Village	Priority
1	Kalve Gowda	Sithiya Gowda	Hosapodu	P1
2	Chenaja Gowda	Sikeri Gowda	Hosapodu	P1
3	Chenaja Gowda	Sivne Gowda	Baduguli	P1
4	Poma Gowda	Kumburaji	Srinivasapuram	P1
5	Siku sithaya	Achika Gowda	Srinivasapuram	P1
6	Jadaya Gowda	Mathva Gowda	Srinivasapuram	P1
7	Kokore mathva Gowda	Kumba Gowda	Srinivasapuram	P1
8	Sithamma(W/O)	Kumba Gowda	Srinivasapuram	P1
9	Malama(W/O)	Jadayamathe Gowda	Srinivasapuram	P1
10	Kumbama	Bathe Gowda	Srinivasapuram	P1
11	Kumba Gowda	Sithiya Gowda	Srinivasapuram	P1
12	Sun matha	Sun KumbaGowda	Srinivasapuram	P1
13	Pasuva Gowda	Mathva Gowda	Srinivasapuram	P1
14	Kumba Gowda	Mathva Gowda	Srinivasapuram	P1
15	Verre Gowda	Kada Gowda	Srinivasapuram	P1
16	Kurusamy	Kumba Gowda	Srinivasapuram	P1
17	Kara Gowda	Thase Gowda	Srinivasapuram	P1
18	Mathe kumbaGowda	Kumba Gowda	Srinivasapuram	P1
19	Jangu Gowda	Jangu Gowda	Srinivasapuram	P1
20	Jadaya Gowda	Pudhi kumba Gowda	Srinivasapuram	P1
21	Pakava Gowda	Thase Gowda	Srinivasapuram	P1
22	Chenaja Gowda	Sithiya Gowda	Srinivasapuram	P1
23	Sivaraji	Nada Gowda	Srinivasapuram	P1
24	Chenaja Gowda	Kurava Gowda	Srinivasapuram	P1
25	Kathiya Gowda	Kathiya Gowda	Srinivasapuram	P1
26	Alagan	Alaga Gowda	Srinivasapuram	P1
27	Pathara Gowda	Kumba Gowda	Srinivasapuram	P1
28	Nanga Gowda	Kada Gowda	Srinivasapuram	P1
29	Chenaja Gowda	Chenaja Gowda	Srinivasapuram	P1
30	Erre Gowda	Thase Gowda	Srinivasapuram	P1
31	Alaga Gowda	Sithiya Gowda	Srinivasapuram	P1
32	Sithya Gowda	Chenaja Gowda	Srinivasapuram	P1
33	Badha Gowda	Mdha Gowda	Srinivasapuram	P1
34	Sithe Gowda	Jangu madha Gowda	Srinivasapuram	P1
35	Jadaya Gowda	Kumba Gowda	Srinivasapuram	P1
36	Vlamma(W/O)	Kari sitha Gowda	Srinivasapuram	P1
37	Madha Gowda	Jangu Gowda	Srinivasapuram	P1

38	Dek jadaya Gowda	Madha Gowda	Srinivasapuram	P1
39	Kurusamy	Pute Gowda	Srinivasapuram	P1
40	Pasmma (W/O)	Kurusithe Gowda	Srinivasapuram	P1
41	Konure Gowda	Kapune kathe Gowda	ShiniVasapuram	P1
42	Kuru sithama (W/O)	Maniya Gowda	Muniswara colony	P1
43	Jadaya Gowda	Pathre Gowda	Srinivasapuram	P1
44	Pgule madhe Gowda	Sadha madha Gowda	Srinivasapuram	P1
45	Chenajama (D/O)Kumba Gowda		Srinivasapuram	P1
46	Jadaya Gowda	Kumba Gowda	Srinivasapuram	P1
47	Masthma (W/o)	Chenaja Gowda	Srinivasapuram	P1

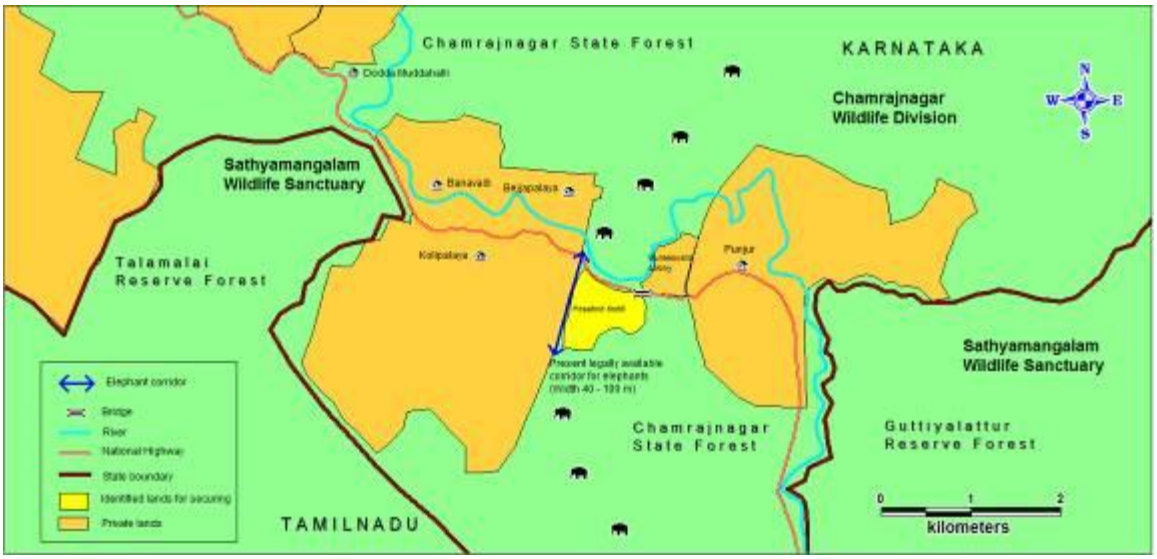
Table 9. List of land owners living in Muneeswara Colony tribal settlement

S.No	Name	Father name	Priority
1	KulaeMadha Gouda	Munia Gouda	P2
2	Kumba Gouda	Madha Gouda	P2
3	Cikka Alaimalai	Erea Gouda	P2
4	Jadaya Gowda	Marea Gouda	P2
5	Ereama (W/O)	Madha Gouda	P2
6	Cikka Purmal	Marea Gouda	P2
7	Jadaya Gowda	Bala Gouda	P2
8	Alai malai	sivanae Gouda	P2
9	Pusari Madha Gouda	Pasuva Gouda	P2
10	Rachia Gouda	Erea Gouda	P2
11	Madhava Gouda	Ramae Gouda	P2
12	Badha Gouda	Ranga Gouda	P2
13	Keri keri Madha Gouda	Pathra Kumba Gouda	P2
14	Jadaya Gowda	Ramae Gouda	P2
15	Jadaya Gowda	Kada Gouda	P2
16	Erea Gouda	Ramae Gouda	P2
17	Malae Gouda	Ramae Gouda	P2
18	Balae Gouda	Ranga Gouda	P2
19	Nanjama (D/O)	Purumal	P2
20	Pomae Gouda	Beala Gouda	P2
21	Madhava Gouda	Marea Gouda	P2
22	Rangavel	Thota mari	P2
23	Kumba Gouda	Madhava Gouda	P2
24	Madhava Gouda	Ranga Gouda	P2
25	Naga	Ranga swamy	P2
26	Puliya Gouda	Madhda Gouda	P2
27	Ranga Gouda	Nanja Gouda	P2
28	Jadaya madhama (W/O)	Madhava Gouda	P2

29	Rajama (W/O)	Thasae Gouda	P2
30	Erea Gouda	Marea Gouda	P2
31	Malae Gouda	Putae Gouda	P2
32	Malae Gouda	Erea Gouda	P2
33	Marea Gouda	Madhae guda	P2
34	Mania	Madha Gouda	P2
35	Shangra	Munia Gouda	P2
36	Madhama (W/O)	sivanae Gouda	P2
37	Kembama (W/O)	Erea Gouda	P2

Hosabodu and Srinivasapuram settlements are considered as Priority I lands for securement because currently the elephant are passing through the narrow corridor adjacent to the above said two settlements. To further strengthen the corridor, efforts should be made to secure the land from Muneeswar colony in second stage in due consultation with the local community. This will also minimize HEC in the area. Recently the Karnataka Forest Department undertook GPS survey by deploying their field staff along with WTI field personnel for each land.

Fig 8: Landscape map showing identified land for securing at Chamrajnagar-Talamalai at Punjur corridor



6. Socio-economic status of three tribal settlements

Socio-economic survey was carried out for Hosabodu and Srinivasapuram villages and sample was attempted in Muneeswara Colony based on priority and feasability. This would help to prepare specific plan for the securement of this corridor.

Table 10. Population status in three tribal settlements

S.No	Name of the tribal settlements	Male	Female	Total population	Total families
1	Hosabodu	96	55	151	41
2	Srinivasapuram	131	110	241	56
3	Muneeswara Colony	155	135	290	63

(Source: Pachayath Board Office, Punjur)

Table 11. Percentage of the various types of Houses recorded in three tribal settlements

S.No	Type of House	Name of the tribal settlements		
		Hosapodu)	Srinivasa puram	Muneeswara colony
1	Earthen	10.5	13.8	0
2	Cemented	89.5	86.2	100
3	Flooring :Mud	36.8	21.9	54.5
4	Flooring :Cemented	47.36	78.12	45.5

Majority of the houses are concrete and the floor cemented in all three settlements; few have thatched roof. During 1980s these houses were constructed by the Government of Karnataka from Tribal Welfare Fund though forest department. The houses are simple to live for one family (Fig. 9). People have also constructed small huts in their respective agriculture lands as temporary sheds mainly to safe guard their crops from elephant's depredation.

Fig. 9. Cemented house and temporary sheds seen in Hosabodu and Srinivasapuram

Table12.Education status of the villagers

S.No	Education status	Hosapodu (%)	Srinivasapuram (%)	Muneeswera colony (%)
1	A	68.2	73.19	54.5
2	B	21.7	14.5	34.09
3	C	6.97	7.98	9.09
4	D	2.32	2.17	1.13
5	E	0.77	2.17	1.13

(A=No formal education or illiterate; B=Primary level or below
C=Middle School or above primary level; D=High School or above middle school level; F=Higher Secondary)

The education status of the tribal people in all three targeted settlements revealed that most of them have no formal education or illiterate followed by primary level or below and middle school or above primary level (Table 12).

Table 13. Occupation of tribal people located in and around the corridor

S.No	Occupation	Hosapodu (%)	Srinivasapuram (%)	Muneeswera colony (%)
1	Agriculture	89.05	85.7	86.67
2	House wife	7.3	9.52	8
3	Private job	1.46	1.58	0
4	Government	1.46	2.38	2.67
5	Business	0.73	0.8	2.67

The occupation data showed that most of them are agriculturist and the major source of income. Though no irrigation facility is available for agriculture, people still dependent on agriculture and is mainly rain fed crops. People undertake agriculture just for six months in a year. Generally tribals are not agriculture oriented persons. Mostly they grow first crop for their own use and second crop for income purpose.

Table 14. Major crops under agriculture practice

S.No	Major crops cultivation	Scientific name	Hosapodu (n=38)	Srinivasa puram (n=36)	Muneeswara Colony (n=22)
1	Maize	*Zea maize*	38	34	
2	Finger millet	*Eleusine coracana*	36	34	
3	Beans		6	3	
4	Soyabean	*Glycine max*	4	-	

Finger millet seemed to be most preferable crop by the people mainly for their food. Other crops such as maize, beans and soyabean are income source crops. It is quite interesting note that all these are preferable crops for elephants also (Table 14).

Table 15. Resources extracted by three settlement people from the corridor

S.No	Resources extracted from corridor areas	Name of the tribal settlements		
		Hosapodu (%)	Srinivasapuram (%)	Muneeswera colony (%)
1	NTFP & Fuel Wood collection	5.26	0	4,54
2	NTFP, Fuel Wood & Agriculture	47.36	83.33	63.63
3	NTFP, Fuel Wood & Fodder Collection	2.63	0	0
4	NTFP, Fuel Wood. Fodder Collection & Agriculture	34.21	13.89	0
5	NTFP, Fuel Wood ,Fodder Collection, Agriculture, & House Construction	10.52	2.78	31.81

(NTFP – Non Timber Forest Produces)

The tribal settlement people depends the corridor for various purpose. They mostly collect NTFP, fuel wood and small timber species and also use for agriculture. NTFP and fuel wood collection are most common.

Table 16. Tribal people's perception on HEC

S.No	Name of the village	Present status of Human elephant conflict		Intensity of conflict has increased over time		Degree of HEC		
		Yes	No	Yes	No	High	Medium	Low
1	Hosapodu (n=38)	92.1	7.89	92.1	7.89	68.4	23.6	7.89
2	Muneeswera colony (n=22)	77.27	22.72	72.27	22.72	36.36	40.9	22.73
3	Srinivasapuram (n=36)	94.44	5.55	94.44	5.55	72.22	19.44	8.33

(High - > 40%; Medium – 30% - 40%; Low – 20% - 10%)

The opinion of tribal settlement people on human elephant conflict revealed that the HEC is really very high and allmost all of them opined that the intensity of conflict has increased over the period (Table 17). This is clearly evidenced from existing width that is not able to support the movement of elephant's population and there is increased interface between humans and elephants.

Table 17. Percentage of tribal people's perception on crop depredation by elephants

S.No	Name of the Village	Ever experience crop damage by elephants		Period of elephant's visits		Degree of crop damage by elephants		
		Yes	No	Seasonal	Through out the year	High	Medium	Low
1	Hosapodu (n=38)	92.1	7.89	76.31	23.68	65.8	26.31	7.89
2	Srinivasa puram	91.67	8.33	63.89	36.11	72.22	19.44	8.33
3	Muneeswera colony	86.36	13.63	13.63	86.36	31.8	54.5	13.63

(High - > 40%; Medium – 20% - 40%; Low – 10% - 20%)

Majority of the people in all three tribal settlements experienced crop depredation by elephant every year. Most of them responded that the degree of crop damage by elephants is high except Muneeswara Colony. This is mainly because presently elephants are moving through a narrow corridor adjacent to Hosabodu and Srinivasapuram tribal settlements. Most of the elephants' visits to the crop fields were seasonal especially between October and December months. Though intensity of elephants' visits is medium in Muneeswara Colony but it exists through out the year. This is manly because of the perennial river that drains adjacent to this settlement.

Table 18. Percentage of tribal people's perception on reasons for HEC

S.No	Name of the Village.	Increase of elephant population	Good forest but loss of habitat quality for elephant	Lack of water	Increase of elephant population as well as good forest but loss of habitat quality for elephant
1	Hosabodu (n=38)	31.57	18.42	7.89	42.1
2	Srinivasapuram (n=36)	30.55	5.55	13.89	50
3	Muneeswera colony (n=22)	27.27	13.63	9.09	50

Most people opined that increased conflict is due to increase of elephant population as well as degradation and loss of habitat quality for elephants. Few people opined that lack of water for elephants especially during dry season as another major reason for human-elephant conflict.

Table 19. Percentage of different mitigating measures used by the tribal people for HEC

S.No	**Types of mitigating measures**	**Hosapodu (n=38)**	**Srinivasa puram (n=36)**	**Muneeswera colony (n=22)**
1	Crackers and Night guarding	34.2	33.33	18.18
2	Night guarding only	65.8	66.07	81.18

The Karnataka Forest Department dug Elephant Proof Trench (EPT) for all three tribal settlements as well as all fringe villages. But due to lack of maintenance and community participation, the EPT has become ineffective. Presently the people use traditional methods of night guarding using machans (tree platforms) (Fig. 10) and crackers to drive away elephants

Fig 10. Tree top machan

Table 20. Details of ex-gratia payment recorded in the tribal settlements

S.No	Name of the Village	Number of people applied for ex-gratia payment		Number of people received ex-gratia payment
		Yes (%)	No (%)	
1	Hosapodu	5.26	9.47	Nil
2	Srinivasa puram	36.11	63.89	Nil
3	Muneeswera colony	45.45	54.44	Nil

Since all three settlements are forest settlements, they are not eligible to claim any wildlife damages as per the Karnataka Forest Department norms and conditions. Therefore none of them were paid ex-gratia payment.

Table 21. Percentage of tribal people's perception on conserving elephants and faith on elephants

Name of the Village	Worth for conserving elephants		Faith on elephants	
	Yes	No	Yes	No
Hosapodu (n=38)	5.26	94.7	100	-
Srinivasa puram (n=36)	5.55	94.44	100	-
Muneeswera colony (n=22)	13.63	86.36	100	-

The people's perception about faith on elephants has not changed so far. On the contrary, most of them expressed no worth for conserving elephants (Table 21). This is mainly because of their lack of awareness on elephant conservation and increased human-elephant conflict and lack of compensation for the loss and the constant threat from elephants.

7. Conservation plan for securing the corridor

1. The corridor should be notified by the state forest department and legally protected under appropriate law to prevent encroachment and developmental activities in the corridor detrimental to animal movement.
2. In consultation with the villagers, the corridor land in Hosabodu and Srinivasapuram settlement should be secured as priority.
3. No construction beallowed on either side of the National highway passing through the corridor.
4. Awareness program targeting the villages living both within and on the fringe of the corridor be carried out through schools and community organizations informing them about the criticality of the corridor area and the increased human-elephant conflict in the area due to its obstruction.
5. Undertake eco-developmental activities in the fringe villages to reduce their dependency on corridor forest, especially in Hosabodu, Srinivasapuram and Muneeswera colony. This should mainly involving providing them alternatives for fuel wood and also stalls feed for their cattles.

3. Chamrajnagar-Talamalai at Muddahalli

Alternate Name : Talavadi- Muddahalli corridor

This is the second corridor that connects the Chamrajnagar and Sathyamangalam Forest Divisions.

About 600 acres of forest land was denotified in 1959 at 138th mile in Chamrajnagar state forest with boundaries namely, North and East- Godimaduhalla, South:- Chamrajnagar – Sathyamangalam Road, West:- Road to Budipaduga. Presently there is narrow forest connectivity available on the eastern side of the Muddahalli village. This forest patch connects Talavadi range of the Sathyamangalam Forest Division (Tamil Nadu) and Punjur Range of the BRT Wildlife Sanctuary, passing between Muduhalli village and Goramadu Doddi. About 100–125 elephants regularly use this corridor as part of their annual seasonal migration.

a. Location: This corridor lies between 11^0 42' – 11^0 49' N and 77^0 00' – 77^0 06' E in the eastern part of the Chamrajnagar District and is bounded in the north by K Gudi range of the Chamrajnagar WLS, in the south west by Talamalai RF, east by Hasanur range and west by Talamalai RF (Fig. 1). The terrain is gently undulating. Vegetation ranges from Sub tropical thorn forest to mixed deciduous (Champion and Seth, 1968) and Eucalyptus plantations available in the corridor. Rich Bamboo patches are also available to elephants for browse and cover. The tree cover is dominated by *Randia dumetorm, Erythroxylon monogynum and Chloroxylon swietenia*.

b. Connectivity: Chamrajnagar state forest of Chamrajnagar Wildife Division and Talamalai reserved forest of Sathyamangalam Forest Division

c. Average length and width: The length of the corridor 1.5 km and the effective width ranges from 200 to 300 meters.

Fig.1 3D map showing Satellite Imagery of Chamrajnagar-Talamalai at Muddahalli corridor at landscape level

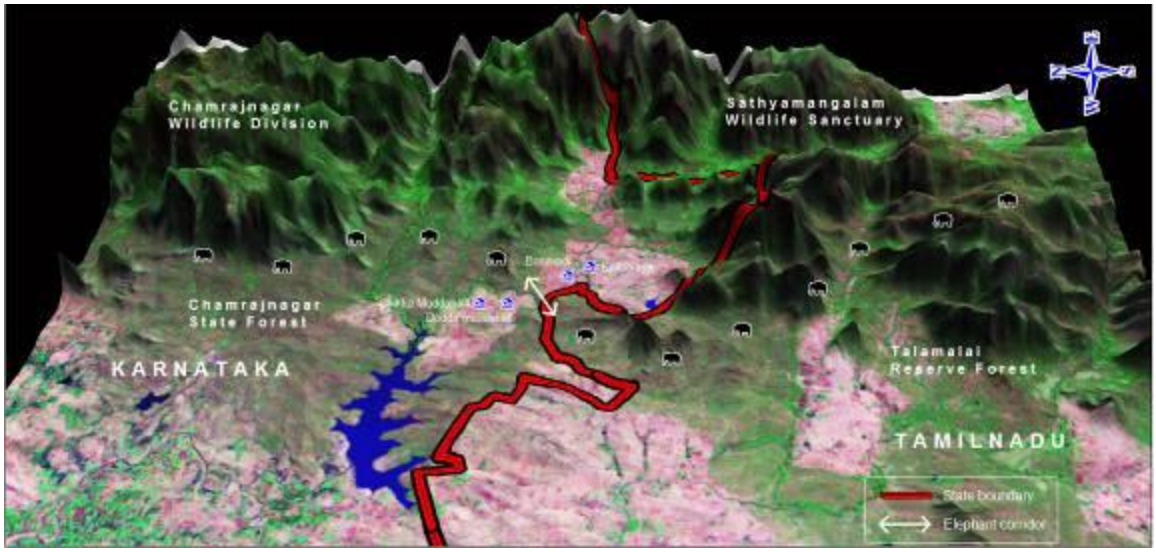


Fig 2. Collecting ground truth information using GPS and recording elephants indirect signs

1. Extent of elephant usage

Three Belt transects (2000 X 10 meters) were laid in the Mudahalli corridor for this study and sampled once in every two month. Also Synchronized elephant census data was collected from the forest ranges of Punjur (BRT Wildlife Sanctuary, Karnataka) and Talavadi (Sathyamangalam Forest Division, Tamil Nadu).

Table 1 Elephant population in and around the corridor area

Year	AF	SAF	JF	AM	SAM	JM	C	MAKHNA	UI	TOTAL
2003-2004	23			1			6	3	12	45
2005-2006	25			6			6			37
2007-2008	30	8	5	8			13			64
2009-2010	25	8	5	7	3	4	13		1	66

(Source: Synchronized elephant census report for the year 2005, 2007 & 2010; Annual Wildlife census report for the year 2003, Dung density was calculated for this present study)

Adult Male and Female	1: 5.3
Adult Female and Calf	1:3.0
Elephant density per Sq Km	0.92

BRT Elephant population	550-600
Sathyamangalam population	850-900

Census results revealed that an average of 100-125 elephants extensively use this corridor every year as part of their annual seasonal home range (Table 2.1). The demography data indicates that both loaners and female led family herds frequently use the area in and around the corridor (Table 1). Kumara and Rathnakumar (2010) estimated that 1.7 elephants per Km^2 for entire BRT WLS. The current study was carried out between October 2009 and April 2010, which is the season for influx of elephants into BRT WLS.

2. *Assessment of habitat quality*

2a. Tree, regeneration and recruitment status in the corridor forest

Table 2 Trees, regeneration and recruitment status (Sampled Area: 0.3 Ha.)

Local name	Scientific Name	Frequency of Trees	Average GBH (cm)	Average Height (m)	Lopping	WC	RC	RG	Food Sp.
Alamaram	*Ficus benghalensis*	2	53.5	9.5	1				✓
Angriki							8	13	✓
Avuriki	*Tephrosia purpurea*							7	✓

Bajai	*Acorus calamus*	2	17.6	2.6		1	1		
Bamboo	*Bambusa arundinacea*						12		✓
Bealamaram							4		✓
Beluga	*Dalbergia lanceolaria*						2		✓
Eucalyptus	*Eucalyptus* sp	4	84.5	6.75	2				✓
Jakalakandi	*Diospyros montana*						3		
Jeevathalai	*Erythroxylon monogynum*	3	18	2.3		2			
Korgi	*Ixora pavetta*	3				3		1	
Kakkai	*Cassia fistula*						3	7	✓
Kadukaai	*Terminalia chebula*						1	1	✓
Kagalie	*Acacia catechu*	10	13.4	1.5	1	3	3	1	✓
Karai	*Randia dumetorum*	1				1	14	21	✓
Karungali	*Acacia chundra*							2	✓
Kottei	*Ziziphus glabrata*							5	✓
Kula	*Persea macrantha*	1			1			2	✓
Kuruvi	*Ixora pavetta*							3	
Lantana	*Lantana camara*						20	10	
Makaali	*Decalepis hamiltonii*	2			2	1	3	2	
Magarai	*Canthium coromandelium*	3				2	4	1	✓
Pannimaram							1	2	✓
Peethai	*Premna tomentosa*	3			2	1	4	5	✓
Porasu	*Butea monosperma*	3	51	4		2	5	7	

Sandalwood	*Santalum album*						3	2	✓
Silla maram	*Strychnos potatorum*	3				3	6	4	✓
Somai	*Soymida febrifuga*	2			2		2	4	
Theakku	*Tectona grandis*							4	✓
Thanku	*Gyrocarpus americanus*	3				3	7	6	✓
Thadasu	*Grewia tiliifolia*	1				1		3	✓
Tharani	*Strobilanthes cuspidata*						6		✓
Udupai	*Chloroxylon swietenia*						5	6	✓
Urugul	*Eriolaena hookeriana*	7	18.5	1.25		3		1	✓
Utharani	*Achyranthes aspera*						2	4	

A total of 35 plant species were recorded in 0.3 Ha. sampled area. Of these, 25 plant species were recorded as palatable food species for elephants. The average GBH was noticed high in *Eucalyptus Sp*. (84.5 cm) followed by *Ficus benghalensis* (53.5 cm) and *Butea monosperma* (51.0 cm). The vegetation composition indicates an encouraging trend for the future because of the presence of good numbers of regeneration and recruitment in the sampled area (Table 2). It was unfortunate that both man made threats such as lopping and wood cutting signs were seen on all trees especially on palatable elephant food species like *Acorus calamus, Erythroxylon monogynum, Ixora pavetta, Decalepis hamiltonii* and *Somida fabrifuga* (Table 2).

Generally elephants use mixed deciduous and thorn forests mainly for browsing during dry season. Therefore standing trees are critical food resources as well as good shade to elephants while they move through corridor areas. Seasonal movements of elephants are in relation to the availability of water, suitable forage and shade (Sykes, 1971; Sivaganesan, 1991; Baskaran, 1998; Ramakrishnan, 2008). The selective felling of standing trees would change the habitat integrity in due course of time. Ramakrishnan

(2008) found that lopping and wood cutting has drastically altered the ground cover and increased many exotic weeds namely *Lantana camara, Eupatorium spp., Barleria prionitis, Stachytarpheta indica,* and xerophytic plants namely *Opuntia dillenii, Euphorbea antequarum* in many corridors of the Nilgiris. This unhealthy trend would induce human-elephant conflict, as the corridors are considered to be the micro habitats to the migratory elephants.

2b. Ground cover status

Table 3. Ground cover availability in the corridor (Sampled Area: 0.015 Ha.)

Ground cover variables	Percent availability
Shrub	21
Herb	15
Climbers	11
Grass	52

Fig 3. Vegetation sampling exercise in corridor area

The rich availability of grass cover in the over all vegetation seemed to be an encouraging trend for elephants (Table 3). Seasonal food preference by elephants has been reported by many studies depending on plants nutritional palatability to elephants. Though browse plants are rich and preferred food items by elephants in thorn forest, grass species would also play a vital role to some extent. Baskaran (1998) recorded 43 browse species and 15 grass species eaten by elephants in the thorn forest areas of the Nilgiri Biosphere Reserve.

Fig 4. Eucalyptus extensively debarked by elephants

2c. Availability of ecological resources to the elephants in the corridor

Table 4. Availability of ecological resources in the Chamrajnagar-Talamalai at Muduhalli corridor (Sampled Area = 0.3 ha)

S.No	Name of the ecological resources	Total numbers
1	Water source (Seasonal)	3
2	Water source (Perennial)	1
3	Fruit bearing trees	4
4	Shade trees	5
5	Natural salt licks	1
6	Elephant food species	25
7	Non-elephant food species	10

This corridor attributes more than 50% of elephant food species in the overall vegetation cover (Table 4). The availability of other ecological resources plays a major role for the elephants to use the corridor effectively. Especially bamboo patches and natural perennial water source are available in plenty in this corridor (Fig 5 & 6).

Fig 5. Bamboo clumps in the corridor area

Fig 6. Perennial water source in the corridor area

3. Threats to the corridor

3a. Developmental activities in the corridor fringe area

Expansion of the villages such as Muduhalli, Goramadu Doddi and Mookanpalya along the fringes of corridor areas has affected the width of the corridor. Recently developed forest nursery near Goramadu doddi area of the corridor has affected the diurnal movement of elephants. Therefore considering the critical value of this corridor, the forest department nursery may be shifted from present location to facilitate undisturbed movement of elephants that are regularly passing through this corridor from Talavadi to Punjur ranges and vice-versa.

3b. Corridor dependent villages/forest settlements

1. Dodda Muduhalli
2. Chiku Muduhalli
3. Goramadu Doddi
4. Boodhipaduga
5. Kumbaragundi
6. Mookanpalya

3c. Traffic intensity

Fig. 7 Traffic intensity round the clock in Chamrajnagar-Talamalai at Muduhalli corridor

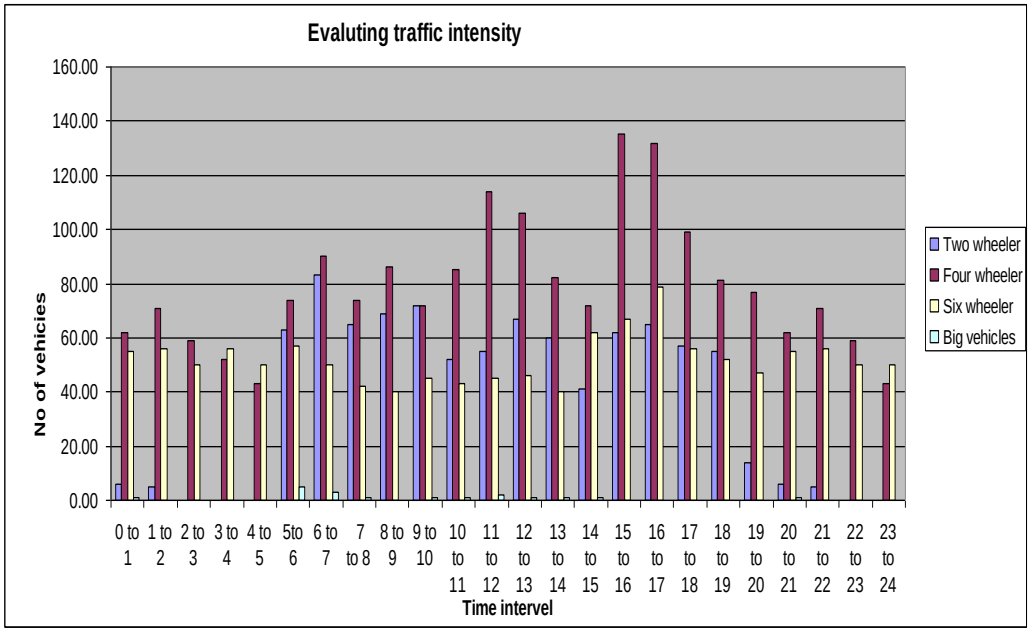


Fig 8. Sathyamangalam and Chamrajnagar national highway bisects the corridor

The traffic intensity was recorded round the clock for two full days on the highway between Sathyamangalam and Chamrajnagar (NH 209), which bisects the Chamrajnagar-Talamalai at Mudahalli corridor. Six wheel and four wheel vehicles were plying more between Chamrajnagar and Sathyamangalam throughout the day. An average of 85 vehicles per hour was observed during this period. The movement of vehicles was observed round the clock and four wheelers were observed very high between 15.00 and 16.00 hrs (Fig. 7). These vehicles were mostly pickup trucks carrying vegetables from the agriculture lands to Chamrajnagar, Sathyamangalam and Mettupalayam vegetable markets.

3. Lands identified for securing

Since the lands were given to Co-operative Framing Society on the western side of the corridor it was difficult to submit survey numbers and extent of area etc. Thus Foot survey was done in those lands using GPS. The ownership of those lands was collected from local sources. The details on the eastern side of the corridor (Godimaduhalla) have been collected from the Government records.

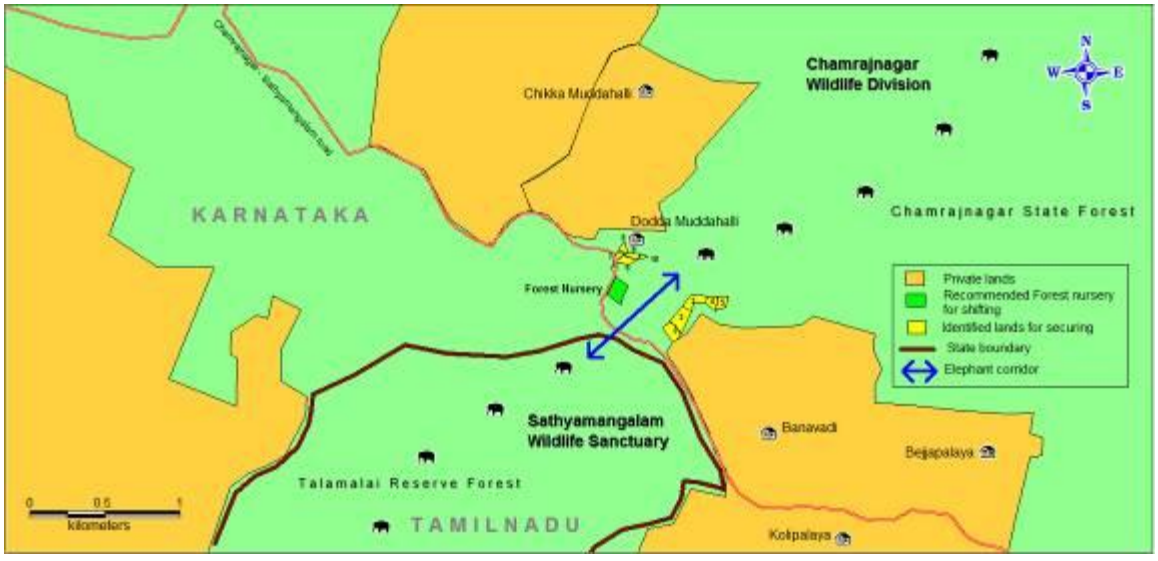
Table 5 List of lands identified for securing near Goramadu Doddi settlement

Name	village	Extent of area (acre)	Priority
Rangae Gowda	Goramadu Doddi	3.25	P1
Dunde Gowda	Goramadu Doddi		P1
Ayoo nayaka	Goramadu Doddi	3.12	P1
Putta vengattamal	Goramadu Doddi	4.38	P1
Rama nayaka	Goramadu Doddi	6.64	P1

Table 6 List of lands identified for securing near Chikumuduhalli village

Name	Village	Extent of area (acre)	Priority
Kamalama	Chikkumudahali	Not known	P1
Maga nayaka	Chikkumudahali	Not known	P1
Sathuru nayaka	Chikkumudahali	Not known	P1
Monkey bay	Chikkumudahali	Not known	P1

Fig 9. Landscape map showing identified land for securing at Chamrajnagar-Talamalai at Muddahalli.



4. Socio-economic status of bordering villages

Socio-economic survey was carried out for the people who are living adjoining to the critical bottleneck area between Chiku Muduhalli and Goramadu Doddi villages. Considering the long term conservation of elephant, the socio economic survey was conducted to understand their current status and help the managers to prepare a specific plan and budget for the securement of this corridor in due consultation with the people and utlising their knowledge.

Table 7 Population status

S.No	Name of the Villages	Male	Female	Total population	Total families
1	Chiku muddahalli	313	337	680	97
2	Goramadu Doddi	90	66	156	39

(Source: Panchayath Board Office, Punjur)

Since the corridor is very close to the above said villages, most of their needs are being met form the corridor areas. The people from this corridor are greatly dependent for fuel wood collection from these areas followed by combination of NTFP collection and preparation of agriculture products.

Table 8 Occupation of adjoining villagers of Muddhalli corridor

S.No	Occupation	Goramadu Doddi (%)	Chiku Muduhalli (%)
1	Agriculture	37.9	40.0
2	House wife	17.2	33.33
3	Studying	10.35	13.3
4	Private job	3.45	6.67
5	Government	6.9	6.67
6	Business	24.14	0

A total of 44 people living very close to the corridor belonging to two villages were interviewed. Most of them are agriculturists (n=17) followed by businessmen (n=7) and Government employees (n=3). Most of the married women are house wives (n=10) and young generations are studying (n=5).

Major crops under agricultural practice: Most of the people grow crop that is also preferred by elephants. Maize, soyabean and finger millets are mainly grown by the villagers, hence high incidences of crop depredation and loss.

Table 9 Education status of the village people

S.No	Education status	Goramadu Doddi (%)	Chiku Muduhalli (%)
1	A	41.5	53.33
2	B	6.9	13.33
3	C	6.9	0
4	D	6.9	13.33
5	E	24.2	6.67
6	F	13.8	13.33

(A=No formal education or illiterate; B=Primary level or below; C=Middle School or above primary level; D=High School or above middle school level; E=Higher Secondary; F=Degree or above higher secondary level)

Out of 44 persons interviewed, almost half of them were illiterate or had no formal education

Table 10 Perception on HEC by the villagers living near Muduhalli corridor

S.No	Name of the village	Present status of Human elephant conflict (%)		Intensity of conflict has increased over time (%)		Degree of HEC (%)		
		Yes	No	Yes	No	High	Medium	Low
1	Goramadu Doddi	100	0	100	0	60	40	0
2	Chiku Muduhalli	100	0	100	0	75	0	25

(High - > 40%; Medium – 30% - 40%; Low – 20% - 10%)

The perception on human elephant conflict of people those who are living in the fringes of the corridor area revealed that the present status of HEC is high and also most of them responded that the intensity of conflict has increased over a period of time (Table 10). This area is known for high influx of elephants during dry season mainly because of attraction towards perennial Suwarnavathy reservoir near to the corridor.

Table 11 Perception of people on crop depredation by elephants

S.No	Name of the Village	Ever experience crop damage by elephants (%)		Period of elephant's visits (%)		Degree of crop damage by elephants (%)		
		Yes	No	Seasonal	Through out the year	High	Medium	Low
1	Goramadu Doddi	80	20	40	60	60	40	
2	Chiku Muddahali	75	25	25	75	75	0	25

High - > 40%; Medium – 20% - 40%; Low – 10% - 20%)

Majority of the people living close to the corridor experienced crop depredation by elephant every year. Most of them responded that the degree of crop damage by elephants is high. This is mainly because of attraction of palatable crops in the fields. No significant change was noticed on period of crop visits by elephants based on questionnaire survey (Table 11). Though intensity of elephant visits is little lower in Goramadu Doddi compared to Chiku Muddahali but it exists through out the year. This is mainly because of Goramadu halla drains adjacent to the settlement.

5. Conservation plan for corridor securement

1. The corridor should be notified by the state forest department and legally protected under appropriate law to prevent encroachment and developmental activities in the corridor detrimental to animal movement.
2. In consultation with the villagers, about 17.4 acres of land belonging to five families from Goramadu doddi settlement and land from four families of

Chikumudahalli village be secured as priority to increase the width of the corridor.

3. The forest nursery near Goramadu doddi settlement in the corridor be shifted outside and fence removed.
4. No construction is allowed on either side of the National highway passing through the corridor.
5. Awareness program targeting the villages living both within and on the fringe of the corridor be carried out through schools and community organizations informing them about the criticality of the corridor area and the increased human-elephant conflict in the area due to its obstruction.

3. Tali Corridor

Alternate Name: Chattiramdoddi – Hunsanhalli corridor

The Bannerghatta National Park, parts of Bangalore Forest Division in the Kanakpura range and the northern part of Hosur Forest Division (Tali Reserve Forest) are at present cut off from the southern part of Hosur Forest Division due to cultivation between Chattiramdoddi and Hunsanhalli villages. If the northern portion, comprising of Bannerghatta National Park and its adjacent ranges, have to maintain their viability as elephant habitat, it is essential to strengthen the corridor in this region.

Location: This corridor is geographically situated within latitude 12^0 34.8'- 12^0 35.4' N and longitude 77^0 34.8 - 77^0 36'E.

Connectivity: Bannerghatta National Park and northern part of Hosur Division with southern part of Hosur Division

Average length and width: The width of the corridor varies between 1300-1500 meters and length is about 2200-2500 meters. But the forest is disconnected for 300m to 350m at some places.

Although the corridor has connectivity on the Karnataka side, it is disconnected near Belalam village (Fig 1) on one side of the State highway after Belalam village towards Marulvadi. The Forest department has fixed long solar power fence on one side of the forest boundary near Belalam village blocking the animal movement. Other side has agriculture areas with some temporary hamlets.

Fig. 1 3D m*ap showing Satellite Imagery of Tali corridor at landscape level*

1. Extent of elephant usage

Table 1 Elephant population in and around the corridor area

Year	AF	SAF	JF	AM	SAM	JM	C	MAKHNA	UI	TOTAL
2006-2007	5	16	12	3	-	1	5	-	-	42
2007-2008										125
2008-2009										120
2009-2010	70	20	16	10	13	4	19	-	7	159

(Source: Synchronized elephant census report for the year 2007 & 2010; Annual Wildlife census report for the year 2008, Dung density was calculated for this present study)

Adult Male and Female 1: 5.7
Adult Calf and Adult Female 1: 3.1
Elephant density per Sq Km 0.6 – 1.0

Bannerghatta NP Elephant population	105 - 191
Hosur Forest Division elephant population	250-300

(Source for elephant population of Bannerghatta NP: Bhaskaran et al. 2007)

Table 2 Elephant dung density based on elephant census conducted in the two ranges of Hosur Division

No. of Transects	No. of dung piles recorded	Total length of the Transects (Km)	Average perpendicular distance of dung piles (km)	Elephant dung density / Km^2
6	110	12	0.0087	526.82

Census result revealed that an average of 100-125 elephants extensively use this corridor every year as part of their annual home range (Table 1). Rameshkumar (1994) recorded that 1.1 – 2.0 elephants/km^2 during dry season (Jan-Apr), 0.6 – 1.0 elephants/km^2 first wet season (May-Aug) and 0.6 – 1.0 elephants/km^2 second wet season (Sep-Oct) between September 1988 and August 1991. The influx of elephants in this corridor during dry season is mainly because of the availability of bamboo rich mixed forest. The dung density per square kilometer in this area was found to be 526.82. Ramkumar and Arumugam (2005) recorded dung density of 637.9/km^2 in Masinagudi-Moyar elephant corridor at Mudumalai Tiger Reserve. Dung density of 618/km^2 was estimated in Karadikkal–Madeswara elephant corridor which is adjoining to this corridor. The study team sighted 23 elephants crossing the highway between Tali and Marulvadi near Dodduru at Karnataka side on 22nd Nov 2010

2. Assessment of habitat quality

2a. Status of tree, regeneration and recruitment class in the corridor forest:

Table 3 Trees, regeneration and recruitment status

Local name	Scientific Name	Frequency of Tree	Avg of GBH	Avg of height	Lopping	WC	RC	RG	Elephant Food sp
Kagali	*Acacia chundra*	5	24.4	4.5	2		10	2	√
Karungali	*Acacia catechu*	7	25.7	4.35				9	√
Velvalam	*Acacia leucophloea*	2		1		2			√
Karuvai	*Acacia nilotica*	2	44.5	4				7	√
Nagarkai mullu	*Achyranthes aspera*	12					12		
Thendigai	*Anogeissus latifolia*	10	35.6	5.13				2	
Anthugeda	*Asparagus recemosus*						2		√
Vambu	*Azadirachta indica*	2	32.4	4.5					√
Mungil	*Bambusa arundinacea*	48						48	√
Poolamaram	*Bombax ceiba*	2	22.5	5				8	
	Bauhinia racemosa	2	28.5	1.95					√
Dhoopamara	*Boswellia serrata*	3	21.7	5.33				2	√
Porasu	*Butea monosperma*	6	34.8	5.41			5	11	
Konnai	*Cassia fistula*	2						2	
Tagari	*Cassia flora*	8				2		6	√
Karuvali	*Cassine glauca*						12		
Katu bauli	*Cleome viscosa*	6	42.5	7.0	1		7		√
Sellai	*Cochlospermum religiosum*	2	48.5	15				2	√
Alamaram	*Ficus benghalensis*	2	45	15	1				√
Kadalai	*Grewia hirsuta*	16					3	13	

Karukati kodi	*Hiptage benghalensis*						15		
Korivi	*Ixora pavetta*	2	25.6	3.25			17	11	√
Uni chedi	*Lantana camara*							22	
	Nama	11	20.5	3.36				5	√
Pongan	*Pongamia pinnata*	1				1			
Karai	*Randia dumetorum*	1	28.8	2.8			2	29	√
Sundai	*Solanum surattense*						22		
Puliya	*Tamarindus indica*	1	55	6.15					√
Pulu vai	*Terminalia paniculata*							3	√
Kadukai	*Terminalia chebula*	2	11.7	2			1		√
Pallichedi	*Trichodesma indicum*						13		
Neveladi	*Vitex altissima*	4	72.5	7.25	-	-	-	-	√
Vappalai	*Wrightia tinctoria*	5	37.5	3.70			20	2	√
Kottai	*Zizyphus xylopyrus*	1	23	3			1	2	√

A total of 34 plant species were recorded in 0.3 Ha. sampled area. Of these, 22 plant species were found to be palatable food species for elephants. Maximum average GBH was noticed in *Vitex altissima* (72.5 cm) followed by *Cochlospermum religiosum* (48.5 cm) and *Ficus benghalensis* (45 cm). On the contrary, maximum average height was noticed in *Cochlospermum religiosum* (15 m), followed by *Ficus benghalensis* (15 m) and *Vitex altissima* (7.25 m). Man made biotic pressure such as lopping and wood cutting signs were seen on almost all trees species especially the palatable elephant food species, except *Pongamia pinnata*. Although lopping and wood cutting signs were encountered considerably high while walking the corridor area, this was unfortunately not reflected in the sampled area. Strong management intervention is needed to curtail lopping and wood

cutting activities. Over exploitation of the secondary dry deciduous has shown a drastic change in its vegetation composition with a predominance of thorny species (Table 3).

Ramesh kumar (1994) recorded 83 tree species in the Hosur forest division, of which *Acacia chundra* was dominant in 6.6 ha. sampled area using strip transect method.

2b. Ground cover status

Table 4. Ground cover availability in the Tali corridor (Sampled Area 0.015 Ha.)

S.No	Ground cover variables	Percent availability
1	Shrub	43
2	Herb	15
3	Climbers	13
4	Grass	29

The rich availability of grass and shrub cover (43%) in the overall vegetation is an encouraging trend for elephants (Table 4). Seasonal food preference by elephants has been reported by many studies depending on plants nutritional palatability to elephants. Though browse plants are rich and preferred food items by elephants in thorn forest, grass species would also play a vital role to some extent.

2c. Availability of ecological resources to the elephants in the corridor

Table 5. Availability of ecological resources in the corridor (Sampled Area = 0.3 ha)

S.No	**Name of the ecological resources**	**Total numbers**
1	Water source (Seasonal)	3
2	Water source (Perennial)	1
3	Fruit bearing trees	6
4	Shade trees	8
5	Natural salt licks	2
6	Elephant food species	24
7	Non-elephant food species	10

Fig 2: Some of the resources available to elephant in the Tali corridor being recorded by the survey team

3. Threats to the corridor

Table 6 Biotic threats recorded in and around Tali corridor

S.No	Name of the village	Cattle grazing (No. of cattle)	Fuel wood		Fodder collection		Agriculture purpose	
			Men	Women	Men	Women	Men	Women
	Balagaari	250-300	4	8	6	4	4	1
	Basuvanpura	75-150	2	5	8	2	0	0
	Daverbetta	350-500	3	12	2	1	0	0
	Chathiram doddi	300-450	1	3	3	1	0	0

Cattle grazing seemed to be a severe threat affecting the quality of the corridor followed by wood cutting and fodder collection (Table 6). Relentless felling of recruitment classes of tree saplings has caused remarkable depletion of tree density in the over all vegetation cover. The recruitment classes are suitable to make poles for edge fencing and for construction of houses and this size class of the tree stand was found to be selectively removed by local people. Fuel wood is mostly collected by women. This observation is

corroborate with the earlier finding by Ramakrishnan *et al.* (1997) in Sujalkuttai-Bannari and Kallar-Vedar Colony elephant corridors, Tamil Nadu.

Fig 3 Tree lopping and man made forest fire in the corridor area

3b. Corridor dependent villages/forest settlements

1) Balagarai	2) Thataparuur
3) Basuvanpura	4) Daverbetta
5) Bandedoddi	6) Thasarampalli
7) Bensekkaldoddi	8) Belalam
9) Sivanalidoddi	10) Lakshmipuram

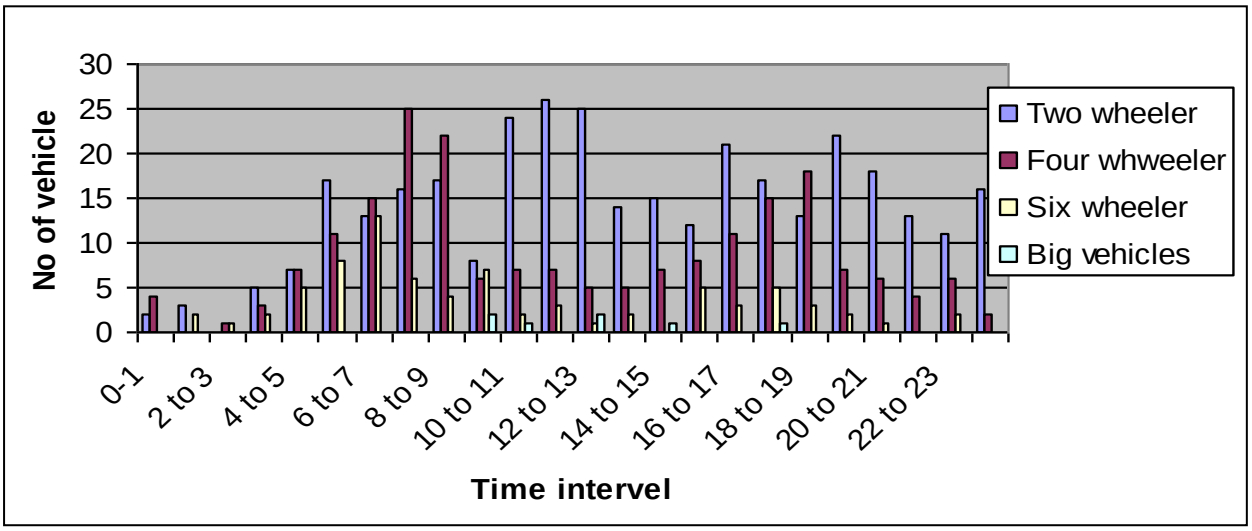
Of the ten villages, Balagarai and Basuvanpura are tribal enclosures located inside the corridor. The livestock grazing and all other requirements for these villages are being met only from the corridor. Therefore, strong eco-development projects need to be initiated for these villages to win the confidence of people towards positive conservation of elephants.

3c. Traffic intensity

The traffic intensity was recorded round the clock for two full days on the highway between Tali and Marulvadi which bisects the Tali elephant corridor near Belalam. Movement of heavy vehicles seemed to be very low. On the other hand four

wheelers and two wheelers were more shuttling between Marulvadi and Tali through out the day. An average of 20-25 vehicles per hour was observed during the study period. The movement of vehicles was observed round the clock and six wheelers were recorded very high between 6.00 – 8.00 AM. These vehicles were mostly pickup trucks carrying vegetables from the agriculture lands to Bangalore and Hosur vegetable markets. Elephants also cross the high way during early morning and late evening hours to access water holes. Our team also had direct sighting of about 23 elephants in late evening on 22.11.2010 crossing the highway near Dodduru village.

Fig. 4 Traffic intensity round the clock in Tali corridor

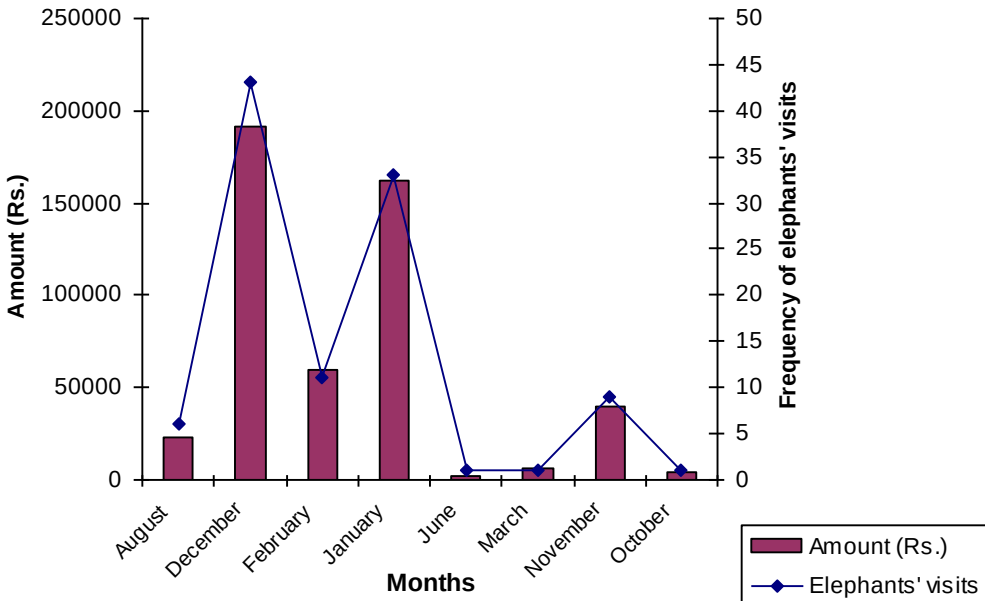


4. Human elephant conflict

Table 7 Status of human death and compensation paid in and around the Tali corridor between 2001 and 2010

Year	Human death	compensation paid (Rs in lakhs)
2001	3	3.0
2002	4	4.0
2003	4	4.0
2004	2	2.0
2005	-	-
2006	6	5.0
2007	-	-
2008	7	7.0
2009	5	5.0
2010	2	Being processed

Fig. 5 Relief amount paid for elephant's crop depredation in and around Tali corridor



The human deaths due to elephants and crop relief fund paid between 2001 and 2010 in the Hosur forest division revealed that the division is facing severe human-elephant conflict issues. 33 human deaths were reported within a period of ten years, at an average

of 3 to 4 human casualties every year. Relief amount of Rupees One lakh per victim is being paid by the State Government as early as possible to take care of the family and prevent retaliation against elephant conservation but is quite inadequate and the ex-gratia needs to be increased.

Cultivation of palatable crops in the corridor fringe areas is the major attraction to elephants for crop raids. Elephants are deliberately invading agriculture areas for taste and nutritional value of the crops than wild plants. The present elephant visits are not corroborate with the earlier study by Rameshkumar (1994). He had observed that the elephants raid crops frequently and consumed more during October and November when the crops are in inflorescence stage. The present study data collected from the forest department for which relief fund was paid revealed that elephants were reported to visit the area during December and January.

5. Land identified for securing

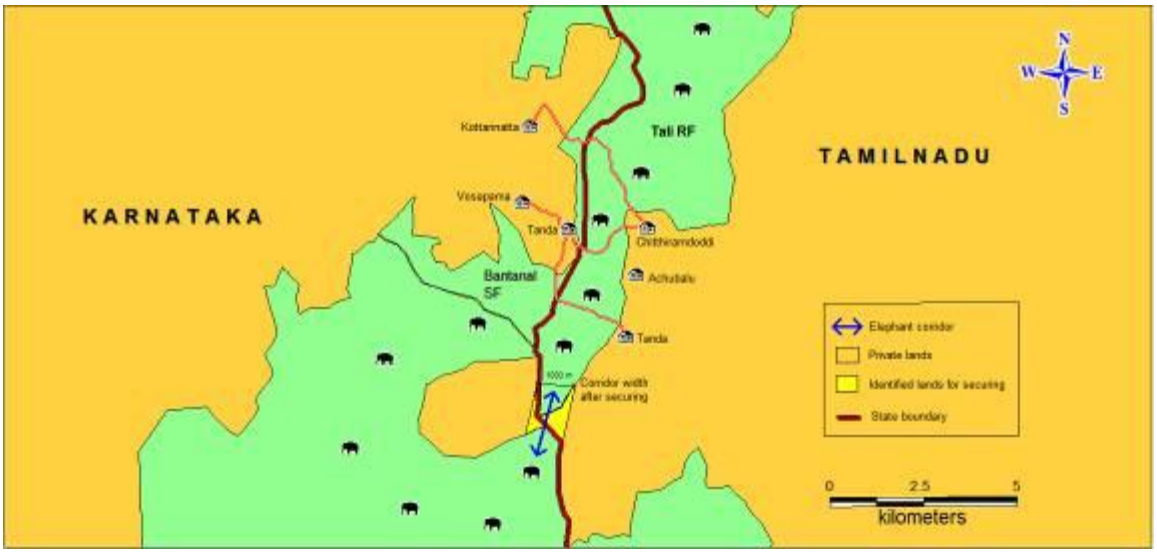
The corridor average width is about 1300-1500 meters and length is about 2200-2500 meters. Although the corridor has connectivity on the Karnataka side, disconnection was seen near Belalam village (fig 7). One side of the State highway after Belalam village towards Marulvadi does not have connectivity. The Forest department has also fixed long

Fig.6 Field officer collecting location of land (left) and details about elephant movement (right)

solar power fence on one side. Other side has agriculture areas with some temporary hamlets. Agriculture being practiced in the area is economically not viable due to crop depredation by elephants.

The lands to be secured to connect forest patches near Belalam village are shown in Fig 7. To increase the width by about 500 meters, about 28 acres of land has to be secured in consultation with the villagers (priority I). Since the corridor is sharing its other boundary with Karnataka forest department, similar practice has to be done in Karnataka state also, where 11 acres of land has to be secured as priority I and 39 acres as priority II respectively.

Fig 7: Landscape map showing identified land for securing at Tali corridor



6. Socio-economic status of three tribal settlements

The socio-economic data was collected for three major settlements which are located inside the corridor namely, Balagaari, Basuvanpura and Poojaradoddi. Although the corridor's width may not be critical for the movement of elephants between Anekkal and Jawalagiri ranges, the above mentioned villages in the Tamil Nadu part are more prone to

human-elephant conflict. Therefore it is recommended to undertake strong eco-development project in these villages as they are totally depended on their surrounding forest areas for all purposes. These villages have about 27 families with a population of about 300 people

Table 8 Human population status in three forest enclosure villages of Tali corridor

S.No	Name of village	Male	Female	Total population	Total families
1	Balagaari	130	120	250	17
2	Basuvanapura	18	10	28	4
3	Poojaradoddi	12	11	23	6

Table 9 Percentage of different type of houses recorded in adjoining villages of Tali corridor

S.No	Type of House	Name of the tribal settlements		
		Balagaari	**Basuvanpura**	**Poojaradoddi**
1	Earthen	21.4	50	100
2	Cemented	78.6	50	0
	Flooring Status			
3	Flooring :Mud	21.4	50	100
4	Flooring :Cemented	78.6	50	0

Houses in Poojaradoddi village houses are still earthen type with mud flooring and the house roofs are made up of thatched leaves using local grasses. Other two villages are considerably good. In Balagaari, out of 14 houses 11 houses are concrete with cemented flooring.

Table 10. Resources extracted from Tali corridor areas

S.No	**Resources extracted from corridor areas**	**Name of the tribal settlements**		
		Balagaari	**Basuranpura**	**Poojaradoddi**
		Percentage		
1	Fuel Wood collection	0	0	0
2	NTFP, Fuel Wood. Fodder Collection & Agriculture	78.6	25	0
3	NTFP, Fuel Wood, Fodder Collection, Agri ulture, & House Construction	21.4	75	100

Resources extracted from the corridor areas are quite interesting in three enclosure villages. None of the villages are dependent for fuel wood resource from the surrounded corridor forest areas as they use agricultural wastes for cooking. On the other hand, majority of them depends on the corridor resources for NTFP collection, fodder collection for their livestock, small timber resources for making agriculture materials and for house construction.

Table 11.Percentage occupation of adjacent villagers of Tali corridor

S.No	**Occupation**	**Balagarai**	**Basuranpura**	**Poojaradoddi**
1	Agriculture	89.3	86.36	100
2	Private job	5.3	0	0
3	Government	0	0	0
4	Business	5.3	13.64	0

The occupation status of the people living in three enclosure villages revealed that the majority of them are purely dependent on agriculture. Very less number of people has private jobs and business in Balagari and Basuvanpura village. The major reason would be that these villages are not easy accessible to any towns due to lack of road and public transport facilities and most of them are either illetrate or with basic primary education

(table 13). Each house of these villages has at least one donkey to carry load to reach near towns.

Table 12. Percentage of major crops grown in the area

S.No	Major crops cultivation	Scientific name	Balagari	Basuranpura	Poojaradoddi
1	Maize	*Zea maize*	21.4	0	0
2	Finger Millet	*Eleusine coracana*	78.6	100	100

Crops preferred by elephants are under practice in all three forest enclosure villages. Finger millet is the main crop grown by the people. Since the lands is neither suitable for food crop such as paddy nor economic crop such viz sugarcane and banana, people mainly dependent on finger millet as their food crop.

Table 13. Education status of the village people

S.No	Education status	Balagari	Basuranpura	Poojaradoddi
		In percentage		
1	A	74.7	92.85	82.6
2	B	10.8	3.57	17.4
3	C	7.2	3.57	
4	D	6.02		
5	E	1.2		
6	F	0		
7	G	0		

A=No formal education or illiterate; B=Primary level or below; C=Middle School or above primary level; D=High School or above middle school level; F=Higher Secondary;G=Degree or above higher secondary level

Almost 79.8% of the people of these three villages are either illiterate or with very basic education and very few have reached till middle school. Hence, the have very little job oppurtunities and mainly depended on agriculture.

Table 14. Perception on HEC in forest enclosure villages of Tali corridor

S.No	Name of the villages	Present status of Human elephant conflict		Intensity of conflict has increased over time		Degree of HEC		
		In percentage						
		Yes	**No**	**Yes**	**No**	**High**	**Medium**	**Low**
1	Balagaari	100		100		78.6	21.4	0
2	Basuranpura	100		100		100	0	0
3	Poojaradoddi	100		100		100	0	0

(High - > 40%; Medium – 30% - 40%; Low – 20% - 10%)

Almost all the people across the villages feel that human-elephant conflict is a major isuue and the incidence of conflict is on the rise in last one decade. Almost 87% feels the conflict is very high

Table 15. Percenatge of people's Perception on reasons of HEC in three forest enclosure villages of Tali corridor

S.No	Name of the Villages	Increase of elephant population	Good forest but loss of habitat quality for elephant	Lack of Water	Elephant population as well as good forest but loss of habitat quality for elephant
1	Balagaari	50	25	12.5	12.5
2	Basuranpura	75	25	0	
3	Poojaradoddi	83.3		16.7	

Reason for ever increasing human-elephant conflict as revealed by the survey indicates that the elephant population has increased in the past decade. About 25% of the people responded that loss of habitat quality followed by water scarcity and increase of elephant population as well as loss of habitat quality as causative factors.

Table 16. Perception of people on crop depredation by elephants in forest enclosure villages of the corridor (in percentage)

S.No	Name of the village	Ever experience crop damage by elephants		Period of elephant's visits		Degree of crop damage by elephants		
		Yes	No	Seasonal	Through out the year	High	Medium	Low
1	**Balagaari (n=14)**	100			100	78.6	21.4	
2	**Basuranpura (n=4)**	100			100	100		
3	**Poojaradoddi (n=6)**	100			100	100		

Crop depredation by elephants still exists in all three forest enclosure villages. Locals also indicated that elephants are seen throughout the year in their agriculture land adjacent to the villages. Degree of crop damage by elephants also seemed to be increasing every year .

Table 17.Percentage of various mitigation measures used by the forest enclosure villages of Tali corridor against HEC

S.No	Types of mitigating measures	Balagaari	Basuranpura	Poojaradoddi
1	Crackers and Night guarding	100	100	100
2	AC charged battery fencing with night guarding	0	0	0

The forest department of Tamil Nadu has erected solar power fence covering all three forest enclosure villages. Due to lack of people's participation the total investment and instrument have failed. In the first year, the fence worked as an effective barrier but during subsequent years, due to lack of maintenance the entire fencing system had been damaged and one or two left over poles were seen in some places during survey. The forest department claims that regular anti-depredation activities are being carried out during the migratory season (October-March). But it is recommended that strong eco-

development activity be carried out in all three enclosure villages with people's participation in order to win their confidence for elephant conservation.

Table 18. Details of ex-gratia payment recorded in the adjoining villages of Tali corridor

S.No	Name of the Village	Number of people applied for ex-gratia payment		Number of people received ex-gratia payment
		Yes	No	
		Percentage of people interviewed		
1	Balagaari	78.6	21.4	57.1
2	Pasuvanapuram	100	0	0
3	Poojaradoddi	0	0	0

Table 19. Livestock population in three forest enclosure villages of Tali corridor

Name of the animals	Balagari (n=14)	Pasuvanapuram (n=4)	Poojaradoddi (n=6)
Cattle	39	22	8
Goat	78	15	13

Livestock is the major source for green manure as well as economic resource for the people to meet their family expenses. Especially goat population was seemed to be high. Donkey was another important animal the people had for carrying loads to near by towns.

Fig 8. Field Officer collecting village data

7. Conservation plan for corridor securement

1. The corridor should be notified by the state forest department and legally protected under appropriate law to prevent encroachment and developmental activities in the corridor detrimental to animal movement..
2. In consultation with the villagers, about 28 acres of land near Belalam village (Tamil Nadu part) and 11 acres (Karnataka part) are to be secured as priority to prevent discontiguity of the corridor.
3. Undertake eco-development activities in Balagarai, Basuvanpura and Poojaradoddi villages to reduce their dependency on corridor forest, especially alternate arrangement for fuel wood and stall feed for cattles.
4. Regulate vehicular traffic in morning and evening.
5. Awareness program targeting the villages living both within and on the fringe of the corridor be carried out through schools and community organizations informing them about the criticality of the corridor area and the increased human-elephant conflict in the area due to its obstruction.

4. Karadikkal - Madeswara Elephant Corridor

Alternate Name : Ragihalli Corridor

The Bannerghata National Park (BNP) although administratively one of the smallest National Parks (102.74 km^2) 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 in Southeast and the Kanakapura forest division of the Karnataka state to the Southwest. These forest divisions further connects to the forest tracks of the Cauvery Wildlife Sanctuary eventually joining the Nilgiri Biosphere Reserve of Western Ghats forest at Nilgiris, stretching through Malaimahadeshwara hills, Biligiri Ranga Temple Sanctuary, Kollegal Forest Division and Sathyamangalam Forests.

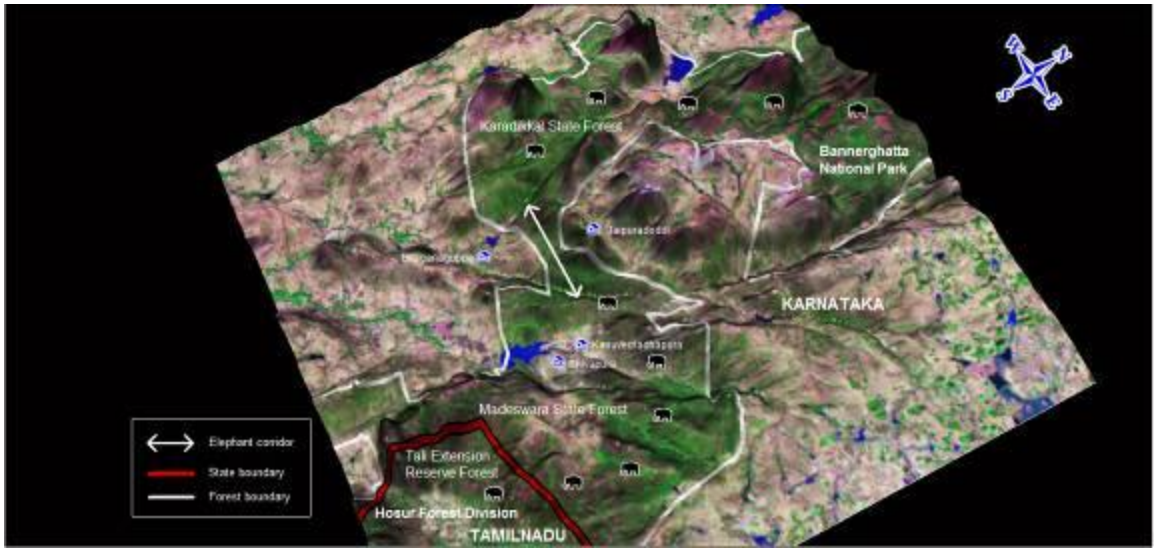
The elephants are found to be distributed in the entire park with seasonal fluctuation. The fluctuations facilitate the presence of more elephants in Bannerghatta and Anekal ranges of the park. To move between these two ranges, they have to traverse through Harohalli range. The Karadikkal-Madeswara elephant corridor located in Harohalli range that facilitates elephant movement between Bannerghatta and Anekal ranges of the park.

Location: This narrow corridor connects the northern and southern portions of Bannerghatta National Park and is located between Bilaganaguppa and Jayapuradoddi settlements connecting Karadikkal – Madeswara State forests. This corridor lies between 77^0 33.6 - 77^0 34.8 E longitidue and 12^0 41.4'- 12^0 42' N latitude. Shivapura is a major settlement adjacent to the corridor. There are no settlements or habitation inside the corridor. The main corridor dependant villages are Bilaganaguppa and Jayapuradoddi.

Connectivity: The corridor connects northern and southern portion of Bannerghata National Park.

Average length and Width: The corridor measures about one kilometer in length and 300-500 meters in width connecting northern and southern portion of BNP.

Fig 1. 3D m*ap showing Satellite Imagery of Karadikkal - Madeswara corridor at landscape level*



Brief profile of Bannerghatta National Park (BNP)

The park lies between $12^0$34' - 12^0 50' N and 77^0 31' - 77^0 38' E and is divided into three wildlife ranges, Viz. Bannerghatta, Harohalli and Anekal 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 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 eight months (April- November) with the maximum rainfall (50%) normally occurring between August and October (Gopalkrishna *et al*, 2010).

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. 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 (*Rusa unicolor*), spotted deer (*Axis axis*), leopard (*Panthera pardus*), wild dog (*Cuon alpines*), wild boar (*Sus scrofa*), sloth bear (*Melursus 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.

1. Estimation of elephant numbers and usage

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/km$_2$ (Table 1) respectively for the BNP (AERCC 2002, 2006; Bhaskaran *et al.* 2007). The mean density clearly shows increasing trend in the elephant population. Also census result revealed that 105 to 191 elephants are extensively using this corridor to fulfill their annual and seasonal requirements.

Table .1 Estimated elephant numbers in Bannerghatta National Park

Year	Elephants/Km^2	Mean No. of elephants	95 % Confidence Interval	
			Lower	Upper
2002	0.68	71	21	121
2005	0.71	74	52	160
2007	1.41	148	105	191

(Source: AERCC 2002, 2006; Bhaskaran et al. 2007)

Dung density was estimated at 618 / km^2 in the present study on the Karadikkal – Madeswara elephant corridor (Table 2). Studies in Flume channel elephant corridor of Mudumalai Tiger Reserve in Western ghats has shown elephant dung density of 637.9 / km^2 which has Dry deciduous and Thorn Forests. (Ramkumar & Arumugam 2005).

Table.2 Elephant dung density in the present study

No. of Belt Transects	**No. of dung piles recorded**	**Total length of the Transects (Km)**	**Width of the Transects (m)**	**Elephant dung density / Km^2**
3	34	5.5	10	618.18

2. Assessment of habitat quality

2a. Status of trees, regeneration and recruitments

A total of 24 plant species were recorded in the 0.3 ha sampled area (Table 3) of which 14 species were considered to be elephant food species. Wood cutting signs were recorded for seven plant species, of which five species are elephant food species. Regeneration and recruitment classes of plant species were also recorded in the sampled area.

Fig. 2 Field team marking a transect in the Karadikkal – Madeswara elephant corridor

Table.3. Status of trees, regeneration and recruitment

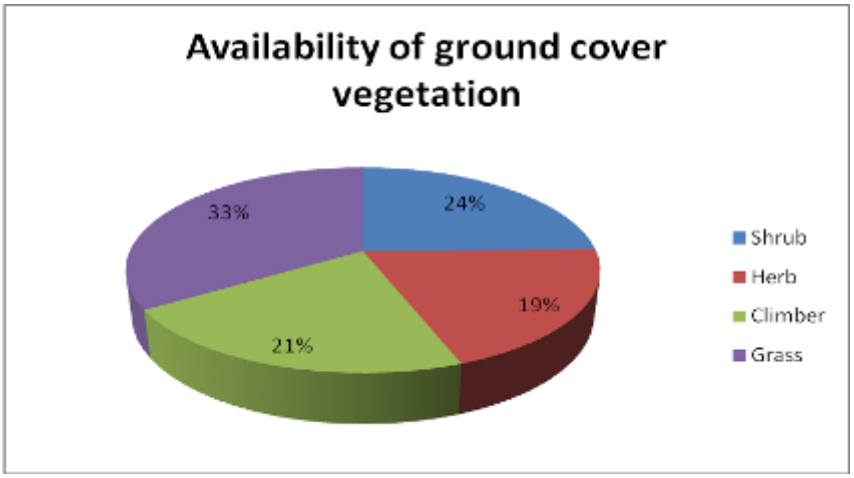
Species Name	Frequency of Tree/Shrub	Average GBH (cm)	Average Height (m)	Lopping	WC	RG	RC	Elephant Food Sp.
Acacia chundra	44	38.7	7.3	-	1	-	15	+
Achyranthes aspera	2	66.7	10.5	-	-	-	-	-
Azadirachta indica	2	67.5	13.2	-	1	-	-	+
Aalipa sps	4	47.2	11	-	-	2	-	+
Anogeissus latifolia	16	35.8	8.62	-	-	20	6	-
Bambusa arundinaca	11	-	-	-	-	4	11	+
Boswellia serrata	6	41.3	11.5	-	-	-	-	-
Cassia fistula	2	40	5.5	-	1	-	-	-
Chyloroxylon swietenia	5	39.8	6.4	-	-	9	-	+
Diospyrous Montana	2	50	10.5	-	-	-	-	+
Eriolaena hookeriana	6	40.1	10.8	-	-	-	2	+
Ficus benghalensis	2	55	12.5	-	1	-	-	+
Jana	2	36	4	-	2	-	-	+
Hardwickia binata	1	22	3-	-	-	-	-	+
Ixora pavetta	3	45	4.6	-	-	2	-	-
Kajalikai	-	-	-	-	-	13	-	-
Lantana camara	-	-	-	-	-	-	31	-
Lagerstroemia parviflora	11	32.2	5.45	-	-	-	-	+
Maytenus emarginata	6	26.1	4.6	-	-	-	11	-
Paptigai	-	-	-	-	-	35	-	-
Randia dumetorum	1	-	-	-	1	-	9	-
Symida febrifuga	3	61.6	15.6	-	-	-	-	+
Santalum album	1	22	-	-	1	-	-	+
Vitex altissima	1	45	8	-	-	-	-	+

WC = Wood cutting, RG = Regeneration, RC = Recruitment class

2.b. Availability of ground cover vegetation

Among the four ground cover vegetation type, grass has attained high percentage of ground cover (33 %) followed by Shrubs (24 %) and climbers (21 %) (Fig. 3).

Fig. 3. Availability of Ground cover vegetation (Sampled Area 0.015 Ha.)



2c. Availability of ecological resources to the elephants

The corridor attributes for 58 % of elephant food species in the overall vegetation cover. The availability of other ecological resources plays a major role for the elephants to use this corridor effectively. Especially bamboo patches and natural saltlicks are available in this corridor

Table .4. Availability of ecological resources in the Karadikkal-Madeswara corridor (Sampled Area = 0.3 ha)

Sl.No	**Name of the ecological resources**	**Total numbers**
1	Water source (Seasonal)	3
2	Water source (Perennial)	2
3	Fruit bearing trees	1
4	Shade trees	2
5	Natural salt licks	1
6	Elephant food species	14

4. Threats to the corridor

3a. Biotic threat to the corridor

Fig. 4 Developmental activities are being done inside the BNP by the private land owners at Kembadoddi (left) and Stone quarry near to Bannerghatta National Park(right)

Table. 5 .Biotic threats to the corridor

S.No	Name of the village	Cattle grazing	Fuel wood collection		Fodder collection		Agriculture purpose	
			Male	Female	Male	Female	Male	Female
1	Kanuvemadhapura	400-500	4	7	12	2	4	-
2	Jayapuradoddi	250-300	-	5	8	-	-	-
3	Beliganaguppa	70-80	-	4	7	2	3	-

3.b. Corridor dependent villages/forest settlements

1) Kanuvemadhapura
2) Jayapuradoddi
3) Sivanahalli
4) Shivapura
5) Beliganaguppa
6) Urigendoddi

Fig.5 Kanuvemadhapura Village

Fig.6 Jayapuradoddi – Bilaganaguppa road

Fig.7 Harohalli-Anekal state highway

3c. Traffic intensity

The traffic intensity was recorded round the clock for two full days on the state highway Anekal – Harohalli and mud road between Jayapuradoddi – Bilaganaguppa, which bisects the Karadikkal – Madeswara corridor exactly in the middle.

An average of 32 vehicles was recorded in an hour in the Anekal – Harohalli state highway (Fig. 7). Vehicle movement was high between 10 – 11 Hrs (83 vehicle) followed by 11 – 12 Hrs (73 vehicle) and 17 – 18 Hrs (62 vehicle). An average of 30 vehicles plies per hour between 18 – 24 Hrs. On the contrary an average of only 3 vehicles were observed between 0 – 6 Hrs. This is good sign for elephants, because most of the elephants are crossing the road during evening and night times.

Since mud road of Jayapuradoddi – Bilaganaguppa bisects the corridor exactly in the middle connecting two main corridor dependant villages, the people movement also was taken in the account for traffic intensity. As expected, the people movement was very high (79 people) compared to vehicle traffic (38 vehicle) during the 24 hours time period. Since four wheeler and other heavy vehicles were banned to use this road, two wheeler and three wheeler were only recorded.

Figure 8. Traffic Intensity in the Harohalli - Anekal road

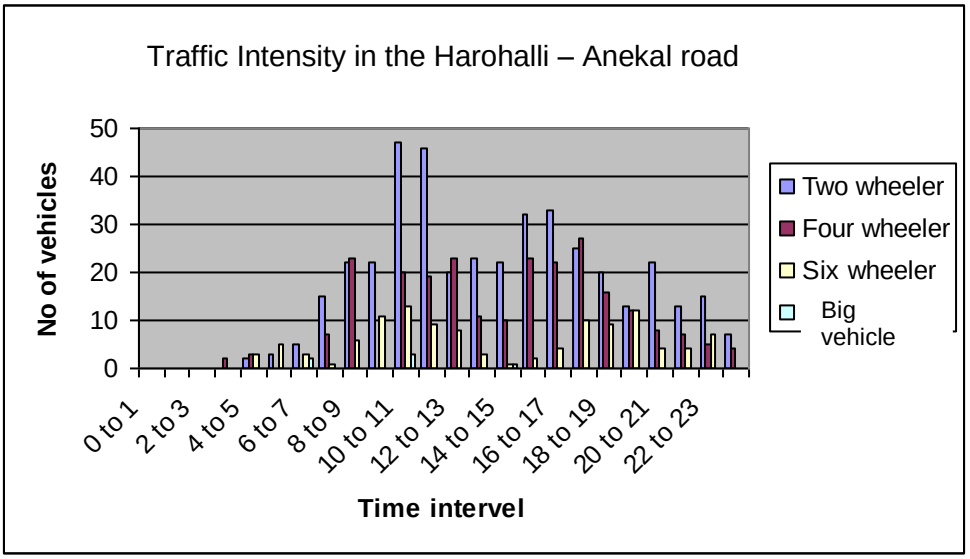
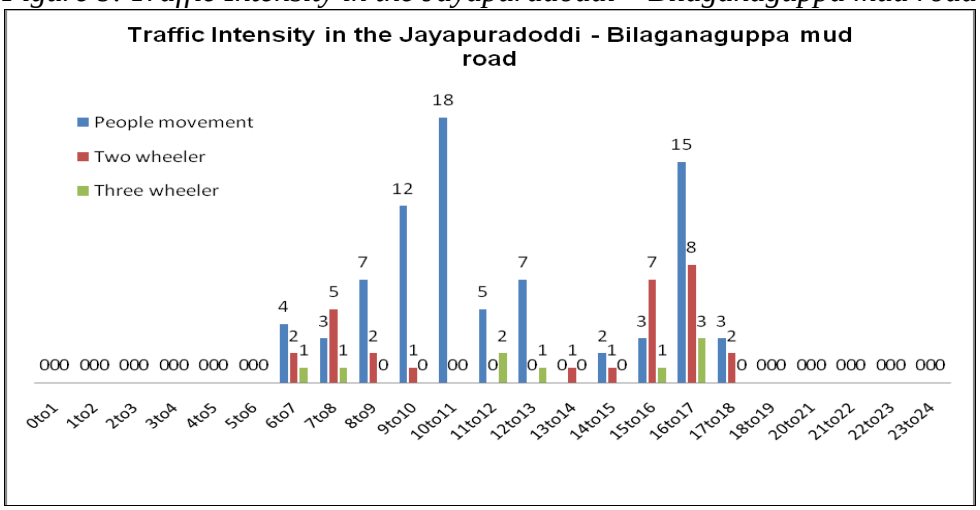


Figure 9. Traffic Intensity in the Jayapuradoddi – Bilaganaguppa mud road



4. Human elephant conflict

4a. Crop Damage

The crop damages were recorded from the records of forest department. Crop damage data was collected from 1998 – 2008. Data was not available from 2002 – 2005. The highest number (1477) of crop depredation was recorded in BNP during 2005 – 2006. Increased trend was recorded from 1998 – 2006 but after 2006 there is decreasing trend in the number of crop depredation in the BNP.

Table.6. 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	**No. of crop damages**	**Compensation (Rs)**
1998 - 1999	428	4,06,178
1999 – 2000	1085	12,56,804
2000 - 2001	1165	14,89,821
2001 – 2002	1247	11,11,550
2005 – 2006	1477	18,48,269
2006 – 2007	825	10,64,723
2007 - 2008	500	5,61,365

4b. Human death and Injuries

The data on human deaths and injuries recorded for a period of 8 years between 1997 and 2008 revealed that on an average two people were killed and similar number of people injured every year by the wild elephants. Most of the human deaths had occurred in the crop fields while guarding during night and on roads during commute.

Table. 7 Human deaths and injuries reported in BNP from 1997 to 2008

Year	No. of Deaths	No. of Injuries	Compensation (Rs)
1998 - 1999	3	1	135020
1999 – 2000	3	1	210012
2000 - 2001	2	2	144996
2001 – 2002	2	1	88021
2005 – 2006	3	6	360512
2006 – 2007	1	4	157595
2007 - 2008	2	1	320006

Source: (BNP Management Plan 2002-04 & 2008-09 to 2012-13)

4c. Elephant death and injuries

On an average two elephants were killed in this park due to human elephant conflict every year. The major cause of death was found to be electrocution caused by illegal power lines drawn by farmers intentionally around their crop fields and elephants coming in contact.

Table. 8 Elephant deaths and injuries reported between 1997 and 2008

Sl.No	Year	No. of deaths	Reason for elephant death			
			Poaching	Electrocution	Natural	Other
1	1997 - 1998	1	0	1	0	0
2	1998 - 1999	2	0	1	0	1
3	1999 - 2000	4	1	2	0	1
4	2000 - 2001	3	0	3	0	0
5	2001 - 2002	1	0	0	1	0
6	2002 - 2003	0	0	0	0	0
7	2003 - 2004	3	0	2	0	1

8	2004 - 2005	3	0	1	1	1
9	2005 - 2006	4	0	1	1	2
10	2006 – 2007	1	0	0	0	1
11	2007 - 2008	1	0	0	0	1

Source: BNP Management Plan (2002-2004 & 2008-09 to 2012-13

The season of arrival of the migratory elephants also coincides with the peak cropping season in the landscape thus making the crops highly vulnerable to raids. This leads to the increasing number of encounters between the man and elephants resulting in loss of not only crops and human lives but also elephant lives in retaliation. In recent past, three incidents of elephant killing using fire arms were reported. This was never a trend in the park and this 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 became the victim.

5. Socio-economic status of three villages

Sample survey was carried out for Kanuvemadhapura village and stake holders of Jayapuradoddi and Bilaganaguppa village to understand their socio-economic condition and dependency on corridor forest.

Fig.8 WTI field officer enquiring with forest officials regarding elephant movement (left) and collecting Socio economic data from the villagers (right).

Table.9 Percentage of various type of houses recorded adjoining villages of Karadikkal & Madeswara corridor

S.No	Type of House	Kanuvemadhapura	Jayapuradoddi
1	Earthen	20	0
2	Cemented	80	80
	Flooring Status	0	0
3	Flooring :Mud	20	0
4	Flooring :Cemented	80	100

Table .11 Resources extracted from Karadikkal & Madeswara corridor areas

S.No	Resources extracted from corridor areas	Name of the tribal settlements		
		Kanuvemadhapura	Jayapuradoddi	Beliganaguppa
1	Fuel Wood collection	0	0	0
2	Fuel Wood, Fodder Collection & House construction materials	20%	40%	40%
3	Fodder Collection, Agri culture	80%	0	60%
4	Agriculture	0	60%	0

Table .11 Percentage occupations of adjoining villagers

S.No	Occupation	Kanuvemadhapura	Jayapuradoddi
1	Agriculture	77.6	50
2	Private job	13.4	25
3	Government	4.5	0
4	Business	4.5	25

Table. 12. Percentage of major crops grown

S.No	Major crops cultivation	Kanuvemadhapura	Jayapuradoddi
1	Maize	0	0
2	Ragi	75	50
3	Avari	0	0
4	Rice	12.5	50
5	Sericulture	12.5	0

Table .13 Education status of the village people

S.No	Education status	Kanuvemadhapura	Jayapuradoddi
	Percentage of people surveyed		
1	A	58.3	0
2	B	5.2	0
3	C	3.12	50
4	D	8.3	0
5	E	7.3	0
6	F	5.2	50
7	G	4.16	0
8	H	8.3	0
9	I		0

A=No formal education or illiterate; B=Primary level or below; C=Middle School or above primary level; D=High School or above middle school level; F=Higher Secondary;G=Degree or above higher secondary level:H=PG Level;I=Engineering or medical or others professional degree

Table .14. Live stock population in three villages

S.No	Name of the animals	Kanuvemadhapura	Jayapuradoddi	Beliganaguppa
1	Cattle	51	0	2
2	Buffalo	1	0	0
3	Goat	0	0	60
4	Sheep	5	0	1200

Table. 15. Perception on Human Elephant Conflict

S.No	Name of the village	Present status of Human elephant conflict		Intensity of conflict has increased over time		Degree of HEC		
		Yes	No	Yes	No	High	Medium	Low
		Percentage of people surveyed						
1	**Kanuvemadhapura**	100	0	100	0	85	15	0
2	**Jayapuradoddi**	100	0	100	0	100	0	0
3	**Beliganaguppa**	100	0	100	0	100	0	0

(High - > 40%; Medium – 30% - 40%; Low – 20% - 10%)

Almost all people had experienced crop damage by elephants at least once in their life. All the people expressed that elephants are visiting the villages almost throughout the year and the intensity of conflict is on the rise.

Table .16 Perceptions of people on crop depredation by elephants

S.No	Name of the Village	Ever experience crop damage by elephants		Period of elephant's visits		Degree of crop damage by elephants		
		Yes	No	Seasonal	Throughout the year	High	Medium	Low
		Percentage						
1	Kanuvemadhapura (n=20)	100	0	0	100	90	10	0
2	Jayapuradoddi (n=4)	100	0	0	100	100	0	0
3	Beliganaguppa	100	0	0	100	100	0	0

High - > 40%; Medium – 20% - 40%; Low – 10% - 20%)

Almost 55 % of the people's feel that increase of elephant population as well as good forest but loss of habitat quality for elephants as the main cause of increased HEC. Fourty percent of people expressed that increase of elephant population only as the main reason for HEC in this region.

Table. 16. Perception of people on reasons for Human Elephant Conflict

S.No	Name of the Village.	Increase of elephant population	Good forest but loss of habitat quality for elephant	Lack of water	Increase of elephant population as well as good forest but loss of habitat quality for elephant
		Percentage			
1	Kanuvemadhapura	40	0	5	55
2	Jayapuradoddi	0	0	0	100
3	Beliganagupa	0	0	0	100

The Karnataka Forest Department has erected AC charged fencing and Rubbel wall for the Bilaganaguppa village. In some places of Bilaganaguppa, Elephant Proof Trenches (EPT) was erected by Forest Department. AC charged fencing and Rubbel wall were also provided to Jayapuradoddi and Kanuvemadhapura villages but most of them are non functional due to lack of maintenance and lack of community participation. Presently people use traditional methods of night guarding using machans (tree platforms) and applying crackers for driving elephants.

Fig. 9 Rubbel wall with AC charged fencing in the Bilaganaguppa village (left) and AC charged fencing in the Bilaganaguppa Village (right)

6. Conservation plan

1. The corridor should be notified by the state forest department and legally protected under appropriate law to prevent encroachment and developmental activities in the corridor detrimental to animal movement.

2) A total of about 87 acres of land has been identified to be secured to increase the width of the corridor from 510 m to 1000 m (Fig. 10-11, Table 18). A private estate is found all along the southern boundary of the corridor. A private resort is also there at the fringe of the corridor. The owner has purchased this land and created a cattle form and resort in 2000-01. Identified lands on the Northern side have been purchased by Bangalore residents as investment. Presently no activities were seen in the proposed land. Even though the present corridor width is intact and there is

no problem for elephants for crossing the area, there are potential threats of new developmental activities coming up along the both boundary of the corridor.

Considering the importance of the corridor and future threats it is suggested to acquire 87 acres of land and keep it as a buffer zone for the corridor to prevent developmental activities along the corridor fringes as well as prevent the elephant straying into the Bilaganaguppa and Jayapuradoddi villages.

3) Kanuvemadhapura and Shivapura villages are also very important for the conservation of Karadikkal – Madeswara elephant corridor. These villages are situated just outside the bottle neck of the corridor. More than 75 families live in these villages and total extent of area is 570 acres. Almost all the peoples are ready to move out from the villages due to severe human elephant conflict. They have voluntarily expressed their interest to forest department to move out from the village if suitable alternatives are available. In case if this is not possible, they should be provided with suitable eco-development assistance and livelihood support to reduce depenedency on corridor forest.

4) Awareness program targeting the villages living on the fringe of the corridor (Jayapuradoddi, Bilaganaguppa, Kanuvemadhapura and Shivapura) be carried out through schools and community organizations informing them about the criticality of the corridor area and the increased human-elephant conflict in the area due to its obstruction.

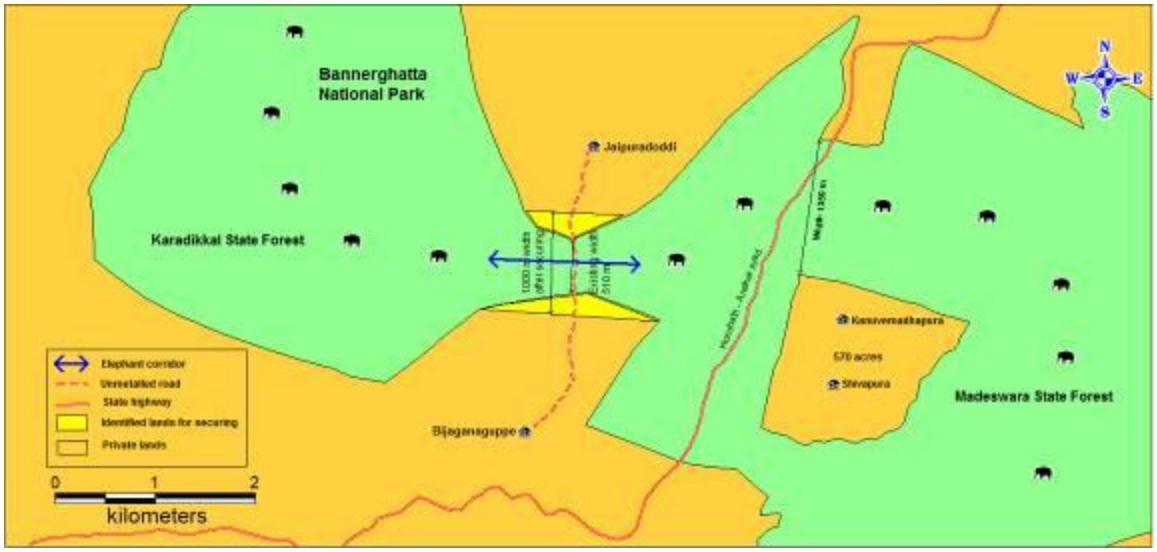
Fig 10. WTI field officers identifying the lands for acquisition (left) and Dr.B.Ramakrishnan showing a private resort located in fringe of the corridor (right).

Table. 18. Details of lands identified for securing

Village Name	Name of the land owners	Extent of Area (acres)	Status of the Land
Jayapuradoddi	Laxmi narayan	35	Patta
	Theiraji		Patta
	Rasu		Patta
	Narayanappa		Patta
Bilaganaguppa	Ravi	52	Patta

Fig.13 Part of the identified land for acquisition in the Bilaganaguppa village (left) and Mr.K.Ramkumar and team members are doing GPS survey along the corridor boundary (right)

Fig. 14 Landscape map showing identified land for securing at Karradikkal- Madheswara corridor



5. Periya at Pakranthalam Elephant Corridor

Alternate Name : Pakranthalam Corridor

The corridor is narrow and connects the northern and southern portions of the Periya Reserve forest in Wayanad North Division along the Mananthavadi-Kuttiadi road at Pakranthalam. The corridor is situated on a hill road and the lower reaches of this corridor pass through fallow estate land.

Location: The corridor lies between longitude 75^0 49.2'- 75^0 49.4'E and latitude 11^0 43.8' - 11^0 43.9'N. Pakranthalam and Pannoth are the major corridor dependant villages situated adjacent to the corridor. There are no settlements or habitation inside the corridor.

Connectivity: Northern and Southern portion of Periya Reserve Forest

Average length and width of the corridor: Length is about 500 meters and width about 300 meters

Fig 1. 3D m*ap showing Satellite Imagery of Periya at Pakranthalam corridor at landscape level*

1. Estimation of elephant numbers

Dung density was estimated at 1000 / km^2 in the present study on the Periya at Pakranthalam elephant corridor. Two one kilometer transects were laid and only 5 meters width followed for observing the dung piles due to poor visibility.

2. Assessment of habitat quality
2a. Status of trees

Totally 17 plant species were recorded in the 0.2 hectare sampled area of which seven species were considered to be elephant food species. Among the plant species *Schleichera oleosa* and *Bischofia javanica* were the dominant species.

Table 1. Status of trees

Tree species Name	Botanical Name	Freq of trees	Average GBH (Cm)	Average Height (Feet)	Elephant Food species
Puvam	*Schleichera oleosa*	12	74	40	-
Vattu	*Macaranga indica*	2	56	35	-
Vattu sp		11	42	30	+
Kattu chamba	*Magnolia nilagica*	5	85	35	+
Vetti	*Aporusa cardiosperma*	11	25	20	+
Mukkani	*Clutia retusa*	5	210	50	-
Chamba	*Magnolia champaca*	6	53	35	-
Neeli	*Bischofia javanica*	11	96	45	-
Vazha	*Dillenia pentagyna*	3	80	45	+
Vayanavu	*Mesua ferra*	10	195	50	+
Thoka vayanaval		7	25	20	-
Periyam	*Syzygium travancoricum*	1	140	45	-
Vella eeti	*Dalbergia lanceolaria*	7	85	40	+
Kolangi		10	240	50	-
Ven pine	*Vateria indica*	1	130	50	+
Ven teak	*Lagerstroemia microcarpa*	4	238	45	-
eeti	*Dalbergia latifolia*	2	145	40	-

2b. Availability of ground cover vegetation:

Among the three ground cover vegetation type, Shrub covered almost 40% of the ground cover followed by grass (30 %) and herb (30 %)

Fig.2 Field officer undertaking vegetation study in the corridor

3. Threats to the Corridor

a) ***Kozhikode-Mananthavady road***: This is the alternative road for the Kalpetta road which connects Kozhikode and Mananthavady. Mainly tourist vehicles and tipper lorries passes throughout the day

b) ***Plantation***: The whole corridor is blocked by a patch of private land which is partially cultivated

c) ***Emerging resorts***: Within 200 meters of the corridor and one meter from the forest boundary, a resort is being constructed. This is going to be a major hurdle for movement of elephants and other animals.

3a. Corridor dependent villages/forest settlements

1) Pakranthalam
2) Pannoth

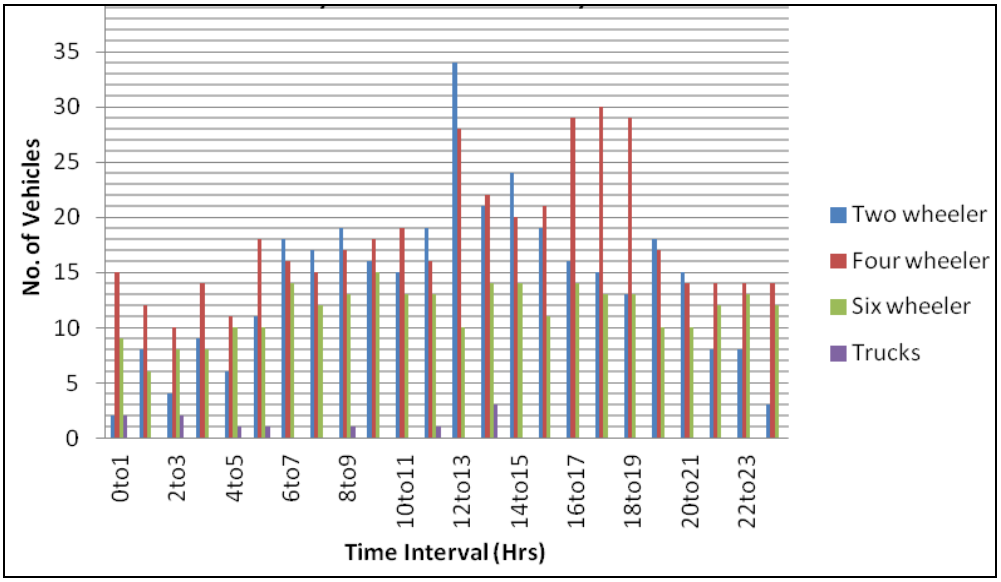
Fig. 3 Mananthavady – Kuttiady state highway bisecting the corridor.

3b. Traffic intensity

The traffic intensity was recorded round the clock for two full days on the state highway Pakranthalam – Mananthavady. An average of 44 vehicles was recorded every hour. Vehicle movement was high between 13 - 14 Hrs (60

vehicle) followed by 14 - 15 Hrs (58 vehicle) and 17 – 18 Hrs (58 vehicle). Day time vehicle movement between 6 – 20 hrs was recorded to be 53. Vehicle movement during nighthours between 20 – 6 hrs was recorded to be 31. As most of the elephants cross the road during evening and night times, the threat from road is still not large due to less movement of vehicle in early morning and evening.

Fig. 4. Traffic Intensity in the Mananthavady – Pakranthalam road



5. Conservation plan

1. The corridor should be notified by the state forest department and legally protected under appropriate law to prevent encroachment and developmental activities in the corridor detrimental to animal movement.
2. About 31.8 acres of land has been identified that should be secured to restore the corridor (Table 2, fig.5). All are private lands owned by four persons. They are not the resident of the area and keeping these areas with business interest and as farm land. Coffee, areca-nut, ginger, turmeric etc are being cultivated in the farm land. Also there is a mobile tower found to be in the exact narrow corridor and subsequently cut off the elephant migration. The mobile tower is located in the 13.5 acre plot and is the most vital land for securement. Since the traditional corridor is almost blocked, the

elephants are mostly through the three plots. Hence it is important to secure all the four land in the corridor to facilitate elephant movement.

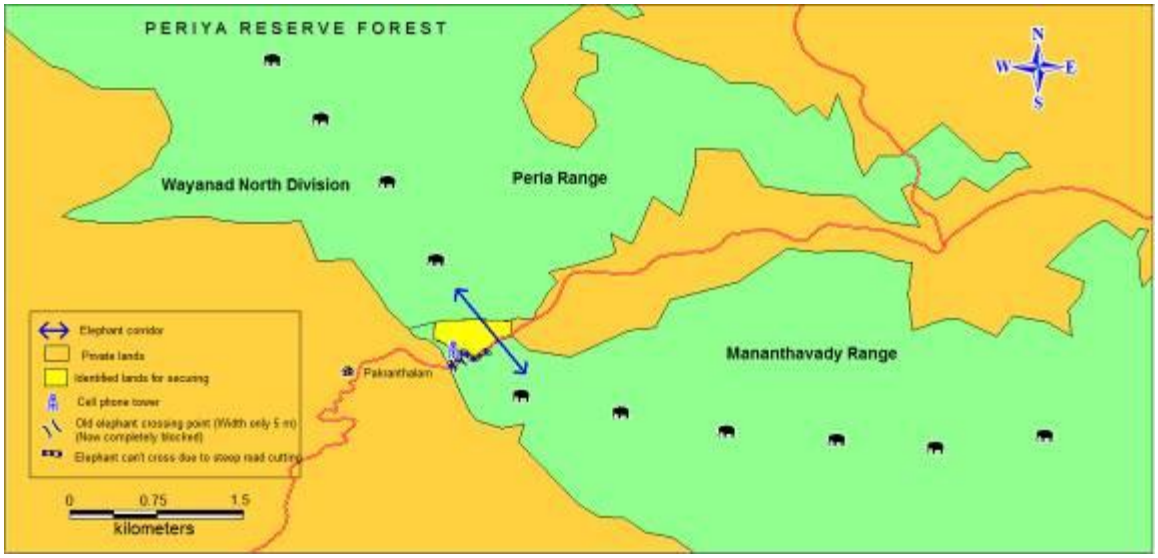
Table. 2 Details of lands identified for acquisition

Name of the land owners	Extent of Area (acres)	Status of the Land
Muhammad Rafeeq	13.50	Patta land
Dr. Chandramohan	6.70	Patta land
Rakesh	8.6	Patta land
Abdulla	3	Patta land

3. Awareness program targeting the villages living on the fringe of the corridor be carried out through schools and community organizations informing them about the criticality of the corridor area and the increased human-elephant conflict in the area due to its obstruction.

4. Eco-development activities to be taken up in the nearby villages (Pakranthalam and Panoth) to reduce dependency on the corridor forests, especially providing alternatives for fuel wood

Fig. 5. Landscape map showing identified land for securing at Periya at Pakranthalam corridor corridor



6. Nilambur Kovilakam – New Amarambalam Elephant Corridor

Alternate Name : Vazhikadavu Corridor

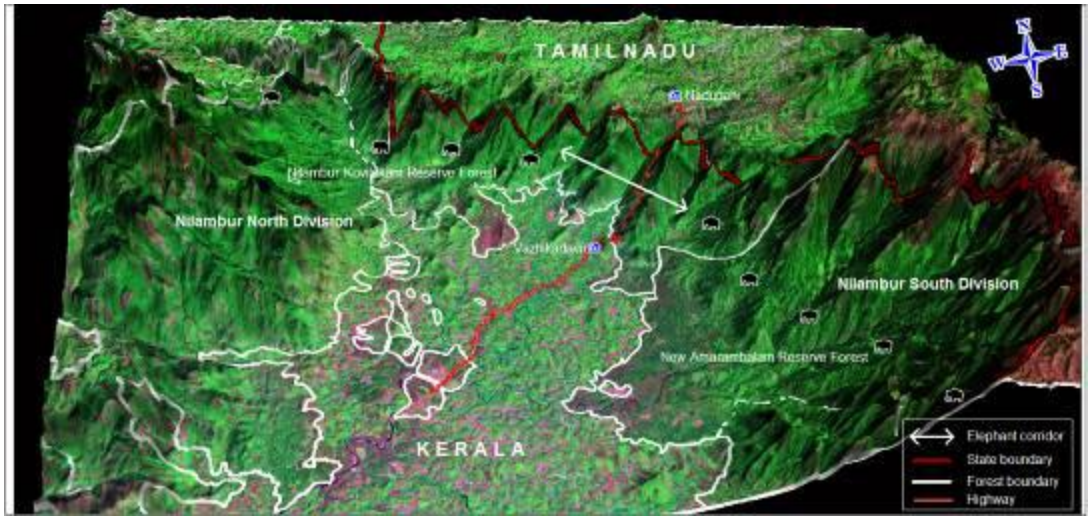
The corridor is situated on the Gudalur-Nilambur Ghat road. A stretch of forest exists on both side of the road. However, the slopes are steep for elephant crossing at most places. The elephants crossing were reported from four points between Vazhikadavu and Nadugani check post.

Location: This corridor lies between longitude 76^0 20.4' - 76^0 24' E and latitude 11^0 24.6' - 11^0 27' N. The corridor is located within the Vazhikavu Range of Nilambur North Forest Division.

Connectivity: The corridor connects Nilambur Kovilakam Reserved Forests of Nilambur North Division and New Amarambalam Reserved Forests of Nilambur South Division. The corridor links Wayanad South Division in the north-west and leads to Nilgiri Biosphere Reserve, Nilambur South Division in the south further to Silent valley and Mukurthi National Park. The corridor is situated on the Gudalur- Nilambur ghat road. A stretch of forest exists on both sides of the road. The slopes are very steep and elephants can cross only in few points.

Average length and width of the corridor: the corridor is about a kilometer in length and width varies between 200-400 meters

Fig.1. 3D m*ap showing Satellite Imagery of Nilambur Kovilakam – New Amarambalam corridor at landscape level*



Extent of elephant usage

The South India synchronized elephant census conducted during 2007 in Kerala indicates a mean density of 0.234 and 0.672 elephants/km^2 in the Nilambur North and Nilambur South Forest Divisions respectively. The elephant population of two divisions revealed that about 430 elephants are extensively using this corridor to fulfill their annual and seasonal requirements.

Four belt transects were laid in the Vazhikadavu range to estimate the population of elephants in the corridor area. Dung density was estimated at 1225 / km^2 in the present study on the Nilambur Kovilakam – New Amarambalam elephant corridor.

1. Assessment of habitat quality

2.a. Assessment of trees

A total of twenty tree species were recorded in the 0.4 ha sampled area of which 11 species were resported to be elephant food species by the locals. *Anogeissus latifolia, Terminalia paniculata* and *Xylia xylocarpa* were the dominant species of trees in the habitat.

Table.1 Status of trees in the corridor area

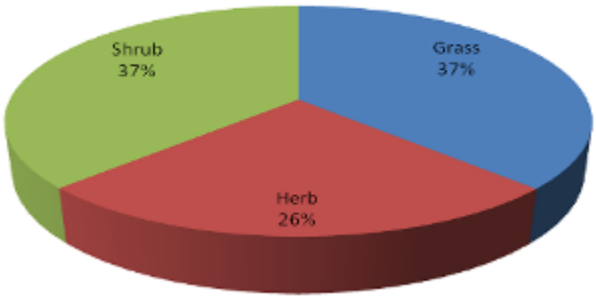
SL : No	Scientific name	Frequency	Average GBH (cm)	Average Height (feet)	Elephant food species
1	*Tectona.grandis*	12	136	35	
2	*Alstonia scholaris*	15	179	30	*
3	*Terminalia.paniculata*	17	243	45	*
4	*Anogeissus latifolia*	21	168	45	*
5	*Holarrhena pubescens*	9	95	30	
6	*Azadirachta indica*	13	212	40	
7	*Dalbergia latifolia*	8	259	45	
8	*Xylia xylocarpa*	16	346	50	*

9	*Dillenia. pentagyna*	9	235	40	*
10	*Syzygium cumini*	6	274	40	*
11	*Clutia retusa*	4	197	35	
12	*Phyllanthus emblica*	5	157	35	*
13	*Miliusa tomentosa*	8	213	40	*
14	*Stereospermum colais*	3	145	40	
15	*Ficus racemosa*	2	324	35	
16	*Bauhinia malabarica*	6	296	45	*
17	*Calophyllum austroindicum*	4	178	35	
18	*Pseudobombax ellipticum*	8	289	45	*
19	*Pometia pinnata*	2	234	40	*
20	*Schleichera oleosa*	8	256	40	
21	Unidentified	41	195.2	39.2	

2b. Availability of ground cover vegetation

The ground cover results reveal that the shrub and grass were found in equal proportion followed by herbs. In spite of cattle grazing from nearby villages, the grass cover was better, although shrubs have also taken over.

Fig. 2. Percentage availability of Ground cover vegetation



2c. Availability of Ecological resources

The Karakodu and Punjakolly river provides water for elephants throughout the year. The number of fruiting and shade bearing trees were limited for the elephants. There were no salt licks found near the corridor area.

Table 2 Availability of ecological resources in the corridor

SL.NO	Ecological resources	Number
1	Water source (Perennial)	2
2	Fruit bearing trees	7/km
3	Natural salt licks	-
4	Shade trees	4/km
5	Elephant food species	11

5. Threats to the corridor

a) ***Gudalur- Nilambur road:*** The National highway (NH-17) connects Ooty with Kozhikode city. Heavy traffic is a major threat for elephants movement between habitats.

b) ***Human settlement and its expansion****:* Human settlements like Vazhikadavu, Vellakatta and Anamari in Vazhikadavu range of North Nilambur Forest Division with over 1000 families have block the movement of elephant and have forced the elephants to use the foothills to move between the habitats.

c) ***Biotic pressure***: villages in and around the corridor are depended on the forest for NWFP collection, cattle grazing and fire wood collection. Grazing is a major problem in this area. Grazing by cattle leads to competition with wild animals for food also spreads diseases and leads to habitat degradation.

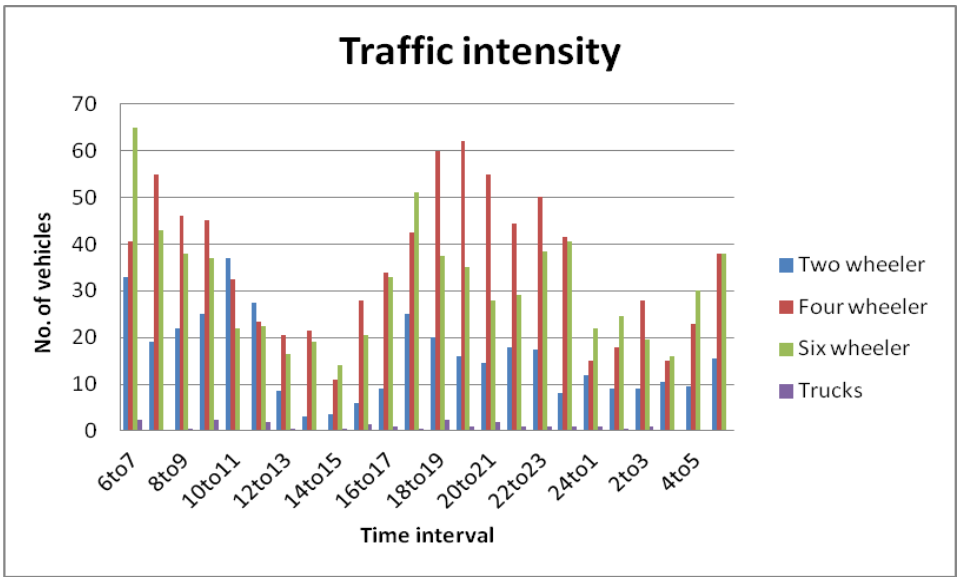
d) ***Plantation***: Private plantation in nearby forest areas with electric fence has further narrowed down the movement of elephants and other wild animals through the corridor. Example the PCK plantation spread over 345 hectares.

Fig 3. View of the corridor area and nearby plantation

Vehicular traffic intensity

The intensity of traffic was recorded for two days (24 hours) on the Gudalur – Nilambur NH -17. Peak vehicular movement was seen between 5-7 am and again between 6-11 pm. Mostly four and six wheel vehicles were seen during this time. The peak movement of vehicle concides with the time for movement of elephants and the vehicles plying at high speed hinders the movement of elephants.

Fig 4. Traffic intensity on Gudalur-Nilambur road



5. Human elephant conflict

Crop damage and injury and loss to human life has been reported from the area and the trend of crop depredation is on the rise as reflected by the depredation claim received by the forest department as well as discussion with the villagers. Two people lost their life due to elephant in Vazhikkadavu range in 2008 and one in 2009.

5. Conservation plan

1. The corridor should be notified by the state forest department and legally protected under appropriate law to prevent encroachment and developmental activities in the corridor detrimental to animal movement.

2. The corridor is located exactly between Vazikadavu and Nadukani ghat road with steep slopes on either side of the road. Elephants could pass the road only at four points. Even in these four places, elephant cannot cross straight to the habitat. After cross the entry point, elephants have to walk some distance of about 20 m to 80m on the road to find the exit point. An average of 42 vehicles passes through highway per

hour. A total of 350 and 334 vehicles are passing between 5 – 8 and 18-21 hours respectively. Hence, traffic should be regulated in morning and evening hours.

3. Awareness program targeting the villages living both within and on the fringe of the corridor be carried out through schools and community organizations informing them about the criticality of the corridor area and the increased human-elephant conflict in the area due to its obstruction.

7. Kottiyur – Periya corridor

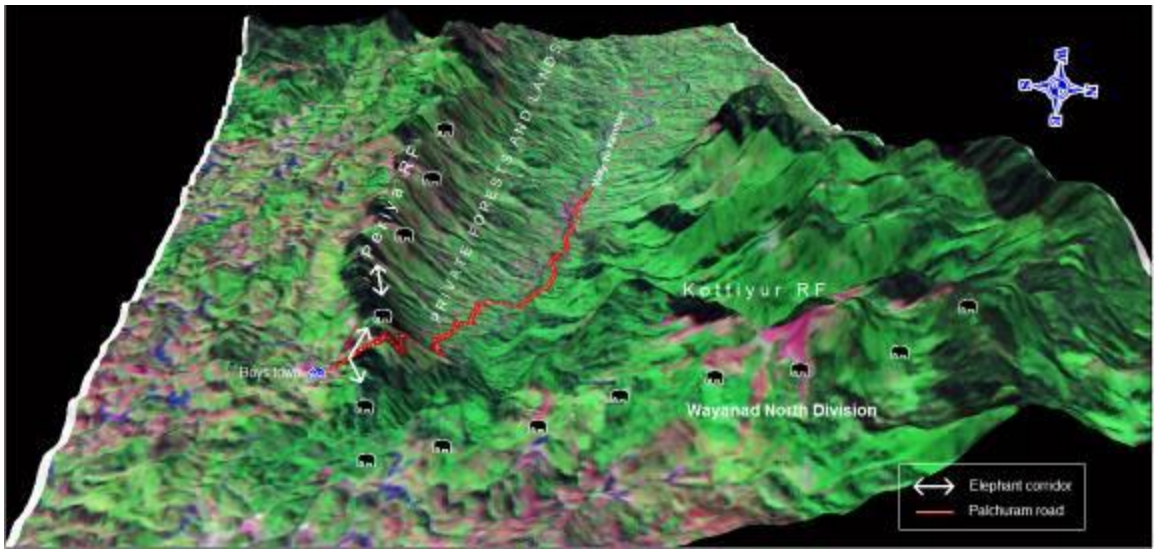
Alternate name: Periya, Palchuram

The corridor is located within the Periya Reserved Forest of Periya Range of North Wayanad Forest Division and extends up to Kottiyur Reserved Forest of Kottiyur Range under Kannur Forest Division. The corridor links Kozhikode Forest Division in the south, Brahmagiri Wildlife Sanctuary in the north, Wayanad Wildlife sanctuary in the north east leading to Nagarhole Tiger Reserve, Bandipur Tiger Reserve, Mudumalai Tiger Reserve through Tirunelli – Kudrakote elephant corridor.

Location: This corridor lies between longitude 75^0 53.4' - 75^0 55.2 E and latitude 11^0 49.8 - 11^0 50.8' N.

Average length and width of the corridor: The length of the corridor is about three kilometers and width varies between 0 and 150 meters. The main corridor dependant village is Boys town.

Fig 1. 3D m*ap showing Satellite Imagery of Kottiyur – Periya corridor at landscape level*



Profile of North Wayanad Forest Division

The area lies between Latitude 11^0 45' and 11^0 58'N and longitude 75 ^{0} 50' and 76 ^{0} 5'E and is bounded by Karnataka state in the North, South Wayanad Division in the South, Wildlife Division in the East and Kannur and Kozhikode Division in the West. This division forms part of Western Ghats. The Altitude varies from 600 mts to 1607 mts and the highest peak is the Brahmagiri Peak (1607mts) in Thirunelli reserve.

The average annual rainfall varies from 3000mm to 3500mm which is received by the southwest and northeast monsoon. The peak rainy season is June and July. September and October receives rain by the North East monsoon. The forest type found in this region is mostly tropical evergreen forest and some patches of moist deciduous forest. The main river in this division is the Kabini river. Number of small streams and rivers from the forest area unite in the Kabini river.

The area supports various 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 (*Rusa unicolor*), spotted deer (*Axis axis*), leopard (*Panthera pardus*), wild dog (*Cuon alpinus*), wild boar (*Sus scrofa*), sloth bear (*Melursus ursinus*), pangolin (*Manis crassicaudata*), common mongoose (*Herpestes vitticollis*) and slender loris (*Loris lardigradus*). (Management plan 2010)

1. Extent of elephant usage

The South India synchronized elephant census conducted during 2007 in Kerala shows estimated mean density of 0.465 and 0.069 elephants/km^2 in the Wayanad North and Kannur Forest Divisions respectively. The elephant population of two divisions revealed that minimum of 121 elephants is extensively using this corridor to fulfill their annual and seasonal requirements.

In the present study, two belt transects were laid. Dung density was estimated at 2533 / km^2 in the Kottiyuur - Periya elephant corridor.

2. Assessment of habitat quality

2a. status of trees

Vegetation survey was done in the corridor to assess the quality of the elephant habitat. Transect of 10m X 20m plot was laid at an interval of 200m in which tree variables such as Girth at Breast Height (GBH) and Height of the trees were recorded covering an area of 0.02ha. Of the 16 tree species identified in the transect, eight were elephant food species and was determined based on indirect feeding sign and discussion with villagers.

Table.1 Status of tree species

Sl.No	Name of the tree species	Frequency	Average GBH (cm)	Average Height (m)	Elephant food sp.
1	*Artocarpus hirsutus*	23	65	30	*
2	*Alstonia scholaris*	12	123	45	*
3	*Grewia tiliifolia*	6	158	50	*
4	*Dialium cocomandelicum*	9	63	25	*
5	*Macaranga indica*	5	96	45	
6	*Merremia peltata*	12	54	40	
7	*Tectona grandis*	15	23	45	*
8	*Oroxylum indicum*	16	54	35	*
9	*Bischofia javanica*	5	58	36	*
10	*Myristica contorta*	3	195	45	*
11	*Calophyllum inophyllum*	9	98	35	
12	*Terminalia paniculata*	8	232	50	
13	*Xylia xylocarpa*	9	45	35	
14	*Mesua ferra*	9	258	50	
15	*Holigarna arnottiana*	6	46	35	
16	Unidentified	38	83	35	

2b. Availability of ground cover vegetation

Among the three ground cover vegetation type, Shrub covers the maximum of ground cover (36%) followed by herbs (33%) and grass (31%) respectively.

2c. Availability of Ecological resources

The ecological survey proves that the plant species in the corridor is very few and the plant species in the private land of the corridor is high and the perennial water source (stream) provides very little support to the elephants.

Table .2 Availability of ecological resources in the corridor

S.No	Ecological resources	Number
1	Water source (Perennial)	1
2	Fruit bearing trees	13
3	Natural salt licks	2
3	Shade Trees	5
4	Elephant food species	12

3. Threats to the corridor

The corridor is threatened by the following factors along with the biotic pressure of the nearby villages.

Table.3. Threats to the corridor

Sl:No	Name	Activities in Progress
1	Palchuram-Manandhavady road	This road was constructed after 2005. Before it was a small jeep road. Brick load lorries regularly passes through this road.
2	Coffee estate	The coffee estate is located inside the corridor at Varaiyal.
3	Boys town village	The village completely blocks the elephant corridor along the Palchuram ghat road.

3a. Vehicular traffic intensity

The intensity of traffic was recorded two full days (24 hours) i.e., morning 6 to next morning 6. The four wheelers were recorded plying throughout the day except night hours and the peak was observed in afternoon and evening hours. The peaks for two wheelers were in afternoon and night 8'o clock. The peak of six wheel vehicles was during the evening hours. Overall traffic is less in the night hours in the Palchuram-Manandhavady road but still hinders elephant movement as peak movement of vehicle coincides with elephant movement.

Fig 2: Vehicular movement on Palchuram-Manandhavady road (24 hrs)

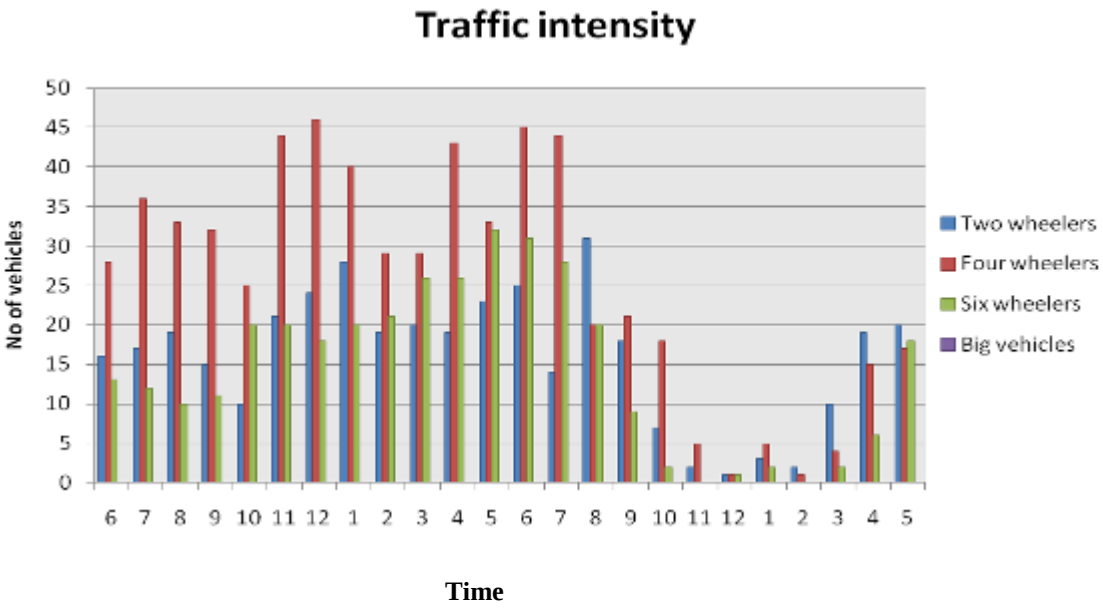


Fig.3 Palchuram ghat road has completely blocked the elephant corridor

Fig. 4 Coffee estate located in center of the elephant corridor

Crop Damage

Crop damage data was collected from 1998 – 2008 from forest department. Data was not available from 2002 – 2005. Over the years there has been an increasing trend of crop depredation by elephants.

Table.4. Crop damages and compensation paid by the Forest Department between 2006 and 2011

Year	No of application sanctioned	Compensation paid (in lakhs)
2006	354	17
2007	389	18.5
2008	416	20
2009	473	25
2010	828	19
2011	362	20

6. Socio-Economic status of the villages

The Kotiyur – Periya Elephant Corridor has five corridor dependant villages. These villages are depended on the forest for fuel wood, stump of bamboo and other tree species for making house and for medicinal plants. Generally Non Timber Forest Produce (NTFP) is not collected by these villagers in the corridor forest. There are lots of people living in these villages and faces severe problems from elephants.

Among the five villages, Boys town is situated in the southern end of elephant corridor through which elephants use to cross between Periya and Kottiyur Reserved Forests in the past. Apart from this place, the corridor is very narrow due to two coffee estates located in the center of the corridor tract at a place near Varaiyal forest station. Thus socio – economic survey was undertaken in the Boys town village and the owners of two coffee estates. The village comes under the Thavinjal Grama Panchayath, Periya Village and Mananthavady Taluk of Wayanad District. This is the border area of Wyanad and Kannur District.

Boys Town

Boys Town village is situated about 18 km away from Mananthavady town. A total of 12 households are in this village with a population of 65 people (28 male and 37 females). They are facing problems from elephants and other wild animals for the last one decade. The State Public Works Department (PWD) constructed a road to Kottiyur through boys town which is known as Palchuram road in 2010. It is a ghat road and elephants used to use this area to cross from Periya Reserved Forest to Kottiyur Reserved Forest through some selected crossing points in the past. After construction of road and culverts, the connection between the Periya and Kottiyur RF has been almost blocked for elephant movement. Hence, the elephants are confined to the Periya and Kannoth RF. This has increased the human – elephant conflict in this region. Still some elephant herds are managing to cross to Kottiyur RF through some private lands of Boys town village.

Fig.5 View of the Boys Town village

Education:

The people are fairly well educated as seen below. School education facility is available at Govt. Higher Secondary School, Periya.

Table.5: Education level of Boys Town Villagers

Education						
LP	UP	HS	Plus Two	UG	Uneducated	Children below 5
12	5	24	7	10	1	6

Livelihood

In Boys town village, some people are cultivating coffee, areacanut, pepper, banana, vegetables, coconut, tea etc. But due to crop raiding by elephants and other wild animals, they are not able to cultivate properly, as a result not earning adequate income. Every year these people lose more than 60% of profit due to human – elephant conflict. Some of them are working as daily wage labour in nearby tea gardens for their livelihoods.

Community Infrastructure

Infrastructure development in the village is in normal situation. All the households are electrified and most of them have all the facilities in the houses. They are depending on public transportation for their daily travelling needs. There is no community hall for community meetings and other functions like religious and social.

Wildlife Conservation

They know well that they are living inside an elephant corridor and if Government or any other organizations provide suitable relocation package, they are ready to leave this area to secure the elephant corridor.

Table 6. Perception on conserving and faith on elephants

Sl. No.	Name of the Village	Worth for conserving elephants		Faith on elephants	
		Yes	No	Yes	No
1	Boys Town	14	0	14	0
2	Varaiyal	2	0	2	0

Table 7. Perception on securing corridor

Sl. No.	Name of the Village	Knowledge on elephant corridor (No. of households/land owners)		Expectation of relocation package		Willingness to sell / leave land	
		Yes	No	Yes	No	Yes	No
1	Boys Town	14	0	12	2	11	3
2	Varaiyal	2	0	2	0	2	0

7. Conservation plan

1. The corridor should be notified by the state forest department and legally protected under appropriate law to prevent encroachment and developmental activities in the corridor detrimental to animal movement.

2. Since the area is very critical, part of it could be declared as eco-fragile area and necessary process undertaken to secure it with people's participation. A total of 48.20 acres of land were identified for securing to restore the corridor and increase the width of the corridor from at Boys town village and Varayal area (Table 7 & 8).

3. Awareness program targeting the villages living both within and on the fringe of the corridor be carried out through schools and community organizations informing them about the criticality of the corridor area and the increased human-elephant conflict in the area due to its obstruction.

4. Voluntary relocation of the people from CRP Kunnu (23 households and 19.14 acres land) and securement of land which the people are willing to.

Table 8. Land details for securing in Varaiyal

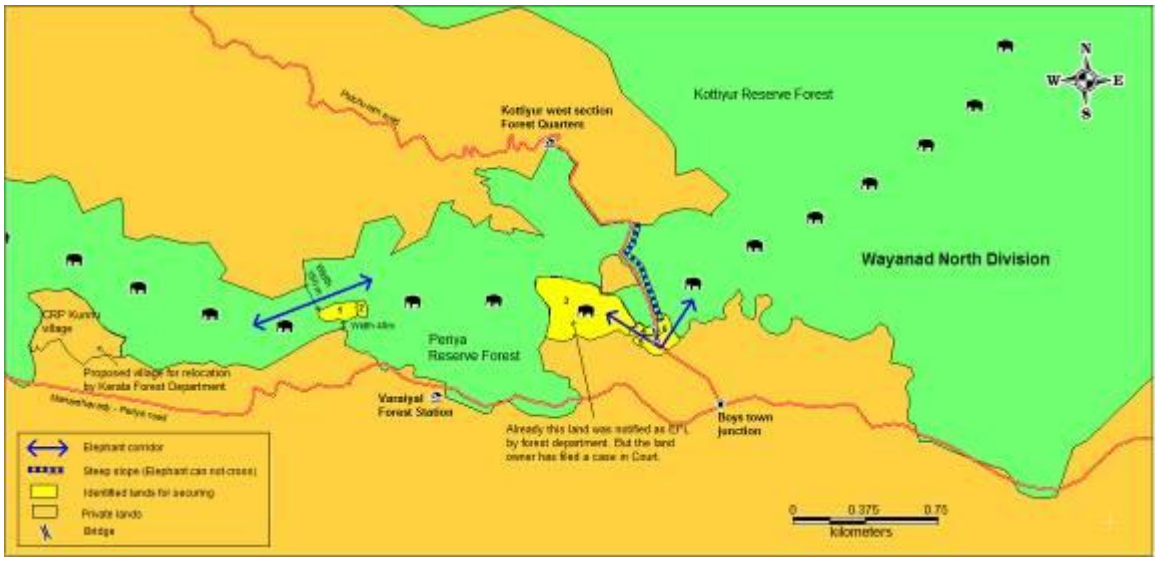
Plot No. as marked in Map	Owner Name	Extend of Land (acre)	Survey Number	Land Use
1	Siraj	5.20	3023	Coffee
2	Muhammadali	1	3023	Coffee
	Total extend	**6.20**		

Table 9. Land details for securing in Boys Town Village

Plot No. as marked in Map	Owner Name	Extend of Land (acre)	Survey Number	Land Use
3	Venus Rubber Estate	12	5/1A	Rubber
3	Thomas	2.70	5/1A	Coffee, Pepper, Coconut, Banana
3	Joseph	2.70	5/1A	
3	Thressiamma	2.70	5/1A	

3	Sebastian	2.70	5/1A	
3	Eliamma	2.70	5/1A	
4	Molly	12	5/1A	Rubber
5	Achamma	0.15	5/1B	Coffee, Pepper, Coconut, Banana
5	Baby	0.45	5/1B	Coffee, Pepper, Coconut, Banana
5	Reji	1.50	5/1A	Coffee, Pepper, Coconut, Banana
5	Mohanan	1.90	5/1A	Coffee, Pepper, Coconut, Banana
5	Mathai Varghese	0.05	5/1B	Banana
5	Somerwell Chacko	0.30	5/1B	Coffee, Pepper, Coconut, Banana
5	Devassya	0.10	5/1B	
5	Mary Sebastian	13.50	5/1A	Rubber
6	Manoj	1.50	5/1A	Coffee, Pepper, Coconut, Banana
6	Sujatha	0.04	5/1B	
6	Kuttichan	1.10	5/1B	Coffee, Pepper, Coconut, Banana
6	T. V Kunjan	3.18	5/1A	Coffee, Pepper, Coconut, Banana
6	Boys Town Church – Rubber Plantation	1.50	5/1B	Rubber
	Total extent of area	**62.77**		
The lands identified for securing from Boys town village is about 42 acres out of 62.77 acre as priority I.				

Fig 6. Landscape map showing identified land for securing at Kottiyur-Periya corridor



SELECTED REFRRENCES

Alva, U.T. (1994) Project Elephant: Management Plan for Karnataka. Government of India.

Asian Elephant Research and Conservation Centre (2002). Southern India Elephant Census 2002. Summary report to Karnataka Forest Department, Asian Elephant Research and Conservation Centre, Bangalore.

Asian Elephant Research and Conservation Centre. (2006). Southern India Elephant Census 2005. Summary report to Karnataka Forest Department, Asian Elephant Research and Conservation Centre, Bangalore.

Badola, R. and Mishra, B. K. (1995). Biotic pressures on Rajaji-Corbett Corridor: Measures for mitigation. In: *Proceedings of the International Seminar on the Conservation of Asian Elephants*, (eds., J.C. Daniel and H.S. Datye), Bombay Natural History Society, Mumbai, Pp 531.

Balakrishnan, M. and Ndhlovu, D. E. (1992). Wildlife utilization and local people: A case Upper Lupande Game Management Area, Zambia. *Environmental Conservation*, 19: Pp 135-144

Bhaskaran, N., Kannan, G. & Sukumar, R. (2007). Southern India Elephant Census 2007. Final report to Karnataka Forest Department. Asian Elephant Research and Conservation Centre, Bangalore.

Dinerstein, E. (1979). *An ecological survey of the royal Karnali Bardia Nepal*. Part I: Vegetation modifying factors and successional relationships. Biol. Conserv., 15, Pp 127-150.

Gopalakrishna, S.P., Somashekar, R.K., Anand, V.D., & Varma, S. (2010). Asian Elephant and Bannerghatta National Park in Eastern Ghats, Southern India. *Gajah* 33 (2010) 47-52

Johnsingh, A. J. T., Prasad, S. N. and Goyal, S. P. (1990). Conservation of the Chilla-Motichur corridor for elephant movement in Rajaji-Corbett National Park areas, India. *Biol. Conservation*. 51, Pp 125-138.

Menon, V., Tiwari, S.K., Easa, P.S and Sukumar, R (2005). *Right of passage: Elephant Corridors of India*. Conservation Reference Series 3. Wildlife Trust of India, New Delhi.

Noss, R. F. (1987). Protecting Natural Areas in Fragmented Landscape, Nat. Areas. Tr., 7, Pp 2-18.

Project Elephant (2008). Ministry of Environment & Forests, Government of India. http://envfor.nic.in/pe/population_we.pdf

Rajeev, B.M.T. (2002) Wildlife Management Plan for Bannerghatta National Park, 2003-04 to 2007-08. Government of Karnataka.

Ramakrishnan, B., N. Sivaganesan and R. K. Srivastava (1997). Human interference and its impact on the elephant corridors in Sathyamangalam and Coimbatore Forest Divisions, Tamil Nadu, Southern India. *Indian Journal of Forestry*, 20 (1), Pp 8 – 19

Ramakrishnan, B. and Ramkumar, K.(2007). Land acquisition perspectives of vital elephant corridors in Coimbatore and Sathyamangalam forest divisions, Tamil Nadu. Final report to Wildlife Trust of India. OSAI environmental organization, Coimbatore.

Ramakrishnan, B, (2008). Significance of corridors to Asian elephant (Elephas *maximus*) and strategies for conservation and management in the Nilgiri Biosphere Reserve, Tamil Nadu, Southern India. Ph.D thesis submitted to Bharathidasan University, Thiruchirapally, Tamil Nadu.

Ramkumar, K., Manimozhi, K. and Paulraj, S. (2002). The status of elephant corridors in and around Mudumalai Wildlife Sanctuary, Tamilnadu, Southern India. *The Indian Forester*, Vol.128, No 2, Pp.197.

Ramkumar, K. and Arumugam, A. (2005). Evaluation of the status, land use pattern and habitat utilization of elephants in corridors of Mudumalai Wildlife Sanctuary and Nilgiris North Forest Division, Nilgiris, Tamil Nadu. Project Report submitted to Nilgiri Wildlife & Environment Association, Udhagamandalam.

Rodgers, W. A. and H. S. Panwar (1988). Planning wildlife protected area in India. Volume I and II. Report to Department of Environment, Forest and Wildlife, Government of India, Wildlife Institute of India. Dehradun.

Simberloff, D. and Cox, J. (1987). Corridors for conservation.*New Scientist*, 1642,63-68.

Singh, V.V. (2008). *Wildlife Management Plan for Bannerghatta National Park*, 2008-09 to 2012- 13. Government of Karnataka.

Sivaganesan, N. (1991). Ecology and conservation of Asian elephants (Elephas maximus) with reference to the habitat utilization in Mudumalai Wildlife Sanctuary, Tamil Nadu, South India. Ph.D thesis submitted to Bharathidasan University, Thiruchirapally, Tamil Nadu.

Sivaganesan, N. and B. Ramakrishnan (1997). An ecological assessment on the development of Sachidhanandha Jothi Niketan School adjoining the Kallar-Jacanare Corridor in Coimbatore forest division, Nilgiris. Wildlife Corridor Project Technical Report: Submitted to the Salim Ali Centre for Ornithology and Natural History, Coimbatore.

Soule, M.E. and D.Simberloff, (1986). What do genetics and ecology tell us about the design of nature reserve?. *Biol. Conserv*ation., 35, 19-40.

Sukumar, R. (1989). *The Asian Elephant: Ecology and Managmnet*. Cambridge University Press, UK, England.

Sunderraj, S. F., B. K. Mishra and A. J. T. Johnsingh (1995). Elephant use of Rajaji-Corbett Forest Corridor. In International Seminar on the Conservation of Asian Elephants, (eds. J.C. Daniel and H.S. Datye). *Bombay Natural History Society*, Pp 261-269.

Varma, S., Venkataraman, A., Sukumar, R. & Easa, P.S. (2005). Elephant corridors of Southern India. In: *Right of Passage: Elephant Corridors of India*. Menon, V., Tiwari, S. K., Easa, P.S. & Sukumar, R. (eds.) Conservation Reference Series 3. WTI, New Delhi. pp 208-255.