

The Nilgiris - Eastern Ghats Landscape



Summary Report

2001-2004



Conservation of Asian Elephant
(*Elephas maximus*) in the Nilgiris-Eastern
Ghats Landscape (NEG), Southern India



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Southern India

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U. S. Fish and Wildlife Service**



Co-Partners

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DEDICATED

To



(Late) Dr.V.Krishnamoorthy

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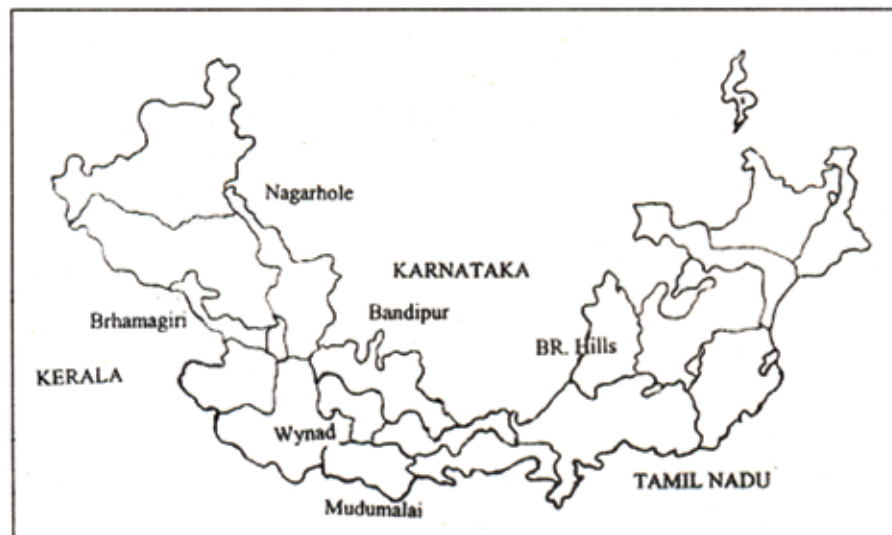


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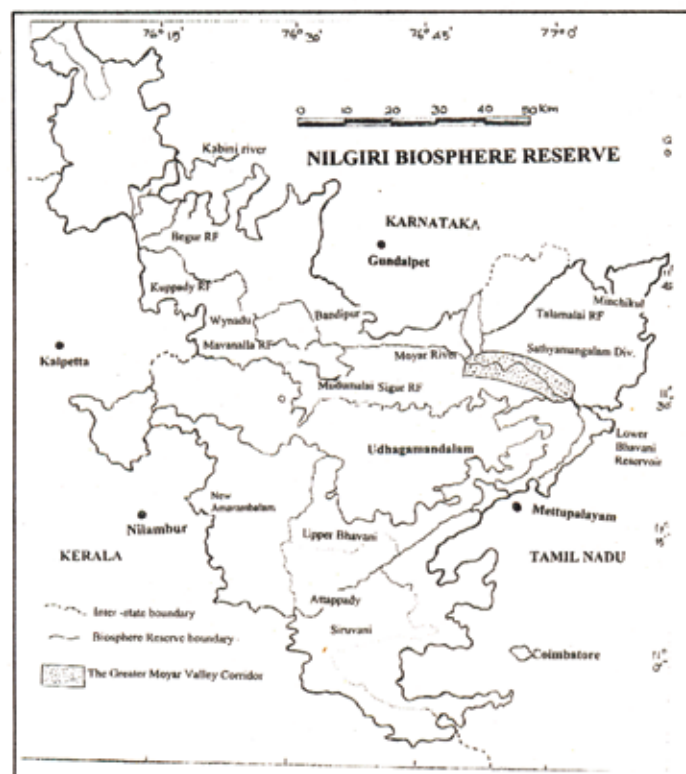
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Map 1. THE NILGIRIS – EASTERN GHATS LANDSCAPE (NEG)



Map 2. NILGIRI BIOSPHERE RESERVE (NBR)



1. Introduction

The Nilgiri Eastern Ghats Landscape has the largest contiguous population of Asian elephants in India. This population of elephants also holds the key to the long-term survival of the species in Asia. Other large mammals such as Gaur, Sambar, Tiger and Leopard also abound the landscape.

The Nilgiri Eastern Ghats Landscape (Map. 1) covers an area of over 12,000 Sq. km and has an estimated population of more than 6,000 elephants. The landscape comprises Elephant Reserve No.7 of the Project Elephant, a conservation project of the Indian Government. The population of elephants extends along the Western Ghats from the Brahmagiri hills in the west, south through the Nilgiri hills and east through the Eastern Ghats within the states of Karnataka, Tamil Nadu and Kerala. The population of elephant still maintains possible links with elephant population in the Elephant Reserve No. 8 (Silent Valley-Coimbatore Forest Divisions). The "Protected Areas" within the reserve, include the Brahmagiri Sanctuary, Nagarhole National Park, Bandipur Tiger Reserve, BRT Sanctuary, Cauvery Sanctuary, Bannarghatta National Park, Mudumalai Wildlife Sanctuary and Wayanad Wildlife Sanctuary. The major portion of the NEG falls in the Nilgiri Biosphere Reserve, Southern India (NBR) (Map. 2).

The most significant threats to the elephant in this landscape are fragmentation and degradation of habitats, human-elephant conflict and poaching for ivory. Increasing human population and their settlements besides activities such as wood collection, grazing and expansion of agriculture are affecting the entire stretch of this landscape leading to habitat degradation (Photo plate 1: a,b,c,d). Fragmentation of habitat and increased human activities are perhaps the reasons for increasing human-elephant conflict (Photo plate 2 : a,b,c,d,e,f) in the NEG. Crop depredation by elephants is common in most forest divisions of the NEG. All these threats are the serious concern for the survival of elephant population in the NEG in the long-run.

The conservation action for maintaining the contiguity of the landscape and for ensuring the long term survival of this elephant population, it is evident that:

- 1) The corridor (the Great Moyar Valley Corridor) linking the larger parts of this landscape need to be restored and improved in all its aspects.
- 2) Human-elephant conflict needs to be alleviated for the benefit of local communities in this region.
- 3) Biotic pressure such as cattle grazing, collection of wood and Non timber forest produces (NTFP) needs to be minimized through community participatory programme

- 4) Poaching of elephants for ivory is to be controlled through establishing an integrated patrolling mechanism (Anti poaching camps) in various vulnerable locations within the NEG and
- 5) Promote a strong awareness for various Government Departments (District Administration - DRDA, Public Works Department, Animal Husbandry, Electricity Board, Local Bodies, Sericulture wing, and Agriculture Department) on the elephant conservation value of the Nilgiri and Eastern Ghats Landscape.

2. Greater Moyar Valley Corridor - NEG

The Greater Moyar Elephant Corridor is located at the junction of Eastern Ghats and Western Ghats. It maintains the habitat contiguity for elephant population between the Thalamalai Plateau in the east, the Mudumalai Wildlife Sanctuary on the west and the east west connectivity of the Bandipur Tiger Reserve in the north of the Moyar-Gorge.

The entire corridor is crucial for the gene flow and dispersal of free ranging animals and is used by elephant population intensively during the dry season (Photo plate 3: a,b,c,d,e,f). The importance of securing this corridor for maintaining contiguity of habitat between different areas of the NEG landscape is thus evident for elephant conservation.

3. Project Goal

Maintain and restore habitat connectivity in the Nilgiri-Eastern Ghats Landscape, Southern India by reducing various human induced pressures through community participatory approach and enhancing protection mechanism in the elephant habitat. The WWF-India, AREAS programme and U.S. Fish and Wildlife Service (*Asian elephant Conservation Fund*) in collaboration with the Tamil Nadu Forest Department and A V C College have implemented this programme between 2001 and 2004.

4. Funding

The U. S. Fish and Wildlife Service, generously funded the following projects:

- a) Management of elephant reserve with special reference to corridors by community participatory programme in the Nilgiri Biosphere Reserve, Southern India, India (\$ 98,279; Rs. 44,22,555) and
- b) Field Training on the Management of Elephant Reserve for the Forest Field Staff of Tamil Nadu, Southern India (\$ 51,870; Rs. 24,89,760) from 2001 to

2004 in collaboration with the World Wide Fund for Nature, India-Asian Rhino and Elephant Action Strategy (AREAS) and A V C College (Autonomous) for the conservation of NEG.

The Tamil Nadu Forest Department, funded the following projects in the NEG:

- a. Management Training for various Co-ordinators for the conservation of Asian elephants (*Elephas maximus*) in Mudumalai Wildlife Sanctuary (\$ 778; Rs. 35,500)
- b. Management Training Programme for Elephant Mahouts, Mudumalai Wildlife Sanctuary (\$ 322; Rs. 14,500) and
- c. Ecology of Asian elephant (*Elephas maximus*) with special reference to Corridor Management in the Coimbatore Forest Division, Tamil Nadu (\$ 556; Rs. 25,000)

5. NEG and Elephant population

The Greater Moyar Valley Corridor (GMVC) holds a significant role for elephants and it acts as a key conservation unit in terms of its uniqueness and seasonal concentration of elephants in the NEG. Increasing human population, expansion of their settlements and associated activities such as grazing by scrub cattle, wood collection, collection of NTFP and poor land use are the serious threats to this corridor. The major objectives were; a) identify the crucial traditional migratory path b) estimate dung density of elephants in different locations of the corridor c) determine the dung density of elephants in various forest settlements and d) estimate the density of elephants during the dry season in the GMVC of the NEG, that is heavily used by elephant herds.

The entire stretch of the GMVC is being used by elephant population (Approximately 350-500 individuals) during the dry season as part of their seasonal range. Nevertheless, the entire corridor is the traditional rout used by elephants to move between upper reaches of the Thalamalai Plateau and Nilgiri Eastern Slope Reserve Forests every year. The following criteria were used for identifying traditional routs of elephants; (a) Occurrence of dung piles (b) Extent of feeding signs and direct sightings of animals.

The initial field surveys showed that tracts between Sigur Plateau and Sujalkuttai (42 km.) within the valley was extensively used by elephants during the dry season (January - May). The entire stretch was divided into five sector's in relation to location of

forest settlements (Photo plate 4: a,b,c,d,e,f). Totally six transects were laid with varying distance (km) in between forest settlements to estimate use pattern of elephants. Occurrence of dung piles on either side of transect including status of dung piles were collected from each survey route. Survey was done once for estimating availability of dung piles from the study transect.

The dung piles of elephants were also studied in various parts of GMVC in both roadside and interior forest. Three kilometer transect was surveyed in both in roadside and interior forest. Quadrates of 50x20 mts were laid in interior of forests at regular interval of 200 mts along the roadside to estimate density of dung piles.

In the GMVC, seventy-five fresh dung piles were located in open thickets, thorn forest, and riparian forest. These dung piles were marked using bamboo stakes bearing date and sample number to estimate dung decay rate. These were monitored at weekly intervals and the state and number of dung piles disappeared in the ground were gathered. The decay rate was estimated only for the tract closer to the settlements such as Kallampalayam, Hallimoyar and Gulithuraipatti.

Dung density of elephants surrounding the forest settlement of Kallampalayam (98.3/ha) was greater followed by Hallimoyar (59.5/ha) and Gulithuraipatti (18.6/ha). The survey revealed that six major paths were used by elephants to migrate between Thalamalai hills and foothills of Nilgiri Eastern Ghats in the NEG (Photo plate 5: a,b,c, d,e,f). It was also observed that elephants showed a strong preference for utilizing habitats closer to Kallampalayam forest settlement (55.7%), followed by Hallimoyar (33.7%) (Table 1). The forest tract adjoining to Gulithuraipatti was the least preferred among the forest settlements by elephant population during the study period.

It is surprisingly noticed that density of cattle dung surrounding the forest settlement of Kallampalayam, had a high density (69/ha) followed by Hallimoyar (60.2/ha) as evident from the signs. Cattle dung was low in Gulithuraipatti (Table 1).

Table 1: Dung density of Elephant and cattle among various forest settlements

S. No.	Name of the forest settlement	Area sampled (Km)	No. of dung piles		Dung density/ha		Relative density	
			Elephant	Cattle	Elephant	Cattle	Elephant	Cattle
1	Kallampalayam	2.2	423	297	98.3	69.0	55.7	49.3
2	Hallimoyar	1.4	256	259	59.5	60.2	33.7	43.0
3	Gulithuraipatti	1.0	80	46	18.6	10.7	10.6	7.7

The result showed that the habitat between Kallampalayam and Gajalahatti (50.6/ha.) forest settlements was heavily used by elephants. The forest tract between Gajalahatti and Gulithuraipatti had a dung density of 40.6/ha (Table 2). The elephant population did not use much the forest tract of Sujalkuttai settlements. The other sector such as Boothikuppai to Kallampalayam had a low number of dung piles as evident from the availability dung piles in those areas of the GMVC.

Table 2. Dung density of elephant and cattle in different forest roads in the GMVC

S.No.	Details of road side transects	Sampled areas (ha.)	Number of during piles		Dung density / ha.		Relative density	
			Elephant	Cattle	Elephant	Cattle	Elephant	Cattle
1.	Sujalkuttai – Boothikuppai	6	227	215	28.1	26.6	12.7	19.0
2.	Boothikuppai – Kallampalayam	3	185	167	22.9	20.7	10.3	14.8
3.	Kallampalayam – Gajalahatti	3	409	190	50.6	23.5	22.9	16.8
4.	Gajalahatti - Gulithuraipatti	1.7	32.8	125	40.6	15.5	18.3	11.1
5.	Gulithuraipatti – Thengumarada	3.5	327	166	40.5	20.5	18.3	14.7
6.	Thengumarada – Mangalapatti	3	313	267	38.7	33.0	17.5	23.6
		20.2 km. 8.08 ha.	1789	1130	221.4/ha.	139.8/ha.		

It is interesting to note that there was not much variation in the availability of dung piles among forest settlements, except, Gajalahatti and Gulithuraipatti sector in the corridor.

Table 3: Elephant density in various sectors in the GMVC

Variables	Sujalkuttai-to Boothikuppai (sampled area 2.7 sq km.)	Boothikuppai to Kallampalayam (Sampled area 1.21 sq. km)	Kallampalayam to Gajalahatti (Sampled area 1.21sq. km)	Gajalahatti to Gulithuraipatti (Sampled area 0.68 sq km)	Gulithuraipatti to Thengumarahada (Sampled area 1.41 sq. km)	Thengumarahada to Mangalapatti (Sampled area 1.21 sq. km)
Dung density/sq km	195.8	380	625.7	636.7	490	433
Decay rate	0.0285	0.0285	0.0285	0.0285	0.0285	0.0285
Defecation rate	13.33	13.33	13.33	13.33	13.33	13.33
Density of elephant / Sq km	0.4	0.8	1.3	1.3	1.0	0.7

Density of elephants was estimated for six major sectors in the GMVC during the dry season (Table 3). The estimated dry season elephant density was higher in the

Kallampalayam and Gulithuraipatti sectors (1.3/sq.km), which is equal to high-density areas in Southern India.

6. Threats to the NEG

Impact of scrub cattle

The impact of scrub cattle and its disturbance to the elephant corridor was studied to demonstrate significance of the community participatory programme for elephant conservation in the NEG. Forest settlements namely Boothikuppai, Doddakombai, Hallimoyar, Kallampalayam, Kembarai, Sujalkuttai, Thengumaragada and Uppupallam in the GMVC were taken up on a priority basis for eliminating the scrub cattle (Unproductive scrub animals). The specific objectives of the programme were to:

1. Estimate the scrub cattle population from the selected settlements.
2. Assess the time activity pattern of scrub cattle in the elephant reserve.
3. Quantify the habitat use pattern of scrub cattle in elephant reserve.
4. Find out the dietary composition of scrub cattle
5. Assess the habitat quality of elephant areas and
6. Estimate the diet share by cattle and elephant population s in the GMVC.

The grazing pressure of 4,593 (2001 survey) scrub cattle within the GMVC in eight focal study villages would tend to reduce the browse resource to elephants, particularly regeneration and recruitment saplings of favoured food species to elephants (Photo plate 6: a, b, c, d, e, f). The greater proportion of grass in the diet of scrub cattle could be serious threats to ground cover which would ultimately expose the ground cover for invasion of unpalatable plants such as *Prosobis juliflora*, *Opuntia dillinii*, *Euphorbia antiquorum*, *Barleria spp.*, and *Jatropha justica*.

The increasing grazing incidences in the elephant corridor by scrub cattle slowly eradicates ground vegetation because of human settlements within the corridor. This is not only fragment the corridor but also reduce the area availability to elephant population which in turn increase the contact of elephants in the crop fields adjoining the forest settlement in the NEG. The increasing trend of human-elephant conflict, of late, in the NEG, perhaps attributed to loss of potential resources to elephant population due to largely the impact of scrub cattle.

Number of scrub cattle population owned by each traditional grazier and cattle owner was collected based on questionnaire to assess the population from each focal village (Table 3). The estimated population was subsequently verified in the field when the cattle visited the forest along with the grazers. Among these settlements, Thengumarahada (1800) has more scrub cattle, followed by Sujalkuttai (906) and Kallampalayam (784) before the incentive the scheme. The scrub cattle move to a distance of maximum 7-km from the settlements. They spend the entire daytime in the forest.

Table 4 : Cattle population in various settlements in different months in the Greater Moyar Valley Corridor

Sl. No	Villages/ Settlements	Cattle population before the incentive scheme		Cattle population after the incentive scheme		Number of cattle removed
		2001	2002	2003	2004	
1	Kallampalayam	784	456	452	320	332
2	Boothikuppai	219	179	139	*	80
3	Kembarai	124	43	62	*	62
4	Uppupallam	82	81	54	*	28
5	Doddakombai	164	-	-	*	425
6	Sujalkuttai	906	779	668	*	238
7	Hallimoyar	514	255	168	133	346
8	Thengumarahada	1800	1288	1229	852	571
	Total	4593	3081	2772	1305	2082

* - Cattle survey was not conducted for the year 2004.

Out of 4593 scrub cattle population in the GMVC, 2082 were removed by providing alternative livelihood scheme through people's participatory approach (Table 3). This was a significant outcome and showed how the participatory approach could change the traditional forest dependents (graziers) in helping elephant conservation programme in the NEG.

Activity pattern of cattle

Focal animal sampling method was used to estimate time activity pattern by scrub cattle (weak and healthy animals) in the forest vicinity adjoining Kallampalayam, Sujalkuttai and Hallimoyar (Table 4).

Table 5 : Percent time spent on various activities by healthy and weak scrub cattle belonging to various settlements during the dry season.

Activities	Sujalkuttai (n =29,316)		Kallampalayam (n =43,260)		Hallimoyar (n =71,526)	
	Healthy Animals	Weaker Animals	Healthy Animals	Weaker Animals	Healthy animals	Weaker Animals
Feeding	95.2	70.2	92.5	86.9	86.6	79
Movement	2.1	28.4	6.5	12	12.4	18.5
Visit to water	2.7	1.4	1.0	1.1	1.0	2.5
Resting	0	0	0	0	0	0

(n =number of minutes animals spent on various activities)

The proportion of time spent on feeding by healthy and weaker animals greatly varied (Table 4). The healthy animals devoted a maximum time on feeding than weaker ones in all the forest settlements. Conversely, time spent on movement for searching forage by weaker was increased irrespective of settlements. There was not any remarkable variation noticed in time spent on visit to water sources during the diurnal activity by both healthy and weak animal. Resting was not at all observed. Thus, the study findings revealed that unproductive cattle, both weak and healthy animals getting into the corridor far off places from the settlements and thus bring rapid degradation of ground cover besides spreading contagious diseases to wildlife population in this region.

Table 6: Grass to browse ratio in the diet of scrub cattle

S.No	Forest settlement	% diet			
		Healthy animals		Weaker animals	
		Grass	Browse	Grass	Browse
1	Sujalkuttai (n = 32,340)	40.2	59.8	41.0	59.0
2.	Kallampalayam (n = 60,430)	91.1	8.9	92.7	7.3
3	Hallimoyar (n = 87,998)	87.7	12.3	91.8	8.2

(n = feeding scores during the focal animal sampling)

Grass to browse ratio was estimated from the feeding observations during the sampling period (Table 5). Observations on feeding were scored as browsing (leaves, branches, barks, shrubs, sedges, bamboo and fruits) and grazing (all species of grasses). Besides, crucial microhabitats of elephants such as riparian forest, deciduous forest, hilltops, nullahs, wooded forest and thorn forest visited by cattle were also recorded during the study period. These microhabitats are potential resource to elephants to meet out their ecological requirements such as food, shade, natural salt licks and water (Photo plate 7: a, b,c,d).

The selection of the microhabitats of elephant such as riparian forests by cattle would add a negative value to elephant's use of patchy resources in the corridor in order to optimize its diet during the dry season. A study on the ground cover (percent occupancy of ground vegetation) indicates a dramatic variation in the availability of grass, shrub and plant weeds. Grass height was more in the interior forest than closer to the settlements. Abundance of weed cover did not show much variation between settlement areas and interior forest. The weed-dominated forests also seemed to be an important area to the elephant in selected settlements such as Kallampalayam and Sujalkuttai where *Prosobis julliflora* is a common tree on the banks of Moyar River and Bhavanisagar reservoir water spread area. The greater time spent on feeding by scrub cattle could slowly remove the green biomass from the ground cover and thus leading to degradation of GMVC in the NEG.

Impact of Non Timber Forest Produce (NTFP) collection

This proposed study as part of community participatory programme for elephant conservation would enable the forest managers to bring out the impacts of NTFP on the GMVC in the NEG. The outcome of this study would bring the changes in the management policy dealing for elephant conservation in the corridor. The common NTFP collected in this area are; *Albizia amara*, *Azadirachta indica*, *Solanum tarvum*, *Sapindus emerginatus*, *Phyllanthus emblica* and *Ziziphus mauritiana*. Some of the NTFP species are eaten by elephants also. The over exploitation of selected species of NTFP and movement of villagers into the corridor for collection confines the free movement of elephants in the corridor areas.

The number of people visiting the corridor is increasing every year and quantity of collection of NTFP is also increasing year by year to meet out the livelihood needs of villagers. The collection of NTFP has caused degradation of the forest by over exploiting critical microhabitats that used by elephants in greater extent for feeding, shade and salt licks. The lopping of branches in the process of collection of NTFP would affect the survival of a few food species that are crucial to elephants for shade during the dry season. For instance, the collection of preferred trees of elephants such as *Tamarindus indica* as NTFP species would reduce the "key food species" of elephants from the corridor during the dry season.

Forest settlements such as Kallampalayam, Gulithuraipatti and Hallimoyar were selected to assess the impact of collection of NTFP by the villagers. The aims were to:

1. Determine the extent of traditional villagers involved in the NTFP collection.
2. Estimate the distance traveled in the corridor for NTFP collection by the villagers and its impacts on corridor.

3. Assess the use pattern of elephants in the NTFP collection site.
4. Assess the habitat diversity - trees, shrubs and ground cover in the collection trail of NTFP and
5. Quantity the extent of economic benefit to the villagers from the collection of NTFP in the GMVC.

Surveys were made in the each target village to identify number of traditional NTFP collectors daily visiting the elephant corridor (Table 6). The project staff accompanied with the NTFP collectors during their visit to the corridor. Most of the occasions villagers have travel extensively to gather their choice of NTFP in relation to seasons. Only traditional NTFP collectors visiting the corridor everyday for collection were identified based on their total dependence on the GMVC for their livelihood.

Table 7 : Percent traditional villagers involved in the collection of NTFP from various forest settlements

S.No	Villages	Male		Female		Tribal		Overall (%)
		(n)	(%)	(n)	(%)	(n)	(%)	
1	Kallampalayam	32	52.4	76	62.6	108	59.5	59.4
2	Gulithuraipatti	16	26.2	27	22.5	43	23.8	23.5
3	Hallimoyar	13	21.4	18	14.9	31	16.7	17.1

The intensity of collection of NTFP by male and female was considerably varied in the study site during the dry season. Generally, women communities have involved more themselves in the collection of NTFP than males (Table 6). The villagers of Kallampalayam and Hallimoyar were mostly involved in the collection of NTFP. Among the tribal communities, the NTFP was mostly targeted by tribal of Kallampalayam forest settlements followed by Gulithuraipatti. The villagers from Hallimoyar have less involvement in the collection of NTFP. It was observed that the behavior of elephants and its movement in the crucial habitats were disturbed because of collection of NTFP by villagers.

While accompanied with NTFP collectors, direct sightings of elephants were recorded. Number of individuals and their activity pattern were gathered during each sighting. Elephants were sighted within 4 km radius of NTFP collection and beyond that, there was no sighting during the study period. It was observed in the field that villagers while collecting NTFP always loudly communicated among themselves to

disturb the elephants and therefore, the sightings were poor during the NTFP collections.

Density of NTFP tree and shrub species was estimated in the trails of NTFP used by villagers. Quadrates of 20x20 mts. were laid along the NTFP collection trails wherein, food plants of elephants were recorded.

The study revealed that only a few species were common in the trails of NTFP and those were; *Prosobis juliflora*, *Albizia amara*, *Hardwickia binnata*, *Commiphora caudate*, and *Bauhinia racemosa*, important food trees to elephant population during the migrating season. This clearly showed that elephant corridor could also subject to threat because of the collection of NTFP. The over exploitation of NTFP collection of certain species shared by elephants would reduce the availability of browse species in the long run to the pachyderm.

It was found that there were fourteen species of shrub species identified along the NTFP trails in the Greater Moyar Valley Corridor, which included six species used by elephants. Therefore, shrub varieties of NTFP are also important food species to elephants and their regeneration and recruitment might be affected by the impact of collection of NTFP by the villagers besides the impact of grazing. The collection of mature fruits of various species of NTFP would also limit the availability of food diversity to elephant population in the long run.

7. Workshops and Meetings

a) Incentive schemes for graziers

Twenty-three workshops were conducted for the graziers to appraise the community participation. The graziers individually expressed their choice of income generation activities based on their expertise. The workshops proved to be a good avenue for exchange of views both collectively and individually. Thus, workshops created an opportunity for villagers to play a more active decision-making role in the process of community participatory approach (Photo plate: 8 a, b, c, d).

The major themes of the workshop:

1. Merits and demerits of the participatory project.
2. Necessity for weaning away the scrub cattle and NTFP collection.
3. The significance of the Moyar Valley Corridor to the NEG
4. Conservation and management programme.
5. Usage of corridor by elephants.

6. Establishment of alternate livelihood for various stakeholders to reduce biotic pressure.
7. Coordination of various institutions and involvement of policy makers in the corridor management and
8. Role of various stakeholder in the management of corridor.

b) Workshop profile

Organizing workshop for the major stakeholders on the themes related to the community participatory programme for the conservation of elephant habitats of NEG has yielded a good platform for achieving the project goals. The details of the workshop profile is furnished below:

Number of workshop conducted	:	23
Number of people attended the workshop	:	510
Number of officials attended	:	144
Number of organizations participated	:	11
Name of the organizations		
<ul style="list-style-type: none"> ▪ Nilgiri Wildlife and Environment Association - Ooty ▪ Nilgiri North Forest Division -, Ooty ▪ Sathyamangalam Forest Division - Sathyamangalam ▪ Special Task Force - Tamil Nadu Police ▪ Women Self Help Groups - Kallampalayam, Hallimoyar and Thengumarahada ▪ Panchayat Board - Thengumarada Panchayat ▪ Panchayat Board - Pungar Panchayat ▪ Sericulture Department - Coonoor, Nilgiris ▪ Indian Institute of Science - Masinagudi camp ▪ Co-Operative Farm Society - Thengumarahada ▪ IBEX Galleghar Pvt. Ltd. - Bangalore 		

Incentive schemes for the beneficiaries (graziers and NTFP collectors) were distributed in the workshops. It was also an opportunity to spread the conservation awareness about elephants on the minds of local villagers and others.

8. Habitat Improvement Programme - NEG

a) Elimination of scrub cattle

During October 2001, the estimated population of cattle from eight villages was 4593, prior to the implementation of the project. Thengumarada forest settlement had the highest cattle population of 1800, followed by Sujalkuttai (n= 906). Eighty-two cattle were observed in the Uppupallam forest settlement.

The census showed that 2082 cattle were removed and shifted out off the Greater Moyar Valley Corridor in the NEG so far. The process of eliminating the remaining scrub cattle from the elephant reserve of the NEG is being continued with the funding support from the WWF-India, AREAS and US FWS Grant for the year 2004-2005.

b) Alternate livelihood schemes

Sixty beneficiaries comprising of graziers (33 families) and NTFP collectors (27 families) were received each \$ 300 (Rs.14,000) for establishing incentive scheme for income generation activity (Photo plate 9: a,b,c,d,e,f,: Table 7). Training programme on Rabbit rearing, Sericulture, and Apiculture were conducted with the assistance of experts. The villagers preferred mostly milch animals and bullocks as incentive schemes because they are traditionally involved in such activities for their income generation. Petty shops and other land-based activities were also selected by the beneficiaries. The project team and the forest department declined to recommend sheep rearing as an incentive scheme, though many of the beneficiaries have requested the same for alternate incentive scheme. Nine different incentive schemes were distributed to the sixty traditional corridor dependent families (Table 7).

The incentive bond was distributed in workshop where the concerned beneficiary given an oath of declaration to accept the scheme for eliminating the scrub cattle and involve in the management of GMVC through local participation. A MoU was signed by each beneficiary and the copy of the MoU sent to the forest department to ensure that these beneficiaries will not venture into the corridor for any purposes after availing the incentive schemes.

The beneficiary schemes for the traditional graziers and NTFP collectors have helped the forest department, thus, directly in managing the elephant reserve, especially the GMVC. The scheme also has attracted other sectors of villagers to involve themselves in the local participatory exercises, although the project could not able to support those groups due to lack of funds and time. It is intended to extend the programme to those villagers also by mobilizing funds both from the State and Central

Governments including oversee funds such as WWF-India, AREAS and U.S. Fish and Wildlife Service.

Table 8: Details of incentive schemes provided to the villagers

Sl. No.	Types of Incentive schemes	Incentive scheme requested by the beneficiaries	No of units availed
1	Milch animal (Stall feeding)	16	20
2	Petty shop	4	4
3	Weaving units	1	Not availed due to marketing problem
4	Bullocks	4	4
5	Integrated Solar Power Fence	9	13
6	Agriculture Improvement	20	17
7	Apiculture	1	1
8	Sericulture Unit	1	1
	Total	56	60

9. Monitoring vegetation in the NEG

To assess the rate of vegetation recovery after the removal of unproductive cattle, two one-hectare plots were fenced using solar power fence where scrub cattle were removed around the vicinity of forest settlements (Photo plate 10: a, b, c, d). Two one has., plots were also chosen for comparison to find out the variation in plant colonization between closed area and open sites. Data collection are being initiated to asses plant diversity in both the closed areas and open areas once in three months to illustrate how the elimination of cattle would benefit the elephant reserve of the NEG in the long run.

This would promote a strong conservation attitude among various stakeholders with regard to the impact of cattle grazing in the elephant reserve. The outcome of the result would benefit the policy makers and the forest department to amend a few policy to ban the unproductive cattle from the GMVC on a priority basis.

The intensity of use of elephant population in the GMVC after the elimination of scrub cattle (2002-2003) was compared with the Year 2003-2004. The higher occupancy

index of elephants and more sightings of males now in the GMVC shows a positive trend after elimination of cattle from the forest settlements.

Nevertheless, it requires a detailed monitoring of population over a long period of time to substantiate the increasing trend of elephants' occupancy after the removal of scrub cattle from the NEG.

Therefore, monitoring elephant population and its habitats are most important as part of future conservation implementation programme in this region.

Table 9: Number of elephant herds sighted between 2002 and 2004 (dry season)

Name of the Transect	No. of herds sighted 2002		Demography status in 2002						No. of herds sighted 2004		Demography status in 2004					
	Total herds	Total individuals	A M	AF	S A M	S A F	J M	JF	Total herds	Total individual	A M	AF	S A M	S A F	J M	JF
Thengumara-rada (to) Kallampalayam	15	59	4	24	6	19	4	2	17	64	5	30	10	10	5	3
Thengumarada (to) Mangalapatti	13	50	5	16	9	7	9	4	16	62	6	18	10	8	12	8
Thengumara-rada (to) Gulithurapatti	14	63	6	14	8	15	7	13	18	74	7	15	9	18	9	16
Thengumara-rada (to) Thulukanpatti	3	28	2	10	2	8	2	4	5	36	3	11	4	9	4	5
Total	45	200	17	64	25	49	22	23	56	236	21	74	33	45	30	32

Lessons from the implementation of the project

1. The participatory project should be acceptable to the villagers in principal before its implementation begins which means that a through benchmark survey has to be done with the involvement of the villagers, forest field staff and local panchayat board.
2. The acceptability of the participatory project depended on the ethnic composition of the community. For instance, villages dominated by a single community were to be more successfully involved in the participatory exercise.

3. The income generation activities should be designed without complex maintenance procedure involved in it. For example, land based activities were found to be a more successful avenue than other entrepreneurs. The sustainability of the income generation activities heavily depended on the immediate economic return from the incentive scheme for the beneficiaries.
4. It is necessary to motivate the stakeholders thoroughly to involve themselves in the income generation, even after the project personnel leave the place. This mechanism was not available in several cases. Such a mechanism is needed from the beginning of the project staff.
5. A community participatory project should have more duration to implement various integrated micro plan activities, particularly in terms of sustainable economic benefit to the villagers that could reduce their forest dependence.
6. The support and assistance of the local political parties are more important for successful implementation of the project and The long-term sustainability of the project depended on the incorporation of the project outcome in the management plan for the forest divisions. This is foremost for showing the success of the participatory programme in a demonstrative scale.

10. Man-elephant conflict

One of the major issues addressed by the WWF India AREAS and US FWS projects between 2001 and 2004 in the NEG site was to develop various mitigating measures for man-elephant conflict in selected forest settlements of the NEG. The GMVC was selected on a priority basis to take an effective step towards conflict mitigative measures. The issue was also focussed by involving local communities in mitigating measures of conflict in order to improve the economic status of the villagers, keeping economic sustainability beyond the project performance period.

With the current funding source from the WWF India AREAS Programme, the efforts are being continued as apart of monitoring exercise to assess the overall success of the man-elephant conflict issues. New forest settlements are also being taken up for addressing man-elephant conflict measures in the extension phase of the project funded by the WWF-India, AREAS.

The community based solar power fence was done for five forest settlements such as Kallampalayam, Gulithuraipatti, Hallimoyar, Pudukadu, and Ramaranai in the NEG as part of mitigating measures for man-elephant conflict.

215 acres of agricultural lands were protected from the crop depredation by this scheme and 235 families belonging to four villages were directly benefited, so far, through these management approach in collaboration with the Tamil Nadu Forest Department (Photo plate 11: a,b,c,d).

A GLANCE OF MITIGATING STEP - SUCCESS MODULE

Table 10 : Crop depredation by elephants in three forest settlements before and after establishing solar power fence system (Number of people interviewed = 28 farmers).

Villages	Before the establishment of fence				After the establishment of fence			
	Total Visits by elephants	Total damage incidences occurred	Demography		Total visits by elephants	Total damage incidences occurred	Demography	
			Family herds	Males			Family herds	Males
Hallimoyar	1049	618	34	12	126	97	11	2
Pudukadu	130	87	7	NIL	NIL	NIL	NIL	NIL
Gulithuraipatti	297	234	16	NIL	NIL	NIL	NIL	NIL
Total	1476	939	57	12	126	97	11	2

The success of the man-elephant conflict step was evaluated from the villages by interviews. It is evident that new cash crops were introduced after erecting the solar power fence in their agricultural lands. The pattern of diversity of crops now grown by the villagers showed that their socio-economic status have been increased through income generation from economically assured crops (Photo plate 12: a,b,c,d). The villagers meals per day were assured even non cropping seasons besides their children's visit to school is regular. Over a period of two years, no attempts were made by the wild animals to break the fence line for getting into the crop fields. The villager's life besides their economy is saved after the solar power fencing for the selected forest settlements.

The greater success of mitigating measures for reducing the crop damage by elephants through involving the local communities have attracted many other forest tribal settlements in the NEG to avail the similar programme. This mechanism would help the forest department to protect the elephant reserve in close harmony with the local villagers in the long-run.

The WWF India AREAS and the U.S. FWS (Asian Elephant Conservation Fund) will be approached besides internal funding agencies to take up similar community participatory fences for trying to address the issues of human-elephant conflict in the NEG in the future programme. This would develop a mechanism of bringing human value as a factor for reducing the people's dependency on the elephant reserve in a holistic approach.

11. Management Measures in the NEG

It is proposed to include the Coimbatore Forest Division with in the NEG landscape, considering the significance of the forest division to elephant population, especially the division connectivity with the Silent Valley National Park, Kerala. Therefore, during the year 2002, with the funding support from the Project Elephant, Government of India, population estimation was carried out. Total block count, and water hole count were attempted.

The Coimbatore Forest Division covers an area of 673 Sq. km. and is located in the southeast of the Nilgiri Biosphere Reserve. This division has six ranges. The vegetation types range from tropical thorn forest at the foot hills to evergreen forest, in relation to terrain, altitude and rainfall. Elephants in this area also range seasonally to protected areas like Mudumalai Wildlife Sanctuary and reserved forests such as Sathyamangalam, Nilgiris North and Nilgiris South.

Elephants were counted from sample blocks selected uniformly across the entire division. A compartment map of the division was obtained and approximately 30% of the blocks (44) were chosen randomly. The sample blocks were systematically scanned by a team for direct count. Variables such as group size and demography were recorded.

Seventy eight elephants were recorded using both total block count and water hole count. Of which 53 elephants were sighted by total block count and 25 were sighted by water hole count method. The adult male to adult female sex ratio was 1: 2 among the classified individuals (n=78). The ideal adult male and female has been reported to be 1: 2. The calf to adult female sex ratio was 1: 2.3 during the census period.

Adult females constituted 35.9% followed by juvenile (30.8%) and adult male (17.9%) in the overall population. The high percentage of calves and juveniles indicates a better reproductive performance of elephants in this region. It is also an encouraging trend that fourteen adult males were sighted. Perhaps, the more sightings of males due to an efficient patrolling through anti- poaching activities, being implemented by the local forest department, funded by the Project elephant, Government of India.

Elephant corridors in the Coimbatore Forest Division (NEG)

Factors such as faulty land use pattern, encroachment, plantation and various development" activities have been leading to loss of habitat contiguity in the Coimbatore Forest Division. Of late, these became so serious, adversely affecting the movement of elephants between Western ghats and Nilgiris Eastern Slopes. In the Coimbatore Forest Division the influx of elephant population occurs especially during post-monsoon and dry season periods. Elephant population from Bandipur Tiger Reserve, Mudumalai Wildlife Sanctuary, Nilgiris North and South Forest Divisions intensively used by elephants for a period of three to four months with the density of 1.5/sq. km.

The major objectives of the project were to assess habitat quality of the corridors, their use by elephants, extent of man-elephant conflict and the impact of developmental activities on elephant movement. The study was carried out between January and March 2004. Five corridors that are critical to contiguity of habitats within the division were identified. Three corridors such as Anaikatty-Anubavi, Maruthamalai-Thanikandy and Kalkothi-Walayar were studied during this period.

Indiscriminate growth of various developmental activities (Educational Institutions, Ashrams, Industries and Resorts) all along the corridor fringes severely hampered the elephant's daily and seasonal usage in Coimbatore Forest Division. These corridors are most important for elephants to seasonal foraging as well as gene exchange between Western Ghats and Eastern Ghats. In some areas, these developmental activities have blocked the corridors (Photo plate 13: a,b,c,d,e,f) and thus, induce more incidences of man elephant conflict issues.

Protection measures - NEG

Protection measures were taken up in terms of establishment of new anti-poaching camps and also renovating the existing vulnerable camps in the NEG. Two camps were strengthened and the results were apparently visible in recent months interms of encounters with poaching gangs. Two cases (one tiger trap was seized and one encounter with the elephant poachers) besides number of poacher camps were destroyed in the GMVC area after the support rendered by the WWF-India, AREAS activities for protection measures. Other infra structure facilities such as communication

net work (wireless sets, walkie-talkies), vehicle (diesel jeep) and two motor cycles have also helped the elephant reserve of the NEG in safe guarding elephant population (Photo plate: a,b,c,d).

Outcome

The outcome of the protection measures made by the WWF India to develop a new proposal for exclusively strengthening anti-poaching camps (Mudumalai WLS, Nilgiri Forest Division and Sathyamangalam Forest Division) in the NEG landscape during 2004-2005 with the funding support from the AeCF of the US-FWS (\$ 54,666: Rs 24,59,970). This programme will be closely implemented with the Tamil Nadu Forest Department.

Water augmentation programme in the NEG

To ensure water sources during the dry season for migrating elephants in the GMVC, temporary ponds (new water holes and desilting the old ones) were done through the WWF-India AREAS programme. The work was done by the local NGO (The Nilgiri Wildlife and Environmental Association, Nilgiris). Water augmentation programme was done to a tune of \$ 6500 between 2002 and 2004 for the benefit of migrating elephants in the GMVC.

The provision of enhancing water sources to migrating elephants in the GMVC during the dry season is the future vision of the WWF India AREAS programme for a successful conservation programme in the NEG. The internal funding agencies from the Government of India and State Government will be approached for such an exercise in the NEG.

12. Conservation programme for other species - NEG

The other "flag ship species" tiger also considerably distributed in the NEG Landscape. As part of the WWF-India, AREAS programme, research on tiger and other species were done between 2002 and 2004 in the Mudumalai WLS.

a) Tiger (*Panthera tigris*)

Today, the major conservation problems that are threatening the wildlife habitats includes grazing by livestock, fire incidences, NTFP collection, lopping and woodcutting and other human induced development activities. These activities have slowly altered and modified the habitats into unproductive weed colonized ecosystem. The weeds such as *Lantana camara*, *Eupatorium sp.*, *Stachytarpheta jamaicana*, *Stachytarpheta indica* and *Chloronea odorata* are slowly invading the natural forest ecosystem and replacing

endemic floral communities. Thus, these weed plants invasion pose a serious problem to herbivores by depleting its natural food resources as well as altering vegetation diversity into a homogenous stand. These weeds are undesirable generally unpalatable, hungry herbivores are forced to consume them in the absence of preferred fodder species which leads a major problem to larger and medium sized carnivores such as tiger, leopard and wild dog that are rely on herbivore communities.

A short term research was attempted from January to April 2003 to quantify the effect of invasion by exotic weeds on tiger prey species in three different levels of weed invaded areas of dry deciduous forest in the Mudumalai Wildlife Sanctuary. The study was conducted with the following objectives,

- a) To estimate different prey group sizes, tendency to form groups and mean group sizes in different weed proportionate areas
- b) To calculate the proportions of different age-sex classes of large herbivores in different level of weed proportionate areas
- c) To estimate the tiger use of different levels of weed invaded areas

The study area was divided into three different weed levels such as less weed infested area (40%), moderate weed infested area (60%) and severely weed infested area (80%). These three weed invaded areas were walked along the game roads twice in a week on foot in the morning (0600 hrs-0900 hrs) and evening (1600 hrs-1800 hrs). Variables such as group size, demography and sex ratio were collected for herbivores. Scats, territory markings and kills of tiger collected in all the three levels of weed invaded areas. The results clearly showed that the two major ungulates chital (68.7/Sq.km) and sambar (12.1/Sq.km) were more abundant in less weed infested area (Table 10). The mean group size of chital, sambar and common langur did not seem any significant difference between weed infested areas.

Table 11 : Density estimates for prey species in the study area in Mudumalai Wildlife Sanctuary

Study Area	Prey species	Density/ Sq.km.	Standard Error	% of Coef. Variation	95% Confidence Interval
SWIA	1. Chital	22.5	5.10	22.64	14.40-34.10
	2. Sambar	6.7	1.90	27.30	3.90-11.40

	3. Common langur	51.1	11.15	21.82	4998.0-11751
MWIA	1. Chital	10.21	2.90	28.30	5.80-17.91
	2. Sambar	1.8	0.44	24.41	1.11-3.00
	3. Common langur	88.9	13.83	15.60	65.50-120.64
LWIA	1. Chital	68.71	10.90	15.84	50.33-93.64
	2. Sambar	12.11	1.11	15.40	9.60-17.60
	3. Common langur	96.43	15.19	15.80	70.84-131.30

(SWIA-Severely Weed Infested Area; MWIA-Moderate Weed Infested Area; LWIA-Less Weed Infested Area)

The estimates of density of prey species to tigers estimates was based on their mean ecological density. The result clearly showed that the biomass of major tiger prey species such as chital (56%), sambar (28%) and common langur (15%) were available more in less weed infested area (59%). The evidences of tiger use of three different levels of weed infested areas revealed that the less weed infested area was preferentially used by tiger than in other two areas. The indirect evidences such as pug marks (n=35), scats (n=12) and territory markings (n=5) were recorded high in less weed infested area. There was no direct sighting were recorded in moderate and severely weed infested areas. On the other hand, tiger was sighted couple of times in the less weed infested area during the study period.

The use of tiger in relation to habitat preference clearly showed with reference to prey species abundance and distribution. Absence of tiger sightings was observed in moderate and severely weed infested areas during the study period.

Out come

The present study findings has showed that invasion of weeds in wooded forest limit the space and prey availability to tiger population (Photo plate: 15: a,b,c,d,e,f). It is proposed to develop a short-term research programme, on a trial basis to find out the effect of habitat modifications that altered due to weed invasion (Lantana) and its impact on tiger habitats.

Gaur (*Bos gaurus*)

The gaur population is widely distributed in the protected areas and managed forests of NEG landscape. They are declining in their numbers due to loss of habitats, weed invasion and diseases. Less information is available on the distribution, population, and ecology of gaur in the NEG, although the species is an integrated part of the tiger habitats. A study was conducted from May to November 2002, to collect information on the following objectives:

1. To estimate the use pattern of gaur in different habitats
2. To quantify the demography of gaur population
3. To find out the habitat preference of gaur in relation to grass growth and
4. To assess selection of various microhabitats by gaur in different habitats

To assess the habitat use pattern, variables such as number of days spent in each habitat, searching hours, number of groups sighted were recorded. Proportion of various age and sex classes was recorded for each sighting to find out the demography. Habitat preference index of gaur was related to grass properties such as % of grass cover, texture and height. To assess the seasonal movement, variables such as time of sighting, habitat type, % of shade, availability of grass, nearest water sources, % of weed occurrence and the presence of salt licks were recorded. Various microhabitats used by gaur in each habitat across months were studied whenever animal was sighted in different microhabitats.

During the study period two hundred and thirty one gaur herds comprising of 1979 individuals were recorded in different habitats. More gaur herds were sighted in dry deciduous forest followed by dry deciduous tall grass forest, moist mixed deciduous forest and thorn forest. There was a variation in habitat use pattern of gaur populations across months in all the habitat types (Table 11).

Table 12 : Encounter rate of gaur from May to October 2002 in different habitat types

Habitat Types	No. of days spent in the field	No. of days gaur sighted	No. of groups sighted	No. of individuals
Dry deciduous forest	54	54	120	1117
Deciduous tall grass forest	43	40	81	663
Moist mixed deciduous forest	21	21	29	191
Thorn forest	12	1	1	8
Total	129	116	231	1979

In dry deciduous forest, more sightings were recorded in June and August. September and October months were the peak sighting season in dry deciduous tall grass forest and moist mixed deciduous forest. The mean group size of gaur herds also considerably varied among months. Mean group size of herds was more in August (12.9) and October (8.5) in dry deciduous tall grass forest and moist mixed deciduous forest respectively. The greater mean group size of gaur in dry deciduous tall grass forest was perhaps attributed to the availability of more grassland that might have attracted big congregation of gaur herds during the late evening hours. The gaur population showed less preference to thorn forest during the study period. The dry deciduous forest was more used by gaur population than other habitat types between May and October.

Out come

The study has led to understand the potentiality of tiger habitats indirectly, keeping gaur as an indicator species to tigers. It is decided to find out the distribution ranges of tigers in the NEG landscape, especially unknown tracts of managed forests (Anaikatti-Sigur Plateau-Moyar Valley-Thalamalai Plateau-Dhimbun tract in the Eastern Ghats) in the NEG.

13. Forest Department and NEG

The forest divisions of Nilgiri North, Sathyamangalam, Mudumalai Wildlife Sanctuary, and managed forests are prime locations for elephant population in the NEG. Buffer zone activities were carried out by the forest divisions in the GMVC of the NEG in order to minimize the forest dependence by the villagers and minimize man-elephant conflict. Activities such as land based schemes, livelihood schemes, and infra structure facilities were provided to the forest settlements in the GMVC to reduce the people's dependence on the elephant reserve. The forest department has established anti poaching network in vulnerable locations including intelligence gathering to prevent elephant poaching in the NEG.

The forest department has fully geared to improve the protection measures in terms of anti-poaching camps, wireless communications and motor pool. The efforts taken for improving the camps were visibly seen in the field in terms of encounters with the elephant poachers (n=2) and destruction of poaching camps by the anti-poaching field staff. The anti-poaching field personnel also managed to rescue a few elephant from problematic situation in the NEG site between 2002-2004.

Outcome

- a. It is proposed to strengthen 16 such camps in the NEG locations with the funding support from the US Fish and Wildlife Service during 2004-2005. The project is in the pipeline. Moreover, the Project Elephant Scheme of the Government of India, also support the NEG in terms of maintaining the anti-poaching camps more efficiently for minimizing the threats to elephants.
- b. The MIKE, CITES schemes, also helps the forest divisions of the NEG by providing infra structure such as GPS for each division to collect data on variables related to poaching incidences including location of carcasses. It is planned to strengthen the existing anti-poaching camps in a more scientific manner (GPS location, map reading and monitoring the elephant movements) in the future programme of the WWF-India and U.S.FWS supported funding.

National Afforestation Programme (NAP): Centrally sponsored NAP is being implemented by the Nilgiri North, Sathyamangalam and Coimbatore Forest Divisions. Despite many efforts made over the past several decades, it has not been possible to reduce the dependence of forest dwelling communities on rural resources to reduce the rate of degradation of forest and other non-forest wood lands. In this context that the centrally sponsored scheme NAP for Integrated Village Afforestation and Eco-Development Programme, are being implemented in forest dependent villages closer to the elephant reserve. The objectives of the NAP are to;

- a. develop regeneration in degraded forests and adjoining areas on a watershed basis.
- b. augmentation of wood and non-wood forests products (fuel wood, fodder and small timber, honey, wax, fruits, and nuts) .
- c. securing people's participation in planning and regeneration efforts to ensure their sustainability and equitable distribution of forest products from the regenerated lands and.
- d. employment generation for the most needy sections of society, particularly those belonging to women, scheduled castes/scheduled tribes and landless rural laborers, inhabiting the forests and adjoining areas.

The NAP funds are used to address the following actions:

- a. Aided natural regeneration
- b. Artificial regeneration

- c. Mixed plantation of trees having NTFFP and medicinal value and
- d. Regeneration of perennial herbs and shrubs of medicinal value

The programme oriented towards welfare needs of the people living along the fringes of the elephant reserve. Micro plans for such schemes were prepared by the WWF India AREAS staff for ten villages in the Sathyamangalam Forest Division of the NEG Landscape.

The scheme of NAP would also complement to the activities carried out by the WWF India AREAS, especially bringing and developing more economic enterprises for the villagers. The poverty elimination programme would prevent the primary stakeholder (graziers) of elephant reserve, preventing them to visit into forest.

Out come

Thus, the NAP, and other agencies also play a significant role in the conservation programme in the NEG for securing elephant habitats.

14. Government Agencies and NEG

Animal Husbandry: New hybrid variety of milch animals was introduced so that the elimination of cattle programme was mostly accepted to the villagers. Hybrid variety of bulls also given to the villagers to improve the genetic viability of the animals in this region that would promote stall feeding instead of free ranging by scrub cattle.

A massive vaccination programme was conducted in the Thengumarahada village on 2001. The purpose of the programme was initiated in this village were to control contagious diseases from the cattle to the wild animals in the Greater Moyar Valley Corridor. Totally 2000 cattle were vaccinated.

Sericulture department: Totally 37 units of sericulture were given to the villagers belonging to the Kallampalayam (12 units), Hallimoyar (10 units) and Thengumarahada (15 units). The department provided subsidized loan facility to the thirty-seven families (mostly graziers) and they are used the funds for managing the sericulture farm, cultivation of mulberry leaves and other farm related appliances.

This approach would indirectly benefit the elephant reserve by preventing farmers getting into jungle for any purpose. The on-going project, funded by the WWF-India, AREAS and U.S.FWS in the GMVC, identified a few graziers for encouraging them to avail this scheme for economic sustainability.

District Rural Development Agency: The DRDA assisted the forest settlement villagers through rural development schemes. Activities such as desilting of ponds and approach road were largely done by DRDA. These activities were useful to the people for their economic development and thus, benefit to the elephant conservation in the NEG.

Hill Area Development Programme (HADP): A variety of developmental activities is implemented by the HADP in this region for promoting an economy based approach for forest settlements. Schemes such as construction of Primary Health Center, improving road facility, construction of group houses for the tribal people and also improvement of agriculture fields were provided to the forest settlements between 2002-2003 (Photo plate: 16, a,b,c,d). These measures have indirectly benefited the forest dependent people in terms of their livelihood status.

The HADP work, of late, taken up in the forest settlement with the view of reducing the pressure on the elephant reserve. This is a healthy trend towards bringing various government agencies in a common platform to achieve the goals of NEG landscape.

Women Self Help Groups (WSHG): Nineteen WSHG are functioning in the GMVC. These are largely supported by the District Administration to take up various welfare measures for the villages. Forest department, village panchayat and other NGOs promoting these groups by giving them contract civil works.

Out come

It is planned to identify a few WSHG who own large number of scrub cattle for supporting them to involve in the elephant management (Photo plate: 17 a,b,c,d,e,f). Activities such as promoting nursery comprising of elephant food species and augmenting perennial water are being attempted by six WSHG from the forest settlements of Kallampalayam, Thengumarada, Hallimoyar and Ramaranai . Thus, the involvement of WSHG directly benefiting the elephant reserve of the NEG.

Water augmentation: Four water tanks were established for elephants adjoining to Kallampalayam forest settlement by the forest department using funds from the SGRY (Samboorna Grama Rojaka Yojana, Government of India). Thus, special schemes such as SGRY has been taken in dealing and solving the water requirement of elephants during the dry spell of the NEG.

15. Capacity Building Programme in the NEG

Field Training for the Forest Field Staff - Tamil Nadu

Asian elephants require a vast habitat diversity to meet its food, water and shade. The estimated annual home range for an elephant herd in the Western Ghats of Mudumalai Wildlife Sanctuary has been 500-600 Sq. Km. Various anthropogenic pressures and other development activities have severely reduced elephant habitats through its distribution ranges in India. These pressures have brought down the resources of elephants to critical levels. These issues have induced man-elephant conflicts, which lead to a strong anti-conservation attitude in the minds of local people. With the result, management of elephant ranges poses a serious problem for the field personnel of the forest department.

The current conservation scenario requires field training on management of elephant reserves for the field staff (foresters, forest guard, and watchers) to manage the reserve in a better fashion for the long-term survival of the species. Such a programme would help the lower staff to develop their skills on the scientific management of elephant reserves. The training project would lead to a better management of elephant habitats by providing field techniques on the management of elephant reserves for the field personnel. It would also lead to a better understanding for the field managers with regard to elephant's value in an ecosystem.

The training programme was provided for fifteen elephant holding forest divisions in the state of Tamil Nadu consisting of four protected areas and eleven reserved forest divisions. Forest Range Officers, Foresters and Forest Guards were recruited for the training programme. The training programme was conducted for 13-15 days for each batch. Each batch comprised of 10-20 participants. Sixteen training batches were conducted over a period of eight months during 2002-2003.

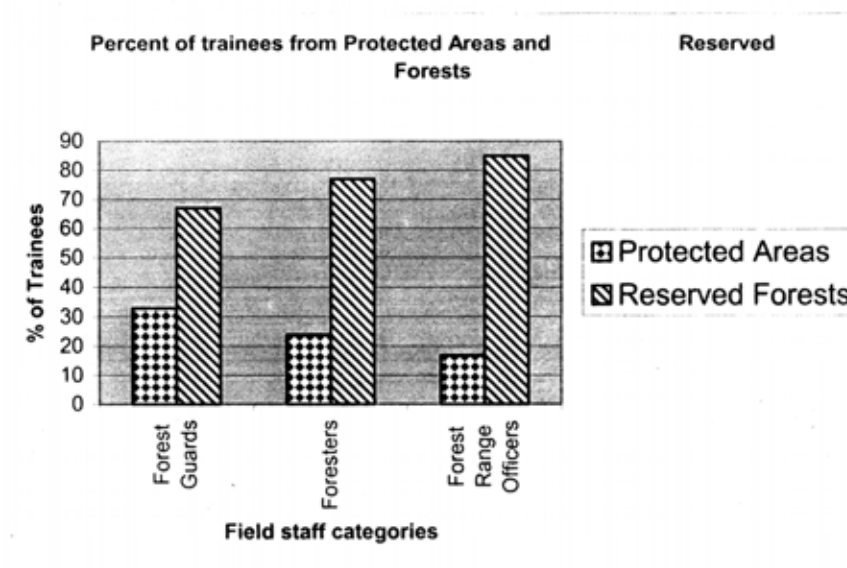
Totally twenty modules comprising of basic ecology, captive elephant management, veterinary care, man-elephant conflict, corridor management, and management of the reserve were covered by thirty-seven resource personnel (Photo plate 18: a,b,c,d,e,f). Special modules such as people's participatory approach, dealing problematic elephants (dry demonstration), success of eco-development programme, health assessment and visit to other protected areas (Tiger Reserve and National Park) were organized for the course.

Activities carried out for each batch

A pre-evaluation test was conducted for the trainees to assess the knowledge about elephants on the day of their arrival to the course. This test helped us to evaluate the trainees for organizing resource persons. The daily feedbacks were received from the

trainees for each lecture. After completion of the training programme, a post evaluation test was conducted for each batch. This test was helped us to examine the knowledge gained by each trainee during the end of the training programme.

Figure 1 : Percent of trainees from various Protected Areas and Reserved Forests



270 field personnel comprising of 204 Forest Guards (76 %), 47 Foresters (17 %), and 19 Forest Range Officers (7 %) from fifteen Forest Divisions have attended the training batches (n=16) (Fig 1). Among the fifteen forest divisions, majority of the trainees were from NEG programme areas such as Coimbatore (13.3%), Erode (10.3%) and Mudumalai (10%). It is to be highlighted that more Forest Guards (33.6%) from the protected areas attended in the training course than other categories (Foresters and Forest Range Officers) (Fig. 1).

After completion of the training programme, feedback forms have been sent to all the trainees who underwent the training course. Human elephant conflict, census modules, protection strategies, biotic threats were considerably implemented by the trainees in their respective forest divisions after the training course. The veterinary care (dealing problematic elephant, captive elephant management) was also attempted by the trainees in the field whenever problems encountered.

It is to be highlighted that the Tamil Nadu Forest Department authorities felt the significance of the course to the frontline staff. This had enabled the WWF India AREAS to extend the project for a year to cover more forest divisions and field staff with the funding support from the U.S. FWS during 2004-2005.

Out come

One significant outcome of the training course from the trainees of the Tamil Nadu was that the data collected during the synchronized elephant census was more scientific for proper compilation of the result. The reason for such an outcome was related to the training programme conducted for the sixteen forest divisions in the state during 2001-2003.

Training for Elephant Mahouts

The traditional relationship between the domestic elephants and mahouts is gradually decreasing in recent years. The knowledge on the management of health care including daily care does not pass on to the mahouts generation. The issue of handling problematic animals poses a challenging task before the new generation of mahouts. To make better management strategy of captive elephant, training programme was organized at Mudumalai Elephant Camp for mahouts managing free ranging elephants in Tamil Nadu.

Twenty elephant mahouts were participated in the programme. Veterinarians and livestock inspector and elephant experts were delivered lectures as well as practical sessions to the trainees in local language (Tamil).

Various aspects such as common diseases and their symptoms, method of cleaning and feeding and assessing the body condition were thoroughly discussed in the training. The resource persons were also discussed about management of musth animals in captive condition and precautions to be taken during musth period. Moreover, the sensitive regions in elephant body were shown to the mahouts to keep the animal safely as part of management of captive elephants.

Field Training Programme for field staff- Karnataka

The successful implementation of the field training project in Tamil Nadu State has attracted the other Southern State Forest Departments to initiate such training course. The Karnataka State harbors nearly 6000 wild elephants. In order to enhance the capacity to the forest field staff on the management of elephant reserve, a training programme was conducted in Karnataka during March 2004. Different categories such as Range Forest Officers, Foresters, Forest Guards and Ministerial Staffs belonging to the elephant holding divisions both from the protected areas and reserve forests were attended the training programme.

Three training batches were conducted in three different places viz., Bandipur National Park, Bannarghatta National Park and Nagarahole National Park. The duration of each batch was three days. Eighty-nine staff were participated in the training programme. 58 Forest Guards, 23 Foresters, 4 Range Forest Officers and 4 Ministerial Staffs have attended the training. Thirteen resource personnel have been invited to deliver their lectures for the training course.

Topics covered were; corridor management, veterinary management, census techniques, human-elephant conflict and ivory trade by experts. Both theory and practical session were given by the resource personnel. Trainees were also taken to the places where the conflict between human and elephant often been noticed. The trainees interacted with the resource personnel to understand various conservation problems existing in their beats/ranges/divisions. Feedback was also obtained from the trainees as well as resource personnel for each training batch.

Most of the trainees have expressed that the training was useful for managing the complex issues of elephant management. The trainees also felt that similar training may be extended for rest of the staff. The course materials were obtained from the resource personnel and converted into local (Kannada) language for its distribution to the field staff.

Elephant Management Training for Administrators

A short-term awareness programme on the status of elephants and key management issues of elephants in the Nilgiris was conducted for various administrators at various levels belonging to government machinery. It is being practiced that several welfare measures are being taken up for the fringe villages by government sectors where elephant's poses a serious threat. The immediate problem is the loss of contiguity of forests because of development activities adjoining to forest settlements. Therefore, the necessity of bringing government departments along with the forest sector to initiate development schemes for the forest villages in total harmony of conservation themes. More over, the need for a close cooperation from other agencies is crucial for an integrated action strategy for a realistic elephant habitat management. In this context, a training programme on elephant management was organized in Mudumalai Wildlife Sanctuary on June 2002 for the local coordinators with the funding support from the Tamil Nadu Forest Department.

Non Government Organizations such as Asian Elephant Research Conservation Centre (AERCC), Nilgiri Wildlife & Environment Association (NWLEA), Tamil Nadu

Green Movement (TNGM), Organization for Social and Illumination (OSAI), and CPR Foundation (CPRF) and the government agencies District Rural Development Agency, Highways department, Public Works department, Tamil Nadu Electricity Board, and Telephone department have attended the awareness programme. The Village Panchayat president and members were also attended.

Out come

The need for an integrated approach by various agencies was realized by all the participants belonging to various departments.

16. Overall outcome

- a. 1,175 villagers belonging to 235 families were benefited from nine settlements through alternative livelihood programme in the NEG landscape between 2001 and 2004. Minimizing dependency of these villagers on the elephant reserve, thus reduce biotic pressure of the NEG landscape that helps to maintain the elephant population in total harmony with the human society.
- b. 215 acres of agricultural lands were protected from crop depredation by elephants through community based mitigating measures, solar power fence, in five forest settlements between 2002 and 2004.
- c. 2,082 unproductive scrub cattle were eliminated from eight forest settlements in the NEG landscape, through WWF-India-AREAS and U.S. Fish and Wildlife Service funded projects. Traditional graziers and non timber forest produce collectors were encouraged to involve in the participatory approach for achieving the elimination of scrub cattle between 2001 and 2003. With the reduction of cattle from the NEG, the forest department minimized the issuing of grazing permit and total ban on the collection of Non Timber Forest Produce in the Nilgiri North Forest Division.
- d. Twenty-three solitary males were sighted between 2001 and 2002, indicating the healthy trend of the population. The sightings of males often in the GMVC, perhaps related to the establishment of anti poaching camps in several vulnerable locations in the NEG landscape.
- e. 592 forest field personnel, twenty mahouts, one hundred staff from various government and non government departments were participated in the capacity buildings on the management of elephant reserve besides 89 forest field staff from Karnataka Forest Department.
- f. Thirteen agencies have been also targeted for creating an awareness programme on the management of elephants in the NEG landscape.

- g. Seven research activities, focusing management of elephant reserve were encouraged as part of academic output for the wildlife biology students between 2002-2004.
- h. Created a realistic and an integrated approach of bringing various government and non-government agencies under one umbrella for achieving the conservation goals of elephant habitats in a large landscape like NEG (12,000 sq km).

17. Future Vision

Formulating an action strategy towards a mechanism of community participatory programme for protecting the NEG landscape for elephant conservation initiatives, keeping, human value as an important factor, in achieving human-elephant relationship in a close eco-friendly harmony. A common platform comprising of related government agencies and policy makers need to be functioned with a single objective for achieving this future vision.

18. Visitors to the NEG



- | | |
|---|--|
| 1. Mr. J. C. Daniel, Bombay Natural History Society, Mumbai | 8. Mr. C. Senthilvel, Secretary, Education Committee, AVC College, Mayiladuthurai |
| 2. Dr. R. Sukumar, Chairman, IUCN, Asian Elephant Specialist Group | 9. Mr Karthikeyan, Chairman, Education Committee, A V C College |
| 3. Dr. Karl A K Stromayer, Chief Biologist, Asian Elephant Conservation Fund, United States Fish and Wildlife Service | 10. Dr. M. C. Sathyanarayana, Lecturer, Zoology Dept., AVC College, Mayiladuthurai |
| 4. Dr. V. Cheeran, Veterinarian, Kerala State | 11. Mr. S. Swetharanyam, Head of the Dept., Zoology, AVC College, Mayiladuthurai |
| 5. Mr. Ajay A Desai, Steering Committee Member, Project Elephant, Govt. of India | 12. Prof. Dr. J. Alphonse Jayabalan, Zoology Dept., AVC College Mayiladuthurai |
| 6. Mrs. Supriya Sahu, IAS, Tamil Nadu State Government | 13. Dr. P. A. Aziz, Senior Principal Scientist, Salim Ali Centre for Ornithology and Natural History, Coimbatore |
| 7. Dr. V. Radhakrishnan, Principal, AVC College, Mayiladuthurai | |

14. Dr. P. Balasubramaniam, Senior Scientist, Salim Ali Centre for Ornithology and Natural History, Coimbatore
15. Mr. M. Maranko, Wildlife Inspector, Regional Office, Southern Region, Chennai
16. Dr. S. Shanmugasundaram, Forest Veterinary Officer, Tamil Nadu
17. Dr. N. S. Manoharan, Director, VOC Park, Coimbatore
18. Dr. N. Kalaiivanan, Assistant Forest Veterinary Surgeon, Theppakkadu, Mudumalai
19. Dr. N. Baskaran, Scientist, Asian Elephant Research Conservation Centre, Bangalore
20. Mr. A. C. Soundarrajan, Nilgiri Wildlife and Environment Association, Udhagai
21. Mr. R. Arumugam, Centre for Ecological Sciences, Masinagudy
22. Mr. C. Arivazhagan, Centre for Ecological Sciences, Masinagudy
23. Mr. Jayachandran, Secretary, Tamil Nadu Green Movement, Nilgiris
24. Mr. M. Kumaravelu, CPR Foundation, Nilgiris
25. Mr. Mohanraj, Key Stone, Kothagiri, Nilgiris
26. Dr. H. S. Dattaraja, Centre for Ecological Sciences, Bangalore
27. Mr. H. S. Suresh, Centre for Ecological Sciences, Bangalore
28. Mr. B. J. Krishnan, Senior Lawyer, Udhagai
29. Mr. P. R. Mani, Livestock Inspector, Tamil Nadu State
30. Mr. K. Kalidasan, Secretary, Organization for Social Awareness and Illumination, Coimbatore
31. Mr. J. C. Kala, IFS, Principal Chief Conservator of Forests, Tamil Nadu State Forest Department, Chennai
32. Dr. Sukdev, IFS, Principal Chief Conservator of Forests and Chief Wildlife Warden, Tamil Nadu State Forest Department., Chennai
33. Prof. K. S. Neelakantan, IFS, Dean, Forest College and Research Institute, Tamil Nadu Agriculture University, Coimbatore
34. Mr. Ananthaswamy, Conservator of Forests, Tamil Nadu Forest Department
35. Dr. T. Sekar, IFS, Conservator of Forests, Coimbatore Circle
36. Dr. H. Basavaraju, IFS, District Forest Officer, Erode Forest Division

37. Dr. S. Paulraj, IFS, District Forest Officer, Hosur Forest Division
38. Mr. Hemant Kumar, IFS, Deputy Director, Regional Office, Southern Region, Chennai
39. Mr. A. Venkatesh, IFS, District Forest Officer, Tanjore Forest Division
40. Mr. A. Udhayan, IFS, Tamil Nadu Forest Department
41. Mr. V. Ganesan, IFS, Wildlife Warden, Indira Gandhi Wildlife Sanctuary
42. Mr. K.P. Duraisamy, District Forest Officer, Sathyamangalam Forest Division
43. Mr. P. Durairasu, IFS, District Forest Officer, Coimbatore Forest Division
44. Mr. A. K. Ulaganathan, IFS, District Forest Officer, Nilgiri North Forest Division
45. Mr. Sriganesh, IFS, District Forest Officer, Nilgiri South Forest Division
46. Mr. Deepak Srivastava, IFS, Tamil Nadu Forest Department
47. Mr. Dinkar Kumar, IFS, District Forest Officer, Tamil Nadu Forest Department
48. Mr. A. Devadoss, Assistant Conervator of Forests, Southern Forest Rangers College, Coimbatore
49. Mr. S John Joseph, (Retd.IFS), Chairman, WWF-India, Chennai
50. Mr. K Sankaramurthy, (Retd.IFS), Project Coordinator, WWF-India, Chennai
51. Mr. Priston Ahimaz, Director, WWF-India, Chennai
52. Mr. Vijayakumar, IPS, Additional Director General of Police, Special Task Force
53. Mr. Chinnasamy, IPS, Superintendent of Police, Special Task Force
54. Mr. C. Thangaraja, Assistant Conervator of Forests, Nilgiri North Forest Division
55. Mr. Srinivasan, Assistant Conervator of Forests, Nilgiri North Forest Division
56. Mr. Krishna Narayan, Director, IBEX Gallagher Pvt. Ltd., Bangalore
57. Mr. George Eapen, IBEX Gallagher Pvt. Ltd., Coimbatore
58. Mr. C. Thangaraja, Assistant Conervator of Forests, Nilgiri North Forest Division
59. Mr. K. K. Rajendran, President, Pungar Panchayat
60. Mr. A. Ravikumar, President, Masinagudy, Panchayat

Theme: Habitat degradation in the NEG

PLATE - 1



Impact of cattle grazing leads to denudation of habitats.



Loss of corridor due to development activities.



Crop fields adjoining elephant reserve.



Human settlement closer to the elephant reserve in Coimbatore Forest Division.

Theme: Human induced threats in the NEG

PLATE - 2



Impact of sheep grazing



Collection of Non Timber Forest Produce (*Solanum torvum*)



Colonization of unpalatable plant (*Opuntia dilenii*)



Expansion of tourism activity closer to the fringes of elephant reserve



Impact of wood collection



Establishment of road in elephant corridors

Theme : Elephant habitats in the NEG

PLATE - 3



A herd of elephants in dry deciduous forest



A herd of elephants in moist deciduous forest



A sub adult tusker in thorn forest



A herd of elephants in bamboo forest



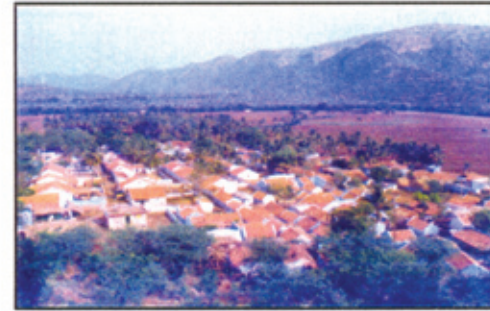
A family herd in a swamp



A herd of elephants in teak plantation

Theme : Forest settlements in the NEG

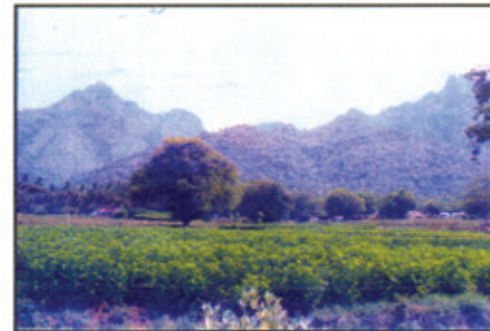
PLATE - 4



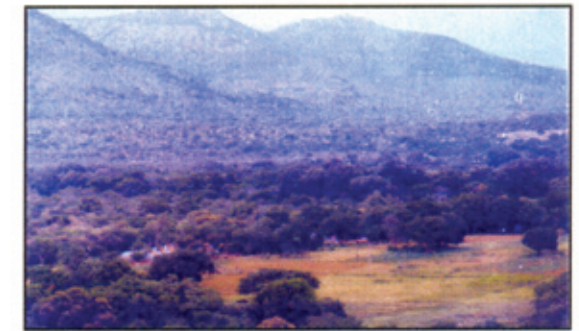
Thengumarahada village in the Greater Moyar Valley Corridor



Pudukadu village in the Greater Moyar Valley Corridor



Hallimoyar forest settlement in the Greater Moyar Valley Corridor



Kallampalayam forest settlement in the Greater Moyar Valley Corridor



Gulithuraipatti forest settlement in the Greater Moyar Valley Corridor



Sujalkuttai, an encroachment (PWD land) area in the Greater Moyar Valley Corridor

Theme : Major migratory paths to elephants in the NEG

PLATE - 5



The forest tract along the Power Line used by elephant population.



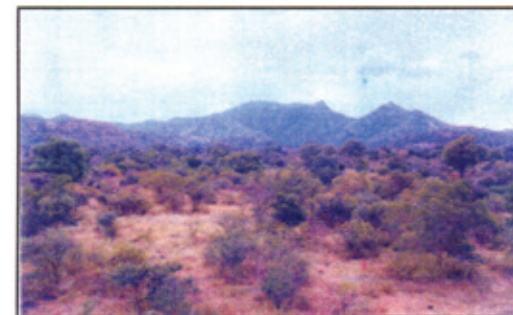
Abandoned road between Mangalapatti and Sirur RF



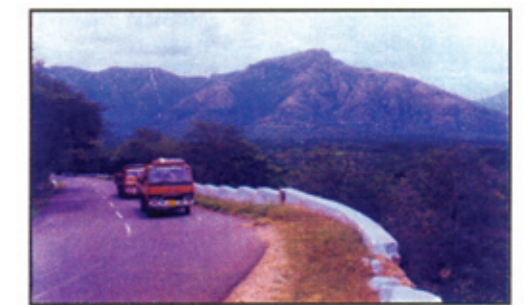
Semmalai Karadu foot hill forest in the Sujalkuttai-Bannari Corridor, used by elephant population.



Foot hill forest of Nilgiri Eastern Ghats along the Bhavanisagar Dam, extensively used by elephants.



Forest tract between Gajalahatti and Talamalai Plateau linking Eastern Ghats



Foot hill forest of Dimbam-Mysore Road in Eastern Ghats used by elephants during dry season



Theme : Impact of cattle grazing in the NEG

PLATE - 6



Cattle population entering into the elephant reserve



Impact of cattle grazing was assessed in the Nilgiri Eastern Ghats



Regeneration and recruitment saplings of elephant food plants severely affected by cattle grazing



Browse resources are crucial to elephant's during the dry season in the Greater Moyar Valley Corridor



Albizzia amara and *Acacia spp.* are favored food trees of elephants in the Greater Moyar Valley Corridor



Invasion of *Prosopis juliflora* is a serious threat to the food resources of elephants in the Greater Moyar Valley Corridor

Theme : Ecological requirements of elephants in the NEG

PLATE - 7



Rich browse availability is an important factor for elephants to use the Greater Moyar Valley Corridor during the dry season

Moyar perennial river, is a boon to elephant population in the Nilgiri Eastern Ghats



Occurrence of natural salt licks is abundantly available in the Greater Moyar Valley Corridor

Micro habitat such as valley, riparian forest and bamboo patches are big attraction to elephants during the dry season



Theme : Awareness Programme on elephant conservation

PLATE - 8



Organizing workshop for various stakeholders as part of Participatory Approach in managing the NEG



Workshop was organized in village level (Hallimoyar)



Villagers expressed their views in decision making

The Project Team used to meet the villagers in the field as part of winning confidence mechanism



Theme : Alternate livelihood schemes for graziers

PLATE – 9



Alternative livelihood scheme-
Milch Animal



Alternative livelihood scheme-Bullocks



Alternative livelihood scheme-Sericulture



Alternative livelihood scheme-Apiculture



Alternative livelihood scheme-Petty Shop



Alternative livelihood scheme-
Land Based Activity

Theme: Human-elephant mitigating measures

PLATE - 10



Cattle population was removed from Hallimoyar Forest Settlement

Habitat denudation due to the impact of scrub cattle



Closed one hectare control plot using solar power fence to monitor the vegetation recovery

Rate of vegetation recolonization in the control plot was monitored by the NEG research team



Theme : Crop damages and mitigating strategies in the NEG

PLATE - 11



Crop damage by elephants has created a strong anti- conservation feeling among the minds of villagers

A cow elephant died in the crop field due to electrocution



A tusker was electrocuted near the crop field

Superior quality of solar power fence was established with community participation as a mitigating measure for crop depredation by wild animals



Theme : Agricultural activities in the forest settlements

PLATE - 12



Plantain garden was grown after the erection of community solar power fence

Mulberry garden was commonly seen after the erection of community solar power fence



Groundnut was commonly grown after the erection of community solar power fence

Paddy was also commonly grown after the community solar power fencing



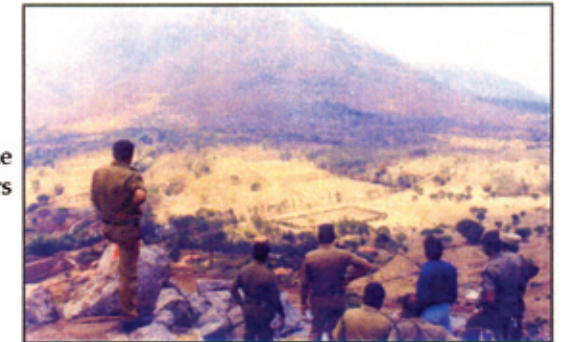
Theme : Status of elephant corridors in the NEG

PLATE - 13



Elephant corridor is blocked by education institution

Development of resorts reduced the size of the corridors



Amusement Park also seriously affecting habitat contiguity

Railway line, a serious threat to migrating elephants in Kalkothi - Walayar Corridor in Coimbatore Forest Division



Theme : Protection measures in the NEG

PLATE - 14



A new anti-poaching camp was established in Gulithuraipatti (Sathyamangalam Forest Division)

A renovated anti-poaching camp was established in Mangalapatti (Nilgiris North Forest Division)



Communication networks was provided to the Forest Department

Motor Pool was provided to increase the patrolling strategy



Theme : Major prey species in tiger habitats of the NEG

PLATE - 15



Gaur (*Bos gaurus*)



Sambar (*Cervus unicolor*)



Spotted deer (*Axis axis*)



Barking deer (*Muntiacus muntjac*)



Black buck (*Antelope cervicapra*)

Theme : Hill Area Development Programme (HADP) in the NEG

PLATE - 16



Primary Health Centre as part of village development programme

Improvement of road in the village (Foot path)



Group houses for the tribal people

Land based irrigation activities



Theme : Women Self Help Group (WSHG) and the NEG

PLATE - 17



Promoting WSHG in elephant conservation programme

Members of WSHG involved in managing control plot solar power fence



Members of WSHG raising elephant fodder species as part of habitat improvement programme

Theme : Capacity building in the NEG

PLATE - 18



Role of elephants in the forest ecosystem



Census techniques offered to the trainees



Management of corridors and their issues were shown to the trainees in the field



Health care of captive elephants was demonstrated to the trainees



Community Participatory Programme for the management of elephant reserve was offered to the trainees



Dealing problematic elephants

Theme : Capacity building in the NEG

PLATE - 19



Use of field instruments by the trainees



Monitoring elephant reserve



Demonstrating solar power fence as an tool for preventing crop damage by wild animals



Assessing age of elephants using molar pattern



Post mortem techniques offered to the trainees



Assessing health condition of elephant



Illustrating elephant corridor in the field



Camp Office : Gajah Illam, Thengumarahada



Elephant herd in Greater Moyor Valley Corridor

Photo by G.Sivasubramanian



Impact of Cattle Grazing



Leads to



"Community participation is the sustainable approach for elephant conservation in the long-run"
- Natarajan Sivaganesan