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ROLE OF ELEPHANTS IN SUJALKUTTAI -BANNARI CORRIDOR IN SATHYAMANGALAM FOREST DIVISION,TAMIL NADU, SOUTHERN INDIA

G. Sivasubramaniyan and N. Sivaganesan
Salim Ali Centre for Ornithology and Natural History
Kalampalayam, Coimbatore 641 010, India.

INTRODUCTION

In forests ecosystem, elephants could play a major role in shaping habitats while eating the canopy vegetation, stripping off bark and uprooting of trees both in Africa (Croze, 1974; Caughley, 1976; Leuthold, 1977; Pellew, 1983; Barnes, 1985) and in Asia (Ishwaran, 1983; Sivaganesan, 1993). Another notion about the elephant is its significance for other faunal communities through its role in the forests ecosystem, especially its ability to disperse seeds (Williamson , 1975).

Although studies (Vancuylenberg, 1977; Olivier, 1978; Choudhury, 1980; Nair *et al.*; 1980; Singh, 1978; Daniel *et al.*, 1987, Easa, 1988; Sukumar, 1989 a & 1989 b; 1990, Desai, 1991; Sivaganesan, 1991) have been carried out on ecology of Asian elephant *(Elephas maximus)* its role in forest ecosystem with regard to its interactions with other herbivores and dispersal of seeds has not been studied much in Peninsular India. Therefore, a study was attempted to :-

a) determine vegetation composition to assess abundance of browse plants available to elephants.
b) assess extent of height alteration on various plant species induced by elephants.
c) determine its impact on various size classes of food trees.
d) identify the plant species dispersed through dung and
e) find out the usage pattern of other fauna in elephant foraging niches.

STUDY AREA

The Sujalkuttai - Bannari corridor is located in the Sathyamangalam Forest Division of Tamil Nadu, Southern India. It is approximately 25 km² in length beginning at the tail end of Moyar Valley (Map 1) linking Bannari Forest Division on the eastern portion of Eastern Ghats and Kallar reserve forest of the Coimbatore Central Forest Division on the West. In many areas this corridor width is narrow(< 1 km) and it forms a bottle neck between

the Nilgiri Eastern slope which is steep and the water logged areas of the Bhavanisagar reservoir. The terrain is undulating. The study site is dominated by thorn forest (6 A/ C 1) apart from southern dry mixed deciduous forests (5 A / C 3) in the hill slopes (Champion & Seth, 1968). Common trees are; *Albizia amara, Acacia sundra, A. latronum, A. leucophloea, A. planifrons, Bauhinia recemosa, Commiphora berryi, Erythroxylum monogynum, Randia dumetorum and Ziziphus mauritiana.* Dominant shrubs are; *Cassia auriculata, Capparis spp., Grewia villosa, Grewia hirsuta,* and *Solanum spp*. Unpalatable and exotic plant species such as *Eupphorbia antiquarum, Opuntia dillenii* and *Prosopis juliflora* are colonizing in many areas which is a major threat to this corridor.

Perennial rivers such as Moyar and Bhavani are of great attraction to elephants during the dry season. The average annual rainfall is 824 mm. This area receives rainfall from both north -east and south - west monsoon but bulk of the rainfall comes from the former, from September to November.

The corridor has sizeable populations of blackbuck (*Antelope cervicopra*), fourhorned antelope *(Tetracerus quadricornis*), striped hyena (*Hyaena hyaena*), gaur (*Bos gaurus*), sambar (*Cervus unicolor*), chital (*Axis axis*), leopard *(Panthera pardus*) and dhole (*Cuon alpinus).*

MATERIAL AND METHODS

Density of various plant species was estimated from 170 strip transects of 25x10 m which are laid randomly in the corridor. Number of individuals of each species, their girth at the breast height (gbh cm) and height (m) were recorded from each transect (Dittus, 1979). Observations on the vegetation modification induced by elephants particularly on mature trees (>10cm gbh) was collected from all the 170 transects. Data on species and parts consumed, total tree height and feeding height from the ground were collected along the feeding trails as followed by White *et.al.*, (1993). Occurrence of feeding signs on mature trees (>10 cm gbh), recruitment (>2m height saplings) and regenetation (<2m height sapling) of various species were also recorded to assess the impact of elephants' feeding. To determine the role of elephants in dispersing seeds of various plant species, 300 fresh (< 1 week old) and 743 old (< 1 month old) dung piles were visually examined in the field itself for occurrence of seeds. Abundance of various seeds in each dung pile was quantified on a four point scale: 1 (< 25 seeds per dung), 2 (< 25-50 seeds per dung), 3 (50-75 seeds per dung) and 4 (> 75 seeds per dung). Other materials like fungi were also noted whenever seen in dung piles to assess significance of elephants in providing various micro-habitats for other animals. Tracks and signs such as scats, pellet groups, kills and spurs of various animals were noted to determine their usage pattern along elephant foot paths and its foraging sites.

RESULTS

Species compostion

A total of 4394 individuals belonging to 47 species were recorded from 3.77 ha area, of which 28 were thorny species accounting for 41.2% of the total trees. These comprised mostly of *Acacia latronum* (230/ha), *Acacia planifrons* (62/ha), *Albizia amara* (46/ha) and *Commiphora berryi* (41/ha) (Table 1). These species constitute major food plants to elephants as evident from their browsing incidence. Among 16 shrub species *Fluggea leucopyrus*, *Grewia villosa*, G. *hirsuta* and *Solanum torvum* were commonly distributed. Shrub species formed up to 57.9% of the total individuals. Creepers/stragglers formed just 0.86% of the total trees enumerated. Unpalatable species such as *Dodonaea viscosa*, *Lantana camara* and *Calotropis gigantea* were observed invading the forested areas.

Feeding height

Elephants have suppressed crown height of *Acacia latronum*, *Albizia amara* and *Commiphora berryi* while feeding on the crown (Table 2). The mean feeding height on the crown portion of various tress by elephants ranged from 2.7 m to 5 m. It is of significance that more feeding signs were observed on noncoppiced individuals of *Acacia latronum* (76.7%) and *Albizia amara* (77%) and thus altering tree heights and in many cases the ultimate fate is total crown distortion.

Species eaten

Forage signs along fresh feeding trails were recorded mostly on *Acacia latronum*, *Commiphora berryi*, *Albizia amara* and *Grewia villosa* while 11 other food species were used less extensively (Table 3). Occurrence of feeding signs on various size classes varied in relation to availability. For example, feeding signs were poor on regenerating saplings. On the other hard, elephants fed predominantly on recruitment individuals of *Acacia latronum* (69%), *Albizia amara* (72%) and *Grewia villosa* (71.0%) (Table 3). Mature tree cover of *Commiphora berryi* was the most favoured species with 96% of the total feeding signs. Mature stands of *Acacia latronum* and *Albizia amara* also showed preference by elephants.

Dung contents

Seeds belonging to grasses, shrubs and trees were observed from 1043 dung piles examined during the study period. Seeds of 10 species of trees, 5 woody shrubs, 3 grasses, 1 creeper and 1 crop were observed in the dung piles and assumed to be dispersed by elephants (Table 4). Among various seed remains, *Grewia villosa* was abundant followed by *Bauhinia racemosa* and *Grewia hirsuta*. Seed remains of other species were low in

Table 1. Density and relative density of various plant species in Sujalkuttai - Bannari Corridor of Sathyamangalam Forest Division (Area sampled 3.77 ha.)

Species	Status	# individuals	Density (per ha)	Relative density
Acacia latronum	T/+	870	230.77	19.80
Acacia leucophloea	T/+	7	1.86	0.16
Acacia mellifera	T/+	9	2.39	0.21
Acacia planiferons	T/+	237	62.86	5.39
Albizia amara	T/+	176	46.68	4.01
Atalantia monophylla	T	2	0.53	0.05
Azadirachta indica	T	13	3.48	0.30
Bauhinia racemosa	T/+	10	2.65	0.23
Calotrophis gigantea	S	3	0.8	0.07
Cardiospermum halicacabum	C/+	5	1.32	0.11
Carssia auriculata	S	83	22.02	1.89
Carissa carandas	T	19	5.04	0.43
Capparis sp.	S/+	54	14.32	1.23
Cissus quadrangularis	C	3	0.8	0.07
Chloroxylon swietenia	T	61	16.18	1.39
Commiphora berryi	T/+	157	41.64	3.52
Dichrostachys cinerea	T/+	50	13.26	1.14
Dodonaea viscosa	S	70	18.56	1.59
Erythroxylum monogynum	S	136	36.07	3.09
Euphorbia antiquarum	T	21	5.70	0.49
Fluggia leucopyrus	S	736	195. 22	16.56
Grewia tiliaefolia	S/+	78	20.68	1.77
Grewia villosa	S/+	730	193. 63	16.56
Grewia hirsuta	S/+	35	9.28	0.80
Gmelina arborea	T	13	3.45	0.30
Gyrocarpus americanus	T	4	1.06	0.09
Jasminum auriculatum	C	13	3.45	0.30
Jasminum sp.	C	17	4.50	0.38
Limonia alata	T	27	7.16	0.61
Lantana camara	S	7	1.86	0.16

Table 1. continued.

Species	Status	# individuals	Density (per ha)	Relative density
Morinda tinctoria	T	1	0.27	0.02
Mundulea sericea	T	13	3.44	0.30
Opuntia dillenii	S	4	1.06	0.09
Prosopis juliflora	T/+	32	8.48	0.83
Premna sp.	T/+	52	13.79	1.18
Pithecellobium dulce	T/+	4	1.06	0.09
Pongamia pinnata	T	2	0.53	0.05
Pteralobium hexapetalum	S/+	4	1.06	0.09
Randia dumetorum	S/+	147	38.99	3.34
Randia malabarica	S/+	8	2.12	0.18
Solanum torvum	S/+	450	119.36	10.24
Sapindus emarginatus	T	2	0.53	0.05
Strychnos potatorum	T	2	0.53	0.05
Tamarindus indica	T/+	3	0.8	0.07
Terminalia tomentosa	T	2	0.53	0.05
Ziziphus mauritiana	T/+	19	5.03	0.43
Ziziphus xylopyrus	T/+	3	0.8	0.07

Total number of plant species recorded = 47
Total number of enumerated individuals = 4394
Total number of elephant food species = 23
Total number of non-food trees = 24
Diversity (H') index of food species = 3.10
Diversity (H') index of non-food tree species = 2.38

+= Food species
T= Tree; S= Shrub; C = Creeper.

number with less than 25 seeds per dung pile. It is of importance to note that *Acacia sundra* and *Hardwickia binata* which were not recorded from the transect but were observed in dung piles. Insect fauna belonging to five families were also noted from the dung piles.

Usage pattern of elephant's foot paths and foraging areas by other species

Large to medium size herbivores used elephant's foraging grounds for foraging and movement (Table 5). Local people also use the elephant trails for collecting fuel wood and lopping of trees. Cattle, sheep and goat have also shared elephant's foraging areas for feeding. However, cattle dung piles were low around the foraging sites of elephants. Pellets of chital, sambar and blacknaped hare were commonly seen around the fresh foraging areas of elephants. The branches broken by elephants may be big attraction to herbivores. However, pellet groups of blackbuck were low in the elephant's foraging areas.

Fauna associated with elephants

Dung piles of elephants provided substrate for a variety of insect fauna. Examination of dung piles revealed that insect groups belonging to 5 families, Anthopidae, Carabidae, Cholorphidae, Mosquidae and Termitidae were found (*Appendix* 1). One species of fungi belonging to *Agaricus* was noticed in old dung piles. Seeds, beetles and other insects found in the dung piles served as source of food for some bird species such as black drongo (*Dicrurus adsimilis)*, common myna (*Acridotheres tristis)*, forest wagtail *(Motacilla indica)*, grey wagtail (*Motacilla cinerea*), grey jungle fowl *(Gallus sonnesalii*), house crow (*Corvus splendens*), Indian roller (*Coracias benghalensis*), Indian peafowl *(Pavo cristatus*), jungle crow (*Corvus macrorhynchos)*, jungle myna (*Acridotheres fuscus*) and white bellied drongo (*Dicrurus caerulescens*). Dung bolus in the water bodies provided food for tadpoles and fingerlings of fishes.

Trees uprooted by elephants form foraging grounds for many herbivores; chital, sambar, blackbuck, cattle, sheep and goat (*Appendix 1*). Elephants create small sized water holes along sandy streams of Bolipallam areas in Karachikorai during peak dry season to drink the subsoil water. Water holes created by elephants are later used by other species such as chital and smaller mammals. Similarly, natural salt areas were dug out by elephants which were later used by sambar, chital, cattle and common mangoose. These salt licks dug out by elephants served as source of salt for other herbivores and livestock.

DISCUSSION

Species composition

The Sujalkuttai- Bannari corridor is dominated by open scrub vegetation with many species of thorny unpalatable species. This is a vital corridor for elephants to move from Moyar Valley to Eastern Ghats. The plant species which are not eaten by elephants, *Fluggea leucopyrus, Opuntia dillennii, Randia malabarica, Dodonaea viscosa, Lantana camara, Calotropis gigantea* and *Euphorbia antiquarum,* are proliferating due to serve biotic pressure from at least nine villages situated closer to the corridor.

Feeding height

The height reduction due to the feeding of elephants on secondary and lateral branches of trees have modified the overall vegetation physiognomy. Obviously the height ranges are easily accesible to elephants for feeding. This shows that elephants effectively control growth of the trees in order to maintain browse line for them. Since pushed over trees commonly coppice from the base, this selective damage could lead to increased availability of food at an accessible feeding level (Croze, 1974; Jachmann & Bell, 1985). In the study area trees appear to develop coppice shoots after being subjected to crown distortion by elephants' feeding activity. However, the distorted crown is available to elephants and other small sized herbivores for foraging. Occurrence of more feeding signs on non-coppice is related to feeding strategy of elephants. This feeding process has led to the formation of browsing line on trees which benefits elephants for feeding in the long run. Many vertebrate herbivores often produce browse lines on trees. In Africa elephants exerted a secondary effect by browsing the *Acacia* regrowth in Masai Mara Park, Kenya (Owen- Smith, 1988).

It is also possible that elephants avoided coppice trees due to non availability of green leafy portions and bark during the dry season. With the heavy grazing intensity of coppice trees by local livestock, the entire canopy layer tends to be degraded much and converted to open thickets of unsuitable habit for various animals.

Feeding

Out of 21 browse species, *Albizia amara, Acacia latronum* and *Commiphora berryi* were extensively used. Generally selection of browse species by elephants was in proportion to their abundance (Kalemara, 1989). Similar trend was also observed in this study. Elephants fed extensively on mature trees of *Commiphora berryi* in proportion to the availability. Preference for browsing on regrowth from previously damaged trees was observed. Similar observation was found by Owen-Smith (1988) for *Colophospermum mopane* in Africa. The present investigation revealed the depletion of *Commiphora berryi* due to heavy crown

Table 2. Extent of height alteration on trees by elephants' feeding activity in Sujalkuttai -Bannari corridor.

Food species	No. of feeding signs	Mean tree height (m)		Mean feeding height (m)		No. of feeding signs on coppice growth trees		No. of feeding signs on non-coppice growth trees	
		SD	Mean	SD	Mean	No	%	No	%
Acacia latronum	270	0.80	3.80	0.64	2.99	63	23.33	207	76.66
Acacia leucophloea	2	1.41	5.00	0.35	3.00	0	00.00	2	100.00
Acacia mellifera	5	0.44	3.80	0.41	3.10	0	00.00	5	100.00
Acacia planifrons	2	0.70	3.50	0.00	3.00	0	00.00	2	100.00
Albizia amara	100	0.82	3.38	0.48	3.07	23	23.00	77	77.00
Bauhinia racemosa	6	0.57	5.83	0.42	3.67	2	33.33	4	66.66
Commiphora berryi	102	0.19	5.08	0.13	3.99	0	00.00	102	100.00
Dichrostachys cinerea	10	0.48	3.70	0.43	3.05	3	30.00	7	70.00
Pteralobium hexapetalam	2	0.07	6.00	0.35	4.50	0	00.00	2	100.00
Pithecellobium dulce	1	0.00	6.00	0.00	5.00	0	00.00	1	100.00
Premna sp.	8	0.33	4.12	0.32	3.06	3	37.50	5	62.50
Randia dumetorum	1	0.00	3.00	0.00	0.00	0	00.00	1	100.00
Ziziphus mauritiana	2	0.35	5.50	0.18	2.75	1	50.00	1	50.00

distortion by elephants. Mature stands of several species have vanished due to uprooting and debarking by elephants in Africa (Croze, 1974; Vesey-Fitzgerald,1974; Field & Ross, 1976 ; Leuthold, 1977 ; Pellew, 1983; Barnes, 1985; Weyerhaeuser, 1985; Swanepoel & Swanepoel, 1986). In few places entire tree cover was converted to open thickets in Africa (Anderson & Walker, 1974; Thompson, 1975; Caughley, 1976; Bell , 1981). Occurrence of more feeding signs on mature trees of *Commiphora berryi* and *Dichrostachys cinerea* perhaps could lead to their disappearance from the corridor site. Sivaganesan (1993) reported possible extinction of *Ziziphus xylopyrus* from dry deciduous forests in Mudumalai Wildlife Sanctuary, as a result of elephants. Loss of plant species due to elephants feeding pressure would be higher in small- sized corridors.

Seed dispersal

Fruits of 16 plants species were dispersed by elephants through their dung. The dispersal of seeds by elephants through dung piles was reported by many authors both in Africa and Asia (Buss, 1961; Wing & Buss, 1970; Field, 1971; Williamson, 1975; Khan 1977; Alexandre, 1978; Short, 1981 & 1983; Barnes, 1982; Sivaganesan, 1992 and White *et. al.*, 1993). Although seed remains of 17 plant species were recorded from the dung piles, only *Grewia villosa* was found to be 34.1% of 1043 dung piles examined over the study period. Elephants utilized a wide variety of *Acacia* species in thorn forests and their seeds were predominantly observed in dung piles during the dry season in Mudumalai Wildlife Sanctuary, Tamil Nadu (Sivaganesan, 1991). Khan (1977) reported that fruits of 13 genera were used by elephants in Malaysia and 5 of them represented in the diet of elephants at Lope Reserve, Gabou . Olivier (1978) found that Asian elephants in rain forest in Malaysia ate fruits rarely.

It is of significance to note that elephants effectively dispersed seeds of many plants species and restored the degraded corridor forests. A few cultivated crops such as *Oryza sativa, Eleucine indica* and *Vigna guiculata* were also dispersed in the forest areas which might have come from cultivated crop fields and thus enhance the genetic diversity of the area. However, the successful establishment of seedlings dispersed through dung appears to be minimum in the study area due to the unsuitable micro habitats, coupled with heavy grazing intensity. Crawley (1983) suggested that availability of micro sites, grazing intensity and herbivore feeding are likely factors governing the seedling establishment. The other negative aspects of elephant's dispersal of seeds is the spread of exotic plants. In the study area, rapid invasion of *Prosopis juliflora* is attributed to more use of its fruits by elephants.

Fauna associated with elephants

Elephants feeding sites in degraded open thickets are heavily utilized by other species. Evidence of cattle using elephant foraging sites is scanty. Grazers move with cattle in rugged terrain which elephants tend to avoid. However, it is not applicable to goats and sheep. These animals are commonly found feeding in foraging areas of elephants. People hesitate to move in elephant's foraging areas such as gallery forests and low lying foot hill forests

Table 3. Percentage feeding signs on various size classes of food species of trees in Sujalkuttai- Bannari corridor.

Food species	Total # of feeding signs	% feeding signs					
		Mature >10cm GBH		Recruitment >2m		Regeneration <2m	
		#	%	#	%	#	%
Acacia latronum	270	72	26.66	186	68.88	12	4.45
Acacia leucophloea	2	2	100.00	0	0.00	0	0.00
Acacia mellifera	5	1	20.00	4	80.00	0	0.00
Acacia planifrons	2	0	0.00	2	100.00	0	0.00
Albizia amara	100	20	20.00	72	72.00	8	8.00
Bauhinia racemosa	6	6	100.00	0	0.00	0	0.00
Commiphora berryi	102	98	96.07	4	3.92	0	0.00
Dichrostachys cinerea	10	8	80.00	2	20.00	0	0.00
Grewia hirsuta	14	0	0.00	11	78.57	3	21.43
Grewia villosa	76	0	0.00	54	71.05	22	28.94
Pithecellobium dulce	1	1	100.00	0	0.00	0	0.00
Pteralobium hexapetalum	2	0	0.00	2	100.00	0	0.00
Premna sp.	8	7	87.50	1	12.50	0	0.00
Randia dumetorum	1	1	100.00	0	0.00	0	0.00
Ziziphus mauritiana	2	2	100.00	0	0.00	0	0.00

Table 4. Occurrence of various plant seeds and insect fauna in elephant dung piles (N = 1043) in Sujalkuttai - Bannari Corridor in Sathyamangalam Forest Division.

Food items in dung piles	Occurrence	% frequency	Ranking			
			1	2	3	4
Acacia lantronum	12	4.05	B			
Acacia chundra	7	2.36	B			
Acacia mellifera	1	0.34	B			
Albizia amara	10	3.38	B			
Albizia lebbeck	3	1.01	B			
Bauhinia racemosa	38	12.84		B		
Capparis sp.	3	1.01	B			
Cardispermum halicacabum	14	4.73	B			
Eleucine indica	2	0.68	B			
Grewia villosa	101	34.12				B
Grewia hirsuta	37	12.50		B		
Hardwickia binata	1	0.34	B			
Jasminum auriculatum	1	0.34	B			
Oryza sativa	15	5.07	B			
Prosopis juliflora	17	5.74	B			
Pteralobium hexapetalum	18	6.08	B			
Tamarindus indica	9	3.04	B			
Vigna unguiculata	3	1.01	B			
Ziziphus mauritiana	1	0.34	B			
Unknown grass spp.	3	1.01	B			
Total	296					
Insect Families						
Anthopidae	5	7.81	B			
Carapidae	8	12.50	B			
Chlorophidae	7	10.94	B			
Mosquidae	12	18.75	B			
Termitidae	32	50.00		B		
Total	64					

Ranking (# of seeds / insects per dung pile):
1= < 25, 2= <50, 3= <75, 4= >100.

Table 5. Tracks and signs of other herbivores and evidences of wood cutting in Sujalkuttai - Bannari Corridor in Sathyamangalam Forest Division (area sampled 3.77 ha)

Tracks & signs	Frequency	Density (per ha)
Sambar pellets	127	33.7
Chital pellets	252	66.8
Blackbuck pellets	12	3.2
Blacknaped hare pellets	123	32.6
Cattle dung piles	62	16.4
Pellets of goat	200	53.0
Wood cutting	69	18.3
Lopping evidence	28	7.4

APPENDIX - 1 Life forms benefited by elephants in Sujalkuttai - Bannari Corridor

Life forms	Purpose
FUNGI	
Agaricus Host	
PLANT SPECIES	
Acacia latronum *Acacia mellifera* *Acacia sundra* *Albizia amara* *Albizia lebbeck* *Bauhinia racemosa* *Capparis sp.* *Cardiospermum halicacabum* *Eleucine indica* *Grass spp* *Grewia villosa* *Grewia hirsuta* *Hardwickia binata* *Jasminium auriculatum* *Oryza sativa* *Prosopis juliflora* *Pteralobium hexapetalum* *Tamarindus indica* *Vigna unguiculata* *Ziziphus mauritiana*	(a) Dispersal of seeds through dung. (b) Restoration of habitats
INSECTS	
Antopidae *Carabidae* *Chlorophidae* *Mosquidae* *Termitidae*	Host
BIRDS	
Common Myna *(Acridotheres tristis)* Jungle Myna *(Acridotheres fuscus)* Forest Wagtail *(Motacilla indica)* Grey Wagtail *(Motacilla cinerea)* Large-pied Wagtail *(Motacilla maderaspatensis)* White-bellied Drongo *(Dicrurus caerulescens)* Black Drongo *(Dicrurus adsimilis)* House Crow *(Corvus splendens)* Jungle Crow *(Corvus macrorhynchos)* Indian Roller *(Coracias benghalensis)* Indian Peafowl *(Pavo cristatus)* Grey junglefowl *(Gallus sonnesalii)*	Feeding

Appendix 1. continued.

AMPHIBIANS / FISHES	
Tadpoles	Feeding on dissolved dung piles
Fish	and their contents such as parasites
AIDING IN AVAILABILITY OF FOOD	
Blackbuck *(Antelope cervicapra)*	
Cattle	Feeding on uprooted trees
Chital *(Axis axis)*	& ripe fruits
Goat	
Sambar *(Cervus unicolor)*	
Sheep	
SUBSOIL WATER CREATED BY ELEPHANTS	
Cattle	
Chital	Drinking
Goat	
Sheep	
SALTLICKS CREATED BY ELEPHANTS	
Cattle	
Chital	Feeding
Sambar	
Sheep	
Common mongoose *(Herpestes edwardsi)*	
ELEPHANT FOOT PATH	
Black buck	
Chital	
Cattle	
Goat	Moving
Hyena *(Hyaena hyaena)*	
Common mongoose *(Herpestes sp.)*	
Leopard *(Panthera pardus)*	
Sambar	
Sheep	
Sloth Bear *(Melursus ursinus)*	

for fuel wood collection in fear of elephants. Recently, Ramakrishnan (1995) reported that large number of people prefer to move 3 km from the village for fuel wood collection to avoid elephants. The more occurrence of pellet groups of chital in elephant foraging areas is perhaps due to its preference for open type of forest coupled with tolerance for human interference. By contrast, low number of pellet groups of sambar could be related to its avoidance of open forest with more biotic threats. The strong preference of blacknaped hare for elephant foraging areas may be associated with open thickets. According to Barnes (1985) elephants feeding pressure on plants affect the woody vegetation density over the whole park and this will have important implications for other ecosystem components such as soil and insect, bird and mammal populations. Elephants play a major role in this corridor. Dung piles of elephants provide host and food for many species. Fungi, insects, birds, tadpoles and fish fingerlings depend on dung piles for shelter and food. It shows co-existence of various species with elephants. Furthermore many browsed species by elephants develop coppice growth which is also used by other herbivores. For example, most of the broken branches and uprooted trees by elephants are used by other herbivores of smaller size than elephants. Similarly, elephants create subsoil water which is used by various species. It is of importance that salt licks used by elephants are easily accessible to other species as well.

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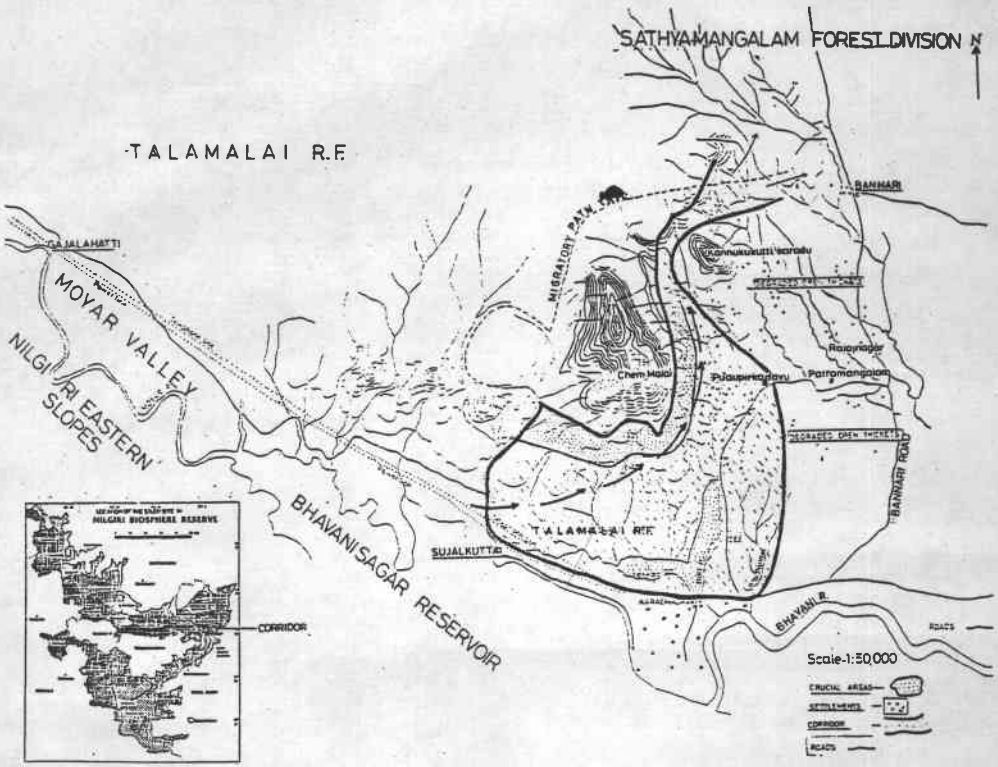
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Map 1. Map of the Sujalkuttai-Bannari Corridor in Sathyamangalam Forest Division, Tamil Nadu, Southern India.