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BIODIVERSITY CONSERVATION PLAN

FOR

MALAYATTUR HIGH VALUE BIODIVERSITY AREA

(Final report of the project KFRI 590/2010 October 2009-March 2010)

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Project proposal

Project No.	: KFRI RP 590/2010
Title	Biodiversity conservation plan for Malayattur high value biodiversity area
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Objectives	1. Identification and consolidation of available data sets including maps and images 2. Preparation of a plan for biodiversity management plan
Duration	October 2009-March 2010
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BIODIVERSITY CONSERVATION PLAN

FOR

MALAYATTUR HIGH VALUE BIODIVERSITY AREA

PART A: THE EXISTING SITUATION

CHAPTER 1: DESCRIPTION OF THE LANDSCAPE

1.1. Name, Location, Constitution and Extent.

1.1.1. Name : Malayattur Forest Division

1.1.2. Location :

The Malayattur Forest Division is one of the oldest Divisions in the State of Kerala. In the princely state of Travancore the Division was known as "Northern Division" and the area under its jurisdiction extended up to the Periyar River, which was the northern boundary of the state. The administrative jurisdiction of the Division mainly lies in Ernakulam Revenue District. A small portion of the area (2.1500 km^2) at Malakkapara in Mukundapuram taluk comes under Thrissur Revenue District. The area is surrounded by Vazhachal Division in the north, Tamil Nadu (Valparai) and Munnar and Mankulam Divisions in the East, Kothamangalam Division in the South and Arabian Sea in the West. The tract lies between 10^0 N and 10^0 30'N latitudes and 76^0 E and 76^0 57'E longitudes. The Reserved Forests of the Division are spread over Aluva, Kunnathunadu and Kothamangalam Taluks of Ernakulam Revenue District and Mukundapuram Taluk of Thrissur District. The Division Office is located at Kodanad. The boundary description is given in **Annexure – I.** (Map 1). The total forest area under the Division is 61,776.59 ha (617.76 km^2) which includes 9253.900 ha of plantation area, 1081.600 ha area given to HNL for raising captive plantations, 266.57 ha handed over to Nature Study Centre, Kalady and an area of 4609.1434 ha as lease. List of leases are given as **Annexure – II**

The Constitution

The Northern Division was bifurcated into Malayattur and Muvattupuzha Divisions with Headquarters at Malayattur and Muvattupuzha respectively by Government order No. GO.R.O.C- 4040/46/Devpt. dt. 3rd July 1946. Thodupuzha Range from Kottayam Division was added to Muvattupuzha Division. The Headquarters of Muvattupuzha Division was subsequently shifted to Malayattur and in June 1950 Muvattupuzha Division was amalgamated with Malayattur Forest Division. The jurisdiction of the Division includes the areas of the present Malayattur, Munnar, Kothamangalam, and

portions of Chalakudy Divisions. As per G.O. No.1011/62/Agri. dt.5-9-1962 Munnar Division was formed separating the high range portion of the reserve forests from Malayattur Division. Again in 1981, as per Government order No. GO (MS) 197/81/ Forest. dt. 31/7/1981, further re-organization of the Divisions came into effect creating Kothamangalam and Vazhachal territorial Divisions and the present Malayattur Forest Division.

Administration

A Range is the unit of administration, which is divided into Forest Stations. The boundary descriptions of the Division and the five Ranges are provided in **Annexure - I.** The details of the Ranges, Stations, Sections and Beats with their Headquarters coming under the Malayattur Division are provided in Table 1.1 and Map 2. As mentioned earlier, during 1981, the territorial jurisdiction of Malayattur Forest Division was reorganised as per GO (MS) No. 197/81/Forest dt. 31.7.1981 with effect from 1.8.1981.

Table 1.1 Ranges with Headquarters

Sl. No.	Ranges	Headquarters	Sq. Km
1	Kalady	Kalady	72.51
2	Kodanad	Kodanad	56.7411
3	Thundathil	Bhoothathankettu	131.40
4	Kuttampuzha	Kuttampuzha	187.04
5	Idamalayar	Ennakkal	170.07

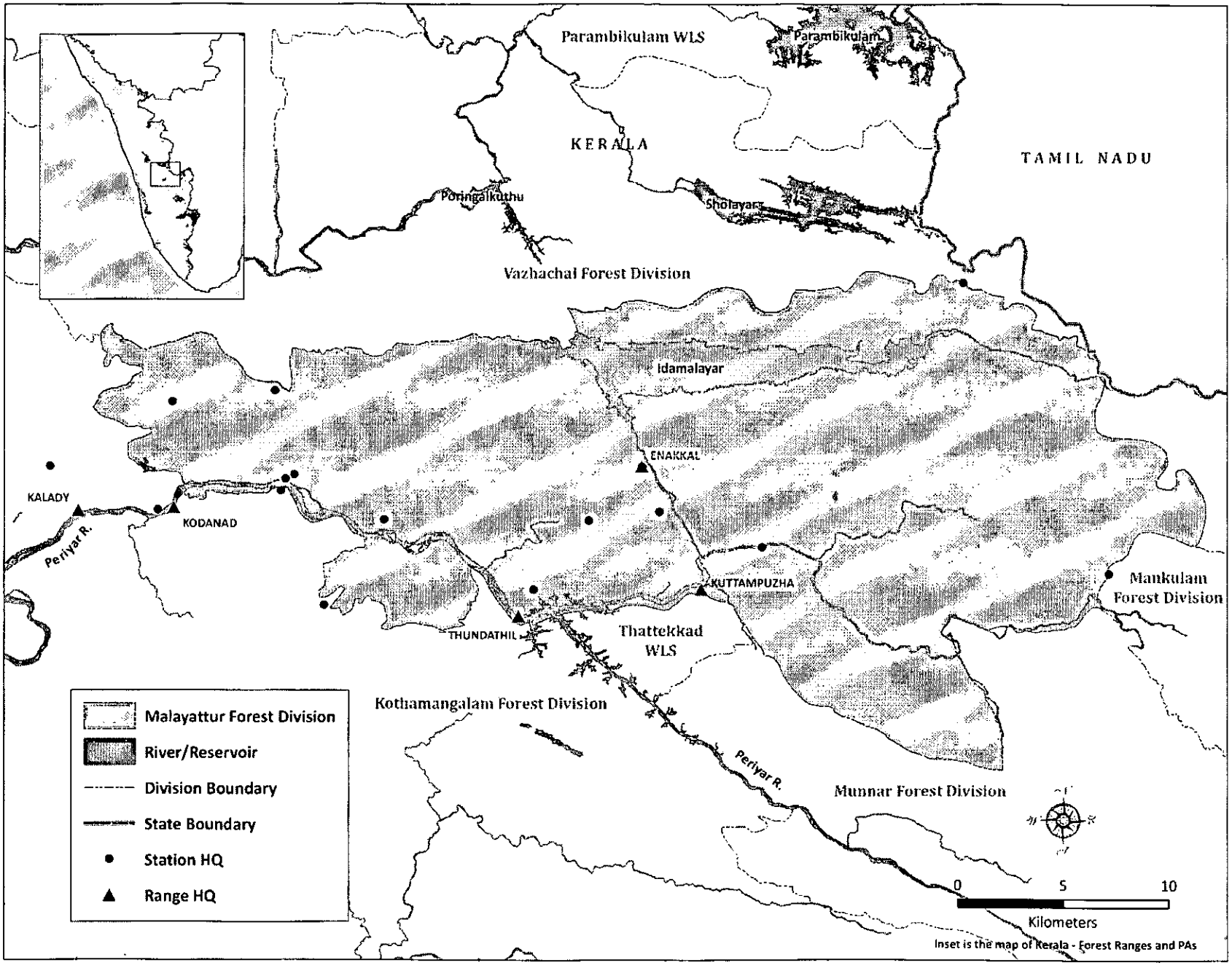
1.1.3. Extent

Distribution of the Area

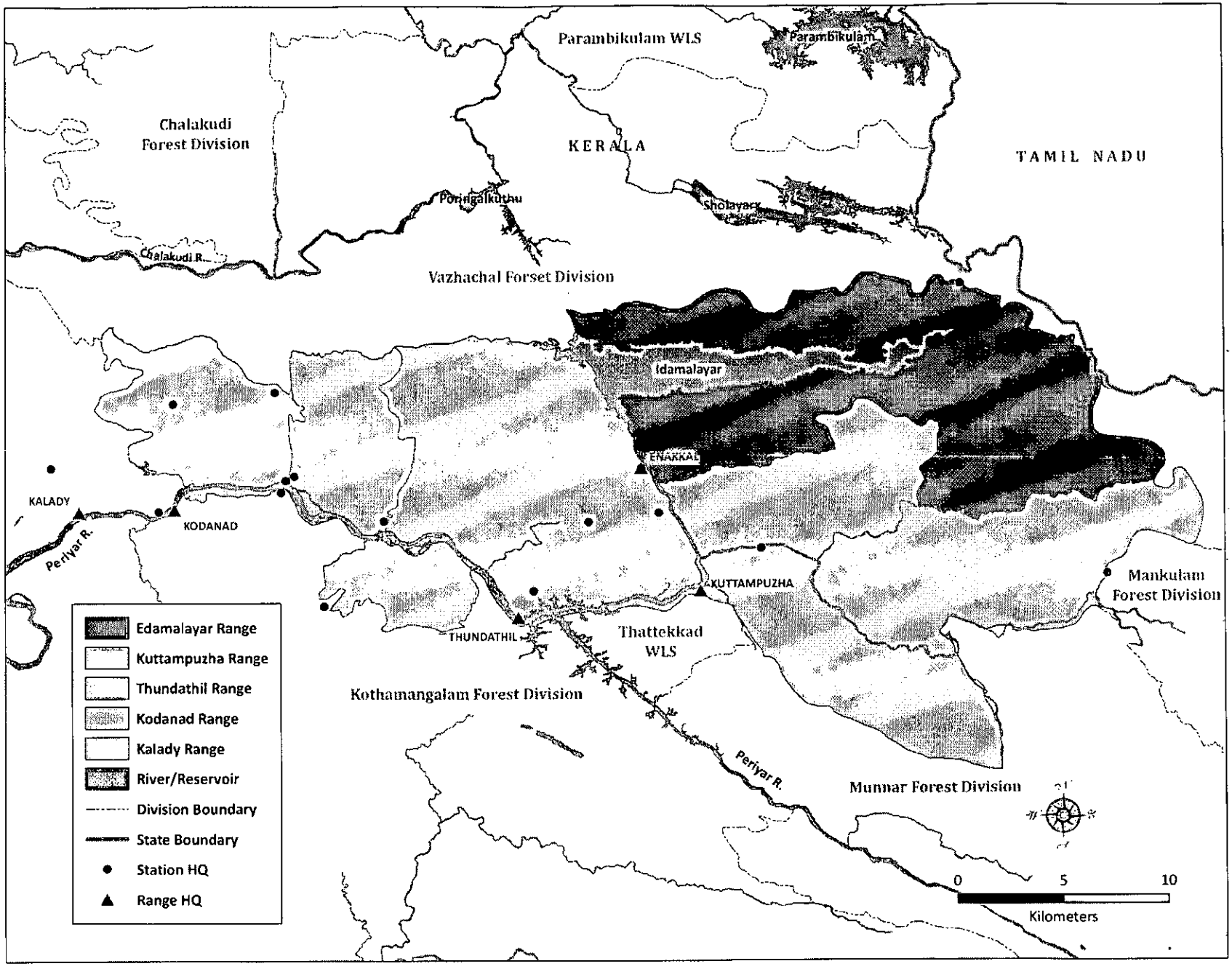
As mentioned earlier, during 1981, the territorial jurisdiction of Malayattur Forest Division was reorganised as per GO (MS) No. 197/81/Forest dt. 31.7.1981 with effect from 1.8.1981.

Reserve Forests

There are 15 Notified Reserve Forests in the Division. Malayattur Reserve is the largest Reserve with an extent of 57351.250 ha covering all the five Ranges. The list of Reserves is given in **Annexure – III.** As per GO (MS) 304/74/AD Agri. (Planning II) Dept. Trivandrum dt.11/11/1974, an area of 537.690 ha of Reserve forests in Kalady Range at Illithodu in Alwaye taluk, was handed over to Agricultural Dept. for Illithodu Collective Farm. Out of this, 23.98 ha from the 1954 teak plantation area in Kalady



Map 1 Malayattur Forest Division



Map 2 Malayattur Forest Division - Ranges

Range was taken back during September 1979 and another 28.50 ha of natural forest from the same range was also taken over by the Forest department during May 1980. This area of 52.48 ha in Kalady Range is dealt as proposed reserve. The above two areas are maintained as such by the Forest Department.

Total extent of forests in Malayattur Forest Division, including the proposed reserve of 52.48 ha, is 61,776.59 ha. The district wise distribution of forest areas in Ranges are given in Table 1.2.

Table 1.2 Range wise distribution of forests of Malayattur Division (Km^2)

District	Kalady	Kodanad	Thundathil	Kuttampuzha	Idamalayar	Total
Eranakulam	72.5148	56.7411	131.40	**187.04**	**170.07**	615.6159
Thrissur	--	--	--			2.1500
Total	**72.5148**	**56.7411**	**131.40**	**187.04**	**170.07**	**617.7659**

1.1.4. Legal Status

All the forests managed in this Division have the legal status of 'Reserved Forests'. These are the absolute property of the State and are notified under section 18 of the "Travancore Forest Act". With the promulgation of the Kerala Forest Act, these Reserve Forests are dealt with under the latter. An extent of 52.48 ha in Kalady Range is a proposed reserve.

Concessions to Hill men

The Hill men residing in this Division were governed by the Kerala Hill men Rules, 1964. They enjoy certain privileges in the forests. They cultivate the land under their possession free of any payment. They are permitted to do fishing and collect bamboo, reeds, etc free of cost for their bonafide domestic and agricultural purposes.

1.1.5. Notification

The present reorganised Malayattur Forest Division started functioning from the year 1981 as per Order No.GO. (MS) 197/82 Forest dt.31/07/1981.

1.2. Topographical Features (overview).

1.2.1 Mountain/Valleys

The forests are situated in the Western slopes of the Western Ghats. The elevation varies from 50m at Boothathankettu to 1,347 m above mean sea level at Sulimalai in Idamalayar Range. The whole area of the Division is hilly in nature and the surface of

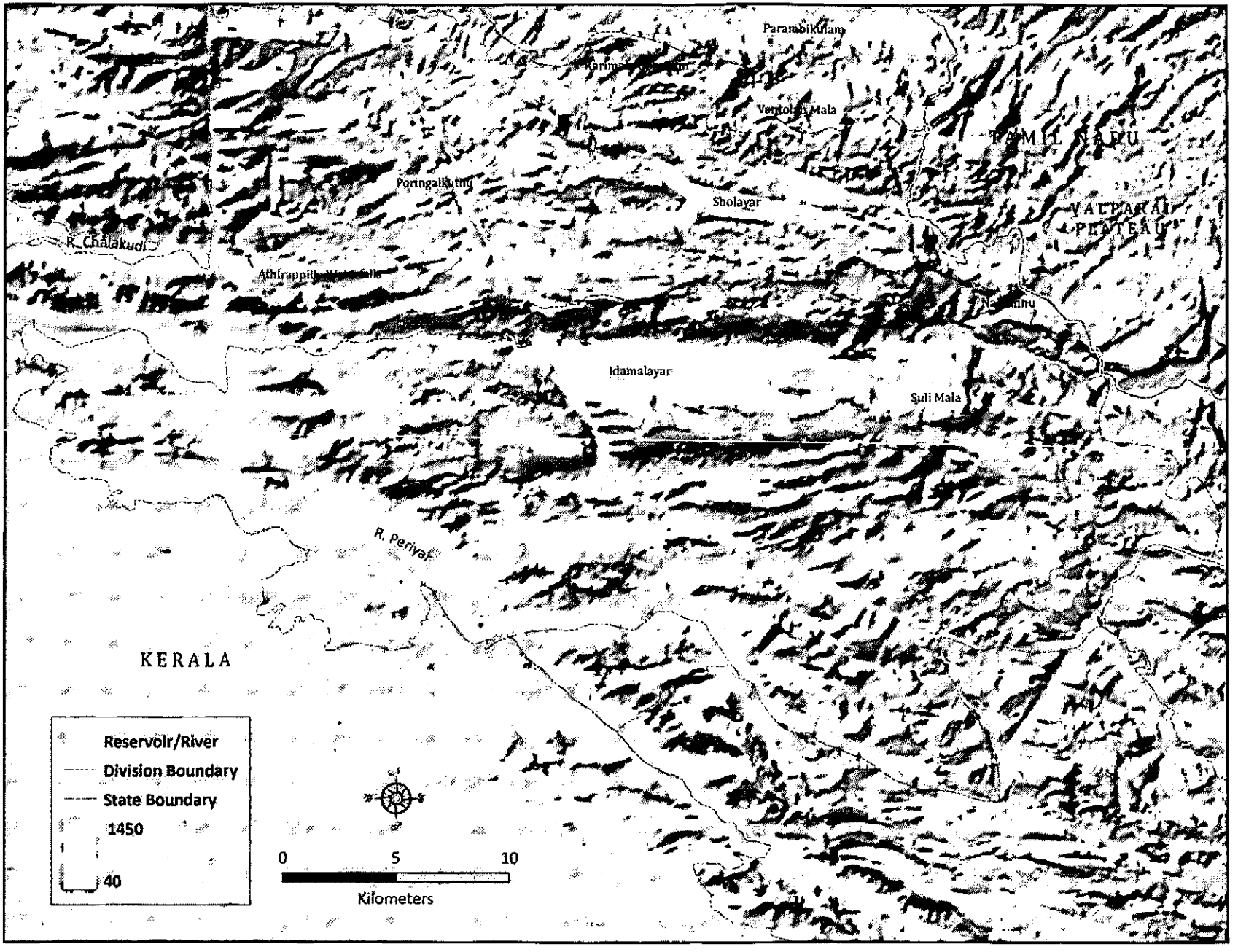
the ground greatly undulating. Most of the area covers foothills of high Ranges of the Western Ghats and thus gentle hills and wider valleys dominate the topography of the Division (Map 3).

1.2.2. Rivers & Streams

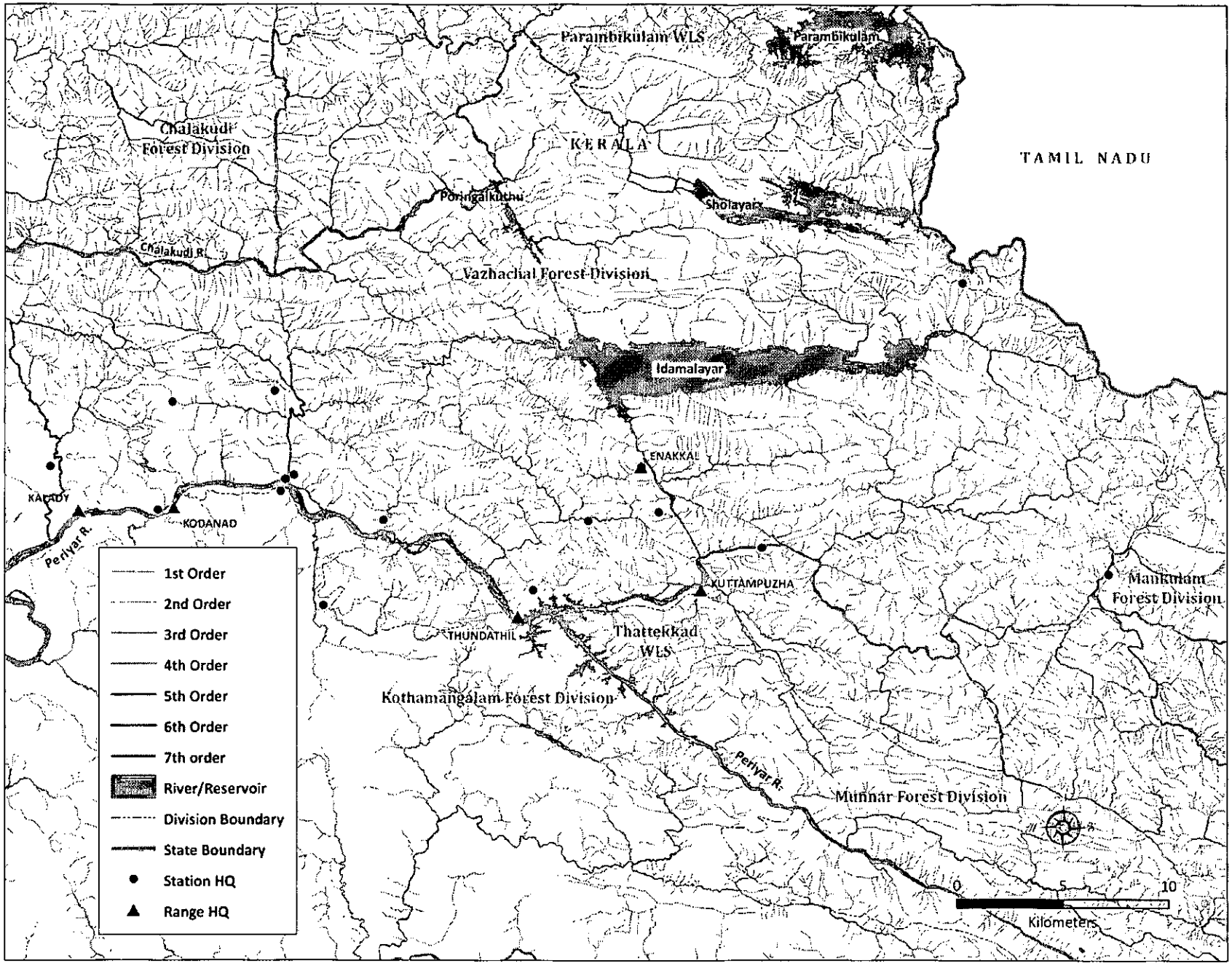
Drainage: This is essentially a huge west draining slope of (Map 4) the High Ranges bounded on the south by the main channel of Periyar River along the south east to north west lineament. The eastern border is formed by the High Ranges and the northern artificial border is identified as the watershed of Idamalayar which drains the southern parts of the Anamala basin. To the west it opens out to the plains of Kerala (Nair, 1988). While the head of this valley is the highest section of Ghats in Kerala, at the western end where Periyar River leaves the tract, the river is less than 20 m. above sea level. The natural fault controlled Idamala channel is unusual in that is the lowest and the deepest penetrating valley in the entire southern section of the Ghats. 35 km. upstream of its confluence with the main Periyar, Idamala valley is only 100 m while the ridges on either side reach up to 1400 m. The eastern most tributaries of Idamala namely Itliyar and Anamalayar have carved out extremely deep and narrow valleys into the west flank of the Eravikulam - Umayamala - Anamudi - Rajamala ridge. The valleys of these tributaries have more than 1200 m. near vertical sides. Part of the Idamala drainage is from the Anamalais of Tamil Nadu.

Nearly 48 km^2 of the Idamala valley has been submerged under the Idamala Hydroelctric scheme, the reservoir of which is the longest in the state and second largest in Kerala after Idukky. The entire area submerged had been uninhabited pristine forests. The Idamala drainage basin is a narrow, long valley extending exactly east - west excepting at its eastern end where it broadens and at the western end where it takes an abrupt south eastern turn.

Idamala River is formed by the Itliyar and the Nadakalar draining the west slopes of the Ervikulam plateau and the north slopes of Anamudi ridge meeting to be joined immediately by Kallar which drains the Valparai plateau of the Anamalais in Tamil Nadu and also the north eastern end of the Eravikulam - Perumalmalai - Katradimalai - Kumarikkalmalai - Podumalai ridge (described earlier). The river till the High Forest Estate is also the state boundary. After Kallar has joined the main Idamala river, it flows due west through a narrow hardly 10 km. wide valley for about 30 km. and then turns abruptly 120° flowing south east till it meets Pooyankutty.



Map 3 Malayattur Forest Division - Relief



Map 4 Drainage - Malayattur Forest Division

19	Puzhadu – Kayattura	2.50	Ghat road 2.50 km.
20	Kurumpanapara – Panachi	4 .00	Ghat road 4 km.
21	Kannakada - Kurumpanapara	3 .00	Ghat road 3 km.
22	Amanthodu – Pezhadu	7 .00	Ghat road 7 km.
23	Kurichilakode .Silver house	0.65	Tar road 0.65 km.
24	Forest colony road	0.30	Tar road 0.30 km.
Total		**54.120**	0.95 km. Tar road. 40.50 km. Ghat road. 12.67 km. Metal road
Thundathil Range			
25	Thundom – Njayappilly	10 .00	Ghat road 10 km.
26	Idamalayar - Anakayam – Kuttampuzha	10 .00	Ghat road 10 km.
27	Marapplam - Vadattupara	4 .00	Ghat road 4 km.
28	Thundathil 1940 pepper	9 .00	Ghat road 9 km.
29	Thundom - Palavanpady – Anakayam	16 .00	Tar 16 km.
30	Thundom - Bhagavathikulam	10 .00	Tar 10 km.
31	Paneli – Thundathil	2.88	Tar 2.88 km.
Total		**61.88**	28.88 km. Tar road , 33 km. Ghat road
Kuttampuzha Range			
32	Kalambikodu - Thattekkad	6.00	Ghat road 6 km.
33	Pinadimedu – Kunjiyar	6.00	Ghat road 6 km.
34	Pooyamkutty - Mayapara	15.00	Ghat road 15 km.
35	Anakulam - Vriyampetty	8.00	Foot path 8 km.
36	Kallchmedu – Variyam	12.00	Foot path 12 km.
37	Variyam – Anakuda	15.00	Foot path 15 km.
Total		**62.00**	27 km. Ghat road, 35 km. Foot path

Road (Total) = 33.180 km, Metal road= 16.670 km., Foot - path= 35.000 km.

1.4. Geology, Rock and Soil

The underlying rock is igneous in origin and consists mainly of gneiss and its metamorphic variations, which support little vegetation on the ridges and hilltops. Large crystals of quartz and flakes of mica are found mixed with coarse soil in higher levels while in the lower portions and valleys, laterite in varying depths occur over the rocks of gneiss origin. Due to metamorphic changes in the original gneiss, various kinds of loamy soils are observed. Soil along the banks of rivers and streams is dark alluvial, rich in flakes of mica and humus, supporting good vegetation. The hilltops contain bare rocks devoid of soil and hence support little vegetation. On the slopes, boulders are embedded with various sedimentary soils supporting fairly good vegetation. Laterite has been formed as a result of *in-situ* disintegration of gneiss due to heavy rains and high temperature through ages. Laterite is found commonly in the western portion of Malayattur Reserve in the foothills and hollows between ridges. Soil derived from laterite is poor, shallow in depth, and unsuitable for deep-rooted species.

Occasionally red ferruginous loamy soil is found due to the weathering of laterite, supporting good vegetation, if enough drainage is available.

Climate

Typical tropical climate is quite suitable for luxuriant growth of vegetation. In the low lying areas it is hot and humid, whereas it is fairly cool at higher elevations. March, April and May are hottest months throughout the region. Average temperature during the hot season shoots up to 33^0 C in low lying areas and about 23^0 C in the hills. Climatic conditions are more or less conducive for the normal growth of the vegetation. However, extreme conditions of torrential rains as well as prolonged periods of drought affect the young crop by way of physical impact of fierce raindrops, water logging or heavy drought. Strong winds coupled with heavy rains cause more damage to young crop in open areas by either breaking the main stem or even uprooting.

Winds

From June to September, winds blow from southwest and bring southwest monsoon and during October to December, easterly and northeasterly winds blow resulting in northeast monsoon.

Rainfall

Copious rains are received from both the monsoons, Southwest from June to August and Northeast during October- November. Major share of the rain occurs during the months of June and July in Southwest monsoon. The average rainfall is 3,700mm per annum.

1.5 Hydrology & Water Sources

Major rivers that traverse through the area are Idamalayar, Pooyamkutty and Periyar. These rivers drain from the high Ranges of Munnar, Chinnar and Western portions of adjoining TamilNadu forests (Map 4). Some of the tributaries of these rivers are perennial. At present, there are two dams in this area, Idamalayar and Bhoothathankettu.

1.6 Vegetation Types

The Composition of the forests of this Division varies with the climatic, edaphic and biotic factors. As the area supports typical tropical climate, all the forests particularly among the foothills support luxuriant vegetation (Plate 1 & 2). Forests of this Division

fall into three major forest types as per the revised classification of forest types of India by Champion and Seth (1968);

1. West coast tropical evergreen. (IA/C4)
2. West coast semi-evergreen. (2A/C2)
3. Southern tropical moist deciduous. (3B/C1)

West Coast Tropical Evergreen (IA/C4)

These forests occur in Pooyamkutty area of Kuttampuzha Range. It is found in places where conditions for the growth of vegetation are conducive and optimum with a well-distributed rainfall of over 1,800mm. This type is confined to stream banks, river basins and pockets between ridges.

Floristic Composition

The canopy is dense and closed. In this type of evergreen vegetation, four distinctive layers of species distribution can be seen, namely top canopy, middle canopy, lower canopy and ground flora. Some of the important species found are

Top canopy

The important species in top canopy are *Dipterocarpus indicus*, *Toona ciliata*, *Hopea parviflora*, *Persa macrantha* and *Bombax ceiba* etc.

Middle canopy

The prominent species in middle canopy are *Actinodaphe malabarica*, *Cinnamomum malabaricum*, *Evodia lunu-ankenda* and *Knema attenuata* etc.

Lower canopy

Third storey consists of species like *Aporosa lindleyana, Xanthophyllum arnottianum, Tabernae-montana heyneana* and *Syzigium laetum* etc.

Ground flora and climbers

The ground flora consists of *Strobilanthus* Spp, *Ixora nilgricans, Elephantopus saber, Pellionia heyneana, Chassalia ophioxyloides* etc. and climbers includes *Acacia intsia, Bridelia scandens, Enteda rheedii, Centrosema pubescens* and *Smilax zeylanica* etc.

West Coast Semi-evergreen (2A/C2)

The Tropical evergreen forests, which were subjected to heavy biotic interference in the past, have degraded into semi-evergreen type. These forests, which look like evergreen forests, consist of heterogeneous mixture of evergreen and deciduous species in the top

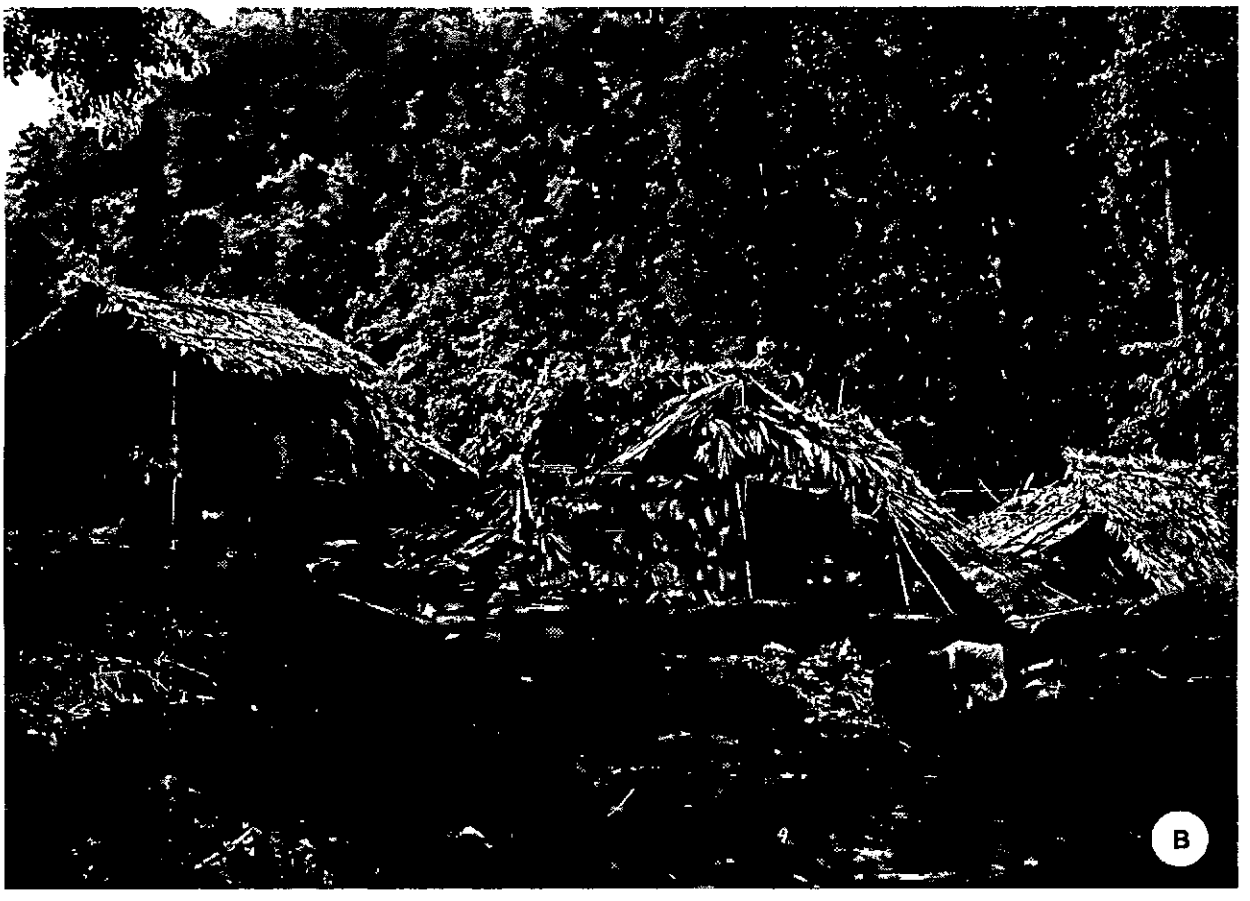


Plate. 1. A. Evergreen forest at Anakkulam. B. Muthuvan settlement.

Plate 2. A. Koompanpara B. Pallikalanmudi.

canopy whereas typically evergreen species occupy the lower canopy. This type is predominantly found in Kuttampuzha valley of Malayattur Reserve, on the bank of Periyar River. The important species composition consists of the following.

Floristic Composition

Top Canopy

The top canopy consists of species like *Artocarpus heterophyllus, Calophyllum apetalum, Mesua ferrea, Persia macarantha, Vateria indica* etc.

Middle Canopy

The second storey contains species like *Carallia brachiata, Cinnamomum malabaricum, Hydnocarpus alpina, Mallotus philippensis, Olea dioica* etc.

Undergrowth

The under growth consists of *Croton zeylanicus, Mussaenda frondosa, Ochlandra scriptoria, Thottea siliquosa, Adenostemma lavenia, Costus speciosus, Rhynchoglossum notonianum, Spilanthes calva* etc.

Climbers

The common climbers are *Calamus* spp., *Spatholobus parviflora, Gnetum* spp. etc.

Southern Tropical Moist Deciduous Forests (3B/C1)

In this type the dominant species are deciduous tree species. Major portion of the forests in this Division is covered under this type. Frequent fires cause a lot of damage to this vegetation. This type occurs both on the lower slopes and on the ridges or on rich loamy as well as laterite soils. Some of the important species found are

Floristic Composition

The important species are *Albizia odoratissima, Alstonia scholaris, Tectona grandis, Schleichera oleosa, Grewia tiliaefolia, Lagerstroemia macrocarpa, Tetrameles nudiflora, Terminalia bellerica, Terminalia paniculata, Albizia lebek, Evodia lunu-ankenda, Xylia xylocarpa, Spondias pinnata, Lannea coromandelica, Aporusa lindleyana, Tabernae montana heyneana, Xanthophyllum arnottiana* etc.

Undergrowth

The under growth consist of *Centrosema pubescens, Dioscorea alata, Hemidesmus indicus, Helecteris isora, Caesalpinia mimosoides, Clerodendrum serratum* etc.

Climbers

The important climbers are *Acacia pinnata, Spatholobus parviflora, Pterolobium hexapetalum, Hemidesmus indicus, Ipomoea mauritiana, Naravelia zeylanica, Passiflora foetida* etc.

Man made forests (Plantations)

Forests of this Division form the natural habitat of teak. Good quality Teak grows naturally in the semi-evergreen and moist deciduous forests. Teak was preferred as the main species for raising plantations in olden days. All the four Ranges harbour teak plantations. The first teak plantation was raised in 1865 in Vembooram near Perumthode but it failed. The first successful teak plantation was raised during 1867. Present area under teak plantation is 7921.71 ha (Pure teak 5588.59 plus teak and elavu mixture 2332.710). Other species like eucalyptus, mahogany, elavu, cashew and bamboo have also been raised. At present 9253.900 ha of forests are managed as plantations in the Division. Certain augmentation planting in degraded forests were done under compensatory afforestation scheme by Social Forestry wing. The objective is to augment the poor stock in degraded areas. Indigenous species are preferred while planting in the gaps and soil and moisture conservation works have also been taken up. The list of plantations of Malayattur Forest Division is given as **Annexure - IV.**

1.7. Wild Fauna and habitats

Malayattur Forest Division is very rich in fauna too which is constituted by a large variety of mammals, birds, reptiles, amphibians, aquatic fauna, butterflies and other insects as well as microorganisms. The wild fauna of the Division includes: Mammals (38 spp.), Amphibians (27 spp.), Birds (270 spp.), Reptiles (29 spp.), Fish (55 spp.) and Butterflies (about 76 spp.).

Mammals- Important mammals include: Lion-tailed Macaque, Slender Loris, Nilgiri Tahr, Elephant, Tiger, Leopard, Wild boar, Barking Deer, Sambar Deer, Spotted Deer, Mouse Deer, Nilgiri Langur, Sloth Bear, Malabar Giant Squirrel, Flying Squirrel, Gaur etc.

Reptiles- The main reptiles found in the Division include: Indian Cobra, King cobra, Russels's Viper, Malabar pit viper, Indian Python, Common Rat snake, Foresten's cat snake, Common Indian Krait, Travancore wolf snake, and

Western Ghats flying lizard. Other Important reptiles are Southern house gecko, Spotted gecko, Bark gecko, Elliote's lizard and Ceylon uropeltid.

Fish- The Pooyamkutty River, a tributary of the Idamalayar River has exceptionally unique fish diversity (Ajitkumar *et al.*, 2001). Thirty-four species belonging to 11 families were identified. Important fish species are *Puntius melanampyx*, *P. filamentosus*, *P. ticto*, *Garra mullya*, *Danio aequipinnatus*, *D. malabaricus*, *Barilius bakeri* and *B. gatensis*. The species like *Hypselobarbus kurali, H. periyarenesis, Anguilla bengalensis, Punitus arulius, Garra surendranathanii, Bhavania australis* and *Mystus malabaricus* are endangered.

Birds- The important the birds are Malabar Grey Hornbill, Malabar Pied Hornbill, Great Pied Hornbill, Red Spurfowl, Stork billed Kingfisher, Small Green Barbet, Malabar Trogon, Blue-bearded Bee-eater, Heart spotted Woodpecker, Baybacked Shirke, Eurasian Black-bird, Brown-breasted Flycatcher, Large- billed Leaf Warbler, Little Spider hunter, Great-eared Nightjar, Malabar Parakeet, White-bellied Tree Pie, White-bellied Blue Flycatcher, Small Sunbird, Niligiri Pipit, Nilgiri Wood Pigeon, Grey-headed Bullbul and Nilgiri Flycatcher. Lesser Fish Eagle and Large Hawk Cuckoo, Lesser adjutant stork, Grey-headed Fish- eagle Peninsular bay owl, Broad-billed roller, Darter, Little Cormorant, Black eagle, Black-capped kingfisher and Black woodpecker.

Butterflies- About 76 butterflies species were reported from different areas of Malayattur forests. The riparian ecosystems attract many butterfly species like *Papilio*, *Leptosia*, *Mycalesis*, *Catopsilia*, *Eurema*, *Melantis*, *Euthalia*, *Precis* and *Amblypadea*.

Amphibians- Twenty seven species of amphibians were identified are mainly from the following genera *Bufo* (3 sps.), *Microhyla(1), Melanobatrachus (1), Indirana* (3 sps.), *Limnonectes* (2 sps.), *Euphylictis* (2 sps.), *Hoplobatranchus* (1sp.), *Rana* (9 sp), *Polypedatus* (1sp.) *Polypedatus* (1 sp.) *Tomopterna* (1sp.) , *Nyctibatrachus* (1 sp.) and *Rhacophorus* (1 sp.)

Animal corridor

Malayattur Forest Division is one of India's highest elephant density habitats and these forest belts through Vazhachal from a crucial corridor between Parambikulam and Malayattur.

1. 8 Forest dependent communities and their interaction with ecosystems:

The different Tribes inhabits in the forests of Malayattur Division are Mannan, Malayar, Muduvan and Arayan (Plate 3). They live in separate colonies and do not mingle with each other. There are 13 tribal colonies in this Division. Traditionally they do not engage themselves in agricultural or any other activities except the collection of honey, wax, tubers etc. from the forests. They normally do not move from their original habitat for employment or for any other purpose. But the younger generation engage themselves in all types of work in and around the forest areas. The Department engages them for Departmental work like planting, weeding, thinning etc. Some of them are engaged as firewatchers by the Department during fire season. The collections of NTFP are mostly done by the hill tribes.

There are Malayar colonies at Pongumchuvadu and Thalumkandom and Muduvan colonies are found in Therakudy, Adichilthotty kudy, Arakappu kudy, Kunjipara, Uriyampettykudy, Variam, Vellaramkuthu, Thalavachapara kudy, Metnampara and Kallelimedu. The Mannan and Arayan are settled in Mannankudy and Uriyampettykudy respectively.

Agricultural customs and wants of the people

Agriculture is the main occupation of the people living around the forests. Paddy was the principal agricultural crop in the past. Owing to economic considerations, cultivation patterns have been changing in favour of cash crops like rubber, coconut, pepper, ginger, vegetables, plantain *etc.* Multi-storey cropping pattern is thus prevalent. Agro-forestry systems are often followed with forest tree species like teak, jackfruit, anjily and even bamboo planted along the margins of agricultural lands. Significant proportion of fuel-wood requirement is met from the homesteads itself.

Timber is the main requirement, next to firewood. Firewood is the major source of fuel for the common man, especially those inhabiting adjacent to forests. In addition to the use of firewood for cooking, it is also used as a fuel in the cottage industries like brick

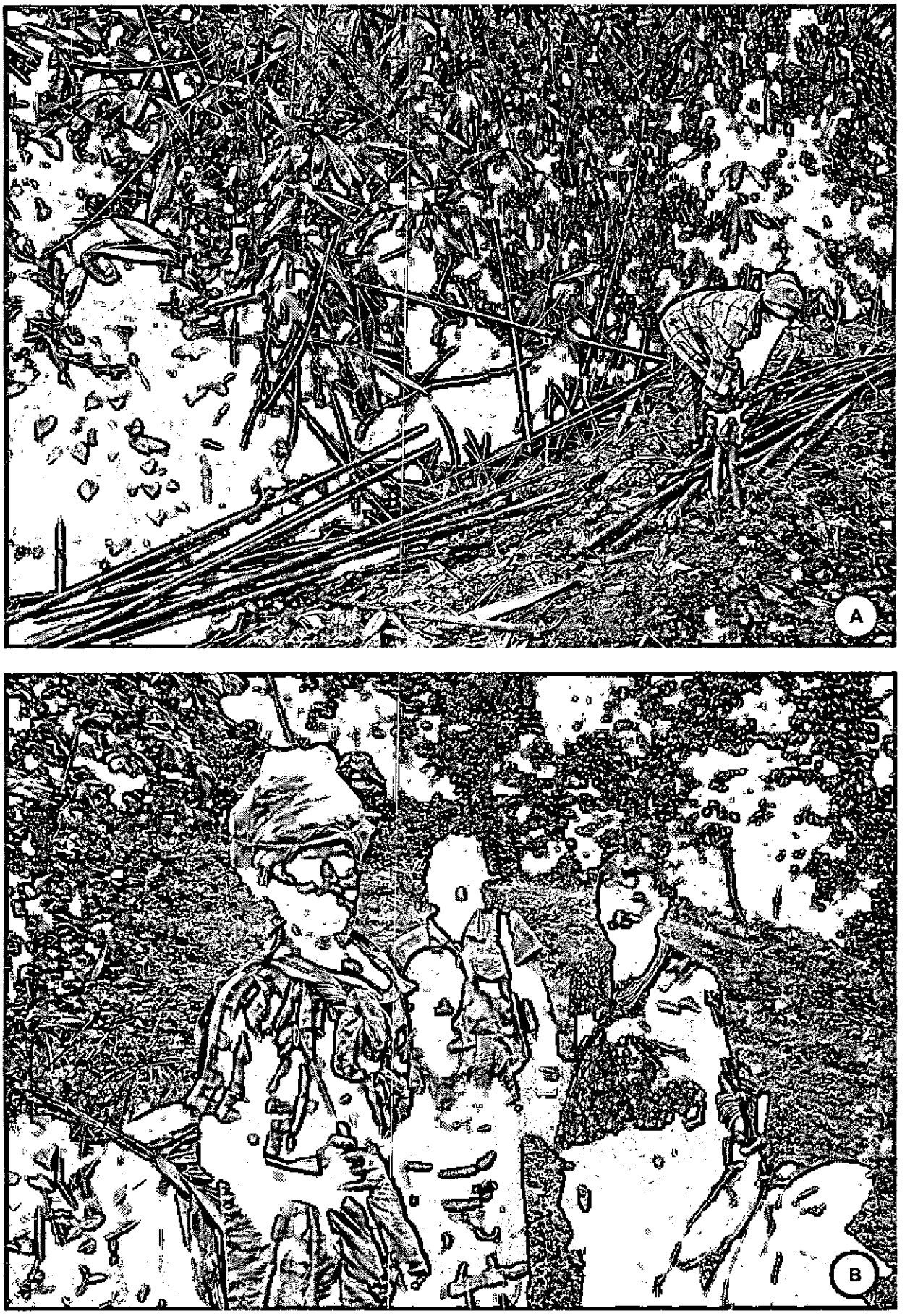


Plate 3. A. Reed extraction from Borring Kavala forests. B. Muthuvan tribal family.

making, pottery etc. Reeds, bamboos, small timber, green manure *etc.* are always in high demand by the people of nearby villages as well as hill tribes.

Bamboo, Eucalyptus and Acacia wood form the main raw material for manufacturing pulp. Hindustan Newsprint Limited Velloor is the sole consumer of the industrial raw materials at present. Malayattur Forest Division is famous for its Reeds. Kerala State Bamboo Corporation, Angamaly is a Government undertaking catering to the marketing needs of local artisans, who use reeds for fabricating handicraft items like bamboo mats. Government allots reeds to the Corporation, who in turn supplies the reeds to artisans on a buy back arrangement for the handicraft items fabricated by them. At present, a quantity of 30000 t of reeds is allotted to the artisans through the Corporation. Approximately 5000 t is collected from Malayattur Division every year.

Regulated grazing is not prevalent in the Division. Nevertheless, cattle from the fringe area mostly depend on the adjoining forests for grazing.

Human- Wildlife conflicts

Several instances of Human wildlife conflicts are reported from various Ranges of the Division. Agricultural crops are damaged by wild boar and elephants. Elephants attacking men also are reported frequently from Arrekkap colony, Illithodu, Vellarumkuthu Colony and Vadattupara. Compensation is being given to the concerned parties by the Department. The details of compensation and wildlife conflicts are provided in Chapter 5.4

Participatory Forest Management in Malayattur Division

Vana Samrakshana Samithy (VSS)

A total of 11 VSS units are working in Malayattur managing total of 26304 ha forest area in five forest Ranges. VSS engaged in NTFP collection also. The NTFP collected are sold through the Girijan Societies. The details are shown in Table 1.4

Table 1.4 Vana Samrakshana Samithy, Malayattur

Sl. No.	Name of VSS	Type (Fringe/ Tribal)	No. of family			Total	Area (ha)	Range
			SC	ST	Others			
1	Chakkimedu-Vadattupara	Fringe	31	1	134	166	84	Thundathil
2	Ponganchuvadu	Tribal	-	87	-	87	2000	Thundathil

3	Thalumkandam	Tribal	-	29	-	29	2000	Thundathil
4	Kannimangalam-Pandupara	Fringe	7	-	105	112	285	Kalady
5	Mulamkuzhy	Fringe	36	-	129	165	300	Kalady
6	Kaprikkad	Fringe	92	-	286	378	35	Kodanad
7	Paneliporu	Fringe	7	-	105	112	72	Kodanad
8	Vembooram	Fringe	Newly formed				28	Kodanad
9	Thalavachapara	Tribal	-	50	-	50	2000	Kuttampuzha
10	Kunchipara	Tribal	-	70	-	70	2000	Kuttampuzha
11	Uriyampetti	Tribal	-	52	-	52	3000	Kuttampuzha
13	Kappayam	Tribal	-	35	-	35	2000	Kuttampuzha
14	Adichilthotti	Tribal	-	61	-	61	2000	Idamalayar
15	Thera	Tribal	-	35	-	35	1000	Idamalayar
16	Variyam	Tribal	-	122	-	122	4000	Idamalayar

1.9 Forestry goods and services commercially harvested.

Markets and marketable produce

Timber

Ernakulam, Alwaye, and Perumbavoor are the principal timber markets in this Division. The development of Cochin shipyard and wood based industries in Ernakulam district has boosted the demand of structural timber. Mushrooming of construction companies supported by gulf money increased the price of timber to a level beyond the reach of common man. At present, timber is imported from Malaysia, Burma and Indonesia to meet industrial needs.

Moratorium on clear felling and selection felling in the natural forests and the forest management objectives spelled out under the National Forest Policy, 1988 have resulted in the reduction of intensity of felling operations. These facts are reflected in fall in timber stock in the depots. Final felling and obligatory thinning operations have also been delayed for various reasons like shortage of funds, labour problems etc.

Government of Kerala had arrangements with Companies like HNL, Grasim Industries, Mavoor, Punalur Paper Mills etc. in the past regarding concessional supply of forest raw material like Eucalyptus, bamboo, reeds etc. At present only HNL is functioning. Details of raw materials supplied to Hindustan Newsprint Ltd., and Bamboo

Corporation, Angamaly from this Division during the past are furnished in Table 1.5 & 1.6 respectively.

Table 1.5 Quantity of reeds supplied to Hindustan Newsprint Limited

Sl. No.	Year	Quantity (No. in lakh)
1	1991-1992	157.69
2	1992-1993	141.14
3	1993-1994	93.12
4	1994-1995	121.67
5	1995-1996	134.75
6	1996-1997	1196.00
7	1997-1998	115.75
8	1998-1999	153.40
9	1999-2000	194.05

Table 1.6 Reeds supplied to KSBC, Angamaly

Year	Numbers	Weight (MT)
1991-1992	7434030	10325.041
1992-1993	1195000	1659.722
1993-1994	5580000	7750.000
1994-1995	5630000	7819.444
1995-1996	1267000	1759.722
1996-1997	4620000	6416.667
1997-1998	5600000	7777.778
1998-1999	2371960	3294.389
1999-2000	3426000	4758.333

Collection of NTFP

In earlier days the right for collection of NTFP was auctioned off to contractors on a yearly basis, taking the Range as a unit. The collection was done by the contractor through hill tribes or experienced local labour. Tribal Co-operative Societies were organized under the co-operatives movement and since 1981 the right of collection of NTFP has been given to these Societies. The right of collection is renewed every year by realizing the amount fixed by the Government. Members of the societies collect the NTFP and the marketing arrangements; including value addition in some cases is done by the apex organization, Kerala Federation of SC /ST Co-operative societies. Since Ambedkar Centenary year, the right of collection of NTFP is given to the Tribal Co-operative Societies free of cost.

Considering the importance of NTFP in the field of herbal medicines and rural life, sustainability of these resources attains paramount importance for conservation. Based on the policy guidelines, tribes and local communities have the first charge on the forests and forest produce. This life support system needs to be maintained without jeopardizing the livelihood of the communities dependent on it. Keeping this in view, it has been thought that the NTFP resources will be managed in partnership with the tribal communities. Guidelines have been issued on the modalities and the programme is expected to take off soon.

For the collection and removal of bamboo, reeds, thatching grass, rubble, sand, *etc.* for bonafide purpose permits are issued to the local bonafide users on payment of seignorage value by concerned Forest Range Officers. The issue of permit is governed by the rules and seignorage rates are notified every year for all forest produce.

1.10 Ecosystem services provided.

The Malayattur forest provides several ecosystem services for human well being. These include the provision of services such as wild food, spices, water, fiber, traditional medicines, plant derivatives and other non-timber products, energy; the regulatory services are as climate, disease, wastes and purification of air and water; the cultural services such as recreation experience including ecotourism, aesthetic and enjoyment and scientific discovery; the supporting services such as soil formation, seed dispersal, photosynthesis and nutrient dispersal and cycling.

1.11 Major conspicuous changes in the habitat since inception

The forests along the lower reaches of Periyar south of Kuttampuzha had been worked for teak even before the arrival of the Europeans. Extraction of teak from the lower reaches of Periyar forests intensified after the dawn of forest management. But the evergreen and semi – evergreen forests of Pooyamkutty and Idamala valleys were never worked as they lacked economically valuable hardwood. Reed was not considered an industrial raw material till recently. Selection felling of evergreen forest timber for plywood industry or for railway sleeper was concentrated elsewhere with better access. The Idamala hydroelectric project was taken up in 1973 and 48 sq. km. of the Idamala valley has been submerged under the Idamala Hydroelctric scheme, the reservoir of

which is the longest in the state and second largest in Kerala after Idukky. The entire area submerged had been uninhabited pristine forests. The Idamala drainage basin is a narrow, long valley extending exactly east – west excepting at its eastern end where it broadens and at the western end where it takes an adrupt south eastern turn. The reservoir waters practically cut off the High Range forests from the northern Sholayar. The position of the wide Idamala reservoir resulted in the disruption of the forest continuity with the Kodasseri forests across the Sholayar watershed. At the tail end of the reservoir on the northern bank, the forests in Kerala side around Malakkapara had also been converted to tea plantations. During the early 1960's 'industrial plantation' activity was taken up with Five Year Plan funding and extensive teak plantations were raised all along the lower reaches of Idamala River on a vast scale. In fact the lower reaches of Periyar from Malayattoor to Thattakkad, in particular the Vemburam Island was one of the first areas in Kerala after Nilambur and along with Konni be tried for large scale teak plantations (Nair, 1988).

The extensive reed beds in Pooyamkutty - Idamala valleys have since the 1970's become the prime raw material collection location for the Hindustan Paper Corporation Newsprint factory at Velloor. There are also lakhs of reed workers in the State who make mats, baskets etc. Some of these reed workers have been organized through the Bamboo Corporation and the collection and distribution of reed is regulated partially. There is a much larger number of unorganized reed workers subsisting on this once plentiful and cheap raw material (Nair, 1988).

1.12 Assessment of inputs of line agencies.

The assessments of inputs of various line agencies are minimal in the High Value Biodiversity areas in Malayattur Forests. In Kuttampuzha, there is a Girijan Service Co Operative Society Ltd 157 and Ponganchuvadu Scheduled Tribal Co-Operative Society No. E 852 at Kodanad, Thundathil and Thalakkulam are tribal Co-Operative Societies permitted for the collection of NTFPs.

1.13 Adjoining landscape description.

The Malayattur Forest Division is bordered to the North by Vazhachal Forest Division, to the south by Thattekkad Bird Sanctuary and areas of Kothamangalam Forest Division. Munnar and Mankulam Forest Divisions border the South east portions.

CHAPTER 2: BIODIVERSITY SIGNIFICANCE

The Asian tropics are among the fabulous treasure-houses of biodiversity with a rich variety of flora and fauna, much of which has never been documented. But their existence is being threatened by human beings. Mankind has been around in the Asian region for some 500,000*y*, but only in the last 10,000*y* or so did they begin to alter their environment irreversibly (Rambo 1979).The main reasons for wide range declining in the biodiversity is due to habitat alterations, increased rates of invasions of introduced non-native species, over-exploitation of the resources and other human-caused impacts. Hence the maintaining and restoring biodiversity in forests promotes their resilience and is an 'insurance policy' and safeguard against expected climate change impacts.

The Malayattur forests are rich repositories of a vast variety of flora and fauna and play a very vital function in preserving the habitat of several threatened or endangered species (Plate 4). The forest areas fall into three forest types viz. West coast tropical evergreen (IA/C4), West coast semi-evergreen (2A/C2) and Southern tropical moist deciduous (3B/C1). The elevation varies from 100 m to 1340 m.

2.1 Biodiversity values (cover unique species, habitats, ecosystems)

Flora and endemism

Nair (1989) reported 340 taxa belonging to 99 families (82 dicotyledons and 17 monocotyledons) were recorded from low and mid elevation areas of Idamalayar - Pooyamkutty valley. Reed breaks with regenerating culm of *Ochlandra travancorica* is of common occurrence in these forest areas. Aquatic vegetation is not diverse but *Rotula aquatica* is commonly seen anchored in rock crevices which, during monsoon get submerged and defoliated (Nair, 1989). In the flora of Pindimedu region, 115 taxa of flowering plants belonging to 47 families were reported. This comes to more than 33.8% of the total number of floristic elements in this area. Most of the Peninsular Indian endemics in the flora in Malayattur forests are species confined to the Western Ghats, which abode about 60% of the Peninsular Indian endemics (Chatterjee, 1939). Such a high degree of endemism noted for the region suggests that evolution must be very active here also as is the case with many other areas in the Western Ghats (Rao,

1978). The dominant families are Rubiaceae (9 sp.), Lauraceae (7 sp.), Fabaceae (8 sp.) and Orchidaceae (7 sp.). Following are the families that contain South Indian endemics in the region with their species content given in parenthesis. Lauraceae (7), Gesneriaceae (1), Meliaceae (2), Ancistrocladaceae (1), Commelinaceae (1), Moraceae (1), Chrysobalanaceae (1), Euphorbiaceae (6), Begoniaceae (2), Orchidaceae (7), Palmae (1), Verbenaceae (2), Guttiferae (3), Burseraceae (1), Apocynaceae (1), Oleaceae (3), Zingiberaceae (1), Connaraceae (1), Bombacaceae (1), Fabaceae s.I (8), Ebenaceae (1), Dipterocarpaceae (6), Musaceae (1), Labiatae (1), Icacinaceae (1), Annonaceae (4), Acanthaceae (3), Tiliaceae (2), Anacardiaceae (4), Flacourtiaceae (2), Balsaminaceae (3), Sapotaceae (2), Celastraceae (1), Cornaceae (2), Myristicaceae (3), Melastomataceae (6), Rubiaceae (9), Bambusaceae (1), Sapindaceae (1), Symplocaceae (2), Myrtaceae (3), Combretaceae (1), Tetramelaceae (1), Rutaceae (1), Staphyleaceae (1), Compositae (1) and Podostemaceae(1). Some of the Peninsular Indian endemic tree species in the area are *Actinodaphne bourdillonii* Gamble, *Aglaia barberi* Gamble, *Atuna travancorica* (Bedd.) Kosterm., *Baccaurea courtallensis* (Wt.) Muell.-Arg, *Calophyllum apetalum* Willd., *Canarium strictum* Roxb., *Cinnamomum riparium* Gamble, *Cullenia exarillata* Robyns, *Dalbergia sissoides* Grah. *ex* Wt. *et* Arn., *Diospyros candolleana* Wt., *Dipterocarpus indicus* Bedd., *Dysoxylum malabaricum* Bedd. ex Hiern, *Garcinia wightii* T. Anders., *Gymnacranthera canarica* (King) Warb., *Hopea glabra* Wt. et Arn., *Humboldtia brunonis* Wall., *Knema attenuata* (Hook.f.et Thoms.) Warb., *Palaquium ellipticum* (Dalz.) Baill., *Syzygium mundagam* (Bourd.) Chithra, *Turpinia malabarica* Gamble, *Vateria indica* L. and so on. Genus *Psychotria* (Rubiaceae) with six Peninsular Indian endemics in the region is one that is maximum represented here with regard to Peninsular Indian endemics, followed by *Cinnamomum* (4 sp.), and *Syzygium* (3 sp.). Species like *Aglaia barberi* Gamble, *Gymnacranthera canarica* (King) Warb., *Cinnamomum macrocarpum* Hook.f., *Bulbophyllum neilgherrense* Wt., *Vateria indica* L., *Begonia albo-coccinea* Hook., *Actinodaphne bourdillonii* Gamble, *Humboldtia brunonis* Wall., *Atuna travancorica* (Bedd.) Kosterm., *Ormosia tranvancorica* Bedd., *Syzygium laetum* (Ham.) Gandhi, *S. mundagam* (Bourd.) Chithra, *Nothopegia beddomei* Gamble, *N. travancorica* (Bedd.) Hook.f., *Grewia gamblei* J.R. Drumm., *Dysoxylum malabaricum* Bedd. ex Hiern., *Miliusa tomentosa* (Roxb.) Sinclair, *Chilocarpus malabaricus* Bedd., *Gomphostemma*

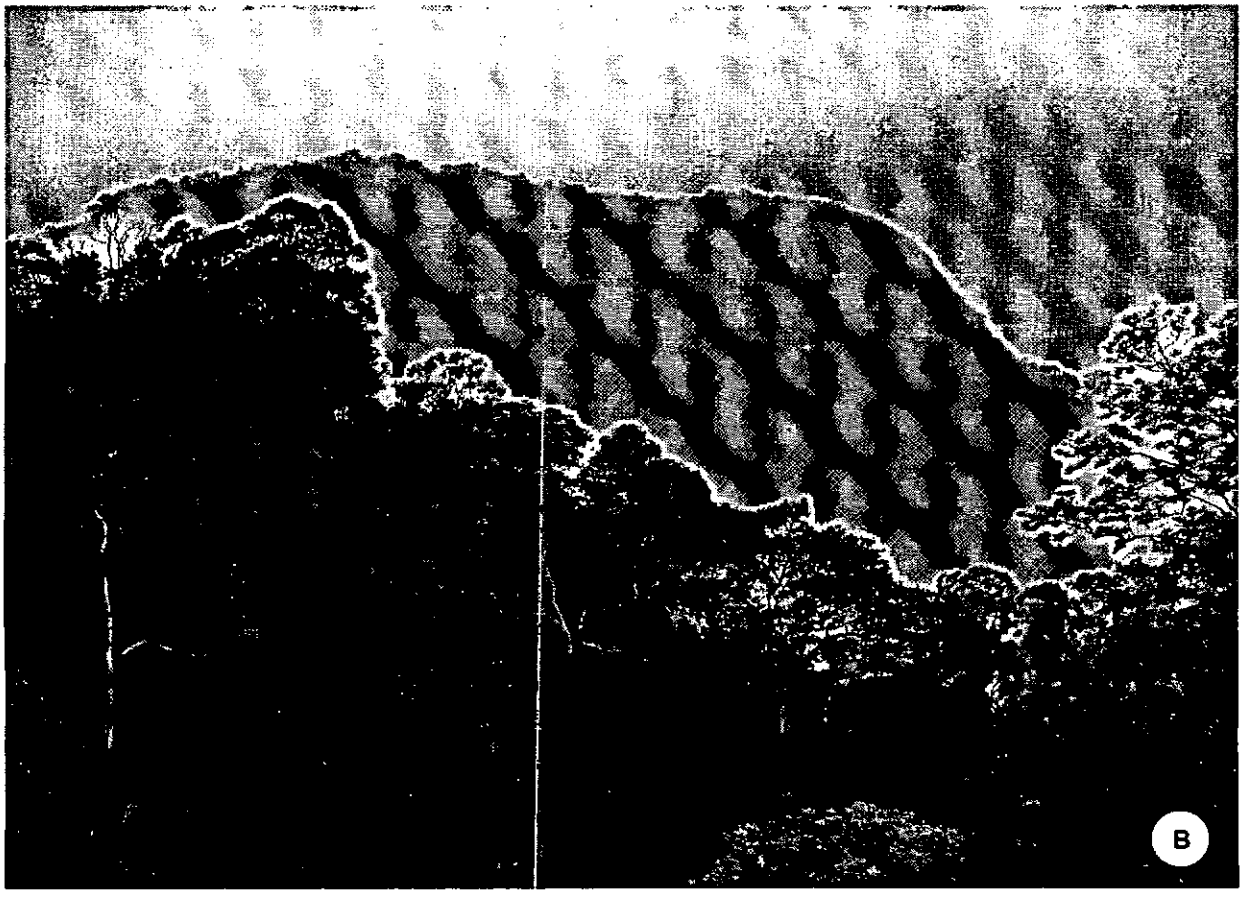


Plate 4. A. Kunjiyar B. Kottakuthu hills - view from Koompanpara

keralensis Vivek., Gopal *et* Ansari, *Goniothalamus wightii* Hook.f. *et* Thomas., *Hopea glabra* Wt. et Arn., *Cleisostoma tenerum* Hook.f., etc. are some of the rare or endangered, highly endemic taxa in the area. The Edamala - Pooyamkutty upper reaches of region contain 171 taxa of flowering plants of which about 35% are endemic to Peninsular India. The flora of Pindimedu region, following categories of economically important plants are seen and the number of species that belong to each category and their percentage in the total number of species in the flora are as follows: Timber yielding plants- 100 taxa (27.02%), Medicinal Plants – 174 taxa (51.17%), Food and fodder yielding plants- 90 taxa (26.47%), Oil yielding plants- 35 taxa (10.58%), Gum and resin yielding plants- 39 taxa (11.47 %), Tan and dye yielding plants- 40 taxa (11.76%), fibre and floss yielding plants- 22 taxa (6.47%), spices, contiments, etc. yielding species- 5 taxa (1.47%), other miscellaneous uses- 21 taxa (6.17%). Similarly, one of the largest teak in Asia with girth at B.H:730 cm, height about 38 m is found in Kappayam forests in Idamalayar range. The Malayattur forests are rich in the diversity in the case of lower groups of plants such as Ferns, Lichen, bryophytes and fungi. Detailed enumerations of these groups were not yet done. The preliminary survey shows that the important pteridophytes in the area are *Lycopodium wightianum, Pteris longipes, P. pellucida, Adiantum caudatum, A. hispidum, A. lunulatum, A. raddianum, Antrophyum coriaceum, A. reticulatum, Nephrolepis hirsutula, N. exaltata, Oleandra musfolia, Asplinium crinicaule, A.ensiforme, A.erectum, A. nidus, A. nitidum, A. tenerum* and *Blechnum orientale.* A checklist of flora is given in Annexure– V.

With regard to the fauna of this region, the diversity is tremendous-be it in case of mammals, birds, reptiles, amphibians or fishes. These animals live in diverse habitats such as dry deciduous forests, riparian fringes and the evergreen patches. The common and rare mammals seen in this area include Nilgiri Tahr, Lion tailed macaque, Bonnet macaque, Nilgiri langur, Elephant, Gaur, Sambhar deer, Spotted deer, Barking deer, Mouse deer, Malabar giant squirrel, Flying squirrel, Porcupine, Indian civet, Toddy cat, Sloth bear, Tiger Leopard, Jungle cat, Wild dog and Indian pangolin.

Elephant *(Elephas maximus)*

The Asian elephant is an endangered species (IUCN) and included in Appendix I of the CITES with the distribution is limited by both the need for daily access to water, and by a preference for feeding on grass. The main problem to the elephant population of Malayattur forests is due to poachers.

Gaur (*Bos gaurus*)

The gaur is classified as a vulnerable species (IUCN) due to habitat loss or degradation and epidemics and included in Appendix I of CITES. The wide declining of gaur population is due to habitat destruction and disturbance (agricultural development, human settlement, extensive logging etc.), indiscriminate hunting and exposure to diseases of domestic cattle.

Sambar (*Cervus unicolor*)

The largest and the most widely spread Indian deer, the Sambar, found in all the habitat types, from moist deciduous to evergreen forests. This species is one among the main prey species for tiger, panther and wild dog. The evidences of Sambar from the observations indicated that they are found throughout the landscape units except nearby human settlements.

Nilgiri tahr (*Hemitragus hylocrius*)

The Nilgiri Tahr (*Nilgiritragus hylocrius*) an ungulate, endangered (Schedule 1 – Wildlife Protection Act (WPA) species) mountain goat endemic to the Nilgiri Hills and the southern portion of the Western Ghats is found an ideal habitat in Nemmara-Vazhachal- Malayattur landscape (Table 2.1). The tahr populations are reported from Sulimala, Vagirian and Manjakkallan areas of Malayattur forests (Balasubramanian *et al.*, 2007). The important fodder species found in this location include *Heteropogon contortus, Arundinella purpurea* and *Ischaemem indicum* etc. The major threat to the tahr populations in these landscape unit is due to poaching. Cattle grazing and alteration of habitat for commercial and forestry plantations exert severe impact on these scattered populations.

Table 2.1 Comparison of Thar populations in Nemmara-Vazhachal- Malayattur landscape.

Location	Latitude	Longitude	Population*
Sulimala	76° 51' 17"	10° 13' 21"	< 5
Vagirian	76° 49' 41"	10° 16' 01"	5-10
Manjakkallan	76° 53' 02"	10° 15' 26"	30 - 50
Karimalagopuram	76° 44' 40"	10° 21' 58"	30-40
Padagiri (Hilltop)	76° 39' 21"	10° 30' 09"	30-40

**Estimation based on indirect evidence (Ramesh et al., 2003)*

Tiger (*Panthera tigris*)

Similarly, a large number of direct and indirect evidences of occurrence of tigers were also found in the adjacent areas especially in Vazhachal, Kollathirumedu and Sholayar Ranges. In many places, tigers struggle for survival with burgeoning human populations competing for similar resources of food and shelter. Tiger populations are threatened throughout their range, either directly from poaching, or from habitat and prey loss.

Sloth bear *(Melursus ursinus)*

The large number of population of the sloth bear (*Melursus ursinus*), an endemic and vulnerable (IUCN) species of the Indian subcontinent is also reported from Malayattur. This species is listed in Appendix I of CITES and Schedule I of the WPA, 1972 are found in a variety of habitats ranging from wet evergreen forest to deciduous and degraded scrub forests. Degradation of the habitat due to overgrazing, tree felling, fire, conversion and reclamation for other uses, and over-extraction of forest resources, appear to be occurring throughout the bear ranges.

Nilgiri langur (*Trachypithecus johnii*)

The Nilgiri langur, (*Trachypithecus johnii*) an endemic to the Western Ghats, exist in almost all habitats, they are more abundant in evergreen forests of Vazhachal and reported to be less in forests lying near to the human habitations in Malayattur. The

species is endangered due to forest fragmentation and poaching for its fur and flesh, the latter is believed to have aphrodisiac properties.

Lion tailed macaque (*Macaca silenus*)

Lion tailed macaque (LTM), is an endangered species (IUCN) listed in Schedule I of W (P) A, 1972. The distribution of the species is restricted in the tropical evergreen forests of Kerala, Karnataka and Tamil Nadu. Their population in the present range is reported to be severely fragmented and isolated due to conversion of medium elevation evergreen forests into reservoirs and forestry and commercial plantations. LTM troops have been observed in evergreen patches of Kappayam areas.

Malabar giant squirrel (*Ratufa indica*)

The Malabar giant squirrel (*Ratufa indica*) is a vulnerable (IUCN) arboreal animal and is fairly common in all types of habitats *viz,* moist deciduous, semi-evergreen, and evergreen forests in Malayattur and very low abundance were reported in the regions near human settlements.

Amphibians

The threatened amphibians in the Division are *Bufo microtympanum, Indirana brevipalmata, Rana temporalis, Rana malabarica, R. aurentica, R.keralensis* and *Nyctibatrachus major.*

Reptiles

The important reptile species are *Indotestudo forstenii, Hemidactylus brooki Melanochelys trijuga, Trimeresurus malabaricus* and *Uropeltis ceylanicus.*

The table 2.2 shows the estimated population of mammals in Malayattur Forest Division. Among mammals the highest density was observed in elephant followed by Bonnet Macaque. The conservation status of RET mammals is provided in Tables 2.3. A checklist of fauna is given as Annexure – V.

Table 2.2 Estimated population of mammals in Malayattur Forest Division

Sl. No	Name of the mammal	Density (No/Sq km^2.)	
		1997	2002
1	Sambar deer	0.0783	0.102
2	Barking deer	0.0147	-
3	Bonnet Maccaque	0.4161	0.5099
4	Common langur	0.1126	0.0162
5	Elephant	0.5776	0.5002
6	Gaur	0.0538	0.0243
7	Malabar Giant squirrel	0.0881	0.0809
8	Nilgiri Langur	0.1175	0.0437
9	Spotted deer	-	0.0065
10	Wild boar	0.1909	0.1392

Source: Easa and Jayaraman, 1997., 2002 and Easa *et al.*, 2002

Table 2.3 Status of mammals recorded from Malayattur Forest Division

Sl. No	Species	Local Name	IUCN		Endemism	CITES	WL (P) A
			Status	Category			
1	*Macaca radiata* E. Geoffroy	Bonnet macaque	LRIc	--	EN- PI	A-II	A-II (1)
2	*Macaca silenus* Linnaeus	Lion-tailed macaque	EN	(B1,2c; C2a)	EN-WG	A-I	A-I (1)
4	*Cuon alpinus adjustes* Pallas	Indian wild dog	CR	(D1)		A-II	A-II (1)
5	*Felis chaus* Schreber	Jungle cat	LRnt	--		A-II	A-II (2)
6	*Panthera pardus* Linnaeus	Leopard	VU	(C2a)		A-I	A-I (1)
7	*Panthera tigris* Linnaeus	Tiger	EN	(C2a)		A-I	A-I (1)
8	*Paradoxurus hermaphroditus* Pallas	Common palm civet	LRIc	--		A-III	A-II (2)
9	*Viverricula indica* Desmarest	Small Indian civet	LRnt	--		A-III	A-II (2)
10	*Axis axis* Erxleben	Spotted deer or chital	LRIc	--			AII(3)
11	*Cervus unicolor* Kerr	Sambar	LRIc	--			AII (3)
12	*Muntiacus muntjak* Zimmermann	Barking deer	LRIc	--			AII(3)
13	*Sus scrofa* Linnaeus	Wild boar	LRIc	--			AII(3)
14	*Moschola meminna* Erxleben	Mouse deer	LRnt	(A1d)			A-I

							(1)
15	*Manis crassicaudata* Gray	Indian pangolin	LRnt	--		A-II	A-I (1)
16	*Hystrix indica* Kerr	Indian Crested Porcupine	LRlc	--			A-II (4)

Source, Ramesh et al., 2003.

Integral part of elephant reserve and Wildlife corridor

The Malayattur forests are part of the Anamalai Parambikulam elephant reserve which is notified as Elephant Reserve No.9 by the MOEF under its '*Project Elephant*'. The migration of elephants from the Parambikulam Plateau, across the Chalakudy River, to Malayattur forests form an important wildlife corridor. The Parambikulam plateau has been deforested and planted with teak by the Forest Department under its plantation and afforestation programmes. Water and vegetation is scarce and consequently the migration of the elephants to the Pooyamkutty forests in the Periyar river basin is an annual affair. The highest elephant density is noted in Malayattur Division indicates elephant movement along the corridor. The details of estimated elephant density in Malayattur Forest Division in the year 2005 and 2007 are shown in Table.2.4

Table.2.4. Details of estimated elephant density in Malayattur Forest Division

Year	Number of Elephant sighted	Estimated elephant density (No./km^2)
2005	162	0.6758
2007	174	0.7525

Source: *Sivaram et al., 2005; Sivaram et al., 2007*

Fish diversity in Pooyamkutty - Idamalayar

The fish fauna in Pooyamkutty found to be diverse with its tributaries 34 species belonging to 11 families were reported by Ajithkumar *et al.*, (2001). *Puntius melanampyx*, *P. filamentosus*, *P. ticto*, *Garra mullya*, *Danio aequipinnatus*, *D.malabaricus*, *Barilius bakeri* and *B. gatensis* were reported to be in abundance.

Bamboo-reed -rattan patches

In almost all areas of the wet evergreen, semi-evergreen, and moist deciduous forests of this Division, Bamboo and reeds are available in large quantity. These form raw material for cottage industries for a large number of families. The Kerala State Bamboo Corporation is extracting and supplying reeds for cottage industries. The Corporation is

also manufacturing Bamboo ply using reed mats. Reed and Bamboo are being extracted by Hindustan News Print Ltd. and by M/s. Grasim Industries. In view of the fact that these areas have high potential to produce reeds and Bamboos in large quantity and in view of the increasing demand from cottage and large scale industries it is high time for implementing schemes for increasing production and for scientific extraction of Bamboos and reeds with least wastage.

2.2 Factors affecting values.

Forests are among the largest carbon sinks on earth and contain about half the world's terrestrial biomass of carbon stocks. Consequently, reducing emissions from deforestation (which today stands for some 20% of human greenhouse gas emissions) is now a cornerstone in many national climate strategies. Climate change is rapidly becoming the biggest threat to biodiversity and is already having significant effects. Species are being forced to adapt to the changing climatic conditions either through shifting habitat, changing life cycle or developing new physical characteristics. Those species that are unable to adapt face extinction. Predictions estimate that up to 1 million species may become extinct, and, in fact, the first extinctions caused by climate change have already occurred. Changes in climate affect biodiversity both directly through changes in temperature and indirectly through the frequency of disturbances such as fires, hurricanes and storms. Climate change will hit hardest those species with low populations, those inhabiting restricted or patchy areas, and those restricted to limited climatic ranges such as coral reefs, mangrove forests, cloud forests and inland water ecosystems. Maintaining and restoring biodiversity in forests promotes their resilience and is an 'insurance policy' against projected consequences of climate change.

Biodiversity is the foundation for the goods and services provided by ecosystems that are crucial for human survival and well being. Loss of biodiversity has negative effects on several aspects affecting human life such as food and energy security and access to clean water and raw materials. The livelihood of many indigenous and local communities, in particular, is adversely affected since their communities are so directly dependent on the products and services provided by the ecosystems they inhabit. Tourism, an important and fast growing industry in large parts of Asia, is vulnerable to

biodiversity loss since rich biodiversity and beautiful nature and countryside have increasingly become major tourist attractions. In general, there is a need to preserve habitats in order to facilitate the long-term adaptation of biodiversity and to fully integrate biodiversity considerations into mitigation and adaptation plans. The link between biodiversity and climate change runs both ways: biodiversity is threatened by climate change, but biodiversity and its components can reduce the impacts of climate change on people and production.

The main factors affecting the biodiversity values in Malayattur forests are

- Forest degradation and removal of evergreen patches
- Human-Wild life conflicts
- Infestation of noxious weeds
- Degradation of watersheds
- Alteration of Wildlife corridors
- Overexploitation of NTFPs including reeds, bamboos and medicinal plants

2.3 Strength-Weakness-Opportunities-Limitation (SWOT) Analysis – Malayattur High Value Biodiversity Area

STRENGTH	WEAKNESS	OPPORTUNITY	THREAT
Low elevation evergreen forests and high density of elephants.	Evergreen forest limited to higher reaches of Kuttanpuzha & Idamalayar ranges	Conservation potential, biodiversity studies.	Expansion of reed (*Ochlandra travancorica*) in to forest areas due to fire and human interference
A large block of riparian in forests in the Kuttampuzha Range,	A number of roads criss-crossing the area for cutting and transporting reed.	Conservation and restoration potential	New development projects, expansion of roads can destroy the riparian systems.
Watersheds of important tributaries of Periyar	One of the tributaries dammed (Idamalayar)	Regulated flow through Periyar Valley Irrigation Project Main Canal and Boothathankettu barrage controlling downstream salinity	Possibility of Pooyamkutty river being dammed for a hydroelectric project. Degradation of watersheds.

Rich biodiversity with endemic flora and fauna	Critically endangered species requiring specific microhabitats	Funding options for conservation, Bio prospecting	Colonization by alien invasive species, loss of microhabitats
Rich in Reed and bamboo resources	Commercial exploitation Increasing human intervention	Fodder for larger mammals. Assessment of reed genetic resources with high fibre content and low lignin content Possibility of evolving a reed utilizing management plan.	Possibility of fire. Over-extraction of reed resources by multiple agencies and depletion of food availability to elephants.
High density of Elephants recorded during wildlife censes in the past, the area being migration and breeding ground.	Loss of continuity and connectivity forests due to encroachments, fire, cultivation etc.	Declaration as high value biodiversity area and possibility of planning long term conservation.	Poaching due to accessibility
Isolated populations of *Dysoxylum malabaricum*	Lack of information autecology	High Conservation potential	Probable local extinction of the species.
The largest viable population of *Dipterocarpus bourdilonii* (Critically Endangered, trees less than 200) at Urulanthanii	Impact of settlements from all sides	High Conservation potential	High risk of extinction due to lack of protection
Tourism potential	Unmanaged tourism, absence of carrying capacity studies.	1.Boothathankettu dam – tourism potential 2. Elephant camp at Kodanadu 3. Pindimedu falls. 4. Kurishumudy – Malayattur (Seasonal) Carrying capacity based eco tourism	Overcrowding, Pollution and degradation
Pilgrim Centres. 1.Kalady 2.Kurishumudy 3. Nature study centre	Insufficient Facilities and information	Heritage Value for conservation education	Overcrowding carrying capacity studies

Wildlife Corridor between Sholayar and Munnar. Edamalai-Pooyamkutty Valley), Second largest evergreen block in Western Ghats	Reservoir (Idamalayar) lying in East West direction. Disrupt easy movement.	Conservation potential at a landscape level. Movement pattern of large mammals need studies, (Eastern end of Idamalayar reservoir ~only 2 -4 km wide)	Expansion of tea estate from Tamil Nadu side on the North East - threat to wildlife corridor.
High biodiversity of invertebrate fauna	Lack of exhaustive exploration	Inventory, Bio prospecting	Uncontrolled Fire and depredation
Settlements of Muthuvan, Mannan, Malayar, Arayan tribes	Forest dependency high	Indigenous knowledge, Forest Protection NTFP. Opportunities for improving livelihood through biodiversity conservation and participatory conservation efforts.(VSS)	Change in attitudes can go against conservation. Ganja and poaching
Irrigation, drinking water and prevention of salinity intrusion downstream	Incomplete irrigation canal system at Idamalayar.	Effective water management	Proposed Boothathankettu Hydroelectric project
A chunk of plantations	Improvement of soil Degraded plantations Low productivity	Afforestation of degraded and failed plantations	

2.3 Strategies to address threats

Strategy I. Conserve critical species, ecosystems and gene pools

- Rare, Endemic and Endangered species
- Conservation and restoration of the area.
- Unique ecosystems and species-specific habitats.
- Riparian ecosystem
- Wild life corridors

Strategy II. Establish models for cost effective afforestation, conversion of degraded plantations to natural forests and sustainable utilization of NTFP.

- Unsustainable collection of NTFPs

- Over exploitation of resources - bamboo, reeds, etc
- Over exploitation of Fish resources

Strategy III. Mitigate human-wildlife conflicts through appropriate methods.

Strategy IV. Develop appropriate measures in natural resource management to mitigate management issues.

- Fire
- Obnoxious Weeds (*Mikania, Lantana* etc.)
- Soil erosion
- Watershed

2.4 Indicators of success

Criteria and indicators are tools which can be used to conceptualise, evaluate and implement sustainable forest management. Criteria define and characterize the essential elements, as well as a set of conditions or processes, by which sustainable forest management may be assessed. Periodically measured indicators reveal the direction of change with respect to each criterion. An indicator is a measure or measurement of an aspect of a criterion. It is a quantitative or qualitative variable that can be measured or described, and which, when observed periodically, demonstrates trends. Thus indicators are measurable or describable characteristics of a chosen criterion that provide a means for tracking changes in environmental, social, and economic conditions affecting forests. There are nine international and regional criteria and indicators initiatives, which collectively involve more than 150 countries. There appears to be growing international consensus on the key elements of sustainable forest management. Seven common thematic areas of sustainable forest management have emerged based on the criteria of the nine ongoing regional and international criteria and indicators initiatives. The seven thematic areas are:

- *Extent of forest resources*
- *Biological diversity*
- *Forest health and vitality*
- *Productive functions and forest resources*
- *Protective functions of forest resources*
- *Socio-economic functions*
- *Legal, policy and institutional framework.*

This consensus on common thematic areas (or criteria) effectively provides a common, implicit definition of sustainable forest management (Table 2.5).

Table 2.5.Criteria, monitoring indicators and research needs in Malayattur forests

Sl. No	Criteria	Monitoring indicators	Research needs
1	***Biodiversity Conservation***	• Number of forest dependent species and status • Population levels of representative species from diverse habitats monitored across their range. • Annual removal of non-timber forest products (e.g. medicinal plants etc) compared to the level determined to be sustainable. • Area and percent of forest affected by invasive plant species beyond the range of historic variation.	• *Mapping and analysis of Biodiversity hot spot areas.* • *Identification of threatened species.* • *Details on actual collection and use of medicinal plants and other non-timber forest products.* • *Impacts of browsing on wild plant populations* • *Inventory of lower forms of fauna and flora.* • *Impact of tourism on biodiversity* • *Developing a GIS based management system.*
		• Percent of water bodies in forest areas with significant impairment. • Number of sites with significant soil	• *Impacts of groundwater development on forest ecosystems, including surface water systems* • *Inventories of ground water resources.*
3	***Soil management***	• Area and percent of forest land with significant soil erosion. • Area and percent of forestland with significantly diminished soil productivity, organic matter, or changes in soil chemistry. • Area and percent of forest land with significant compaction or change in soil physical properties resulting from human activities.	• *Soil quality indicators.* • *Methodologies for measuring soil quality.* • *Methodologies for restoring soil quality.*
		• Area of forest affected by pests, disease, wildfire, etc. (e.g., insect and disease/tree	

4	***Forest ecosystem health and vitality***	mortality listings/maps, damage appraisal reports, wildfire listings). • Number of sites where illegally deposited wastes • Number fires reported by cause and fire danger rating. • Percent of aquatic ecosystems damages • Percent of the landscape exhibiting stress symptoms • Number of sites exhibiting forest health problems that can be attributed to adjacent land uses and activities	• *Determination of fire-weather index.* • *Mapping of fire prone, weed infested and degraded areas.*
6	***Socio-economic function.***	• Value of wood and NWPF removals	• *Monitor and quantify the collection of NTFPs and NTFP dependency of Tribes and fringe area people*
7	***Legal, policy and institutional framework.***	• Planning and budget allocation available. • Reliable data • Appropriate guidelines for policy implementation • Accurate management plans and harmonization of land-use policies	• *Need for integrating national and international policies on forest resources development to emphasize the linkage between utilization and sustainable management.*

CHAPTER 3: HISTORY OF PAST MANAGEMENT AND PRESENT PRACTICES

3.1. Past management: Conservation and forest management history

3.1.1. Conservation and forest management history up to 1900

The forests of Malayattur had been regulated under the Government of Travancore since later part of eighteenth century. However, the regulations had the focus on extraction, that also particularly teak. Collection of other species was allowed to the citizens of the State and organized working of forests for timber was a State monopoly. It has been traced to the close of eighteenth century. Teak was the most important timber. Rosewood was declared so in 1844, ebony and sandal were added to the list in 1865. The Forest Act was passed in 1888. In 1892 forest administration was introduced for Malayattur forests. In 1895 Malayattur forests were notified as Reserved Forest under the Forest Act. In 1897 a reorganization of the department and formation of Ranges took place and focus of this management was mainly timber extraction. Simultaneously forests were being used for cultivation and elephant capturing as well.

Shifting cultivation

Shifting cultivation was practiced both by the tribals and local people. Tribals cultivated areas in the interior forest and the local people selected land for cultivation near to their habitation. A proclamation to restrict shifting cultivation was made in 1870 under which people were allowed to cultivate in grasslands, reed jungles and marshy places without permission, but lands on hillsides with Teak and Blackwood trees were not allowed to be cleared. Another proclamation issued in 1881 permitted people to clear land within four miles of the inhabited place. The Forest Act was passed in 1888, which helped in exercising more control over unauthorized clearings.

Elephant Capturing

From the information available, elephant capturing was in existence in the Division from the beginning of Nineteenth century (1810) and pit system of capturing was in practice. In the beginning Government allowed people to dig pits, on payment of a tax per pit, and the elephants thus captured become the property of the person who dug the

pits. After a period Government also started digging pits without banning the private people in doing so. But, the elephants captured by the private persons were taken over by the Government paying Rs.150/- per elephant. In 1875, this system was stopped and since then Government became the sole authority for elephant capturing. Mortality rate was more in pit system of capturing. Hence introduction of Kheddah system was thought of during the year 1874. But, the pit system of capturing continued to be in practice with slight improvements to reduce the mortality rate. Presently no elephant capturing operations are taken up in the Division.

3.1.2. History after 1900

In the year 1901 the depot system was reintroduced and removal on permit system was completely stopped. It was also ordered by Government to register the produce, before the removal of the same, under the cover of passes issued by the Range Officers. During the year 1904, rules regarding the management and control of the hill-men living within the reserve forests were passed. These rules also contained the nature and extent of the privileges and concessions enjoyable by the hill-men. The order insisting the marking of all trees before felling came into existence in the year 1905. Disposal of residual tree growth through auction (sale coupe) to make the area available for planting commenced in the year 1907.

Abolition of Royalties

As already mentioned in earlier the Teak, Rose wood, Ebony and Sandal were treated as royal trees and Government enjoyed complete right over such trees. It was decided by Government during the year 1932 (G.O.R.Dis.No.858/32/Devpt.dt 27th May 1932) to abolish the monopoly over royal trees standing on registered holdings (private lands) and fixed a period to remove all such trees by the Forest Department and to permit the people to have the right over such trees which come up thereafter. The owners of the land from where royal trees were extracted were paid "Kudivila".

The period for the removal of the royal trees was extended till 1950 since the work could not be got completed in the original period decided by the Government.

Plantations (Teak)

First attempt to plant teak in Malayattur Division was made on13th of May 1865 on Vembooram Island about 6.5km East of Malayattur, which was a failure. From 1867 onwards-successful teak plantations were raised regularly, both at Malayattur and Konni. No planting was done at Malayattur from 1874 to 1891 and the reasons according to Mr. Bourdillon were the fear of fever in the plantation areas and the greater cost of labour compared to Konni area. During the period, even regular maintenance work in the plantations, like weeding, climber cutting, thinning, etc, were neglected. From 1892 to 1906 raising and maintenance of plantations were done in a very systematic way.

The increase in the extent of teak plantations in the State resulted in several problems, which required careful consideration. In the year 1928 Mr. M.P. Jacob, Deputy Conservator, was deputed to study the problems and to prepare a scheme for the management of the teak plantations in the State. The Government approved the scheme prepared by Mr. M.P. Jacob in 1932. The scheme was for 10 years and included prescriptions for the extension of plantations, thinning and cultural operations. In the absence of a revision, the prescriptions were continued to be in practice for several more years.

Taungya system

During 1920, Deputy Conservator, Konni Division, suggested Taungya system in raising plantations and the first attempt of raising teak under taungya was found successful in Konni Forest Division. In Malayattur Division the taungya system was introduced in the year 1922, and after initial difficulties due to non-availability of experienced taungyadars and scarcity of labour for hill cultivation, became successful.

Other species

The first attempt of experimental planting with some exotic species such as *Ailanthus grandis, Swietenia macrophylla* and *Hevea braziliensis* was done during the period from 1906 to 1916 and there is no valuable information regarding the performance of

these species. Planting of some jungle wood species were tried successfully in a small scale at Paneli in 1941 and continued planting till 1945.

Past Systems of Management and their results

As mentioned earlier Malayattur forest comprising an area of 345 square miles (89355 ha.) was notified as reserved forest under section 18 of the Forest Act in 1895. A preliminary Working Plan for Malayattur reserve was prepared in the year 1900 for the period from 1900 to 1906. The total area was divided into six annual blocks under a single Working Circle. No information regarding the nature and extent of operations carried out during the plan period is available.

Another Working Plan was introduced from the year 1907 in which the area was divided into twelve annual coupes and the prescription was merely the order in which the fellings had to be conducted. The plan was silent about the annual quantity of timber to be removed or the other operations to be carried out in the forests.

During the year 1912, Mr. M. Velu Pillai prepared a Working Plan for the reserved forests of Malayattur Division. In the Working Plan a more scientific approach was made in the management of the forests. Under selection felling working circle three felling series were prescribed. The felling operations were intended to improve the capital value of the forests. Apart from this, various prescriptions for the regeneration of selected species by sowing of seeds in limited areas after felling, extension of teak plantations, restocking of open areas abandoned by hill-men, elephant capturing, construction and maintenance of buildings and roads, maintenance of records, etc. were suggested. Miscellaneous prescriptions consisted of the proposals for the extraction of bamboo, rattan, collection of NTFP, etc.

The period of Mr. M. Velu Pillai's Working Plan was till 1933, but the felling, selecting the easily accessible areas, continued till the year 1945.The prescriptions in the management scheme for teak plantations, prepared by Mr. M.P. Jacob and approved by the Government in the year 1928 were also followed in the Division.

In the meanwhile, during 1938-39, Mr. M.P. Jacob prepared a working scheme for the smaller Reserve of Thodupuzha Range. Sri. T.P. Viswanathan prepared a Working Plan for the Muvattupuzha part of Malayattur Division for the period from 1951-52 to 1966-67. The areas covered by both the above plans do not come under the jurisdiction of the present Malayattur Division and hence are not discussed in detail.

Sri. N. Sreedharan Pillai prepared a Working Plan for the Malayattur portion of old Malayattur Division for a period from 1947-48 to 1961-62. Most of the portions covered in the plan are still within the jurisdiction of the present Malayattur Forest Division. Seven Working Circles were prescribed in the plan, namely:

1. The Coppice Working Circle.
2. The Selection Working Circle.
3. The Conversion Working Circle.
4. The plantation Working Circle.
5. The Bamboo and Reed Working Circle.
6. The Minor Forest Working Circle.
7. The protection Working Circle.

The primary objective was the exploitation of semi-evergreen and deciduous forests to assure sustained supply of fuel wood to the Fertilizer factory, (FACT) at Alwaye. Maintenance and extension of plantations, improvement of the capital value of forests, soil and water conservation, etc, were also aimed at. Most of the areas in the present Kalady and Kodanad Ranges were worked under either of the three Working Circles, namely, the Coppice Working Circle, the Conversion Working Circle, or the Plantation Working Circle, during the plan period. Kottapara Reserve Forest worked under the Coppice Working Circle was subsequently converted into Eucalyptus plantations. The Selection Working Circle was confined to Malayattur Reserve only.

After the expiry of the period of the above Working Plan, there was no working plan for the period till 1973. In the meanwhile a separate Industrial Plantation Circle was formed to raise large-scale plantations of industrial importance. The entire Kottapara Reserve was planted with Eucalyptus. Major portion of Thundathil Range was converted into teak plantations.

The period of Sri. Kurian Akkara's Working Plan was from 1974-75 to 1984-85. In his Working Plan eight Working Circles were provided. Selection felling was not taken up since no area was available. Government stopped clear felling during 1983 and subsequently selection felling during 1987.

Animal Rehabilitation Centre and Picnic spot

The Elephant kraal attracts many tourists to Kodanad. A picnic spot was started in the same locality during 1980 to improve the facilities to the tourists. A mini zoo was also started just adjacent to this, during the same year.

As per G.O. (RT) 272/93 dated 20/5/1993 the Mini Zoo was declared as Wildlife Center at Kodanad. This is being maintained and gradually developed into a place for nature education and rehabilitation centre for keeping the disabled and confiscated wild animals.

Sri. M. Ramachandran's Working Plan (1985 - 95)

Shri M.Ramachandran, Assistant Conservator of Forests, wrote the first Working Plan for the reorganised Malayattur Forest Division for the period from 1985-86 to 1994-95, the prescriptions of which were accepted and followed by the Department even though formal approval by the Government was not received due to some administrative reasons. The Working Plan written by Shri. M. Ramachandran proposed five Working Circles as follows.

1. Plantation Working Circle
2. Bamboo, Reed and Rattan Working Circle
3. Minor Forest Produce Working Circle
4. Tribal welfare Working Circle
5. Protection Working Circle

Miscellaneous prescriptions for wildlife management, fire protection, infrastructure, social forestry etc. were provided.

Kerala Forestry Project (KFP)

Operations were carried out in the degraded areas, both in the Natural forests and Plantations to recoupe the areas to its original status. Based on the status of natural

regeneration, crown density, occurrence of gaps, intensity of weeds, human interference, soil conditions and stage of succession, the areas were treated under either Assisted Natural Regeneration (ANR), or Restoration of Degraded Forests – I (RDF – I), or Restoration of Degraded Forests – II (RDF – II), or Restoration of Reeds, Bamboos and Canes (RRB) or under Improved productivity of pulp wood plantations. The operations carried in such areas were mainly clearing weed growth, planting, climber cutting, soil working, soil and moisture conservation operations and fire protection.

In letter NO.8-118/86-FC dt.31st January 1995 Government of India gave approval under section 2 of the Forest (Conservation) Act 1980 to divert and assign 28588.59 ha of forest land encroached prior to 1/1/1977 as per the conditions contained in the letter No.8-118/86-FC dt. 23rd March 1993. One of the conditions for the assignment of the said land was," The State Government shall give firm commitment that funds for the compensatory afforestation over double the degraded forestland shall be provided to the forest department as per the phased compensatory afforestation scheme. The compensatory afforestation shall be done with in a period not exceeding five years."

3.2 Present practices

Other land use – Villages, Agriculture, Developmental programmes, and Tourism

The tourist spots are frequently visited by thousands of tourists through out the year. As elsewhere in the State Malayattur Forest Division is having many locations, which can be developed into very good tourist attractions. Elephant kraal and the picnic spot at Kodanad, Idamalayar and Bhoothathankettu reservoirs, Vempooram Island near Kodanad etc. are some of such locations. There is very good scope for adventure tourism like mountaineering, water skating etc. within the jurisdiction of this Division. As already mentioned the main object of eco- tourism should be to make the people aware of the significance of the conservation of our valuable forests and its bio diversity.

Animal Rescue Centre

A picnic spot on the bank of Periyar River and a Mini Zoo adjacent to the forest colony at Kodanad, were started during 1980 by Sri. M.K. Divakaran Nair, the then Divisional Forest Officer. As per G.O. (RT) 272/93 dated 20/5/1993 the mini zoo was declared as Wildlife Center, Kodanad and subsequently renamed as Wild Animal Rescue Centre (A.R.C). From that time onwards the A.R.C is being maintained and gradually developed into a place for nature education and tourism. It became a place for keeping the disabled and confiscated wild animals also. The picnic spot and the A.R.C are visited by people from far and near. For visitors, elephant riding also is arranged. Entrance into the mini zoo is allowed through permits. Details of revenue and expenditure realized for last three years are given in Table 3.1

Table 3.1 Revenue and Expenditure from animal rehabilitation centre

Sl. No.	Year	Revenue (Rs.)	Expenditure (Rs.)
1	1997-'98	58,052.00	16,20,791.00
2	1998-'99	55,722.00	16,08,900.00
3	1999-2000	52,945.00	4,45,866.00

Proposal for zoo at Kaprikkad

The present area occupied by the A.R.C is not at all sufficient to accommodate the animals available at present. There is a proposal to start a zoo at Kaprikkad and an area of about 13 ha has been selected for shifting the animals. The work may be completed and the animals shifted at the earliest. This will provide better facilities to the animals and will increase the number of tourists visiting the zoo.

Research, Monitoring and Wildlife health

There are only few studies on Malayattur forests in the past conducted by various research institutions and NGOs. One of the significant studies is the long term environmental and ecological studies of Pooyamkutty hydroelectric project in the Western Ghats of Kerala- Preconstruction stage analysis by Balasubramanyan *et al.,* (1989). In this study information on soil, wildlife, vegetation, floristic, human impacts and ecological parameters were conducted by a team of experts from Kerala Forest Research Institute. Ajithkumar *et al.,* (2001) studied the fish diversity of Pooyamkutty River. Ramesh *et al.,* (2007) studied the physical and bioclimatic features, richness of

vertebrates, spatial features of selected large mammals and resource dependency of tribal communities in Malayattur forests. There is a big gap in the knowledge of the biodiversity resources of this forest reserve, especially lower groups of plants. No systematic studies were carried about Lichens, algae, liverworts and mosses. There is no detailed information with regard to soil microflora, aquatic micro organisms, arthropods, mollusks and wild animal parasites.

Similarly the information about the productivity of various habitats is lacking. Detailed data on the extent of human pressure on the forest is also not available. At present, there is no institutional arrangement to monitor the wildlife health in Malayattur Forest Division.

3.3 Administration and organization

The Division is headed by a Divisional Forest Officer. The Division is further sub divided into basic units - Forest Ranges manned by Forest Rangers and each Range is further sub divided into Stations, Sections, and Beats manned by Deputy Rangers, Foresters and Guards. There are five Ranges, Kodanad, Kalady, Idamalayar, Thundathil and Kuttampuzha Ranges in the Division and the pattern of present staff position are shown in Table 3.2 and 3.3.

Table 3.2 Staff position in Malayattur Forest Division

Name of post	Sanctioned strength	Present strength
Deputy Conservator of Forest	1	1
Asst. Dy. Conservator of Forest	1	0
Administrative Assistant	1	1
Junior Superintendent	2	2
U.D. Clerk	7	6
L.D. Clerk	7	6
L.D. Typist	2	2
Surveyor- (II Grade)	1	1
Draft man (II Grade)	1	1
U.D. Compiler	1	1
Peon	5	5
Survey lascar	2	1
Driver (II Grade)	1	1
P.T. Sweeper	1	1

Table No. 3.3 Details of staff strength in Ranges

Name of Post	Kalady		Kodanad		Thundathil		Kuttampuzha		Edamalayar	
	SS	PS	SS	PS	SS	PS	SS	PS	SS	PS
Range Officer	1	1	1	1	1	1	1	1	1	1
Dy. Ranger	3	3	3	3	4	4	4	2	3	3
Forester	9	8	10	10	12	11	12	12	12	11
Forest Guard	30	18	33	20	40	21	40	21	40	21
Head Accountant	1	--	--	--	--	--	--	--	--	--
U.D. Clerk	1	1	3	3	1	1	1	--	1	1
L.D. Clerk	2	2	--	--	1	1	1	1	1	1
Peons	1	1	1	1	1	1	1	1	1	1
Driver (Grade- II)	3	1	3	1	4	1	4	2	4	1
Mahout	--	--	12	4	--	--	--	--	--	--
P.T. Sweeper	1	1	1	1	1	1	1	1	1	1

SS – Sanctioned Strength *PS – Present Strength*

The Forest Department does not maintain any permanent labourers and utilise the services of hired labourers for both skilled and unskilled works from nearby villages of Malayattur, Kalady, Angamaly, Mangapara, *etc.* Preference is given to tribes; from near by tribal settlements. The works such as raising of nursery, planting, cultural operations and tending works such as weeding, climber-cutting, soil working, extraction of timber, poles firewood, fire-protection works and boundary consolidation works are carried out either departmentally by engaging local labourers.

CHAPTER 4: FUNCTIONAL SECTORS IN THE LANDSCAPE

4.1 Forestry (D*)

The plantations include all the plantations raised in the Division except those come under bamboo, reed and rattan. The total area of the plantations is 9253.9 ha. Pure teak plantations have been raised over an area of 5588.59 ha. Out of an area of 2611.08 ha where a mixture of teak and softwood plantations have been raised under softwood series an area of 2332.71 ha is added to the pure teak plantations except an area of 278.37 ha where teak is absent. In these plantations, the percentage of softwood species is very low. The growth of the available trees is not appreciable, except those standing in the margins. A sizeable area of eucalypts plantations was handed over to the Hindustan Newsprint Limited for raising captive plantations. Area under other species is small. Therefore, all the plantations raised and maintained in the Division are dealt together under the Plantation Working Circle. The bamboo and reed plantations are included under a separate Working Circle. Range wise details of plantations under each species are given in Table 4.1. The details of reed and bamboo supplied to different agencies during the period of 2008-2009 are provided in Table.4.2

Table No. 4.1 Distribution of area of each plantation in the Division

Sl. No.	Species	Range	Area (ha)
1.	Teak	Kalady	1163.27
		Kodanad	1796.35
		Thundathil	2501.35
		Kuttampuzha	127.62
Sub Total			**5588.59**
2.	Soft wood with Teak. (Teak and Elavu mixture)	Kalady	174.97
		Kodanad	115.98
		Thundathil	1491.77
		Kuttampuzha	549.99
Sub Total			**2332.71**
3	Cashew	Kalady	261.60
Sub Total			**261.60**
4	Mahogony	Kalady	21.00
Sub Total			**21.00**
5	Pulp wood (Eucalyptus and Acacia spp.)	Kodanad	270.03

Sub Total			**270.03**
6	Cocoa-Pepper (Vanalakshmi)	Kalady	5.00
Sub Total			**5.00**
7	Matty	Thundathil	5.00
Sub Total			**5.00**
8	Rose wood	Kuttampuzha	10.00
Sub Total			**10.00**
9	Grevillea	Thundathil	36.41
Sub Total			**36.41**
10	Medicinal plantation	Thundathil	4.85
		Kalady	1.00
Sub Total			**5.85**
11	Soft wood series where Teak is absent	Kodanad	244.68
		Thundathil	33.69
Sub Total			**278.37**
Grand Total			**8814.56**
H.M.S. augmentation with cashew in open areas of 1956 cashew			
1	Cashew	Kalady	33.88
Total			**33.88**
Pepper plantation under planted in Teak & Elavu			
2	Pepper	Thundathil	72.54
Total			**72.54**

Table 4.2 The details of reed and Bamboo supplied to different agencies during the period of 2008-2009.

Agency	Reed		Bamboo
	Nos.	M.T	M.T
M/s. Hindusthan News Print Ltd. Vellur	5523696	7671.8	4737.1
Kerala State Bamboo Co-orperation Limited. Angamaly	1121760	1558	
Total	**6645456**	**9229.8**	**4737.1**

4.2 Agriculture (D)

Agiculture is practiced only in some of the tribal settlements and certain non tribals living in enclosures within the Malayattur Forest Division. It is mainly of the home steads agroforestry type and does not cause any damage to the forests. These agroforestry systems also attract wildlife and cause human and material loss.

4.3 Integrated development (Eco-development and Development through District administration (D)

Panchayath has a housing scheme in the Division. Kerala State Electricity Board, Tribal department and Health department have various projects in the Division.

4.4 Tourism (D)

As mentioned earlier, the elephant kraal and the picnic spot at Kodanad, Idamalayar and Bhoothathankettu reservoirs (Plate 5), Vempooram Island near Kodanad etc. are some of the tourist locations (These are outside the HVBA).

4.5 Fisheries (D)

Fishing is done in a small scale by the tribals. Fish cultivation is practiced in Idamalayar reservior by the private agencies.

4.6 Tea/Coffee Estates (I **)

There are no Tea/Coffee Estates in Malayattur HVBA

4.7 Road/ Rail transport (D)

Road : Expansion of traffic and improvement of the old Alwaye – Munnar road passing through the Pooyamkutty (Kuttampuzha range) and included in the HVBA can harm the integrity and continuity of the forests, wildlife movements and the biodiversity in the area. Strict regulation on traffic has to be enforced by;

1. Installing checkposts and regulating odd hour traffic
2. Installing road signs and boards to alert drivers regarding animal movement, non-littering of the hazards
3. Not widening the road and maintaining it as metalled.

4.8 Industry (D)

There are no industrial activities in Malayattur HVBA

4.9 Mining (D)

There are no mining activities in Malayattur HVBA

4.10 Thermal power plants (I)

There is no thermal power plant in Malayattur HVBA

4.11 Irrigation projects (D)

There is a barrage at Boothathankettu (outside HVBA) for irrigating through Periyar valley irrigation project and the major water source is Pooyamkutty and Idamalayar rivers flowing through the HVBA.

4.12 Temple tourism (D)

In Kalady range a place called Malayattur is an important Pilgrim centre where a Nature Study Centre exists. This area is outside the designated HVBA where there is no temple tourism.

4.13 Communication projects (D)

One watch Tower is being constructed and other than this there is no communication project in Malayattur HVBA.

** D : Affects wildlife directly*

***I : Affects wildlife incidentally*

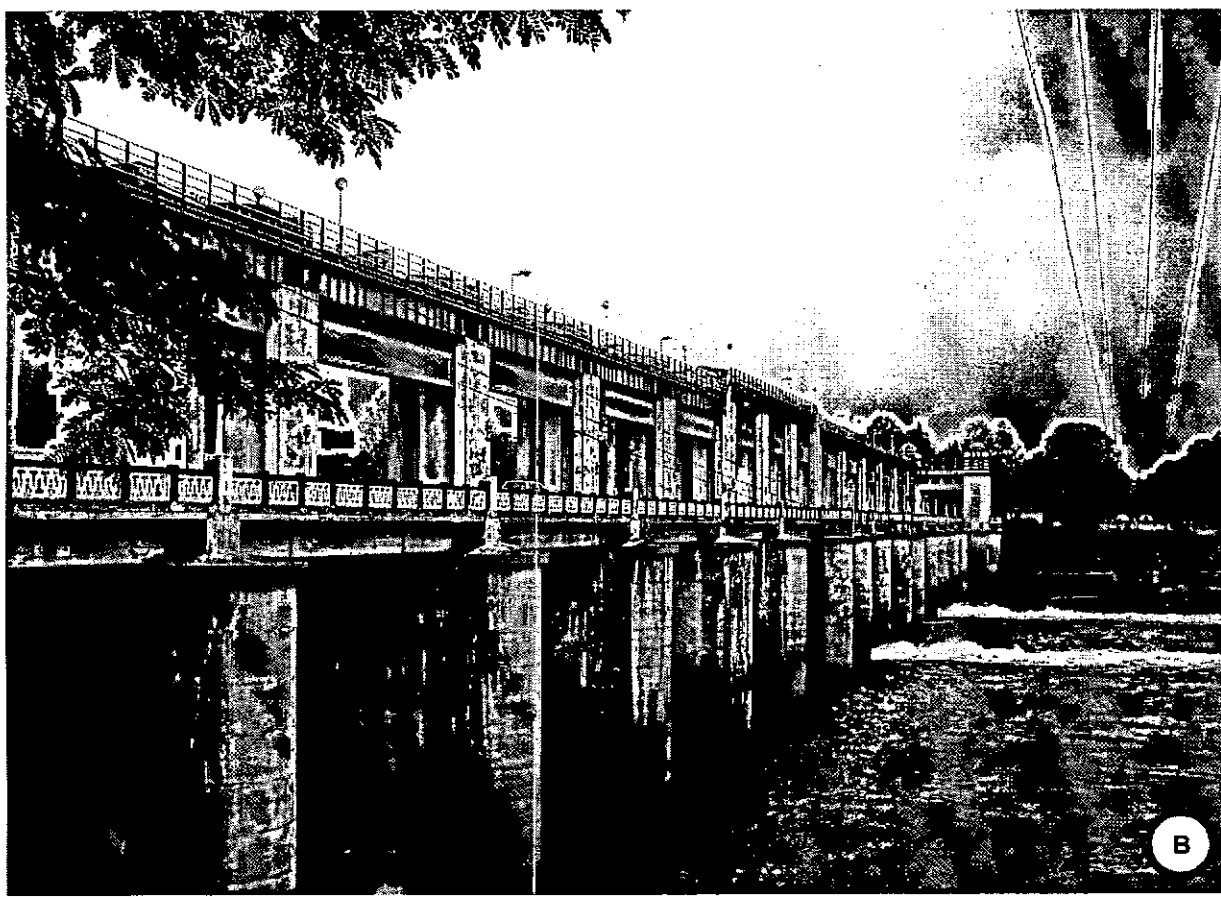


Plate 5. A. Teak Plantations B. Bhoothathankettu reservoir

CHAPTER 5: LAND USE PATTERNS AND CONSERVATION MANAGEMENT ISSUES

5.1 Land use Classification in Malayattur HVBA

The total extent of the forest coming under the Division is 61,776.59 ha which includes 9253.900 ha of plantations, 1081.600 ha area given to HNL for raising captive plantations, 266.57 ha handed over to Nature Study Centre, Kalady and an area of 4609.1434 ha as lease. The details of land use pattern in Malayattur HVBA (Map 5) (area coming under Idamalayar and Kuttampuzha ranges) is provided in Table 5.1.

Table 5.1.The details of land use pattern in Malayattur HVBA

Sl. No	Vegetation	Area (km^2)
1	Medium Elevation Evergreen Dense	28.008
2	Medium Elevation Evergreen Disturbed	5.765
3	Medium Elevation Evergreen Highly Disturbed	2.415
4	Low Elevation Evergreen Dense	12.71
5	Low Elevation Evergreen Disturbed	31.4
6	Low Elevation Evergreen Highly Disturbed	4.1
7	Medium Elevation Semi-evergreen	9.9054
8	Low Elevation Semi-evergreen	27.204
9	Evergreen mixed with reed	106.56
10	Moist Deciduous	2.93
11	Moist Deciduous Bamboo	11.102
12	Moist Deciduous Woodland	18.017
13	Bamboo	6.09
14	Reed/Bamboo	9.858
15	Teak plantations	6.726
16	Thickets	14.376
17	Grassland /rock	8.518
18	Home gardens and settlements	17.21
19	Rubber	0.3468
20	Water body	48

Out of the 371.24 km^2 area, 36.188 km^2 represents medium elevation evergreen, 48.21 km^2 low elevation evergreen forests. About 106.56 km^2 is occupied by evergreen type

mixed with reed. Nearly an area of 80 km^2 represents dense forests in Malayattur HVBA.

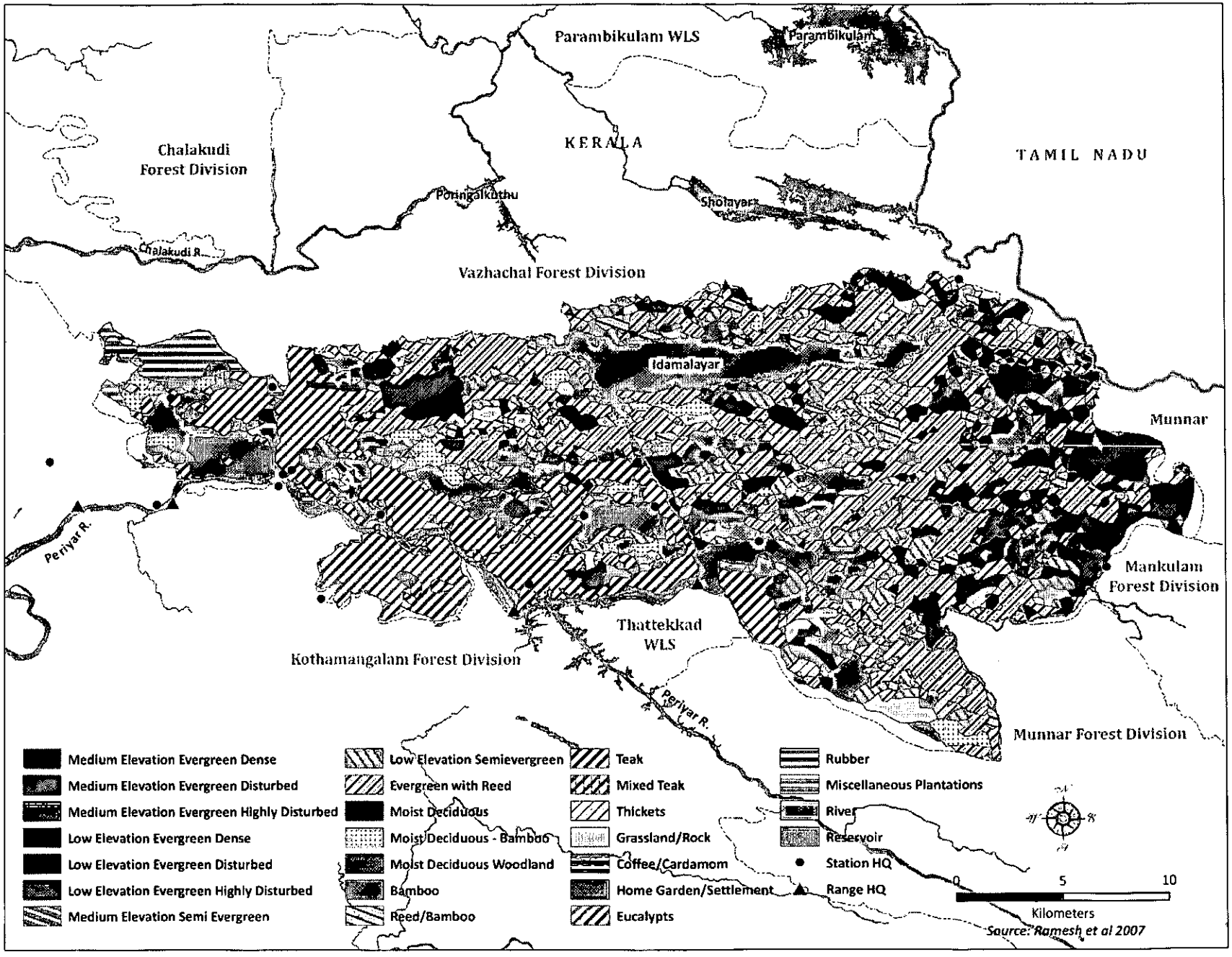
5.2. Socio economic Profile of Villages

There are 13 tribal settlements in Malayattur Forest Division (Table 5.2). Ten settlements belong to the tribal group "Muthuvan", two to "Malayar" and one to Mannan. One Arayan settlement is found adjacent to Muthuvan at Uriyampetty kudy in Kuttampuzha Range. All are dependant on forests and members of Vana Samrakshana Samithis (VSS). Collection and marketing of Non Timber Forest Products is the main source of income and NTFP is sold through Girijan Society.

Table 5.2 Tribal Settlements in Malayattur Forest Division

Sl. No.	Range	Colony	Area (ha.)	Sect	Family	Population
1	Thundathil	Pongumchuvadu	73.57	Malayar	63	282
2	Thundathil	Thalumkandom	29.79	Malayar	26	103
3	Kuttampuzha	Therakudy	48.00	Muthuvan	17	82
4	Idamalayar	Adichilthotty kudy	15.00	Muthuvan	52	221
5	Kuttampuzha	Arakappu kudy	12.00	Muthuvan	24	104
6	Kuttampuzha	Kunjipara	35.00	Muthuvan	53	239
7	Kuttampuzha	Koodalar	25.00	Mannan + Muthuvan	11	48
8	Kuttampuzha	Uriyampetty kudy	45.00	Muthuvan + Arayan	32 + 34	200
9	Kuttampuzha	Variyam Muduvankudy	35.00	Muthuvan + Mannan	106	395
10	Kuttampuzha	Vellaramkuthu	26.00	Muthuvan	122	422
11	Kuttampuzha	Thalavachapara kudy	20.00	Muthuvan	44	186
12	Kuttampuzha	Mettanapara (Enippara)	30.00	Muthuvan	69	286
13	Kuttampuzha	Vettivettakadu	10.00	Muthuvan	6	26
Total			**404.36**		**659**	**2594**

Amruth and Gurukkal (2007) conducted the detailed inventory of socio economic status of various tribal settlements in Malayattur Division. The ethnographic sources of early twentieth century describe the *Muthuvan* population subsisting on the slash and burn cultivation of the *Finger millet* and other millets on the steep upper slopes in the forest



Map 5 Malayattur Forest Division - Landuse

areas. Later they took to the hill paddy cultivation in concert with *Mannan* and settled down in the lower altitudes. The shifting cultivation accounts for their migration from place to place after due intervals. *Muthuvan* are enterprising cultivators and their hamlets are located in inaccessible and interior forest areas. The community in general possesses large holdings compared to those of the *Kadar*, *Malasar* and *Malamalasar*.

Average size of landholding is 0.48 ha. The officially allotted land area per family for cultivation is only about 0.5 to 1.5 ha, but they usually cultivate more area than actually allotted to them. Crops cultivated vary from hamlet to hamlet depending on the local climate and the proximity to marke. Usually the cultivation is a mix of edible and cash crops. Edible components vary from varieties of finger millet, corn, hill paddy to tuber crops such as yams. Cash crops such as pepper, areca, cardamom, lemon grass and rubber are being cultivated. Cultivation is mostly a family enterprise.

Apart from the agriculture wage labour, the reed harvesting especially for Kerala State Bamboo Corporation (KSBC) and Hindustan Newsprints Limited (HNL), forms a supplementary income earning activity. Inter household labour exchange for cultivation exists assuming the status of wage labour. Another income earning activity is collection of NTFP. The items preferred are honey, dammar, and wild nutmeg. The choice of NTFP is also influenced by their availability. Locations of habitations of the *Muthuvan* community are relatively wet areas with evergreen or semi- evergreen forests and the reed brakes. The *Muthuvan* cultivate cardamom as undergrowth in the evergreen forests adjacent to their hamlets. The extent of such cultivation used to be larger, but now reduced in extent and intensity due to the restrictions imposed by the Forest Department. Cardamom and other cash crops are sold through intermediaries, who or their agents, visit the hamlet and purchase the produce by levying an amount towards transportation charges. Though modern amenities such as television and radio come to the aid of the *Muthuvan* while arriving at the market rates of their products, they fail to resist the under valuation of their products in the absence of a competitive market. Similarly, majority of the NTFP collected by the *Muthuvan* also are sold through these exploitative intermediaries. Although bank accounts are opened for receiving the financial assistance, these are hardly operated as an instrument of saving.

The *Muthuvan* also form labour force of the Forest Department during seasonal forestry operations such as fire protection and thinning in plantations. The system of slash and burn
cultivation prevalent during the early half of 20th century was progressively restrained for longer period by the Land Revenue Department and the Forest Department during the colonial and post-colonial periods through a series of measures.
Educational facilities are not easily accessible to the *adivasi* people, for hamlets are far away from the schools and hostels run for them. However, a large proportion of the *Muthuva* children receive primary education though the number of dropouts is high. As part of the *Sarva Siksha Abhiyan* programme (SSA-Universal Education Programme), multilevel, single teacher, schools have been opened at most of the settlements in the division. In Wariam colony there is a school and generally children of the Mannan tribe attend school more than Muthuvans.

Various agencies such as, Village Panchayaths, Forest Department and Tribal Development Departments have been providing housing facilities. Very often, these housing schemes are inadequate for their requirements. Traditional house of the *Muthuvan* is made of bamboo, small poles, reed and mud. A large portion of the annual savings is spent on tobacco and towards the expenses made at the time of festivals and pilgrimage to Palani and Sabarimala. Rice has taken over as the staple diet in the place of millets and other cereals.

There are five small settlements belonging to *Mannan* area, these are Arekkappu, Pettivara, Gopalankuti (Variyam), Chembumkandam (Variyam) and Koodallarkuty. There are 504 individuals in 118 households. Like *Muthuvan, Mannan* also have legends of their
migration from the Tamil Nadu plains centuries back. Compared to other *adivasis* they are more organised under their chieftains called *Rajamannan*. Shifting cultivation was the main vocation of the *Mannan* prior to their sedentarization. In general, they have larger land holdings generally put to intensive cultivation of cash and food crops. Now most of the *Mannan* hamlets have the agroforestry oriented home-garden system influenced by the shifts in market prices of agricultural commodities. The *Mannan*

settlements are located mostly in the reed growing areas. Income from agriculture is supplemented by the seasonal labour from reed working. Collection and marketing of selected items of NTFPs especially honey and dammar supplement income seasonally. They are more inclined to sell their produce from agriculture and forests to the private merchants who advance money. Wherever the educational facilities are accessible, children are sent to school. Housing conditions are better compared to the other tribal communities. Most of the households in the landscape have solar powered lamps and some of the households have televisions.

The Malayarayan settlement is located in Uriyampetty-Thumbimedu where hamlet premise is shared with Muthuvan. The Malayarayan are enterprising agriculturists and are capable of appropriating aids and subsidies provided to scheduled tribes by the Government agencies. Naturally they have always been successful in acquiring land from all possible sources. They are more competitive in interacting with the settlers and in the process of they acquired better access to education and other benefits than all other adivasi populations. Households with relatively larger holdings cultivate a mix of cash and food crops. Households with smaller holdings generate income from NWFP and wage labour. Access to market in terms of availability of transportation facilities helps them obtain better margin on their agricultural products.

5.3 Resource Dependence of Villages

The Tribal settlements in Malayattur Forest Division are to an extent dependent on various resources from the forest for livelihood. They use forest for shelter, building houses, fetching water, fuel wood and at times gather food (yams, tubers, fruits, seeds). They use plants as medicines. To an extent NTFP collection and sale support their livelihood. VSS provides employment to the tribal population. More details are provided in the earlier section.

5.4 Human - Wildlife Conflicts

Human-wildlife conflict (HWC) is fast becoming a critical threat to the survival of many globally endangered species, in particular to large and rare mammals. The case studies from countries all over the world demonstrate the severity of the conflict and

suggest that greater in depth analysis of the conflict is needed in order to avoid overlooking the problem and undermining the conservation of threatened and endangered species. A set of global trends has contributed to the escalation of HWC worldwide. These can be grouped into human population growth, land use transformation, species habitat loss, degradation and fragmentation, growing interest in ecotourism and increasing access to nature reserves, increasing livestock populations and competitive exclusion of wild herbivores, abundance and distribution of wild prey, increasing wildlife population as a result of conservation programmes, climatic factors and stochastic events. Wildlife is an integral part of forest ecosystem. The damage by the wildlife can be ignored in natural forests. However animals like porcupine, wild boar, rodents, deer and elephants are known to cause damage in plantations.

A number of instances of Human wildlife conflicts were reported from various Ranges of the Division. Agricultural crops are damaged by wild boar, pigs, deer and elephants. Elephants attacking human beings are common in recent days. Compensation are being given to the concerned parties by the department. Conflict is largely confined to Arrekkap colony, Kappayam, Illithodu, Vellarumkuthu colony and Vadattupara. Details of various human- wildlife conflicts and compensation paid for the period from 2005 to 2009 are given in Tables 5.3 and 5.4.

Table 5.3 Details of wildlife attack during the period 2006 - 2008

Nature of HWC	2006-07	2007-08	Total
Human injury	3	8	11

Table 5.4 Compensation details of crop damage due to wild animals.

Sl. No	Year	Amount (Rs)	Conflict areas
1	2004-2005	10,000	Varium, Pinavoor Kudy, Urulanthanni
2	2005-2006	35,420	Vellarumkuthu, Varium, Illithode, Vadattupara, Koovappara, Kuttiyamchal
3	2006-2007	45,650	Pooyamkutty, Koovappara, Kappayam,

			Moolamkuzhy, Mamalakkandam, Vadattupara
4	2007-2008	57,799	Vadattupara- Chakkimedu, Varapetty, Iringole, Vettampara, Panamkuzhy, Illithode, Vellarumkuthu, Adichilthotti-Muthuvankudy.
5	2008-2009	27,250	Vettampara, Ponginchuvadu colony, Vettampara, Varium.
6	2009-2010	96,687	Variyum, Kandathikuzhy, Manikyamangalam, Ponginchuvadu Colony

5.5 Assessments of Inputs of Line agencies / Other Departments

The inputs of various line agencies are minimal in the High Value Biodiversity area in Malayattur Forests. In Kuttampuzha, there is a Girijan Service Co operative Society Ltd 157 and Ponganchuvadu Schduled Tribal Co-operative Society No. E 852 at Kodanad, Thundathil and Thalakkulam are tribal Co-operative Societies permitted for the collection of NTFPs. As such the Forest Department Provides maximum support to the inhabitants of HVBA.

5.6 Stakeholder support

The key stakeholders in the Division are:

1. Local communities
2. Government agencies especially Forest Department
3. Local self government and PFM Institutions
4. Academic & Research Institutions
5. Tourists and NGOs etc.

The forest management activities affect these stakeholders. Hence all of them are closely linked to forest management and their support is required for conservation needs.

5.7 Protection and Management issues

There are several threats to conservation and management of Malayattur Forest Division viz., cattle grazing, poaching, ganja cultivation, tree felling, sand mining, illicit distillation, firewood collection, illegal collection of NTFP, collection of poles etc. There is a lack of enough staff, transportation facilities and fire arms. The area to be protected is very large and one person cannot cover all the areas allotted to him in the stipulated time. New trek paths are needed. Only one vehicle and one pistol are allotted to one range. Among the measures to overcome these constraints are participative strategies, scientific inputs, technical devises and trained human resource.

Work Environment

A traditional and time tested work environment as in the past exists in the Division. Most approaches are bureaucratic and formal. There is no appreciation for innovative and community oriented programmes. The capacity building of human resources is not in the agenda. Staff are fatigued, disoriented and impulsive.

5.7.2 Human Resource Development (HRD) Plan

HRD plan should include the training needs as well as amenities to staff. Training is needed for officials, frontline staff as well as VSS members. HRD plan should include the training needs as well as the staff amenities to be provided. Training is needed for officials, frontline staff as well as VSS members. On the job training, short term training, specialised trainings etc., can be planned depending on the need. The short term on job training such as computer application especially office packages, statistical data analyses, collection of biological material and interpretation, weapon training, tourism and interpretation can be planned using senior police officers, NGOs, lawyers, senior veterinary surgeons, faculty from KAU, WTI, WII, KFRI and WTI etc. as resource persons. The various subjects of training can be protection (use of arms, unarmed combat, legal issues etc.,), census, monitoring, ecodevelopment, ecotourism, habitat management, wildlife health, GIS etc., Amenities may include provision of ration to interior camps, taking care of the residential, educational and medical needs of staff and their families. Incentives/ awards should also be a part of the HRD plan. Provision of gears such as shoes, ruck sack, sleeping bags, rain coats and medicine kit

should also be planned. Such amenities are not sufficient at present and the same trend needs to be maintained.

Front line staffs have been given training in use of GPS, camera traps and collection of rainfall data. These trainings should be continued so as to train all the staff.

- The various subjects of training can be protection (use of arms, unarmed combat, legal issues etc.,), census, monitoring, eco-development, ecotourism, pilgrimage management, habitat management, wildlife health, GIS etc.,
- The training for GPS, biodiversity valuation and biological materials collection should be conducted for Foresters and forest guards at KFRI.
- For legal issues training & workshops should be conducted with Public Prosecutors as resource persons

Training needs assessment.

Training needs of the staff as well as the stakeholders, VSSs etc., needs to be assessed through Training needs assessment workshop. Anticipating inclusions in the curriculum the following themes are suggested:

1. Training on legal issues.
2. Training on survey and demarcations.
3. Training on use of equipments like weapons, GPS.
4. Training on Biodiversity valuation.
5. Training on biological materials collection.
6. Eco-development training
7. Training in Ecotourism
8. Personality development.

5.7.3 Professionalism –Systems and Protocols

Genuine success in work and life means more than being in a comfortable position to support yourself and your family, looking forward everyday to go to work, earning the respect of all including family, friends, colleagues and other stake holders in business, utilising one's powers and skills towards the betterment and growth of self and others.

All these are possible only when we are having professionalism at work. To achieve the success in a career in forestry the following are important:

1. Free and fair work environment
2. Access to basic facilities for self and family
3. Academically and physically well trained
4. Presence of awards and honors.

5.7.4. Research priorities, Main projects

Although various research projects were carried out in the forest areas of Malayattur, most of them were at the macro level and not of applied nature. Species level research for endangered and rare species is also scanty. Research priorities should be identified based on the threats identified for the area and the methodology should be based on landscape management approaches.

Priorities of research must be intended to achieve following objectives.

1. To promote research and monitoring programmes in order to ensure management decision based on sound scientific knowledge.
2. To enhance ecological and cultural integrity.
3. To find solution to threats to biodiversity.
4. To enhance public awareness and people's participation in conservation.

The levels of research priorities are the following

- *Landscape level priority* – diversity of habitats in the conservation zone, the vegetational change, and weed invasion, if any, within the different habitats need to be monitored.
- *Ecosystem level priority* - There is a need to document the ecosystem services provided by different zones. Attempts can also be made to assess the monetary value of these ecological goods and services. This will add value to the area and indirectly help in the conservation efforts. The major areas include the ecosystem productivity, integrity, regeneration status, wild life and ecosystem relations, weeds on ecosystem, its impacts, changes in the ecosystems with respect to population of flora and fauna etc..

- *Species level priority* – Research on rare and endangered species as well as endemic plant species, mammals (Lion- tailed Macaque, Nilgiri langur and Nilgiri tahr), fishes, Reptiles, birds, butterflies and insects need to be done. For flowering plants, phenology, natural regeneration factors, population size estimation are important. The habitat, group size, distribution of LTM, population size, specific niches and nesting patterns of horn bills, habitat suitability, the movement pathway for elephant and tiger also have high priorities.
  - Human dimension – the major priority includes
  - Settlements and private estates and their impact on wildlife
  - Levels of participation of VSS in conservation
  - Sustainability of VSSs
  - Conservation awareness level of local people
  - Livelihood options for local people
- The ecology and habitat of fishes, amphibians, and insects need to be studied and documented. The lower groups of plants like algae, fungi, lichens Ferns and mosses) and smaller animals (mollusks, helminthes and even the microbes) also need to be studied.
- Studies on population structure, mapping movements of elephants and leopards: The movement pattern of elephants needs to be studied to understand the corridors. Also, the male female ratio was earlier skewed (probably due to poaching). This ratio needs to be monitored.
- Human wildlife conflicts, Wild life health monitoring, mortality, natality, population density and population structure monitoring are also important.

Important research projects

- Land use and vegetation assessment
- Mapping and analysis of Biodiversity Hotspot areas
- Identification of threatened species and methods for conservation
- Mapping of fire prone, weed infested and degraded areas
- Determination of fire- weather index
- Forest and NTFP dependency of Tribes and fringe area people
- Human - Wildlife conflict assessment and methods for mitigation

- Value additions and marketing of NTFP
- Monitoring of avifauna with special reference to Hornbills
- Monitoring and mapping of elephant movement
- Assessment of fish biodiversity
- Assessment of wildlife health
- Studies on small carnivores including leopard
- Inventory of lower forms of fauna and flora
- Developing a GIS based management system.

Monitoring Framework

Monitoring and evaluation is a very important part of any management process as it is very essential to measure a management activity. It helps to evaluate the progress and success of the implementation of the plan and also helps to find out the shortcomings and make corrective alterations if necessary. Following activities will be taken up for extensive and intensive monitoring and regular up-dation (Table 5.5). The things to be monitored are

- Monitoring status of endangered and endemic species
- Monitoring the collection of NTFPs.
- Monitoring illegal hunting and poaching
- Monitoring of weed eradication.
- Monitoring of fire control measures.
- Monitoring of wildlife health and veterinary care.
- Monitoring of tourist activities in neighboring areas.
- Monitoring of watersheds.
- Monitoring of social welfare activities.
- Monitoring of key sites.
- Monitoring of forest offences.
- Monitoring of activities of eco-development activities
- Creation of library.

Table 5.5 Monitoring framework

No.	Things to be monitored	Methods	Who will monitor	When to be monitored
1.	Endangered and endemic species	Daily diaries	Forest Guards Project associates	During regular patrolling and field surveys
2	NTFP collection	Survey and enumeration	Range Officer in concerned Range of BCP	Monthly.
3	Vegetation	Permanent sampling plots, remote sensing, repeat photography.	Research Associate and Project associates	Once in a year.
4	Wild life health and veterinary care	Observational methods	Veterinary surgeon and Special team members	Monthly.
5	Watershed monitoring	Run off, siltation, etc.,	Special team needs to be set up. Some external assistance from Research Institutions can be sought.	Regularly. Some equipment can be set up.
6	Human – Wildlife conflicts	Reports from field staffs, office records	Field protection staff of respective areas	Monthly.
7	Ecodevelopment activities	Progress reports from field	DFO of concerned area.	Monthly.
8.	Fire prone areas, fire control, illegal hunting	Field visits	Special team members BCP	Monthly
9	Social welfare	Tribal hamlet meetings	Special team members BCP	Monthly
10	Lab and Library	Observational methods	Range Officer in concerned Range of BCP	Monthly

Wildlife Health Monitoring

International Wildlife Health Institute defines health as a condition of the environment that allows species to prosper within a complicated ecosystem (habitat) where sustainable biodiversity is the monitor of success. Therefore, disease is not the only

monitor of health of an ecosystem and may indeed be an integral part of a "healthy" ecosystem. The studies indicate that about 60 percent of the 1,415 infectious diseases, infecting both humans and animals are originated in animals. In many instances, the poachers that rely on wildlife for meat are vulnerable to pathogens from the forest. The diseases, which pass between wildlife and domestic animals are Avian Influenza (wildfowl, game birds and poultry), Foot and Mouth disease (cattle, pigs, sheep and deer), Swine Fever (pigs and wild boar) TB (deer, badgers and cattle). The main threats to the Wildlife Health are Climate change, Emerging diseases and environmental toxins.

The following strategies can be adopted for Wildlife health monitoring:

- **Establishment of a Veterinary laboratory**

  A veterinary lab is needed to be evolved to undertake parasitological studies with the consultation of College Veterinary Sciences and Veterinary Department.

- **Observational methods**

Monitoring the condition of animals:

The animal body responds to the changes in its habitat, which is governed by many interrelated component factors which are often seasonal in nature. Conditions of live animals can be assessed by looking at their appearance or body condition and condition of dead animals can be assessed by estimating the extent of fat deposition in the body (Milton, 1987).

The commonest method of monitoring the appearance of free living mammals is by body condition evaluation (BCE). BCE is generally expressed in the form of indices, referred here as Body Condition Index (BCI). BCE involves judging the physical condition of live animals, based on the visual estimation of the degree of protuberance (on the hip, chest, abdomen, back, head and tail) of bony processes on the body surfaces. In the field one can rate these body parts using a binocular or a spotting telescope. Value of BCI can be obtained by giving scores for different body parts. Records of BCI of different species can be maintained in a specific format (**Annexure VI**). The 'remarks' column status is for further classification of animals based on their physiological state (pregnancy, lactation) social status (dominant/ subordinate/territorial) and feeding behavior (crop-raider, man–eater).

BCE of ungulates: Riney (1960) described this method. The generalized description and evaluation of different body parts of ungulates is given in Table 5.6 the sum of scores (BCI) can range between 0 and 10. Smaller the BCI better will be the health condition of the animal. For all the practical purposes, ungulates with BCI of 0-4 can be considered 'good', 5-7 as 'fair' and those with 8-10 as poor.

Table 5.6 Generalized description and evaluation of different body parts of ungulates

Body part	Point= 0	Point=1	Point=2	Score
1. Flank area	Depression is barely visible Flank area outline is indistinct	Flank area slightly concave & outline visible	Depression concave & tucked in	
2. Ribs	Thoracic surface is smooth and ribs are difficult to see	Ribs are visible but not all can be counted with ease	Ribs prominent with distinct inter-costal depressions	
3. Pelvic girdle	Bony projections of pelvic girdle are barely visible	Pelvic girdle outline slightly visible	Bony projections of pelvic girdle are clearly visible	
4. Vertebral column	When seen laterally, it runs smooth without any breaks. Lumbar processes visible	Lateral processes or lumbar vertebrae are visible but not prominent	Lateral processes of lumbars very prominent. Dorsal processes of vertebrae seen	
5. Lumbar shelf	No depression in shelf. Appears almost round from behind	Slight depression on either side	Depression deep and concave	
Body Condition Index (BCI) =				
(Interpretation 0- 4= 'Good',5-7= 'Fair', 8-10= 'Poor'				

(Riney, 1960)

BCE of elephants: The description and evaluation of different body parts of Asian elephants is provided in the Table 5.7.

Table 5.7 Description and evaluation of different body parts of Asian elephants

BODY PART	Point= 0	Point=1	Point=2	Score
1.TEMPORAL DEPRESSION	Flat and frontal ridge vaguely defined	Slightly concave and frontal ridge defined	Deeply concave	
2. SCAPULA	Spinous process of the scapula not visible	Spinous process visible	-----	
3. RIBS	Thoracic barrel smooth and ribs barely visible	Ribs visible	Ribs clearly demarcated with pronounced intercostal depressions	
4. FLANK AREA	Flank are depression barely visible	Sunken flank area Depression visible	---------	
5. PELVIC GIRDLE	External angle of ilium not visible	Visible but not pronounced	External angle jutting and pronounced	
6. TAIL	Muscular, not bony	Joints of tail vertebrae seen	Thin & bony. Vertebrae can be easily counted	
7. LUMBAR SHELF	Shelf not present. Round when seen from the rear	Lumbar shelf appears flat and not round	Pronounced concave shelf on either side of the vertebral column	
Body Condition Index (BCI) =				
(Interpretation 0-4= 'Good',5-8= 'Fair', 9-12 = 'Poor')				

➢ **Laboratory based methods of monitoring**

1. Post mortem examination (Necropsy)

From an outbreak point of view, the information on the nature and magnitude of outbreak, evidence of similar out break among livestock, species affected, and mortality in different species, history of similar outbreaks, etc. are essential details to be gathered during a disease investigation operation. These particulars have been given in the outbreak history form (**Annexure VII**). Similarly gathering background information about the nature and probable cause of death is also an important part of the disease investigation procedure. The clinical

signs of the animal before death (can be gathered from those who had seen the animal during illness) and the surroundings of the dead animals should be thoroughly investigated for the presence of pug marks, hoof marks, presence or absence of faecal material around the animal, discharge of the body fluid etc. All these things form an important part of the post mortem report (**Annexure VIII**). The post mortem examination helps for the detection of gross lesions or abnormalities that may point to the presence of clinical or sub-clinical disease. The vast majority of 'new diseases' can be diagnosed initially by post mortem and by through examination with correct collection of samples. It is imperative to retain pathological materials so that they can be used for further studies. When dealing with the threatened species, the establishment of a reference collection that comprise fixed and frozen tissues, blood smears, sera, paraffin blocks, freeze-dried bacterial isolates is required. The Laboratory specimen form is shown in **Annexure XI**.

2. Faecal analyses of suspected animals

- Parasite screen - Faecal samples should be collected at least semiannually; direct, flotation, and sedimentation should be performed on every sample to detect intestinal parasitism.
- Enteric pathogen screen - Aerobic culture of feces for enteric pathogens should include special media for the detection of *Salmonella spp.*

3. Serological Surveys

Antibody detection by serological investigations is an efficient method of monitoring the prevalence of infectious diseases in a population. This procedure involves the restraint of animals, collection of blood and subjecting the sera for the presence / absence of antibodies against the diseases. A higher prevalence of antibodies against particular diseases for many years denotes that the disease is endemic to that population.

4. Macro-Parasitological investigations

Helminths and arthropods constitute the category of Macro-parasites. Many wild animals harbour a naturally high number of macro-parasites. Keeping the records of ecto- parasitological findings (ticks, flies, fleas and lice) can provide valuable information on host – parasite relationships such as arthropod species

composition and their relative abundance on different species of hosts. Recording details of ectoparasites can be done in the format given in the **Annexure IX**. Helmithic infections (Endoparasite) can be monitored either by recovering the parasite from the host or by identifying the parasite ova in the faeces. Screening faecal samples for the presence of eggs of helminths and oocytes of coccidian is one of the earliest methods of monitoring prevalence of helminthic infections. The post mortem examination helps to recover the endoparasites from Respiratory system, Liver and Gall bladder etc. (Ahluwalia, 1972). The recording details of endotoparasites can be done the format given in the **Appendix X**.

5. Screening for micro-parasites

Bacteria, viruses, blood protozoans, fungi and rickettsiae are referred as microparasites or microbes. Their prevalence can be to some extent known by isolation after postmortem investigations and a systematic screening of different biological materials. This helps of not only to understand their prevalence, but also of the existence of wildlife and domestic reservoirs of pathogens. These biological materials can be of any source. It can be faeces, blood, saliva, urine, body fluids or aborted fetus.

Faecal samples can not only be useful for detecting parasite ova of animals, but also many bacterial, viral, fungal and rickettsial organisms. To obtain a successful isolation, however, the samples have to be collected directly from the animal with strict aseptic precautions and preserved under recommended methods to avoid contamination by other organisms. Diseases like Johne's disease, *Salmonellosis*, *Ornithosis*, Q-fever, *Coronovirus* and Parvovirus infections can be diagnosed from freshly collected and appropriately preserved faecal samples. Apart from faeces, blood is another source of biological material for isolation and identification of organisms that cause *Viremia*, *Bacteremia* and *Parasitemia*. Although the collection of blood and preparation of blood smear from large mammals requires immobilization, this method of disease monitoring can be effortlessly practiced by collecting whole blood from frogs, reptiles, rodents, mongooses and many other species. In fact frogs and

small reptiles themselves can make important collection of live specimens for isolating many unknown, but possibly epidemiologically important, organisms.

- Maintenance of sanitation and hygiene at water levels
- Immunization programmes of domestic animals.
  - The immunization programmes have to be conducted to the domestic animals such as dogs, cats, ferrets and livestock should be vaccinated against rabies;
- Regular monitoring of bone marrow
- Health cards for all live stock from the concerned authorities.
- **Creation of awareness among the local peoples**

  Awareness Campaign among local people can be organized with the help of EDCs/ VSS committees about the communicable wildlife diseases and prevention measures.
- **Training of field staff**: the basic ideas of understanding the Wildlife health is an essential component of Wildlife health monitoring. The field staff may be trained about the diseases, symptoms, mode of dissemination etc. so that they will be able to report immediately and take preventive measures. Training workshops also should be organized in the area of wildlife health management, wildlife restraint techniques, wildlife damage control and field investigations of wildlife mortality events.
- **Maintenance of record of disease out break**

  The records on all incidences of diseases should be maintained for future reference.
- **Wildlife Rescue Centre**

  The existing Veterinary hospital should be upgraded to different rescue operations, treatment and release operations, health monitoring of wildlife, wildlife health research, laboratory, vaccination of domestic cattle etc. with the help of a veterinary surgeon.
- **Monitoring and evaluation**

  In recent history there are only few records, available for disease outbreak. It may be due to inadequate wild animal health monitoring. Lack of disease survey network may lead to negligence to some very infectious and dangerous

disease outbreak. For this, continuous wildlife health monitoring, treatment of sick animals, proper disease preventive work and research are required to be carried out by a team of dedicated experts.

- **Snail survey**

  Snails and slugs are host to an array of different nematode parasites. Several nematodes use snails and slugs as definitive hosts and many others use snails and slugs as intermediate hosts, including nematodes. Snail population could be monitored and controlled if found necessary to identify the larval stages.

Mortality Survey

The mortality of the wild life may be due to environmental stress, disease outbreak, poisoning or accidents. Heavy mortality rate for any species can change the survival possibility. The data on mortality is very important to know the population dynamics, disease outbreak etc., This will help us to make necessary change in management strategies if needed. This should be a regular phenomenon. Field staff should note down the mortality of wild animals if any, the species, reason etc., in their daily diaries and report it to the office. Information can be compiled at the range level and sent to the concerned DFO's office. Mortality survey can be done in following steps:

- Mortality register should be maintained at range level on daily basis for each and every type of mortality.
- Monthly compiled record at range level should be sent to Divisional Forest office.
- Separate record should be maintained for mortality other than that attributable to an offence and mortality attributed to poaching or an act of vandalism.
- Survey record can be maintained in prescribed form given in Sawarkar guide for "Planning Wildlife Management in Protected Areas and Managed Landscapes".
- All records should be analyzed at RO office monthly and report should be submitted to DFO.
- Mortality data should be collected by the field staff at block.
- All mortality information should be reported instantly to range office and if needed, specimen should be collected and sent for pathological investigation.

BIODIVERSITY CONSERVATION PLAN

FOR

MALAYATTUR HIGH VALUE BIODIVERSITY AREA

PART B: THE PROPOSED MANAGEMENT

CHAPTER 6: VISIONS, GOALS AND OBJECTIVES

6.1 Vision

Vision and objectives

The overall vision is "Conservation of rich biodiversity and forests with active participation of local communities for ecological security, livelihood for the forest dependents, and production of goods and services for meeting people's needs with the support of an effective/vibrant management system facilitated by a well structured and enabled forestry organization." The high biodiversity zones and natural forests in the Malayattur division should be protected under sound ecosystem management, to retain their natural character and biological diversity.

6.2 Management Goals

The main goals of proposed Biodiversity Conservation Plan for Malayattur HVBA are

- To locate areas of the high biodiversity value, improve the existing forest cover, and enhance their productive capacity for ecological security and environmental goods and services.

- To strengthen the conservation measures for maintaining rich biological diversity and gene pool with the active participation of local communities.

- To enhance the staff capacity of Malayattur HVBA to achieve the objectives of the Biodiversity Conservation Plan.

6.3 Management Objectives.

- To establish a separate wing under the DFO to plan and implement the programme.

- Identify critical habitats and utilise the information on the current distribution, and site-specific locations for conservation of selected flora and fauna.
- Monitor the known populations of RET species.
- Establish protocol for silvicultural practices, seed collection, and propagation and gradual replacement of degraded areas.
- Monitor the collection and continuous inventory of the medicinal plants, wild edible resources, NTFPs to determine sustainability.
- Develop and implement guidelines for preventing further significant infestations of noxious invasive plants.
- To protect the wildlife resource and ecological process and critical habitat area vital to the welfare of the wildlife and thereby maintain viable, healthy wildlife populations.
- Phasing out failed/poorly stocked plantations and converting them to natural forests.
- Identify and prevent the areas with accelerated soil erosion and mitigate ongoing soil erosion on problem sites.
- To prepare GIS based database for managing the biodiversity.
- Train the forest field staff on identification and management of wild and invasive species.
- Promote the sustainable management of Malayattur forest division by working with forest communities and to develop the capacity building of Vana Samarakshana Samithis (VSS), Panchayat and other groups having interface with forest as appropriate.
- To develop training opportunities to equip forest field staff and VSS about the forest resources and the conservation of biological diversity.
- Improve the existing infrastructure in the Division through establishment and maintenance of buildings, equipments, interpretation centre and staff quarters.

CHAPTER 7: MANAGEMENT STRATEGIES

Delineation of High Value Biodiversity Area and other Management Zones

Of the total extent of Malayattur Forest Division covering an area of 617.77 km^2, two ranges viz., Kuttampuzha and Idamalayar (371.24 km^2) and Idamalayar Station of Thundathil Range have been designated as HVBA for long term conservation. Within the HVBA, two zones (Conservation and Ecorestoration and Ecodevelopment) have been identified for the purpose of implementing the Biodiversity Conservation Plan (Map 6). The conservation zone (188 km^2) and ecorestoration and ecodevelopment zone (183.24 km^2) together constitute 371.24 km^2 which is 58% of the total area of Malayattur Forest Division.

1. **Conservation Zone** (188 km^2)

   Areas (Idamalayar and Kuttampuzha Ranges) in the conservation zone are to be managed primarily for conservation values and the activities that endanger these values will be avoided/ restricted. Only, NTFP collection on a sustainable basis will be permitted and extraction of reed will not be permitted. These are highly biodiversity-significant areas, important for intensive conservation. All these areas are important in terms of floral diversity, specific habitats of fauna and for the dispersal of animals towards south east and north direction.

2. **Ecorestoration and Ecodevelopment Zone** (183.24 km^2)

   It will include areas where degraded natural forests, plantations of poor stocking and human settlements (nine) are present.

Zone & theme approaches to management strategies

Zone plans

1. Conservation Zone

Details of the Area:

The natural forests in Idamalayar and Kuttampuzha ranges provide more or less continuous cover with three main types of forests viz., Evergreen, Semi-evergreen and Moist deciduous (pure and mixed with reed). These forests are very important as they are repositories of unique biodiversity (flora and fauna). Locations of High Biodiversity

Value viz., Pallikkallanmudi, Keerithodu, Palavanpadi, Kappayam, Thera, Edinjakuthu, Elavanchodu, Pattambli in Idamalayar Range and Anakkulam, Koonthrapuzha, Thottikkayam, Pothidukki, Chethikkandam, Uriyankatty, Vazhippara and Varunthalakkulam areas in Kuttampuzha Range are important conservation areas.

Objectives

- Assess the vegetation, identify RET species, protect and improve the biodiversity of these areas.
- Assess the diversity of flora and fauna
- Develop GIS based management system
- Restore corridors for movement of wild animals.

Strategy: - Conserve and restore critical species, ecosystems and gene pools

A. Conservation and Restoration

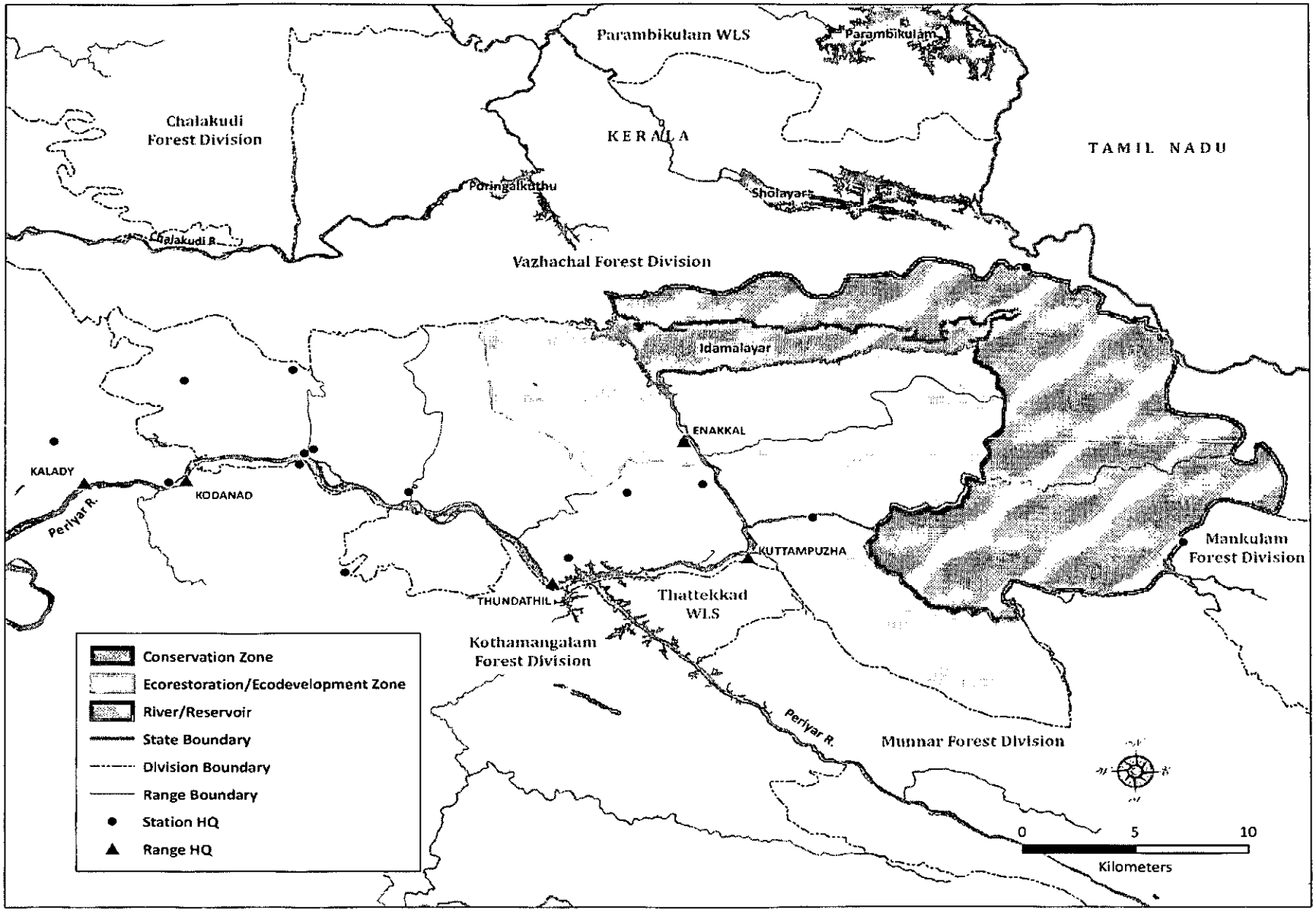
Action Plans

- The proposed area should be tackled only on scientific principles.
- There will not be any removal of bamboo/reed or dead wood.
- The area should be protected from fire, soil erosion, invasive weeds, grazing, illicit felling and encroachment etc.
- All the degraded areas may be restored with native species only
- Vegetation and species richness assessment by lying of some permanent plots to compare these areas with other disturbed areas.
- The gene pools of resource species should be identified based on genetic variability
- Tourism in the conservation zone is to be prohibited.

B. Rare, Endemic and Threatened species

Action Plans

- To identify and protect the endemic and threatened species and promote their recovery to viable levels.
- Develop ex-situ conservation and in-situ recovery plans.



Map 6 Management Zones in Malayattur HVBA

C. Unique ecosystems and species-specific habitats.

Action Plans

- Identify and assess unique ecosystems and species-specific habitats especially low elevation evergreen forests which cover an area of ca. 12 km^2.
- Unique ecosystems such as species-specific habitats of tahr, elephants and elephant corridors, hornbills and others need to be identified and their status should be assessed based on the ecological studies.
- Demarcate and map the identified unique ecosystems and species-specific habitats and prepare habitat-specific plans.

D. Riparian Ecosystem

Action Plans

- Identify, demarcate, and conduct inventory of all different ecosystems coming under the Division
- Prepare site-specific management plans.
- In less degraded areas some pioneer species like *Homonoia, Syzigium, Barringtonia* and some quickly growing species like *Macaranga* and *Vateria* may be used.
- Restriction of tourism along critical riparian ecosystems.
- Prevention of encroachment of riparian area by individuals, institutions and private entrepreneurs.

E. Wildlife corridors

Action Plans

- Identify, map and document the existing and potential corridor for elephants and other larger mammals.
- Conduct detailed studies (ecological, socio-economic, landuse pattern, etc.) and assess the status of the corridors.
- Develop specific plan for management of the corridors specifying relocation plan (voluntary), managing through PFM, enriching the corridor, curtailing further encroachment, etc.

- Avoid temporary settlements for reed extraction in wildlife corridors.

2. Ecorestoration and Ecodevelopment Zone

Objectives

1. Maintain the environmental stability through preservation and wherever necessary, restoration of ecological balance that has been adversely disturbed by depletion & degradation of forests.
2. Conserve the available natural forests with variety of flora and fauna, which represent the remarkable biological diversity and genetic resources.
3. Accord sustainable development of human settlements in the HVBA on environmentally sound and socially just lines with active participation of stakeholders promoting conservation oriented lifestyles.

Strategy:-Establish models for cost effective afforestation, conversion of degraded plantations to natural forests and sustainable utilization of NTFP.

A. Natural forest areas

Action plans

- Ecorestoration of degraded natural forests will be attempted by carrying out operations for assisting natural regeneration, soil and moisture conservation. The forests will be managed on a sustainable basis in consultation with communities involved. Gaps will be planted up with native species through VSS.
- Integration of soil and moisture conservation measures in forestry activities particularly in catchment areas.

B. Poorly stocked plantations

Action plans

- Conduct scientific studies for phasing out poorly stocked and failed plantations and converting them into natural forests.
- Carry out long term monitoring of natural succession in poorly stocked plantations.

C. Bamboo and Reed extraction areas

Action plans

- Enforce felling rules strictly.
- Promote natural regeneration of reed and rattan areas under close supervision.
- For reeds, no culms less than two years should cut and all new culms and not less than one fourth of the old culms will be left in the clump. Only mature rattans should be extracted and uprooting to be avoided. For clumped rattan species, the whole clump should not be extracted. Clumps with less than six mature culms shall not be felled and no culms shall be removed with rhizome in the case of bamboos. For clumped rattan species, the whole clump should not be extracted. Clumps with less than six mature culms shall not be felled and no culms shall be removed with rhizome in the case of bamboos.
- Prevent overlapping extraction of reeds by HNL / Bamboo Corporation.
- Banning extraction of rare and endangered species.
- Felling shall not be done on very steep slopes and in June, July and August, as it is the regeneration period. No felling should be done on slopes above 30° gradient.
- No felling of bamboo and reeds should be done 20 meter wide on either side of the stream banks.
- There shall be one full inter node with septa intact above ground level after felling.
- In case any flowering is noticed in an annual coupe, felling should be suspended immediately and further work can be permitted only after seed fall is completed and all culms from such clump will be clear felled.
- Phase out the extraction in the area to provide disturbance free habitat for elephants, tiger etc.
- Strictly avoid extraction in Wildlife corridors.

D. Non Timber Forest Products - areas

Action plans

- Identify the important NTFPs and their habitat.

- Stock maps showing the extent and intensity of availability based on inventory for the selected species should be prepared.
- Conduct total inventory of vegetation in a given locality for enumerating the availability of species and their distribution etc. The medicinally important plants and their associates identified and encouraged through managerial interventions.
- Areas where regeneration is poor will be closed to NTFP collection for sufficient period of time and harvested at the discretion of the Range officer in charge.
- The species that regenerate by rhizomes, sufficient rhizomes are to be left behind for propagation.
- The herbs and shrubs, where fruits are collected shall be done only after seeding, in case of plants that propagate by seeds.
- Injuries like debarking or blazing deep on the tree, cutting or lopping of branches, burning the bottom etc must be prohibited.
- Do not cut deep steps for climbing the trees to collect honey which cause permanent injury and sometimes death of the host.
- Tribes should be trained in scientific methods of collection and value addition to receive more profits.
- The tendency of the people engaged in collection to set fire for easy collection of certain produce should be prohibited and collection of bark should not be allowed.
- Degraded patches, fire affected patches failed plantations etc., could be taken up to enrichment planting of species like *Pittosporum tetraspermum, Aegle marmelos, Aristolochia indica, Pseudarthria viscida, Anamirta cocculus, Coscinium fenestratum, Desmodium gangeticum* and *Curcuma pseudomontana* etc, for which planting techniques have been suggested by Kerala Forest Research Institute. The tribal VSS can be involved for these works.
- Monthly meeting may be called in each colony to monitor the collection and payments. Officers connected with the society may be directed to attend the meeting and impart training to tribes on importance of sustainable production of NTFPs. No produce should be transported without the valid permits.

E. Human settlements

There are ten human settlements (Table 5.2) covering an area of 17.2 km^2 with high dependency on forests. The conservation plan proposes to integrate conservation oriented schemes through the following actions:

Action plans

- To assess the human forest interactions in each settlements
- Revisit the microplans of Vana Samrakshana Samithis in the settlements and mainstream them towards conservation
- Develop Institutions and attitudes for full fledged participation of stakeholders
- Enhance the livelihood options of stakeholders through establishment of mini enterprises
- Provide adequate training and capacity building for managing the enterprises
- Provide infrastructure, educational and health facilities in all settlements

Theme Plans

Theme plans include strategies which are common to all zones and include the following.

1. Habitat Management
2. Human-Wildlife Conflict
3. Infrastructure and communication Development
4. Livelihood improvement in human settlements
5. Fire Management
6. Watershed Management
7. Soil Conservation
8. Protection and
9. Wildlife Health

Strategies:

- Develop appropriate measures in natural resource management to mitigate management issues.
- Mitigate human-wildlife conflicts through appropriate methods.

1. Habitat Management

In habitat management the integrity of forests, availability of food, water and shelter for wildlife has to be maintained or enhanced. Fire protection is one of the steps towards maintaining the habitat. Artificial impounding of water by way of check dams, ponds, waterholes etc, and manipulation of cover by creating open patches and providing closed shelters are some of the activities prescribed in this regard.

Objectives

1. Habitat improvement for flora and fauna.

Actions

- **Weed Eradication:** Weeds like Mikania, Lantana and Eupatorium should be removed by uprooting during monsoon in phased manner but continuously for three years, then alternate year, wherever needed.
- **Fire control:** Fire lines should be properly maintained. Clearing of grass and weeds for a width of 5.2 m. helps in preventing fire spreading from one area to other. These fire lines also act as patrolling routes for the staff. Fire lines are also to be made in the surroundings of shola forest and small evergreen patches. Also along the roads fire lines should be maintained properly.
- **Control burning:** Controlled burning prevents disastrous late fires and provides new shoots for herbivores. A close monitoring of effects of burning should also be carried out and prescriptions modified accordingly.

2. Human-Wildlife Conflict

Human-wildlife conflict is emerging as a major concern in the Division in the recent years. Shrinking forests and shortage of food often forces wild animals towards populated areas and this friction results in the loss of life and property. The changing landuse pattern in the peripheries of protected areas due to demographic changes is

affecting wildlife habitats. These pressures influence the movement pattern, habitat utilisation and behaviour leading to regular increase in the race for survival between man and animals. In Malayattur, the main damage caused to crops and human life is by elephants and wild pig. Such conflicts should be avoided by adopting appropriate reconciliatory measures in the interest of both man and wildlife. Ever increasing competition between man with its livestock on one side and wild animals on the other for common natural resources use has led to human-wildlife conflict.

Objectives

- To minimize Human Wildlife conflicts.
- To minimize damage to crop, livestock and human by wild animals.

Actions

- Trenches and electric fencing may be established along the areas where elephant intrusions are frequent.
- Prompt action with reference to the decision and payment of compensation within 30 days of the incident.
- Ecorestoration activities to be conducted to reduce the impact of Human-wildlife conflict.
- Relocation of settlements in sensitive areas and migration paths of wildlife.
- Waste management systems that restrict wildlife access to refuse, especially in the case of plastics. The tourists dump the bottles, carry bags and food wastes in to the forests choke sewerage system, damage the soil and kill domestic animals and wildlife.
- Awareness campaign among local people should be taken up with help of VSSs.
- Training to field staff in wildlife management and mitigation of conflicts may be provided.

3. Infrastructure and Communication Development

To provide adequate protection to the biodiversity and manage the conserved area, proper infrastructure and communication are of great importance.

Objectives

To create new infrastructure and communication facilities for Malayattur Forest Division

Actions

Construct necessary buildings, acquire necessary infrastructure and develop wireless network system on a priority basis.

4. Livelihood improvement in human settlements

There are ten settlements in the Malayattur HVBA. All are tribal settlements belonging to Muthuvan and Mannan.

Objective

- Improvement of livelihood through biodiversity based enterprises reducing dependency on forests and human – wildlife conflicts.

Actions

- Revisit the existing microplans of VSS and reorient them towards conservation of biodiversity
- Strengthen participation in management by providing adequate capacity building in training to VSS.
- Plans establish and run microenterprises for the income generation of stakeholders.
- Provide necessary access to educational and health facilities.

5. Fire Management

Fire is one of the most destructive elements that disfigure the forests. In natural forests and in plantations the fire is a main problem in recent which retard wood production. Vadattupara, Chakkimedu, Elavumpocket, Kalappara, Kappayam, Ennakkal, Narakakkallu, Anakkulam, Karimpani are some of fire prone areas need future fire management.

Objectives

- Protect the habitats by minimizing and preventing the occurrence of forest fire.
- Determine fire weather index
- Promote community awareness and fire management through VSS.

Actions

- Construction and maintenance of fire lines
- Determination of fire weather index with the help of automated weather stations.

4. Watershed Management

The identification of degraded watersheds and their restoration is an important thing to maintain healthy ecosystem. The main water source areas like Manthrapara, Mattupettukoothu, Pindimedu, Prakkuthu, Pachamkoothu, Kandanpara, Arakkamuthi, Kodumbirikuthu are to be protected and tourism to these areas not to be allowed. All the areas above 30^0 slopes and more than 1500 m altitude and banks of rivers and streams are to be kept undisturbed without any operations except fire protection.

Objective

To identify degraded watersheds, restore, conserve and improve the catchments areas of Kunjiyar and Idamalayar etc. for the overall benefit of wildlife and the surrounding agro-economy.

Actions

Identify and prioritize watersheds and conduct ecorestoration.

5. Soil Conservation

Degradation of forest cover results in accelerated soil erosion, which has to be controlled for ecosystem benefits.

Actions

- Identify and prioritize areas that have accelerated soil erosion.
- Gully plugging with vegetative barriers
- Soil Moisture Conservation trenches
- Sunken ponds

6. Protection

The main illegal activities are tree felling, unauthorised NTFPs collection especially medicinal plants, Ornamental fish collection, poaching, ganja cultivation, grazing etc.

Objectives

Protect the forests and biodiversity by controlling and preventing illicit activities such as hunting, poaching, grazing and unauthorised NTFP collection.

Actions

Equip, train and motivate stakeholders in forest protection activities through VSS.

7. Wildlife Health and Veterinary care

Veterinary care in areas rich in wildlife can be assured by wildlife health monitoring through direct and indirect observations, post-mortem examinations, free vaccination and preventive measures like de worming domestic livestock and extension awareness to owners. The details are provided in Chapter 5. 7 Wildlife Health monitoring.

CHAPTER 8: MAINSTREAMING STRATEGY WITH VARIOUS FUNCTIONAL SECTORS

The various production sectors are important to mainstreaming the biodiversity conservation concerns in Malayattur Forest Division. This would involve modification of developmental activities /practices in the key production sectors to make them more 'conservation friendly'.

8.1 Forestry (D*)

The goal of the forestry sub-sector is sustainable development of forest resources and restoration of watersheds to provide environmental, social and economic benefits to the local people. The forestry operations in the failed plantation areas can be phased out slowly to convert them into natural forests.

- Retention of threatened and endemic species
- Monitoring of watershed areas.
- Monitoring the wildlife especially populations of Lion Tailed Macaque , Nilgiri Tahr, Tiger in standardised formats
- Foot patrolling by field staff to ensure protection
- Regulating livestock grazing in areas prone to wild ungulates
- Payment of compensation for Human - Wild life conflicts and crop damages.
- Timely payment of compensation for livestock depredation by wild carnivores
- Fire protection through VSS
- Ensuring and regulating collection of Non Timber Forest Produce, protection of the NTFP source areas (Arakkamuthy, Kathippara, Anakkulam, Keerithodu, Valiyakadavu, Amanthuli, Pattambli, Varium, Uchanthi, NadapparaUriyankatty). Ensure protection of these areas from forest fires and prevent illegal extraction.
- Ensuring sustainable collection of Non Timber Forest Produce like Thelli *(Canarium strictum),* Pathirippu (*Myristica beddomei),* Koova (*Curcuma*

Zeodaria), Marottikkuru (*Hydnocarpus pentandra*), Cheenikka (*Acacia concinna),* Kodampuli *(Garcinia gummi-gutta),* Urulunchikka *(Sapindus trifoliata),* Kallurvanchi *(Rotula aquatica),* Kattu manjal *(Curcuma Sp),* Kattu kurumulaku *(Piper sp.)* Kattupavakka *(Momordica dioica)* and Analivenga *(Pittospermum neelgherrense)* and Maramanjal *(Coscinium fenestratum)*

- The Arakkamuthi area is represented remnants of locally known as *Muniyara, the* dolmens found here belongs to the Megalithic Age. These Dolmenoids were burial chambers made of four stones placed on edges and covered by a fifth one called the cap stone. These dolmens should be protected.
- The degraded plantation such as 1971, 73, 75, 77, 78, 81 and 82 in Kuttampuzha range can be gradually restored with native species.
- Ensuring the availability of species of tubers/ leafy vegetables most frequently used by tribals, in their settlements.
- The water sheds that frequently used by tribals, ensuring its protection and restoration through VSS.
- Involve KSEB and Gramma Panchayath in the restoration of main streams in the catchments of reservoirs.
- Already harvested plantation areas have to be brought to natural forests with the help of VSS and NGOs by assisted regeneration of forests.
- Monitoring village cattle for disease and regulating livestock grazing in areas prone to wild ungulates.
- Maintaining grassy lands and marshy areas.
- Incentives to local communities from the fund accruing through recycling of gate receipts, as a reciprocal commitment for their involvement in conservation.
- Ensuring sustainable extraction of Reeds and bamboos and avoid extraction of immature clumps and extraction in the identified wildlife corridors.
- Fire prone areas like Kandanpara-Vakkathippara, Veppilathandu, Kuthiramudy, Kallady, Kuttiyal and Mangathodi should be frequently monitored.
- Exchange of wildlife presence data with nearby protected areas.

- Review of vegetation, threatened species information and the status of wildlife in the meetings of Forest Development Agency and Biodiversity Conservation Programme (BCP).
- Those forests areas allotted for film shooting should be limited and thoroughly monitored to ensure this area free from plastics, pollution and other floral and faunal damage.

8.2 Agriculture (D)

There is no large scale agricultural practice or shifting cultivation in the tribal settlements, since they get income through NTFP collection. However the rubber, gingers, curcuma and manjakoova are cultivating in the settlements are often failures due to Wildlife crop damage by elephants, deer and porcupine.

- Adoption of 'eco-agriculture' (organic farming) as a land use to produce food as well as to conserve wildlife in tribal settlements.
- Discourage sudden change in cropping patterns to avoid accentuating human-wild animal conflicts
- Maintaining a habitat mosaic, *viz.* fallow land, cultivation field, fruit orchard, plantation, under planting of spices, small timber etc. to mimic natural forest
- Promoting soil conservation.
- Providing economic incentives for safeguarding wildlife concerns
- Providing incentive for carbon, water and other environmental services to local people
- Compensating losses due to crop damage by wildlife
- Recognizing the value of traditional farming in conservation
- Fostering use of green manure and discourage use of chemical manures and pesticides
- Facilitating marketing of local products through the Harijan -Welfare Societies

8.3 Integrated development (Ecodevelopment, Development through District administration)(D).

Eco-development

- Ensuring proper drinking water supply to the indigenous tribal colonies.
- Electric fencing
- Participatory village level planning and preparation of village level micro plans for eco development.
- Providing inputs for resource substitution, income generation, community welfare, ecotourism for reducing the resource dependency of local people on surrounding forests
- Ensuring reciprocal commitments with the local people through respective Eco-development committees, forming part of a MoU in the micro plan for safeguarding biodiversity conservation interest

Development through District Administration

This involves a coordination of various sectors operating in the landscape pursuing development, where biodiversity conservation have to be integrated through agreements between the Forest Department, district authorities and Eco-development committees.

8.4. Tourism (D)

Tourism should be restricted in HVBA.

8.5. Fishes (D)

Monitor the illegal collection of native and ornamental fishes in order to conserve them.

8.6. Tea / Coffee estates (I **)

There are no Tea /Coffee estates in Malayattur HVBA

8.7. Road / Rail Transport (D)

- The old Alwaye – Munnar road should not be widened and tarred.
- Restrictions in night traffic should be enforced.

8.8 Industry (D)

- Construction activities should not lead to depletion of forests
- Preventing pollution on account of gaseous and other effluents
- Organizing service systems relating to drinking water, drainage, garbage disposal so as not to disturb the habitat of both plants and wildlife.

8.9 Mining (D)

There is no mining operation in Malayattur HVBA

8.10. Thermal power plants (I)

There is no Thermal power plant operating in Malayattur HVBA

8.11 Irrigation projects (D)

The Idamalayar reservoir of the Kerala State Electricity Board falls within the HVBA. The following provisions need be implemented towards conservation of the waterbody along with its drainage area:

- Restrict boating in the reservoir
- Control fishing activities
- Position boat patrolling

8.12 Temple tourism (D)

There is no temple tourism operating in Malayattur HVBA

8.13 Communication projects (D)

- The new projects should avoid slopes, streams, forest areas and wetlands especially the animal corridors and habitats rich in wildlife.
- The BSNL and KSEB should do the regular checking and maintenance of power lines and telephone lines of existing projects to prevent sagging and hence electrocution of elephants and other animals.
- Joint checking operations should be planned in vulnerable places by KFD and KSEB.

** D = Affects wildlife directly.*

*** I = Affects wildlife incidentally.*

CHAPTER 9: IMPLEMENTATION PLAN

9.1 Enabling environment and HRD plan

Conservation of biodiversity on sustainable principles forestry management practice has to combine both the science of forestry and the science of management. Hence the staff managing high value biodiversity area requires constant training in various subjects:

1. Training on legal issues.
2. Training on survey and demarcations.
3. Training on use of equipments like weapons, GPS.
4. Training on Biodiversity valuation.
5. Training on biological materials collection.
6. Eco-development training
7. Training in Ecotourism
8. Personality development.

Motivation and building morale of staff in a strategic point of action and the starting point for creating an environment conducive for pro-active action. Human resource management is of utmost importance and to get the best of human resources an enabling environment to perform must be first created. This begins with a fair placement norm, fair systems of assessment, equal career growth opportunities for all, good departmental culture, professional systems and annual audit of institutions and personnel.

9.2 Management plan and capacity building

9.2.1 Management Planning: A plan detailing the protocols and procedures need be developed in order to implement the HRD and HVBA plans.

9.2.2 Inventorying, assessing, monitoring of habitat and species: Consultancies have to be given for developing protocols for inventorying, assessing both habitat and species. One Research Associate (RA) in HVBA and project assistants at Range level and two assistants at beat level need be engaged. While the beat assistants will be drawn from the local population, others will be biologists, ecologists and sociologists. Provision of modern equipments in computing, satellite maps, GIS and GPS facilities etc. are essential. Necessary vehicles, Camera traps, analytical equipments, weather monitoring station, water monitoring equipments have to be provided.

9.2.3 Staff Development & Capacity Building: Staff development and capacity building will be ensured through trainings, field visits in India and abroad and through conduct of scientific research and preparation and presentation of scientific papers. Staffs are encouraged to visit other countries to learn about better practices and approaches to biodiversity conservation.

Special emphasis on leadership and strategic skills at the middle and top level and managerial skills at the bottom level is essential. Staff morale is to be improved beginning with provision of minimal facilities- furnished accommodation and ration to all field staff.

The scheduling of duties suggested are such that staff would have a fifteen day stay at station followed by a five day break to visit family. Till such time as accommodation is provided for family at nearest town staff may be paid fare by bus/train to visit home.

A system of annual Awards is suggested for the Best Beat/Section/Range/Division and for the Best Forest Guard/Forester/Range officer/DFO

9.2.4 Wildlife Research:

Important research projects

- Land use and vegetation assessment
- Mapping and analysis of Biodiversity Hotspot areas
- Identification of threatened species and methods for conservation
- Mapping of fire prone, weed infested and degraded areas

- Determination of fire- weather index
- Forest and NTFP dependency of Tribes and fringe area people
- Human - Wildlife conflict assessment and methods for mitigation
- Value additions and marketing of NTFP
- Monitoring of avifauna with special reference to Hornbills
- Monitoring and mapping of elephant movement
- Assessment of fish biodiversity
- Assessment of wildlife health
- Studies on small carnivores including leopard
- Inventory of lower forms of fauna and flora
- Developing a GIS based management system.

Gaps in information will be bridged through prioritized research. A priority list will be prepared through a participatory workshop with all stakeholders. Basic information will be collected through setting up of weather monitoring station, water monitoring stations, permanent monitoring. Research programmes will be carried out through surveys, Plots/ Transects and periodic census.

9.2.5 Education and Awareness:

Conservation oriented education and awareness about the HVBA are important in the development of the area as envisioned. Local communities, students and others will be targeted to instill the principles of conservation and sustainable development. The local community need develop a sense of ownership. A visitor centre and interpretation centre will be established for conducting regular camps.

Suggested Park Interpretation Themes and use of media:

- Role and significance of Malayattur HVBA and their relationship with long term conservation of biodiversity.
- Importance of Landscape level Management
- Media- Explained photo panel exhibit in Visitor centre and interpretation centre
- Conservation History of Malayattur HVBA
- Media- Explained photo panel exhibit in Interpretation Centre
- Varied ecosystem found in Malayattur HVBA

- Media- Explained photo panel exhibit in Visitor centre and Interpretation centre,
- Rare and endangered species found in Malayattur HVBA
- Endemism in Malayattur HVBA
- Media- Explained photo panel exhibit in interpretation centre, video film at visitor centre, computer quiz in interpretation centre
- Media- Explained photo panel exhibit, demonstration with the help of local technique, materials etc. in interpretation centre

9.2.6 Audit & Certification:

A system of annual audit and certification of institutions and individuals will be introduced. This will ensure transfer of change to field and management and monitoring of this change. Audit and certification will be done for the Beat, the Station, the Range, the Division, the Circle and the State.

9.3 Anti-poaching and Infrastructure

(A) Anti poaching:

9.3.1 Strengthening of beat infrastructure: Basic facilities to be provided at the beat level. Provision for accommodation (staff quarters) with water, energy source and communication facilities such as wireless sets, mobile phones is to be provided. Each beat will have suitable basic camping facility (dormitory).

9.3.2 Community beat assistants (four per beat): Four beat assistants to be posted for support to the beat staff in each beat. These beat assistants will be drawn from local community, be well trained and oriented to document what enters and leaves the beat and monitor the habitat and species within the beat.

9.3.3 Informant networks: The beat staff will develop an informant network so that they receive information on all that happens within their jurisdiction. They must know who and what enters their beat and who and what leaves their beat on a daily basis.

9.3.4 Intelligence network: The Range and Division will develop an intelligence network to monitor the functioning of the beat.

9.3.5 Communications: Field staff to be provided with good communication- wireless, mobile phones, internet.

9.3.6 Vehicles: 5 Jeeps for each station and two boats are essential for field monitoring and implementing the plan. One rescue vehicle also needed.

9.3.7 Field rations: All field staff to be provided field rations including facilities to have the food cooked.

9.3.8 Secret funds: Secret funds may be provided at Division level so that information of value is paid for thereby improving the quality of information and upgrading protection.

9.3.9 Crime cells at Division, Circle and State: A Crime Cell to monitor offences, offenders and devise suitable strategy to be set up at Division, Circle and State level. At Circle and State this cell will function under the leadership of an ACF.

(B) Infrastructure:

9.3.10 Offices: Maintenance of the existing offices are enough.

9.3.11 Field camps: Three field camps with basic facilities and furnishing are needed.

9.3.12 Staff quarters: Staff quarters are provided for the Range officer and Research Associate.

9.3.13 Staff quarters at nearest education centre:

9.3.14 Watch towers: Provision for one watch tower. Location to be chosen by HVBA staff

9.3.15 Road network: Maintenance of the existing roads.

9.3.16 Inspection paths: Provision for new trek paths and maintenance of existing trek paths and inspection paths.

9.3.17 Lab and library facilities: Purchase of basic laboratory instruments and books and periodicals.

9.3.18 Communication network (mobile and wireless);

9.3.19 Vehicles: As already stated purchase of 5 wheel jeeps and 2 boats and one rescue vehicle are needed.

9.3.20 Field gear for staff: Uniform, foot gears, tents, rain coats, sleeping bags, Head lamps, etc., need to be purchased.

9.3.21 Veterinary care: For vaccination and rescue etc.,

9.3.22 Staff welfare: For improving living amenities, reimbursing travel costs.

9.4 Restoration of habitat:

9.4.1 Habitat improvement through:

a) Enrichment planting
b) Removal of exotic weeds
c) Soil and moisture conservation
d) Fire protection
e) Management of Vayals

9.4.2 Safeguards/retrofitting:

a) Safeguards
b) Retrofitting

9.5 Eco-development and community oriented activities and Mechanism of Stakeholder involvement

9.5.1 Alleviating human –Wildlife conflicts through:

a) Fencing/trenching and Elephant proof wall
b) Compensation
c) Relocation of problematic animals

9.5.2 Strengthening co-existence through:

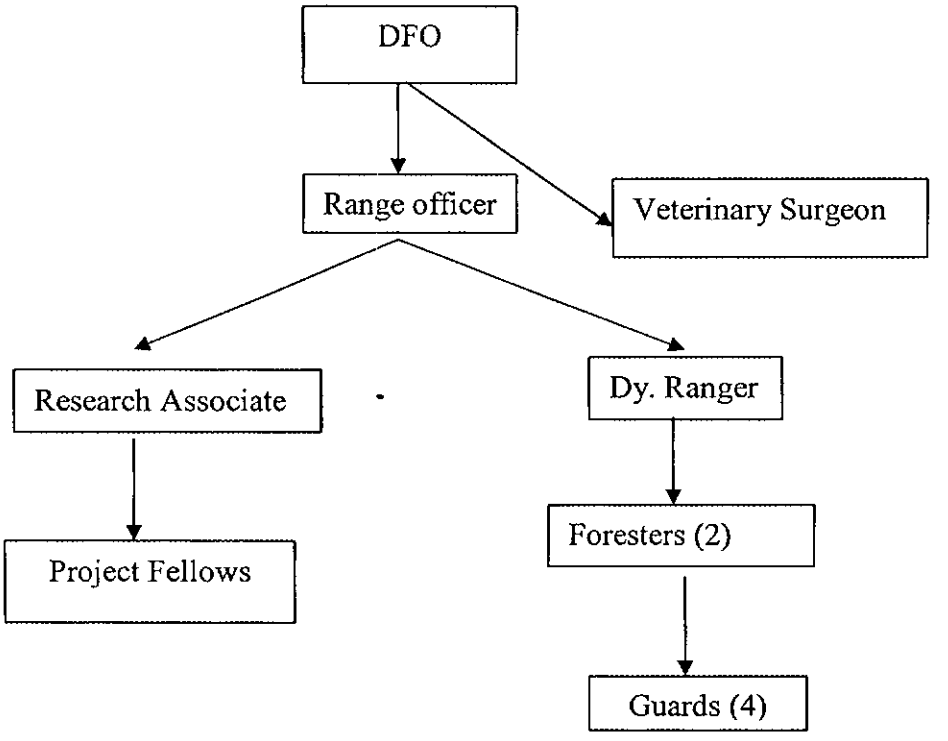
a) Participatory approach (EDC/JFM)
b) Entry point activities
c) Programmes to gain ownership by local community
d) Eco-Development Programmes
e) Eco-tourism
f) Relocation
g) Trans-boundary issues (in case of inter-state/country)

9.6. Systems, protocols and its institutional set up.

The implementation of the Biodiversity Conservation Plan (BCP) of Malayattur forest Division will be directly carried out by the Divisional Forest Officer under direct supervision of CF (Central circle) and guided by the CCF (Biodiversity). The protocol of the implementation is as follows.

- Monthly meeting of RO (BCP) and DFO
- Quarterly meeting of RO and DFO with CF
- Half yearly reporting to CCF (Biodiversity)
- Yearly progress presented before PCCF and other CCFs.

The institutional set up is provided in the chart given below:



9. 7 Duties and responsibilities at each level

- The DFO will assist planning and execution and report to CCF biodiversity through CCF biodiversity through CF Central circle
- The Range Officer in charge of BCP will supervise the field activities and provide financial and fiscal support and report to the DFO.

- The Research Associate and Project Assistants will implement the intended activities with the help of research and department staff and VSS. He will report to the DFO.

9. 8. Monitoring

Monitoring and evaluation is a very important aspect of any management process as it is very essential to measure the activity. It helps to evaluate the progress and success of the implementation of the plan and also helps to find out the shortcomings and make corrective measures, if necessary.

To evaluate how effective the management prescriptions fulfill in achieving the desired objective of conservation, the following matrix is used (Table 9.2).

Table 9.2 Monitoring and evaluation of activities

Sl. No	Intended intervention	Management prescriptions	Criteria to evaluate effectiveness
1	Ecological sustainability	Protection	Boundary demarcation, fire lines, trek paths, Less human animal conflicts, illegal activities
2	Protection of the habitat and strengthen the conservation measures	Maintaining integrity of the habitat	Increased biodiversity
3	Integrate human and forest conservation issues	Minimize negative impact of people and increase collaboration with local people	Improve relations between forest officials and villagers, improved employment opportunities and livelihood, reduction in human wildlife conflicts.
4	Restoration of habitats	Restoration of riparian ecosystems, grasslands, watersheds and eradication of alien and exotic weeds. Eco-restoration of degraded areas	Increased biodiversity ecosystem services
5	Sustainable collection and	Monitoring collection	Enhanced turn over and

	of NTFPs	And value addition	profits
6	Human Resource Development	Staff amenities and provision for staff training.	Number of staff trained. Motivation and efficiency of staff increased in conservation activities
7	Strengthening wildlife health monitoring and veterinary care	Immunization of cattle around the reserve. Direct observation and recording the body condition of animals.	No instance of epidemics. Monitoring the waterholes and snail survey etc.
8	Tourism and Nature education	Diverse tourism opportunities and facilities.	Tourists satisfied and forests conserved
9	Socio-economic issues	More jobs to local people in protection and intelligence	Whether local people are gainfully employed
10	Recognizing the people's rights	Increasing outreach activities	Informed local people with less conflicts (Human –forests)
11	Succession in failed plantations	Monitoring and assisted natural regeneration	Area under natural forest increased, Biodiversity enhanced

Process

The criteria listed above have to be evaluated. The criteria and the process of evaluation is given in Table 9.3. Some evaluation needs to be done at the level of field staff such as forest guard and watcher and need to be submitted to the Range Officer in charge of conservation and to the Divisional Forest Officer. The result may be evaluated in the District Level Management Committee.

Table 9.3 Criteria and Process of evaluation

Sl.	What	How	By whom	when

No	(Criteria)			
1	Ecological sustainability	Boundary demarcation, fire lines, trek paths, Human animal conflicts, illegal activities	Research Associate (RA), Biodiversity Conservation Programme	Yearly
2	Protection of wildlife and its habitat	Maintaining the habitat integrity of the elephants, tigers etc	Range Officer (RO) and RA Biodiversity Conservation Programme	
3	Boundary demarcation	Extent/length	RO Biodiversity Conservation Programme	Yearly
4	Fire lines, trek paths	Length	RO Biodiversity Conservation Programme	Yearly
5	Human – animal conflicts	Number	RO, Biodiversity Conservation Programme	Yearly
6	Human Resource Development	Number of trainings conducted and staff trained	RO, Biodiversity Conservation Programme	Yearly
7	Integrate human and forest conservation issues		RO, Biodiversity Conservation Programme	Yearly
8	Strengthening Veterinary Facility	No of cattle immunized	Veterinary Officer, Biodiversity Conservation Programme	Continuous record maintenance
9	Tourism	Study carrying capacity	RA Biodiversity Conservation Programme	Yearly
10	Pollution effect of	Sample plots in zone of	RA Biodiversity	Before and after peak tourist

	tourist areas	influence	Conservation Programme	season
11	Future of the plantation areas	Vegetation Plot monitoring	RA Biodiversity Conservation Programme	Yearly
12	Socio – economic issues	Functioning of VSS	RA and RO Biodiversity Conservation Programme	Meetings of the BCP committee
13	Recognizing the people's rights	Less number of conflict	RO	Meetings of the BCP committee
14	Animals with poor health condition	Number of animals	Veterinary Officer	Yearly
15	Illegal activities	No. of offence cases	Range Officer	Monthly
16	Research projects	Number	RO and RA	Yearly
17	Weed removal (progress)	Extent (ha)	Range Officer	Monthly/yearly
18	Extent of weed invasion	Sample plots in field	RA of Biodiversity Conservation Programme	Yearly
19	Exotics fishes in river (population density)	Capture recapture method	RA of Biodiversity Conservation Programme	Yearly
20	Trainings conducted and staff trained	Numbers	RA Research Biodiversity Conservation Programme	yearly

Strategy

To conserve and enhance the biodiversity wealth of Malayattur Forest Division through participatory research and action programmes involving stakeholders and trained staff of the Kerala Forest Department.

9.9 State Level Monitoring

The State level steering and coordination committee can carry out the monitoring also. The institutional set up is as follows:

Committee

- Principal CCF (General) - Chairman
- PCCF & Chief Wildlife Warden
- Concerned CFs
- Concerned DFOs
- Scientist (2)
- NGO's (2)
- CF (Biodiversity) – Member secretary

9.9.1 Regional Level Monitoring and Co-ordination.

Committee

- CF (Central circle) –Chairman
- CF (BCP)
- DFO Malayattur
- Range officer of the concerned Range (HVBA)
- Terrestrial ROs
- Scientist (2)
- NGOs (2)
- RO (HVBA)- Member Secretary
- Research Associate

9.9.2. District Level Management, Monitoring and Co-ordination.

Committee

- District Collector – Chairman
- CEO - Member
- DFO
- Representatives of the officials from
  - PWD
  - Social Welfare Department
  - Tribal Welfare Department
  - Health Department

- ❖ Agricultural Department
- ❖ Animal Husbandry Department
- ❖ Education Department
- ❖ Power and Irrigation Department
- ❖ Scientists
- ❖ Presidents of concerned Panchayaths
- ❖ NGOs

Forest Beat Management and Monitoring.

Committee

- ➢ RO – Chairman
- ➢ Dy. Ranger Member secretary
- ➢ Concerned Foresters -2
- ➢ VSS Presidents
- ➢ NGO (1)
- ➢ Scientist (1)

Institutional Mechanism

Implementation

The Range Officer will implement through VSS. He will report to the DFO.

Research

The priority of research will be decided and Research Associate will lead the programme assisted by Research fellows and report to the Range Officer.

Monitoring and Evaluation

The Monitoring and Evaluation will be carried out by District level, Regional level, and state level committees.

- ➢ District level – Once in three months
- ➢ Regional level- Once in six months
- ➢ State level – Once in a year

9.10 Audit and Certification.

The implementation of SFM in each Forest Management Unit will be audited and certified by competent external agencies.

CHAPTER 10: ORGANISATIONS, ADMINISTRATION AND BUDGET

10.1 Structure and administration.

Governing body for Biodiversity Conservation programme at Malayattur Forest Division is given below:

1. Hon'ble Minister of Forest, Govt. of Kerala – Chairman.
2. Principal Secretary to Govt. (F&W), Kerala – Vice chairman.
3. Principal Chief Conservator of Forests, Kerala.
4. Chief Conservator of Forests (Wildlife), Kerala.
5. Chief Wildlife Warden, Kerala – Member Secretary
6. Chief Conservator of Forests (Ecodevelopment and tribal welfare), Kerala
7. Conservator of Forests (Central Circle Thrissur), Kerala
8. Divisional Forest Officer, Malayattur
9. Director, Kerala Forest Research Institute, Peechi, Thrissur
10. Vice chancellor, Kerala Agricultural University, Mannuthy
11. Concerned Member of Legislative Assembly
12. District Panchayath President.

Executive Committee

1. DFO Malayattur Chairperson
2. Range officer in Charge
3. Research Associate
4. Veterinary Surgeon
5. Dy. Ranger
6. Presidents of VSS

10.2 Staff deployment

The existing vacancies of Forest Guards need to be filled at the earliest. The tribal people need to be deployed for the strike force. Means of recruiting them needs to be devised and Govt. orders got to be issued in this regard. Formation of such strike force is very urgent. Sufficient amenities should be provided to the staff. For guards camping

in remote places, rations should be provided. Same is the case with other Field gears and equipments. Insurance facilities for staff, medical amenities etc., also should be provided. The proposed staff for implementing Biodiversity Conservation Programme at Malayattur Forest Division in Table 10.1.

Table 10.1 Proposed staff for implementing Biodiversity Conservation Programme at Malayattur Forest Division

Sl. No.	Designation	Strength	Training/ Area of Specialisation
1	Range Officer	1	As per State norms/preferably M.Sc. with aptitude to research
2	Foresters	2	As per State norms
3	Forest Guards	4	As per State norms
4	Field Biologist	Depends on project needs	Doctorate in biological sciences, experience in Forest research
5	Veterinary Surgeon	1	BVSc & AH
6	Research Associates	Depends on project needs	M.Sc. in Botany/Zoology/Forestry with 2 years experience
7	Project Fellows	Depends on project needs	1st Class M.Sc. in Botany/Zoology/Forestry/Sociology
8	Field Staff	2	From VSS
9	Protection watchers	10	

Suggested Strategies:

- The biodiversity conservation area should be notified and handed over to the management committee immediately.
- Staff requirement should be assessed and existing vacancies should be filled at earliest.
- A trained Range officer on Biodiversity – Wildlife management can be posted.

10.3 Co-ordination

➢ Co-ordination with other Government Departments

To ensure the biodiversity conservations of Malayattur forests the Coordination must be ensured with the District Administration, District, Block and Village Panchayaths, and various departments like Tribal Welfare, Tourism, KSEB, Agriculture, Animal Husbandry, PWD and Irrigation. Through the coordination of these Departments periodic seminars, inter-departmental discussions, the awareness about the conservation areas, future management decisions, problems related to management and understanding of integrating conservation inputs into developmental activities can be done.

➢ Co-ordination with VSS

The VSS can be coordinated by biodiversity conservation management committee. Several VSSs, either by their location or activities can be grouped together as Confederation. An advisory body can be constituted out of the Chairpersons of various VSSs forming the Confederation. This will facilitate institution building, seeking resources from the Local Government or the District Administration, and periodically reviewing the working of the VSSs within the Confederation. A higher-level body before the Reserve level can be constituted with the Range Officers as Secretaries to these bodies.

➢ Co-ordination with NGOs

Similarly the active participation of the NGOs the awareness programmes, training programmes, village eco-development programmes and regular meetings can be coordinated.

10.4 Fund raising strategies

The funds from Central Government & State Government, following strategies will augment the financial resources of Malayattur forest Division. The activities of line departments such as Rural Development agencies, Panchayats (LSG), Social Welfare

Department, Tribal Welfare Department, Veterinary etc. can be coordinated to benefit the cause of conservation efforts. The various schemes available with these departments can be put to use in the proper way to ensure conservation programmes. The other sources include

- Ministry of Environment and Forests
- The State Plan for Biodiversity Conservation
- Local Panchayath development
- State and National Medicinal Plant Board.
- Community-based Ecotourism Programmes.
- Centrally Sponsored Schemes for Rural Development
- Centrally Sponsored Schemes for Wildlife and Biodiversity Conservation
- The Tribal Welfare Development Fund / SC-ST Department.
- Grants, donation or assistance of any kind from foreign Governments and other external agencies subject to Government rules.

10.5. Calendar of operations: - The details of calendar of operations are given below in Table 10.2.

Table 10.2 Calendar of operations

Sl.No	Activity	Year								
		1	2	4	5	6	7	8	9	10
1	Positioning Forest Department Staff									
2	Advertisement and recruitment Training of project staff									
3	Civil Works									
4	Purchase of permanent equipments									
5	Instrumentation									
6	Reference library setting/ Purchase of books									
7.	HRD Training									
	Research Programmes									
8	Land use and vegetation assessment									
9	Mapping and analysis of Biodiversity Hotspot areas									
10	Identification of threatened species and methods for conservation									
11	Mapping of fire prone, weed infested and degraded areas									
12	Determination of fire weather index									

13	Forest and NTFP dependency of Tribes and fringe area people									
14	Human – Wildlife conflict assessment and methods for mitigation									
15	Value additions and marketing of NTFP									
16	Monitoring of avifauna with special reference to Hornbills									
17	Monitoring and mapping of elephant movement									
18	Assessment of fish biodiversity									
19	Assessment of wildlife health									
20	Studies on small carnivores including leopard									
21	Staff amenities									
	Action programmes									
22	Identification of degraded watersheds and restoration									
23	Identification of degraded forests and restoration									
24	Project support to newly formed VSS									
25	Contribution to core fund of newly formed VSS									

26	Social welfare monitoring									
27	Implementation support									
28	Annual review									
29	Dissemination programme									
30	Livelihood improvement (Value addition, marketing and enterprise development)									
31	Anti poaching activities									
32	Vigilance									
33	Fire Protection									
34	Patrolling and communication									
35	Disease surveillance									

10.6 Activity budget

Budget (Rs. in lakhs) for implementing Biodiversity Conservation Plan in Malayattur Forest Division													
Sl. No.	**Particulars**	**Para. of the Biodiv. plan**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**Total**
I	**Management Planning & Capacity Building**												
1	**Management Planning**												
a	Assistance for preparing inventory	9.2.2	5.0	3.0	1.0	0.0	0.0	0.0	3.0	0.0	0.0	0.0	**12.0**
b	Status survey	9.2.2	4.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**7.0**
c	Development of inventorying, assessing and monitoring protocols for habitat species.	9.2.2	4.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**5.0**
d	Development of regional and landscape plans	9.2.2	6.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**8.0**
e	Procurement of hardware, Software, GIS etc.	9.2.2	0.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**10.0**
f	Computer and accessories	9.2.2	1.5	0.0	1.5	0.0	0.0	1.5	0.0	1.5	0.0	0.0	**6.0**
g	GPS	9.2.2	1.0	0.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	**4.0**
h	Camera, Camera traps	9.2.2	0.0	2.0	0.0	0.0	2.0	0.0	0.0	2.0	0.0	0.0	**6.0**
i	Satellite imageries, digitization facilities	9.2.2	0.0	2.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	**3.0**
j	Consultancies	9.2.2	0.0	5.0	5.0	5.0	2.0	2.0	2.0	2.0	2.0	2.0	**27.0**
k	Seminars/workshops	9.2.2	2.0	0.0	0.0	3.0	0.0	0.0	3.0	0.0	0.0	3.0	**11.0**
2	**Strengthening Wildlife Research, education and nature**												

	awareness												
a	Research	9.2.4	0.0	5.0	5.0	5.0	5.0	2.0	2.0	2.0	2.0	2.0	**30.0**
b	Census, Survey	9.2.4	2.0	2.0	0.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	**8.0**
c	Setting up monitoring plots/transects	9.2.4	0.0	2.0	2.0	0.0	0.0	2.0	2.0	0.0	0.0	0.0	**8.0**
d	Weather stations	9.2.4	0.0	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**12.0**
e	Water monitoring stations	9.2.4	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**7.0**
f	Monitoring and evaluation	9.8	0.0	0.0	3.0	0.0	0.0	0.0	3.0	0.0	0.0	1.0	**7.0**
g	Foreign tours	9.2.3	0.0	0.0	5.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	**10.0**
h	In country tours	9.2.3	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	**3.0**
i	Consultancies	9.2.3	0.0	5.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	**10.0**
j	Workshops and Seminars	9.2.2	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	**3.0**
k	Publications	9.2.5	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	1.0	1.0	**4.0**
l	Visitor centres (2)	9.2.5	0.0	10.0	10.0	10.0	1.0	1.0	1.0	1.0	1.0	1.0	**36.0**
m	Interpretation centres	9.2.5	0.0	5.0	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	**10.0**
n	Nature camps*	9.2.5	0.0	1.0	1.1	1.2	1.3	1.5	1.6	1.8	1.9	2.1	**13.6**
o	Equipment for research and education	9.2.2	5.0	5.0	5.0	0.0	0.0	0.0	0.0	6.0	6.0	6.0	**33.0**
3	**Staff Development & Capacity Building**												
a	Basic training in systems and protocols and professional working	9.2.3	3.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	**5.0**
b	Special training in use of GIS, use of camera traps, antipoaching, legal, forensics	9.2.3	0.0	0.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	**4.0**
c	Leadership and managerial skills	9.2.3	2.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	**3.0**
d	Fair placement norms	9.2.3	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.5**

e	Grievance redressal mechanism	9.2.3	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	**2.0**
f	Awards	9.2.3	0.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	**18.0**
4	**Independent evaluation and status survey**												
a	An annual audit of the Division, Range, Station, beat	9.2.6	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**9.0**
b	An annual audit of individual performance	9.2.6	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**9.0**
c	Annual audit of systems and protocols	9.2.6	0.0	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	**4.5**
II	**Anti-poaching & Infrastructure Development**												
1	**Anti poaching**												
a	Strengthening of beat infrastructure	9.3.1	4.0	4.0	4.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	**16.0**
b	Community beat assistants	9.3.2	5.0	5.5	6.1	6.7	7.3	8.1	8.9	9.7	10.7	11.8	**79.7**
c	Informant networks	9.3.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
d	Intelligence network	9.3.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
e	Arms and ammunition	9.3.1	10.0	0.0	0.0	0.0	0.0	10.0	0.0	0.0	0.0	0.0	**20.0**
f	Communications	9.3.5	2.0	0.0	0.0	2.0	0.0	0.0	0.0	2.0	0.0	0.0	**6.0**
g	Field rations	9.3.7	5.0	5.5	6.1	6.7	7.3	8.1	8.9	9.7	10.7	11.8	**79.7**
h	Secret funds	9.3.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
i	Crime cells at Division, Circle and State	9.3.9	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
2	**Infrastructure**												
a	Offices	9.3.10	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**12.0**
	Field camps	9.3.11	5.0	10.0	10.0	10.0	0.0	0.0	0.0	1.0	1.0	1.0	**38.0**

b													
c	Staff quarters	9.3.12	10.0	20.0	10.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	**45.0**
d	Staff quarters at nearest education centre	9.3.13	0.0	0.0	7.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	**14.0**
e	Watch towers	9.3.14	0.0	8.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	**10.0**
f	Road network		2.0	6.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	**24.0**
g	Inspection paths	9.3.16	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	**20.0**
h	Lab and library facilities	9.3.17	0.0	15.0	12.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	**41.0**
i	Communication network (Mobile and Wireless)	9.3.18	2.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	**4.0**
j	Vehicles (5 Jeep and 2 Boats) and POL	9.3.19	5.0	8.5	8.5	6.0	6.0	1.0	1.0	1.0	1.0	1.0	**39.0**
k	Field gear for staff	9.3.20	6.0	0.0	0.0	6.0	0.0	0.0	6.0	0.0	0.0	6.0	**24.0**
3	**Wildlife Veterinary care**												
a	Vaccination	9.3.21	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
b	Captive breeding	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
c	Ex-situ conservation programme	9.3.21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
d	Rescue camps	9.3.21	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
e	Rescue vehicles	9.3.21	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**7.0**
f	Monitoring wildlife health	9.3.21	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	**20.0**
g	Medicines etc.	9.3.21	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	**5.0**
h	Maintaining clinics	9.3.21	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
1	Engaging mazdoors	9.3.21	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
4	**Staff welfare**												
a	Improving living amenities for staff	9.3.22	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	**20.0**
b	Day offs to visit family	9.3.22	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**

c	Reimbursing travel costs to visit family	9.3.22	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
III	**Restoration of Habitat**												
1	**Habitat improvement**												
a	Enrichment planting	9.4.1a	0.0	2.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	2.0	**6.0**
b	Removal of exotic weeds	9.4.1b	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	**30.0**
c	Soil and moisture conservation	9.4.1c	0.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**45.0**
d	Fire protection	9.4.1d	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	**80.0**
e	Vayal management	9.4.1e	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	**20.0**
f	Vista clearance	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
g	Water holes	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
2	**Safeguards/retrofitting**												
a	Safeguards	9.4.2a	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
b	High-tension wire/railway line	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
c	Retrofitting	9.4.2b	0.0	0.0	10.0	0.0	0.0	10.0	0.0	0.0	10.0	0.0	**30.0**
IV	**Eco-development & Community oriented activities**												
1	**Human-wildlife conflict**												
a	Fencing/Trenching/Elephant Proof walls	9.5.1 a	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	**40.0**
b	Compensation	9.5.1 b	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	**20.0**
c	Relocation of problematic animals	9.5.1 c	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
2	**Strengthening co-existence**												
a	Participatory approach (EDC/PFM)	9.2.5a	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	**20.0**
b	Entrypoint activities	9.2.5b	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**4.0**
c	Programmes to gain ownership by local community	9.2.5c	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**

	Incentive for protection	9.2.5d	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
d	Ecodevelopment programmes	9.2.5e	0.0	4.0	6.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	**14.0**
e	Relocation	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
f	Ecotourism	9.2.5f	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	**10.0**
g	Trans-boundary issues	9.2.5g	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
V	**Grand Total**		**138.5**	**223.0**	**192.2**	**125.0**	**91.5**	**120.6**	**118.8**	**101.3**	**111.9**	**109.2**	**1332.0**

10.7 Fund Requirement (10 year plan)

For the ten year research operation and all management prescriptions the budget required is Rs. **1332.0** lakhs.

10.8 Expected Outcomes

Within a period of ten years the following outcomes are anticipated:

- Establishment of a full- fledged Malayattur HVBA with stakeholders participation
- Positioning of trained and motivated staff
- Baseline information of flora, fauna and ecosystems.
- *Ex situ* conservation of RET species
- Improvement of livelihood opportunities through conservation oriented programmes for the settler population.
- Establishment of a learning centre on green lifestyles for people at large.

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ANNEXURE I

GOVERNMENT OF KERALA

ABSTRACT

Forest Department – Re-organization of Central Circle – Bifurcation of Territorial Jurisdiction to form High Range Circle and Central Circle – Delineation of Boundaries of Divisions and Ranges – Orders issued.

AGRICULTURE (FOREST ESTABLISHMENT) DEPARTMENT

G.O. (M.S) No. 197/81/Forest Dated, Trivandrum, 31st July 1981.

Read: -

1. G.O. (M.S) No. 1011/62/Agri. DT. 5/9/1962
2. Letter No. P1.16117/77 DT. 11.2.1978 from the Chief Conservator of Forests.
3. G.O. (M.S) No. 34/81/AD DT. 7/2/1981
4. Letter No. P1.16177/77 DT. 2/6/1981 from the Chief Conservator of Forests.

O R D E R

In the Government Order read as 3rd paper above Government have ordered the redistribution of Territorial jurisdiction of the Divisions in Central Circle in the place of the Industrial Plantation Circle. The Chief Conservator of Forests in his letter read as 4th paper above the forwarded detailed proposals to effect the re-organization. Government have considered the proposals in detail and they order that the Territorial jurisdiction of the Central Circle and the High Range Circle will be defined as follows:

Central Circle

1. Thrissur Forest Division
2. Chalakudy Forest Division
3. Vazhachal Forest Division
4. Malayattur Forest Division
5. Timber Sales Division (Functional)

High Range Circle

1. Kothamangalam Forest Division
2. Munnar Forest Division
3. Kottayam Forest Division
4. Grassland Afforestation Division (Functional)

5. Timber Sales Division (Functional)

1. The present Thodupuzha Range will be detached from Malayattur Division and attached to Kothamangalam Division. The detailed boundary description of the Territorial Forest Divisions and the Ranges coming under the Central and High Range Circle is given in the ***Appendix*** to this order. The Headquarters of the Central Circle will be at Thrissur and that of High Range Circle at Kottayam. The Headquarters of the Territorial Divisions will be as shown in the ***Appendix.***

2. The Timber Sales Division of the Central Circle will be located at Kalady. The Head quarters of the Kottayam Forest Division will be shifted from Kottayam to Painavu as soon as suitable office building becomes available there. The Timber Sales Division of the High Range Circle will be located at Perumbavoor. The Headquarters of the Grassland Afforestation Division will be at Peermade.

3. The redistribution of Territorial jurisdiction as ordered above will take affect from the 1st August 1981.

(BY ORDER OF THE GOVERNOR)

K.L.N. RAO,
SPECIAL SECRETARY

Appendix

Malayattur Division **Headquarters – Kodanad**

	Ranges		Headquarters
1.	Kalady	:	Kalady
2.	Kodanad	:	Kodanad
3.	Thundathil	:	Thundathil
4.	Kuttampuzha	:	Kuttampuzha

Boundary Description of Malayattur Division

North: From Arabian Sea boundary proceeds due east to Cherai and thence along the road to Parur Junction and thence eastwards along the road to Desom. From Desom towards north along NH.47 upto Angamaly. From Angamaly along Angamaly-Manjapra road to Chandrapura and thence along the road upto the point where it ends Perumthode. Thence along Perumthode towards north upto Kochumedupara and thence along the streamlet towards east where it is called Koomullel thodu and reaches Anaikampara. From there the boundary proceeds eastwards along Vilangupara rock stretch and reaches Vilangupara where the boundary line cuts Adirampilly Vilangupara road. From there the line goes along Raprathodu first and then along the Southern boundary of Vazhachal Forest Division. Thus again the lines join the Raprathodu and proceeds along the thodu till it meets the Kulineerka thodu above Perumuzhy. Thence the boundary proceeds north till it reaches Kappayam. From Kappayam the boundary proceeds east through Airakunnu, Veehappara and joins the State boundary at Mukuttumudi.

East: From Mukottumudi the boundary turns south through Pannimadakuthu, Valampara, and Availipalai and reaches Perumbankuthu boundary of Munnar Forest Division.

South: Thence line turns west through Anakulam and reaches Kunjiyar and turns south and reaches Parapoya. Thence the boundary lines turn west and proceeds through Periya Malai, Pazhamudi and joins Periyar River. Thence the line follows the Periyar River from Palamattom till it joins Idamalayar River above Bhoothathankettu. From Bhoothathankettu the boundary proceeds along Bhoothathankettu-Thangalam road through Thrikkariyur and gets into Aluva-Kothamangalam road and reaches Perumbavoor. From Perumbavoor the boundary proceeds along Perumbavoor-Muvattupuzha road upto Muvattupuzha. Thence along boundary proceeds along Muvattupuzha-Ernakulam road upto Kaniyampuzha. From Kaniyampuzha reach Kochi Corporation boundary Chamburakavu Canal near Thriupunithura. Thence Corporation boundary up to Arabian Sea including Willington Island.

West: Lakshadweep Sea up to the point where a line running due from Cherai reaches Arabian Sea.

Boundary Description of Kuttampuzha Range
Headquarters – Kuttampuzha

North: Starting from Kappayam the boundary line proceeds eastwards through the Division boundary upto Kerala State boundary at Mukuttumudi.

East: From Mukuttumudi to south along the division boundary upto Perumbankuthu (right side of the boundary Munnar Division).

South: From Perumbankuthu west wards through Anakulamar and reaches Kunjiyar and turns south and reaches Parapoya. Thence the boundary turns west and proceeds through Periyamalai Pazhamudi and joins Periyar.

West: Boundary proceeds along Periyar river course join Idamalayar. Thence the boundary follows Idamalayar against its flow, turns north where Kuttampuzha joins Idamalayar and Proceeds upto Perumuzhi where Idamalayar turns east. From Perumuzhi, boundary proceeds north and reaches Kappayam.

Boundary Description of Thundathil Range
Headquarters – Thundathil

North: Starting from Anaikamppara proceeds east along Vilangupara rock stretch and cuts Adirappilly Vilangupara road at Vilangupara. From there goes along Raprathodu first and then goes along the southern boundary of Vazhachal Division then again joins the Raprathodu till it meet Kulineerkalthodu above Perumuzhi.

East: Thence along the right bank of Idamalayar up to the confluence of Kuttampuzha river and Idamalayar.

South: Thence along the right bank of Idamalayar till it joins the Periyar and thence along the Mannathuthodu till it joins with Periyar.

West: From the confluence of Mannathuthodu with Periyar it goes along Mannathuthodu towards north along the streamlet originating from Edakallena and then along the ridge from Edakallena to Sulamedu via Erattumugham and thence along the ridge towards northeast till it reaches Anaikampara.

Boundary Description of Kodanad Range
Headquarters – Kodanad

North: From Arabian Sea along Malayattur Division boundary upto Desom and then along right bank of Periyar river upstream upto the confluence of Perumthodu and Periyar then along Perumthodu Pullamthodu upto Kochumedumpara. From Kochumedumpara along Kochumlloolthodu upto Anappara.

East: Western boundary of Thundathil Range upto Periyar. Then along Periyar upto Bhoothathankettu.

South: From Bhoothathankettu along the southern boundary of Malayattur Division upto Arabian Sea.

West: Arabian Sea.

Boundary Description of Kalady Range
Headquarters – Kalady

North: From Desom along National Highway 47 up to Angamaly and then along Division boundary up to Kochimedumpara.

East: Western boundary of Kodanad Range.

South & West: Right bank of Periyar river upto Desom.

ANNEXURE – II

Details of Lease areas in Malayattur Forest Division

Sl. No.	Name of Lease	Area (ha)	Purpose
1	Plantation Corporation of Kerala	358.3300	For raising rubber plantation
2	Executive Engineer, KSEB	3126.6500	Hydro – electric project Idamalayar
3	Executive Engineer, KSEB	1.9600	Mini hydro – electric project
4	Executive Engineer, KWW	3.3570	Water supply scheme
5	Sub – division, Telecom, Kalady	0.3500	Laying out under ground cable
6	Hindustan Newsprint Ltd.	0.7500	Construction of quarters
7	Hindustan Newsprint Ltd.	1081.6000	Raising captive plantation
8	All Kerala Dhevara Sabha, Kodanad	0.2023	Temple
9	Harijan Union, Kottappady	0.5290	Temple
10	St. Thomas church, Malayattur	9.1866	Pilgrimage
11	P. Thomas, Padayatty house, Kalady	0.0485	Pump house
12	Joseph Kurian, Kannampuzha, Kalady	0.1720	Pump house
13	K.P. Varkey, Kalakkudy house, Panamkuzhy	0.0080	Pump house
14	Executive Engineer, Idamalayar	26.0000	Main canal Idamalayar irrigation project
Total		**4609.1434**	

ANNEXURE – III

Name of Reserved Forests in Malayattur Forest Division

Sl. No.	Name of Reserve	Range	Area (ha.)	Date of declaration	Total
1	Malayattur	Kalady	5277.200	02/04/1895	**57351.25**
		Kodanad	3223.040	02/04/1895	
		Thundathil	13140.000	02/04/1895	
		Kuttampuzha	35711.010	02/04/1895	
2	Kottapara	Kodanad	1932.000	08/01/1925	**1932.000**
3	Imbakodu teak	Kodanad	15.410	08/01/1925	**15.410**
4	Perumthode	Kodanad	332.400	05/05/1914	**332.400**
5	Kallilgrazing Block	Kodanad	56.820	05/05/1914	**56.820**
6	Erampakad TP	Kodanad	15.4100	22/02/1966	**15.4100**
7	Panamkuzhy	Kodanad	40.340	22/02/1966	**40.340**
8	Kaprikkad TP	Kodanad	58.680	30/07/1932	**58.680**
9	Illithodu	Kalady	193.200	05/08/1913	**193.200**
10	Kurichimala	Kalady	320.000	08/05/1934	**320.000**
11	Arattukadavu	Kalady	83.900	08/05/1934	**83.900**
12	Karakkad	Kalady	366.000	23/01/1924	**366.000**
13	Thanikadavu	Kalady	513.200	14/08/1917	**513.200**
14	Kurisumudi	Kalady	441.200	24/04/1909	**441.200**
15	Mulamkuzhy	Kalady	4.300	23/10/1943	**4.300**
Total			**61724.110**	**Grand Total**	**61724.110**

ANNEXURE –IV

List of Plantations in Malayattur Forest Division

Kalady Range

Sl. No.	Plantation	Species	Area (ha.)	Remarks
1	1950, Pandupara	Teak	112.45	
2	1951, Kannimangalam.	Teak	43.08	
3	1952, Karakkad.	Teak	17.50	
4	1954, Illithodu	Teak	23.98	
5	1956, Manjappara	Teak	158.64	
6	1958, Karakkad	Teak	1.95	
7	1960, Kannimangalam	Teak	4.05	
8	1961, Perumthode	Teak	8.45	
9	1962, Evergreen	Teak	63.90	
10	1963, Pandupara	Teak	101.17	
11	1970, Pandupara	Teak	46.54	
12	1976, Pothuppara	Teak	40.30	
13	1976, Manjappara	Teak	49.60	
14	1977, Manjappara	Teak	73.00	
15	1978, Manjappara	Teak	29.30	
16	1979, Manjappara	Teak	80.10	
17	1980, Manjappara	Teak	83.79	
18	1980, Mallana	Teak	6.90	
19	1981, Mallana	Teak	26.63	
20	1982, Mallana	Teak	19.34	
21	1983, Mallana	Teak	18.53	
22	1992, Mallana	Teak	16.30	Recommended as failed plantation
23	1994, Mallana –A	Teak	16.20	Recommended as failed plantation
24	1994, Mallana – B	Teak	26.50	Recommended as failed plantation
25	1994, Mallana – C	Teak	5.50	Recommended as failed plantation
26	1995, Mallana –A	Teak	29.16	Recommended as failed plantation
27	1995, Mallana –B	Teak	2.25	
28	1996, Mallana	Teak	3.25	
29	1997, Mallana – A	Teak	10.97	
30	1997, Mallana – B	Teak	10.12	
31	1997, Mallana – C	Teak	8.91	
32	1997, Mallana – D	Teak	13.37	Recommended as failed plntn.
33	1997, Mallana – E	Teak	11.54	Recommended as failed plantation
34	1952, Pandupara	Teak & Elavu mixture	83.16	
35	1954, Pandupara	Teak & Elavu mixture	25.92	
36	1961, Kannimangalam	Teak & Elavu mixture	52.49	

37	1976, Pandupara	Teak & Elavu mixture	13.40	
38	1980, Karakkad	Mahogony	21.00	
39	1956, Karakkad	Cashew	258.56	
40	1996, Karakkad	Cashew	3.04	
41	1993, Karakkad	Cashew	8.5	H.M.S. augmentation with cashew in open areas of 1956 cashew
42	1994, Karakkad	Cashew	6.58	H.M.S. augmentation with cashew in open areas of 1956 cashew
43	1995, Karakkad	Cashew	7.8	H.M.S. augmentation with cashew in open areas of 1956 cashew
44	1996, Karakkad	Cashew	11.00	H.M.S. augmentation with cashew in open areas of 1956 cashew
45	1994, Kunthirumudi	Bamboo	19.80	
46	1995, Kunthirumudi	Bamboo	21.12	
47	1996, Kunthirumudi	Bamboo	24.00	
48	1986, Kannimangalam	Bamboo	30.00	Under planting in1951 Teak Kannimangalam.Poor stock.
49	1986, Kannimangalam	Bamboo	10.00	Under planting in1961 T&E.Poor stock.
50	1981, Kurisumudi	Cocco-Pepper	5.00	Under Vana Lakshmi
51	1998, Neeleswaram	Medicinal	1.00	.

Kodanad Range

Sl. No.	Plantation	Species	Area (ha.)	Remark
1	1935, Vempooram	Teak	10.73	
2	1936, Vempooram	Teak	3.66	
3	1936, Mallana	Teak	13.06	1918, Mallana – felled in 1936, present crop is coppice of 1936
4	1946, Kaprikkad	Teak	38.45	
5	1948, Kaprikkad	Teak	15.71	
6	1949, Kaprikkad	Teak	10.09	
7	1950, Kaprikkad	Teak	9.31	
8	1950, Kaprikkad- B	Teak	4.05	
9	1951, Kaprikkad	Teak	4.65	
10	1952, Mallana	Teak	27.74	1917, Mallana – felled in 1952, present crop is coppice of 1952
11	1961, Vempooram	Teak	3.14	
12	1962, Perumthode	Teak	21.94	
13	1966, Perumthode	Teak	20.14	
14	1966, New Athirappilly	Teak	21.74	

15	1967, Perumthode	Teak	23.49	
16	1967, New Athirappilly	Teak	50.26	
17	1968, New Athirappilly	Teak	82.72	
18	1968, Perumthode	Teak	41.70	
19	1969, New Athirappilly (Perumthode)	Teak	28.40	
20	1969, New Athirappilly	Teak	49.18	
21	1970, Perumthode	Teak	21.31	
22	1970, New Athirappilly	Teak	30.43	
23	1970, Pothuppara	Teak	55.60	
24	1971, Pothuppara	Teak	180.19	
25	1971, Perumthode	Teak	20.89	
26	1971, New Athirappilly	Teak	50.00	
27	1972, Perumthode	Teak	24.89	
28	1973, Perumthode	Teak	18.26	
29	1974, Perumthode	Teak	39.97	
30	1975, Mallana	Teak	18.39	
31	1976, Mallana	Teak	12.84	
32	1976, Mallana	Teak	8.04	
33	1976Pothuppara	Teak	170.82	
34	1976, Pothuppara	Teak	160.00	
35	1977, Mallana	Teak	16.71	
36	1977, Pothuppara	Teak	69.10	
37	1977, Pothuppara	Teak	55.83	
38	1977, Pothuppara	Teak	36.84	
39	1978, Pothuppara	Teak	27.68	
40	1979, Pothuppara	Teak	61.00	
41	1979, Pothuppara	Teak	56.30	
42	1980, Pothuppara	Teak	29.44	
43	1982, Kottapara	Teak	36.00	
44	1983, Kottapara	Teak	24.70	
45	1983, Thodakkayam	Teak	14.60	
46	1984, Pothuppara	Teak	31.80	
47	1997, Paneli Bit - 1	Teak	13.02	
48	1997, Paneli Bit - 2	Teak	4.40	
49	1997, Paneli Bit - 3	Teak	3.50	
50	1997, Kaprikkad	Teak	1.90	
51	2000, Vempooram	Teak	3.50	
52	2000, Kaprikkad	Teak	7.30	
53	2001, Vempooram	Teak	10.49	
54	1942, Paneli	Teak & Elavu mixture	8.10	
55	1944, Paneli	Teak & Elavu mixture	11.34	
56	1945, Paneli	Teak & Elavu mixture	10.73	
57	1946, Paneli	Teak & Elavu mixture	10.53	
58	1947, Paneli	Teak & Elavu mixture	21.76	
59	1977, Kottapara	Teak & Elavu mixture	135.26	
60	1981, Paneli	Teak & Elavu mixture	1.00	
61	1982, Bhagavathikulam	Teak & Elavu mixture	76.12	
62	1983, Vadakkumbagam	Teak & Elavu mixture	16.00	
63	1983, Thodakkayam	Teak & Elavu mixture	13.50	
64	1984, Pezhadu	Teak & Elavu mixture	10.30	

65	1987, Amanthodu	Teak & Elavu mixture	5.78	
66	1987, Kaprikkad	Teak & Elavu mixture	1.26	
67	1988, Kottapara	Teak & Elavu mixture	17.69	
68	1988, Amanthodu	Teak & Elavu mixture	21.29	
69	1980, Panamkuzhy	Bamboo	12.00	
70	1981, Kaprikkad	Bamboo	1.55	
71	1981, Paneli	Bamboo	4.99	
72	1981, Kottapara	Bamboo	20.00	
73	1986, Perumthode	Bamboo	40.00	Under planted (1968 TP Perumthode)
74	1999, Mekkappala –	Eucalyptus, *Acacia auriculiformis* & *A. mangium*	150.43	Effective area 110 ha. balance rocky patches
75	2000, Kaprikkad	Pulp wood	13.40	
76	2001, Kottapara	Eucalyptus clones, *Acacia Auriculiformis*, *A. hybrid* & *A. mangium*	106.20	

Thundathil Range

Sl. No	Plantation	Species	Area (ha.)	Remark
1	1966, Idamalavali	Teak	494.00	
2	1968, Idamalavali	Teak	270.25	
3	1969, Idamalavali	Teak	224.18	
4	1969, Thundathil	Teak	50.25	
5	1970, Idamalavali	Teak	238.75	
6	1971, Pothuppara	Teak	201.90	
7	1971, Idamalavali	Teak	348.32	
8	1972, Thundathil	Teak	50.39	
9	1972, Thundathil	Teak	71.65	
10	1973, Idamalavali	Teak	111.67	
11	1976, Idamalavali	Teak	92.50	
12	1978, Idamalavali	Teak	138.44	
13	1982, Njayappilly	Teak	16.02	
14	1982, Karimpani	Teak	51.38	
15	1982, Karimpani	Teak	54.42	
16	1983, Karimpani	Teak	43.00	Planted in failed area of 1969, Grewilia
17	1984, Pulavanppadi	Teak	6.00	
18	1994, Karimpani -A	Teak	22.80	
19	1994, Karimpani -B	Teak	7.68	
20	1994, Karimpani -C	Teak	7.75	
21	1951, Thundathil	Teak & Elavu mixture	21.50	
22	1961, Thundathil	Teak & Elavu mixture	40.63	
23	1962, Thundathil	Teak & Elavu mixture	58.78	
24	1963, Thundathil	Teak & Elavu mixture	79.00	
25	1964, Thundathil	Teak & Elavu mixture	65.03	
26	1965, Thundathil	Teak & Elavu mixture	86.30	
27	1966, Idamalavali	Teak & Elavu mixture	84.63	

28	1968, Thundathil	Teak & Elavu mixture	21.45	
29	1969, Thundathil	Teak & Elavu mixture	15.48	
30	1973, Thundathil	Teak & Elavu mixture	54.72	
31	1974, Thundathil	Teak & Elavu mixture	38.97	
32	1974, Thundathil	Teak & Elavu mixture	12.69	
33	1975, Thundathil	Teak & Elavu mixture	64.40	
34	1976, Thundathil	Teak & Elavu mixture	120.86	
35	1977, Thundathil	Teak & Elavu mixture	100.40	
36	1977, Thundathil	Teak & Elavu mixture	101.76	
37	1977, Thundathil	Teak & Elavu mixture	94.76	
38	1978, Thundathil	Teak & Elavu mixture	86.82	
39	1978, Thundathil	Teak & Elavu mixture	81.00	
40	1978, Thundathil	Teak & Elavu mixture	112.00	
41	1978, Pothuppara	Teak & Elavu mixture	21.88	
42	1980, Thundathil	Teak & Elavu mixture	81.24	
43	1981, Pothuppara	Teak & Elavu mixture	15.04	
44	1982, Bhagavathikulam	Teak & Elavu mixture	32.43	
45	1991, Vadattupara	Teak & Elavu mixture	17.65	
46	1993, Paramudy	Teak & Elavu mixture	16.04	
47	1969, Thundathil	Grewilia	36.41	43 ha, planted with teak during 1983
48	1992, Pulayanadavu	Bamboo	8.96	
49	1992, Ponginchuvadu	Bamboo	10.00	
50	1994, Karimpani	Bamboo	9.75	
51	1983, Njayappilly	Reeds	2.00	
52	1983, Njayappilly	Matty	5.00	
53	1977, Njayappilly	Pepper	3.14	Under planted in 1966, Idamalavali Teak & Elavu mixture
54	1979, Njayappilly	Pepper	20.05	Under planted in 1966, Idamalavali Teak & Elavu mixture
55	1980, Njayappilly	Pepper	49.35	Under planted in 1966, Idamalavali Teak & Elavu mixture
56	1995, Thalumkandom	Medicinal	4.85	

Kuttampuzha Range

Sl. No.	Plantation	Species	Area (ha.)	Remark
1	1971, Urulanthanni	Teak	61.77	
2	1973, Urulanthanni	Teak	65.85	
4	1975, Kuttampuzha	Teak & Elavu mixture	118.75	
5	1977, Kuttampuzha	Teak & Elavu mixture	55.00	
6	1977, Kuttampuzha	Teak & Elavu mixture	158.00	
7	1978, Kuttampuzha	Teak & Elavu mixture	88.00	
8	1981, Kuttampuzha	Teak & Elavu mixture	118.24	
9	1982, Kuttampuzha	Teak & Elavu mixture	12.00	
3	1975, Kuttampuzha	Rose wood	10.00	
10	1984, Pooyamkutty	Reeds	10.00	

ANNEXURE V
LIST OF ANGIOSPERMS IN MALAYATTUR HVBA

Sl.No	Family & Botanical name	Distribution & Status
	ANNONACEAE	
1	*Miliusa eriocarpa* Dunn.	Below Kathippara Saddlle dam site, in the moist deciduous forests; endemic of Southern India, very rare and endangered the area.
2	*Miliusa tomentosa* (Roxb.) Sinclair	Moist deciduous forests along the hill tops Avarkutty; endemic to Southern Western Ghats, very rare in the area.
3	*Polyalthia fragrans* (Dalz.) Bedd.	Fairly common in the moist deciduous forests of Tholnada, Avarkutty and Anakulam, and in the degraded semievergreen forest at Pinavur.
4	*Uvaria narum* (Dunn.) Wt. et Arn.	Fairly common along the sides of rocks at Pindimedu.
	ACANTHACEAE	
5	*Andrographis paniculata* (Burm.f.) Vahl ex Nees	In the open areas at Manali; rare.
6	*Justicia betonica* L.	As an undergrowth in the evergreen forests between Anamalai and Manali; rare.
	ANCISTROCLADACEAE	
7	*Ancistrocladus heyneanus* wall. ex Grah.	Pinavur degraded semievergreen forests; an endemic shrub of peninsular India, fairly common in the forest floor.
	APOCYNACEAE	
8	*Alstonia scholaris* (L.) R. Br.	Pindimedu, in open reed areas of the river valleys; rare.
9	*Chilocarpus malabaricus* Bedd.	Anakulam, along riverside hedges; this species first described from Northern Kerala was subsequently in Karnataka in 1964. This is possibly the first collection of the species from Kerala after more than 100 years of its type collection.
10	*Ervatamia divaricata* (L.) Burkill	Pindimedu, Meenkuthi and Anakulam forests; fairly common.
11	*Ichnocarpus frutescens* (L.) R. Br.	Tholnada and Anakulam, along hedges; fairly common.
	ANACARDIACEAE	
12	*Holigarna arnottiana* Hook.f.	Pindimedu and Pinavur in the open reed areas of the river valleys; a species endemic to Peninsular India, rare in the area.
13	*Holigarna grahamii* (Wt.) Kurz	Anakulam moist deciduous forests; an endemic tree of Southern India, very rare

		in the area.
14	*Lannea coromandelica* (Houtt.) Merr.	Pindimedu, river banks; rare.
15	*Mangifera indica* L.	Pindimedu, near the KSEB Camp shed; rare.
16	*Nothopegia beddomei* Gamble	River beds at Anakulam; a highly endemic species, so far known only from the Tamilnadu part of the Western Ghats, growing in an endangered state in the area.
17	*Semecarpus anacardium* L.f.	Upper reaches of Tholnada in the degraded moist deciduous forest; rare.
	ARALIACEAE	
18	*Schefflera venulosa* (Wt. et Arn.) Ham.	Tholnada and Pinavur; fairly common.
	AGAVACEAE	
19	*Dracaena terniflora* Roxb.	Pinavur, Tholnada and Anakulam, in the dense forests bordering rivers; fairly common.
	ARACEAE	
20	*Pothos scandens* L.	Tholnada, Pindimedu, etc.; common climbers on riverside trees.
	ARISTOLOCHIACEAE	
21	*Thottea siliquosa* (Lamk.) Ding Hou	Manali, forest bordering tribal settlements; a Peninsular Indo-Sri Lankan species, rare in the area
	BOMBACACEAE	
22	*Cullenia exarillata* Robyns	Anakulam semi-evergreen forests; a Peninsular Indo-Sri Lankan species, very rare in the locality
	MYRISTICACEAE	
23	*Knema attenuata* (Hook.f. et Thoms.) Warb.	River valleys at Pindimedu, before Avarkutty and at Anakulam; endemic trees of Southern India, very rare in the area.
24	*Myristica dactyloides* Gaertn.	River banks at Tholnada, Pindimedu Dam site and at Anakulam; a Penisular Indo-Sri Lankan species, very rate in the area.
25	*Myristica malabarica* Lamk.	Moist deciduous forests of the river valleys of Kunjiar, Thuduppi river and Pooyamkutty river; a very rare and endangered Peninsular Indian endemic in the area.
	LAURACEAE	

26	*Actinodaphne bourdillonii* Gamble	River valleys at Pindimedu and Tholnada; a highly endemic tree species of Southern Western Ghats, very are in the area.
27	*Actinodaphne madaraspatana* Bedd. ex Hook. f	Reed areas in the river valleys at Pindimedu and Anakulam; an endemic species of Southern India, very rare in the area.
28	*Actinodaphne malabarica* Balakr.	Pinavur semievergreen area and river valleys of Pindimedu; an endemic tree species of Southern Peninsular India, very rare in the area.
29	*Cinnamomum macrocarpum* Hook.f	Below saddle dam site and on the way to Manikantanchal; an endemic tree species of Southern Western Ghats, very rare in the area.
30	*Cinnamomum malabatrum* (Burm.f.) BI.	Up-stream sides of Thuduppi river; an endemic tree of Southern Peninsular India, scarce in the area.
31	*Cinnamomum verum* J.S. Persl.	Anamalai, forests adjoining the dam site; very rare.
32	*Cinnamomum riparium* Gamble	Curious shrubs forming part of the riparian vegetation, mainly along the banks of Kunjiar, Thuduppi river and at Anakulam; fairly common, endemic of Western Ghats near hill streams.
33	*Cinnamomum sulphuratum* Nees	Reed areas in the valleys of Pooyamkutty river; a rare tree species in the area, endemic to Peninsular India.
34	*Litsea accendentoides* K. et V.	Anakulam, along stream sides and in moist deciduous forests; fairly common.
35	*Litsea bourdillonii* Gamble	Between Manali and Meenkuthi tribal settlements; a highly endemic species confined to Southern Peninsular India, very rare and endangered in the locality.
36	*Gymnacranthera canarica* (King) Warb.	Streamsides between Meenkuthi tribal settlement and Anakulam; an endemic tree of Southern Western Ghats, very rare in the area.
37	*Neolitsea cassia* (L.) Kosterm.	Between Meenkuthi and Anakulam, in the moist deciduous forests; rare.
38	*Persea macrantha* (Nees) Kosterm.	Meenkuthi tribal settlement area, along the fringes of grassy slopes; a tree species confined to Peninsular India and Sri Lanka, very rare and endangered in the area.
	CHLORANTHACEAE	

39	*Peperomia dindigulensis* Miq	Tholnada area, as epiphytic on riverside tree trunks; fairly common
40	*Piper nigram* L.	Thalakkanny area, as root climbers on trees; rather rare.
41	*Pothomorphe subpeltata* (Willd.) Miq.	Kunjiar and on the way to Anakulam, in wet, shaded areas near rocks; rather rare.
42	*Thottea siliquosa* (Lamk.) Ding Hou	Along forest pathsides, almost throughout the area; a fairly common Peninsular Indo-Sri Lankan species.
43	*Naravelia zeylanica* (L.) A.DC.	Along hedges at Tholnada; rare
44	*Cissampelos pareira* L	Along the hedges and stream-sides at Pindimedu and Tholnada; fairly common
45	*Diploclisia glaucacens* (Bl.) Diels	Climbers on river side trees at Pindimedu; rare
	MELIOSMACEAE	
46	*Meliosma simplicifolia* (Roxb.) Walp.	Anakulam, in moist deciduous forests; rare
	ULMACEAE	
47	*Trema orientalis* (L.) Bl.	Disturbed forest areas and reed and Mikania growing parts of Pindimedu, Tholnada, Avarkutty, Anakulam and Pinavur; common.
48	*Artocarpus heterophyllus* Lamk.	River valleys at Pindimedu and Kunjiar and tribal settlement areas near Anakulam; fairly common.
49	*Artocarpus hirsuta* Lamk	Between Tholnada and Avarkutty, along the sides of forest paths; rare.
50	*Ficus arnottiana* (Miq.) Miq.	Dry deciduous, rocky areas along the right bank of Pooyamkutty river, Avarkutty and Saddle dam area; fairly common.
51	*Ficus benghalensis* L	Pindimedu to Kunjiar, along the sides of rocks near streams; common
52	*Ficus hispida* L.f	Pinavur and Pindimedu, in rocky areas; fairly common.
53	*Ficus religiosa* L.	Pindimedu, as epiphytic on rocks bordering the stream; fairly common.
54	*Ficus talbotii* King	Epiphytic on rocks along stream sides, Tholnada ; rare
55	*Ficus tinctoria* Forst. f.	In the rocky areas below Kathippara ; rare
56	*Ficus travancorica* King	Tholnada to Metnappara, along the sides of rocks; an endemic species of South India, very rare in the area.
57	*Ficus tsjahela* Burm. f.	Kunjiar and Tholnada, in rocky areas; fairly common.
58	*Strebles taxoides* (Heyne) Kurz	Pinavur and Pindimedu right bank of Pooyamkutty river; fairly common

	URTICACEAE	
59	*Boehmeria glomerulifera* Miq.	In the shady areas below rocks, Kunjiar; fairly common
60	*Boehmeria malabarica* Wedd.	Pinavur, in the semievergreen areas; fairly common
61	*Elatostema lineolatum* Wt.	Shaded areas, between Avarkutty and Anakulam; fairly common.
62	*Laportea interrupta* (L.) Chew	Kunjiar river banks, in shade; fairly common.
63	*Laportea crenulata* (L.) Chew	Semievergreen forest floor in the Anamalai- Manali region; abundant.
64	*Oreocnide integrifolia* (Gaud.) Miq.	In the evergreen forests between Anamalai and Manali; fairly common as an undergrowth.
65	*Pellionia heyneana* Wedd.	Pinavur and between Avarkutty and Anakulam in shaded localities; common
66	*Pouzolzia zeylanica* (L.) Benn.	Kunjiar and Tholnada, in partially shaded areas along forest path sides; common.
	NYCTAGINACEAE	
67	*Boerhavia difusa* L.	Pooyamkutty river sides;fairly common.
	AMARANTHACEAE	
68	*Cyathula prostrata* (L.) BI.	Pindimedu, in dry open areas; a fairly common weed.
	POLYGONACEAE	
69	*Polygonum barbatum* L.	Marshy areas along he sides of Kunjiar river; common
70	*Polygonum chinense* L.	Along river sides and in wet areas at Pindimedu, Kunjiar, Saddle dam area, etc.; common.
	DILLENIACEAE	
71	*Dillenia pentagyna* Roxb.	In the dry, reed areas at Tholnada and Pindimedu right bank of the river; rather rare.
	DIPTEROCARPACEAE	
72	*Dipterocarpus bourdillonii* Brandis	River valleys of Kunjiar, Anakulam and below Saddle dam site; an endemic tree of Southern Western Ghats, very rare in the area.
73	*Dipterocarpus indicus* Bedd.	River banks at Pindimedu and Tholnada and in the degraded semievergreen forest patch at Pinavur; an endangered species in the area, endemic to Peninsular India.
74	*Hopea glabra* Wt. et Arn.	River banks of Thuduppi; an endemic species of Southern Western Ghats, highly endangered in the area.
75	*Hopea parviflora* Bedd.	Pinavur disturbed, semievergreen forest patch; a rare, endemic of Southern India

		with only 20-30 trees in the locality.
76	*Vateria indica* L.	Saddle dam area, Kunjiar and Anakulam, confined to valleys and river banks; an endemic tree of Southern Western Ghats, very rare in the locality.
77	*Vateria macrocarpa* Gupta	Anakulam, along river banks and in the valleys; an endemic tree of Southern Western Ghats, very scarce in the locality.
	GUTTIFERAE	
78	*Calophyllum apetalum* Willd.	Tholnada, along the watercourses of Thuduppi river; an endemic tree species of Peninsular India, fairly common here.
79	*Calophyllum austro indicum* Kosterm.	Anakulam and Pindimedu, along the sides of rivers; fairly common.
80	*Calophyllum elatum* Bedd.	Sides of the river between Avarkutty and Anakulam; an endemic tree species of South India, rare in this locality.
81	*Calophyllum inophyllum* L.	Fairly common in the Manikantanchal area.
82	*Garcinia cambogia* (Gaertn.) Desr.	River banks of Kunjiar and at Pindimedu; rare.
83	*Garcinia Morella* (Gaertn.) Desr.	Pindimedu, along the sides of Pooyamkutty river; rare.
84	*Garcinia wightii* T. And.	Along the sides of Thuduppi river; endemic to Peninsular India, rare in the area.
85	*Mesua ferrea* L.	Pindimedu, Avarkutty and Anakulam, along the sides of rivers; rare.
	ELAEOCARPACEAE	
86	*Elaeocarpus serratus* L.	In the open reed and Mikania growing areas of Pindimedu, Tholnada, Kunjiar and Manikantanchal; common.
87	*Elaeocarpus tectorius* (Lour.) Desr.	Pindimedu, in the open reed areas away from water courses; fairly common.
88	*Elaeocarpus tuberculatus* Roxb.	Stream banks at Anakulam and in the open areas at Pindimedu and Tholnada-up; fairly common.
	TILIACEAE	
89	*Grewia emarginata* Buch. – Ham.	Along the sides of Thuduppi river; rare.
90	*Grewia gamblei* J.R.Drumm.	Thuduppi river banks; a highly endemic species of Southern Western Ghats, very rare in the area.
91	*Grewia tilifolia* Vahl	Deciduous forests between meenkuthi and Anakulam; fairly common.
	THEACEAE	
92	*Gordonia obtusa* Wall. ex Wt. et Arn.	Evergreen forests between Anamalai and Manali as undergrowth; an endemic

		species of Peninsular India, very rare in the area.
	STERCULIACEAE	
93	*Helecteris isora* L.	Pindimedu, Tholnada, Anakulam, Pinavur, etc. mainly in open areas; very common.
94	*Leptonychia caudata* (Wall. ex G. Don) Burrett	Banks of Thuduppi river and above Manikantanchal; rare.
95	*Pterospermum suberifolium* (L.) Lamk.	Along forest pathsides, Pindimedu; rare.
96	*Sterculia guttata* Roxb.	Pindimedu, in the river valleys; rare.
	MALVACEAE	
97	*Sida cordifolia* L.	Pindimedu in the open areas along forest pathsides; fairly common.
	MORACEAE	
98	*Artocarpus heterophyllus* Lamk.	Between Anamalai and Manali, along forest path sides; a species native to South- West India, introduced elsewhere in the tropics; rare.
99	*Streblus taxoides* (Heyne) Kurz	Between Meenkuthi and Anakulam, in the bushy areas; common.
	BARRINGTONIACEAE	
100	*Careya arborea* Roxb.	River banks, mainly around Tholnada; fairly common.
	FLACOURTIACEAE	
101	*Casearia esculenta* Roxb.	Pindimedu, in the open areas and along the hedges; fairly common.
102	*Flacourtia indica* (Burm.f.) Merr.	In the dry, open areas between Meenkuthi and Anakulam; rare.
103	*Hydnocarpus alpina* Wt.	Pindimedu, along river sides; fairly common.
104	*Hydnocarpus pentandrus* (Ham.) Oken	Anakulam and Manikantanchal areas, mainly along the sides of water courses; fairly common
	PASSIFLORACEAE	
105	*Passiflora foetida* L.	Hedges around Tholnada; fairly common.
	BEGONIACEAE	
106	*Begonia albo-coccinea* Hook.	Pindimedu and on the way to Anakulam, in damp, shady areas below rocks; a highly endemic species of Southern Western Ghats, very rare and endangered in the area.
107	*Begonia malabarica* Lamk.	Almost thoughout the area, in shaded, wet localities; common.
	BUXACEAE	
108	*Sarcococca pruniformis* Lindl.	Meenkuthi, along the fringes of moist deciduous forests; very rare.
	TETRAMELACEAE	

109	*Tetrameles nudiflora* R. Br.	Huge trees in the forests between Meenkuthi and Anakulam; an endemic tree species of South India, fairly common in the area.
110	*Cleome viscose* L.	Stream –beds of Pooyamkutty river a Pindimedu; fairly common.
	SPOTACEAE	
111	*Isonandra perrottiana* Wt.	In the degraded semievergreen forest patch at Pinavur; a very rare, Penisular Indian endemic in the area.
112	*Madhuca longifolia* (Koen.) Mac Bride var.*longifolia*	Pindimedu, mainly along the right bank of the river; fairly common.
113	*Madhuca longifolia* (Koen.) Mac Bride var. *latiflolia* (Roxb.) Cheval.	Along the banks of Kunjiar up-stream; rare.
114	*Palaquium ellipticum* (Dalz.) Baill.	Anakulam, in the stream beds; a very rare endemic species, fairly common in the upper Ghats namely Manali area.
	EBENACEAE	
115	*Diospyros buxifolia* (Bl.) Hiern	Right bank of Pooyamkutty river at Pindimedu and Tholnada; rare.
116	*Diospyros candolleana* Wt.	In the disturbed semievergreen forest patch at Pinavur; a rare, endemic of Southern India, growing almost endangered in the area.
117	*Diospyros ovalifolia* Wt.	Pindimedu, along the river valleys; an endemic species of Western Ghats, very rare in the area.
	SYMPLOCACEAE	
118	*Symplocos cochinchinensis* (Lour.) Moore	Anakulam, moist deciduous forests; rare.
119	*Symplocos macrocarpa* Wt. ex C.B. Cl.	Anakulam and Manikantachal areas; fairly common, endemic.
120	*Symplocos racemosa* Roxb.	Anakulam river valleys; endemic to Southern India, fairly common in the area.
	ROSACEAE	
121	*Photinia integrifolia* Lindl. Var. *sublanceolata* Miq.	Meenkuthi, open vallies of the Ghat; an Indo- Malayan species, very rare in the area.
122	*Rubus indicus* Thumb.	Anakulam, along hedges; rare.
	RANUNCULACEAE	
123	*Naravelia zeylanica* (L.) A. DC.	Outskirts of the forests near Manali tribal settlements; fairly common.
	CHRYSOBALANACEAE	
124	*Atuna travancorica* (Bedd.) Kosterm.	Thalakkanny area in the river valleys; a highly endemic species of Southern Western Ghats, very rare and endangered in the area.

	MIMOSACEAE	
125	*Acacia torta* (Roxb.) Craib	Pinavur, Pindimedu and Avarkutty, along hedges; very common.
126	*Albizia amara* (Roxb.) Boiv.ssp. amara Brenan	Tholnada up and Thalakkanny areas in the dry forests; rare.
127	*Albizia lebbeck* (L.) Willd.	Saddle dam area in the dry deciduous forests along hill sides; rare.
128	*Albizia odoratissima* (L.f.) Benth.	Pindimedu, in the open river valleys and reed areas; rare.
129	*Mimosa pudica* L.	Weed in the open areas; common.
130	*Mimosa invasia* Mart. Var *inermis* Adelb.	River banks at Meenkuthi, mostly in the soil deposits along river banks; an American weed so far known only from Changanacherry in Central Kerala; very rare.
131	*Xylia xylocarpa* (Roxb.) Taub.	Pindimedu, Avarkutty and Tholnada, in the open rocky areas; fairly common.
	CAESALPINIACEAE	
132	*Bauhinia purpurea* L.	Pindimedu left bank, Tholnada, Saddle dam area and Thalakkanny, along river banks; fairly common.
133	*Bauhinia racemosa* Lamk.	Tholnada, along the river sides; rare.
134	*Cassia fistula* L.	Tholnada, Kathippara and Pindimedu, in dry open localities; fairly common.
135	*Cassia occidentalis* L.	Pindimedu in open areas; a common weed.
136	*Humboldtia brunonis* Wall.	highly endemic species of Southern Western Ghats, very rare and endangered in the area.
137	*Humboldtia vahliana* Wt.	River banks, Pooyamkutty, Thuduppi river, Anakulam, Kunjiar and at the power house site at Pinavur; endemic to Peninsular India, common.
138	*Pterolobium hexapetalum* (Roth) Sant.	Manikantanchal area; a climber endemic to Peninsular India, very rare in the locality
	PAPILIONACEAE	
139	*Abrus precatorius* L.	Hedges along forest pathsides; fairly common.
140	*Butea parviflora* Roxb.	Kunjiar up stream sides; rare
141	*Crotalaria juncea* L.	Pindimedu forest pathsides; weed, fairly common.
142	*Dalbergia benthamii* Prain	Stream sides, above Manikantanchal; a very rare and endangered species firest reported from India in 1986 from Central Kerala (previously known only from Hongkong).
143	*Dalbergia horrida* (Dennst.) Mabb.	Manikantanchal and before Avarkutty; a very rare woody climber, endemic to

		Peninsular India.
144	*Dlabergia latifolia* Roxb.	Tholnada hill tops; rare
145	*Dalbergia sissoides* Grah. ex Wt. et Arn.	Avarkuty in the dry open areas; very rare.
146	*Dalbergia volubilis* Roxb.	Avarkutty, in the dry open areas near rocks; rare.
147	*Desmodium herbaceum* Lindl.	Tholnada, in the open areas; rare
148	*Desmodium heterophyllum* (Willd.) DC.	Tholnada in the rocky areas; fairly common.
149	*Desmodium triangulare* (Retz.) Merr.	Pindimedu, along the dry forest pathsides, rare.
150	*Erythrina stricta* Roxb.	In the dry open forests of Avarkutty and Saddle dam site; very rare.
151	*Flemingia macrophylla* (Willd.) Prain ex Merr.	Between Meenkuthi and Anakulam in the moist deciduous forests; fairly common.
152	*Ormosia travancorica* Bedd.	Along the sides of Kunjiar up-stream; a highly endemic species of the Western Ghats of Kerala, represented by an endangered population in the area.
153	*Pongamia pinnata* (L.) Pierre	Pindimedu, Meenkuthi, Anakulam and Pinavur; rare.
154	*Pterocarpus marsupium* Roxb.	Pindimedu and Tholnada-up; rare
155	*Tephrosia purpurea* (L.) Pers.	Pindimedu, in waste places and along road-sides; common.
	PODOSTEMACEAE	
156	*Polypleurum stylosum* (Wt.) J. B. Hill	In the flowing waters of the riers in the study area; attached to rocks; an Indo-Sri Lankan aquatic species of hill streams, common in the rivers of the project area.
157	*Willisia selaginoides* (Bedd.) Warm. ex Willis	In the swift flowing waterfall sides, Kunjiar; an endemic aquatic of Wesern Ghat hill streams, rare in the area.
	LYTHRACEAE	
158	*Ammania baccifera* L.	River banks, Pindimedu; rare
159	*Lagerstroemia microcarpa* Wt.	River valleys and reed areas at Pindimedu, Tholnada, Avarkutty and Anakulam; fairly common.
160	*Lagerstroemia reginae* Roxb.	Stream sides and valleys, Pindimedu, Kunjiar, etc., fairly common.
	MYRSINACEAE	
161	*Ardisia pauciflora* Heyne	Anamalai to Manali, as undergrowth in the evergreen forests; a highly endemic species of the Western Ghats south of Karnataka, very rare and endangered in this locality.
162	*Ardisia solanacea* Roxb.	Dry forest patches between Manali and

		Meenkuthi; an endemic species of Peninsular India, very rare and endangered in the area
163	*Maesa indica* (Roxb.) DC.	Along hedges bordering the rivulets at Meenkuthi; near the tribal settlements; fairly common.
	MYRTACEAE	
164	*Syzygium caryophyllatum* (L.) Alston	Pooyamkutty river banks at Pindimedu; very rare.
165	*Syzygium cumini* (L.) Skeels	Stream sides, Pinavur and Tholnada ; rare
166	*Syzygium jambos* (L.) Alston	Kunjiar up-stream sides ;rare
167	*Syzygium laetum* (Ham.) Gandhi	Between Avarkutty and Anakulam, along stream sides; an endemic species of Southern Western Ghats, very rare and endangered in the area.
168	*Syzygium mundagam* (Bourd.) Chithra	Between Avarkutty and Anakulam, along river sides; a highly endemic species of the evergreen forests of the Western Ghats of Kerala, represented in the project area by an endangered population of 3-4 trees only.
169	*Syzygium occidentale* (Bourd.) Gandhi	Pindimedu, along the river banks; a highly endemic tree to Southern Western Ghats, represented in the area by an endangered population of 6-7 individuals.
170	*Syzygium munronii* (Wt.) Chandr.	Along the river sides and in the densely forested valleys between Meenkuthi and Anakulam; an endemic tree of Peninsular India, very rare in the locality.
	MELASTOMATACEAE	
171	*Memecylon heyneanum* Benth.	Kunjiar valleys, in the moist deciduous forests; fairly common.
172	*Memecylon malabaricum* (C.B.Cl.) Cogn.	Dry , rocky areas of the right bank of Pooyamkutty river at Pindimedu; a Peninsular Indian endemic species, fairly common in the area.
173	*Memecylon umbellatum* Burm. f.	Tholnada , Saddle dam site, Pinavur, etc.; common
174	*Osbeckia aspera* Bl.	Kunjiar and Anakulam areas, in the openings along river banks; fairly common.
175	*Osbeckia zeylanica* L.f.	Kunjiar up-stream banks, in open areas; fairly common.
176	*Sonerila brunonis* L.	Anakulam, along the sides of rocks in wet, humid areas; rare.
177	*Sonerila elegans* Wt.	Shaded rock sides, Avarkutty to Anakulam; a fairly common endemic herb of Peninsular India.

178	*Sonerila speciosa* Zenk.	Meenkuthi to Anakulam in the moist deciduous forests; herbs, endemic to Western Ghats of Peninsular India, very rare and endangered in this locality.
179	*Sonerila versicolor* Wt. var. axillaries Gamble	Kunjiar river valleys; very rare, endemic to Southern India.
180	*Sonerila wallichii* Benn.	Pindimedu, along the shaded sides of rocks; a rare species in the area, endemic to Southern India.
	COMBRETACEAE	
181	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd.	Drier parts of the forests between Manali and Anakulam; rare.
182	*Terminalia gella* Dalz.	Pindimedu in the reed areas and river valleys; rare.
183	*Terminalia paniculata* Roxb. ex Roth	Kunjiar valleys, Tholnada hill top, Pinavur semievergren forest patch, etc.; an endemic species of Peninsular India, fairly common in this locality.
	CORNACEAE	
184	*Mastixia arborea* (Wt.) Bedd.	Kunjiar, Anakulam, Thalakkanny and Manikantanchal moist deciduous forests; rare, endemic to Peninsular India.
185	*Mastixia arborea* (Wt.) Bedd. var. *meziana* (Wang.) Matthew	Pindimedu, along the right bank of Pooyamkutty river and Manikantanchal moist deciduous forests; a very rare taxon, endemic to South India.
	SANTALACEAE	
186	*Scleropyrum pentandrum* (Dennst.) Mabb.	Sides of Thuduppi river below Thuduppi falls; endemic to Peninsular India and Sri Lanka, very rare and endangered in the area.
187	*Viscum orientale* Willd.	Along the banks of Thuduppi river, as parasitic on Helicteris isora bushes; rare.
188	*Dendrophthoe falcata* (L.f) Etting	Parasitic on trees boardering Kunjiar river; fairly common.
189	*Scurrula cordifolia* (Wall.) G. Don	Parasitic on trees in the Tholnada area; rare
	CELASTRACEAE	
190	*Bhesa indica* (Bedd.) Ding Hou	Semievergreen forest pockets between Meenkuthi and Anakulam; a highly endemic huge tree species, endangered in the locality and represented by 4-6 individuals only.
191	*Celastrus paniculata* Willd.	Manali to Anakulam in the deciduous forests; rare.

192	*Euonymous dichotomus* Heyne ex Roxb.	Anakulam moist deciduous areas; rare.
193	*Lophopetalum wightianum* Arn.	Pindimedu, in the river valleys; endemic to Peninsular India, very rare in the area.
194	*Microtropis latifolia* Wt.	Manali to Meenkuthi, in the moist deciduous forests; highly endemic species of the Southern Western Ghats from Karnataka southwards, very rare and endangered in the area.
	ICACINACEAE	
195	*Gomphandra coriacea* Wt.	Above Thuduppi falls, along river sides; a highly endemic species of Southern Peninsular India, endangered in the area.
196	*Gomphandra tetrandra* (Wall. ex Roxb.) Sleum.	Stream sides , above Thuduppi falls; rare.
	DICHAPETALACEAE	
197	*Dichapetalum gelonoides* (Roxb.) Engler	Reed areas between Kunjiar and Koompanpara; rare.
	EUPHORBIACEAE	
198	*Agrostistachys indica* Dalz.	Pindimedu, Tholnada and Aanakulam, as undergrowth in the stream side vegetation; an endemic species of Peninsular India, very rare in the area.
199	*Agrostistachys meeboldii* Paz et K. Hoffm.	Anakulam, degraded semievergreen forests; fairly common.
200	*Antidesmà bunius* (L.) Spreng.	Pindimedu, sides of the river; common.
201	*Antidesma menasu* Miq. ex Tul.	Tholnada and Kunjiar, river banks; fairly common.
202	*Aporosa acuminata* Thw.	Pindimedu, right bank of Pooyamkutty river and Anakulam; fairly common.
203	*Aporosa lindleyana* (Wt.) Baill.	Kunjiar, Anakulam, Pindimedu right bank, etc.; fairly common.
204	*Baccaurea courtallensis* (Wt.) Muell.-Arg.	Anakulam, Pinavur, Kunjiar and around Saddle dam site; an endemic species of Peninsular India, fairly common throughout the area.
205	*Blackia calycina* Benth.	Anakulam, semievergreen forests; fairly common.
206	*Breynia rhamnoides* (Retz.) Muell.-Arg.	Anakulam, along hedges; rare.
207	*Bridelia scandens* (Roxb.) Willd.	Tholnada and Kunjiar river sides; fairly common.
208	*Croton bonplandianum* Baill.	Manali tribal settlement area, near cultivated lands; rare.
209	*Drypetes oblongifolia* (Bedd.) Airy Shaw	Anakulam, moist deciduous forests; an endemic species of Peninsular India, very rare in the area.

210	*Emblica officinalis* Gaertn.	Pindimedu, right bank of Pooyamkutty river; fairly common.
211	*Epiprinus mallotiformis* (Muell.-Arg) Croizat	Anakulam, semievergreen forests; a species endemic to Peninsular India, very rare in the area.
212	*Glochidion ellipticum* Wt.	Anakulam semievergreen forests; a Peninsular Indian endemic, very rare in the project area.
213	*Glochidion zeylanicum* (Gaertn.) Juss.	Pinavur, degraded semievergreen forest patch; rare.
214	*Homonoia riparia* Lour.	Throughout, along the river banks; very common.
215_	*Kirganelia reticulata* (Poir.) Baill.	Tholnada, along forest pathsides; fairly common
216	*Macaranga peltata* (Roxb.) Muell.-Arg.	Throughout, in disturbed, reed areas; common
217	*Mallotus philippensis* (Lamk.) Muell.-Arg.	Pindimedu, right bank of Pooyamkutty river and Pinavur degraded semievergreen forests; common.
218	*Phyllanthus debilis* Klein ex Willd.	In the open areas between Manali and Meenkuthi; rare.
219	*Securinega leucopyrus* (Willd.) Muell.-Arg.	Pindimedu, right bank of the river; fairly common.
220	*Tragia involucrata* L.	Tholnada, Kunjiar and Pinavur, in open places; common.
	RHAMNACEAE	
221	*Ziziphus oenoplia* (L.) Mill	Below Kathippara and Pindimedu in dry, rocky areas; fairly common along hedges.
222	*Ziziphus zylopyrus* (Retz.) Willd.	Pindimedu, dry, right bank of the river; fairly common.
	LEEACEAE	
223	*Leea indica* (Burm.f.) Merr.	Tholnada and Pinavur; fairly common.
	VITACEAE	
224	*Cissus quadrangularis* L.	Pindimedu, along hedges; fairly common.
225	*Cissus repens* Lamk.	Streamsides of Saddle dam area; rare.
226	*Tetrastigma lanceolarium* (Roxb.) Planch.	Pinavur, disturbed semievergreen forests; fairly common.
	STAPHYLEACEAE	
227	*Turpinia malabarica* Gamble	Along the slopes between Meenkuthi and Anakulam, more towards Anakulam side; an endemic tree species of South India, fairly common in the area.
	CONNARACEAE	
228	*Connarus monocarpus* L.	Pindimedu, right bank of Pooyamkutty river; rare.
229	*Connarus wightii* Hook.f.	Pindimedu, right bank of the river; an

		endemic species of Southern Peninsular India, very rare in the dry places of this region.
	SAPINDACEAE	
230	*Dimocarpus longan* Lour.	Pinavur degraded semievergreen forests; rare.
231	*Lepisanthes tetraphylla* (Vahl) Radlk.	Anakulam, moist deciduous forests; rare.
232	*Otonephelium stipulaceum* (Bedd.) Radlk.	Tholnada and Anakulam in the moist deciduous forests; an endemic tree of Peninsular India, very rare at Pooyamkutty.
233	*Sapindus laurifolius* Vahl	Way to Mankulam from Anakulam, along forest path sides; rare.
234	*Schleichera oleosa* (Lour.) Oken	Pinavur and around Saddle dam site; rare.
	BURSERACEAE	
235	*Canarium strictum* Roxb.	Anakulam semievergreen forests; a very rare species, endemic to Peninsular India.
	RUTACEAE	
236	*Acronychia pedunculata* (L.) Miq.	Anakulam, in the degraded semi-evergreen forest; rare.
237	*Clausena dentate* (Willd.) Roem. et Schult.	Forests between Meenkuthi and Anakulam; rare.
238	*Glycosmis arborea* (Roxb.) DC.	Pindimedu, forest pathsides; rare.
239	*Toddalia asiatica* (L.) Lamk.	Anakulam, along the hedges; fairly common
240	*Zanthozylum rhetsa* (Roxb.) DC.	Anakulam and Avarkutty, in reed areas; rare.
	MELIACEAE	
241	*Aglaia barberi* Gamble	Saddle dam area in the open forests; a highly endemic species of the Southern Western Ghats represented by a very endangered population of two trees in the area.
242	*Aglaia elaegnoidea* (Juss.) Benth.	Deciduous forests along the slopes between Meenkuthi and Anakulam; rare.
243	*Aphanamixis polystachya* (Wall.) Parker	Pindimedu and above Manikantanchal, in the deciduous forests; very rare.
244	*Cipadessa baccifera* (Roth) Miq.	In the deciduous forests between Meenkuthi and Anakulam; rare.
245	*Dysoxylum malabaricum* Bedd. ex Hiern	Anakulam, semievergreens; a species endemic to Southern Western Ghats, very rare in the area.
246	*Toona ciliata* M. Roem.	Pinavur disturbed semievergreen forests; rare.

247	*Trichilia connaroides* (Wt. et Arn.) Bent.	Pindimedu, in the river beds; rare.
	OXALIDACEAE	
248	*Biophytum sensitivum* (L.) DC.	Pinidimedu, wet sides of rocks; fairly common.
	BALSAMINACEAE	
249	*Impatiens chinensis* L.	Kunjiar and Pindimedu, in wet places; fairly common during post monsoon months.
250	*Impatiens cordata* Wt.	Anakulam, in shady, wet areas; an endemic species of Peninsular India, fairly common in the locality.
251	*Impatiens maculata* Wt.	Anakulam, in shaded, damp areas; an endemic herb of South India, rare in the area.
252	*Impatiens scapiflora* Heyne	Pindimedu, and Kunjiar in wet, shaded areas; a herb endemic to South India, fairly common in the locality.
253	*Impatiens grandis* Heyne ex Wall.	In the evergreen forest floor, near path sides between Anamalai and Manali; a Peninsular Indian endemic balsam, rare in the locality.
	XANTHOPHYLLACEAE	
254	*Xanthophyllum flavescens* Roxb.	Pinavur and Anakulam, as undergrowth in moist deciduous forest; fairly common.
	LILIACEAE	
255	*Chlorophytum laxum* R. Br.	In the open areas at Manali; fairly common.
	UMBELLIFERAE	
256	*Centella asiatica* (L.) Urb.	Pindimedu, along wet sides of rocks; fairly common.
257	*Hydrocotyle javanica* Thunb.	Way to Anakulam in deeply shaded, wet sides of rocks; fairly common.
	LOGANIACEAE	
258	*Strychnos nux-vomica* L.	Pindimedu, banks of the river; rare.
259	*Stychnos potatorum* L.f.	Anakulam, along hedges; rare.

	POTALIACEAE	
260	*Fagraea ceilanica* Thunb	Pindimedu, below Metnappara and in the Anakulam area; fairly common.
261	*Strychnos potatorum* L.f.	Meenkuthi to Anakulam in dry, open areas; rare.
	SOLANACEAE	
262	*Rauvolfia sepentina* Benth. ex Kurz	Way to Metnappara, along the sides of the hillock in cultivated land; very rare and endangered Indian endemic.
263	*Solanum erianthum* D. Don	Pindimedu, in dry, open areas; fairly common
264	*Solanum torvum* Sw.	Pindimedu, in open areas; fairly common.
	BORAGINACEAE	
265	*Cynoglossum zeylanicum* (Hornem.) Thumb. ex Lehm.	Way sides from Avarkutty to Anakulam; rare, endemic of South India and Sri Lanka.
	EHRETIACEAE	
266	*Rotula aquatica* Lour.	Pindimedu, Kunjiar and other water courses in the area, in rock crevices; a very common shrub in the area, endemic to Peninsular India and Sri Lanka.
267	*Agrostemma rostratum* Wall.	Forest floor between Anamalai and Manali; a species earlier known from North-East India and recorded from Neriamangalam, Idukki District, Kerala in 1968, very rare and endangered in the area.
268	*Anisomeles malabarica* (L.) R. Br. ex Sims.	Meenkuthi, open areas near tribal settlements; common.
269	*Gomphostemma keralensis* Vivek., Gopal.et Ansari	Forest floor between Anamalai and Manali; a species recently described from Idukki, very are and endangered in the area.
270	*Leucas aspera* (Willd.) Linik	Open areas near the tribal settlements at Manali and Meenkuthi; common.
271	*Pogostemon paniculatus* (Willd.) Benth.	In the open dry areas of Manali and Meenkuthi tribal settlements; fairly common.
	VERBENACEAE	
272	*Callicarpa tomentosa* (L.) Murr.	Below the Koompanpara Saddle dam mount, in reed areas; fairly common.

273	*Clerodendrum viscosum* Vent.	Tholnada, in waste places; fairly common.
274	*Gmelina arborea* Roxb.	Avarkutty, forest path sides; rare.
275	*Lantana camara* L. var. *aculeata* Mold.	Pindimedu, along hedges; common.
276	*Premna tomentosa* Willd.	Tholnada, in reed areas; rare.
277	*Tectona grandis* L.f.	Growing wild in the Tholnada and Pindimedu area, in the deciduous forests; rare.
278	*Vitex altisima* L.f.	Pindimedu, Tholnada and below Metnappara hillock; fairly common.
279	*Vitex negundo* L.f.	Tholnada, open areas; rare.
	LABIATAE	
280	*Anisomeles malabarica* (L.) R. Br. ex Sims.	Pindimedu in rocky areas; fairly common
281	*Hyptis suaveolens* (L.) Poit.	Pindimedu, in dry, rocky areas; a common weed.
282	*Gomphostemma keralensis* Vivek., Gopal. et Ansari	Towards Anakulam side from Avarkutty, as a shade loving species along the wet sides of rocks; a highly endemic species so far known only from Idukki, endangered in the locality.
283	*Pogostemon paniculatus* (Willd.) Benth.	Pindimedu, in open dry areas; common.
	OLEACEAE	
284	*Chionanthus mala-elengi* (Dennst.) P. S. Green	Pindimedu and Kunjiar river valleys; an endemic tree of Peninsular India, fairly common in the locality.
285	*Jasminum malabaricum* Wt.	Tholnada and along the sides of Thuduppi river above; a wild species of jasmine, endemic to Peninsular India, fairly common in the area.
286	*Jasminum rottlerianum* Wall. ex DC.	Pinavur semievergreen forest patch and Manikantanchal forest outskirts; endemic to Peninsular India, rare in the area.
287	*Olea dioica* Roxb.	Pindimedu, right bank of the river and Tholnada- up; fairly common.
	SCROPHULARIACEAE	
288	*Scoparia dulcis* L.	Pindimedu, waste places; common.
289	*Striga angustifolia* (Don) Saldanha	Pindimedu, river deltas; rare.
	GESNERIACEAE	
290	*Scoparia dulcis* L.	Pindimedu, waste places; common.

291	*Striga angustifolia* (Don) Saldanha	Pindimedu, river deltas; rare.
292	*Aeschynanthus perrottetii* A. DC.	Pindimedu, as epiphytic on trees; a very rare and endangered species in the area, endemic to Peninsular India.
293	*Rhynchoglossum notonianum* (Willd.) Burtt	Pindimedu, river banks; very rare.
294	*Rhynchotechum permolle* (Nees) Burtt	Anakulam, in shaded, wet areas; rare.
295	*Gymnostachyum febrifugum* Benth.	Avarkutty, Kunjiar and Anakulam; very rare along shaded, humid, forest path sides; endemic to Peninsular India.
296	*Gymnostachyum latifolium* (Dalz.) T. Anders.	Mankulam, along forest pathsides; very rare in the area; an endemic species of Peninsular India, very rare and endangered in the area.
297	*Justicia betonica* L.	Anakulam, shaded forest floor; rare.
298	*Justicia wynaadensis* (Nees) T. Anders.	Pinavur disturbed semievergreen forests; a highly endemic species of Peninsular India, very rare and endangered in the area.
	CAMPANULACEAE	
299	*Lobelia nicotianaefolia Roem.* et Schult. Var. trichandra Wt.	Forest outskirts, Anakulam; fairly common.
	RUBIACEAE	
300	*Agrostemma rostratum* Wall.	Anakulam semievergreen areas, in shade; a species known from North-East India and recently (1968) reported from Neriamangalm, very rare in the area.
301	*Chassalia curviflora* (Wall.) Craib var. *ophioxyloides* (Wall.) Deb et Krishna	Shaded, wet, forest pathsides at Anakulam; rare.
302	*Hedyotis umbellata* (L.) Lamk.	Open areas at Manali and Meenkuthi, mostly in wet localities; fairly common
303	*Ixora arborea* Roxb. ex J.E. Sm.	Pindimedu, along river banks; fairly common.
304	*Ixora nigricans* R. Br.	Pindimedu and Pinavur areas; fairly common.
305	*Ixora pavetta* Andrews	Kunjiar and Saddle dam area; rare.
306	*Mussaenda laxa* (Hook.f.) Hutch. ex Gamble	Tholnada, along river side hedges; an endemic species of Peninsular India, rare in the locality.
307	*Ophiorrhiza eriantha* Wt.	Pinavur, Semi evergreen forests, as part of the ground flora; endemic to Peninsular India, rare in the area.
308	*Ophiorrhiza mungos* L.	Pindimedu, way to Anakulam and elsewhere in shade; fairly common.
309	*Pavetta calophylla* Bremek.	Undergrowth in the evergreen forests of

		Anamalai; a rare, endemic shrub of Peninsular India, endangered in this locality.
310	*Pavetta zeylanica* Gamble	Below Metnappara hillock; a species endemic to Peninsular India, very rare in the area.
311	*Psychotria barberi* Gamble	Evergreen forests at Anamalai in shaded, humid areas; a highly endemic shrub of Southern Western Gahts represented by an endangered population of 5-10 plants in the area.
312	*Psychotria congesta* (Wt. ex Arn.) Hook. f.	Forests adjoining Thuduppi falls; Peninsular Indian endemic, very rare in the area.
313	*Psychotria connata* Wall. ex Roxb.	Pindimedu and Thuduppi areas; endemic to Peninsular India, very rare in the locality.
314	*Psychotria dalzellii* Hook. f.	Anakulam semievergreen forests as undergrowth; endemic to Peninsular India, very rare and endangered in the area.
315	*Psychotria johnsonii* Hook. f.	Tholnada, towards the upper side of the ghat; endemic to Peninsular India, very rare in the locality.
316	*Psychotria nigra* (Gaertn.) Alston	Saddle dam area in shades; rare
317	*Psychotria nudiflora* Wt. et Arn.	Tholnada and along the banks of Thuduppi river in shade; an endemic of South India, very rare in the locality.
318	*Psychotria octosulcata* Talbot	Tholnada, along the shaded stream sides; a rare species in the area, endemic to Peninsular India.
319	*Psychotria anamallayana* Bedd.	Evergreen forests and tribal cardmon cultivation areas near Manali; a highly endemic species of Southern Western Ghats, very rare and endangered in the area.
320	*Randia dumetorum* (Thumb.) Poir.	Anakulam, outskirts of the forests; fairly common.
321	*Wendlandia bicuspidata* Wt. et Arn	Anakulam, in open areas; very rare in this area, but very common in the upper ghat like Manali.
	COMPOSITAE	
322	*Blainvillea acmella* (L.) Philipson	Weed, in Pindimedu waste places; fairly common.
323	*Blumea lacera* (Burm.f.) DC.	Waste places, Pindimedu; rare,weed.
324	*Blumea mollis* (D. Don) Merr.	Forests near Manali, in shade; rare.
325	*Crassocephalum crepidioides* (Benth.)	Shaded, wet localities between Anamalai

	S. Moore	and Manali, in semi evergreen forests; a weed, rare in the area.
326	*Chromolaena odorata* (L.) King et Robinson	Tholnada, along hedges; a common exotic weed.
327	*Erigeron karvinskianus* DC.	In shaded areas of the forest between Meenkuthi and Anakulam; rare.
328	*Elephantopus scaber* L.	Pindimedu, open waste places; fairly common.
329	*Emilia sonchifolia* (L.) DC.	Pindimedu, forest path sides; common.
330	*Gynura lycoperscifolia* DC.	In the forest floor near Meenkuthi; rare.
331	*Mikania micrantha* H.B.K.	Throughout, especially in open, reed areas; most common.
332	*Tridax procumbens* L.	Pindimedu, waste places; common.
333	*Vernonia arborea* Ham.	Throughout, in open, reed growing areas; the endemic tree composit of South India, very common here.
334	*Vicoa indica* (L.) DC.	Throughout, in open, reed growing areas; the endemic tree composit of South India, very common here. Thuduppi, open weed areas; common.
335	*Amischophacelus axillaries* (L.) Rolla Rao et Kammathy	Forests around Manali tribal settlements; fairly common.
336	*Aclisia secundiflora* (Bl.) Bakh.f.	Above Thuduppi falls; rare.
337	*Aneilema ovalifolium* (Wt.) Hook.f. ex C.B. Cl.	Pindimedu in wet places; fairly common.
338	*Commelina benghalensis* L.	Pindimedu, river sides and wet areas; common.
339	*Commelina diffusa* Burm.f.	Wet localities, Pindimedu; fairly common.
340	*Commelina paludosa* Bl.	Tholnada, in shaded, wet areas; common.
	ERIOCAULACEAE	
341	Eriocaulon quinquangulare L.	Thuduppi, river deltas; common.
	CYPERACEAE	
342	*Bulbostylis barbata* (Rottb.) C.B. Cl.	Pindimedu, waste places; fairly common.
343	Cyperus exaltatus Retz.	Pindimedu, dry forest path sides; fairly common
344	*Cyperus tenuispica* Steud.	Metnappara hill sides, in disturbed areas; common.
345	*Fimbristylis dichotoma* (L.) Vahl.	Pindimedu, open waste areas; fairly common.
	GRAMINEAE	
346	*Centothecca latifolia* (Osbeck.) Trim.	Anakulam, in the semievergreen forests; rare.
347	*Chloris barbata* Sw.	Pindimedu, dry path sides; fairly common

348	*Coix lacryma*-jobi L.	Temporary deltas of Thuduppi river above Tholnada; very rare.
349	*Cymbopogon caesius* (Hook.f.et Arn.) Stapf	Tholnada, in open areas; common.
350	*Cynodon dactylon* (L.) Pers.	Pindimedu, dry open areas; fairly common.
351	*Digitaria ciliaris* (Retz.) Koen.	Pindimedu, dry, rocky open areas; common.
352	*Eragrostis uniloides* (Retz.) Nees ex Steud.	Pindimedu, forest path sides; fairly common
353	*Panicum repens* L.	Kunjiar river deltas; common.
354	*Bambusa arundinacea* (Retz.) Roxb.	Saddle dam site, in open areas; fairly common.
355	*Ochlandra travancorica* Benth. ex Gamble.	Throughout the project area; most common.
	MUSACEAE	
356	*Ensete superbum* (Roxb.) Cheesm.	Between Avarkutty and Anakulam in semievergreen forests, along river banks and in watersheds; an endemic species of Peninsular India, rare in the area.
	ZINGIBERACEAE	
357	*Alpinia malaccensis* (Burm.f) Roxb.	Forest pathsides, Pindimedu to Kunjiar and Avarkutty to Anakulam; common.
358	*Amomum cannicarpum* (Wt.) Benth.	Forest pathsides and river valleys on the way to Anakulam; fairly common.
359	*Elettaria cardamomum* (L.) Manton	Along the sides of rivers in deeply shaded areas on the way to Anakulam; rare.
	COSTACEAE	
360	*Costus speciosus* (Koenig) Smith	Throughout, along forest path sides; common.
	MARANTACEAE	
361	*Schumannianthus virgatus* (Roxb.) Rolfe	Throughout in open areas; very common.
	PALMAE	
362	*Calamus thwaitesii* Becc.	Pinavur, Kunjiar stream sides and on the way to Anakulam; an endemic species of Peninsular India, fairly common in the area.
	PONTEDERIACEAE	
363	*Monochoria vaginalis* (Burm.f.) Persl.	Thuduppi river banks; rare.
	PANDANACEAE	
364	*Pandanus fascicularis* Lamk.	In the watersheds between Anamalai and Manali; fairly common alon the deeply shaded sides of the ravines.
365	*Rhaphidophora lacinata* (Burm.f.)	Tholnada, as climbers on riverside trees;

	Merr.	very rare.
366	*Remusatia vivipara* (Lodd.) Schott	Pindimedu, in the debris deposited along the sides of rocks; very rare.
	HYPOXIDACEAE	
367	*Curculigo orchioides* Gaertn.	Tholnada, in open areas; rare.
368	*Molineria trichocarpa* (Wt.) Balakr.	Tholnada, in open areas, along with grasses; rare.
	SMILACACEAE	
369	*Smilax zeylanica* L.	Below the Saddle dam site and aljng the right bank of the river at Pindimedu; fairly common.
	DIOSCOREACEAE	
370	*Dioscorea oppositifolia* L.	Along the hedges at Pindimedu, on the way to Anakulam, etc.; fairly common.
371	*Dioscorea pentaphylla* L.	Pinavur and on the way to Anakulam, along the hedges; fairly common.
	ORCHIDACEAE	
372	*Bulbophyllum fimbriatum* (Lindl.) Reichb.f.	Epiphytic on trees around Tholnada; an endemic orchid of Peninsular India, fairly common in the area.
373	*Bulbophyllum fischeri* Seidenfaden	Tholnada, as epiphytic on riverside trees; rare.
374	*Bulbophyllum neilgherense* Wt.	Pindimedu and Tholnada, as epiphytic of river bank trees; rare, endemic to Peninsular India.
375	*Cleisostoma tenerum* Hook. f.	Between Pindimedu and Tholnada, as epiphytic on river side trees; a highly endemic orchid, confined to Southern Western Ghats, very rare and endangered in the area.
376	*Dendrobium barbatulum* Lindl.	Between Tholnada and Avarkutty in dry areas; and endemic species of Peninsular India, rare in the locality.
377	*Dendrobium herbaceum* Lindl.	Tholnada, as epiphytic on river side trees; rare.
378	*Dendrobium macrostachyum* Lindl.	Saddle dam area and Anakulam, as epiphytic on river side trees; fairly common.
379	*Dendrobium ovatum* (Willd.) Kranz.	Tholnada, as epiphytic on trees; very rare, endemic to Peninsular India.
380	*Luisia zeylanica* Lindl.	Pindimedu and below Metnappara, along Thuduppi river sides; rare
381	*Pholidota pallida* Lindl.	Tholnada, as epiphytic on riverine trees; rare.
382	*Podochilus malabaricus* Wt.	Tholnada, as epiphytic on river bank trees; rare.
383	*Sirhookeria latifolia* (Wt.) O. Ktze.	Between Tholnada and Avarkutty and along Thuduppi river banks, as epiphytic on trees; an endemic orchid of Peninsular India, fairly common in the

		area.
384	*Terniola zeylanica* Tub.	Koompanpara Saddle dam area, as epiphytic on trees;
385	*Vanda tessellata* (Roxb.) Hook. ex G. Don	Tholnada, Kunjiar and Avarkutty, as epiphytic on trees; rare.

LIST OF FAUNA IN MALAYATTUR HIGH VALUE BIODIVERSITY AREA

Mammals

Sl. No.	Common Name	Scientific Name
1	Slender Loris	*Loris tardigradus malabaricus* Wroughton
2	Bonnet macaque	*Macaca radiata radiata* E. Geoffroy
3	Jungle cat	*Felis chaus* Schreber
4	Tiger	*Panthera tigris tigris* Linnaeus
5	Leopard	*Panthera pardus* Linnaeus
6	Small Indian civet	*Viverricula indica* Desmarest
7	Toddy cat	*Paradoxurus hermaphroditus* Pallas
8	Common mangoose	*Herpestes edwardsii* Geoffroy & Hilliare
9	Ruddy mangoose	*Herpestes smithii smithi* Gray
10	Brown mangoose	*Herpestes fuscus fuscus* Waterhouse
11	Wild dog	*Cuon alpinus Laniger*
12	Indian flying fox	*Pteropus gigantius* Brunnich
13	Indian false vampire	*Megaderma lyra* Linnaeus
14	Short nosed fruit bat	*Cynoptures sphinix*
15	Great eastern horseshoe bat	*Rhinolophus luctus*
16	Indian pipistrelle	*Pipistrellus coromandra*
17	Jungle striped palm squirrel	*Funambulus tristriatus*
18	The striped palm squirrel	*Funambulus palmarum*
19	Malabar giant squirrel	*Ratufa indica maxima*
20	Small travancore flying squirrel	*Petinomys fuscocapillus*
21	Indian field mouse	*Mus booduga*
22	Indian more rat	*Bandicota bengalensis*
23	Bandicoot rat	*Bandicota indica*
24	Indian Bush rat	*Galunda ellioti*
25	Common house rat	*Rattus rattus*
26	House mouse	*Mus musculus*
27	The brown rat	*Rattus norvegicus*
28	Indian porcupine	*Hystrix indica*
29	Elephant	*Elephas maximus maximus*
30	Sambar	*Cervus unicolor*
31	Barking deer	*Muntiacus muntjac*
32	Mouse deer	*Tragulus meminna*
33	Wild boar	*Sus scrofa*
34	Indian pangolin	*Manis crassicaudata*
35	Lion-tailed macaque	*Macaca silenus* Linnaeus
36	Nilgiri tahr	*Nilgiritragus hylocrius*
37	Gaur	*Bos gaurus* H.Smith
38	Spotted Deer	*Axix axis*

Reptiles

Sl. No.	Common Name	Scientific Name
EMYDIADAE		
1	Indian pond terrapin	*Melanochelys trijuga*
TRIONYCHIDAE		
2	Travancore tortoise	*Indotestudo forstenii*
GECKONIDAE		
3	Southern house gecko	*Hemidactylus frenatus*
4	Spotted gecko	*Hemidactylus brooki*
5	Bark gecko	*Hemidactylus leschenaulti*
SCINCIDAE		
6	Common skink	*Mabuya carinata*
7	Bronze grass skink	*Mabuya macularia*
8	Slender hill skink	*Sphenomophus dussumieri*
AGAMIDAE		
9	Elliote's lizard	*Calotes elliotti*
10	Common garden lizard	*Calotes versicolor*
11	South Indian flying lizard	*Draco dussumiery*
VARANIDAE		
12	Indian monitor lizard	*Varanus bengalensis*
CHAMAELEONIDAE		
13	Indian chameleon	*Chameleo ceylanicus*
UROPELITIDAE		
14	Ceylon uropeltid	*Uropeltis ceylanicus*
BOIDAE		
15	Common sand boa	*Eryx conicus*
16	Indian python	*Python molurus*
COLUBRIDAE		
17	Common green whip snake	*Ahaetullanasuta*
18	Striped keel back	*Amphiesma stolata*
19	Ceylon cat snake	*Boiga ceylonensis*
20	Foresten's cat snake	*Boiga forstenii*
21	Rat snake	*Coluber mucosus*
22	Common trinket snake	*Elaphe helena*
23	Travancore wolf snake	*Lycodon travancoricus*
24	Checkered keel back	*Xenochrophis piscator*
ELAPIDAE		
25	Cobra	*Naja naja*
26	Common krait	*Bangarus caeruleus*
27	Bibron's coral snake	*Calliophis bibroni*
VIPERIDAE		
27	Rusel's viper	*Vipera russelli*
28	Humpnosed pit viper	*Hypnale hypnale*
29	Malabar pit viper	*Trimeresurus malabaricus*

Amphibians

Sl. No.	Common name	Scientific Name
		BUFONIDAE
1.	Common Asian toad	*Bufo melanostictus* Schneider
2	Small eared toad	*Bufo microtympanum* Boulenger
3		*Bufo fergusonii*
		MICROHYLIDAE
4		*Microhyla omata*
5		*Melanobatrachus indicus*
		RANIDAE
6	Beddome's frog	*Indirana beddomii* Gunther
7	Short webbed frog	*Indirana brevipalmata* peter
8	Small handed frog	*Indirana semipalmata* Boulenger
9	Kerala warty frog	*Limnonectes keralensis* Dubois
10	Cricket frog	*Limnonectes limnocharis* Boie in Weimann
11	Indian green frog	*Euphylictis hexadactylus* Lesson
12	Indian skipping frog	*Euphlyctis cyanophlyctis* Schneider
13	Indian bull frog	*Hoplobatranchus tigerinus* Daudin
14	Bronze frog	*Rana temporalis* Gunther
15		*Rana* hexadactyla
16		*Rana cyanophlytctis*
17		*Rana keralensis*
18		*Rana limnocharis*
19		*Rana semipalmata*
20		*Rana aurentica*
21		*Rana beddomii*
22	Fungoid frog	*Rana malabarica*
23		*Tomopterna rufescence*
24	Large wrinkled frog	*Nyctibatrachus major* Boulenger
25		*Micrixalus nudis*
		RHACOPHORIDAE
26		*Polypedatus maculatus*
27	Malabar Flying Frog	*Rhacophorus malabaricus*

Birds

Sl. No.	Common Name	Scientific Name
1	Little Grebe	*Trachybaptus ruficollis*
2	Little cormorant	*Phalacrocorax niger*
3	Indian Shag	*Phalacrocorax fuscicollis*
4	Cormorant	*Phalacroccrax carbo*
5	Darter or Snake Bird	*Anhinga rufa*
6	Grey Heron	*Ardea cinerea*
7	Purple Heron	*Andea purpurea*
8	Little Green Heron	*Ardeola striatus*
9	Pond Heron or Paddy Bird	*Ardeola grayii*
10	Cattle Egret	*Bubulcus ibis*
11	Large Egret	*Andea alba*
12	Smaller Egret	*Egretta intermedia*
13	Little Egret	*Egretta garzetta*
14	Night Heron	*Nycticorax nycticorax*
15	Chestnut Bittern	*Ixobrychus cinnamomeus*
16	Malay or Tiger Bittern	*Gorsachius melanolophus*
17	Yellow Bittern	*Ixobrychus sinensis*
18	Black Bittern	Ixobrychus flavicollis
19	Open bill Stork	*Anastomus oscitans*
20	White necked Stork	Ciconia episcopus
21	Pintail Duck	*Anas acuta*
22	Spot bill Duck	*Anas poecilorhyncha*
23	Garganey	*Anas querquedula*
24	Black winged Kite	*Elanus caeruleus vociferus*
25	Black Crested Baza	*Aviceda leuphotes*
26	Honey Buzzard	*Pernus ptilorhyncus*
27	Pariah Kite	*Milvus migrans govinda*
28	Brahminy Kite	*Haliastur Indus*
29	Shikra	*Accipiter badius batleri*
30	Crested Goshawk	*Accipiter trivirgatus*
31	Sparrow -Hawk	*Accipiter niscus*
32	Besra Sparrow- Hawk	*Accipiter virgatus*
33	Crested Hawk- Eagle	*Spizactus cirrhatus*
34	Bonelli's Eagle	*Hieraaetus fascatus*
35	Booted Hawk- Eagle	*Hieraaetus pennatus*
36	Black Eagle	*Ictinaetus malayensis*
37	Grey Headed Fishing Eagle	*Ichthyophaga ichthyaetus*
38	Scavenger Vulture	*Neophron percnopterus*
39	Pale- Harrier	*Circus pygargus*
40	Montagu's Harrier	*Circus pygargus*
41	Pied Harrier	*Circus melanoleucos*
42	Marsh Harrier	*Circus aeruginosus*
43	Short- toed Eagle	*Circaetus gallicus*
44	Crested serpent Eagle	*Spilornis cheela*
45	Osprey	*Pandion haliaetus*
46	Pergrine Falcon	*Falco peregrinus*

47	Red headed Merlin	*Falco chicquera*
48	Kestrel	*Falco tinnunculus*
49	Indian Kestrel	*Falco tinnunculus objurgatus*
50	Travancore Red Spurfowl	*Galloperdix spadicea stewarti*
51	Grey Jungle Fowl	*Galius sonneratii*
52	Banded Crake	*Rallina eurizonoides*
53	Ruddy Crake	*Porzana fusca*
54	Baillon's Crake	*Porzana pussila*
55	White breasted Waterhen	*Amaurornis phoenicurus*
56	Kora or Water Cock	*Gallicrex cinerea*
57	Pheasant-tailed Jacana	*Hydrophasianus chirurgus*
58	Bronze winged Jacana	Metopidius indicus
59	Painted Snipe	*Rostratula benghalensis*
60	Black winged Stilt	*Himantopus himantopus*
61	Small Indian Pratincole	*Glareola lacteal*
62	Red wattled Lapwing	*Vanellus indicus*
63	Little Ringed Plover	*Charadrius dubius*
64	Green Sandpiper	*Tringa ochropus*
65	Wood Sandpiper	*Tringa glareola*
66	Common Sandpiper	*Tringa hypoleucos*
67	River Tern	*Sterna aurantia*
68	Grey fronted Green Pigeon	*Treron pompadora*
69	Orange breasted Green Pigeon	*Treron bicinata*
70	Imperial Green Pigeon	*Dacula aenea*
71	Blue Rock Pigeon	*Columba livia*
72	Nilgiri Wood Pigeon	*Columba elphinstonii*
73	Spotted Dove	*Streptopelia chinensis*
74	Emerald Dove	*Chalcophaps indica*
75	Large Indian Parakeet	*Psittacula eupatria*
76	Rose ringed Parakeet	*Psittacula krameri*
77	Blossom headed Parakeet	*Psittacula cyanocephala*
78	Blue winged Parakeet	*Psittacula columboides*
79	Malabar Lorikeet	*Loriculus vernalis*
80	Red winged Crested Cuckoo	*Clamator coromandus*
81	Pied Crested Cuckoo	*Clamator jacobinus*
82	Common Hawk- Cuckoo	*Cuculus varius*
83	Indian Cuckoo	*Cuculus micropterus*
84	Cuckoo	*Cuculuscanorus*
85	Indian Banded Bay Cuckoo	*Cacomantis sonneratii*
86	Indian Plaintive Cuckoo	*Cacomantis passerinus*
87	Rufous Bellied Plaintive Cuckoo	*Cacomantis merulinus*
88	Drongo Cuckoo	*Surniculus lugubris*
89	Koel	*Eudynamys scolopacea*
90	Crow pheasant	*Centropus sinensis*
91	Lesser Coucal	*Centropus toulou*
92	Barn Owl	*Tyto alba*
93	Grass Owl	*Tyto capensis*
94	Peninsular Bay Owl	*Phodilus badius ripleyi*
95	Collared scopes Owl	*Otus bakkamoena*
96	Eagle Owl or Great Horned Owl	*Bubo bubo*
97	Forest Eagle Owl	*Bubo nipalensis*

98	Brown Fish Owl	*Bubo zeylonensis*
99	Jungle Owlet	*Glaucidium radiatum*
100	Brown Hawk-Owl	*Ninox scutulata hirsute*
101	Short –eared Owl	*Asio flammeus*
102	Ceylon Frogmouth	*Batrachostomus moniliger*
103	Great eared Nightjar	*Eurostopodus macrotis*
104	Indian Jungle Nightjar	*Caprimulgus indicus*
105	Common Indian Nightjar	*Caprimulgus asiaticus*
106	Franklin's Nightjar	*Caprimulgus asiaticus*
107	Long tailed Nightjar	*Caprimulgus macrurus*
108	Large Brown throated Spine tail Swift	*Chaetura gigantea*
109	White rumped Spinetail Swift	*Chaetura sylvatica*
110	Alpine Swift	*Apus melba*
111	House swift	*Apus affinis*
112	Plam Swift	*Cypsiurus parvus*
113	Crested Tree Swift	*Hemiprocne longipennis*
114	Malabar Trogon	*Harpactes fasciatus*
115	Lesser Pied Kingfisher	*Ceryle rudis travancoreensis*
116	Common Kingfisher	*Alcedo atthis taprobana*
117	Three toed Kingfisher	*Ceyx erithacus erithacus*
118	Stork billed Kingfisher	*Pelargopsis capensis capensis*
119	White breasted Kingfisher	*Halcyonsmyrensis fuscus*
120	Chestnut headed Bee-eater	*Merops leschenaulti*
121	Blue tailed Bee-eater	*Merops philippinus*
122	Green Bee-eater	*Merops orientalis*
123	Blue bearded Bee-eater	*Nyctyornis athertom*
124	Indian Roller	*Coracias benghalensis*
125	Broad billed Roller	*Eurystomus orientalis*
126	Hoopoe	*Upupa epops*
127	Common Grey Hornbill	*Tockus birostris*
128	Malabar Grey Hornbill	*Tockus griseus*
129	Malabar Pied Hornbill	*Anthracoceros coronatus*
130	Great Pied Hornbill	*Buceros bicornis*
131	Large Green Barbet	*Megalaima zeylanica inornata*
132	Small Green Barbet	*Megalaima viridis*
133	Chrimson throated Barbet	*Megalaima rubricapilla*
134	Wryneck	*Jynx torquilla*
135	Speckled Piculet	*Picumnus innominatus*
136	Rufous Woodpecker	*Micropternus brachyurus*
137	Little Scalybellied Green Woodpecker	*Picus myrmecophoneus*
138	Lesser Golden backed Woodpecker	*Dinopium benghalense*
139	Indian Golden backed Three toed Wood pecker	*Dinopium javanense malabaricum*
140	Great Black Woodpecker	*Dryocopus javensis*
141	Pigmy Woodpecker	*Picoides nanus*
142	Heart spotted Woodpecker	*Hemicircus canente*
143	Large Golden backed woodpecker	*Chrysocolaptes lucidus*
144	Indian Pitta	*Pitta brachyura*
145	Bush Lark	*Mirafra assamica*
146	Rufous tailed Finch-Lark	*Ammomanes phoenicurus*
147	Malabar Crested Lark	*Galerida malabaricus*

148	Eastern Skylark	*Alauda golgula*
149	Crag martin	*Hirundo rupenstris*
150	Dusky Crag Martin	*Hirundo concolor*
151	Eastern Swallow	*Hirundo rustica gutturalis*
152	House Swallow	*Hirundo tahiti*
153	Wire tailed Swallow	*Hirundo smithi*
154	Indian Cliff Swallow	*Hirundo fluvicola*
155	Red rumped Swallow	*Hirundo daurica*
156	House Martin	*Delichon urbica*
157	Grey Shirke	*Lanius excubitor*
158	Baybacked Shirke	*lanius vittatus*
159	Rufous backed Shirke	*Lanius schach*
160	Brown Shirke	*Lanius cristatus*
161	Golden Oriole	*Oriolus oriolus*
162	Balck napped Oriole	*Oriolus chinensis*
163	Balck headed Oriole	*Oriolus xanthornus*
164	Balck Drongo	*Dicrurus adsimilis*
165	Grey or Ashy Drongo	*Dicrurus leucophaeus*
166	White bellied Drongo	*Dicrurus caerulescens*
167	Bronzed Drongo	*Dicrurus aencus*
168	Hair crested Drongo	*Dicrarus hottentottus*
169	Greater Racket- Tailed Drongo	*Dicrurus paradiseus*
170	Ashy Swallow- Shrike	*Artamus fascus*
171	Grey headed Myna	*Sturnus malabaricus malabaricus*
172	Blyth's Myna	*Sturnus malabaricus blythi*
173	Rosy Pastor	*Sturnus roseus*
174	Common Myna	*Acridotheres tristis*
175	Jungle Myna	*Acridotheres fuscus*
176	Grackle or Hill Myna	*Gracula religiosa*
177	Common Tree Pie	*Dendrocitta vagabunda*
178	Southern or White bellied Tree Pie	*Dendrocitta vagabunda*
179	House Crow	*Corvus splendens*
180	Jungle Crow	*Corvus macrorhynchos*
181	Pied Flycatcher Shrike	*Hemipus picatus*
182	Malabar Wood Shrike	*Tephrodornis pondicerianus*
183	Large Cuckoo- Shrike	*Coracina novaehollandiae*
184	Black headed Cuckoo-Shrike	*Coracina melanoptera*
185	Scarlet Minivet	*Pericrocotus flammmeus*
186	Small Minivet	*Pericrocotus cinnamomeus*
187	Common Lora	*Aegithina tiphia*
188	Gold fronted Chloropsis	*Chloropsis aurifrons*
189	Jerdon's or Goldmantled Chloropsis	*Chloropsis cochinchinensis*
190	Fairy Bluebird	*Irena puella*
191	Grey headed Bulbul	*Pycnonotus priocephalus*
192	Ruby throated Bulbul	*Pycnonotus melanicterus gularis*
193	Red Whiskerred Bulbul	*Pycnonotus jocosus*
194	Red vented Bulbul	*Pycnonotus cafer*
195	Yellow browed Bulbul	*Hypsipetes indicus*
196	Spotted Babbler	*Pelorneum ruficeps*
197	Black headed Babbler	*Rhopocichla atriceps*
198	Rufous Babbler	*Turdoides subrufus*

199	Jungle Babbler	*Turdoides striatus*
200	Wynaad Laughing Thrush	*Garrulax delesserti delesserti*
201	Quaker Babbler	*Alcippe poioicephata*
202	Brown Flycatcher	*Muscicapa latirostris*
203	Brown Breasted flycatcher	*Muscicapa muttui*
204	Refous tailed Flycatcher	*Muscicapa ruficauda*
205	Red breasted Flycatcher	*Muscicapa parva*
206	White bellied blue Flycatcher	*Muscicapa pallipes*
207	Blue throated Flycatcher	*Muscicapa srubeculoide*
208	Tickell's Blue Flycatcher	*Muscicapa tickelliae*
209	Verditer Flycatcher	*Muscicapa thalassina*
210	Nilgiri Flycatcher	*Muscicapa albicaudata*
211	White browd fantail flycatcher	*Rhipidura aureola*
212	Paradise Flycatcher	*Terpsiphone paradisi leucogaster*
213	Black napped Flycatcher	*Hypothymis azurea styani*
214	Streaked Fantail Warbler	*Cisticola juncides*
215	Franklin's Wren Warbler	*Prinia hodgsonii*
216	Jungle Wren Warbler	*Prinia sylvatica*
217	Tailor Bird	*Orthotomus sutorius*
218	Pallas's Grasshopper Warbler	*Locustella certhiola*
219	Grasshoper Warbler	*Locustella naevia*
220	Broad tailed Grass Warbler	*Schoenicola platyura*
221	Thick billed Warbler	*Acrocephalus aedon*
222	Indian Great Reed Warbler	*Acrocephalus Stentoreus*
223	Blyth's Reed Warbler	*Acrocephalus dumetorum*
224	Paddyfield Warbler	*Acrocephalus agricola*
225	Booted Warbler	*Hippolais caligata*
226	Lesser White throat	*Sylvia curruca*
227	Tytler's Leaf Warbler	*Phylloscopus tytleri*
228	Tickell's Leaf Warbler	*Phylloscopus affinis*
229	Large billed Leaf Warbler	*Phylloscopus magnirostris*
230	Greenish Leaf Warbler	*Phylloscopus trochiloides*
231	Blue Chat	*Erithacus brunneus*
232	Magpie –Robin	*Copsychus saularis*
233	Shama	*Copsuchus malabaricus*
234	Indian Robin	*Saxicoloides fulcata*
235	Blue headed Rock Thrush	*Monticola cinclorhynchus*
236	Malabar Whistling Thrush	*Monticola horsfieldii*
237	Pied Ground Thrush	*Zoothera wardii*
238	Orange headed Ground Thrush	*Zoothera citrina citrina*
239	White throated Gound Thrush	*Zoothera citrina cyanotus*
240	Grey Tit	*Parus major*
241	Valvet fronted Nuthatch	*Sitta frontalis*
242	Kerala Rock Pipit	*Anthus similies travancoriensis*
243	Paddy field pipit	*Anthus novaeseelandiae*
244	Forest wagtail	*Motacilla indica*
245	Grey headed Yellow Wagtail	*Motacilla thunbergi*
246	Blue headed Yellow Wagtail	*Motacilla flava beema*
247	Yellow backed Wagtail	*Motacilla flava lutea*
248	Western Yellow headed Wagtail	*Motacilla citreola*

249	Grey Wagtail	*Motacilla cinerea*
250	White Wagtail	*Motacilla alba*
251	Large Pied Wagtail	*Motacilla maderaspatensis*
252	Tickell's Flowerpecker	*Dicaeum erythrorhynchos*
253	Purple rumped Sunbird	*Nectarnia zeylanica*
254	Small Sunbird	*Nectarinia minima*
255	Loten's Sunbird	*Nectarinia lotenia*
256	Purple Sunbird	*Nectarinia asiatica*
257	Yellow backed Sunbird	*Acthopyga siparaja*
258	Little Spiderhunter	*Arachnothera longirostris*
259	House Sparrow	*Passer domesticus*
260	Yellow throated Sparrow	*Petronia xanthocollis*
261	Travancore Baya	*Ploceus philippinus*
262	Streaked Weaver Bird	*Ploceus manyar*
263	Red Munia	*Estrida amandava*
264	Green Munia	*Estrilda formosa*
265	White throated Munia	*Lonchura malabarica*
266	White Backed Munia	*Lonchura striata*
267	Rufous bellied Munia	*Lonnchura kelaarti*
268	Spotted Munia	*Lonchura punctulata*
269	Black headed Munia	*Lonchura malaca*
270	Common Rosefinch	*Carpodacus erythrinus*

Butterflies

Sl. No.	FAMILY	SCIENTIFIC NAME
PAPILIONIDAE		
1	Southern Common Bird Wing	*Troides minos* Cramer
2	Malabar Rose	*Pachliopta pandiyana* Moore
3	Common Rose	*Pachliopta aristolochiae*(Fabricius
4	Crimson Rose	*Pachilopta hector* Linnaeus
5	Common Mime	*Chilasa clytia* Linnaeus
6	Blue Mormon	*Papilio polymnestor* Cramer
7	Common Banded Peacock	*papilio crino Fabricius*
8	Paris Peacock	*Papilio paris* Linnaeus
9	Malabar Banded Peacock	*Papilio Buddha* Westwood
10	Malabar Raven	*Papilio darvidarum* Woodmason
11	Red Helen	*Papiliohelenus* Linnaeus
12	Common Mormon	*Papilio polytes* Linnaeus
13	Malabar Banded sword Tail	*Papilio liomedon* Moore
14	Lime Butterfly	*Papilio demoleus* Linnaeus
15	Common Blue Bottle	*Graphium sarpedon* Felder
16	Tailed Jay	*Graphium agamemnon* Felder
17	Spot Swordtail	Pathysa nomius Esper
PIERIDAE		
18	Psyche	*Leptosia nina* Fabricius
19	Common Jesebel	*Delias eucharis* Drury
20	Great Orange Tip	*Hebomoia glaucippe* Linnaeus
21	Common Emigrant	*Catopsilia crocale* Cramer
22	Lemon Emigrant	*Catopsilia Pomona* Fabricius
23	Mottled Emigrant	*Catopsilia pyranthe* Linnaeus
24	Common Grass Yellow	*Eurema hecabe* Moore
HESPERIDAE		
25	Water Snowflat	*Tagaiades litigiosa* Moschler
26	Chestnut Angle	*Odontoptilum angulata* Felder
27	Golder Eagle	*Caprona ransonnetti* Felder
28	Giant Red Eye	*Gangara thyrsis* Fabricius
29	Common Dartlet	*Oriens gola* Moore
30	Common Dart	*Potanthus dara* Moore
31	The Goon	*Sancus pulligo* Mabille
DANAIDAE		
32	Glassy Tiger	*Parantica aglea* Cramer
33	Dark Blue Tiger	*Tirumala septentrionis* Gmelin
34	Plain Tiger	*Danaus chrysippus* Linnaeus
35	Blue Tiger	*Tirumala limniace* Gmelin
36	Common Crow	*Euploea core* Cramer
SATYRIDAE		
37	South Indian Glad Eye Bush	*Mycalesis patnia junonia* Butler

	Brown	
38	Dark Brand Bush Brown	*Mycalesis mineus* Linnaeus
39	Bamboo Tree Brown	*Lethe europa ragalva* Frushtorfer
40	Tamil Cats Eye	*Zipoetis saitis* Hewitson
41	Common Fivering	*Ypthima baldus* Fabricius
42	Common Fourring	Ypthima huebneri Kirby
43	White Fourring	*Ypthima ceylonica* Hewitson
44	Common Evening Brown	*Melantis leda* Cramer
45	Great Evening Brown	*Melanitis zitenius* Herbst
46	Common Palm Fly	*Elymnias hypermnestra* caudata Butler
NYMPHALIDAE		
47	Common Nawab	*Eriboea athama* Drury
48	Cray Count	*Euthalia lepidea* Butler
49	Baron	*Euthalia aconthea* Frutistorfer
50	Clipper	*Parthenos sylvia* Cramer
51	Commander	*Moduza procris* Frutistorferr
52	Common Sailer	*Neptis hylas varmona* Linnaeus
53	Common Lascar	*Neptis hordonia* Stoll
54	Great Egg Fly	*Hypolimnas bolina* Linnaeus
55	Danaid Egg Fly	*Hypolimnas missipus* Linnaeus
56	Blue Oak Leaf	*Kallima philarchus* Westwood
57	Yellow Pansy	*Precis hierta hierta* Fabricius
58	Lemon Pansy	*Precis lemonias* Linnaeus
59	Peacock Pansy	*Precis almana almana* Linnaeus
60	Grey Pansy	*Precis atlites* Johanssen
61	Chocolate Pansy	*Precis iphita* Cramer
62	Rustic	*Cupha erymanthis* Drury
63	Tamil Yeoman	*Cirrochroa thais* Fabricius
64	Angled Castor	*Ariadne ariadne* Linneaeus
65	South Indian Common Castor	*Ariadne merione* Cramer
66	Tamil Lacewing	*Cethosia nietneri* Felder
ACRAEIDAE		
67	Tawny Coster	*Acraca violae* Fabricius
LYCAENIDAE		
68	Red Pierrot	*Talicada nyseus nyseus* Guerin
69	Common Pierrot	*Castulius rosimon* Fabricius
70	Banded blue Pierrot	*Discolampa ethion* Fruhstorfer
71	Lesser Grass Blue	*Zizeeria otis decreta* Butler
72	Common Cerulean	*Jamides celeno* Cramer
73	Large Oakblue	*Amblypadea amantes amantes* Hewitson
74	Yam Fly	*Loxura atymus surya* Moore
75	Plumbeous Sliverline	*Spindasis schistacea schistace* Moore
76	Common Imperial	*Cheritra freja* Fabricius

Fishes

Sl. No.	Name of the Species	Local Name
MEGALOPIDAE		
1	*Megalops cyprinodes* Broussonet	
2	*Anquilla bengalensis bengalensis* Grey	Maniangal
CYPRINIDAE		
3	*Danio malabaricus* Jerdon	
4	*Danio aequipinnatus* Mc Clelland	Thuppalam minungi
5	*Rasbora daniconius daniconius* Hamilton	Kaniyatty
6	*Amblypharyngodon melettnus* Valenciennes	
7	*Cyprinus carpio* communits Linnaeus	Goldfish
8	*Punitus filamentosus* Valenciennes	Chelykuthy
9	*Punitus curmuca* Hamilton	Paral
10	*Punitus vitattus* Day	Paral
11	*Punitus ticto ticto* Himalton	Paral
12	*Punitus melanampyx melanampyx*	Vazhakka-varayan
13	*Punitus amphibius* Valenciennes	Kooral
14	*Punitus sarana subnasutus* Valenciennes	Kuruva
15	*Puntius parrah* Day	Paral
16	*Osteobrana bakeri* Day	
17	*Labeo rohita* Hamilton	Rohu
18	*Labeo calbasu* Habilton- Buchanan	Kakka -chekita
19	*Osteochilus thomassi* Day	
20	*Osteochilus nashi* Day	
21	*Tor khudree* Sykes	Kuyil
22	*Catla catla* Himalton	Catla
23	*Ctenopharyngodon idella* Valenciennes	Grass carp
24	*Garra mullya* Sykes	Kallumutty
25	*Hypsilobarbus kurali* Menon and Rama Devi	Kooral
COBITIDAE		
26	*Noemacheilbnus guentheri* Day	
27	*Noemacheilus triangularis* Day	
COBITINAE		
28	*Lepidocephalus thermalis* Valenciennes	Eylory
HOMALOPTERIDAE		
29	*Bhavania australis* Jerdon	Kalpoolon
BAGRIDAE		
30	*Mystus montanus* Jerdon	Koory
31	*Mystus oculatus* Valenciennes	Chillan- koory
32	*Horabagrus brachysoma* Gunther	Manga- kkoory
SILURIDAE		
33	*Ompok bimaculatus* Bloch	Thalamban

34	*Wallago attu* Schneider	Vala
35	*Pseudotropius mitchelli* Gunthes	Velly vala
CLARIIDAE		
36	*Cllarias batrachus Linnaeus*	Muzhy
HEMIRAMPHIDAE		
37	*Hetropneustus fossilis* Bloch	Kary
SISORIDAE		
38	*Glypothorax madraspatamum* Day	Kallan-koory
HEMIRAMPHIDAE		
39	*Hyporhamphus limbatus* Valenciennes	Ottachundan-kuluva
BELONIDAE		
40	*Xenentocdon cancila* Hamilton	Konthan koluva
CYPRINODONTIDAE		
41	*Aplocheilus lineatus* Valenciennes	Karoopu
CHANNIDAE		
42	*Channa marulius* Hamilton	Urul
43	*Channa orientalis* Schneider	Vatton
44	*Channa striatus* Bloch	Varal
AMBASSIDAE		
45	*Parambassis thomassi* Day	Valiya Aringil
46	*Parambassis dayi* Bleeker	Cheira Aringil
NANDIADAE		
47	*Pristolepis malabarica* Gunther	Chembally
CICHLIDAE		
48	*Etroplus suratensis* Bloch	Karimeen
49	*Etroplus maculates* Bloch	Pallathy
50	*Oreochromis mossabicca* Peters	Thilapi
GOBINAE		
51	*Glossogobius giuris* Hamilton and Buchanan	Chattipoolon
BELONTIDAE		
52	*Marcopodus cupanus* Valenciennes	Karinkana
MASTACEMBELIDAE		
53	*Mastacembeles armatus* Lacepede	Aaroon
54	*Mastacembeles guentheri* Day	Puzhu Aaroon
55	*Tetraodon travancoricus* Hora and Nair	Putterfish

ANNEXURE VI - BODY CONDITION EVALUATION FORM

PROTECTED AREA: ..... SPECIES: .....

DATE	LOCALITY	AGE & SEX	*SCORES FOR DIFFERENT BODY PARTS*									BCI	REMARKS
			1	2	3	4	5	6	7	8	9		

1. Flank area
2. Ribs
3. Pelvic girdle
4. Vertebral column
5. Temporal depression
6. Tail contour
7. Lumbar shelf

INVESTIGATOR : .....

SIGNATURE : .....

Annexure -VII

DISEASES OUTBREAK HISTORY FORM

1. Nature and magnitude of outbreak isolated case/Sporadic/ epidemic/poaching/.....
2. If sporadic /isolated case, species affected .....
3. If epidemic, a) Any morbidity /mortality among livestock :Yes/No/Unknown/.....
   b) Past history of similar or other epidemic :.....
   c) Habitat description of the epidemic area : .....

		SPECIES OF WILDLIFE AND LIVESTOCK AFFECTED							
d) Species of animals affected in the order of severity									
e) Mortality	1. Actually seen								
	2. A guesstimate								
f) Age class & sex of dead individuals	ADULT MALE								
	ADULT FEMALE								
	SUBADULT MALE								
	SUBADULT FEMALE								
	YEARLINGS								
	JUVENILES								
g) Date of onset of deaths									
h) Date of last death seen									
i) Number of ailing animals									
j) Census figures									

4. Proximity of wildlife deaths to the location of villages (Distance) :.....
5. Livestock component a) Cattle movement in the park : Seasonal/daily/.....
   b) Extent of livestock-wildlife overlap : .....
   c) Areas of such overlap :.....
6. Environmental conditions a) Season b) Food availability c) Others factors

....

Date : ..... ***Signature*** : .....

Protected area : ..... ***Name & Address*** : .....

ANNEXURE VIII.

RECORD OF POST MORTEM EXAMINATION

SPECIES :	PROTECTED AREA : .....
AGE :	LOCALITY : .....
SEX :	HABITAT : .....
CAPTIVE/WILD :.....	WEATHER : .....
WEIGHT :.....	DATE & TIME OF DEATH :.....
AMBIENT TEMPERATURE :.....	TIME OF PM EXAMINATION :.....

I. HISTORY OF DEATH/ OUTBREAK

1.Clinical signs before death :.....
.....
.....
2. Surroundings of the carcass.....
.....
3. Other information
.....

II. EXTERNAL EXAMINATON

BODY CONDITION INDEX : .....
PRESENCE OF WOUNDS :.....
RIGOR MORTIS :.....
SUPERFICIAL LYMPH GLANDS : .....
MUCOUS –MEMBRANE :.....
NATURAL ORIFICES : .....
OTHER ABNORMALITIES :.....

III. INTERNAL EXAMINATION

A. SUBCUTANEOUS TISSUE	
B. BODY CAVITIES 1. POSITION OF VISCERAL ORGANS 2. PERITONEAL CAVITY 3. PLEURAL CAVITY AND PLEURA	
C. RESPIRATORY SYSTEM 1. LARYNX 2. BRONCHI AND BRONCHIOLES 3. LUNGS (Appearance & Colour) 4. LYMPH GLANDS 5. DIAPHRAGM	
D. HEPATIC SYSTEM 1. LIVER (Appearance, size, colour) 2. LIVER TISSUE 3. GALL BLADDER 4. LYMPH GLANDS	
E. CIRCULAORY & LYMPHATIC SYSTEMS 1. PERICARDIAL SAC 2. HEART MUSCLE 3. HEART CHAMBERS 4. LARGE BLOOD VESSELS 5. SMALL BLOOD VESSELS (Mesenteric) 6. SPLEEN (Appearance, size, colour) 7. SPLENIC TISSUE	
F. DIGESTIVE TRACT 1. PHARYNX 2. OESOPHAGUS	

H. HEAD 1. BUCCAL & NASAL CAVITIES 2. TONGUE 3. BRAIN AND SPINAL CORD			
I. MUSCULATURE			
J. SKELETON			
3. STOMACH	(i) Rumen (ii) Reticulum (iii) Omasum (iv) Abomasum		
4. SMALL INTESTINES	(i) Duodenum (ii) Jejunum (iii) Ileum		
5. LARGE INTESTINES	(i) Colon (ii) Caecum (iii) Rectum		
6. LYMPH GLANDS (Mesenteric)			
G. UROGENITAL ORGANS 1. URINARY BLADDER 2. KIDNEYS (Appearance) 3. KIDNEYS (Colour and appearance)			
1. REPRODUCTIVE ORGANS	(i) Testes/Ovary (ii) Penis/Uterus		
5. LYMPH GLANDS			

IV. SUMMARY OF MAJOR FINDINGS

V. SPECIMENS COLLECTED FOR LABORATORY DIAGNOSIS	
1).....	4).....
2).....	5).....
3).....	6).....

VI. PROVISIONAL DIAGNOSIS

VII. REMARKS

.....

.....

.....

PLACE :..... **SIGNATURE :**.....

DATE :..... **NAME :**.....

ADDRESS:..... **DESIGNATION:**.....

.....

ANNEXURE IX

RECORD SHEET FOR ECTOPARASITES

HOST :..... PROTECTED AREA :.....

SEX : ..... LOCALITY :.....

AGE :..... PRESERVATIVE USED :.....

STATE : Dead/ill/health/ ..... BODY CONDITION INDEX :..... COLLECTED BY :.....

DATE OF COLLECTION :.....

SPECIMEN CONTAINER CODE :.....

ECTOPARASITE	SPECIES/ TYPE	BODY SITE	NUMBERS PRESENT	NUMBERS COLLECTED	INDIVIDUAL SPECIMEN CONTAINER NO.	REMARKS
1. TICK	1.					
	2.					
	3.					
2. FLEAS	1.					
	2.					
3. FLIES	1.					
	2.					
4. LICE	1.					
	2.					
5. MITES (Scab/Mange)						
6. SKIN WARBLES						

INVESTIGATOR'S NAME :.....

DESIGNATION :.....

SIGNATURE :.....

DATE :.....

ADDRESS : .....

.....

.....

ANNEXURE X.

RECORD SHEET FOR ENDOPARASITES

SPECIES :..... BODY CONDITION INDEX :.....
AGE & SEX : ..... FAT RESERVES :.....
DATE OF DEATH:..... CAUSE OF DEATH :.....

BODY REGION	PARASITE TYPE	YES /NO	LOCATION	DEGREE OF INFECTION	INDIVIDUAL CONTAINER NO.
A. Subcutaneous tissue	1. Round worms				
	2. Warble fly larvae				
	3. Others				
B. Body cavities	1. Cysts in abdomen				
	2. Cysts in thorax				
	3. Cysts in pelvis				
	4. Filarid worms				
C. Respiratory system	1. Worms in passage				
	2. Lungworms				
	3. Cysts in lung				
	4. Cysts in diaphragm				
D. Liver and Gall bladder	1. Flukes				
	2. Tape worms				
	3. Round worms				
	4. Cysts in liver				
E. Heart and blood vessels (Take blood smear for protozoans)	1.Worms in heart muscle				
	2. Cysts in heart muscle				
	3. Filarid worms				
	4. Blood flukes in vessels				
F. Digestive system (Take faeces for egg & oocyst count)	1. Rumen flukes				
	2. Tape worms				
	3. Round worms				
	4. Others				
G. Urogenital organs (Collect urine)	1. Kidney worms				
	2. Others				
H. Head	1. Eye worm				
	2. Larvae (in cavities)				
I. Muscles	1. Round worms 2. Cysts				

PROJECTED AREA :..... SIGNATURE :..... LOCALITY :.....
NAME :.....
DATE :..... DESIGNATION :.....
ADDRESS :.....

ANNEXURE XI

LABORATORY SPECIMEN FORM

Please examine the specimen for:.....
.....

SPECIMEN NO :.....	SPECIES :.....
SPECIMEN TYPE :	SEX :.....
PRESERVATIVE USED :.....	AGE :.....
COLLECTION DATE :.....	WEIGHT :.....
PROTECTED AREA :.....	

DISEASE SUSPECTED: .....

HISTORY OF AILMENT/DEATH/OUTBREAK:.....
.....
.....
.....

TIME LAG BETWEEN DEATH & COLLECTION:.....
TIME LAG BETWEEN COLLECTION & PRESERVATION:.....
MODE OF DESPATCH : Post/rail/air/bus/messenger :.....
TIME OF DESPATCH : .....

Investigator's name :..... Signature :.....

Sender's Address	Laboratory Address